

Dec. 19, 1967

F. HAUVILLE

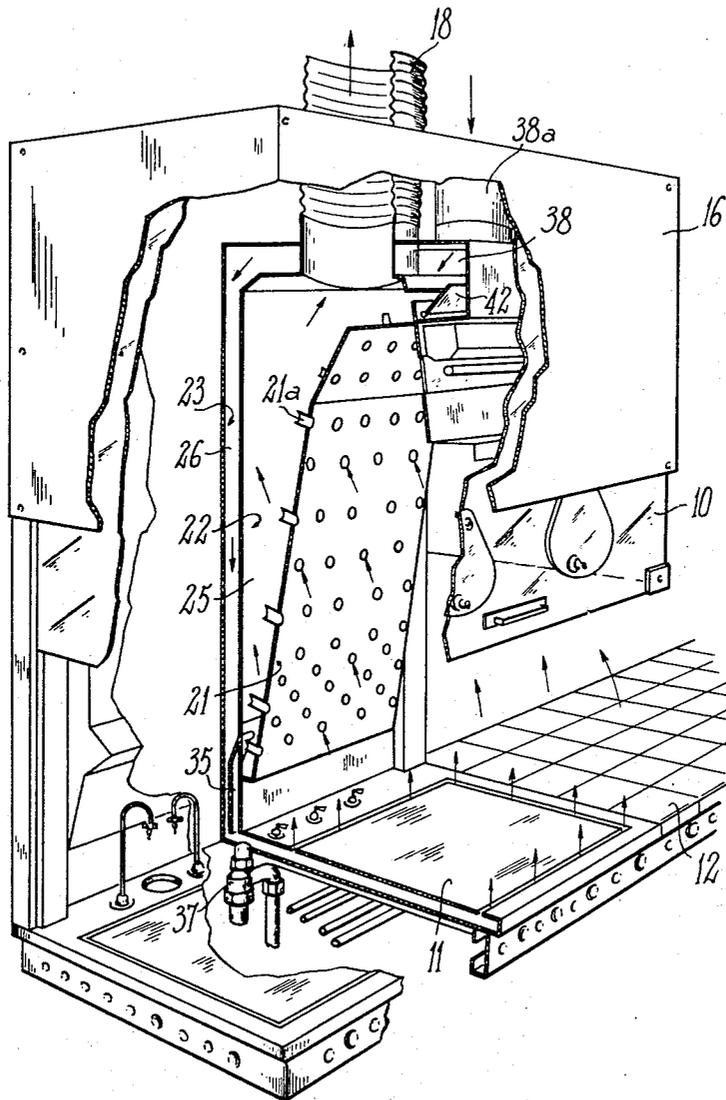
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FUME-CHAMBER VENTILATING DEVICE

Filed March 9, 1966

4 Sheets-Sheet 1

FIG. 1



*Francois Hauville,*  
Inventor

*By. Wendert, Lind & Ponack,*  
Attorneys

Dec. 19, 1967

F. HAUVILLE

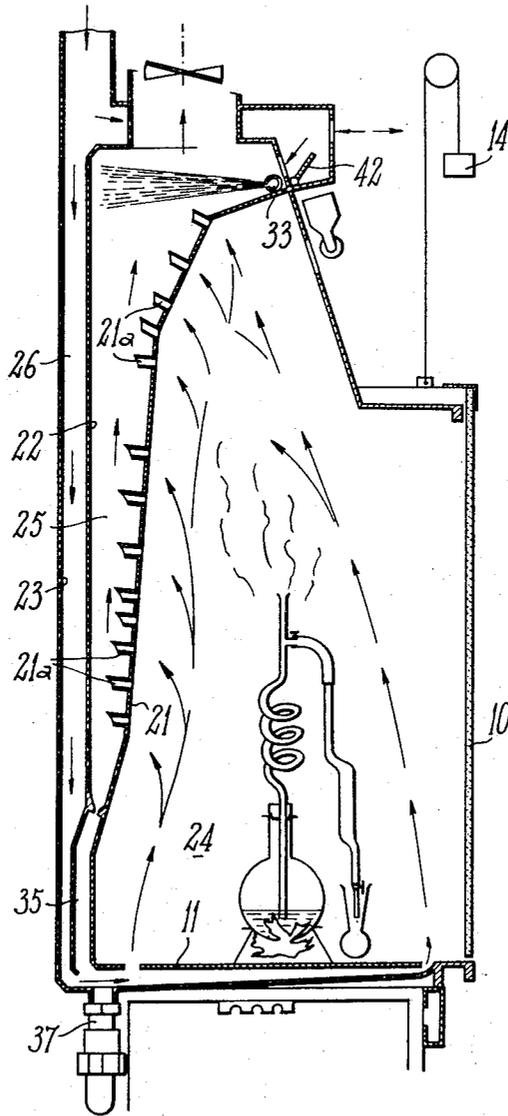
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Filed March 9, 1966

