

Aug. 14, 1962

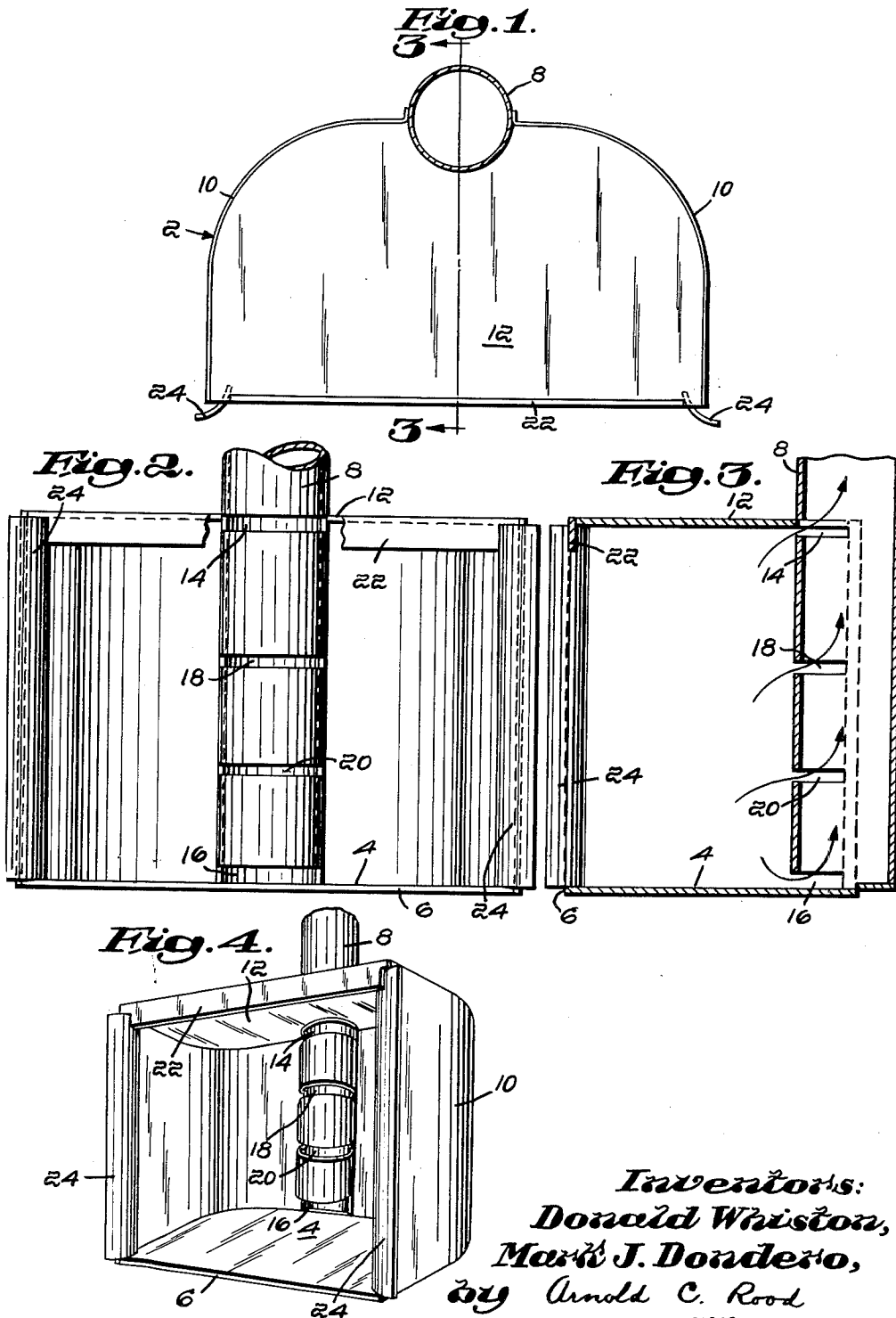
D. WHISTON ET AL

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FUME HOOD

Filed Dec. 16, 1959

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