United States Patent

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[54] **FUME HOOD**
12 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** ..... **98/115 LH**
[51] **Int. Cl.** **F23j 11/02**
[50] **Field of Search** ..... 98/115 LH, 115 K, 115 SB

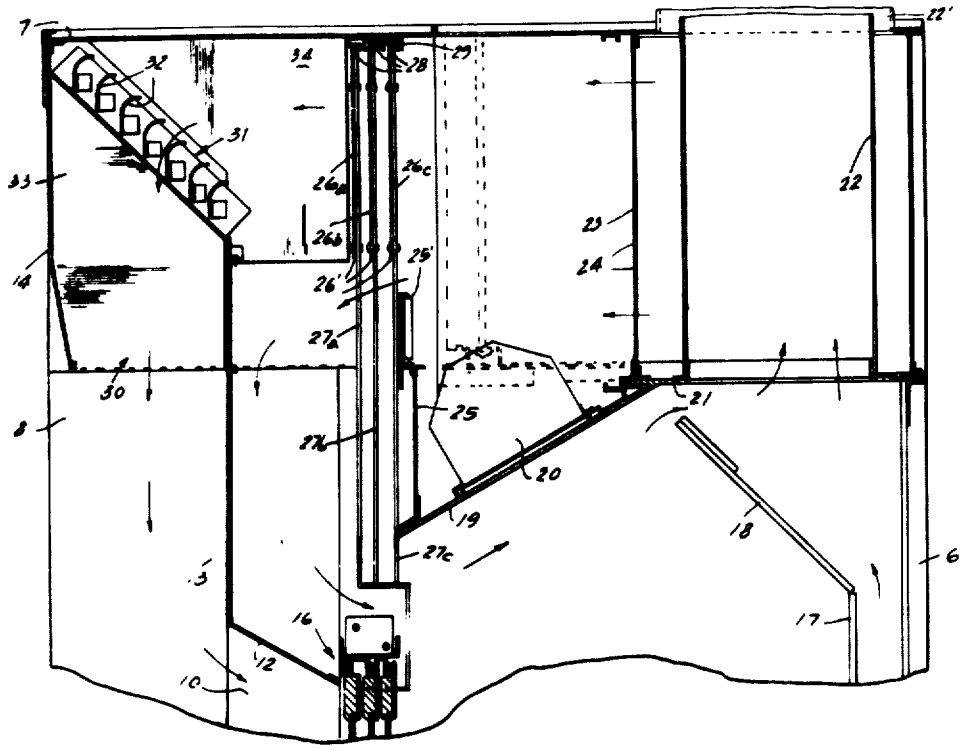
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ABSTRACT: A fume hood structure employing laterally slidable closure means for the access opening thereof, and utilizing an auxiliary air flow through such closure means when the latter is in an open position, in which the amount of such auxiliary air flow is controlled by lateral movement of such closure means, means being provided for directing such air to adjacent the opening in such closure means.



