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(54) Keksinnön nimitys - Uppfinningens benämning - Title of the invention

Setti ilmavirran puhdistamiseksi

SEPARATION SYSTEM FOR PAINT OVERSPRAY

Separation system for paint overspray

[0001] The present invention relates to a set for cleaning an airflow.

[0002] The modular arrangement of filter modules made of cardboard is known from WO 03/084638 A2. They serve to separate paint particles or paint mist (overspray) from an exhaust air of a spray booth in which, for example, parts for a motor vehicle are painted.

[0003] It is noteworthy here that a very large multiplicity of different paints is used. As a result, a wide variety of types of paint impurities which differ, for example, by particle size and moisture content are present in the exhaust air of spray booths. For relatively small, dry particles, labyrinths with small openings and strong deflections have to be provided for the separation, with the result that the particles are stopped by their inertia (or by the centrifugal force) on impact walls of the labyrinth or of the separator, while the cleaned air emerges behind the filter module.

[0004] In the case of large particle sizes with a high moisture content, a large amount of paint can be separated in a cleaning module over a short time. In particular when the cleaning modules are arranged in the base of the spray booth, this results in a high load on the cleaning module which is manufactured from cardboard, which load is further increased by the suction action of a fan for generating the air flow through the cleaning modules. In the case of cleaning modules according to the prior art, this leads to the separation structures which are present therein collapsing under their own weight which is loaded with paint and no longer fulfilling their function.

[0005] It is an object of the invention to provide a set comprising a hollow body and cleaning substructures which permit a broadened field of use, i.e. are

suitable for separating paint particles and paint mist with a greater diversity than is the case in the prior art.

[0006] This object is solved by a set having the features of claim 1.

[0007] According to the invention, this is done by the set comprising a hollow body which comprises an inlet opening for inletting an air flow to be cleaned and an outlet opening for outletting the cleaned air flow, and multiple cleaning substructures as separating structures for cleaning the air flow by separating particles and/or for filtering the air flow. By providing a set in which at least two different combinations of cleaning substructures are arrangeable in the hollow body, an even broader applicability can be achieved.

[0008] In particular, it may be provided that cleaning substructures and/or the cleaning modules are exchangeable independently of one another.

[0009] Further advantageous embodiments are defined in the dependent claims.

[0010] In order to be able to remove even very fine paint mist from the air flow, it may be provided that the at least two cleaning substructures comprise a filter structure. Such filter structures may be configured in different ways. For example, a mat or a fleece of glass fibers may be used here. Preferred thicknesses of such mats or fleeces are preferably below 20 cm and especially preferably below 10 cm. In addition, so-called Columbus material may be used as filter material. This consists of paper, preferably used paper, into which parallel and offset slots are punched or cut. Openings are created by tension transversely to the slots. Several sheets of this material may advantageously be used as filter material.

[0011] Separating structures may likewise be configured in different ways. For example, they may be rectangular structures after unfolding in a plan view. However, diamond-shaped structures are also known (for example marketed

under the name "Andreae").

[0012] Cleaning modules may be arranged in slide-in frames. These slide-in frames may extend over a wall, the ceiling or the base of the spray booth. In these slide-in frames, the cleaning modules may be arranged one behind the other and individually removed or replaced.

[0013] The at least two cleaning sub-structures may comprise at least one separating structure for cleaning an airflow, wherein the at least one separating structure preferably comprises at least two impact walls which are consecutive in the direction of the airflow and which are provided with openings.

[0014] The separating structure may be given increased stability by the provision of at least one stabilizing wall.

[0015] It may be provided that the at least one stabilizing wall is connected to the at least two impact walls.

[0016] It may also be provided that the at least one stabilizing wall is connected to the at least two impact walls in a foldable and/or articulated manner.

[0017] Furthermore, it may be provided that the at least one stabilizing wall is aligned substantially parallel to the airflow.

[0018] Preferably, separating structures may be provided in different geometrical dimensions, in particular thicknesses.

[0019] Likewise, separating structures may be provided which are optimized, in particular by the size of the openings, for the separation of particles of different size. In particular, the separating structures may be designed such that those with greater geometrical dimensions, in particular thicknesses, are optimized for the separation of larger particles and vice versa.

[0020] This enables a precise adaptation of the cleaning module to the present contamination in the airflow (particle size, degree of moisture). This also enables a selective exchange of cleaning modules arranged one behind the other, which is advantageous since separating structures optimized for different particle sizes reach their capacity limit at different speeds.

[0021] Furthermore, it is advantageous that storage is necessary to a lesser extent due to the selective exchangeability of the cleaning modules.

[0022] For a good fit of the cleaning sub-structures in the hollow body, it may be provided that the cleaning sub-structures, in a view along an axis which, in the state arranged in the hollow body, is substantially parallel to the airflow, comprise an outline which substantially corresponds to a cross section of a hollow space of the hollow body which is preferably perpendicular to the airflow. This also ensures that no partial flow of the airflow remains uncleaned because no path leads past the cleaning sub-structures.

[0023] Especially preferably, it may be provided that at least one separating structure is foldable. Due to the reduced volume, the storage and the transport of the separating structures is considerably facilitated.

[0024] This effect is further reinforced if it is provided that the at least one separating structure is substantially flat after folding.

[0025] The reinforcing effect of a stabilizing wall may be improved by the folding of the separating structure in the state arranged in the hollow body being prevented by inner walls of the hollow body.