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FIG. 2



*Francois Hauville,  
Inventor*

*By Wenderoth, Lind & Braack,  
Attorneys*

Dec. 19, 1967

F. HAUVILLE

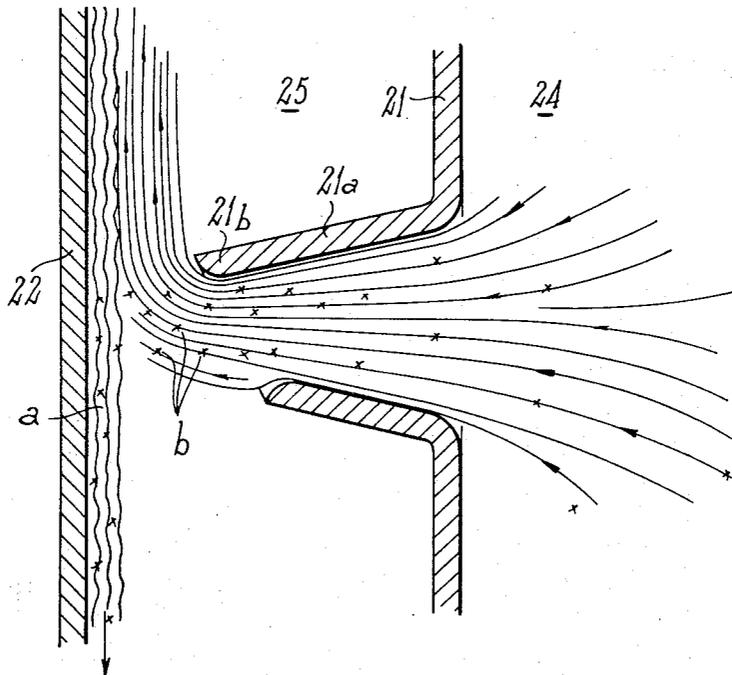
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FUME-CHAMBER VENTILATING DEVICE

Filed March 9, 1966

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FIG. 3



*Francois Hauville,*  
Inventor

*Ray Weenderoth, Lind & Brack,*  
Attorneys

Dec. 19, 1967

F. HAUVILLE

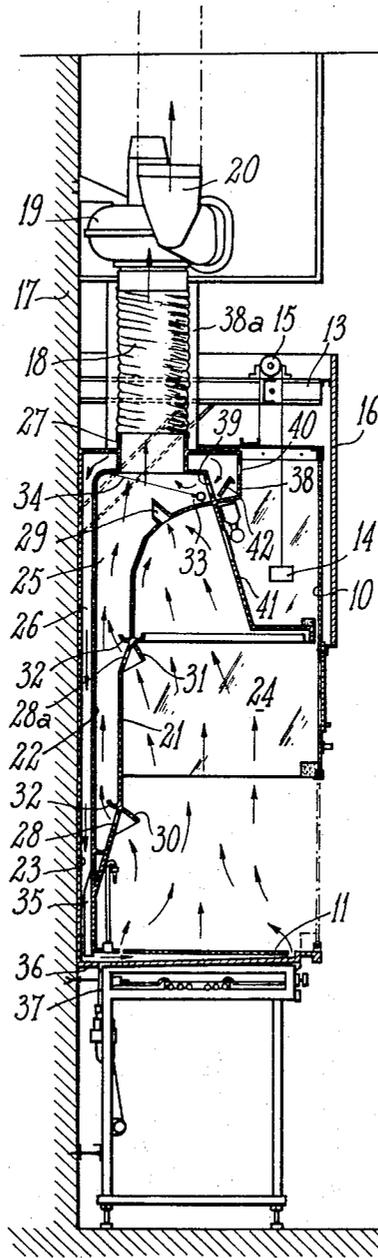
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FUME-CHAMBER VENTILATING DEVICE

