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**LUEDI**(10) **Pub. No.: US 2015/0087218 A1**(43) **Pub. Date: Mar. 26, 2015**(54) **CONFIGURATION AND METHOD FOR  
VENTILATING A ROOM, MORE  
PARTICULARLY A LABORATORY ROOM**(52) **U.S. Cl.**  
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USPC ..... **454/237**(71) Applicant: **H. LUEDI + CO. AG**, Regensdorf (CH)(72) Inventor: **HANSJOERG LUEDI, WOLLERAU**  
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**F24F 7/04** (2006.01)(57) **ABSTRACT**

A configuration ventilates a room with an access area and on either side work tables. The configuration has an air supply duct arranged above the access area for supplying fresh air, and an air exhaust air duct arranged above this for extracting exhaust air. The air supply duct has two side air supply slit outlets, and a central partition section. The exhaust air duct has two slit-like exhaust openings extending parallel to the air supply duct and are arranged in the ceiling so that on each side of the access area an air roll is formed through which supply air warmed up in the region of the work tables passes vertically into the region of the ceiling. The work tables have in an area of the back, a slit-like opening through which warm air can flow upward out from the area underneath the table top.

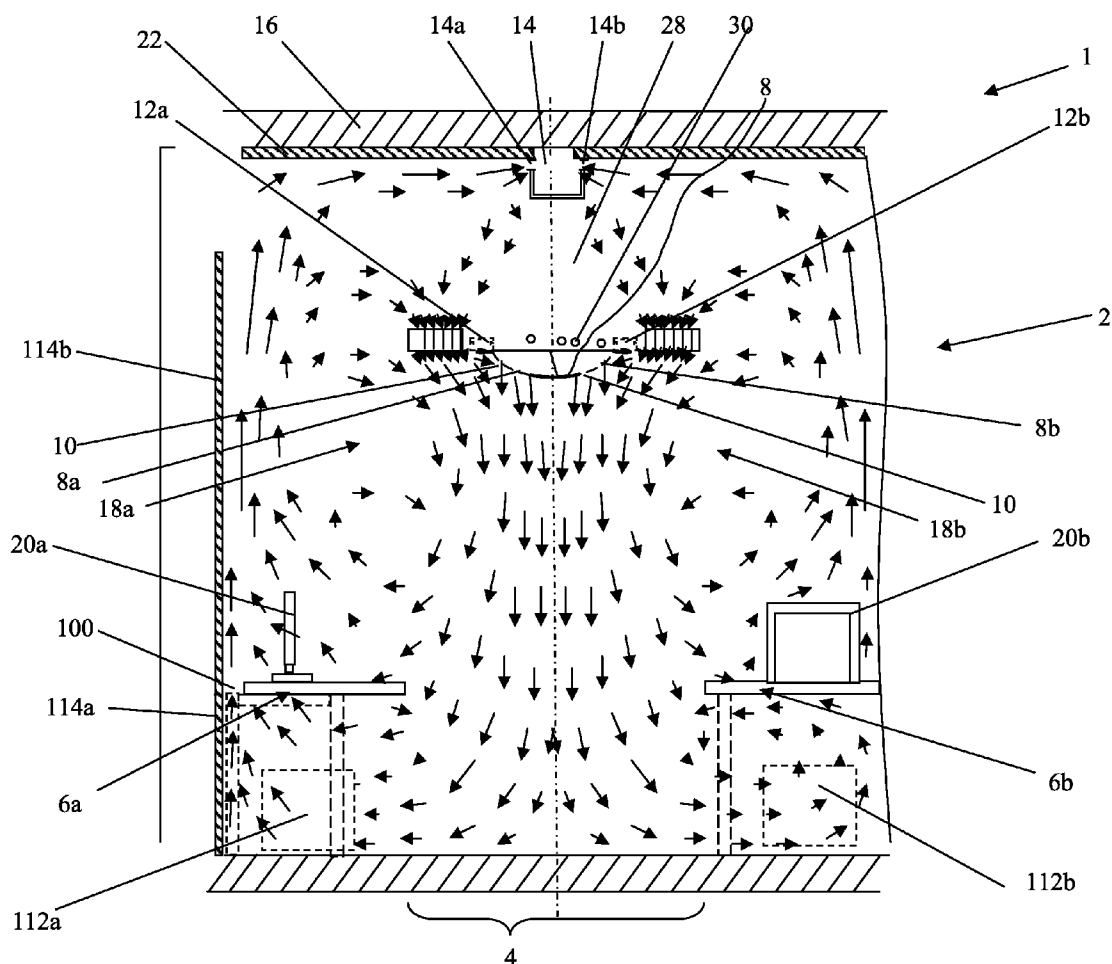


Fig. 1

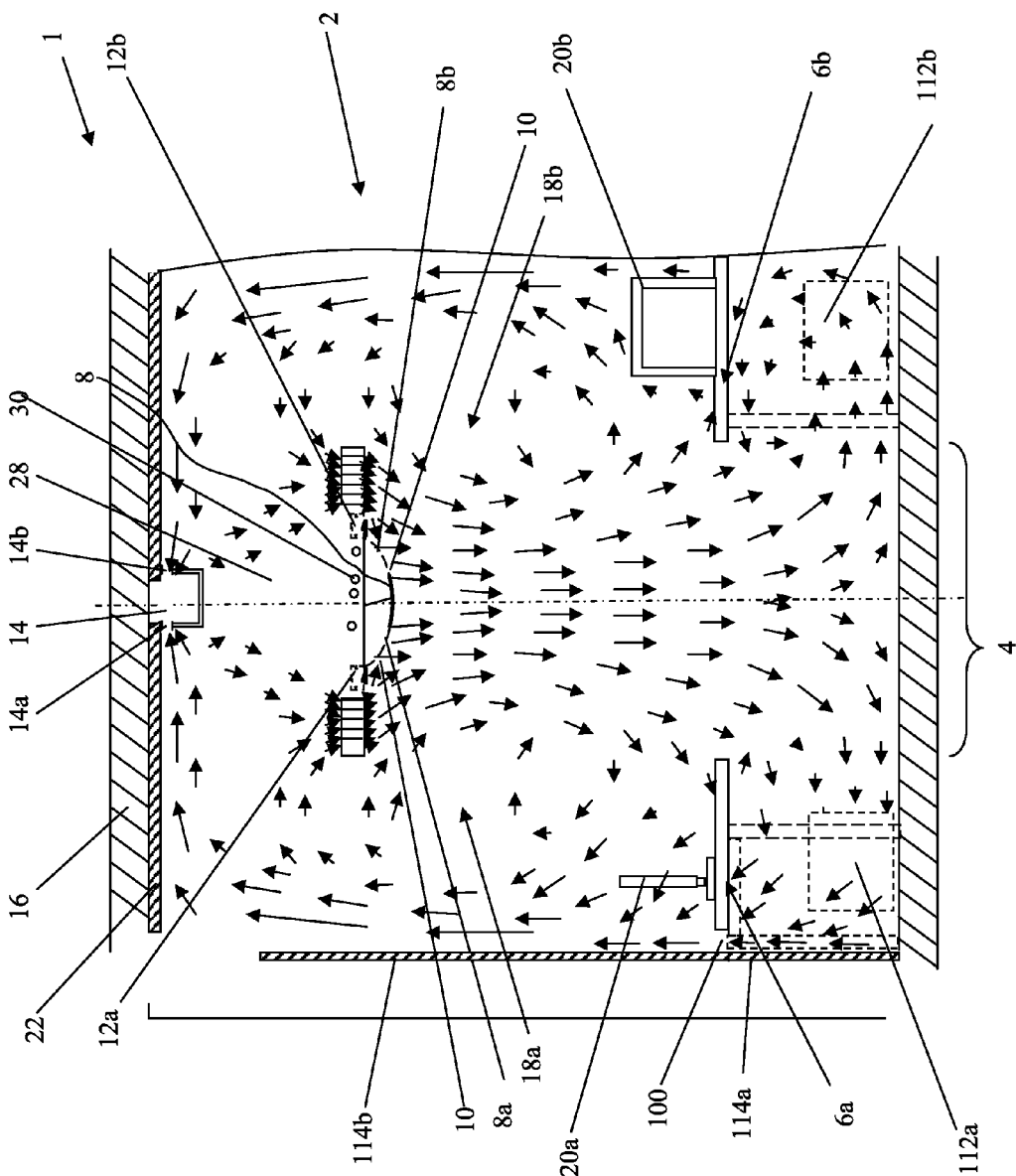
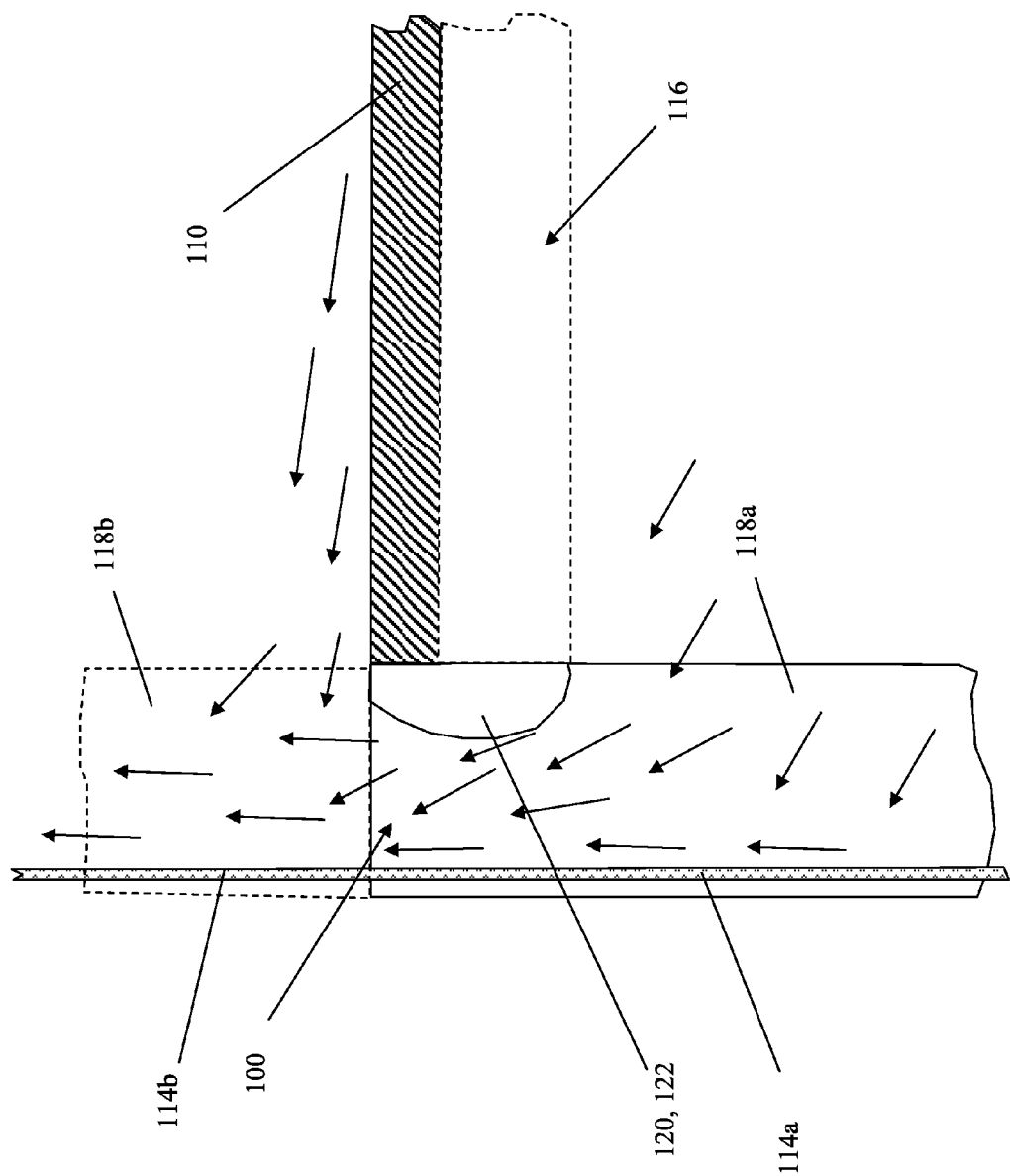


