May 9, 1967 L. N. NELSON ET AL 3,318,227

FUME HOOD

Filed March 10, 1965 8 Sheets-Sheet 1

Fig. 1.

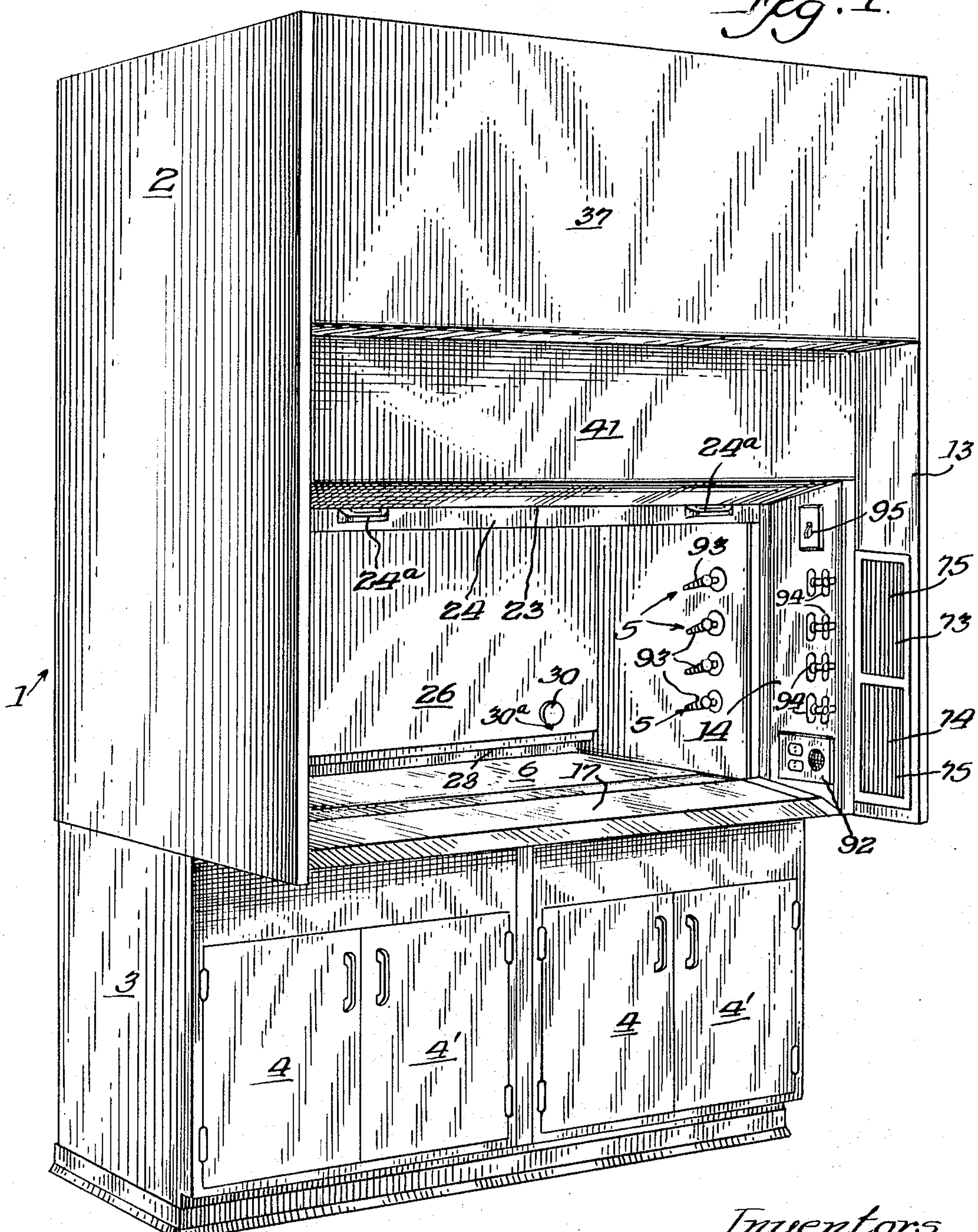

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