Filed March 9, 1966

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FIG. 4



*Francis Hauville*  
Inventor

*By Wendt, Lind & Mack,*  
Attorneys

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**FUME-CHAMBER VENTILATING DEVICE**

Francois Hauville, Boulogne-sur-Seine, France, assignor to Teclab, Rueil, Hauts-de-Seine, France

Filed Mar. 9, 1966, Ser. No. 532,984

Claims priority, application France, Mar. 12, 1965,

8,994, Patent 1,438,343

10 Claims. (Cl. 98—115)

**ABSTRACT OF THE DISCLOSURE**

A hood for the working surfaces of laboratory tables. The internal space of the hood is divided by a partition into a working chamber and a suction chamber. Means are provided for establishing a circulation of air between the two chambers. The partition separating the working chamber from the suction chamber comprises a plurality of vents in the form of conduits formed by truncated cones of convergent tubes which accelerate the circulation of air between the two chambers and are located so that such air strikes the internal wall of the suction chamber and the solid residues carried by the air are separated and entrained by the suction so that they strike a sheet of water projected upon the wall of the suction chamber.

This invention relates to improvements in ventilating devices for equipping notably the hoods or so-called "fume-chambers" usually provided above working benches, tables and like surfaces in laboratories.

These fume-chambers, due to the frequently delicate and sometimes dangerous nature of the works performed on the underlying working surfaces, must compulsorily be equipped with ventilating means capable of meeting particularly strict safety and efficiency requirements while ensuring a ventilation of the working surfaces without causing any disturbance in the various operations performed thereon.

Fume-chamber ventilating devices intended for double-enclosure fume-chambers, i.e. systems comprising an inlet or "handling" chamber and an exhaust chamber, are already known, the gaseous residues released during the laboratory handling operations being drawn from this exhaust chamber and vented to the outer atmosphere.

This two-chamber arrangement of known fume venting devices is obtained by using internal partition means dividing the hood into two chambers communicating with each other through vertically staggered apertures.

However, experience teaches that none of these known devices is capable of providing a satisfactory and complete solution to the problem of educting gaseous or other residues released during handlings on the working surfaces.

Moreover, certain known arrangements comprise means for directing fresh air from the outer atmosphere onto the working surface with a view notably to promote the eduction of residues, notably of gaseous nature, released during these handling operations.

The problem consists essentially first in separating from their vehicle (which is normally the air stream introduced into the fume-chamber) all kinds of particles capable of forming in the fume-chamber condensates of agglomerates likely to develop risks of fire and/or explosion, and second in exhausting the gaseous residues to the outer atmosphere so that they are definitely free of any risk of polluting the atmosphere, and third in enabling the laboratory staff to perform their handling operations under the best possible and safest conditions.

These various requirements are fully met by the improvements brought by the present invention of which the essential purposes are listed hereafter:

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Avoiding the accumulation of condensates and agglomerates of any nature in the fume-chamber ventilating ducts, and the eduction of the residue polluting same to the outer atmosphere.

5 Separating the particles of all kinds usually carried along in a conventional-type ventilation duct by the suction speed of their vehicle (air) as this vehicle flows through the exhaust chamber of the system.

10 Applying this separation to all particles having a density greater than air and therefore likely to be stopped along the walls of the air exhaust ducts of the fume-chamber by a reduction in the flow rate or a surface unevenness.

15 Avoiding the formation of corrosive or detonating agglomerates.

Avoiding the mixing of two condensates of different nature likely to constitute a dangerous assembly.

