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(54) **Laminar flow cabin for research laboratories**

(57) The present invention relates to a laminar flow cabin (1) of the type comprising an operating plane (4) supported by a lower box portion (2) and surmounted by a plenum or upper box portion (3), and provided with a transparent protective front panel (5) movable between a completely lowered position and a completely raised position, further comprising air intake means (2a) able to convey said laminar air flow, wherein it comprises means for movement (10) of said operating plane (4), which is thus movable in the vertical direction relative to said lower box portion (2).

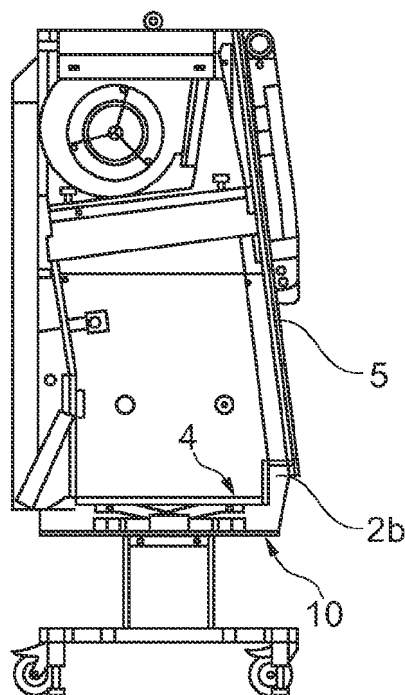


Fig. 3

Description

Field of the invention

[0001] The present invention relates to a cabin with laminar air flow that is particularly suitable for use in research laboratories that carry out animal experiments, and that require a working area with controlled contamination.

State of the art

[0002] The use of workstations such as booths or cabins with laminar air flow, for carrying out various operations on the cages or tanks containing the animals, is known in animal breeding departments.

[0003] Cabins of this type provide forced control of the air flow with partial recirculation, with a reduced working opening at the front and front aspiration of ambient air (called protective or of containment) which, passing under the operating plane and through the top of the space, is subdivided into ideal unidirectional laminar flow lines, parallel to one another. This solution provides notable cleanness of the flow, without turbulence, thus greatly reducing not only cross-contamination of the products manipulated within it but also dispersion of the infectious agents and therefore contamination of the environment and of the operator.

[0004] Laminar flow cabins thus perform multiple functions: protection of the animals from mutual and/or external contamination, protection of the operator and protection of the laboratory environment.

[0005] The operation most commonly carried out by the technician comprises cage changing, an operation in the course of which the animals are transferred from a dirty cage to a clean cage, and together with the animals, the technician transfers any cage accessories, for example a food trough and water bottles.

[0006] During the operation of cage changing, it is necessary to observe precise safety requirements to prevent harmful agents, allergens and pathogens escaping from the workstation and being dispersed in the surroundings, exposing the operator to the risk of inhaling said substances. Naturally, means are also put in place to prevent any external agents contaminating the animals, therefore these workstations or changing cabins provide cross-protection from the inside of the cabin to the outside and vice versa. The main tool guaranteeing such protection is the laminar flow that flows around the periphery of the workstation, as is known from the prior art, but also the presence of a protective glass that leaves an opening of predetermined dimensions, as well as the height of the operating plane are all means that contribute to obtaining the result in terms of protection.

[0007] For briefly illustrating what is known in this field, there are broadly two main types of cabins:

- laminar flow cabins that mainly guarantee protection

of the samples from contamination (not protection of the operator and of the environment);

- biological safety cabins that guarantee protection of the operator and of the environment when the sample (in the present case the laboratory animal) is represented by pathogenic or potentially pathogenic biological material as well as of the sample itself. The classification, description and requirements of a technical nature that biological safety cabins must possess are established by product standards issued at national level such as, to mention just one, European standard EN12469, which divide biological safety cabins into three different classes, corresponding to different operating schemes and constructions, for guaranteeing different levels of safety.

[0008] According to the classification provided by the standard, biological safety cabins of class I ensure protection from biological agents for the operator and for the working environment outside the cabin but not for the product being manipulated. Protection is provided by the flow of air entering through the open front section and filtration of all the air that is expelled on a HEPA filter prior to discharge to the environment.