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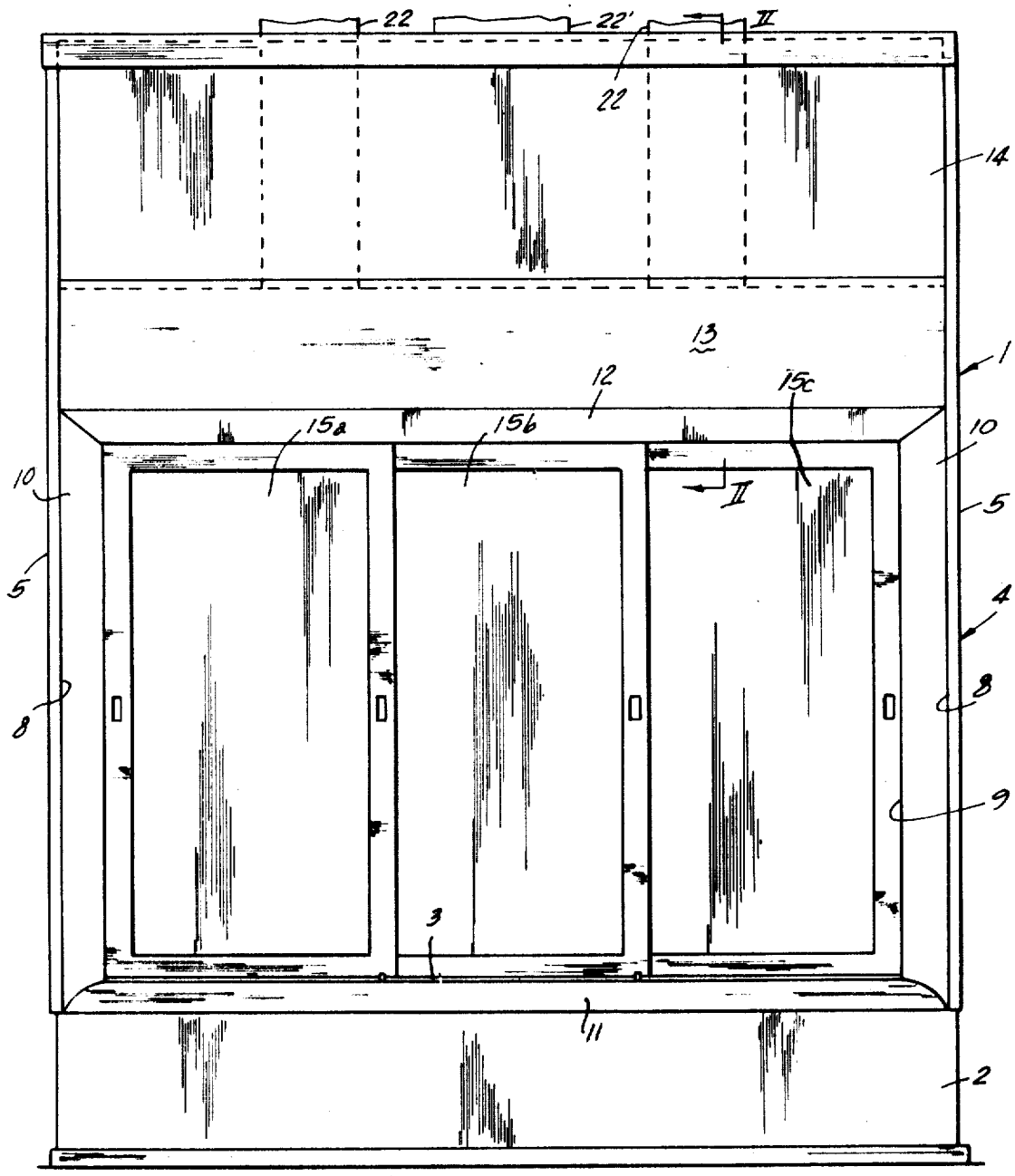