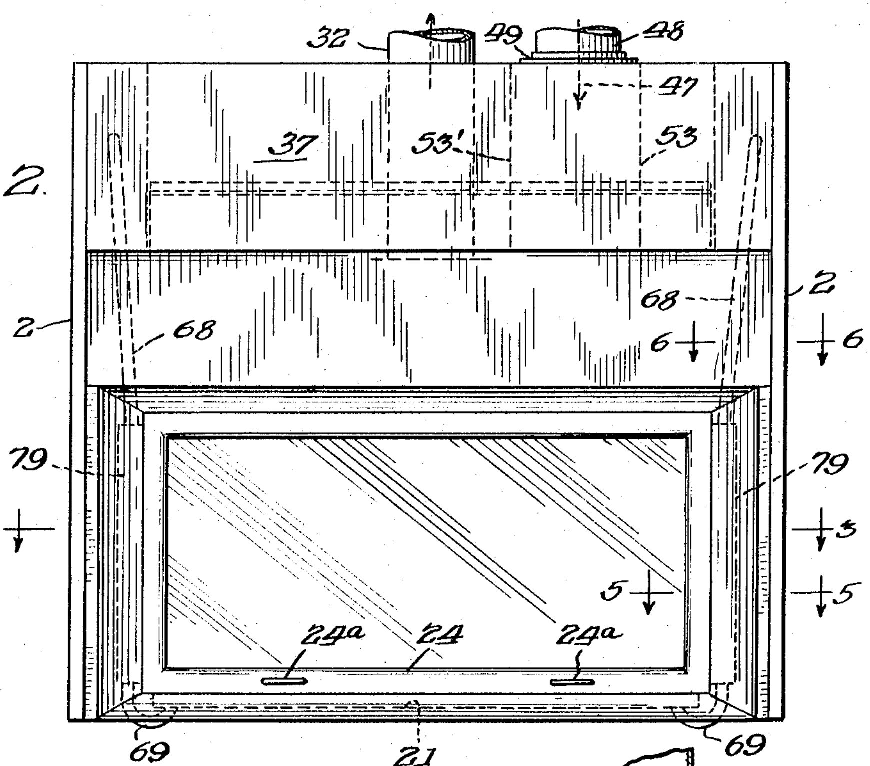
Fig. 2.



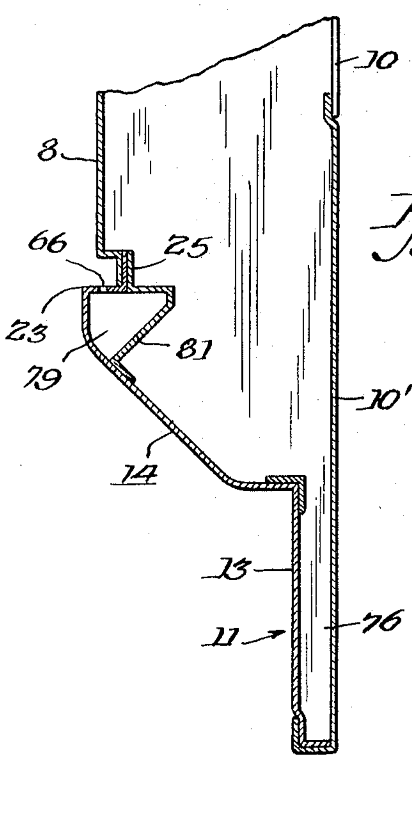
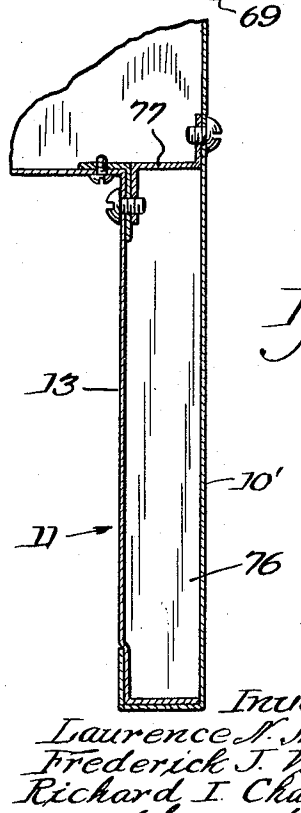


Fig. 5.