[0009] The biological safety cabins of class II (which includes the cabin according to the present invention) as well as providing protection from biological agents for the operator and for the working environment outside the cabin, provide protection of the material being processed, in our case laboratory animals, from external contaminants. The partial front opening permits ingress of air that is aspirated from the grid positioned at the bottom of the front opening and then, after passing through the HEPA filter, is introduced from above into the working chamber, creating a vertical laminar flow. The amount of air aspirated is approximately 30% of the amount of air that generates the vertical laminar flow. An amount of air equal to that which generated the protection (or containment) barrier is expelled from the top of the cabin through another HEPA filter. The amount of air filtered and recirculated in the working zone in conditions of laminar or unidirectional flow is equal to 70%.

[0010] The biological safety cabins of class III are hermetically sealed cabins of the glove-box type, where the operator is physically separated from the product, with a HEPA filter on the ingoing air and double HEPA filters in series on the outgoing air. These cabins guarantee excellent protection of the environment and of the operator but poor protection with respect to the product.

[0011] Thus, biological safety cabins of class I, II and III are currently marketed.

[0012] The level of safety offered by class II cabins (since they guarantee excellent protection both of the product and of the operator and of the environment) obviously is also reflected in the level of convenience of use by the operator. These cabins are certainly more inconvenient than the regular cage changing cabins normally used, in which the front opening is wider, since in this

case the operators have a smaller front opening available for inserting their arms inside the cabin and for executing the operations that are required, and moreover the operating plane in the case of the cabins used in animal breeding departments is at a lower height relative to the height of the free edge on which the air intake grid is positioned for the purpose of ensuring greater physical containment and especially to facilitate the operations of cage opening and closing. An example of a situation in which it is necessary for the operating plane to perform a function of physical containment is that in which the animals undergoing the experiments are particularly active (even among laboratory rats and/or guinea pigs, some species are decidedly more lively than others) and tend to run about or even make small jumps. In all of these cases, to prevent the animals escaping from the operating plane and running away, it is important for said plane to have means of physical containment, effectively constituted for example by a raised edge. The operator therefore has greater difficulty in working with cabins of class II, which however offer a higher level of safety.

Summary of the invention

[0013] The main aim of the present invention is therefore to provide a laminar flow booth or cabin that can easily be used in biohazard conditions, i.e. microbiological safety, or not, therefore both for execution of laboratory experimental procedures and typically for cage changing of the cages of animals in animal breeding departments, making it easy to introduce even bulkier cages in the cabin.

[0014] With this aim, the purpose of the present invention is to provide a laminar flow cabin with microbiological safety level which is more convenient to use and more ergonomic for the user.

[0015] This aim and these and other purposes that will become clearer in the following are achieved with a laminar flow cabin of the type comprising an operating plane supported by a lower box portion and surmounted by a plenum or upper box portion, further comprising air intake means able to convey said laminar air flow under said operating plane, characterized in that said operating plane is movable in the vertical direction relative to said air intake means.

[0016] Moreover, the laminar flow cabin according to the present invention is characterized in that said upper plenum comprises a protective transparent front panel, which is also movable in a substantially vertical direction between a completely raised position and a completely lowered position, passing through one or more intermediate positions.

Brief description of the drawings

[0017] Further characteristics and advantages of the present invention will become clearer from the following detailed description, given as a non-limiting example and

illustrated in the accompanying drawings in which:

Fig. 1 shows a perspective view of the whole laminar flow cabin according to the present invention in a first operational configuration;

Fig. 2 shows a front view of the laminar flow cabin according to the present invention in the operational configuration of Fig. 1;

Fig. 3 shows a sectional view according to plane A-A indicated in Fig. 2 of the cabin according to the present invention;

Fig. 4 shows a front view of the laminar flow cabin according to the present invention in a second operational configuration;

Fig. 5 shows a sectional view according to plane E-E indicated in Fig. 4 of the cabin according to the present invention;

Fig. 6 shows a front view of the laminar flow cabin according to the present invention in a third operational configuration;

Fig. 7 shows a sectional view according to plane I-I indicated in Fig. 6 of the cabin according to the present invention;

Fig. 8 shows a view of the means for raising the operating plane of the cabin according to the present invention.

Detailed description of the preferred embodiment of the invention

[0018] According to a preferred embodiment of the present invention illustrated in the aforementioned drawings as a non-limiting example, the laminar flow cabin 1 according to the present invention comprises a lower box portion 2 which supports air intake means, constituted for example of the grid 2a, and an operating plane 4.

