

LABORATORY FUME HOOD WITH PROFILED FRAME IN THE FRONT SLIDE

The present invention relates to a frame profile for the sash of a laboratory fume cupboard.

Such devices, such as fume cupboards, are an essential component of laboratories. All laboratory work in which gases, vapors, suspended solids or liquids are handled in hazardous quantities and concentrations must be carried out in fume cupboards to protect laboratory personnel. In addition, fume cupboards should also protect laboratory personnel from fire and, if necessary, explosions occurring inside the working chamber. For this purpose, the working chamber is closed at the rear end and on both sides. A vertically movable sash is only provided on the user side, i.e. the front side. This sash can also have one or more cross slides that can be moved manually in a horizontal direction, which allow access to the working chamber even when the sash is closed vertically.

DE 10 2016 113 822 A1 relates to a ventilated safety cabinet with a housing and a horizontally movable drawer. The drawer is automatically retracted by means of a motor and a toothed belt.

DE 20 2006 007 633 U1 also discloses a safety cabinet for holding explosive substances. The safety cabinet has a cabinet door that can be opened and closed pneumatically.

DE 10 2012 011 775 A describes a control device for a fume cupboard, in particular a position sensor that detects the position of the sash of the fume cupboard.

DE 10 2008 030 029 B4 discloses a laboratory fume cupboard comprising a sash with two cross slides. A flow profile is arranged on the underside of the sash. Flow profiles are also arranged on the side posts of the fume cupboard.

DE 103 38 284 B4 also discloses a laboratory fume cupboard which has respective flow profiles on the underside of the front sash and on the front of the side posts.

One objective of the present invention is to further increase the safety and thus the retention capacity of a laboratory fume cupboard comprising at least one cross slide and to further reduce the energy requirement of such a laboratory fume cupboard.

This objective is solved by the subject matter of independent patent claim 1. Optional or preferred features of the invention are indicated in the dependent claims.

According to the invention, a laboratory fume cupboard is provided which has two side posts and a sash connected to the side posts so as to be movable in the vertical direction

for opening and closing a fume cupboard working chamber, wherein the sash comprises a frame, in which at least one cross slide movable in the horizontal direction is arranged, which in an open position defines a cross slide access opening into the fume cupboard working chamber, and wherein the frame has an inflow surface for room air, which is at
5 least partially convex and faces the cross slide access opening.

Preferably, the entire frame inflow surface is convex and faces the cross slide access opening.

Even more preferably, the frame inflow flow surface is designed in the shape of an airfoil.

It is advantageous if the frame has an upper horizontally extending frame element and a
10 lower horizontally extending frame element, which extend from one side post to the other side post, and if the inflow surfaces of the upper horizontally extending frame element and the lower horizontally extending frame element are designed in the form of an airfoil.

It is also advantageous if the frame has a first vertically extending frame element and a second vertically extending frame element, and if the inflow surfaces of the first vertically
15 extending frame element and the second vertically extending frame element are designed in the shape of an airfoil.

Preferably, the upper horizontally extending frame element is cut with a mitre to the first vertically extending frame element and to the second vertically extending frame element.

It is also preferred if the lower horizontally extending frame element is cut with a mitre to
20 the first vertically extending frame element and to the second vertically extending frame element.

According to a preferred embodiment of the invention, a vertical edge of the cross slide has a cross slide inflow surface for room air, which is convex.

Even more preferably, the convex cross slide inflow surface is provided on a cross slide
25 attachment element, which is attached to the vertical edge of the cross slide.

Furthermore, a horizontal cross-sectional area of the convex cross slide inflow surface is preferably crescent-shaped.

It is advantageous if a horizontal cross-sectional area of the convex cross slide inflow surface has an elliptical shape, in particular encloses a circular arc in a range of 60° to
30 120°.

It is even more advantageous if a front end face of each side post is formed with a convex side post inflow surface for room air.

It is also preferable if a vertical hollow profile is arranged on the front end face of each side post, which has the convex side post inflow surface.

- 5 According to a further preferred embodiment of the invention, a front edge of the worktop, which delimits the working chamber on the floor side, is formed with a convex worktop inflow surface for room air.