[0026] Preferably, it may be provided that the at least one stabilizing wall is arranged substantially centrally with respect to a direction in the plane of the impact walls. This may optimize the reinforcing effect of the stabilizing wall.

[0027] The at least one stabilizing wall may be connected to the at least two impact walls, wherein this is preferably the case in a foldable and/or articulated manner. This is easily realizable, for example via a film hinge. This enables a very flat structure in the folded state, which has a high stiffness in the unfolded state.

[0028] Furthermore, it may preferably be provided that the at least one stabilizing wall is aligned substantially parallel to the airstream. This is because in particular when the cleaning module is arranged in a base or a ceiling of a spray booth, the direction of the airflow corresponds to that direction of the main load of the separating structure.

[0029] Especially preferably, it may be provided that the hollow body and/or at least one separating structure consists of cardboard, paper or cardboard. An especially simple disposal or recycling of the separating structures or the cleaning modules is thereby enabled. However, it is also entirely conceivable to manufacture separating structures and/or hollow bodies of metal, plastic, wood or the like.

[0030] In a further preferred embodiment, it may be provided that at least one separating structure comprises at least two flaps which are oriented substantially parallel to the airflow and between which a further separating structure is arrangeable in the hollow body. It is thereby possible for a separating structure to serve for different provided geometrical dimensions, in particular thicknesses. This means that it may be used either with a separating structure arranged between the flaps, or without. In the latter case, the flaps serve as a spacer with respect to an inner wall of the hollow body or a further separating structure.

[0031] Further advantages and details of the invention can be seen with reference to the figures and the associated description of the figures. In the figures:

Fig. 1a to 1h show different perspective, schematic illustrations of cleaning modules for a better understanding of the invention,

Fig. 2a to 2h show perspective illustrations of a separating structure in different folded states for a better understanding of the invention,
Fig. 3a to 3c show a further embodiment of a separating structure according to the invention in different folded states,
Fig. 4a and 4b show schematic illustrations of different combination possibilities of separating structures in cleaning modules for a better understanding of the invention, and
Fig. 5a to 5e show illustrations of arrangement possibilities of cleaning modules in slide-in frames for a better understanding of the invention.

[0032] The cleaning module 10 illustrated in Fig. 1a comprises firstly a hollow body 5, and an inlet opening 6 for inletting the air flow to be cleaned. Since the outlet opening is arranged on the rear side of the hollow body 5, it cannot be seen in these illustrations. The outlet opening is configured substantially analogously to the inlet opening 6.

[0033] The hollow body 5 has opening elements 8 configured as opening flaps. These are open in the present illustration, so that the view of the interior of the hollow body 5 becomes free. In Fig. 1a, multiple cleaning substructures 7 are illustrated, which in this case are all configured as separating structures 1. The separating structures 1 have impact walls 2 which are provided with openings 3. For the sake of clarity, not all impact walls 2 and all openings 3 are provided with reference symbols, since these are partially present in a multiplicity.

[0034] Fig. 1b is analogous to Fig. 1a only with the difference that two of the cleaning substructures 7 are configured as filter structures 9. These filter structures 9 comprise glass fiber mats or fleeces, but may also comprise Columbus material or the like.

[0035] In Fig. 1c, the cleaning module 10 is illustrated again, but this time with closed opening elements 8. In this state, the cleaning module may be used.

[0036] The opening elements 8 may also be configured as removable lids

(shoebox-like), which is illustrated in Figs. 1d and 1e. Otherwise, the cleaning module 10 from Figs. 1d and 1e is analogous to those from Figs. 1a to 1c.

[0037] In Figs. 1f to 1h, further embodiments are illustrated, wherein the cleaning substructures 7 in these cases do not extend over the entire cross-sectional area (from the point of view of the airflow, which is indicated next to Fig. 1f by an arrow) of the hollow body 5.

[0038] In Figs. 2a to 2h, a first embodiment of a separating structure 1 in different folded states for a better understanding of the invention is illustrated. Fig. 2a in this case first shows the separating structure 1 in the delivery state. Parts of the structure are then unfolded (figure 2b). The entire separating structure 1 is then folded together once again, wherein the parts unfolded in figure 2b point towards each other.

[0039] Then, the separating structure 1 is present such that it may be used in a cleaning module 10 (figure 2e). Figure 2f corresponds to figure 2e, wherein the separating structure 1 is illustrated rotated, which is illustrated by arrows. After use in a cleaning module 10, for example during disposal of the cleaning module 10, the separating structure 1 may be made substantially flat (figure 2h) by a single folding operation (figure 2g). This may simplify the disposal.

[0040] Figures 3a to 3c show a further separating structure 1 according to the invention. This may be transferred from the delivery state (figure 3a) into the operating state (figure 3c) by a folding operation (figure 3b), which is indicated by arrows. The arrangement of the stabilizing walls 4 between the impact walls 2 can be seen particularly clearly in this embodiment. The stabilizing walls 4 are arranged substantially centrally with respect to a direction in the plane of the impact walls 2. Flaps 11 can likewise be seen, between which, on the one hand, further separating structures 1 may be arranged — in order to save space — and which, on the other hand, may function as spacers, with the result that the separating structure 1 is fixedly seated in the cleaning module 10.