[0019] The lower box portion contains, as is known from the prior art, means for intake and conveyance of the laminar air flow, means for filtering the incoming air from grid 2a and similar devices, and is surmounted by an upper box portion 3 which holds similar means for movement and filtration of the air as known from the prior art, and further comprises a transparent front panel 5 preferably made of glass.

[0020] Said front panel 5 is connected to the front part of the upper box portion 3, and is movable between a completely lowered position and a completely raised position, passing through one or more intermediate positions, owing to means for moving the front panel, not shown in the drawings. These means for movement can be of the type known from the prior art.

[0021] Similarly, the laminar flow cabin according to the present invention is provided with means 10 for moving the operating plane 4, said means comprising in particular, in the embodiment shown here as an example of a possible solution, a motorized system with a pantograph, illustrated in Fig. 8, which allows vertical movement of said operating plane.

[0022] Still according to one possible embodiment of the present invention, the operating plane 4 is movable between a first position, illustrated for example in Figs. 1 and 3, in which the plane is lowered to produce a difference in level with the edge 2b of the lower box portion 2 on which the air intake grid 2a is installed.

[0023] The cabin according to the present invention comprises a central control unit, programmable and actuable by the operator, for coordinated movement of the operating plane 4 and the front panel 5.

[0024] With particular reference to what is shown in Figs. 1 to 3, the cabin according to the present invention can be used, in a first configuration, for the normal procedures of cage changing.

[0025] In fact, by entering a suitable password for use of the cabin in cage changing configuration, for example, the operating plane 4 is lowered, by the movement means 10, by an amount of about 100-120 mm relative to air intake grid 2a and the front panel 5 is positioned in the intermediate position, corresponding to a situation in which the working front opening is at a height of 320 mm.

[0026] In this configuration, simply by pressing a pedal control located on the floor, the user activates raising of the operating plane 4 and simultaneous raising of the front panel 5 until it reaches the configuration in which front panel 5 is in the completely raised position corresponding to a front opening of 450 mm and a raised position of operating plane 4, flush with the air intake grid 2a. In this non-operating configuration of the cabin, the operations of inserting the unwieldy, and heavy (since these cages contain one or more rodents, food and water bottles) cages in the cabin and removing them from the cabin are facilitated.

[0027] In cage changing configuration, in fact, the operating plane 4 is, as mentioned, arranged at a lower level relative to edge 2b on which the air intake grid 2a is housed. The difference in level of about 120 mm that is created between the operating plane and the edge of the lower box portion 2 makes both insertion and especially removal of cages of larger dimensions in and from cabin 1 difficult and tiring for the operator.

[0028] With suitable programming of the control unit of the laminar flow cabin according to the present invention, for example by entering a second password different from the first, the cabin can easily be used in microbiological activities in compliance with European standard EN12469 giving fundamental safety and hygiene requirements for microbiological safety sites.

[0029] In this configuration, the operating plane 4 is raised until it is flush with the air intake grid 2a, while front panel 5 moves to a lowered position in which the front opening is of only 250 mm (as expressly stated in European directive EN12469).

[0030] This configuration, in which the operator is able to work in conditions of biosafety, is shown in Figs. 4 and 5.

[0031] Still operating the appropriate control, which as mentioned can for example be of the pedal type, the op-

erator can move the opening of the front panel 5 bringing the panel into the completely open position in which the front aperture is of 450 mm, for example, without the operating plane 4, already flush with the edge of lower box portion, moving.

[0032] This configuration, shown in Figs. 6 and 7, allows the operator to introduce cages easily into the laminar flow cabin. Once the cages or other bulky objects are inserted, the front panel 5 can be moved back to the completely lowered position in which the front opening is of 250 mm.

[0033] It has thus been shown that the laminar flow cabin according to the present invention achieves the proposed purpose and aims.

[0034] In particular, it is illustrated how the laminar flow cabin according to the present invention, through coordinated action, by means of a central control unit, of means for moving the front panel and of means for moving the operating plane, can easily be used both for cage changing (in particular, it proves ideal for those unwieldy cages) and for microbiological procedures (e.g. manipulation of pathogenic and non-pathogenic microorganisms, such as viruses, bacteria etc.).