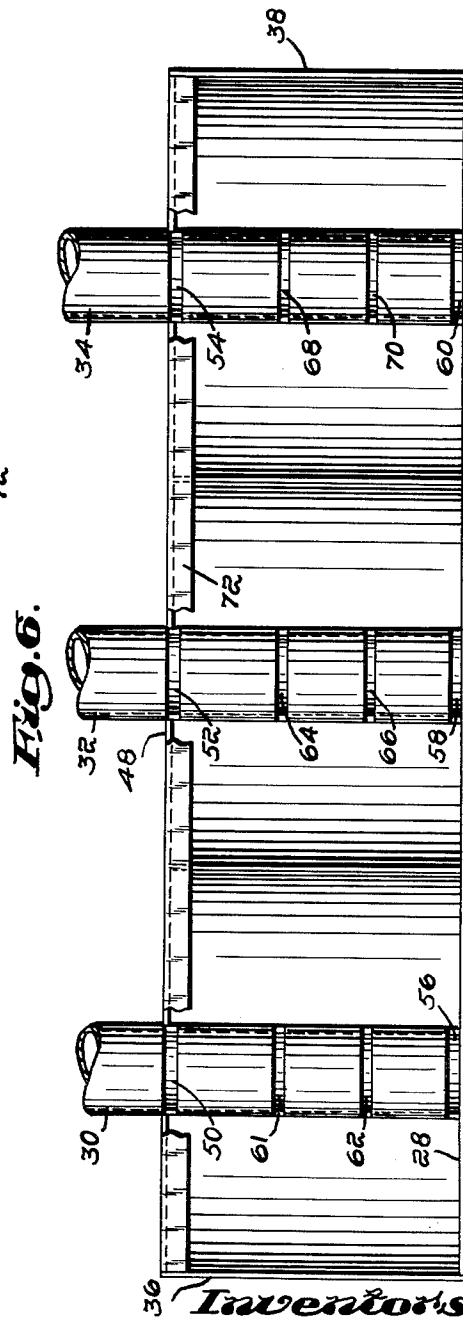
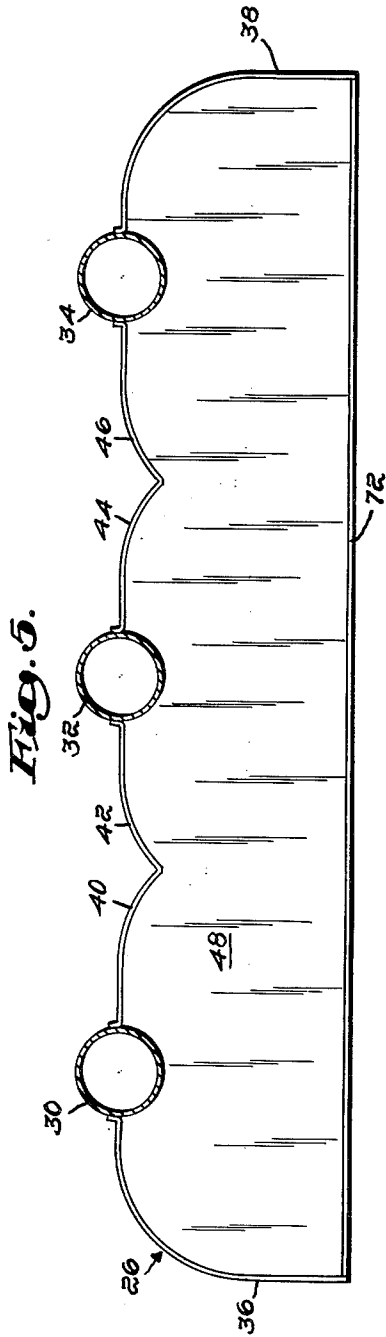
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Fig. 7.

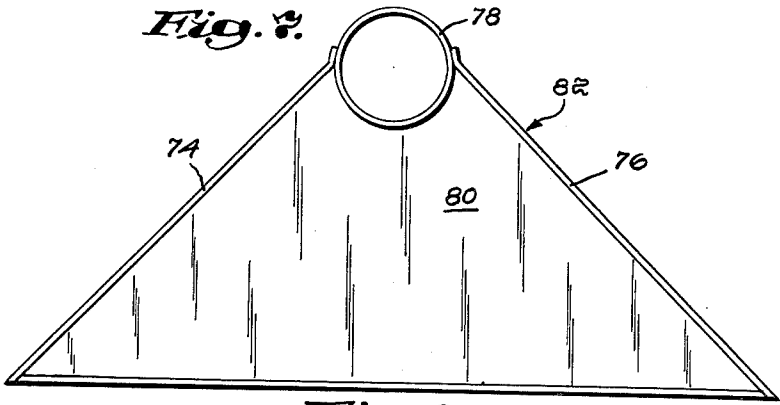


Fig. 8.