According to a still further preferred embodiment of the invention, a horizontal hollow
10 profile is arranged on the front edge of the worktop, which has the convex worktop inflow surface.

The invention will now be described purely by way of example with reference to a preferred embodiment and with reference to the attached figures. The figures show:

- Fig. 1 a perspective view of a conventional laboratory fume cupboard;
- Fig. 2 a front view of a front sash of a conventional laboratory fume cupboard
15 with three cross slides;
- Fig. 3 a perspective view of a laboratory fume cupboard according to a preferred embodiment of the invention;
- Fig. 4 a vertical sectional view of a section of the laboratory fume cupboard shown in Fig. 3;
- 20 Fig. 5 a front view of the laboratory fume cupboard shown in Fig. 3, which is partially cut horizontally;
- Fig. 6A the flow behavior of inflowing room air over a conventional sash profile;
and
- Fig. 6B the flow behavior of inflowing room air over a sash profile according to the
25 invention.

The fume cupboard 1 shown in perspective in Fig. 1 corresponds approximately to the fume cupboard that has been marketed by the applicant almost worldwide under the name Secuflow® since around 2002. This fume cupboard is equipped with a support jet

technology developed by the applicant and requires an exhaust air volume flow of only 270 m³/(h·lfm) due to the support jet technology.

5 The fume cupboard 1 has a fume cupboard working chamber 30 which is limited at the rear by a rear wall, preferably by a baffle wall 32 spaced from the rear wall, at the sides by two side walls 36, at the bottom by a base plate 34 or worktop, at the front by a lockable sash 70 and at the top preferably by a ceiling panel.

10 The sash 70 is preferably designed in several parts in such a way that several vertically displaceable window elements extend telescopically one behind the other in the same direction when the sash 70 is opened and closed. The window element arranged furthest down in the closed position of the sash 70 preferably has an aerodynamically optimized profile at its front edge, for example an airfoil profile 75. In addition, the sash 70 has horizontally displaceable window elements, so-called cross slides 71, which allow the laboratory personnel access to the fume cupboard working chamber 30 even when the sash 70 is in the closed position. The cross slides 71 are enclosed by frame elements, of which only the vertical frame elements 72 are shown in Fig. 1.

It should be noted at this point that the sash 70 can also be designed as a two-part sliding window, the two parts of which can be moved in opposite directions in the vertical direction. In this case, the counter-rotating parts are coupled via cables or belts and pulleys with weights that balance the mass of the sash 70.

20 Preferably, there is a duct between the baffle wall 32 and the rear wall of the fume cupboard housing 60, which leads to an exhaust air collection duct 50 on the upper side of the fume cupboard 1. The exhaust air collection duct 50 is connected to an exhaust air device installed on the building side.

25 A piece of furniture 62 is arranged below the worktop 34 of the fume cupboard working chamber 30, which serves as storage space for various laboratory utensils. According to the terminology used here, this piece of furniture 62 is to be understood as part of the housing 60 of the fume cupboard 1.

30 Hollow profiles 10 are provided on the front end faces of the side posts 61 of the fume cupboard 1. Similarly, a hollow profile 20 is provided on the front end face or on the front edge of the worktop 34.

When the term "on the front end face" or "front edge" is used here, this term is not to be understood literally. Rather, it also refers to constructions that are only provided or attached in the area of the front face or in the area of the front edge.

5 Similar to the aerodynamically optimized airfoil profile 75 on the underside of the lowest window element 70, the airfoil-shaped inflow side of the hollow profile 10 or the side post profile 10 is also preferably aerodynamically optimized. The same preferably also applies to the hollow profile 20 on the front face of the worktop 34. The airfoil-like or flow-optimized profile geometry enables a low-turbulence, in the optimum case even a turbulence-free inflow of room air into the fume cupboard working chamber 30 when the sash 70 is partially
10 or fully open.

The reason for this is that the airfoil-like profile geometry of the profiles 10, 20, 75 is designed in such a way that a flow separation of the inflowing room air only takes place at the downstream edge (area) of the profile geometry, and thus only within the fume cupboard working chamber 30 (see also Fig. 6B).