Fig. 2



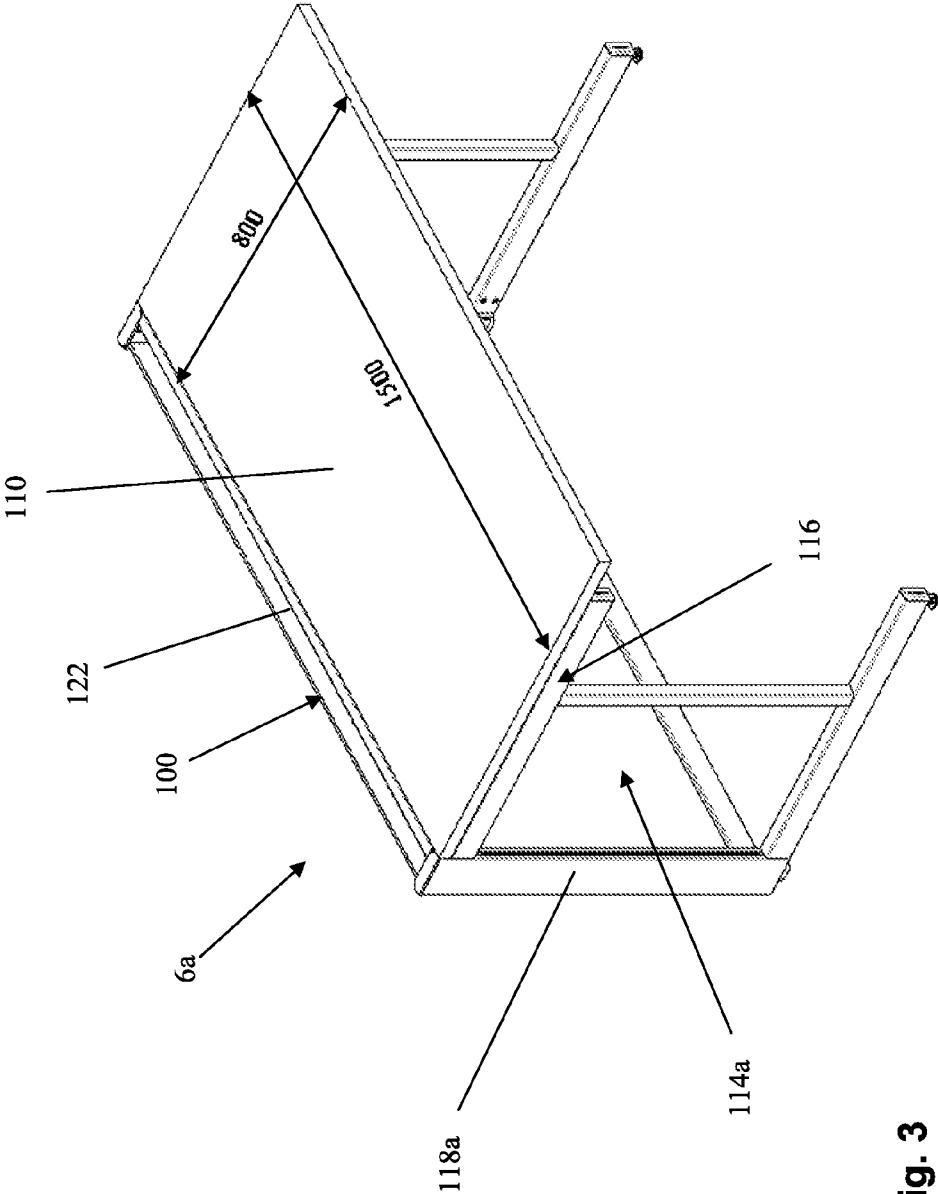


Fig. 3

# CONFIGURATION AND METHOD FOR VENTILATING A ROOM, MORE PARTICULARLY A LABORATORY ROOM

## CROSS-REFERENCE TO RELATED APPLICATION

**[0001]** This application claims the priority, under 35 U.S.C. §119, of German application DE 10 2013 015 799.4, filed Sep. 24, 2014; the prior application is herewith incorporated by reference in its entirety.

## BACKGROUND OF THE INVENTION

**[0002]** 1. Field of the Invention

**[0003]** The invention relates to a configuration for ventilating a room, more particularly a laboratory room.

**[0004]** In building technology, for ventilating research laboratories, e.g. for chemical or physics research, ceiling constructions are used in which the pipes for the supply air, exhaust air, as well as the technical gases required in the laboratory, fluids, power and data lines etc. are arranged on a support frame which is mounted on the building roof.