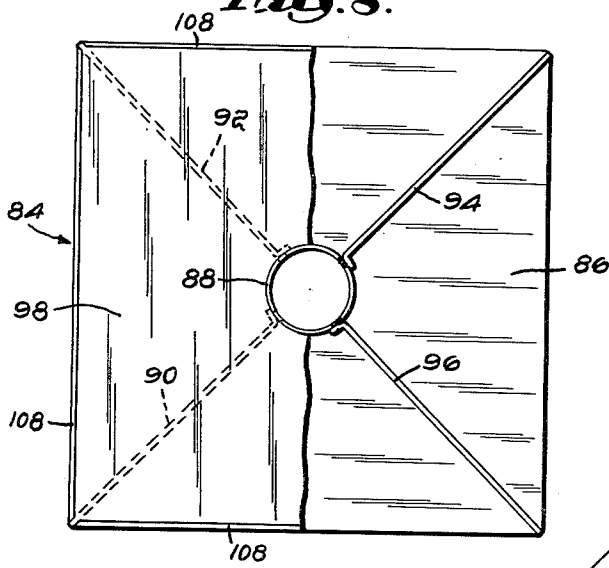
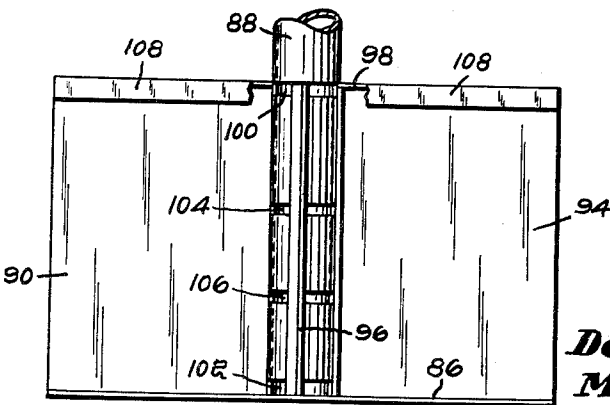


Fig. 9.



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3,049,069

FUME HOOD

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14 Claims. (Cl. 98—115)

This invention relates to ventilating hoods, and more particularly to laboratory exhaust hoods for removing chemical mists, fumes, dusts and the like.

By the present invention, there are provided hoods within which chemical operations may be conducted and noxious products resulting therefrom effectively removed without contamination of the room atmosphere or danger to the chemical operator. This is accomplished by improved hood constructions which provide an even flow of air of uniform velocity across the open front of the hood, which air moves in eddy-free fashion through the hood and out through the rear of the hood into an exhaust conduit, carrying with it noxious products of chemical operations carried on within the hood.

In the drawings illustrating specific embodiments of the invention:

FIGURE 1 is a top plan of a fume hood contemplated by this invention;

FIG. 2 is a front elevation of the hood shown in FIG 1;

FIG. 3 is a vertical section taken on line 3—3 of FIG. 1;

FIG. 4 is a perspective view of the hood shown in FIGS. 1, 2 and 3;

FIG. 5 is a top plan view of a fume hood embodying multiple units;

FIG. 6 is a front elevation, partly broken away, of the multiple unit hood shown in FIG. 5;

FIG. 7 is a top plan view of a single unit hood embodying planar side wall members;

FIG. 8 is a top plan view, partly broken away, of a modified form of hood embodying four units disposed about a central exhaust conduit; and

FIG. 9 is an elevation taken on line 9—9 of FIG. 8.