15 With the aid of the hollow profiles 10, 20, so-called support jets, i.e. compressed air jets consisting of compressed air, are introduced along the side walls 36 and the worktop 34 into the fume cupboard working chamber 30. These compressed air jets are conventionally generated by a fan arranged below the worktop 34 and inside the housing 60. The hollow profiles 10, 20 are preferably located in front of the plane of the foremost sash element 70. The jets of compressed air therefore preferably only reach the fume
20 cupboard working chamber 30 when the sash 70 is partially or fully open.

The fume cupboard 1 shown in Fig. 1 is purely exemplary, since the invention can be applied not only to a fume cupboard 1 as shown in Fig. 1, but can also be applied to other types of fume cupboards, for example bench-top fume cupboards, low-room bench-top
25 fume cupboards, deep fume cupboards, walk-in fume cupboards and mobile fume cupboards. These fume cupboards also comply with the European series of standards DIN EN 14175 valid on the filing date of the present patent application. Furthermore, the fume cupboards may also comply with other standards, for example ASHRAE 110/2016, which is valid for the USA.

30 If reference is made to a standard in this description and the patent claims, this always refers to the currently valid standard. This is because experience has shown that the regulations specified in the standards are constantly becoming stricter and therefore a

fume cupboard that complies with the current standard also complies with the regulations of an older standard.

Fig. 2 shows a front view of an exemplary sash 70 known from the prior art, which has three cross slides 71. Each cross slide 31 has a recessed grip 71a, which can be used to
 5 move the respective cross slide 71 manually in a horizontal direction if necessary. The cross slides 71 do not all lie in a vertical plane, but are slightly offset horizontally in relation to one another, as each cross slide 71 is guided in a guide provided specifically for it in the horizontal frame elements 73, 74.

Fig. 2 also shows the vertical frame elements 72, in each of which a vertical edge 76 of
 10 the left or right cross slide 71 shown in Fig. 2 is accommodated in the closed position. The frame elements 72, 73, 74 enclose the cross slides 71 in the same way as a closed picture frame encloses a picture. Furthermore, the frame elements 72, 73, 74 are conventionally planar, i.e. the inflow surface for room air during operation of the fume cupboard 1 is flat. In addition, the aerodynamically optimized airfoil profile 75 already mentioned in
 15 connection with Fig. 1 can be seen on the lower edge of the sash 70, i.e. on the lower edge of the frame element 73.

Fig. 3 shows a perspective view of a fume cupboard 1 according to a preferred embodiment of the invention. In contrast to the fume cupboard 1 shown in Fig. 1, in Fig. 3 the fume cupboard 1 is shown without the base furniture 62. Furthermore, the sash 70
 20 comprises frame elements 82, 83, 84, comparable to a picture enclosed by a closed frame. Thus, the sash 70 comprises two vertical frame elements 82, which are spaced apart by the width of the sash 70, and a lower horizontal frame element 83 and an upper horizontal frame element 84, which are spaced apart by the height of the sash 70 or the cross slide 71, as the case may be. In Fig. 3, the left-hand cross slide 71 is shown in a
 25 slightly open position, in which the cross slide 71 defines a cross slide access opening 71a, through which the fume cupboard working chamber 30 is accessible even when the sash 70 is closed. The vertical edge 76 of the cross slide 71, which cannot be seen in Fig. 3, is preferably provided with an attachment element 85, since it extends over the entire height of the vertical edge 76 of the cross slide 71.

30 Fig. 4 is a vertical sectional view of a section of the fume cupboard 1 shown in Fig. 3. In Fig. 4, the worktop 34 is shown, at the front edge of which a hollow profile 20 is provided, which has an aerodynamically optimized, airfoil-shaped inflow surface 20a for room air. A duct 21 is also indicated, from which compressed air (so-called support jets) emerges into the working chamber 30 of the fume cupboard.

The sash 70 comprises two cross slides 71 that can move in opposite directions horizontally, to the underside of which the lower horizontal frame element 83 is attached. The lower horizontal frame element 83, which is arranged in the direct vicinity of the hollow profile 20, has a convex inflow surface 83a for room air. The inflow surface 83a is preferably aerodynamically optimized and shaped like an airfoil.