20 Rapidly reducing the temperature of the vapors released by the operations performed in the fume-chamber as in the case of a condenser in order to increase their density and thus produce condensates heavier than, and therefore definitely dissociated from, atmospheric air.

25 According to a specific feature of this invention these various objects are achieved by providing a communication between the handling chamber and the exhaust chamber by means of duct-like vent passages extending for example horizontally and causing this air on the one hand to flow at a relatively high speed from one chamber to the other, and on the other hand to undergo sudden and sharp changes of direction by causing this air, previously accelerated by said vent passages, to suddenly switch from a horizontal direction to a vertical direction.

30 During the sudden change of direction of the air stream all the particles are projected with force against the inner wall of the suction duct, the inertia of their mass forcing them to continue their initial path.

35 According to another feature of this invention, as the internal wall of the suction duct is constantly swept by a water curtain, the particles thus fixed to its surface are trapped, diluted and entrained to exhaust.

40 According to another feature characterizing the present invention, the duct supplying fresh air from the outer atmosphere comprises means for causing this fresh air to be directed under the working surface of the laboratory table, whereby handling operations can be performed thereon under the best possible conditions while promoting and directing the flow of air streams into the handling chambers with a view to cause them to flow undisturbed into the suction chamber.

45 According to a complementary feature of the invention, the fresh-air supply duct comprises one or more orifices providing a communication between this duct and the upper portion of the suction chamber, each one of these orifices being adapted to be closed more or less by a shutter of which the degree of opening is inversely proportional to the opening of the movable register of the hood, whereby the quantity of air introduced into the handling chamber can be varied at will.

50 The various features and advantages of this invention will appear as the following description of two typical forms of embodiment of the invention proceeds. Of course, these forms of embodiment are given by way of example and should not be construed as limiting the present invention since many modifications may be brought thereto without departing from the spirit and scope of the invention.

55 This description is given with reference to the attached drawing, in which:

60 FIGURE 1 is a perspective view, with parts broken away, showing a fume-chamber equipped with the device of this invention according to a first form of embodiment thereof;

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FIGURE 2 shows on a slightly larger scale the same device as seen in vertical section and elevation;

FIGURE 3 is a section showing on a larger scale a duct-shaped vent passage of the device of this invention; and

FIGURE 4 is a view similar to FIGURE 2 of another form of embodiment of the device according to this invention.

The movable register 10 of the hood is surrounded by a casing 16 in which it is adapted to move freely.

The hood secured to a rear wall 17 having a bracket 13 rigidly fastened or embedded therein is connected through a flexible hose 18 to a suction duct 19 (see FIGURE 4) comprising a suction fan mounted in an exhaust pipe 20.

The ventilation device comprises a series of partitions 21, 22, 23 made from a chemically inert material, which constitute on the one hand a so-called handling chamber 24 in which the gas, vapors, smokes, fumes, etc. from the laboratory handling operations performed on the underlying working surface 11 are collected and on the other hand a suction chamber 25, and finally a jacket or lining 26 for a purpose to be set forth presently.

The innermost partition 21 has inserted therein, in the vicinity of its upper portion, a perforated tube 33 from which a fine curtain or sheet 34 of water of any other suitable liquid is sprayed onto the inner surface of partition 23 for trapping the dust particles and thus prevent same from being retained by the walls of the exhaust chamber where the mixing of these particles with the ambient vapors might produce a coating likely, in the long run, to exert a detrimental action on the material, even if inert constituting the walls of the elements concerned. The ejection of water, in the form of a curtain or sheet, towards the rear wall of the exhaust chamber, promotes the condensation of the released vapors. It is also effective for reducing the aggressiveness of certain acids by diluting same and avoiding the formation of dangerous compounds.

The partition 21 separating the suction chamber 25 from the handling chamber comprises, according to this invention, a plurality of duct-shaped vent passages 21a, as shown more particularly in FIGURE 3.

Each vent passage consists in this example of a convergent tube section projecting into the suction chamber 25 and having a length selected as a function of the rate of acceleration which it is desired to impart to the air jets issuing from the handling chamber.