[0035] Moreover, it has been shown that, owing to the possibility of coordinated movement of the operating plane and front panel, the laminar flow cabin according to the present invention is more ergonomic for the operator in the phases of cage insertion and removal, in particular for those that are bulkier, guaranteeing in the operational phase, optimum protection of the product and, specifically, of the animal, of the operator and of the environment.

[0036] Numerous modifications can be made by a person skilled in the art while remaining within the scope of protection of the present invention.

[0037] The scope of protection of the claims is not to be limited by the illustrations or by the preferred embodiments shown as examples in the description, but rather the claims must comprise all the characteristics of patentable novelty deducible from the present invention, including all characteristics that would be treated as equivalent by a person skilled in the art.

Claims

1. Laminar flow cabin (1) of the type comprising an operating plane (4) supported by a lower box portion (2) and surmounted by a plenum or upper box portion (3), and provided with a transparent protective front panel (5), mobile between a completely lowered position and a completely raised position, further comprising air intake means (2a) to convey said laminar air flow, characterized said front panel (5) is also mobile between said completely lowered position and said completely raised position passing through one or more intermediate positions and in that it further comprises means (10) for moving said operating

plane (4), which is thus vertically mobile with regard to said lower box portion (2), said means for moving said operating plane (4) being contained below said operating plane (4) within said lower box portion (2).

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2. Laminar flow cabin (1) according to the preceding Claim, **characterized in that** said air intake means comprise an air intake grid (2a) placed in correspondence to the front edge (2b) of said lower box portion (2). 10
3. Laminar flow cabin (1) according to one or more of the preceding Claims, **characterized in that** said means for moving said operating plane (4) comprise a pantograph structure (10) . 15
4. Laminar flow cabin (1) according to one or more of the preceding Claims, **characterized in that** it further comprises at least a central control unit for simultaneously controlling the movement of said operating plane (4) and the movement of said front panel (5). 20
5. Laminar flow cabin (1) according to the preceding Claim, **characterized in that** said central control unit is connected and controlled by a control which can be actuated by the operator. 25
6. Laminar flow cabin (1) according to the preceding Claim, **characterized in that** said control is a pedal control placed on the floor. 30
7. Laminar flow cabin (1) according to one or more of the preceding Claims, **characterized in that** said central control unit can move said front panel (5) and said operating plane (4) so that said operating plane (4) lowers of a given amount with respect to the air intake grid (2a) and the front panel (5) is positioned in an intermediate position corresponding to an intermediate front opening between the completely open position and the completely closed one. 35 40
8. Laminar flow cabin (1) according to one or more of the preceding Claims, **characterized in that** said central control unit can move said front panel (5) and said operating plane (4) so that said operating plane (4) is at the same height as the front edge (2b) of said lower box portion (2) and said front panel (5) is in a completely raised position. 45 50
9. Laminar flow cabin (1) according to one or more of the preceding Claims, **characterized in that** said central control unit can move said front panel (5) and said operating plane (4) so that said operating plane (4) is at the same height as the front edge (2b) of said lower box portion (2) and said front panel (5) is in a completely lowered or a completely raised position. 55