[0041] In figures 4a and 4b, cleaning substructures 7 of different geometrical dimensions, in particular thicknesses, and different combinations of their arrangement in a cleaning module 10 are illustrated schematically. In this embodiment, the cleaning substructures 7 are provided in three different thicknesses of 100 mm, 200 mm, 300 mm or 500 mm, wherein the thicknesses are respectively noted on the cleaning substructures 7. Similarly, there are cleaning modules 10 in different embodiments which differ by the total thickness of cleaning substructures 7 which they are capable of accommodating. Also here, the different total thicknesses of 100 mm, 200 mm, 300 mm or 500 mm are noted on the cleaning modules 10.

[0042] In figure 4b, some different combination options are illustrated, which are numbered consecutively. In the embodiments 1 to 6, a cleaning module 10 which can accommodate cleaning substructures 7 with a total thickness of 500 mm is respectively used. In the embodiments 7 to 9, the cleaning module 10 accommodates cleaning substructures with a total thickness of 300 mm.

[0043] The embodiments 10 and 11 relate to cleaning modules 10 with a total thickness of 200 mm. Embodiment 12 relates to a cleaning module with a total thickness of 100 mm. Embodiment 13 relates to a cleaning module with a total thickness of 500 mm. The different combination options can be taken from this.

[0044] It should be noted that the cleaning substructure 7, which is 300 mm thick, has flaps 11. For the sake of clarity, not all flaps 11 are provided with reference signs. This cleaning substructure 7 configured as a separating structure 1 can thereby serve as a cleaning substructure 7 with a thickness of 300 mm (embodiments 6 and 7 in Fig. 4b) or with a thickness of 200 mm (embodiment 1 from Fig. 4b).

[0045] Cleaning modules 10 may be arranged one behind the other in slide-in frames 12. Also here, different combinations are possible, which is respectively

illustrated schematically (left) on the one hand and perspectively (right) on the other hand in Figures 5a to 5e. Preferably, cleaning modules 10 which are optimized for coarser paint impurities or paint droplets are arranged facing the contaminated airflow. These can then be individually changed. Those cleaning modules 10 which reach their capacity limit later can remain longer in the slide-in frames 12.

Patenttivaatimukset

1. Setti, joka muodostuu ontosta kappaleesta (5), joka käsittää sisääntuloaukon (6) puhdistettavan ilmavirran sisääntuloa varten ja ulostuloaukon puhdistetun ilmavirran ulostuloa varten, sekä useista puhdistusosarakenteista (7) erotusrakenteina (1) ilmavirran puhdistamiseksi erottamalla hiukkasia ja/tai ilmavirran suodattamiseksi, jossa ainakin kaksi puhdistusosarakenteista (7) käsittävät erotusrakenteen (1) ilmavirran puhdistamiseksi,

t u n n e t t u siitä, että

onttoon kappaleeseen (5) on sijoitettavissa ainakin kaksi eri puhdistusosarakenteiden (7) yhdistelmää,

jossa ainakin yksi erotusrakenne (1) käsittää ainakin kaksi olennaisesti ilmavirran suuntaisesti suunnattua läppää (11), joiden väliin on sijoitettavissa ontossa kappaleessa lisäerotusrakenne (1),

jossa läpät (11) on konfiguroitu siten, että läpät (11) ovat sijoitettavissa välikkeinä onton kappaleen (5) sisäseinämään tai lisäerotusrakenteeseen (1).

2. Patenttivaatimuksen 1 mukainen setti,

jossa puhdistusosarakenteet (7) voidaan poistaa ontosta kappaleesta (5) ja/tai sijoittaa onttoon kappaleeseen (5) ontossa kappaleessa (5) olevan avauselementin (8) kautta.

3. Patenttivaatimuksen 1 tai 2 mukainen setti, t u n n e t t u siitä, että ainakin kaksi puhdistusosarakennetta (7) käsittävät suodatinrakenteen (9).

4. Jonkin patenttivaatimuksen 1–3 mukainen setti, t u n n e t t u siitä, että erotusrakenteet (1) on järjestetty eri geometrisissa mitoissa, erityisesti paksuuksissa (100, 200, 300).

5. Jonkin patenttivaatimuksen 1–4 mukainen setti, t u n n e t t u siitä, että ontto kappale (5) on olennaisesti neljäkäsmäinen.

6. Jonkin patenttivaatimuksen 1–5 mukainen setti, t u n n e t t u siitä, että puhdistusosarakenteet (7) käsittävät akselin myötäisessä näkymässä, joka akseli on onttoon kappaleeseen (5) sijoitetussa tilassa olennaisesti ilmavirran suuntainen, ääriviivat, jotka vastaavat olennaisesti onton kappaleen (5) ontelon poikkileikkausta, joka on edullisesti kohtisuora ilmavirtaan nähden.

7. Jonkin patenttivaatimuksen 1–6 mukainen setti, t u n n e t t u siitä, että ainakin yksi erotusrakenne (1) käsittää edullisesti ainakin kaksi ilmavirran suunnassa peräkkäistä kimmahdusseinää (2), jotka on varustettu aukoilla (3).

8. Patenttivaatimuksen 7 mukainen setti, t u n n e t t u siitä, että ainakin kahden kimmahdusseinän (2) väliin on sijoitettu ainakin yksi poikittain kimmahdusseiniin (2) nähden suunnattu vakautusseinä (4).

9. Patenttivaatimuksen 7 tai 8 mukainen setti, t u n n e t t u siitä, että ainakin yksi erotusrakenne (1) on kokoon taitettava.

10. Patenttivaatimuksen 9 mukainen setti, t u n n e t t u siitä, että ainakin yksi erotusrakenne (1) on kokoon taittamisen jälkeen olennaisesti litteä.