Fig. 1

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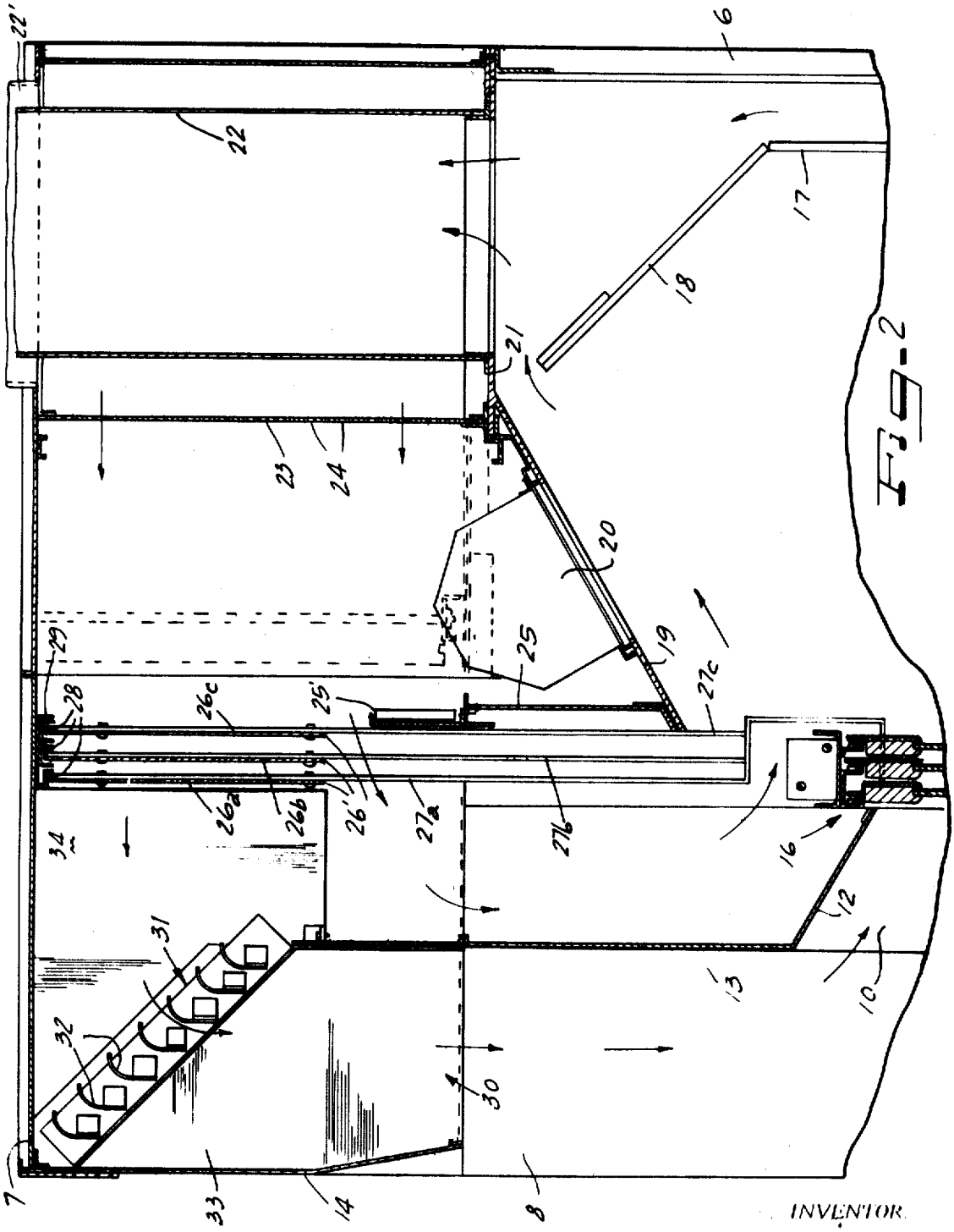
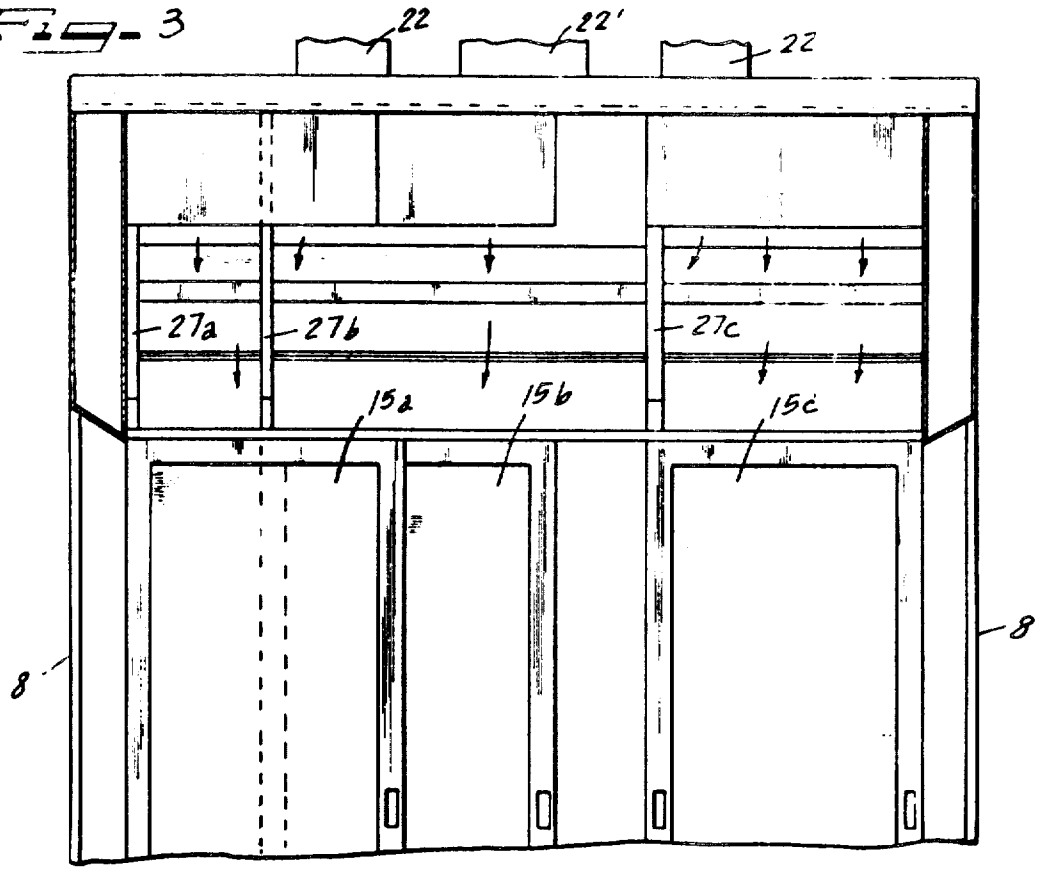