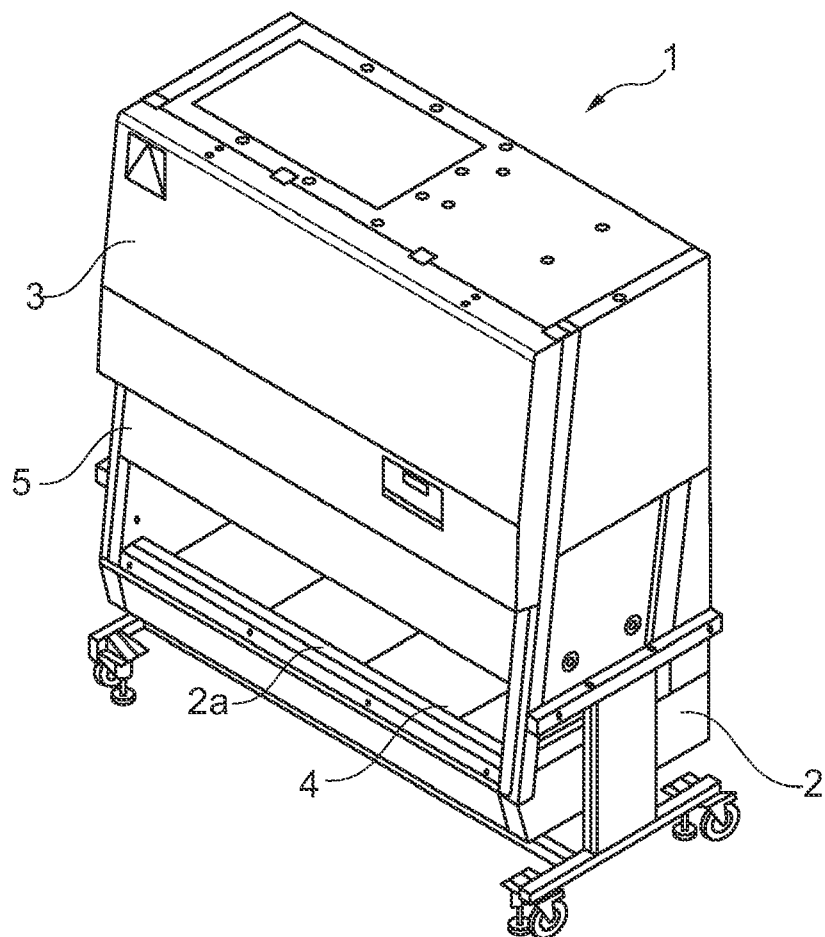


Fig. 1

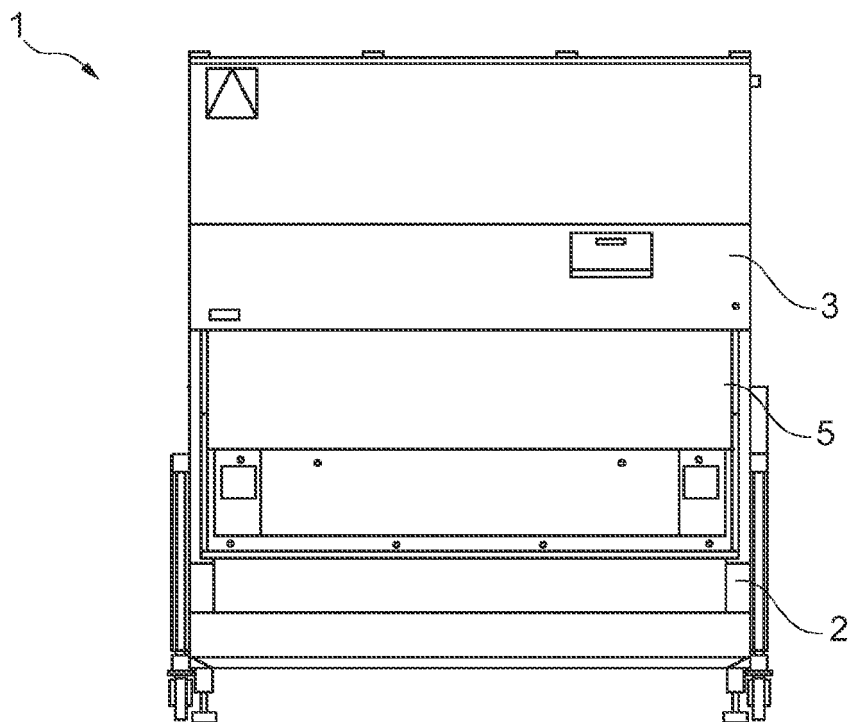


Fig. 2

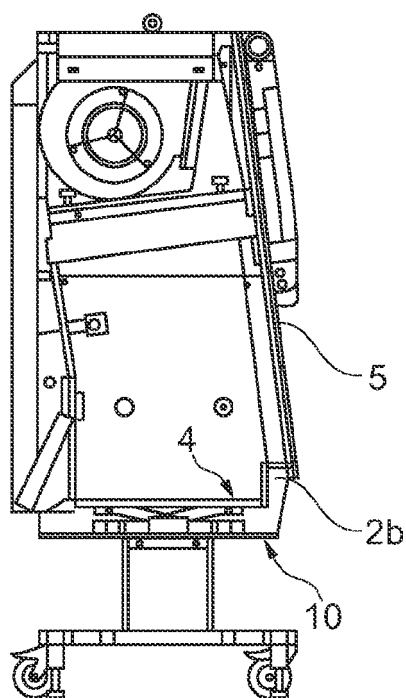


Fig. 3

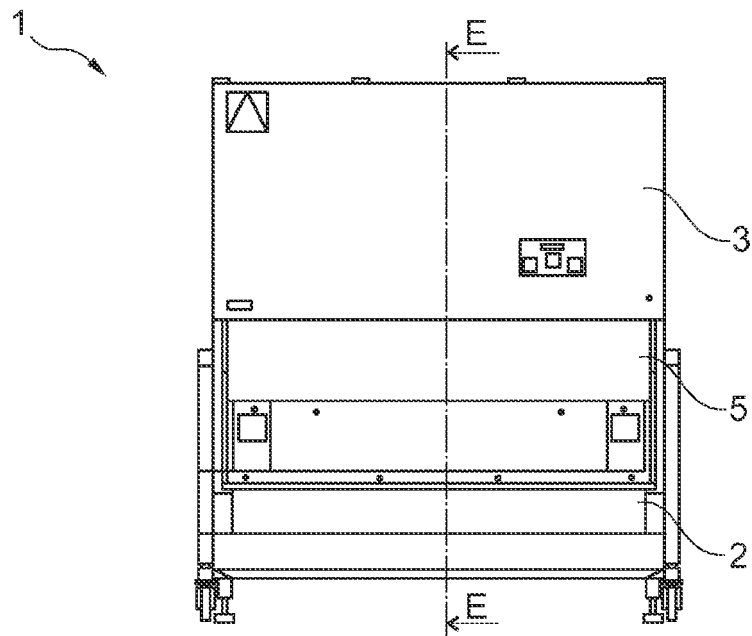


Fig. 4

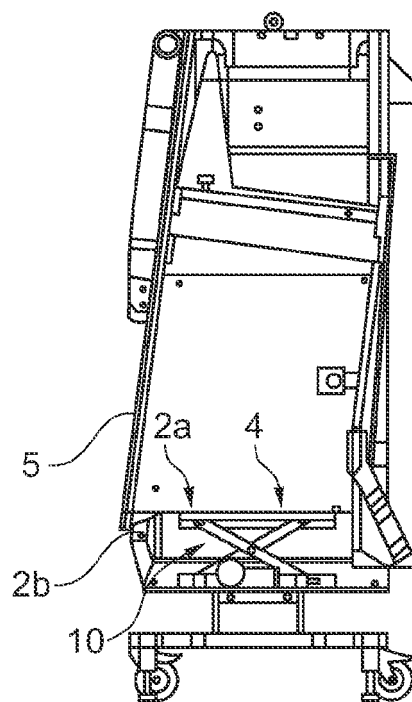


Fig. 5

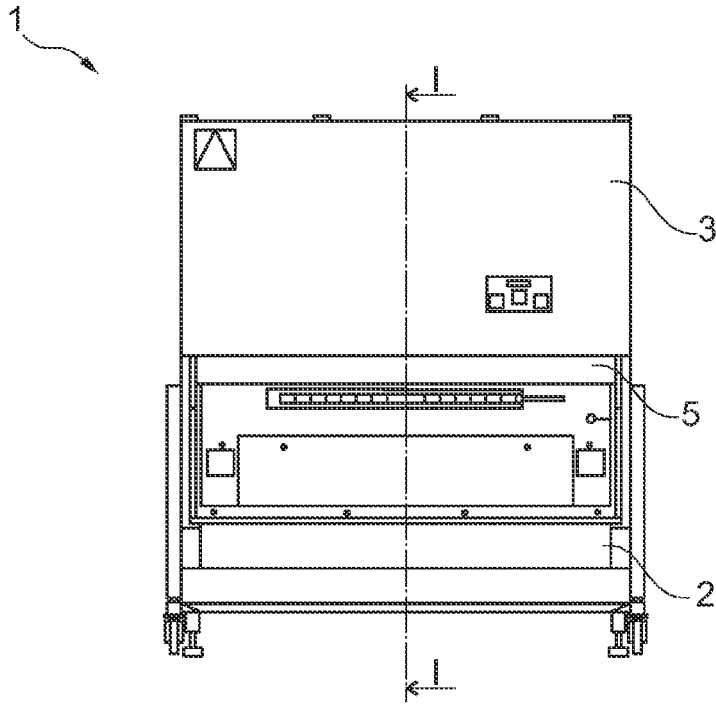


