(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) **World Intellectual Property Organization**
International Bureau

(43) **International Publication Date**
6 August 2015 (06.08.2015)

(10) **International Publication Number**
WO 2015/114582 A1

(51) **International Patent Classification**:
B08B 15/02 (2006.01) ***B01L 9/02*** (2006.01)

(21) **International Application Number**:
PCT/IB2015/050717

(22) **International Filing Date**:
30 January 2015 (30.01.2015)

(25) **Filing Language**: English

(26) **Publication Language**: English

(30) **Priority Data**:
107434 30 January 2014 (30.01.2014) PT

(71) **Applicant**: **LABORIAL, SOLUÇÕES PARA LABORATÓRIO S.A.** [PT/PT]; Via Francisco Sá Carneiro – Rua "A", 91, Zona Industrial da Maia I, Sector VIII, P-4475-132 Maia (PT).

(72) **Inventor**: **MOITA GORGULHO SOARES BRANCO, José Carlos**; Rua Dr. Augusto Martins, n.º 56 12º Andar, P-4470-145 Maia (PT).

(74) **Agent**: **VIEIRA PEREIRA FERREIRA, Maria Silvina**; CLARKE, MODET & CO., Rua Castilho, 50-9º, P-1269-163 Lisboa (PT).

(81) **Designated States** *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

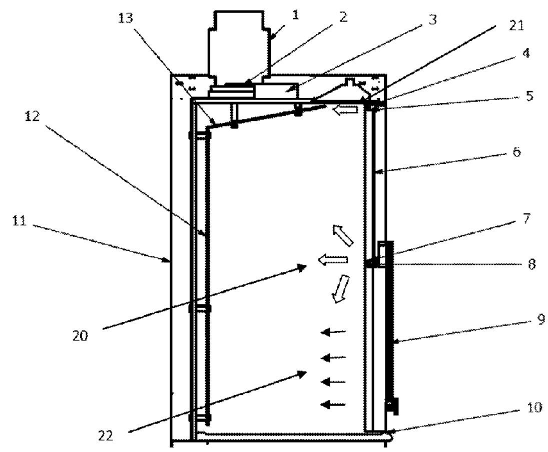
Published:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(54) **Title**: FUME HOOD

Fig. 2



(57) **Abstract**: Low-flow fume hood suitable for reducing the amount of airflow required for adequate isolation and extraction for a laboratory workstation comprising: a housing; a movable front window (9) movably connected to the housing; one or more air exhaust outlets for connecting air flow to one or more extract fans; a first air inlet profile (8) for connecting air flow from one or more inlet fans, wherein the first air inlet profile is arranged substantially horizontal and at the upper edge of the front window opening; baffle or baffle assembly (12,13) mounted adjacent to the rear wall of the housing for providing a directed and vertically controlled air flow to the air exhaust outlets; wherein said first air inlet profile comprises two rows of ejectors, spaced at intervals along said first air inlet profile and each row of ejectors is directed respectively along two different planar directions into the inside of the fume hood.

WO 2015/114582 A1

D E S C R I P T I O N

"FUME HOOD"

Technical Field

[0001] The disclosure relates to fume hoods, or cupboards, for laboratory workstations, to isolate and extract toxic, noxious or unpleasant fumes or other gaseous or other airborne emissions, such as airborne particles or droplets, in particular low-flow fume hoods suitable for reducing the amount of airflow required for adequate isolation and extraction.

Background Art

[0002] Fume hoods, or cupboards, for laboratory workstations are enclosures which are intended to isolate a zone in which experimental or laboratory procedures which are likely to generate toxic, noxious or unpleasant fumes or other gaseous or other airborne emissions such as airborne particles or droplets, which may then be carried out with safety.

[0003] Fume hoods aim to achieve this isolation by arranging for a flow of air into the enclosure, away from the user, to be vented or fed to purification apparatus depending upon the nature and scale of the fumes or other emissions. This flow may be forced by use of one or more extractor fans, which may be located at the fume hood and/or further away, for example integrated in building air ducts, connected by extraction ducts.

[0004] Fume hoods will normally include a movable window which can be opened and closed by the operator of the fume hood, normally by sliding the window in the vertical direction, but it may also open by laterally sliding two overlapping window parts, or even by combining multiple opening systems – for example, a vertically sliding window which has two laterally sliding overlapping window parts. Independently of the opening system, the movable window defines a window opening that may be closed, partially or fully open, depending on the position of the movable window. This window opening gives the operator access to the working zone and also serves as an inlet for air flow into the enclosure.

[0005] Fume hoods may also comprise two frontal window parts – a movable window part and a fixed window part. The movable window part can be opened and closed as referred above. The fixed window part assures that, when the movable window part is open, only part of the front of the fume hood is opened, allowing sufficient opening for operator access while maintaining enclosed a sufficient portion of the front of the fume hood.

[0006] Preferably, one or both of the movable and fixed windows include a transparent surface such the interior of the fume hood may be visible from the outside. This may simply be a glass surface framed and/or supported in a metal structure.

[0007] During operation of a fume hood, air extracted from the interior chamber must of course be replaced by additional air. The additional air can be drawn from the room containing the cupboard, but in the case where the room is heated or the air in the room is otherwise conditioned, the energy consumption of the room heating or the air conditioning is adversely affected by the flow of air into the cupboard. If a number of fume hoods are present in the same room, the total flow of air may be quite above what the building air conditioning equipment is designed to support and will also have an environmentally negative impact. Higher air flows also cause increased filter maintenance costs in the air conditioning equipment.

[0008] It is known to supply additional air from outside the room to replace at least part of the air withdrawn from the fume hood, this additional air being introduced into the room near the fume hood. It has however also been found necessary to heat this air when the cupboard is used in a heated room, to avoid discomfort due to the cold air blowing onto the operator head and shoulders.

[0009] It is also known (e.g. US3747505) to supply additional air introduced directly inside the fume hood to compensate for the withdrawn air. However, this also requires additional ducts and fans to introduce air to the operating chamber at a rate less than the rate of extraction of air or gas from the operating chamber, so as to maintain the operating chamber at a pressure slightly less than ambient pressure. This is more costly and requires complex air duct constructions. Worse, in case of malfunction of the air exhaustion, this compensation air inlet, if kept in operation, will then force the contaminated air through the window into the room.

[0010] It is an objective of the disclosure to overcome these shortcomings of the prior art. It is an objective of the disclosure to provide less costly equipment, requiring less air flow and less energy, lowering the costs in maintaining filters.

Disclosure of the Invention

[0011] In practice, it is found that relatively stagnant pockets of air are formed inside fume hoods, such that contaminants are not fully extracted or may even accumulate. The disclosed fumed hood incorporates means to create additional air flows, in particular to avoid stagnant air pockets. These means are forced air, e.g. introduced by a fan, into one or more air inlets directing air flow into the fume hood.

[0012] It is also found in practice that turbulent air flow around the edges of the operator's window opening allows some leakage of possibly contaminated air back into the space occupied by the operator. The disclosed fumed hood incorporates additional air inlets arranged close to or at the edges of the operator's window, in order to reduce or eliminate leakage of interior air.