Fig. 6.



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FUME HOOD

Filed March 10, 1965 8 Sheets-Sheet 3

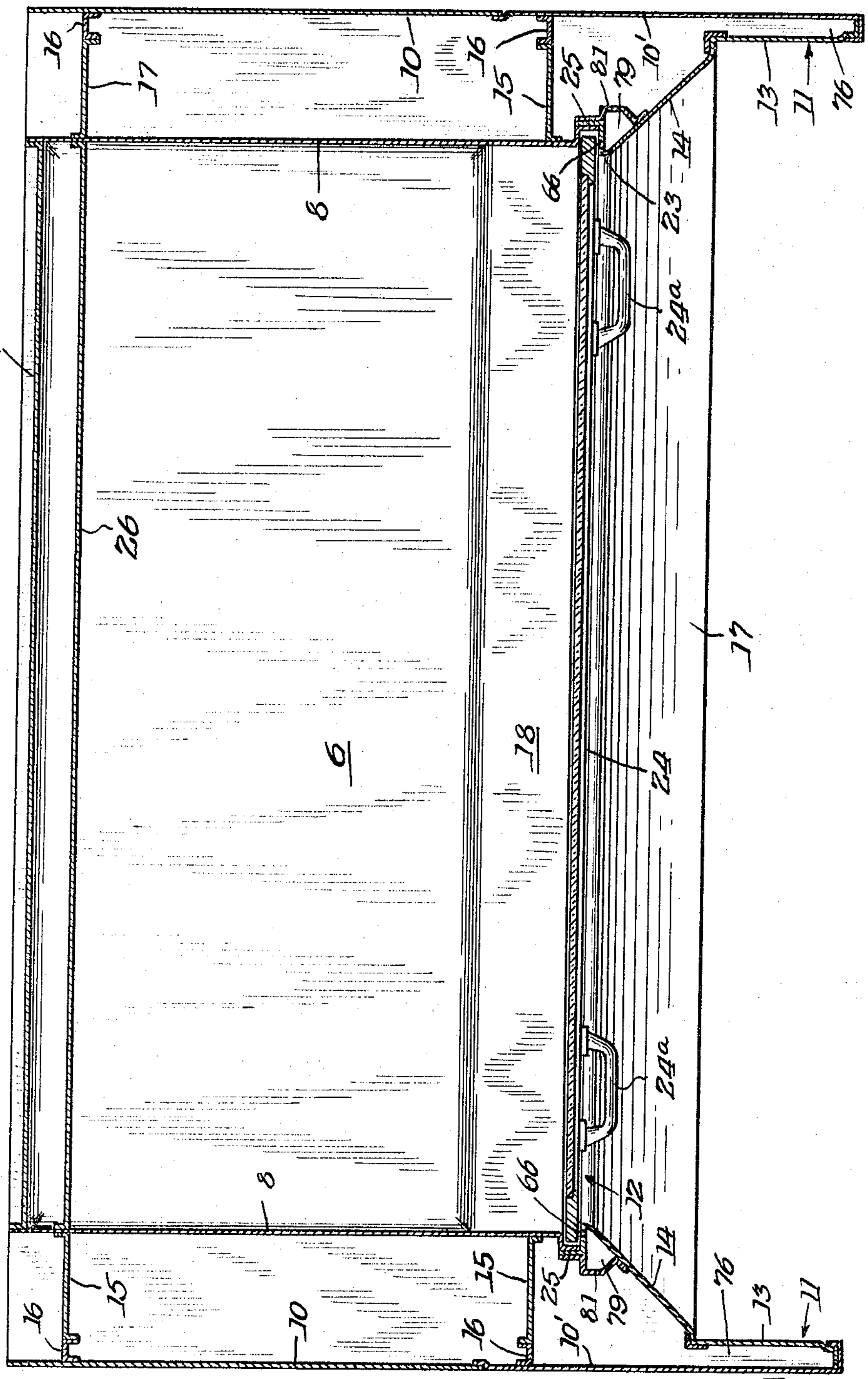

Fig. 3