These vent passages may have any desired and suitable orientation, that is, either uniform throughout the surface area of partition 21 or different according to their specific position in this area, and their distribution may be regular or not.

Advantageously, and as in the selected example illustrated, the tube sections constituting these vent passages have bevelled outlets in order to impart a preferential direction to the air stream issuing therefrom. Their edges are either sharp as shown or slightly rounded as shown at 21b.

The vent passages according to this invention have a twofold purpose. Their first function consist in accelerating the rate of flow of the air jets materialized by arrows in FIGURE 3, as they pass through the duct passages and thus project by inertia, like a gun tube, onto the surface swept by the water sheet *a* dripping on the wall 23, the heavier-than-air particles *b* conveyed by the air stream.

The second function of these vent passages is to divide the suction surface into several zones and therefore increase this surface and create, due to the evaporation produced by the air jets in the water sheet 34 dripping at *a* on the partition wall 23, a marked temperature reduction within the suction chamber 25. Thus, these vent passages act as a mechanical cooling system. As a consequence of this marked temperature drop is to precipitate, in the form of condensates, the vapors released in the handling chamber as they flow through the vent passages, and

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therefore to increase their weight. Thus, they can be separated from the air conveying them by the inertia corresponding to their density. The duct-shaped perforations or ducts distributed all over the outer surface of the suction chamber of the fume exhaust system afford a better distribution of the suctional effect on the gases and vapors penetrating into the handling chamber. The device is not attended by any ventilation pressure reduction and does not increase the usual sound level, so that it can be mounted directly behind the handling chamber without causing any inconvenience for the operator. The particles and vapors of all kinds released from the handling chamber are from the onset condensed, separated from the air stream, trapped, diluted and subsequently educted, without having to follow any preliminary path likely to enable them to become or constitute a corrosive, detonating or inflammable compound, thus avoiding the presence of foreign substances in the ventilation ducts which, in the long run, are always a cause of reduced efficiency of the ventilation system. Finally, as the ventilation ducts remain in a spotless condition their maintenance is considerably facilitated.

The liquid residue and condensates are collected by the troughs 32 at the lower portion of the eduction chamber where they flow through a duct 35 into an inclined vat 36 disposed beneath the working surface 11 and connected to a discharge pipe 37.

The jacket 26 consisting of the space left between partitions 22 and 23 communicates through a passage 38 with a duct 38a receiving fresh air from the external atmosphere by suction. The passage 38 comprises two series of apertures 39, 40 opening the first one into the exhaust chamber and the second one into the space overlying the inclined panel 41 of the fixed hood portion.

The above-mentioned first aperture 39 is adapted to be closed by a shutter 42 connected to the movable register 10 of the fume-chamber by control means such that said shutter moves towards the aperture 39 as a function of the upward movement of the movable register of the fume-chamber.

Finally, the jacket means of the ventilation passage 26 comprises an extension beneath the working surface so as to supply fresh air directly thereto.

Due to the specific arrangements provided according to this invention for directing fresh ventilation air into the device, it is possible:

To direct fresh scavenging air into the upper portion of the exhaust chamber in order to facilitate the eduction;

To collect gases and the like which have not been introduced into the inlet chamber, due to the slight suction produced around the orifice 40;

To set up a "closed" ventilation circuit by lowering the hood completely, due to the delivery of fresh air to the working surface, thus practically avoiding any taking of air from the room which might prove undesirable for certain operations and which, in any case, would produce a detrimental "sweeping" of the working surface; and finally

To vary the quantity of air introduced into the inlet chamber.

In the specific form of embodiment illustrated in FIGURE 4, the handling chamber 24 and the suction chamber 25 (the latter being connected through a portion having the shape of a tubular section 27 to the eduction hose 18) communicate with each other through a series of elongated, staggered orifices 28, 28a and, in the upper portion of the device, through nozzles 29.

Different suction rates may be obtained by altering the combined dimensions of the orifices and of said inlet chamber.