**[0005]** From international patent disclosure WO 2012/031700, corresponding to U.S. patent publication No. 2013/0210336, an arrangement is known in this connection for ventilating a laboratory room which has an access area which is defined on both sides by work tables. Fresh air is thereby introduced into the room via an air supply duct arranged above the access area and contains two lateral air supply sections which extend along the access area and which each have a plurality of circular air outlet openings from which the supply air exits laterally in the direction of the work tables. The fresh air is drawn out again via an exhaust air duct which is arranged there-above and which has two slit-like exhaust openings which extend substantially parallel to the air supply duct and which are arranged in the region of the ceiling of the roof so that on either side of the access area an air roll is formed over which the supply air which has heated up in the region of the work tables passes vertically up into the region of the ceiling of the room. With the arrangement described the table tops of the work tables close at the back flush with a rear wall at which the air rises up from the region above the table tops. The air heated up underneath the table tops thereby flows away in the direction of the center of the access area over the edge of the table tops and mixes there with the cool fresh air which is supplied from above. Intermixing of the cool fresh air being supplied and the rising warm air thereby takes place which increases the amount of fresh air supplied and thereby the energy requirement needed to provide the fresh air.

## SUMMARY OF THE INVENTION

**[0006]** It is accordingly an object of the invention to provide a configuration and a method for ventilating a room that overcome the above-mentioned disadvantages of the prior art of this general type, with which the amount of energy which is required to provide the supply of cooled fresh air can be further reduced.

**[0007]** According to the invention a configuration for ventilating a room, more particularly a laboratory room, which has an access area which is defined on both sides by work tables, contains an air supply duct arranged above the access area for supplying preferably cooled fresh air into the room, this will hereinafter also be called supply air. The air supply

duct can be configured either as an elongated continuous sheet metal duct with a preferably rectangular cross-section and two downwardly directed elongated slot nozzles which are arranged at the sides of the longitudinal axis and which are supplied with fresh air from one end of the sheet metal duct via a transverse pipe. Equally it is possible to make up the air supply duct from several elongated cassette-type partial sections with downwardly directed slot nozzles arranged in pairs therein, wherein the partial sections can each have a length in the range from 1.5 to 4 m and are each fed individually and separately from above via air supply pipes which stem from a central main air supply line. In the preferred embodiment of the invention the air supply duct is however a hollow body, preferably with a D-shaped cross section and made from a preferably flexible material, e.g. from an air-permeable textile or from a plastic foil which has a plurality of air outlet openings from which the supply air exits above the access area.

**[0008]** The air supply duct has in this embodiment preferably two side air supply sections which are preferably configured as strips and which extend along the access area and each have a plurality of circular air outlet openings which are preferably introduced into the air supply sections as perforations for example by a laser or the like, and from which the supply air preferably emerges solely in the lateral direction, i.e. inclined at an angle to the vertical central axis of the access area, in the direction of the work tables. The two lateral air supply sections are spaced apart from one another by a substantially air-impermeable central partition section whose central longitudinal axis preferably runs along the central middle plane of the access area and which separates the first and the second air supply section from one another.

**[0009]** An exhaust air duct is arranged above the air supply duct at a distance of preferably 0.8 to 1.5 m, and in the same way as also the air supply duct, extends preferably along the vertical central plane of the access area and extracts the spent exhaust air which is warmer than the supply air out from the room.

**[0010]** The exhaust air duct advantageously has two slit-shaped vents which extend substantially parallel to the air supply duct and which are arranged at the highest possible place in the area of the ceiling of the roof.

**[0011]** The outflow angle and the size of the slit nozzles of the air supply duct according to the embodiment first described, and the size and the number of air outlet openings arranged in the two lateral air supply sections, as well as the width of the partition section of the embodiment of the air supply duct last described, are thereby selected in the same way as the size and shape of the air exhaust openings of the exhaust air duct so that an air roll or an air turbulence is formed on each side of the access area. The center of the roll is preferably approximately in the region of the edge of the work tables on the access side, and preferably at the halfway height between the air supply duct and the floor.

**[0012]** Although the air supply duct, or its hollow body in the case of the preferred embodiment last described, can also be made of an air-permeable textile material, it particularly preferably consists of a thin, more particularly also light-permeable membrane with low air permeability, by way of example a plastics-coated textile fabric. The air supply duct hereby preferably extends over the entire length of the access area of the laboratory, and can in the case of several laboratory workstations arranged in succession preferably also run over the entire length of the central accesses of all the laboratories.