In the embodiment illustrated in FIGS. 1—4, the hood is designated generally as 2. As shown, hood 2 has a flat bottom member 4 extending rearwardly from a front working surface or edge 6. Apparatus for conducting chemical operations may be disposed on bottom member 4. Exhaust conduit 8 extends upwardly from the rear of bottom member 4. A pair of side wall members 10 are secured to exhaust conduit 8 and extend in curvilinear fashion from said exhaust conduit to the front ends of bottom member 4. The side wall members 10 present a generally concave surface toward the front edge 6 of the hood. As shown, approximately half of the perimeter of exhaust conduit 8 extends into the enclosed space of bottom member 4. Top member 12 is secured to exhaust conduit 8 and side wall members 10 and forms the closed top of hood 2. The front edges of top member 12, bottom member 4 and side wall members 10 define the front opening and working space of the hood. The portion of exhaust conduit 8 extending into the enclosed space of the hood is shown as provided with a transverse slot 14 adjacent to top member 12, another transverse slot 16 adjacent to bottom member 4 and a pair of spaced transverse slots 18 and 20 disposed intermediate between slots 14 and 16. Apron 22 is shown as secured to the front edge of top member 12 and extending downwardly a short distance therefrom. Vertical baffle members 24 are disposed adjacent to the front edges of side wall members 10 but spaced therefrom. Baffle members 24 exhibit a generally convex surface to the front of hood 2, and assist in directing air from the room into the hood.

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Generally speaking, for the preferred functioning of the hood, it has been found desirable that the total cross-sectional area of slots 14, 16, 18 and 20 in the portion of the perimeter of the conduit 8 extending into the enclosed space be in the general neighborhood of about 10% greater than the cross-sectional area of exhaust conduit 8. It has further been found generally desirable that the transverse dimensions of top and bottom slots 14 and 16 be somewhat greater than the corresponding dimensions of intermediate slots 18 and 20. For general operation the cross sectional area of exhaust conduit 8 is desirably within the general neighborhood of about one-twelfth to about one-twentieth of the opening at the front of the hood.

In operation the upper end of exhaust conduit 8 may be connected to the conduit of a suction exhaust system. Such exhaust system (not shown) may discharge into the atmosphere or into a closed recovery system depending upon the character of the exhaust fumes. The lower end of exhaust conduit 8 may also be connected to the exhaust system and additionally may be connected to a drain, as operating conditions indicate.

When suction is applied to exhaust conduit 8 and the hood is in operation, the air within the hood and the adjacent room air outside of and in front of the hood exhibits uniform velocity in arcuate fashion centering upon exhaust conduit 8, the velocity of the air increasing as it approaches exhaust conduit 8. Furthermore the air passes through the hood smoothly and without eddy currents, and consequently without directing any of the air back into the room. By reason of the advantageous air motion accomplished by the hood of this invention, contamination of the room atmosphere is prevented and an operator working in front of the hood is protected from noxious air-borne products of chemical operations conducted within the hood.

It will be understood of course, that exhaust conduit 8 may be connected to an exhaust system so that the exhaust air passes downwardly through exhaust conduit 8 rather than upwardly as hereinabove described. It will further be appreciated that spray nozzles may be disposed within exhaust conduit 8 to wet down or otherwise treat exhaust gases with water or other liquid.

An embodiment of the invention providing extended working space for one or more operators is shown in FIGS. 5 and 6. Thus hood 26 is shown as having a flat bottom member 28 extending rearwardly from a front working surface. A plurality of exhaust conduits 30, 32 and 34 extend upwardly from the rear of bottom member 28 and substantially centrally of predetermined longitudinal segments of said bottom member 28. A pair of outer side wall members 36 and 38 secured to exhaust conduits 30 and 34 respectively extend in curvilinear fashion from said exhaust conduits to the front ends of bottom member 28. Side wall members 36 and 38 define the outer sides of hood 26 and present a generally concave surface toward the front of the hood. Approximately half of the perimeter of each circular exhaust conduit 30, 32 and 34 projects over bottom member 28 toward the front of the hood. Intermediate wall members 40 and 42 are secured to exhaust conduits 30 and 32 respectively and extend in curvilinear generally concave fashion toward the front of the hood approximately to the extent of the forward projection of exhaust conduits 30, 32 and 34. Intermediate wall members 44 and 46 are secured to exhaust conduits 32 and 34 respectively and extend arcuately forwardly in similar fashion to intermediate wall members 40 and 42. Intermediate wall members 40 and 42 are secured together at their forward ends as are also intermediate wall members 44 and 46, thus completing the wall enclosure of the hood. Top member 48 is secured to exhaust conduits 30, 32 and 34 and wall members 36,

40, 42, 44, 46 and 38 and forms the closed top of hood 26. The front edges of said top member, bottom member and side wall members define the front opening and working area of the hood. The top portions of exhaust conduits 30, 32 and 34 extending into the enclosed hood area are provided with transverse slots 50, 52 and 54 adjacent to top member 48 and transverse slots 56, 58 and 60 adjacent to bottom member 28. In addition there are shown a plurality of spaced transverse slots disposed intermediate between said top and bottom slots, namely slots 61 and 62 in exhaust conduit 30, slots 64 and 66 in exhaust conduit 32 and slots 68 and 70 in exhaust conduit 34. An apron 72 is shown as secured to top member 48 and extending downwardly therefrom at the front of the hood.