Fig. 2

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Fig. 3



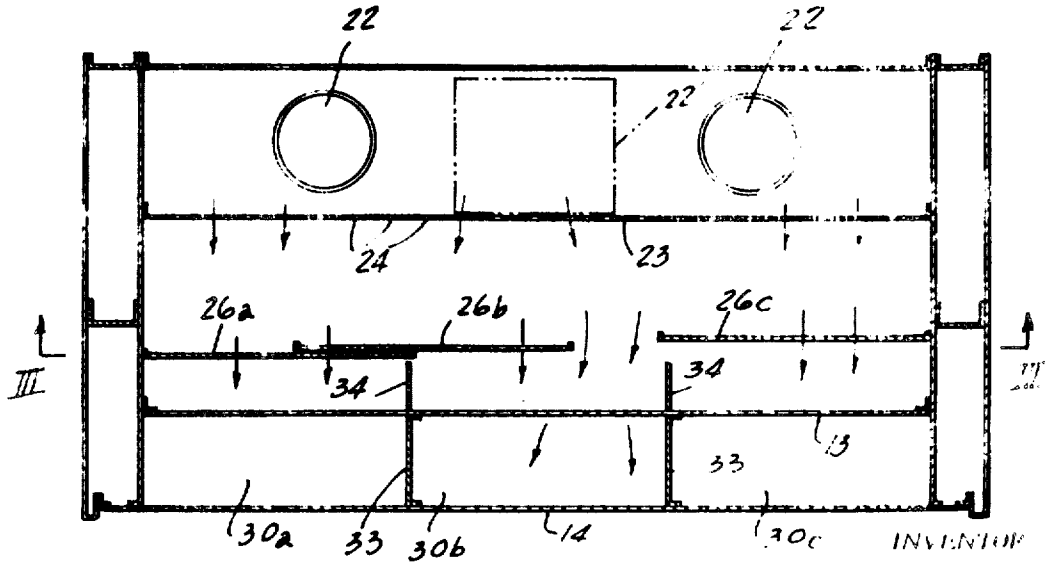


Fig. 4

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FUME HOOD

BACKGROUND OF THE INVENTION

Fume hoods in the form of an enclosure over a work surface, and adapted to be connected to a suitable air discharge system have been in use for many years, such hoods normally being provided with an access opening which may be closed by a vertically sliding door or panel. Initially, such hoods drew all the air exhausted directly from the room unless the flow was stopped off by completely closing the sash. However, the use of a hood, the closure means is in at least a partially open position to permit access and performance of operations on materials within the hood, and the full amount of room air is drawn into the hood and carried out the discharge system. With the extensive use of air conditioning in laboratories and the like, the losses of cooled air through such a fume hood may be considerable and can materially increase the operating costs in connection with such air conditioning.

It has therefore been in practice in recent years to provide an auxiliary air flow from the fume hood to the exterior thereof adjacent the closure member when the latter is in an open position. thus the amount of room air inducted into the system may be considerably reduced. Some system have utilized 50 percent room air and 50 percent auxiliary air and illustrated in Nelson et al. Pat. No. 3,318,227 is a fume hood structure of the auxiliary air type in which the inducted air through the access opening comprises 70 percent and the other 30 percent comprises room air. It will be appreciated that when the access opening is closed, auxiliary air should flow into the fume head to provide air circulation, which is exhausted through the discharge system. A simple way of effecting such flow is illustrated in the above referred to patent in which construction the amount of auxiliary air discharged directly into the fume hood and that discharged at the exterior thereof, for flow through the access opening into the hood, is controlled by vertical movement of the closure means for such access opening, the inlet duct for the auxiliary air directly into the fume hood being so located that the closure member functions as a damper to vary the direct and indirect flow of the auxiliary air.

However, in many cases it is desired, for one reason or another, for example where a walk-in type fume hood is involved, or for other reasons, to employ laterally slidable closures, usually a plurality of laterally slidable closure members being utilized. Obviously in such an arrangement the previous types of air control are no longer suitable.