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FUME HOOD

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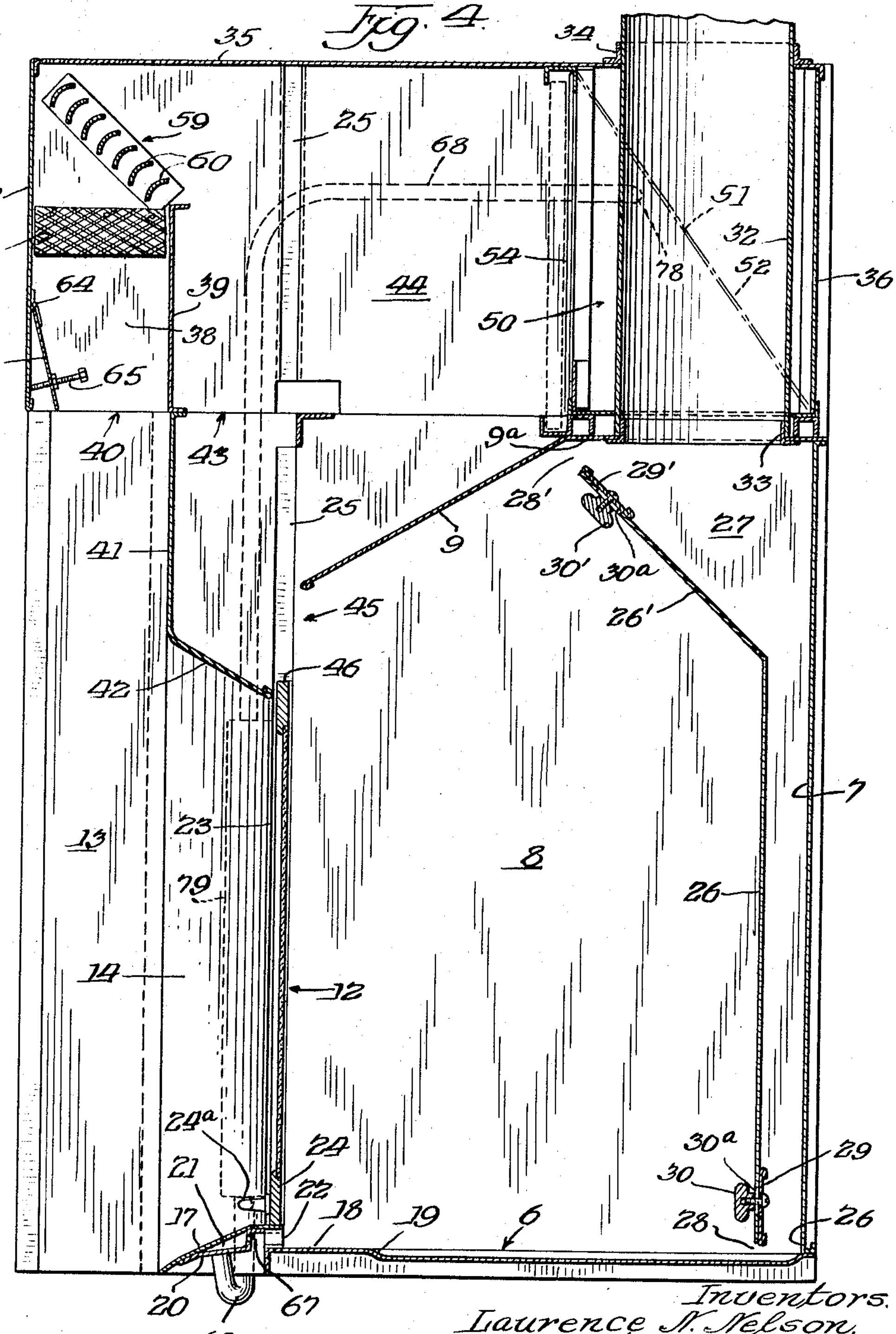
Fig. 4.