[0013] It is disclosed a fume hood for a laboratory workstation comprising: a housing; a movable front window movably connected to the housing, and arranged to be moved to open and close the fume hood and to give operator access of the interior of the fume hood through a window opening in the housing; one or more air exhaust outlets for connecting air flow to one or more extract fans; a baffle or baffle assembly mounted adjacent to the rear wall of the housing for providing a directed and vertically controlled air flow to one or more air exhaust outlets; a first air inlet profile for connecting air flow from one or more inlet fans, wherein the first air inlet profile is arranged substantially horizontal and at the upper edge of the front window opening; wherein said first air inlet profile comprises two rows of ejectors, spaced at intervals along said first air inlet profile and each row of ejectors is directed respectively along two different planar directions into the inside of the fume hood.

[0014] Providing the two rows of ejectors creates air flow in two planes at different directions into the fume hood and enables a much lower air flow to be used by the fume hood. This has in particular advantages in reducing the consumption of conditioned air and reducing maintenance and energy costs.

[0015] The first air inlet profile may be arranged substantially horizontal either at the upper edge of the front window opening or at the lower edge of the fixed front window. These locations are in fact the same: substantially half-way between the interior bottom and interior top of the front of the fume hood.

[0016] In an embodiment, the two planar directions may be arranged: one substantially horizontal and another flowing upwards from the first air inlet profile; or one flowing upwards and another downwards from the first air inlet profile.

[0017] The disclosed specific planar directions were found to be advantageous in terms of fume and contaminant extraction while ensuring the ability to use lower air flows.

[0018] In an embodiment the two planar directions are arranged at an angle measured downwards from the vertical of respectively 75-110° and 130-160°, in particular 85-100° and 140-155°, further in particular 87-93° and 147-153°;
or the two planar directions are arranged respectively at an angle measured downwards from the vertical of 25-60° and 130-160°, in particular 30-55° and 140-155°, further in particular 43-47° and 147-153°;

or the two planar directions are arranged respectively at an angle measured downwards from the vertical of substantially 90° and 150°, or at an angle measured downwards from the vertical of substantially 45° and 150°.

[0019] In an embodiment, the first air inlet profile further comprises a third row of ejectors spaced at intervals along said first air inlet profile, such that the three rows of ejectors are directed by the first air inlet profile curvature along respectively three different planar directions into the inside of the fume hood.

[0020] The provision of three planar directions improves fume and contaminant extraction while ensuring the ability to use lower extraction air flows.

[0021] In an embodiment, the three planar directions may be arranged: one substantially horizontal, another flowing upwards and yet another flowing downwards from the first air inlet profile.

[0022] In an embodiment, the three planar directions are arranged at an angle measured downwards from the vertical of respectively 25-60°, 75-110° and 130-160°; in particular 30-55°, 85-100° and 140-155°; further in particular 43-47°, 87-93° and 147-153°;

or wherein the three planar directions are arranged respectively at an angle measured downwards from the vertical of substantially 45°, 90°, and 150°.

[0023] In an embodiment, the first air inlet profile and the inlet fan or fans are configured to inject into the inside of the fume hood an airflow per meter of width of the fume hood of 6.0 – 25.0 m^2/h, in particular 10.0 – 17.5 m^2/h, further in particular substantially 12.5 m^2/h. Typically, for a fume hood of 1200mm width, this airflow is thus 0 – 30 m^3/h, in particular 12.0 – 21.0 m^3/h, further in particular substantially 15.0 m^3/h.

[0024] An embodiment comprises, further to said first air inlet profile, a second air inlet profile for connecting air flow from one or more inlet fans, wherein said second air inlet profile is arranged horizontally at the top front interior edge of the housing and directed to the interior of the fume hood, and wherein said second air inlet profile comprises at least one row of ejectors spaced at intervals along said second air inlet profile and wherein the second air inlet profile row of ejectors is directed along a planar direction into the inside of the fume hood.

[0025] The second air inlet profile allows an improved air extraction in the top part of the fume hood, in particular near the ceiling of the fume hood.

[0026] In an embodiment, the directed planar direction of the row of ejectors of the second air inlet profile is substantially horizontal. The disclosed planar direction was found to be advantageous in terms of fume and contaminant extraction while ensuring the ability to use lower air flows by the fume hood.

[0027] In an embodiment, the second air inlet profile and respective inlet fan or fans are configured to inject into the inside of the fume hood an air flow in relation to the air flow of the first air inlet profile of 1:4.0 – 1:2.5, in particular 1:3.3 – 1:2.7, further in particular substantially 1:3. Typically, for a fume hood of 1200mm width, this airflow can be 2.5 – 4.0 m^3/h, in particular 3.0 – 3.7 m^3/h, further in particular substantially 3.3 m^3/h.

[0028] In an embodiment, the rows of ejectors of either one or both of the air inlet profiles are rows of perforations in the air inlet profile and are directed along a planar direction by a curvature of the air inlet profile exterior surface. Perforations are relatively easy to produce and, by using a surface curvature perpendicular to the intended ejection direction, ejectors may be thus easily obtained. However, other kinds of ejectors may be used such as nozzles, directed tubelets, among others.

[0029] In an embodiment, the air flow directed to the inside of the fume hood by either one or both of the air inlet profiles is regulated to be constant along the length of the air inlet profile at an upstream air flow location in respect of the air inlet profile ejectors. It was found to be advantageous to regulate air flow at a location prior to the actual ejectors, thus obtaining an easier to set and more stable air flow regulation.

[0030] In an embodiment, either one or both of the air inlet profiles comprises an inner wall separating the air inlet profile into two longitudinal parts, the part of the air inlet profile connecting air flow from the one or more inlet fans and the part of the air inlet profile which has rows of ejectors directed to the inside of the fume hood, wherein said inner wall comprises a row of perforations, linearly spaced at intervals along said air inlet profile and arranged such that the air flow directed to the inside of the fume hood is regulated to be constant along the length of the air inlet profile. This inner wall is relatively easy to obtain and provides an airflow regulation prior to the actual ejectors, thus obtaining an easier to set and more stable air flow regulation.

[0031] In an embodiment, the air flow directed to the inside of the fume hood is regulated to be constant along the length of the air inlet profile either by: varying the area of the inner wall perforations spaced at equal intervals; or by varying the interval at which are spaced the inner wall perforations of equal area. It is within the usual skills in this area the dimensioning of these in order obtain said regulation. In particular this will depend on the actual characteristics of the used air flow fans and respective connecting duct sections and curvatures. The perforations may be circular, rectangular or any other suitable shape.

[0032] In an embodiment, either one or both of the air inlet profiles and respective ejector rows extend laterally to the full width of the interior of the fume hood. This has the advantage that the full width of the fume hood has air flow to facilitate fume and contaminant extraction over its full width.

[0033] An embodiment comprises two linear ventilated-air inlets arranged vertically at each of the lateral edges of the window opening, for directing air towards the interior of the fume hood. This has the advantage of providing additional air flow towards the interior and near the window opening in order to further reduce the possibility of contaminants or fumes escaping to the outside space.

[0034] In an embodiment, the movable front window is movable by sliding, in particular by vertically sliding in a plane substantially parallel to the front of the fume hood. This is advantageous construction option enabling easier operator access.

[0035] In an embodiment, either one or both of the air inlet profiles has a wedged profile with an acute angle such that air flow is compressed in the direction of the inside of the fume hood, providing an intensified directed air flow into the fume hood.