An inflow surface 83a, as described in connection with the lower horizontal frame element 83, is also provided on the other frame elements 82 and 84. This can be seen in part in Fig. 5, which is a partially vertically sectioned front view of the fume cupboard shown in Fig. 3.

In Fig. 5, the two vertical frame elements 82 are shown partially horizontally sectioned, and it can be seen that both vertical frame elements 82 each have a convex, preferably aerodynamically optimized, airfoil-shaped inflow surface 82a for room air. It can also be seen that the hollow profiles 10, which are provided in the region of the end faces of the side posts 61 and in the direct vicinity of the vertical frame elements 82, each have a convex inflow surface 10a, which is preferably airfoil-shaped.

Although it is not clearly visible in Fig. 5, the upper horizontal frame element 84 is also designed with a convex, preferably aerodynamically optimized, airfoil-shaped inflow surface 84a for room air.

Fig. 5 shows a sash 70 with two cross slides 71 arranged to move in opposite directions horizontally in the frame elements 83 and 84. The vertical edges 76 of the two cross slides 71 also have a convex cross slide edge inflow surface 85a. The convex inflow surface 85a is preferably provided on a cross slide attachment element 85, which is attached to the vertical edge 76. A horizontal cross-sectional area of the inflow surface 85a of the cross slide attachment element 85 is preferably crescent-shaped. Even more preferably, the horizontal cross-sectional area of the inflow surface 85a has an elliptical shape, in particular the horizontal cross-sectional area of the inflow surface 85a encloses a circular arc in a range from 60° to 120°.

As indicated in Fig. 5, the frame elements 82, 83, 84 are cut with a mitre and butt-jointed. In other words, the upper horizontally extending frame element 84 is cut with a mitre and connected to both vertically extending frame elements 82, and the lower horizontally extending frame element 83 is cut with a mitre and connected to both vertically extending frame elements 82.

With the inflow surface 83a, the convexity follows the direction of flow of the room air from bottom to top, i.e. the convex inflow surface 83a forces the room air to move upwards, while the convex inflow surface 84a forces the room air to move downwards. With the inflow surfaces 82a, on the other hand, the convexity is such that the room air performs a
 5 sideways deflection movement such that it has to overcome a hill rising sideways before it enters the fume cupboard working chamber 30.

Similar considerations apply to the inflow surface 85a of the cross slide attachment element 85, which is attached to the vertical edge 76 of the cross slide 71, with the difference, however, that in the area of the vertical edge 76, the inflow surface 85 does
 10 not continue to rise in the direction of flow of the room air, but runs downhill from there. In other words, the symmetry plane of the inflow surface 85a of the cross slide attachment element 85 is preferably in the plane of the cross slide 71.

The shape of the underside of the lower frame element 83 almost corresponds to the shape of the upper side of the hollow profile 20. In other words, the shape of the underside
 15 of the lower frame element 83 is complementary to the shape of the upper side of the hollow profile 20. The same applies to the vertical frame elements 82 and the hollow profiles 10.

Fig. 6A shows the flow behavior of incoming room air over a conventional sash profile 73. The flow pattern, which is only schematically indicated, clearly shows the early flow
 20 separation at the front edge of the sash profile 73. The flow separation therefore takes place outside the fume cupboard working chamber 30 of the fume cupboard 1.

Fig. 6B, on the other hand, shows the flow behavior of incoming room air over a sash profile 83 according to the invention. Here, the flow separation occurs much later, namely
 25 at the rear edge of the sash profile 83, and thus within the fume cupboard working chamber 30 of the fume cupboard 1. The significantly smaller backflow area in the embodiment according to the invention of Fig. 6B results in a lower potential discharge of harmful substances compared to the significantly larger backflow area of the conventional embodiment of Fig. 6A.

Due to the flow-optimized frame elements 82, 83, 84 of the sash 70, the room air can flow
 30 into the fume cupboard working chamber 30 during operation of the fume cupboard 1 through an even partially open sash 71 without premature flow separation, which in turn effectively prevents harmful substances from potentially escaping from the fume cupboard working chamber 30 and the associated health hazard for the laboratory employee. This

is particularly advantageous if the laboratory employee decides to carry out any work inside the fume cupboard working chamber 30 not through the sash 30, but rather through the cross slide 71 and to keep the sash 30 closed in the process. The inflow surfaces 82a, 83a, 84a, 85a of the frame elements 82, 83, 84 and the cross slide attachment element
5 85, which are at least partially convex, are arranged in such a way that they face the cross slide access opening 71a when the cross slide 71 is open.