For the preferred operation of multiple-unit hood 26, it has been found desirable that the total cross-sectional area of all of the said slots be in the general neighborhood of about 10% greater than the total cross-section of exhaust conduits 30, 32 and 34. It has further been found desirable that the total cross-sectional area of the exhaust conduits be in the general neighborhood of about one-twelfth to about one-twentieth of the total area of the hood opening.

It will be understood of course that the extent of forward projection of intermediate wall members 40, 42, 44 and 46 may be varied, but the construction described above is presently preferred.

The operation of hood 26 is as described above with reference to FIGS. 1-4. The air movement however tends to be in the form of overlapping arcuate waves directed respectively toward exhaust conduits 30, 32 and 34.

In FIG. 7 is illustrated an embodiment of the invention which is similar to that shown in FIGS. 1-4 except that side wall members 74 and 76 are planar in character, as distinguished from the concavely curvilinear side wall members of FIGS. 1-4. In FIG. 7 can also be seen the exhaust conduit 78 and top member 80. The operation of the embodiment shown in FIG. 7, designated 82, is the same as that described hereinabove with reference to FIGS. 1-4, and the incoming air moving in arcuate wave fashion toward the exhaust conduit 78 and moving faster as it approaches said exhaust conduit.

FIGS. 8 and 9 illustrate a multiple-unit hood which is advantageous, for example, where wall space is limited. Thus there is shown a hood 84 having a substantially rectangular flat bottom member 86. An exhaust conduit 88 extends upwardly from the central portion of bottom member 86. Four side wall members 90, 92, 94 and 96 are secured to spaced portions of exhaust conduit 88 and each extends in planar fashion from said exhaust conduit 88 to a corner of rectangular bottom member 86. Approximately one-quarter of the perimeter of exhaust conduit 88 projects into each of the enclosed areas. Top member 98 is secured to the exhaust conduit and the side wall members and forms the top of the hood. The front edges of the top member, bottom member and said side wall members, define the four front openings and working areas of the hood. The portions of exhaust conduit 88 extending into each of the enclosed areas is provided with a transverse slot 100 adjacent to the top member, another transverse slot 102 adjacent to bottom member 86 and a plurality of spaced transverse slots 104 and 106 disposed intermediate between slots 100 and 102. Apron 108 is shown as secured to the periphery of top member 98 and as depending a short distance therefrom. The total cross-sectional area of all of slots 100, 102, 104 and 106 is preferably in the general neighborhood of about 10% greater than the cross-sectional area of exhaust conduit 88, and the cross-sectional area of exhaust conduit 88 is preferably in the neighborhood of about one-twelfth to about one-twentieth of the total area of the four hood openings.

While FIGS. 8 and 9 show a hood construction having a rectangular base and four hood openings, it will be appreciated that the base member might be of triangular or

other polygonal shape with a corresponding number of hood openings.

The operation and advantages of the construction shown in FIGS. 8 and 9 are as described above with reference to FIGS. 1-4.

So far as materials of construction are concerned, the hood of this invention may be built from a variety of materials, non-metallic such as plastic, or metallic, and in the case of metals, ferrous or non-ferrous metals may be utilized. For many purposes, galvanized sheet steel is highly satisfactory. Where corrosive chemical products are encountered, stainless steel may be desirable.

Metallic hood parts may be secured together in any suitable manner, namely by mechanical means, soldering or welding.

So far as the exhaust conduit is concerned, a cross-section of circular or elliptical shape is generally preferred, but polygonal cross-sectional shape also may be employed to advantage in carrying out the invention.

It will be noted that the wall members illustrated herein extend from the exhaust conduit to the front of the hood in concavely curvilinear fashion or in planar fashion, but in both cases the wall members present a continuously progressive surface from the front of the hood to the exhaust conduit.

It will further be noted that the hoods illustrated herein are of firm and rigid character without requiring the use of structural frame members. Arcuate wall member as illustrated particularly contribute to structural rigidity.