The arrangement according to this invention, which consists in establishing a communication between the inlet chamber and the exhaust chamber by means of a plurality of staggered orifices, is advantageous, inter alia,

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in that the gaseous volumes released above the working surface or table can be evacuated at different and fractional rates; under these conditions, all consequents detrimental to the equipment in case of a sudden release of considerable gaseous volumes at the level of the working surface are practically eliminated.

Moreover, according to this invention, properly directed baffle means 30, 31 overlie the orifices 28, 28a. These baffle means are adapted not only to set up a path for the gaseous streams or jets but also to prevent these from following a preferential path towards the walls on which condensation effects might take place. This condensation, due to the specific arrangement contemplated herein, take place on the walls of the exhaust chamber. The condensates are collected in troughs 32 overlying the afore-mentioned orifices 28, 28a, in order to prevent their back-flow, through these orifices, into the inlet chamber. The nozzles 29 have the same function as the above-mentioned baffle means as far as the upper portion of this chamber is concerned.

Of course, this invention should not be construed as being limited by the specific form of embodiment described hereinabove and illustrated in the attached drawing. Thus, in those cases where the direct eduction of gaseous residues to the atmosphere is prohibited, for safety reasons, these residues, after properly filtering and scrubbing same, may be recycled in the ventilation duct. In other cases this duct, instead of being connected directly to a device for supplying air under pressure, may be connected to a simple air intake disposed at a proper location.

Although the present invention has been described in conjunction with a preferred embodiment, it is to be understood that modifications and variations may be resorted to without departing from the spirit and scope of the invention, as those skilled in the art will readily understand. Such modifications and variations are considered to be within the purview and scope of the invention and appended claims.

What I claim is:

1. A fume hood particularly for laboratory tables to separate the solid residues and the gaseous residues from the fumes and evacuate them separately comprising a casing, a partition in said casing dividing said casing into a working chamber and an evacuation chamber having an internal wall communicating with one another, evacuation means for the solid residues at the lower portion of said casing, means for ejecting the gaseous residues to the atmosphere at the upper portion of said casing, suction means for establishing a circulation of air between said chambers, a plurality of vents in the form of conduits formed by convergent tubes in said partition projecting into said evacuation chamber and directed towards said internal wall so that air charged with said residues in said working chamber flows at greater speed into said evacuation chamber, said vents strongly projecting the solid residues upon said internal wall, means for projecting a current of descending fluid upon said internal wall to trap

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and dilute said solid residues and carry them towards said evacuation means while the gaseous residues are ejected to the atmosphere.

2. A fume hood as set forth in claim 1 wherein said vents are shaped as truncated cones.

3. A fume hood as set forth in claim 1 wherein said vents are distributed over the entire surface of said partition to increase the suction surface and produce a temperature drop in said fumes thus causing the residues carried along by said air to condense as they flow through said vents to facilitate their projection in the form of condensate on to said internal wall.

4. A fume hood as set forth in claim 1 wherein said tubes have beveled ends.

5. A fume hood as set forth in claim 1 wherein said tubes have rounded ends.

6. A fume hood as set forth in claim 1 wherein said suction means has a fresh air supply duct having an opening beneath said working chamber extending horizontally to supply fresh air to said working chamber.

7. A fume hood as set forth in claim 6 wherein said fresh air supply duct comprises a plurality of orifices to connect said duct with the upper portion of said evacuation chamber and shutter means are associated with said orifices to control the quantity of air introduced into said working chamber.

8. A fume hood as set forth in claim 7 wherein said hood has a movable register and said shutter means are opened in proportion to the opening of said movable register.

9. A fume hood as set forth in claim 1 wherein said partition has vertically staggered inlet apertures formed therein and said inlet apertures are provided with shutter means to preferentially direct the gaseous residues from said working chamber to said evacuation chamber.

10. A fume hood as set forth in claim 1 wherein said evacuation means comprises troughs for collecting the condensates from said residues and preventing them from penetrating into said evacuation chamber.

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ROBERT A. O'LEARY, *Primary Examiner.*

MEYER PERLIN, *Examiner.*

M. A. ANTONAKAS, *Assistant Examiner.*