[0036] Note that the vertical alignment of the perforations between the different rows is normally advantageous for construction of the air inlet profiles, but vertically scattered arrangements of the perforations may also be used, but still along the disclosed horizontal perforation rows.

[0037] Note that although rows of ejectors in the air inlet profiles are mentioned, each of these can be interchangeable with a longitudinal slit along the air inlet profile, said slit being arranged to create a planar direction of air flow. Alternatively, an air inlet profile may comprise a number of slits linearly arranged along the air inlet profile, said slits being arranged to create a planar direction of air flow.

Brief Description of the Drawings

[0038] The following figures provide preferred embodiments for illustrating the description and should not be seen as limiting the scope of invention.

[0039] **Figure 1:** Schematic representation of an embodiment of the fume hood.

[0040] **Figure 2:** Schematic representation of an embodiment of the fume hood.

[0041] **Figure 3:** Schematic representation of an embodiment of the fume hood showing a detail of the front upper part, in particular the fixed window.

[0042] **Figure 4:** Schematic representation with a profile section of the air inlet profile at the upper edge of the window opening.

[0043] **Figure 5:** Schematic representation with a perspective view of the air inlet profile at the upper edge of the window opening.

[0044] **Figure 6:** Schematic representation with a detailed perspective view of the air inlet profile at the upper edge of the window opening.

[0045] **Figure 7:** Schematic representation with a profile section of the air inlet profile arranged at the upper edge of the window opening, showing details of three perforations corresponding to three rows of perforations.

[0046] **Figure 8:** Schematic representation of a prior art air inlet profile (e.g. US3747505).

[0047] **Figure 9:** Schematic representation of a perforated longitudinal inner wall of the air inlet profile.

[0048] **Figure 10:** Schematic representation of the dimensioning of the perforations of the longitudinal inner wall of the air inlet profile, showing the optional variable area of the perforations.

[0049] **Figure 11:** Photograph of experimental comparison between (a) prior art high-flow fume hood and (b) presently disclosed low-flow fume hood with three sets of ejector rows in the air inlet profile.

[0050] **Figure 12:** Photograph of experimental comparison of embodiments of the presently disclosed low-flow fume hood between (a) rows of ejectors B+C and (b) rows of ejectors A+C.

[0051] **Figure 13:** Photograph of experimental comparison of embodiments of the presently disclosed low-flow fume hood between three different values of air flow (a - 5 m^3/h; b -10 m^3/h; c - 15 m^3/h).

[0052] **Figure 14:** Photograph of experimental comparison of embodiments of the presently disclosed low-flow fume hood between (a) having only the air inlet profile at the upper edge of the window opening and (b) having both said first air inlet profile and a second air inlet profile arranged horizontally at the top front interior edge of the housing and directed to the interior of the fume hood.

[0053] In the figures, the following are represented:

(1) Extraction collector;

(2) Air inlet fan;

(3) Air inlet collector;

(4) Perforated inner wall of the second air inlet profile;

(5) Second air inlet profile, arranged horizontally at the top front interior edge of the housing;

(6) Fixed front window;

(7) Perforated inner wall of the first air inlet profile;

(8) First air inlet profile, arranged at the upper edge of the front window opening;

(9) Movable front window;

(10) Workstation surface;

(11) Housing back panel;

(12) Back baffle assembly;

(13) Top baffle assembly;

(14) Recess for mounting the fixed window in the first air inlet profile;

(15) Air flow perforations of the first air inlet profile;

16) Air flow perforations of the perforated inner wall of the first or second air inlet profile;

(20) Air flow from the first air inlet profile;

(21) Air flow from the second air inlet profile;

(22) Passive air flow from the exterior of the fume hood, induced by the exhaust air flow, and the first air inlet profile or both air inlet profiles;

(23) Prior art air inlet profile;

(24) Perforations of a prior art air inlet profile.

Detailed disclosure of the Invention

[0054] Figure 1 shows a side view an embodiment of the fume hood having a fixed front window (6), a movable front window (9), a back baffle assembly (12) for extraction, a top baffle assembly (13) for extraction, a first air inlet profile (8) arranged at the upper edge of the front window opening (8) directed to the inside of the fume hood, a second air inlet profile (5) arranged horizontally at the top front interior edge of the housing, and a perforated inner wall of the first air inlet profile (7) for regulating the air flow along the length of the first air inlet profile (8).

[0055] Figure 2 shows a side view an embodiment of the fume hood having an extraction collector (1), an air inlet fan (2), an air inlet collector (3), a fixed front window (6), a movable front window (9), a workstation surface (10), a housing back panel (11), a back baffle assembly (12), a top baffle assembly (13), a first air inlet profile (8), arranged at the upper edge of the front window opening, a perforated inner wall of the first air inlet profile (7), a second air inlet profile (5), arranged horizontally at the top front interior edge of the housing, a perforated inner wall of the second air inlet profile (4). It is also shown the air flow from the first air inlet profile (20), the air flow from the second air inlet profile (21), and the passive air flow from the exterior of the fume hood, induced by the exhaust air flow, and the first air inlet profile or both air inlet profiles (22).

[0056] Figure 3 shows an embodiment of the fume hood showing a detail of the front upper part, in particular the fixed front window (6), a first air inlet profile (8), arranged at the upper edge of the front window opening, a perforated inner wall of the first air inlet profile (7), a second air inlet profile (5), arranged horizontally at the top front interior edge of the housing, and a perforated inner wall of the second air inlet profile (4). It is also shown the air flow from the first air inlet profile (20) and the air flow from the second air inlet profile (21).

[0057] Figure 4 shows an embodiment profile section of the first air inlet profile (8), located at the upper edge of the front window opening, in particular a perforated inner wall of the first air inlet profile (7) and a recess (14) for mounting the fixed window in the first air inlet profile. It is also shown how the air inlet profile may optionally have a wedged profile with an acute angle (AA) such that air flow is compressed in the direction of the inside of the fume hood.

[0058] Figure 5 shows an embodiment perspective view of a first air inlet profile (8) to be arranged at the upper edge of the window opening, in particular a perforated inner wall (7) and air flow perforations (15).

[0059] Figure 6 shows an embodiment detailed perspective view of the first air inlet profile (8) to be arranged at the upper edge of the window opening, in particular a perforated inner wall (7) and air flow perforations (15).

[0060] Figure 7 shows a profile cut section of the first air inlet profile to be arranged at the upper edge of the window opening, showing details of three perforations corresponding to three rows of perforations placed at three angles from the vertical (A, B, C).

[0061] Figure 8 shows a prior art (e.g. US3747505) air inlet profile (87) having one row of perforations (98) which defines a planar direction of air flow directed to the inside of the fume hood, but the present disclosure comprises at least two rows of ejectors in two different planar directions.

[0062] Figure 9 shows the perforated longitudinal inner wall (7) of an embodiment first air inlet profile (8), but it can also represent the inner wall (4) of the second air inlet profile (5), showing in particular the air flow perforations (16) of the perforated inner wall of either the first or second air inlet profile.

[0063] Figure 10 shows embodiment circular perforations (16) of either longitudinal inner wall (7, 4) of the air inlet profiles (8, 5) showing the optional variable diameter (i.e. variable area) of the perforations.