It will be seen that by utilizing the hood of this invention, chemical operations resulting in noxious products may be carried out without pollution of room atmosphere and without danger to a chemical operator carrying out such chemical operations in the hood.

It will be understood that various modifications may be made while still coming within the scope of the invention.

Having disclosed our invention, what we claim as new and desire to secure by Letters Patent of the United States is:

1. A fume hood comprising, in combination, a flat bottom member extending rearwardly from a front edge and providing a working surface, a plurality of exhaust conduits extending upwardly from the rear edge of said bottom member and substantially centrally of predetermined longitudinal segments thereof, a pair of outer side wall members each secured at a vertical edge to a side of an outer exhaust conduit and each extending in curvilinear fashion from the respective exhaust conduits to one of the front edge ends of said bottom member, defining the outer sides of said hood and presenting generally concave surfaces toward the front of the hood, a portion of the perimeter of each said exhaust conduits projecting over the bottom member toward the front of the hood, a plurality of intermediate wall members each secured at a vertical edge to a side of one of said exhaust conduits and extending in curvilinear generally concave fashion toward the front of said hood, adjacent intermediate wall members being secured together to complete the hood enclosure, a top member secured to said exhaust conduits and to the side and intermediate wall members and forming the closed top of said hood, the front edges of said top member, bottom and side wall members defining the front opening into the enclosed space of said hood, the portion of each said exhaust conduit extending into the enclosed area being provided with a plurality of openings, the total area of said openings in each of said conduits being approximately ten percent greater than the cross-sectional area of said conduit.

2. An exhaust hood for mists, fumes, dusts and the like, comprising, in combination, a flat bottom member extending rearwardly from a front edge and providing a working surface, a plurality of exhaust conduits of generally circular cross-section extending upwardly from the rear edge of said bottom member and substantially centrally

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of predetermined longitudinal segments thereof, a pair of outer side wall members each secured at a vertical edge to a side of an outer exhaust conduit and each extending in curvilinear fashion from the respective exhaust conduits to one of the front edge ends of said bottom member, defining the outer sides of said hood and presenting generally concave surfaces toward the front of the hood, approximately half of the perimeter of each of said exhaust conduits projecting over the bottom member toward the front of the hood, a plurality of intermediate wall members each secured to one of said exhaust conduits and extending in curvilinear generally concave fashion toward the front of said hood approximately to the extent of the forward projection of said exhaust conduit, adjacent intermediate wall members being secured together to complete the hood enclosure, a top member secured to said exhaust conduits and to the side and intermediate wall members and forming the closed top of said hood, the front edges of said top member, bottom member and side wall members defining the front opening to the working space within said hood, the portion of the surface of each of said exhaust conduits extending into the enclosed space being provided with a transverse slot adjacent to the top member, another transverse slot adjacent to the bottom member and a plurality of spaced transverse slots disposed intermediate between said top and bottom slots, the total area of all of the slots in said surface of each conduit being in the general neighborhood of 10% greater than the cross-sectional area of said particular conduit, the total cross-sectional area of said exhaust conduits being in the neighborhood of about one-twelfth to about one-twentieth of the total area of said front opening.

3. A fume hood comprising, in combination, a substantially rectangular flat bottom member, an exhaust conduit of substantially circular cross-section extending upwardly from the central portion of said bottom member, four side wall members secured to spaced portions of said exhaust conduit and each extending in planar fashion from said exhaust conduit to a corner of said rectangular bottom member, approximately one-fourth of the perimeter of said exhaust conduit projecting into each of the enclosed areas, a top member secured to said exhaust conduit and side wall members and forming the closed top of said hood, the front edges of said top member, bottom member, and said wall members defining the four separate front openings each into one of four respective enclosed spaces in said hood, the portions of said exhaust conduit extending into each of the enclosed areas being each provided with a transverse slot adjacent to the top member, another transverse slot adjacent to the bottom member and a plurality of spaced transverse slots intermediate between said top and bottom slots, the total area of all of said slots in the conduit wall located in all said working spaces being in the general neighborhood of 10% greater than the total cross-sectional area of said exhaust conduit, the cross-sectional area of said exhaust conduit being in the neighborhood of about one-twelfth to about one-twentieth of the total area of all of said hood openings.