11. Patenttivaatimuksen 9 tai 10 mukainen setti, t u n n e t t u siitä, että erotusrakenteen (1) kokoon taittaminen on onttoon kappaleeseen (5) sijoitetussa tilassa estetty onton kappaleen (5) sisäseinämillä.

12. Jonkin patenttivaatimuksen 7–11 mukainen setti, t u n n e t t u siitä, että ainakin yksi erotusrakenne (1) käsittää poikittain ilmavirran suuntaan nähden sivusuunnassa siirrettyjä ja/tai ilmavirran suunnan myötäisesti suuruudeltaan erilaisia aukkoja (3),

jossa erityisesti aukkojen koko on sovitettu erikokoisten hiukkasten erottamiseen.

13. Jonkin patenttivaatimuksen 1–12 mukainen setti, t u n n e t t u siitä, että ontto kappale (5) ja/tai ainakin yksi erotusrakenne (1) koostuu kartongista, paperista tai pahvista.

Fig. 1a

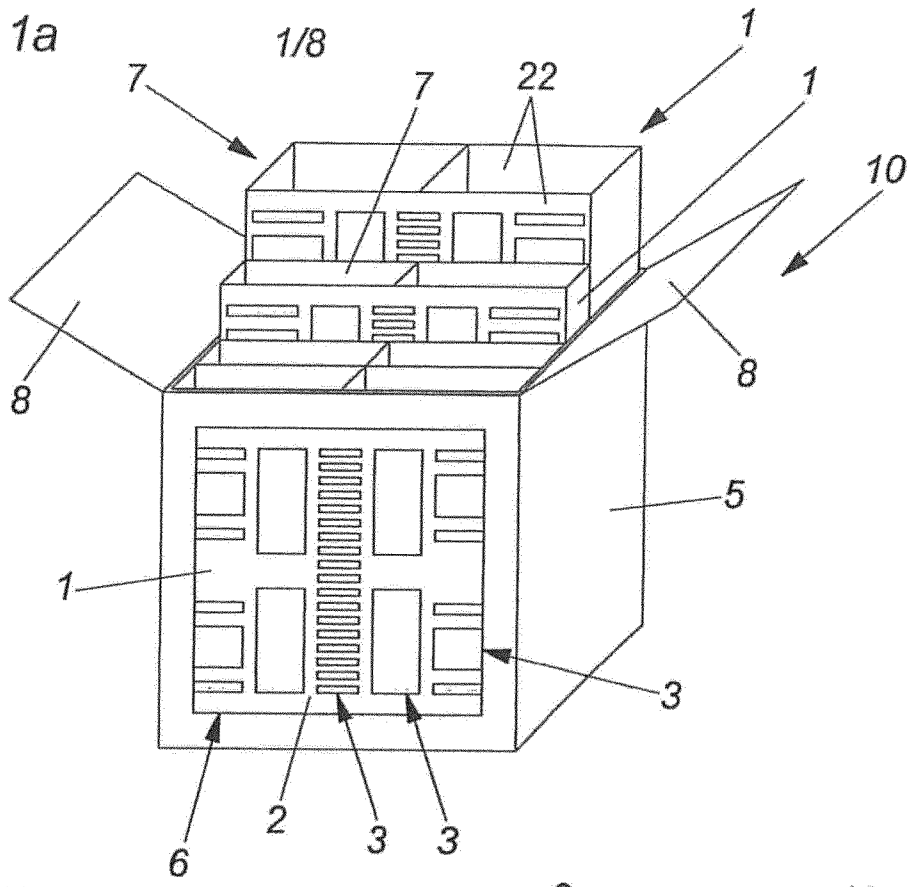


Fig. 1b

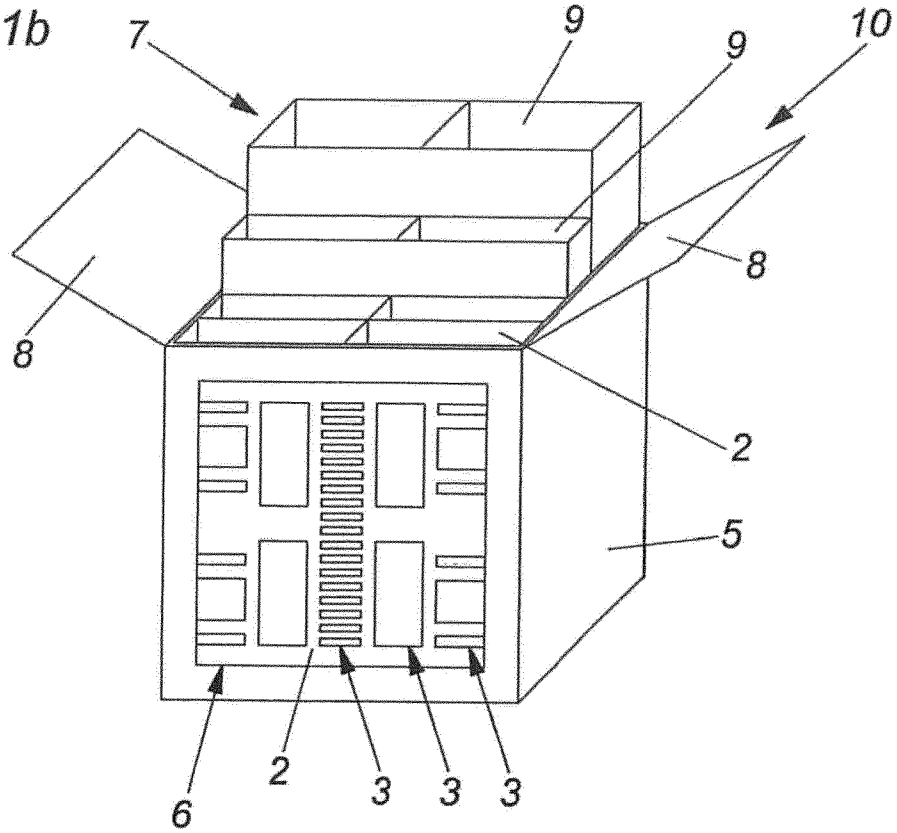


Fig. 1c

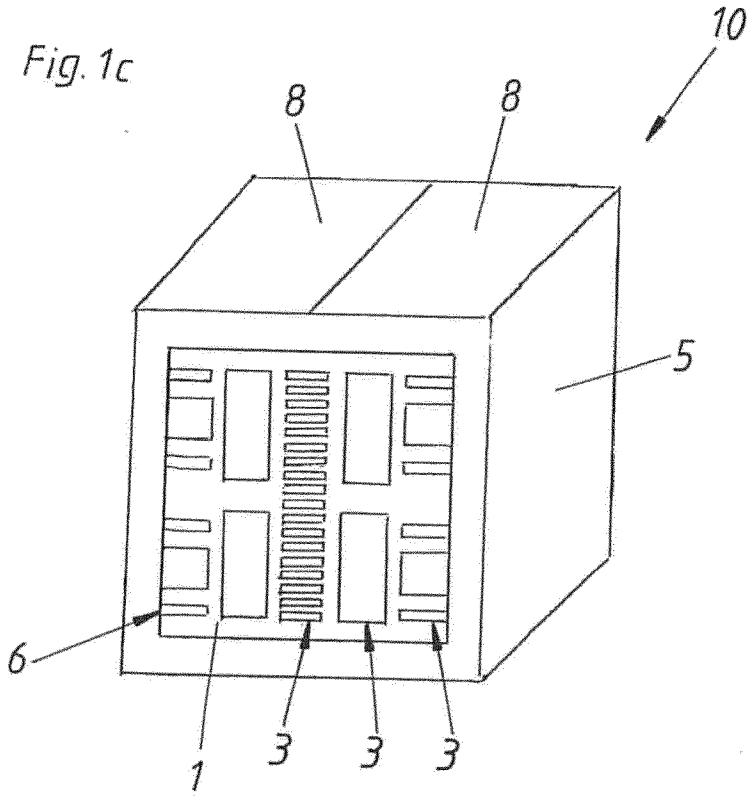


Fig. 1d

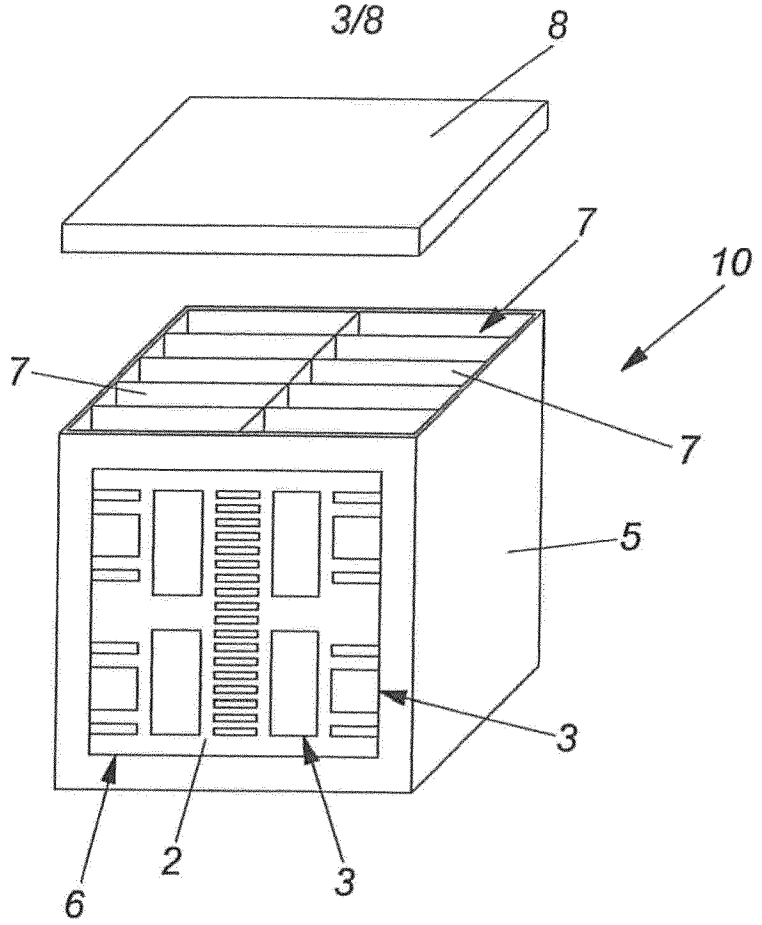
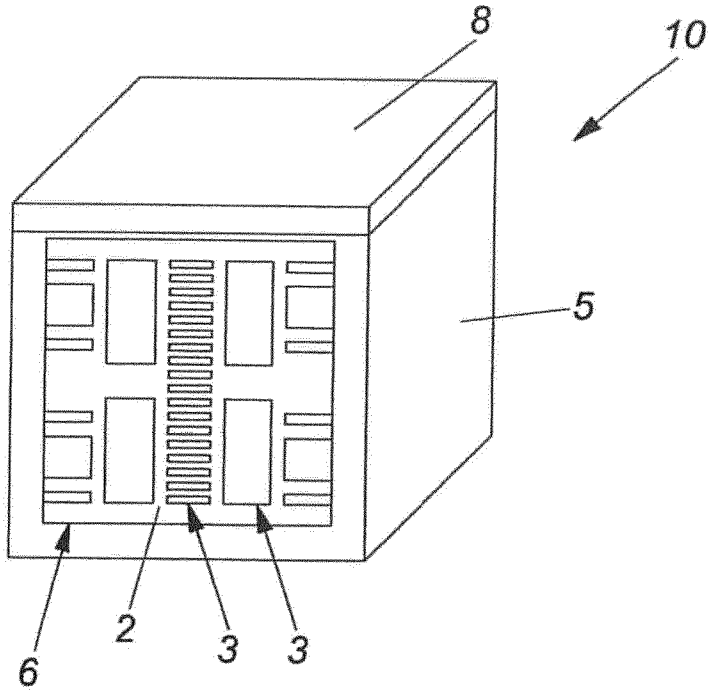