In addition, the energy consumption of the fume cupboard 1 can be reduced due to the improved inflow of room air through the cross slide 71, because a reduced exhaust air volume flow is sufficient to ensure the same break-out safety.

Claims

1. Laboratory fume cupboard (1), having two side posts (61) and a sash (70)
 5 connected to the side posts (61) so as to be movable in the vertical direction for
 opening and closing a fume cupboard working chamber (30), the sash (70)
 comprising a frame (82, 83, 84) in which at least one cross slide (71) movable in the
 horizontal direction is arranged, which, in an open position, defines a cross slide
 access opening (71a) into the fume cupboard working chamber (30), and wherein
 10 the frame (82, 83, 84) has an inflow surface (82a, 83a, 84a) for room air which is at
 least partially convex and faces the cross slide access opening (71a).
2. Fume cupboard (1) according to claim 1, wherein the entire frame inflow surface
 (82a, 83a, 84a) is convex and faces the cross slide access opening (71a).
- 15 3. Fume cupboard (1) according to claim 1 or 2, wherein the frame inflow surface
 (82a, 83a, 84a) is designed in the shape of an airfoil.
4. Fume cupboard (1) according to one of the preceding claims, wherein the frame
 (82, 83, 84) comprises an upper horizontally extending frame element (84) and a
 20 lower horizontally extending frame element (83), which extend from one side post
 (61) to the other side post (61), and wherein the inflow surfaces (84a, 83a) of the
 upper horizontally extending frame element (84) and of the lower horizontally
 extending frame element (83) are designed in the shape of an airfoil.
- 25 5. Fume cupboard (1) according to one of the preceding claims, wherein the frame
 (82, 83, 84) comprises a first vertically extending frame element (82) and a second
 vertically extending frame element (82), and wherein the inflow surfaces (82a) of
 the first vertically extending frame element (82) and of the second vertically
 30 extending frame element (82) are designed in the shape of an airfoil.
6. Fume cupboard (1) according to claims 4 and 5; wherein the upper horizontally
 extending frame element (84) is cut with a mitre to the first vertically extending
 frame element (82) and to the second vertically extending frame element (82).
- 35 7. The fume cupboard (1) according to any one of claims 4 to 6; wherein the lower
 horizontally extending frame element (83) is cut with a mitre to the first vertically

extending frame element (82) and to the second vertically extending frame element (82).

- 5 8. Laboratory fume cupboard (1) according to one of the preceding claims, wherein a vertical edge (76) of the cross slide (71) has a cross slide edge inflow surface (85a) for room air, which is convex.
- 10 9. Fume cupboard (1) according to claim 8, wherein the convex cross slide edge inflow surface (85a) is provided on a cross slide attachment element (85) which is attached to the vertical edge (76) of the cross slide (71).
- 15 10. Fume cupboard (1) according to claim 8 or 9, wherein a horizontal cross-sectional surface of the convex cross-slider edge flow surface (85a) is crescent-shaped.
- 20 11. Fume cupboard (1) according to one of claims 8 to 10, wherein a horizontal cross-section of the convex cross slide inflow surface (85a) has an elliptical shape, in particular encloses a circular arc in a range from 60° to 120°.
- 25 12. Laboratory fume cupboard (1) according to one of the preceding claims, wherein a front end face of each side post (61) is formed with a convex side post inflow surface (10a) for room air.
- 30 13. Laboratory fume cupboard (1) according to claim 12, wherein a vertical hollow profile (10) is arranged on the front end face of each side post (61), which has the convex side post inflow surface (10a).
14. Fume cupboard (1) according to one of the preceding claims, wherein a front edge of the worktop (34), which delimits the working chamber (30) on the floor side, is formed with a convex worktop inflow surface (20a) for room air.
15. Fume cupboard (1) according to claim 14, wherein a horizontal hollow profile (20) is arranged at the front edge of the worktop (34), which has the convex worktop inflow surface (20a).