4. A fume hood comprising, in combination, a bottom member providing a substantially flat surface extending rearwardly from a front edge, an exhaust conduit extending upwardly from the rear portion of said bottom member, a pair of side wall members each attached at one edge to a side of said conduit and extending therefrom to the front edge of said bottom member and presenting a continuously progressive surface toward the front of the hood, and a top member secured to said conduit and to said side wall members and forming a closed top for said hood, the front edges of said top member, bottom member and side wall members defining the front opening to the space within said hood, a portion of the wall of said exhaust conduit being exposed to said space, and a plurality of openings in said portion of said wall, the total area of said openings lying in said

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portion of said wall being approximately 10 percent greater than the cross-sectional area of said exhaust conduit, the cross-sectional dimensions of said conduit being a minor fraction of the length of said front edge of said top member or said bottom member.

5. A fume hood comprising, in combination, a bottom member providing a substantially flat surface extending rearwardly from a front edge, an exhaust conduit extending upwardly from the rear portion of said bottom member, a pair of side wall members each attached at one edge to a side of said conduit and extending therefrom to the front edge of said bottom member and presenting a continuously progressive surface toward the front of the hood, and a top member secured to said conduit and to said side wall members and forming a closed top for said hood, the front edges of said top member, bottom member and side wall members defining the front opening to the space within said hood, a portion of the wall of said exhaust conduit being exposed to said space, and a plurality of substantially horizontally directed slots in said portion of said wall, the total area of said slots lying in said portion of said wall being approximately 10 percent greater than the cross-sectional area of said exhaust conduit, the cross-sectional dimensions, of said conduit being a minor fraction of the length of said front edge of said top member or said bottom member.

6. A fume hood comprising, in combination, a bottom member providing a substantially flat surface extending rearwardly from a front edge, an exhaust conduit extending upwardly from the rear portion of said bottom member, a pair of side wall members each attached at one edge to a side of said conduit and extending therefrom to the front edge of said bottom member and presenting a continuously progressive surface toward the front of the hood, and a top member secured to said conduit and to said side wall members and forming a closed top for said hood, the front edges of said top member, bottom member and side wall members defining the front opening to the space within said hood, a portion of the wall of said exhaust conduit being exposed to said space, and a plurality of substantially horizontally directed slots in said portion of said wall, the total area of said slots lying in said portion of said wall being approximately 10 percent greater than the cross-sectional area of said exhaust conduit, the cross-sectional dimensions of said conduit being a minor fraction of the length of said front edge of said top member or said bottom member, the cross-sectional area of said exhaust conduit being between approximately one-twelfth and approximately one-twentieth of the area of said front opening.

7. A fume hood comprising, in combination, a bottom member providing a substantially flat surface extending rearwardly from a front edge, an exhaust conduit of substantially circular cross-section extending upwardly from the rear portion of said bottom member, a pair of side wall members each attached at one vertical edge to a side of said conduit and extending therefrom to the front edge of said bottom member and presenting a continuously progressive surface toward the front of the hood, and a top member secured to said conduit and to said side wall members and forming a closed top for said hood, the front edges of said top member, bottom member and side wall members defining the front opening to the space within said hood, a portion of the wall of said exhaust conduit being exposed to said space, and a plurality of substantially horizontally directed slots in said portion of said wall, the total area of said slots lying in said portion of said wall being approximately 10 percent greater than the cross-sectional area of said exhaust conduit, the cross-sectional dimensions of said conduit being a minor fraction of the length of said front edge of said top member or said bottom member.

8. A fume hood comprising, in combination, a bottom member providing a substantially flat surface extending rearwardly from a front edge and having curved side

edges, an exhaust conduit of substantially circular cross section extending upwardly from the rear portion of said bottom member, a pair of curved side wall members each attached at one vertical edge to a side of said conduit and extending therefrom in curvilinear fashion along respective side edges to the front edge of said bottom member and presenting a continuously progressive surface toward the front of the hood, and a top member secured to said conduit and to said side wall members and forming a closed top for said hood, the front edges of said top member, bottom member and side wall members defining the front opening to the space within said hood, a portion of the wall of said exhaust conduit being exposed to said space, and a plurality of openings in said portion of said wall, the total area of said openings lying in said portion of said wall being approximately 10 percent greater than the cross-sectional area of said exhaust conduit, the cross-sectional dimensions of said conduit being a minor fraction of the length of said front edge of said top member or said bottom member.