Fig. 1e



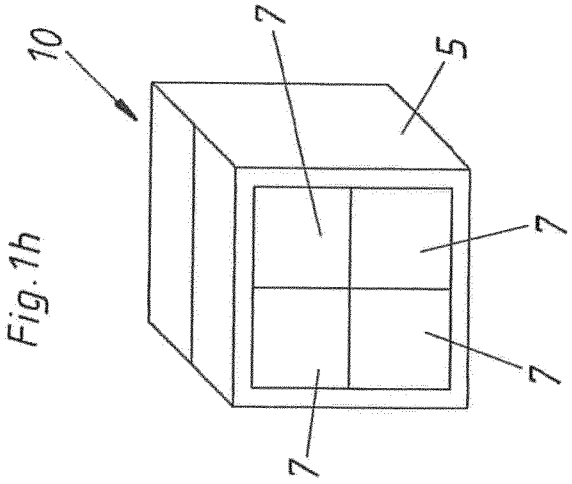


Fig. 1h

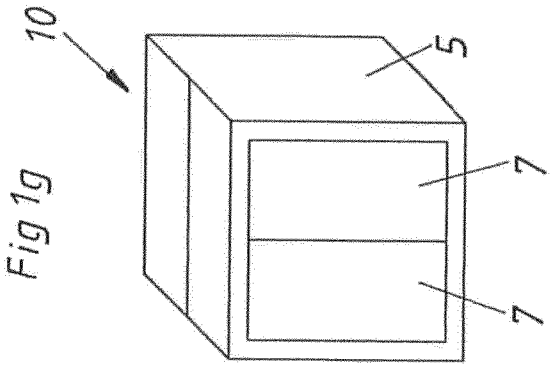


Fig 1g

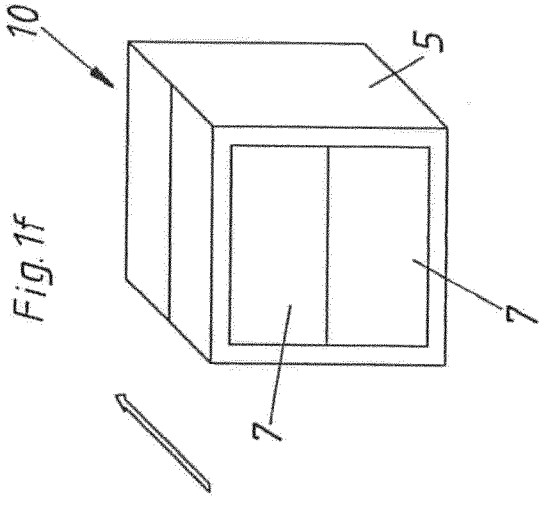


Fig. 1f

Fig. 2a

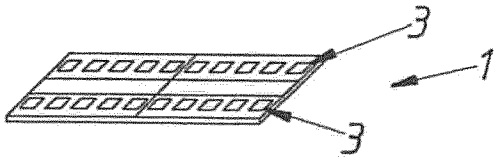


Fig. 2b

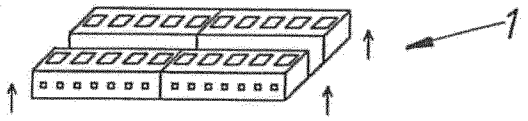


Fig. 2c

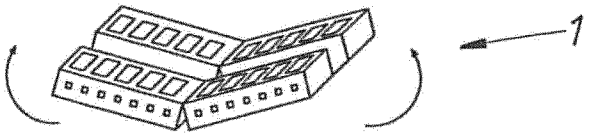


Fig. 2d