The present invention therefore has as its main objective the production of a fume hood structure employing laterally movable closure members arranged to actuate suitable auxiliary air control means whereby the amount of auxiliary air discharged at the exterior of the fume hood is controlled by the position or positions of the closure means for the access opening thereof, whereby the quantity of air discharged down the exterior of the hood in proportioned to the opening and the flow is directed to the area immediately in front of the opening and whereby the remainder of the auxiliary air is drawn directly into the hood over its entire length to properly ventilate the hood interior.

BRIEF SUMMARY OF THE INVENTION

The present invention is directed to a fume hood structure employing laterally movable closure members in conjunction with an auxiliary air duct arranged to discharge air to the exterior of the fume hood adjacent the closure members as well as provide a flow of air into the fume hood above the closure members. Control of the amount air discharged at the exterior of the fume hood is effected by a plurality of valve or damper members operatively connected to a closure members for actuation thereby with movement of a closure member in an opening direction being operative to move the corresponding damper member into a similar open position and permit the flow of auxiliary air therethrough from which it may be discharged at the exterior of the fume hood. A comparatively small air discharge opening may be provided, for example, adjacent the bottom of the damper members whereby air may continuously flow therethrough, for discharge directly into the fume hood when the closure members thereof are in a closed position.

As the auxiliary air discharge opening resulting from a partially opened damper member may be positioned at different locations intermediate the sides of the fume hood, depending upon the particular closure member moved and the direction of movement thereof, to insure a direct flow of air from such opening to the exterior of the fume adjacent the open closure member, baffle means are provided to effect the desired direction of such air flow.

The present invention thus provides all of the advantages of prior constructions utilizing vertically movable closure members, and at the same time provides an exceedingly simple and foolproof arrangement whereby lateral movement of the closure members will automatically provide the right amount of auxiliary air at the desired location.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features and advantages of the invention will be readily apparent from the following description of a preferred embodiment thereof, taken in conjunction with the accompanying drawings, in which like reference characters indicate like or corresponding parts, although variations and modifications may be effected without departing from the spirit and scope of the novel concepts of the disclosure, and in which:

FIG. 1 is a front elevational view of a fume hood embodying the present invention;

FIG. 2 is a sectional view taken approximately on the line II—II of FIG. 1;

FIG. 3 is a sectional view taken approximately on the line III—III; and

FIG. 4 is a transverse section taken approximately on the line IV—Iv of FIG. 2.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 1 which illustrates the general type of fume hood to which the present invention is applicable, the reference numeral 1 designates a generally rectangularly shaped structure having a base 2 the upper surface 3 of which forms a work surface which is enclosed by a fume hood structure, indicated generally by the numeral 4, having exterior sidewalls 5, a rear wall 6 and a top wall 7. The exterior sidewalls 5 extend forwardly of the base 2 to provide forwardly extending wings 8 at each side of the hood which tend to reduce cross drafts or other disturbances in front of the fume hood creating turbulence in the incoming auxiliary and room air and thus have the effect of partially isolating the fume hood opening 9 from the room in which the device is installed. As will be apparent from a reference to FIGS. 1 and 2 the opening 9 is framed by angularly disposed vertical fascia members 10 and similarly shaped bottom and top members 11 and 12 respectively, a panel 13 extending vertically upward from the front edge of the fascia member 12 as clearly illustrated in FIG. 2. Also extending across the front of the structure, substantially in line with the front edges of the wings 8, is front upper panel 14 which thus is spaced outwardly with respect to the panel 13.

The opening 9 is adapted to be closed by a plurality of closure members such as the glazed doors 15*a*, 15*b* and 15*c*, the number of which will depend upon the size of the enclosure, such doors being supported adjacent their top edges for lateral sliding movement to provide a maximum access opening approximately equal to the size of two of the closure members. The supporting structure of such closure member, indicated generally by the numeral 16 may be of conventional construction employing horizontally extending channel hangers adapted to receive roller members carried by the respective

members, and in like manner suitable means may be provided adjacent the lower edges of the members for guiding the same in their opening closing movements. Specific constructional details of the closure members **15** and base **2** form no part of the invention and therefore have not been illustrated in detail.