9. A fume hood comprising, in combination, a bottom member providing a substantially flat surface extending rearwardly from a front edge and having curved side edges, an exhaust conduit of substantially circular cross section extending upwardly from the rear portion of said bottom member, a pair of curved side wall members each attached at one vertical edge to a side of said conduit and extending therefrom in curvilinear fashion along respective side edges to the front edge of said bottom member and presenting a continuously progressive surface toward the front of the hood, and a top member secured to said conduit and to said side wall members and forming a closed top for said hood, the front edges of said top member, bottom member and side wall members defining the front opening to the space within said hood, a portion of the wall of said exhaust conduit being exposed to said space, and a plurality of substantially horizontally directed slots in said portion of said wall, the total area of said slots lying in said portion of said wall being approximately 10 percent greater than the cross-sectional area of said exhaust conduit, the cross-sectional dimensions of said conduit being a minor fraction of the length of said front edge of said top member or said bottom member.

10. A fume hood comprising, in combination, a bottom member providing a substantially flat surface extending rearwardly from a front edge and having curved side edges, an exhaust conduit of substantially circular cross section extending upwardly from the rear portion of said bottom member, a pair of curved side wall members each attached at one vertical edge to a side of said conduit and extending therefrom in curvilinear fashion along respective side edges to the front edge of said bottom member and presenting a continuously progressive surface toward the front of the hood, and a top member secured to said conduit and to said side wall members and forming a closed top for said hood, the front edges of said top member, bottom member and side wall members defining the front opening to the space within said hood, a portion of the wall of said exhaust conduit being exposed to said space, and a plurality of substantially horizontally directed slots in said portion of said wall, the total area of said slots lying in said portion of said wall being approximately 10 percent greater than the cross-sectional area of said exhaust conduit, the cross-sectional dimensions of said conduit being a minor fraction of the length of said front edge of said top member or said bottom member, the cross-sectional area of said exhaust conduit being between approximately one-twelfth and approximately one-twentieth of the area of said front opening.

11. A fume hood comprising, in combination, a bottom member providing a substantially flat triangular-shaped surface extending rearwardly to an apex from a front edge, an exhaust conduit extending upwardly from the said apex, a pair of substantially planar side wall members each attached at one edge to a side of said conduit and extending therefrom to the front edge of said bottom member and presenting a continuously progressive surface toward the front of the hood, and a triangular-shaped top member secured to said conduit and to said side wall members and forming a closed top for said hood, the front edges of said top member, bottom member and side wall members defining the front opening to the space within said hood, a portion of the wall of said exhaust conduit being exposed to said space, and a plurality of substantially horizontally directed slots in said portion of said wall, the total area of said slots lying in said portion of said wall being approximately 10 percent greater than the cross-sectional area of said exhaust conduit.

12. In a fume hood having top, bottom, side and rear walls enclosing a hood space which has a prescribed open frontal area surrounded by edges of said top, bottom and side walls, exhaust conduit means of substantially uniform cross-sectional area extending between the bottom and top walls at the rear of said hood, opening means through said conduit means in communication with the interior of said hood, the cross-sectional area of said conduit means being between approximately one-twelfth and one-twentieth of said frontal area and the cross-sectional dimensions of said conduit means being a minor fraction of any horizontal boundary dimension of said frontal area.

13. In a fume hood having top, bottom, side and rear walls enclosing a hood space which has a prescribed open frontal area surrounded by edges of said top, bottom and side walls, exhaust conduit means of substantially uniform circular cross-sectional area extending between the bottom and top walls at the rear of said hood, opening means through said conduit means communicating with the interior of said hood, the cross-sectional area of said conduit means being between approximately one-twelfth and one-twentieth of said frontal area and the cross-sectional dimensions of said conduit means being a minor fraction of any horizontal boundary dimension of said frontal area.

14. In a fume hood having top, bottom, side and rear walls enclosing a hood space which has a prescribed open frontal area surrounded by edges of said top, bottom, and side walls, exhaust conduit means of substantially uniform cross-sectional area extending between the bottom and top walls at the rear of said hood, opening means through said conduit means communicating with the interior of said hood, the total area of said opening means being about ten percent greater than said cross-sectional area, and the cross-sectional dimensions of said conduit means being a minor fraction of any horizontal boundary dimension of said frontal area.

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