Fig. 6

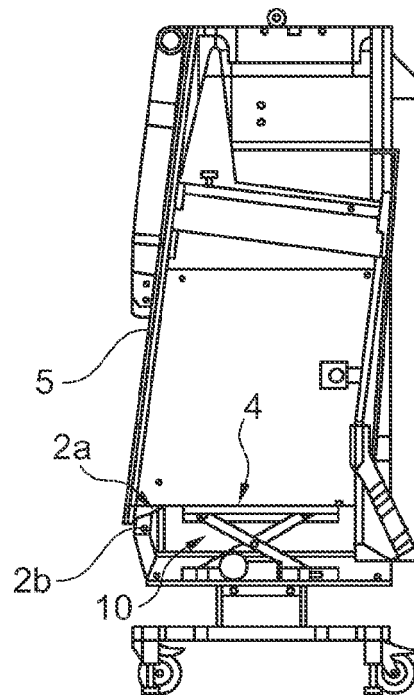


Fig. 7

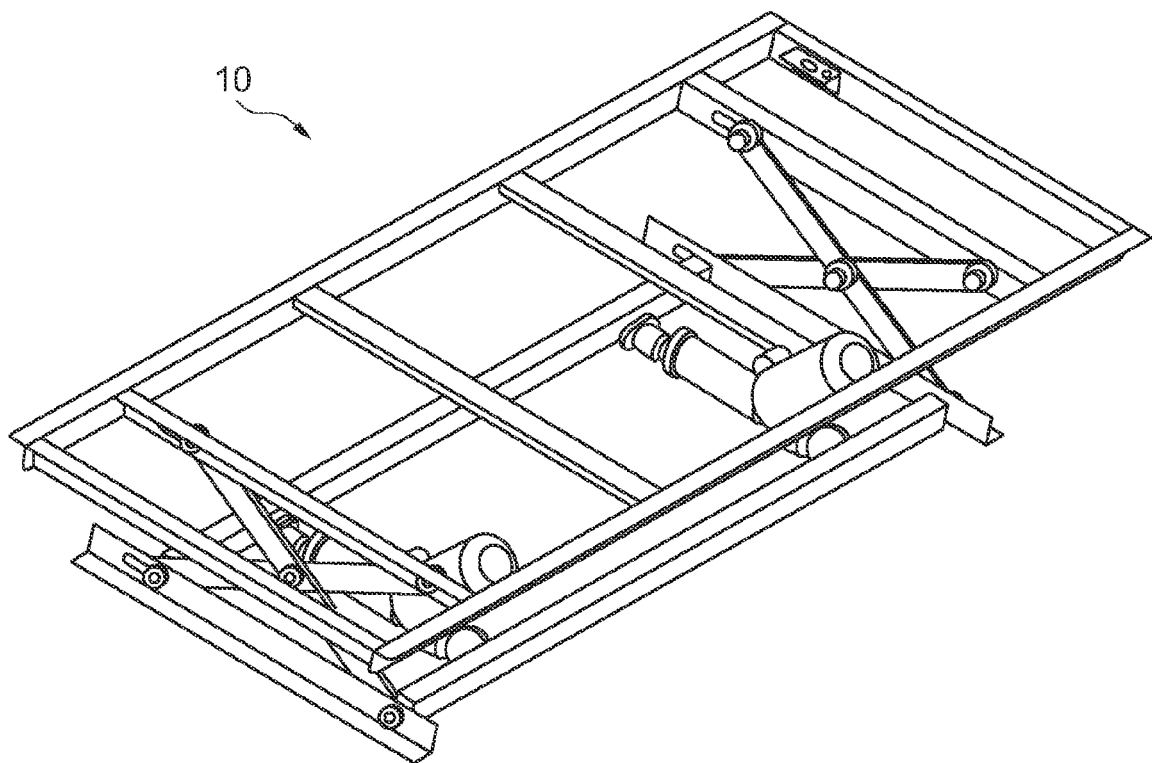


Fig. 8



EUROPEAN SEARCH REPORT

Application Number
EP 11 17 1150

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 23 September 2011	Examiner Batres Arnal, Lucía
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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Place of search The Hague		Date of completion of the search 23 September 2011	Examiner Batres Arnal, Lucía
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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