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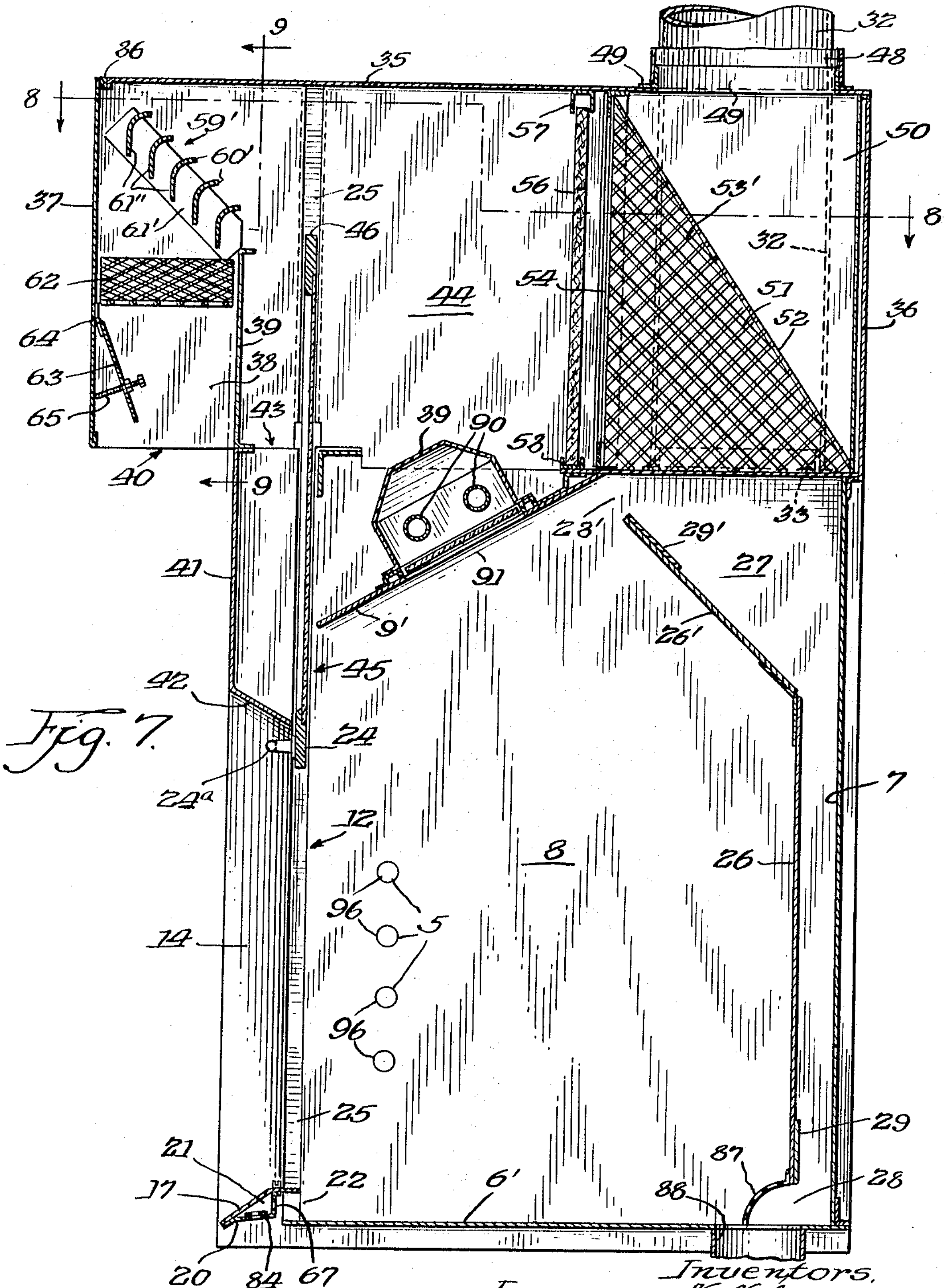

Fig. 7.