[0064] The pictured tests (figs. 11 – 14) were carried out with a 1200mm width fume hood, with the window open in order to test the exhaustion when the operator is actively working in the workstation through the window opening. The pictures are side photographs of the fume hood, i.e. the same view point of Fig. 1 - the open window is to the right, the back extraction baffles are to the left, the workstation surface to the bottom and the housing ceiling and top baffles to the top of the picture. A smoke source was used with different air flow scenarios. These are described below and summarised in table 1.

Figure	Airflow	Air inlet profiles	Overall extraction	Ceiling extraction
11a	430	-	++	++
11b	300	A+B+C	++	+
12a	300	B+C	++	+
12b	300	A+C	++	+
13a	300	$5m^3/s$	-	+
13b	300	$10m^3/s$	++	+
13c	300	$15m^3/s$	-	-

14a	300	B+C	++	+
14b	300	B+C+D	++	++

Table 1

[0065] Fig. 11 compares embodiments of the presently disclosed low-flow fume hood between (a) prior art high-flow fume hood and (b) presently disclosed low-flow fume hood with three sets of ejector rows in the air inlet profile. It was observed that the overall extraction of fumes is equivalent between the two. However, the extraction at the top of the tested low-flow fume hood was not as good as the reference fume hood, even if it can be considered satisfactory because there is not a window opening at that upper part of the fume wood – note that while the operator is not directly affected, nevertheless there is some possibility that contaminants could accumulate in the upper part of the fume hood.

[0066] Fig. 12 shows a comparison of embodiments of the presently disclosed low-flow fume hood between (a) sets of injectors B+C and (b) sets of injectors A+C. It was observed that both setups were effective at overall extraction, even if both were not as good as the reference in the top part of the fume hood. The observations show that two rows of ejectors (B+C, A+C) in two different planar directions are sufficient for ensuring overall extraction of fumes.

[0067] Fig. 13 shows a comparison of embodiments of the presently disclosed low-flow fume hood between three different values of air flow at the first air inlet profile (a - 5 m^3/h; b - 10 m^3/h; c - 15 m^3/h). It was observed the lower air flow value (a) is not sufficient for ensuring overall extraction because the fumes flow in an organized circular way, flowing abundantly to the top and recirculates fumes and contaminants . The intermediate air flow value (b) creates airflow such that stagnant pockets are not formed – the fumes are extracted in a more directed flow. The higher air flow value (c) creates too much turbulence and the fumes are thus able to contaminate a large part of the space, approaching the window opening, and even intermittently going beyond the opening, thus the fume hood being unable from preventing contamination of the outside space. The optimal values were established to be substantially proportional to the fume hood width.

[0068] Fig. 14 shows a comparison of embodiments of the presently disclosed low-flow fume hood between (a) having a first air inlet profile at the upper edge of the window opening and (b) having both said first air inlet profile and a second air inlet profile arranged horizontally at the top front interior edge of the housing and directed to the interior of the fume hood. It was observed that, by adding the second air inlet profile, the ceiling extraction was improved. The air flow of this second air inlet profile was observed to be best when proportionally related to the air flow of the first air inlet profile by a factor of approximately 1/3. The air flow values of the second air inlet profile were also established to be substantially proportional to the fume hood width.

[0069] The term "comprising" whenever used in this document is intended to indicate the presence of stated features, integers, steps, components, but not to preclude the presence or addition of one or more other features, integers, steps, components or groups thereof.

[0070] The disclosure is of course not in any way restricted to the embodiments described and a person with ordinary skill in the art will foresee many possibilities to modifications thereof without departing from the basic idea of the disclosure as defined in the appended claims.

[0071] The above described embodiments are combinable.

[0072] The following dependent claims set out particular embodiments of the disclosure.

C L A I M S

1. Fume hood for a laboratory workstation comprising:
   - a housing;
   - a movable front window movably connected to the housing, and arranged to be moved to open and close the fume hood and to give operator access of the interior of the fume hood through a window opening in the housing;
   - one or more air exhaust outlets for connecting air flow to one or more extract fans;
   - a first air inlet profile for connecting air flow from one or more inlet fans, wherein the first air inlet profile is arranged substantially horizontal and at the upper edge of the front window opening;
   - a baffle or baffle assembly mounted adjacent to the rear wall of the housing for providing a directed and vertically controlled air flow to the air exhaust outlets;

   wherein said first air inlet profile comprises two rows of ejectors, spaced at intervals along said first air inlet profile and each row of ejectors is directed respectively along two different planar directions into the inside of the fume hood.

2. Fume hood according to claim 1 wherein the two planar directions are arranged at an angle measured downwards from the vertical of respectively 75-110° and 130-160°, in particular 85-100° and 140-155°, further in particular 87-93° and 147-153°; or wherein the two planar directions are arranged respectively at an angle measured downwards from the vertical of 25-60° and 130-160°, in particular 30-55° and 140-155°, further in particular 43-47° and 147-153°;
   or wherein the two planar directions are arranged respectively at an angle measured downwards from the vertical of substantially 90° and 150°, or at an angle measured downwards from the vertical of substantially 45° and 150°.

3. Fume hood according to any of the previous claim wherein the first air inlet profile further comprises a third row of ejectors spaced at intervals along said first air

inlet profile, such that the three rows of ejectors are directed by the first air inlet profile curvature along respectively three different planar directions into the inside of the fume hood.

4. Fume hood according to the previous claim wherein the three planar directions are arranged at an angle measured downwards from the vertical of respectively 25-60°, 75-110° and 130-160°; in particular 30-55°, 85-100° and 140-155°; further in particular 43-47°, 87-93° and 147-153°;
or wherein the three planar directions are arranged respectively at an angle measured downwards from the vertical of substantially 45°, 90°, and 150°.

5. Fume hood according to any of the previous claim wherein the first air inlet profile and the inlet fan or fans are configured to inject into the inside of the fume hood an airflow per meter of width of the fume hood of 6.0 – 25.0 m^2/h

6. Fume hood according to any of the claim 1 to 4 wherein the first air inlet profile and the inlet fan or fans are configured to inject into the inside of the fume hood an airflow per meter of width of the fume hood of 10.0 – 17.5 m^2/h.

7. Fume hood according to any of the claims 1 to 4 wherein the first air inlet profile and the inlet fan or fans are configured to inject into the inside of the fume hood an airflow per meter of width of the fume hood of 12.5 m^2/h.

8. Fume hood according to any of the previous claim comprising, further to said first air inlet profile, a second air inlet profile for connecting air flow from one or more inlet fans, wherein said second air inlet profile is arranged substantially horizontal and at the top front interior edge of the housing and directed to the interior of the fume hood, and wherein said second air inlet profile comprises at least one row of ejectors spaced at intervals along said second air inlet profile and wherein the second air inlet profile row of ejectors is directed along a planar direction into the inside of the fume hood.

9. Fume hood according to the previous claim wherein the directed planar direction of the row of ejectors of the second air inlet profile is substantially horizontal.

10. Fume hood according to any of the previous claim wherein the second air inlet profile and the respective inlet fan or fans are configured to inject into the inside of the fume hood an airflow in relation to the air flow of the first air inlet profile of 1:4.0 – 1:2.5, in particular 1:3.3 – 1:2.7, further in particular substantially 1:3.