The perforation which in the preferred embodiment is preferably provided as a micro-perforation with a hole size in the range between 0.1 mm and 1 mm, preferably 0.4 to 0.6 mm and more particularly preferably 0.5 mm in the as such essentially air-impermeable material of the air supply duct, is ceased in the region of the central partition section in order to form this separation. The arrangement of the air outlet openings of the micro-perforation is advantageously in rows transversely to the longitudinal axis of the access area at a distance of one to some centimeters, preferably 2 cm. In the preferred embodiment of the invention the air outlet openings inside one row have a spacing of about 4 mm, whereby in the case of a standard laboratory an air exchange rate in relation to the surface area is produced in the region of between 12.5-37.5 m<sup>3</sup>/m<sup>2</sup>/h, which corresponds approximately to 4 to 12 times the air exchange rate in a standard laboratory.

**[0013]** The invention is characterized in that at least one of the work tables, but preferably all of the work tables, have around their back a slit-like opening through which warm air, which is generated for example by electrical appliances such as workstation computers, refrigerators, plug socket strips etc., as well as also the body heat from personnel working at the tables, can flow upward out from the area underneath the table top. The slit-like opening can either be formed in the table top of the work table, or can be formed at the back of the rear edge of the table top by a recess which preferably extends between the two rear vertical posts or table legs of the table, when the latter in known manner has a supporting frame, preferably of metal.

**[0014]** In the preferred embodiment of the invention vertical guide plates are arranged in the rear area at the back of the work tables, these plates preferably extending vertically both in the area underneath and also in the area above the table tops and serving as guide faces at which the heated air rises up. Through the thereby adjusting coanda effect the rising warm air is moved from the area underneath the table top in the direction of the guide face and as it flows up it is forced toward the guide face which has the advantageous effect that through the guide face the rising air is channeled so that it no longer mixes as intensely with the cool fresh air which is flowing in from above. The energy requirement of the arrangement according to the invention is hereby reduced even further.

**[0015]** In the preferred embodiment of the invention a first guide plate is arranged underneath the table top, and/or a second guide plate extends upward out from the slit-like opening and up toward the ceiling of the room.

**[0016]** In order to be able to utilize the advantages of the arrangement according to the invention to the full extent when tables are placed back to back, the second guide plate is advantageously formed from a material which is particularly impermeable to laser light and/or from a fire-retardant material or a material having high mechanical strength, more particularly an explosion-resistant material. The guide plate hereby advantageously and simultaneously fulfills also the functions of protection against laser radiation, fire-protection barrier and/or explosion protection.

**[0017]** Alternatively the second guide plate can also be made of a transparent material, preferably of glass or Plexiglas, in order despite a spatial separation of two work places placed back to back relative to one another to obtain the advantages regarding the air flow and to enable see-through inspection at the same time.

**[0018]** The at least one work table preferably has a frame which has two frame posts at the back between which extends

the slit-like opening. The two posts at the back are thereby preferably made of metal or plastics profiles which can be extended in the vertical direction by adding on further posts. The added further posts which can preferably be fixedly connected to the lower frame posts by connector elements can advantageously be provided with socket grooves for receiving further vertical guide plates and/or horizontal shelf bases or energy ducts or horizontal supports on which the horizontal shelf bases or energy ducts are positioned. The shelf bases thereby likewise extend only up to the vertical plane of the access-side longitudinal edge of the slit-like opening so that the warm air rising up out of the opening in the table top, or in the work table, can likewise flow unimpeded in the ensuing free space behind the shelf bases and up into the ceiling area.

**[0019]** According to a further embodiment of the invention, in order to assist the flow movement of the air rising up out from the area underneath the table top, at least one of the longitudinal edges of the slit-like opening, more particularly the access-side longitudinal edge on the side of the access area, has an arcuate rounded cross-sectional shape, preferably a trumpet-shaped or venturi-shaped cross-sectional form. It is hereby achieved that the rising warm air is concentrated to an even narrower zone which additionally acts against intermixing with the supplied cold air.

**[0020]** Finally the invention relates to the advantageous use of at least one work table having a frame and a table top which has in the region of its rear side a slit-like opening through which warm air can flow upward out from the area underneath the table top, in an arrangement previously described for ventilating a laboratory room. Although the invention was described previously and in the following solely using the example of a laboratory room, the arrangement according to the invention can equally be used for ventilating offices which are to be included in the protection.

**[0021]** Other features which are considered as characteristic for the invention are set forth in the appended claims.

**[0022]** Although the invention is illustrated and described herein as embodied in a configuration for ventilating a room, more particularly a laboratory room, it is nevertheless not intended to be limited to the details shown, since various modifications and structural changes may be made therein without departing from the spirit of the invention and within the scope and range of equivalents of the claims.