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FUME HOOD

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Fig. 8.

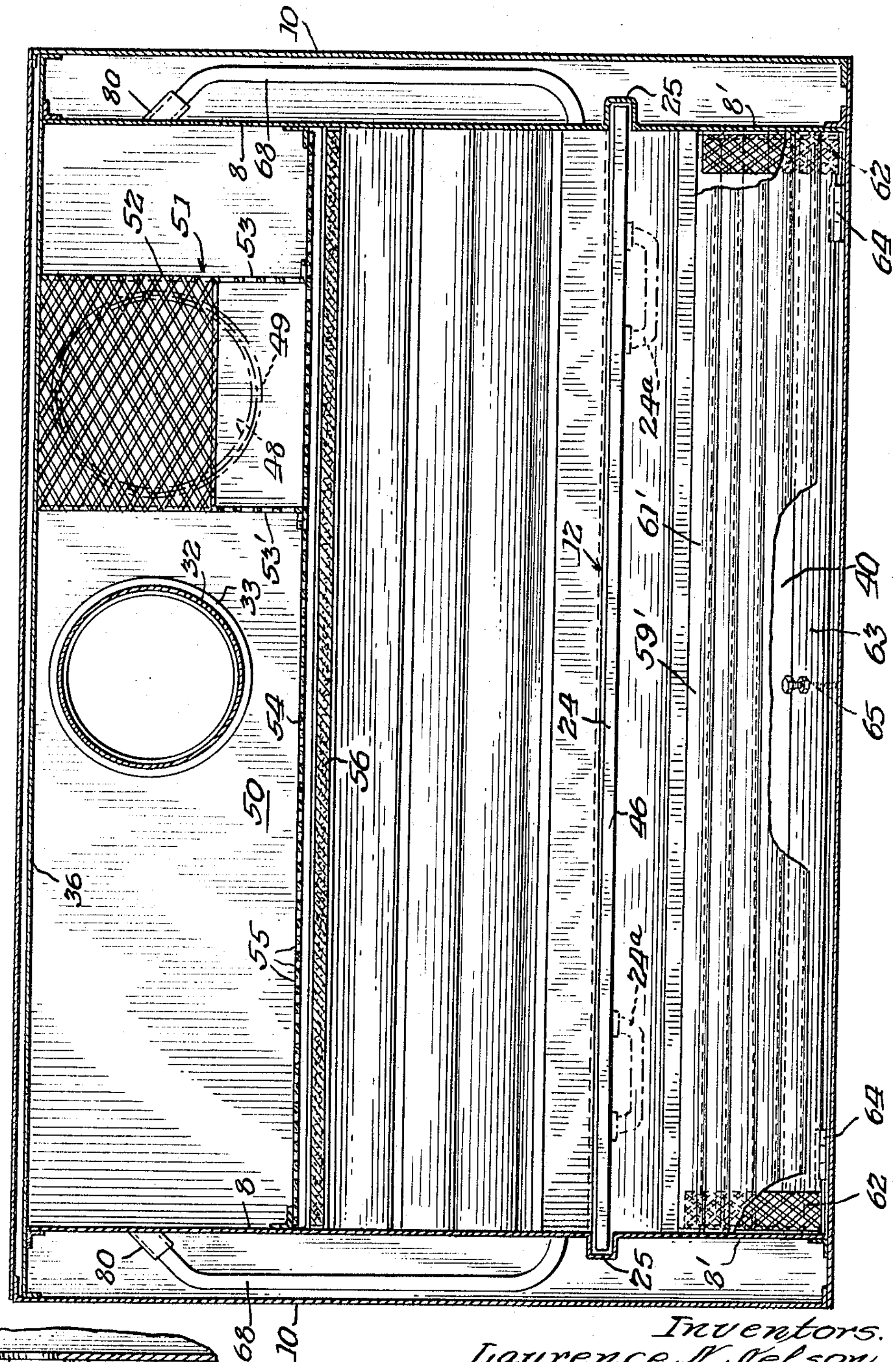

Fig. 8A.