11. Fume hood according to any of the previous claim wherein the rows of ejectors of either one or both of the air inlet profiles are rows of perforations in the air inlet profile and are directed along a planar direction by a curvature of the air inlet profile exterior surface.

12. Fume hood according to any of the previous claim wherein the air flow directed to the inside of the fume hood by either one or both of the air inlet profiles is regulated to be constant along the length of the air inlet profile at an upstream air flow location in respect of the air inlet profile ejectors.

13. Fume hood according to the previous claim wherein either one or both of the air inlet profiles comprises an inner wall separating the air inlet profile into two longitudinal parts, the part of the air inlet profile connecting air flow from the one or more inlet fans and the part of the air inlet profile which has rows of ejectors directed to the inside of the fume hood,
wherein said inner wall comprises a row of perforations, linearly spaced at intervals along said air inlet profile and arranged such that the air flow directed to the inside of the fume hood is regulated to be constant along the length of the air inlet profile.

14. Fume hood according to the previous claim wherein the air flow directed to the inside of the fume hood is regulated to be constant along the length of the air inlet profile either by:
varying the area of the inner wall perforations spaced at equal intervals; or

by varying the interval at which are spaced the inner wall perforations of equal area.

15. Fume hood according to any of the previous claim wherein either one or both of the air inlet profiles and respective ejector rows extend laterally to the full width of the interior of the fume hood.

16. Fume hood according to any of the previous claim further comprising two linear ventilated-air inlets arranged vertically at each of the lateral edges of the window opening, for directing air towards the interior of the fume hood.

17. Fume hood according to any of the previous claim wherein the movable front window is movable by sliding, in particular by vertically sliding in a plane substantially parallel to the front of the fume hood.

18. Fume hood according to any of the previous claim wherein either one or both of the air inlet profiles has a wedged profile with an acute angle such that air flow is compressed in the direction of the inside of the fume hood.