Likewise, the interior of the work enclosure may be of conventional design, provided with rear and top baffle walls **17** and **18** as well as a top wall **19** which may contain illuminating means **20**, the rear baffle **17** terminates above the work surface and the baffle **18** terminates short of the wall **19** to provide respective air outlets through which air may be discharged from the enclosure interior to a suitable exhaust system. In the particular embodiment of the invention illustrated a horizontally disposed wall **21** extending across the rear portion of the hood, which is provided with two air discharge ducts **22** through which air from the enclosure may be withdrawn. Also extending across the structure is a vertically extending wall **23**, the lower edge of which terminates adjacent the front edge of the horizontally extending wall **21**. The wall **23** may be provided through out its area with a perforation **24** so that a pressurized plenum is formed to provide a uniform flow of air, supplied through the air inlet duct **22**; forwardly therethrough across the entire width of the hood. Extending upwardly from adjacent the front edge of the top wall **19** is a baffle wall, indicated generally by the numeral **25**, illustrated as being formed in two sections with the upper edge of the top section **25** defining the bottom edge of an air discharge opening.

As illustrated in FIGS. **2**, **3** and **4** positioned above and carried by the respective closure members **15** are respective damper members **26***a*, **26***b* and **26***c*, each of which comprises a generally rectangular shaped plate supported from the associated closure member by respective vertically extending members **27***a*, **27***b*, and **27***c*, the latter extending downwardly to adjacent the upper supporting structure **16** and then rearwardly to a position rearward of the innermost closure member then downward to adjacent the closure members. They then extend forwardly to the associated closure member and are secured thereto. As illustrated in FIG. **2**, the upper edges of the damper members terminate in inverted U-shaped channels **28** which are slidable in inverted guide members **29**, whereby the damper members are maintained in proper alignment throughout their travel with the associated closure member. Referring to FIGS. **3** and **4**, the respective damper members **26** each have a horizontal width generally corresponding to the width of the associated closure member and is disposed substantially directly thereabove.

As will be apparent from a reference to FIGS. **2** and **4**, the space between the wall **23** and the damper members **26** forms an air distribution chamber into which auxiliary air is discharged through the openings **24**, in the wall **23**, whereby such auxiliary air is distributed entirely across the fume hood structure. Assuming that all of the closure members are in positions to completely close off the access opening **9**, the damper members **26** will form a continuous damper structure extending completely across the hood, restricting the flow of auxiliary air to the opening between the upper edge **25'** of the wall **25** and the lower edges **26'** of the respective damper elements. At the same time, it will be noted from a reference to FIG. **2** that the wall **25** and the panel **13**, in cooperation with the fascia member **12**, form a duct for conducting air discharged from the opening below the damper members **26** into the work space through the opening defined by the supporting structure **16** for the closure members and the forward edge of the wall **19**. Consequently, when the closure members **15** extend completely across the access opening, auxiliary air flow into the hood will be limited to that flowing through such duct into the upper portion of the hood, from which it will ultimately be discharged through one of the ducts **22**.

The front panel **14** and upper portion **13'** of the panel **13** defines a channel **30** extending across the hood which communicates with the space at the discharge side of the damper members **26** whereby air, in dependence upon the position of the respective dampers **26**, may be discharged through the channel **30**, down along the panel **13** between the wings **8** through the closure members **15**. To facilitate such flow, extending across the hood is a deflector assembly, indicated generally by the numeral **31**, which extends from the junction of the front panel **14** with the top wall **7** diagonally downward to adjacent the upper edge of the panel **13'**, such deflector structure having a plurality of curved horizontally extending vanes or louvers **32** disposed to direct auxiliary air, passing to the exterior of the damper members **26**, into the duct **30** from which it is discharged as previously described.

To direct air passing through the opening defined by two damper members and discharge from the duct **30** to adjacent the opening between two closure members **15** respective baffle members **33** are positioned in the duct **28** thereby dividing such duct into respective sections **30***a*, **30***b* and **30***c*, each of which has a width generally corresponding to the width of the corresponding damper member **26** and closure member **15**, whereby the air discharged through the duct **30** will be directed to adjacent such an opening. To further insure that air to be discharged through one of the duct sections **30***a*, *b* or *c* from being laterally diffused and discharged from another duct section, additional baffles **34**, disposed in alignment with respective baffles **33** are positioned between the deflector **31** and the dampers **26**, as clearly illustrated in FIG. **4**, in effect forming a continuation of the baffles **33**. Baffles **33** may be secured to adjacent structural elements of the hood structure by any suitable means, as for example, laterally extending flanges disposed along the generally vertical edges of the baffles **33** and secured to the adjacent **13'** or panel **14**. In like manner the baffles **34** may be provided with horizontally extending flanges secured to the top wall **7** and suitable flange means or brackets secured to the adjacent wall **13'**.