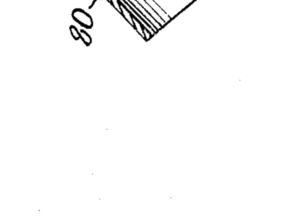

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Fig. 9.

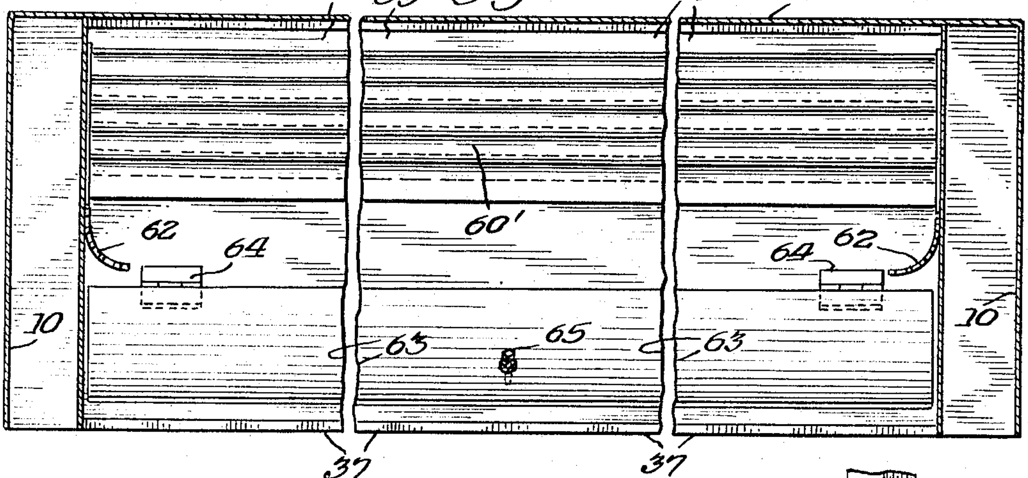


Fig. 10.

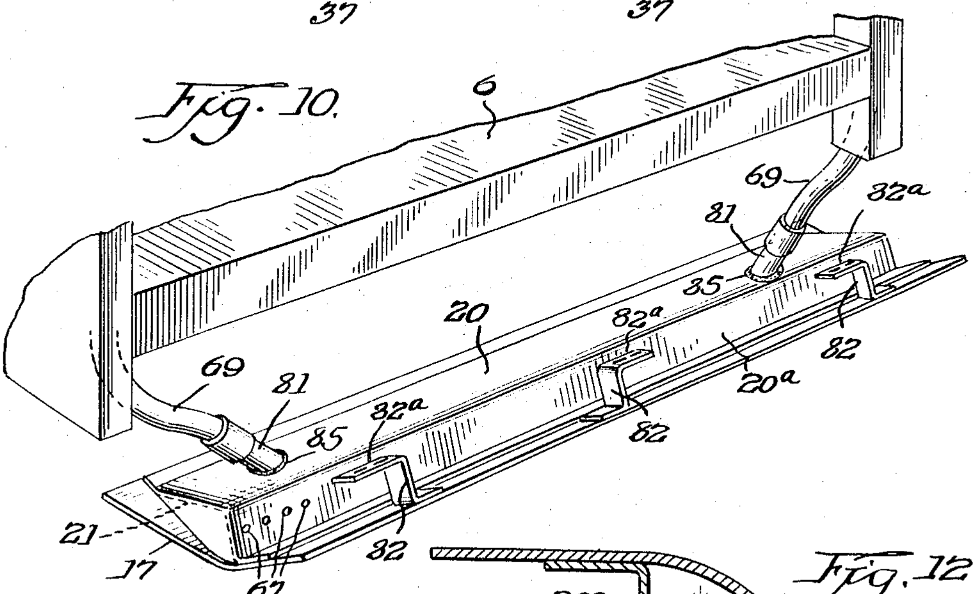


Fig. 11.