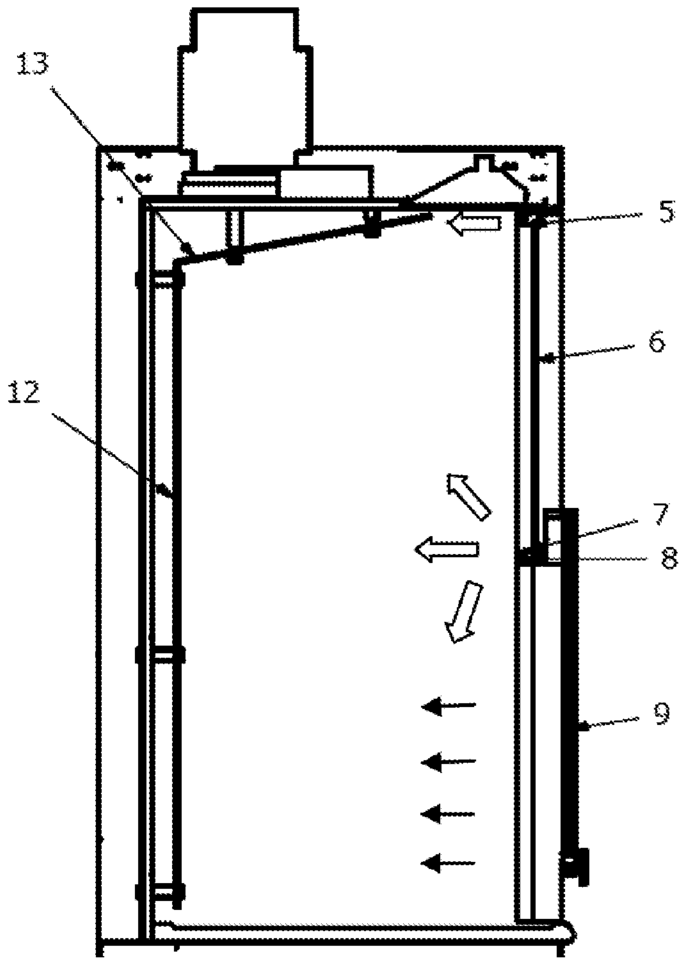


Fig. 1

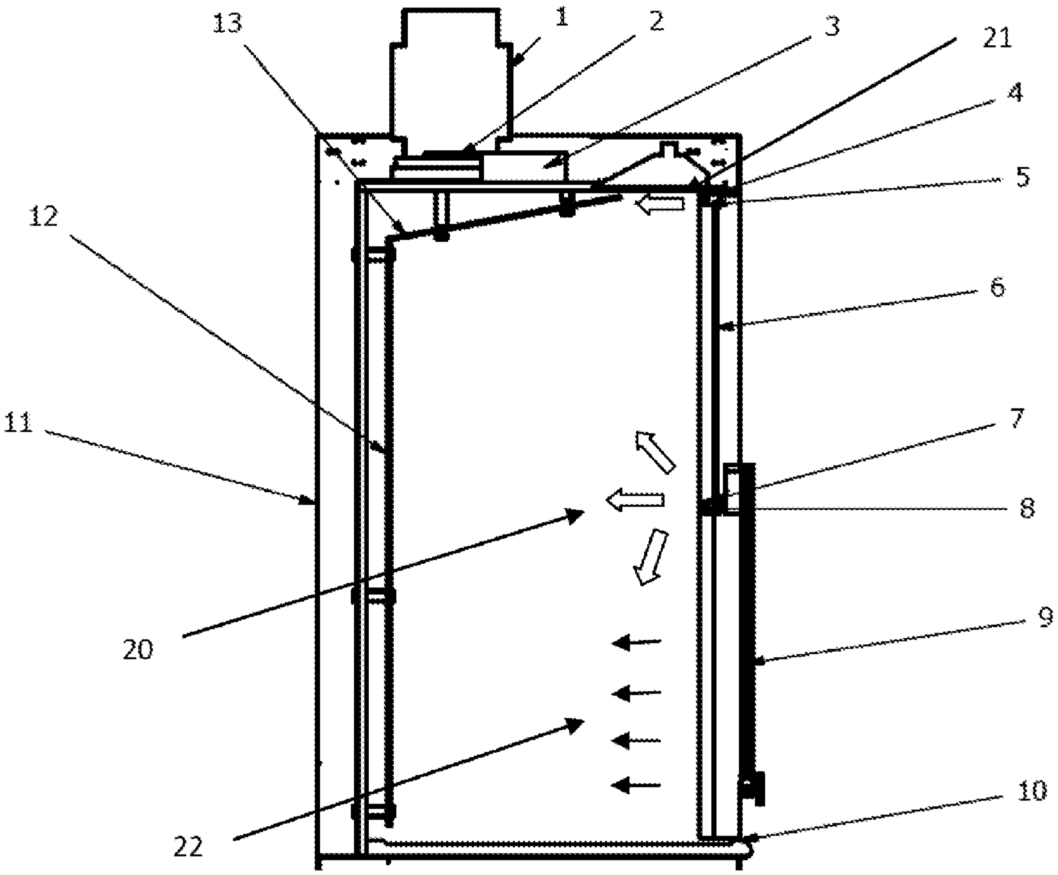


Fig. 2

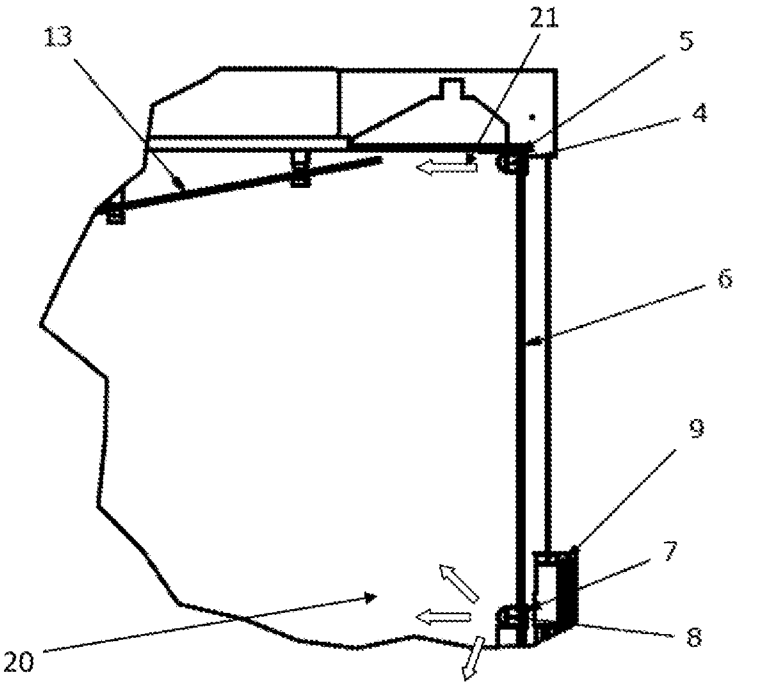


Fig. 3

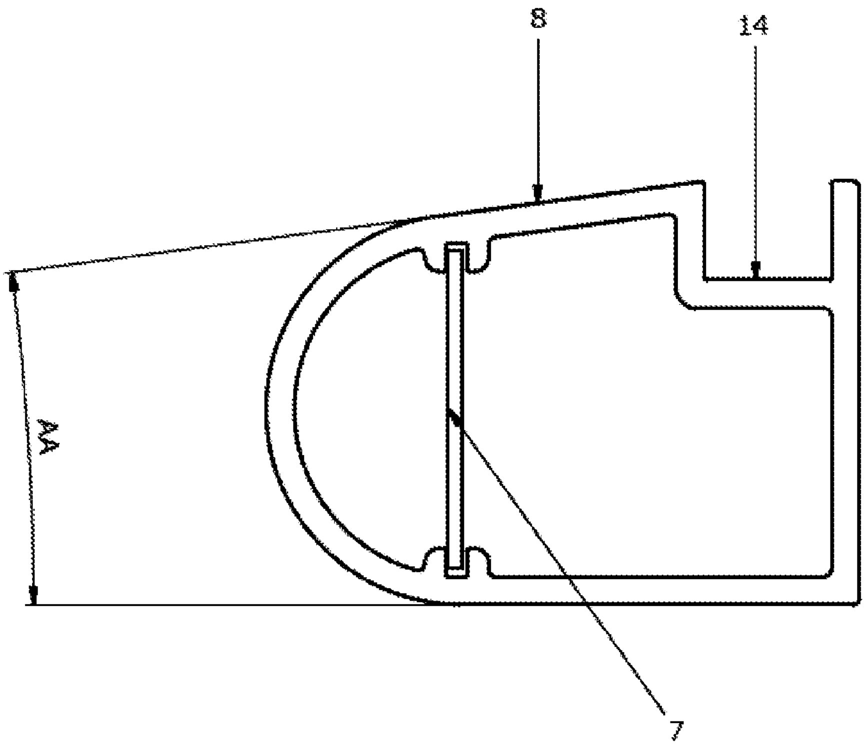


Fig. 4

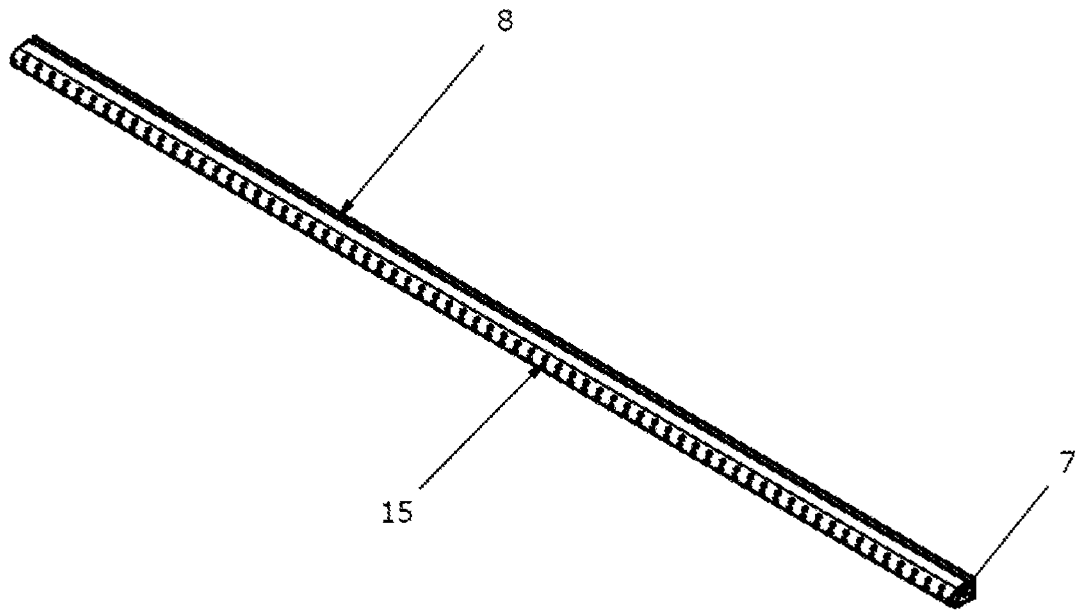


Fig. 5

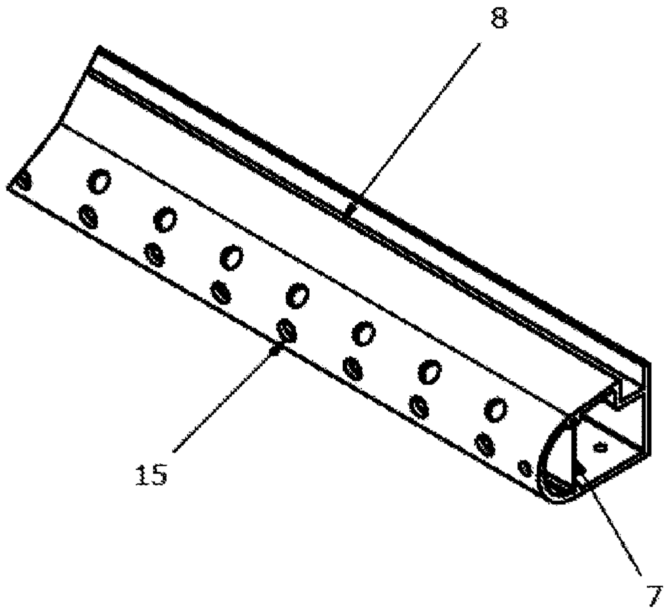


Fig. 6

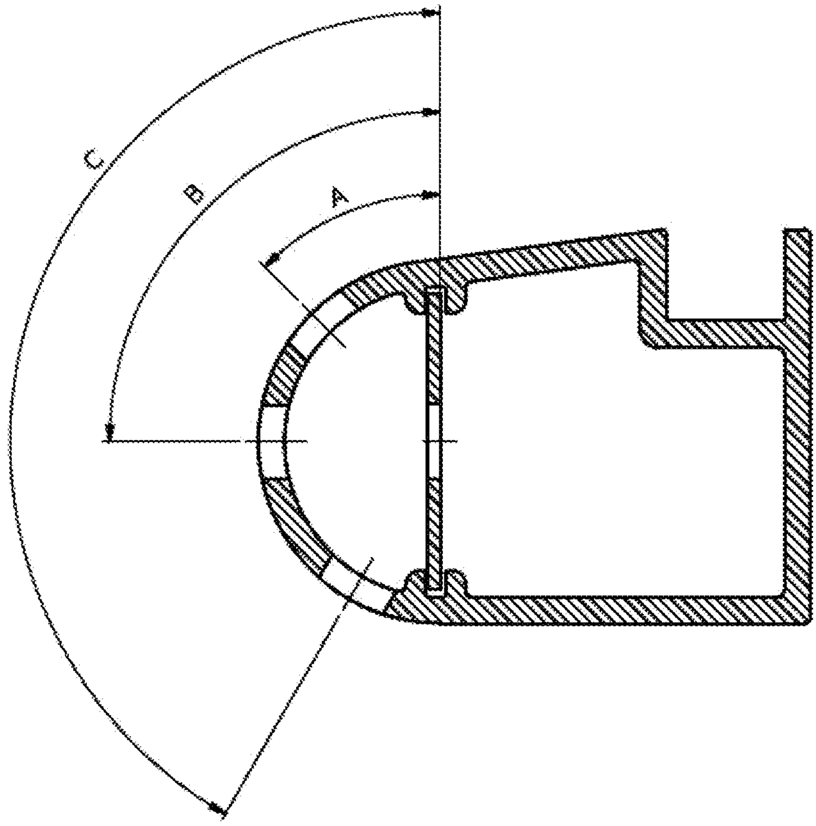


Fig. 7

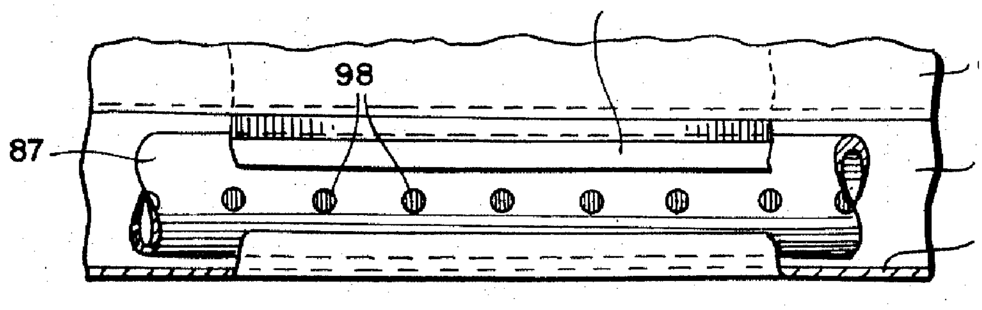


Fig. 8

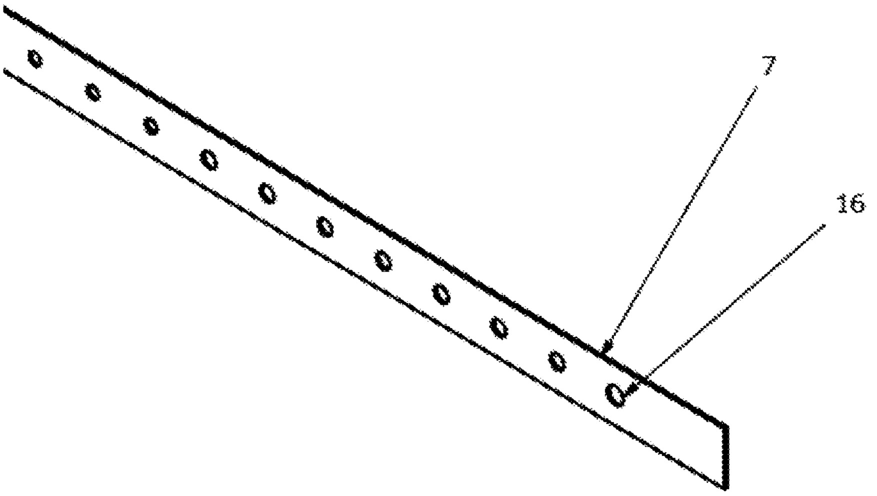


Fig. 9

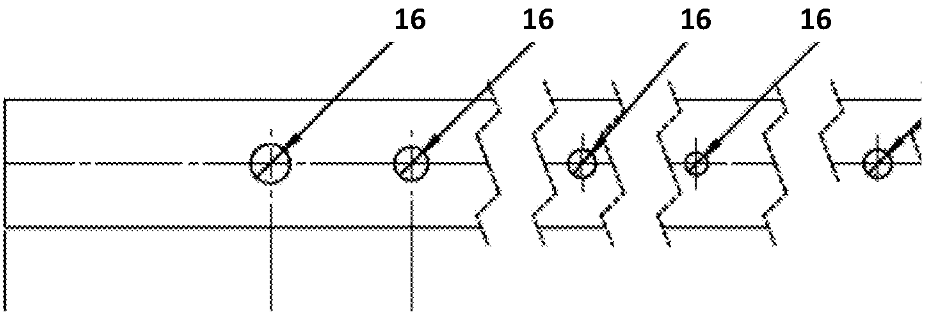


Fig. 10

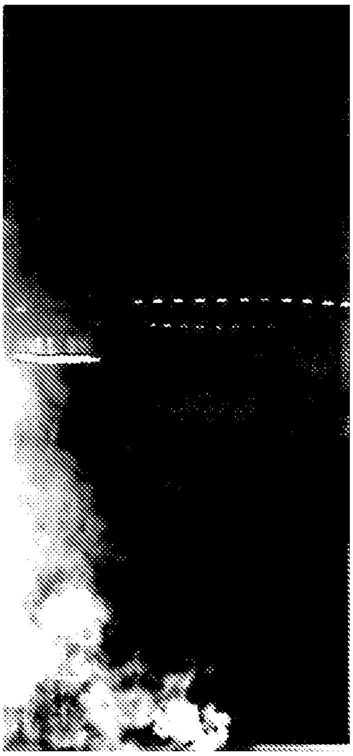


Fig. 11a

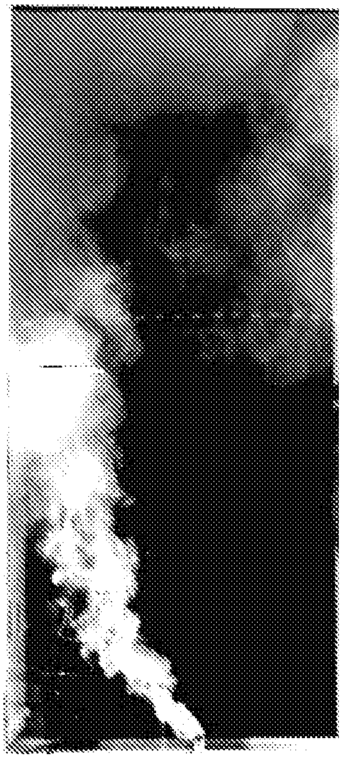
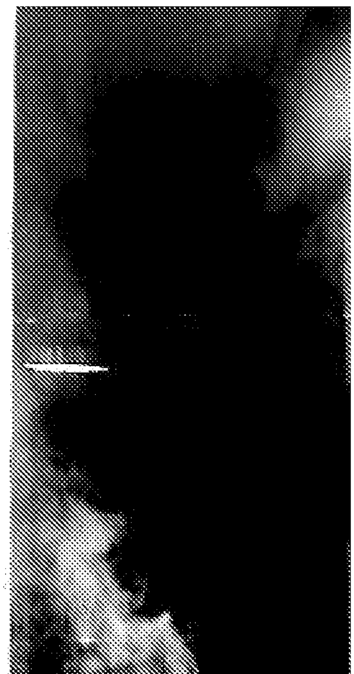


Fig. 11b



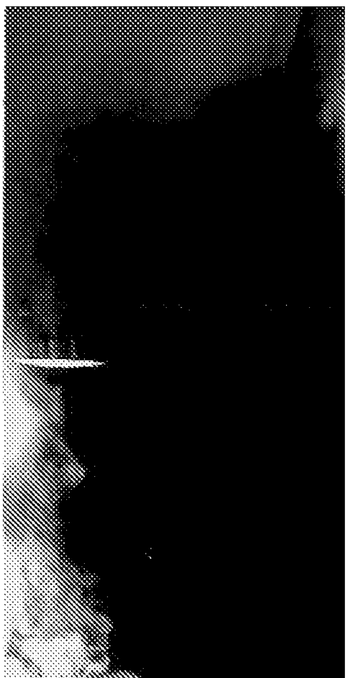


Fig. 12a

Fig. 12b

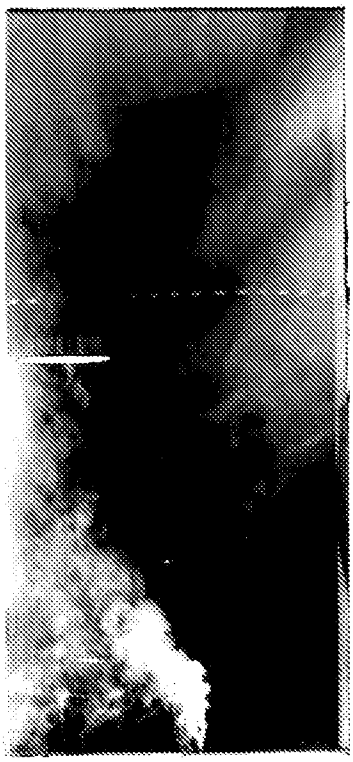


Fig. 13a

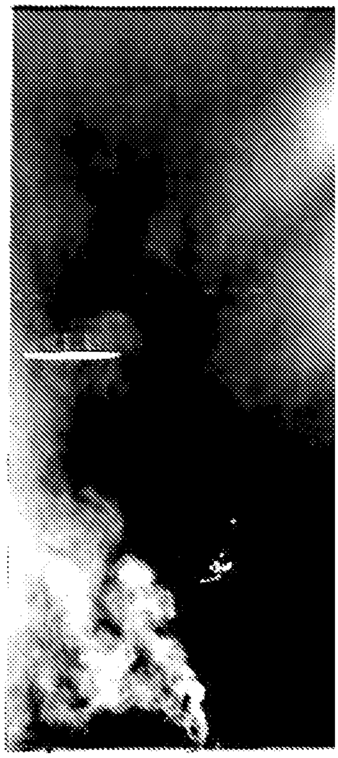


Fig. 13b