As previously mentioned, and as will be apparent from a reference to FIGS. **2** and **3**, irrespective of the positioning of the respective dampers, auxiliary air is free to flow through the openings **24**, through the space below the dampers **26**, into the channel between the panel **13'** and the wall **25** for discharge above the closure members **15** into the upper portion of the enclosure. However, when a closure member such as the closure member **15***b* is moved to an open position, as for example, as illustrated in FIGS. **3** and **4**, the opening created between the right-hand edge of the damper **26***b* and the left-hand edge of the damper **26***c*, as viewed in FIGS. **3** and **4**, will permit the air passing through such opening to the deflected into the duct section **30***b* of the duct **30**, from the lower end of which it will be discharged to adjacent the opening created between the adjacent edges of the closure members **15***b* and **15***c*, whereby air will tend to be inducted through such opening.

The size of the bypass opening below the damper members **26**, and the other cooperable elements, particularly the height of the dampers **26** will be selected to provide a desired ratio of available auxiliary air adjacent an open closure member **15** to achieve a desired ratio of auxiliary air to room air passing through such opening. Likewise, by suitable dimensioning, the amount of bypassed air below the dampers may be readily calculated to meet desired conditions.

In this connection, it will be particularly noted that air flowing from the air distribution chamber disposed between the wall **23** and the dampers **26**, through the opening below the lower edges **26'** of the dampers may, in the absence of other forces acting thereon, flow either downwardly between the walls **13**, **25** into the fume hood or through the deflector **31** and the discharge from the duct **30** to the exterior.

In practice such opening in the air distribution chamber is carefully proportioned with respect to the opening into the fume hood, above the doors **15**, and the normal volume of air withdrawn through the exhaust ducts **22**. It will be appreciated that a positive air pressure within the hood is to be avoided under all conditions of operation as any toxic fumes within the hood might thereupon be forced through any leakage openings such, for example, as may exist above the doors **15**, etc., into the room.

Consequently, in the present invention, auxiliary air may, at any time when the volume of such air flowing from the air distribution chamber is greater than that being withdrawn through the ducts **22**, flow through the duct **30** into the room without pressurizing the interior of the fume hood.

This possibility might occur for example, if the suction developed by the exhaust blower associated with the ducts **22**, for any reason drops below its normal valve, but not sufficient to activate any safety devices.

Consequently, the ducts, discharge openings, etc. are so proportioned that the duct **30** and associated passageways are adequate to conduct all auxiliary air, whereby the amount of such air directly entering the fume hood at any time is primarily dependent upon the air pressure drop within the hood and not upon the pressure of the auxiliary air flowing below the dampers **26**, or around an open damper.

While I have illustrated the duct **30** as being divided into three sections by the baffles **33**, obviously any desired number of baffles **33** and **34** may be employed to provide for greater localization of air discharged at the front of the hood. However, in most applications, a construction such as illustrated will be adequate.

The present invention may be readily employed in connection with fume hoods of widely differing physical design but which incorporate laterally slidable access doors or closure members similar to those therein described.

It will be appreciated from the above disclosure that I have provided a novel fume hood arrangement, employing laterally slidable closure members, in which control of auxiliary discharged at the exterior of the closure members is effectively controlled in correspondence with the position of closure members involved and in accordance with the size of the opening created. It will also be noted that the construction is extremely simple as well as being fool-proof in operation and adds relatively little to the overall cost of manufacture of such a fume hood.

I claim:

1. In a fume hood employing laterally slidably closure means for the access opening thereof, the combination of a fume hood housing cooperable with a plurality of movable closure members to form a chamber, with said members forming at least a part of a sidewall of such chamber and movable laterally relative to said housing and one another to provide an opening in such wall by means of which access may be effected to the chamber interior, means for discharging auxiliary air adjacent the exterior of said closure members comprising a duct structure disposed above said chamber and having a discharge opening adjacent the top of said closure members, and means cooperable with said first means responsive to lateral movement of said closure members for operatively varying the amount of auxiliary air discharged therefrom in response to changes in the relative positions of said closure members, said air varying means comprising damper members arranged to extend across the duct structure forming a damper assembly operative to control the amount of air therethrough, and means for effecting movement of said damper member in response to movement of said closure members.