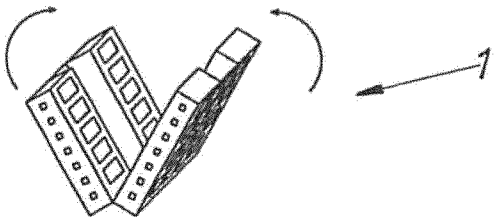


Fig. 2e

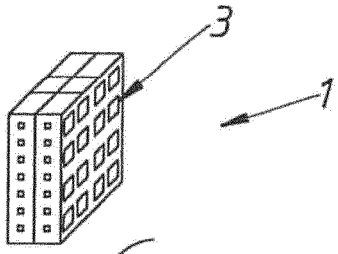


Fig. 2f

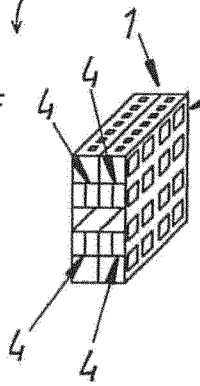


Fig. 2g

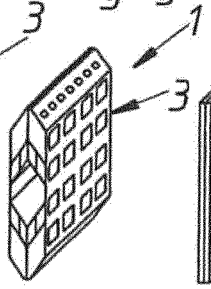


Fig. 2h

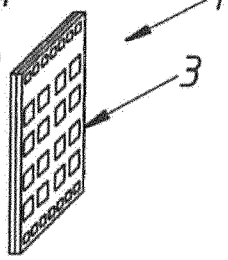


Fig.3a

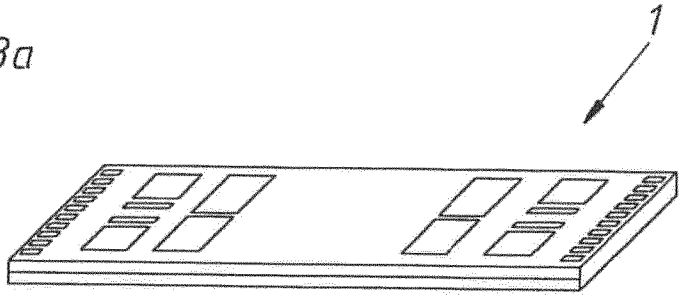


Fig.3b

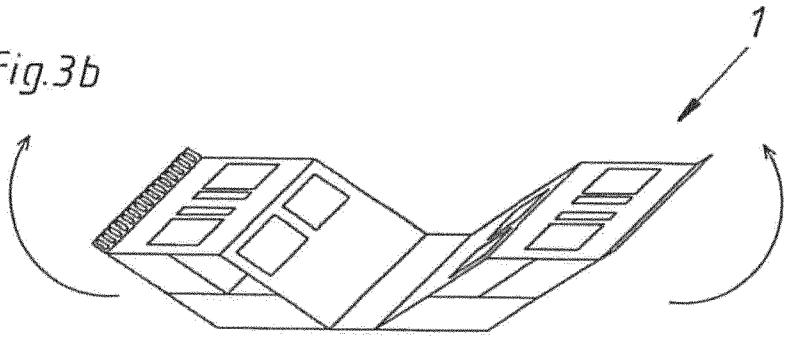


Fig.3c