**[0023]** The construction and method of operation of the invention, however, together with additional objects and advantages thereof will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

#### BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

**[0024]** FIG. 1 is a diagrammatic cross-sectional view of a laboratory room with a ventilation system according to the invention;

**[0025]** FIG. 2 an enlarged detailed view of a work table in a region of a slit-like opening; and

**[0026]** FIG. 3 is a diagrammatic, perspective view of the work table used in the arrangement according to the invention.

#### DETAILED DESCRIPTION OF THE INVENTION

**[0027]** Referring now to the figures of the drawings in detail and first, particularly to FIG. 1 thereof, there is shown a

configuration 1 according to the invention for ventilating a room 2, more particularly a laboratory room, which has an access area 4 which is defined on either side by work tables 6a, 6b. The configuration contains an air supply duct 8 arranged above the access area and through which preferably cooled fresh air is supplied from a non-illustrated fresh air generator or a fresh air fan. The air supply duct 8 has two lateral air supply sections 8a, 8b which extend along the access area 4 and which each have a plurality of circular air outlet openings 10 from which the supply air emerges at the side in the direction of the work tables 6a, 6b. The two lateral air supply sections 8a, 8b are separated from one another by a substantially air-tight central partition section which has for example  $\frac{1}{3}$  of the width of the air supply duct 8 and has no air outlet openings. With the embodiment of the invention illustrated in FIG. 1, the air supply duct 8 is made of a flexible textile material which is substantially air-impermeable and has the cross-sectional shape of a suspended D which is received on two spaced apart supports 12a, 12b of a support frame which is otherwise not shown in further detail. According to the invention media lines 30 for, for example water, gas, power etc. are guided above the flat section of the D-shaped air supply duct 8 which is clamped and preferably tensioned in associated longitudinal grooves of the supports 12a, 12b, these media lines 30 being supported for example by a cross beam, which is not shown in further detail, and are accessible from the side.

[0028] Above the air supply duct 8 at a distance of for example 80 cm to 1 m there is an exhaust air duct 14 which contains two slit-like exhaust openings 14a, 14b which extend substantially parallel to the air supply duct 8 and which are arranged in the region of a ceiling 16 of the room 2 so that on either side of the access area 4 an air roll 18a, 18b is formed each time and vertically conveys the warm air generated in the region of the work tables 6a, 6b through heat sources 20a, 20b, such as for example display screens, electric work appliances or boiler devices etc., into the area of the ceiling 16 of the room 2 from where it is diverted in the direction of the exhaust openings 14a, 14b and is drawn into these by a fan (not shown in further detail), as is indicated by the arrows, not named in further detail, in FIG. 1.

[0029] As can be further derived from the illustration of FIG. 1 on the left-hand side, the work table 6a according to the invention is provided with a slit-shaped opening 100 which is arranged in a table top 110 of the table 6a. The work table 6b on the opposite right side which is designated to clarify the different flow conditions, is on the other hand a conventional work table which has a closed table top underneath which the air heated by electrical appliances 112b and personnel, builds up.

[0030] As can further be derived from FIGS. 1 and 2, a vertical guide plate 114 is arranged in the region of the back of the at least one work table 6a and extends vertically up to the edge of the slit-shaped opening 100 to serve as a guide face at which the heated air rises up. The guide plate thereby contains advantageously a first guide plate 114a underneath the table top, and/or a second guide plate 114b, which extends from the slit-shaped opening 100 out up toward the ceiling of the room.

[0031] As can be derived in detail from the illustration in FIGS. 2 and 3, the work table 6a has a frame 116 which has two frame posts 118 at the back between which extends the slit-like opening 100. As is indicated by the dotted lines in FIG. 2, further posts 118b can be fitted in the vertical direction

onto the posts 118a and are provided in the same way as the posts 118 with vertical longitudinal grooves into which the guide plates 114a, 114b are inserted.

[0032] Finally at least one of the longitudinal edges 120 of the slit-like opening 100, more particularly the access-side longitudinal edge lying on the side of the access area, can have for assisting the flow movement of the upwardly flowing air underneath the table top 110 an arcuate rounded cross-sectional form 122, preferably a trumpet-shaped or venturi-shaped cross-sectional form, as shown in FIG. 2. Through this configuration of the longitudinal edge as a flow profile the rising warm air flow is displaced toward the second guide plate 114b whereby a narrower flow zone, seen from the side, is produced in which the air rises upward.