2. A fume hood as defined in claim **1**, wherein said means for effecting damper movement comprises respective members, each rigidly connecting a respective damper member to the corresponding closure member whereby such damper member is movable with the associated closure member.

3. A fume hood as defined in claim **3**, wherein said damper means are coextensive in lateral width with the associated closure members, said dampers being spaced upwardly from the adjacent hood structure to form an air bypass opening through which air may flow when said dampers are in closed positions, said chamber being provided with an opening therein communicating with said bypass opening whereby said bypass air may flow into said chamber.

4. A fume hood as defined in claim **3**, wherein said chamber opening is disposed adjacent the top edge of said closure members.

5. A fume hood as defined in claim **4**, wherein said duct structure is divided laterally by respective baffle members operative to direct air flow resulting from an open damper member to adjacent the open closure member carrying such damper.

6. A fume hood as defined in claim **4**, wherein said duct structure has a generally L-shaped portion, extending across the housing at the top thereof and downwardly across the housing at said closure members with said duct having a discharge opening disposed adjacent the tops of said closure member at the exterior thereof, and deflector means extending across the duct and disposed to direct air passing through the damper assembly through such discharge opening, said baffle members being disposed at each side of said deflector means.

7. A fume hood as defined in claim **6**, wherein the baffles at one side of said deflector means are aligned with respective baffles at the opposite side thereof, a pair of aligned baffles being disposed substantially in alignment with the respective junctures of adjacent closure member when the latter are in closed positions.

8. In a fume hood employing laterally slidable closure means for the access opening thereof, the combination of a fume hood housing cooperable with a plurality of movable closure members to form a chamber, with said members forming at least a part of a sidewall of such chamber and movable laterally relative to said housing and one another to provide an opening in such wall by means of which access may be effected to the chamber interior, duct means communicating adjacent end with the chamber interior and at the opposite end exteriorly of the chamber for discharging auxiliary air adjacent the exterior of said closure members, means for discharging auxiliary air into said duct intermediate the ends of the latter, and means responsive to lateral movement of said closure members for operatively varying the amount of auxiliary air discharged from said duct to the hood exterior in response to changes in the relative positions of said closure members, said auxiliary air varying means comprising damper members, defining a part of a wall of such duct, operative to control air flow therethrough, and means for effecting movement of said damper means in response to the movement of said closure members, said duct having an opening therein for the flow of auxiliary air into said duct irrespective of the setting of said auxiliary air-varying means.

9. In a fume hood employing laterally slidable closure means for the access opening thereof, the combination of a fume hood housing cooperable with a plurality of movable closure members to form a chamber, with said members forming at least a part of a sidewall of such chamber and movable laterally relative to said housing and one another provide a vertically extending opening in such wall by means of which access may be effected to the chamber interior, means for providing a discharge of auxiliary air laterally along the adjacent exterior of the upper portions of said closure members, and control means cooperable with said first means, responsive to lateral movement of said closure members, for restricting auxiliary air discharge therefrom when said closure members are in closed positions and effecting an auxiliary air discharge therefrom adjacent the upper end of such a vertically extending opening resulting from relative movement of a closure member.

10. A fume hood as defined in claim **9**, wherein said control means is constructed to vary the amount of auxiliary air so discharged in response to changes in the size of such vertically extending opening resulting from changes in the relative positions of said closure members.

11. In a fume hood employing laterally slidable closure means for the access opening thereof, the combination of a fume hood housing cooperable with a plurality of movable closure members to form a chamber, with said members forming at least a part of a sidewall of such chamber and movable laterally relative to said housing and one another to provide a vertically extending opening in such wall by means of which

access may be effected to the chamber interior, duct means extending laterally across such sidewall above said closure members, said duct means communicating adjacent one end with the chamber interior and at the opposite end exteriorly of the chamber for discharging auxiliary air adjacent the exterior of the upper portions of said closure members, means for discharging auxiliary air into said duct means intermediate the ends of the latter, and respective means for each closure member, responsive to lateral movement of the associated closure member, for controlling the discharge of auxiliary air adjacent the upper portion of the associated closure member, and operative to correspondingly vary the amount of auxiliary air so discharged from said duct means to the hood exterior, in response to changes in the relative positions of said closure members, said duct having an opening therein for the flow of auxiliary air into said duct means irrespective of the setting of said auxiliary air-controlling means.

12. A fume hood as defined in claim 11, comprising duct means communicating with said first duct means and the interior of said chamber for directing auxiliary air in said first duct means into the chamber interior.