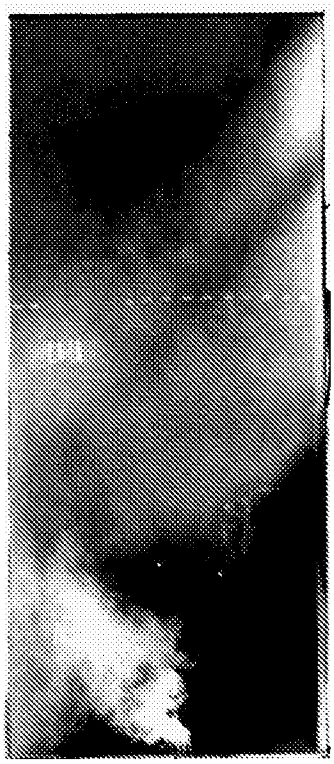


Fig.13c

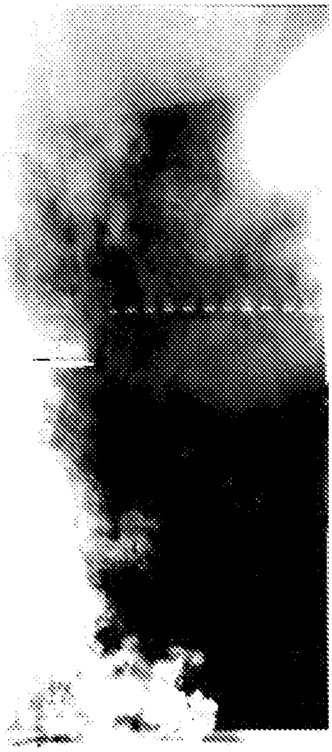


Fig. 14a

Fig. 14b

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2015/050717

A. CLASSIFICATION OF SUBJECT MATTER
INV. B08B15/02 B01L9/02
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B08B B01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	FR 1 253 778 A (SVENSKA FLAEKTFABRIKEN AB) 10 February 1961 (1961-02-10) the whole document -----	1-7,11, 15,17,18 13,14 8-10,16
X A	US 6 461 233 B1 (GILKISON KEVIN C [US] ET AL) 8 October 2002 (2002-10-08) abstract; figures column 8, line 44 - column 9, line 20 -----	1-7,11, 12,15 8-10,13, 14,17,18
X A	GB 2 428 086 A (SMARTFIX UK LTD [GB]) 17 January 2007 (2007-01-17) abstract; figures page 3, line 1 - page 4, line 30 -----	1,2,5-7, 12,15-18 3,4, 8-11,13, 14
	-/--	

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29 May 2015	08/06/2015

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Plontz, Nicolas

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2015/050717

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	DE 199 18 445 A1 (POETTER KLIMA GMBH [DE]) 2 November 2000 (2000-11-02) abstract; figures column 1, line 40 - column 2, line 68 column 4, line 41 - column 5, line 23 -----	1-7,11, 12,15,18 8-10,16, 17
Y	US 4 534 281 A (PARKS JAMES D [US] ET AL) 13 August 1985 (1985-08-13) abstract; figures 1,3,5,7 column 3, line 16 - column 4, line 44 -----	13,14

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2015/050717

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
FR 1253778	A	10-02-1961	NONE	
US 6461233	B1	08-10-2002	NONE	
GB 2428086	A	17-01-2007	NONE	
DE 19918445	A1	02-11-2000	NONE	
US 4534281	A	13-08-1985	NONE	