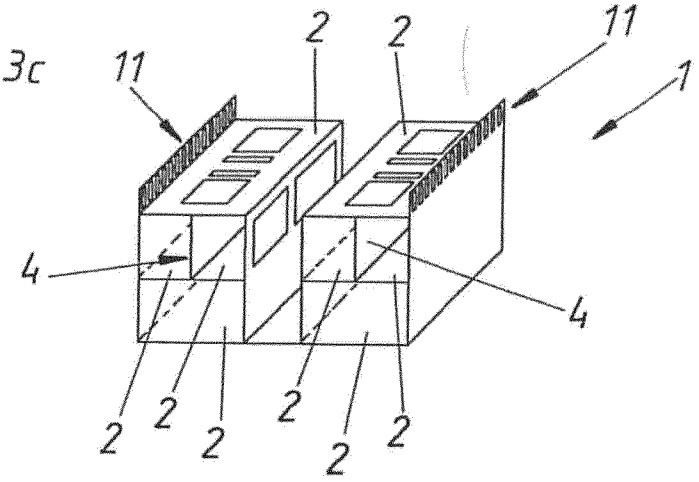


Fig 4a

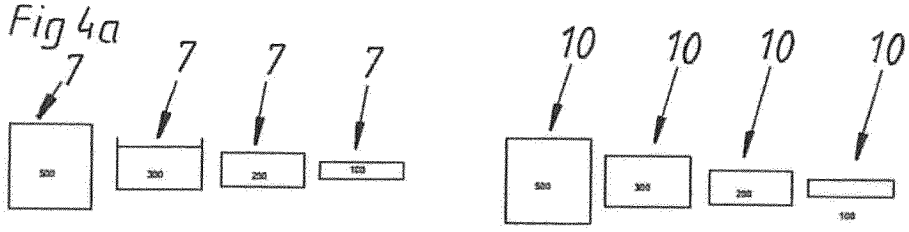


Fig. 4b

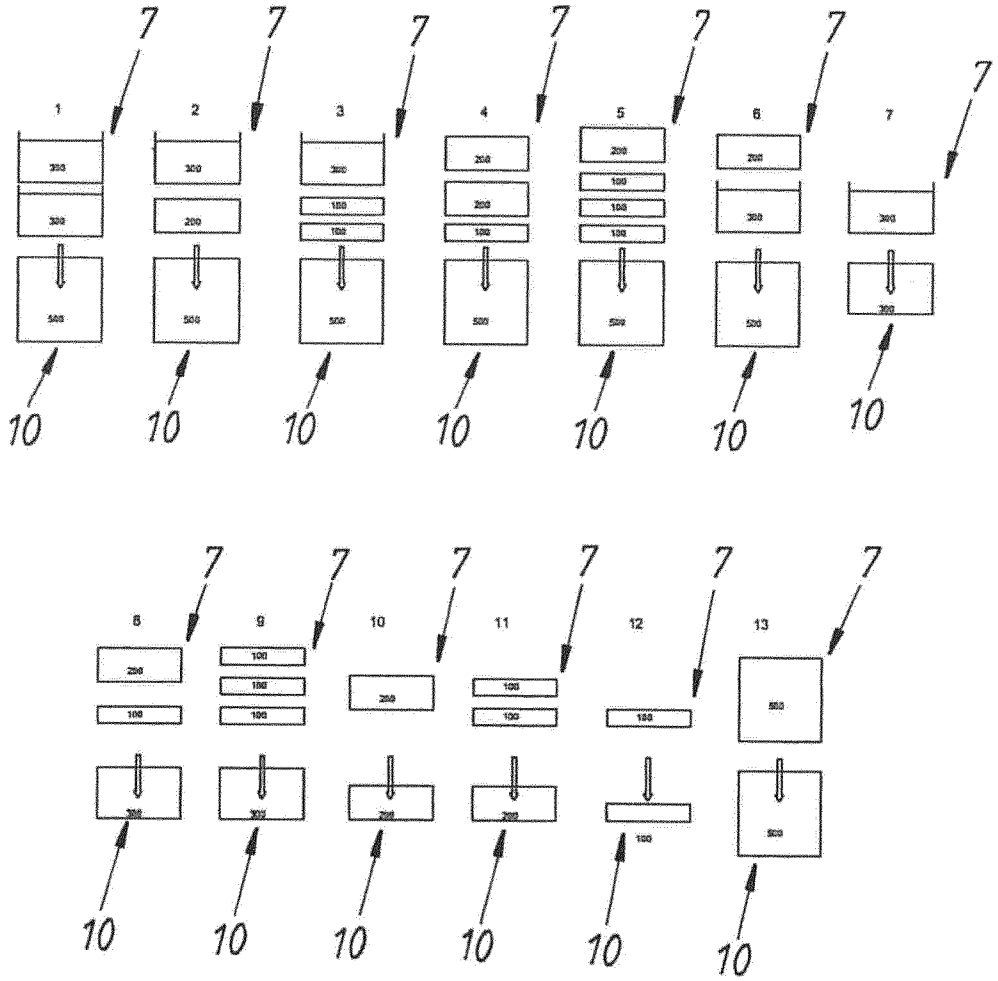


Fig.5a

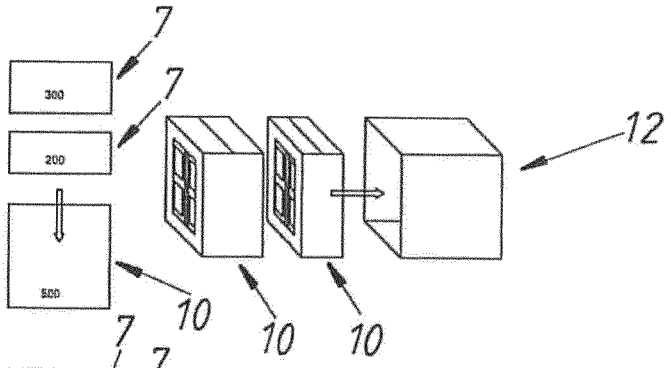


Fig.5b

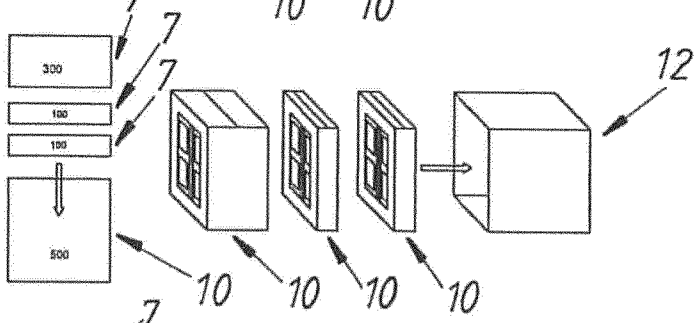


Fig.5c

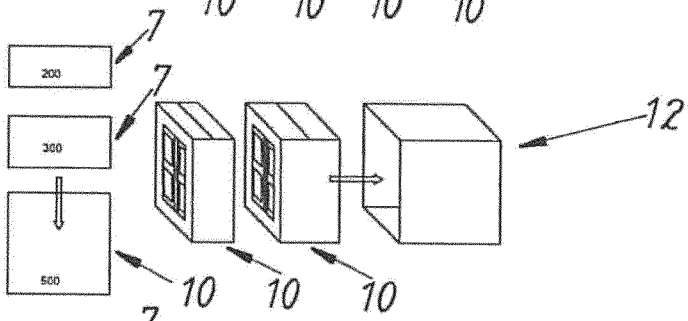


Fig.5d

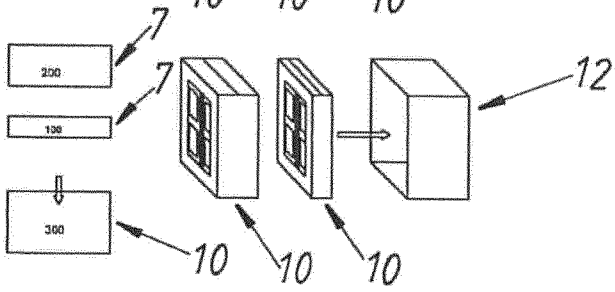


Fig.5e