1. A configuration for ventilating a room having an access area and defined on both sides by work tables, the configuration comprising:

an air supply duct disposed above the access area for supplying fresh air into the room, said air supply duct having two side air supply sections or slit outlets formed therein, and a substantially air-tight central partition section;

an exhaust air duct disposed above said air supply duct for extracting exhaust air from the room, said exhaust air duct having two slit-shaped exhaust openings formed therein and extending substantially parallel to said air supply duct and disposed in a region of a ceiling of the room so that supply air heated in a region of the work tables passes vertically up into an area of the ceiling of the room; and

at least one of the work tables having in a area at a back a slit-shaped opening formed therein through which warmed supply air can flow upward out from an area underneath a table top of the at least one work table.

2. The configuration according to claim 1, further comprising a vertical guide plate disposed in the area at the back of the at least one work table and extends vertically up at an edge of said slit-shaped opening, and which serves as a guide face at which the warmed air rises up.

3. The configuration according to claim 2, wherein said vertical guide plate includes a first guide plate disposed underneath the table top, and/or a second guide plate extending upwards out from said slit-shaped opening (100) up toward the ceiling of the room.

4. The configuration according to claim 3, wherein said second guide plate contains a material selected from the group consisting of a non-transparent material non-transparent to laser light, a fire-retardant material, a material having a high mechanical strength, and an explosion-resistant material.

5. The configuration according to claim 3, wherein said second guide plate is made from a transparent material, glass or Plexiglas.

6. The configuration according to claim 1, wherein the at least one work table has a frame which has two frame posts at the back between which said slit-shaped opening extends, and that said two frame posts can be lengthened in a vertical direction by adding on further posts wherein said further posts have socket grooves formed therein for receiving guide plates and/or horizontal shelf bases or energy ducts.

7. The configuration according to claim 3, wherein said at least one work table has at least one longitudinal edge next to said slit-shaped opening having an arcuate rounded cross-

sectional shape for assisting a flow movement of upwardly flowing air underneath the table top.

8. The configuration according to claim 7, wherein said at least one longitudinal edge is an access-side longitudinal edge lying on a side of the access area, and said arcuate rounded cross-sectional shape has a trumpet-shaped or venturi-shaped cross-sectional form.

9. A configuration for ventilating a room having an access area, the configuration comprising:

an air supply duct disposed above the access area for supplying fresh air into the room, said air supply duct having two side air supply sections or slit outlets formed therein, and a substantially air-tight central partition section;

an exhaust air duct disposed above said air supply duct for extracting exhaust air from the room, said exhaust air duct having two slit-shaped exhaust openings formed therein and extending substantially parallel to said air supply duct and disposed in a region of a ceiling of the room so that supply air heated in the room passes vertically up into an area of the ceiling of the room; and

at least one work table having a table top and in an area at a back a slit-shaped opening formed therein through which warmed supply air can flow upward out from an area underneath said table top of said at least one work table, said at least one work table disposed at a side of the room.

10. The configuration according to claim 9, wherein said at least one work table has a frame with two frame posts at said back between which said slit-shaped opening extends, and that said two frame posts can be lengthened in a vertical direction by adding on further posts wherein said further

posts have socket grooves for receiving guide plates and/or horizontal shelf bases or energy ducts.

11. The configuration according to claim 9, wherein said at least one work table has at least one longitudinal edge next to said slit-shaped opening having an arcuate rounded cross-sectional shape for assisting a flow movement of upwardly flowing air underneath said table top.

12. The configuration according to claim 11, wherein said at least one longitudinal edge is an access-side longitudinal edge lying on a side of the access area, and said arcuate rounded cross-sectional shape has a trumpet-shaped or venturi-shaped cross-sectional form.

13. A method of setting up a configuration for ventilating a room having an access area, which comprises the steps of:

providing an air supply duct disposed above the access area for supplying fresh air into the room, the air supply duct having two side air supply sections or slit outlets formed therein, and a substantially air-tight central partition section;

providing an exhaust air duct disposed above the air supply duct for extracting exhaust air from the room, the exhaust air duct having two slit-shaped exhaust openings formed therein and extending substantially parallel to the air supply duct and disposed in a region of a ceiling of the room so that supply air heated in the room passes vertically up into an area of the ceiling of the room; and

providing at least one work table in the room, an area at a back of a table top of the work table having a slit-shaped opening formed therein through which warmed supply air can flow upward out from an area underneath the table top.

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