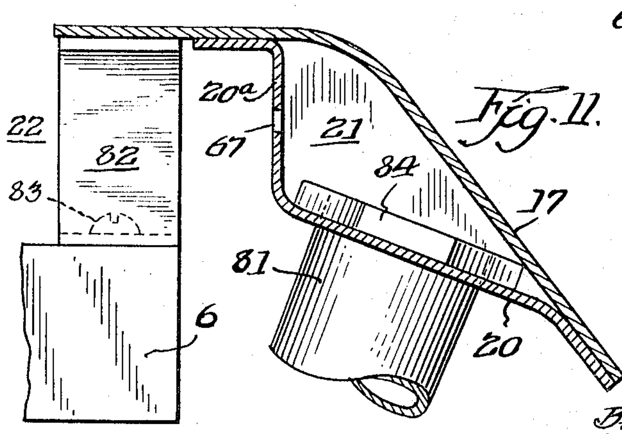
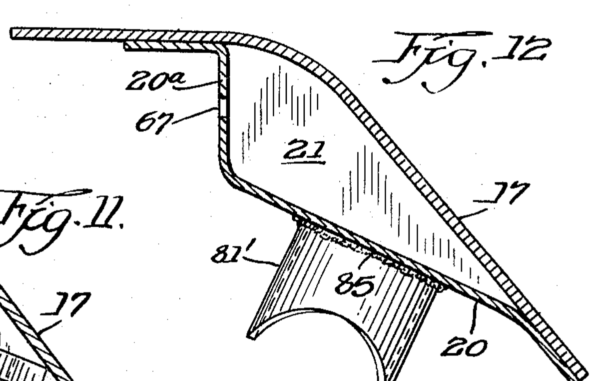


Fig. 12



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FUME HOOD

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Fig. 14

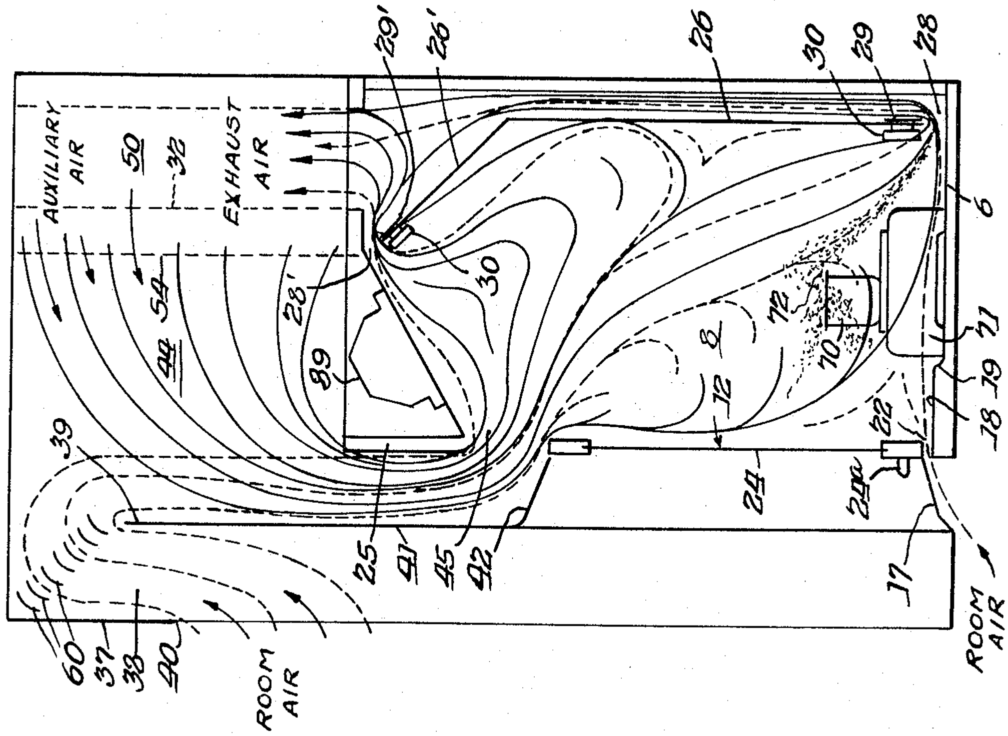
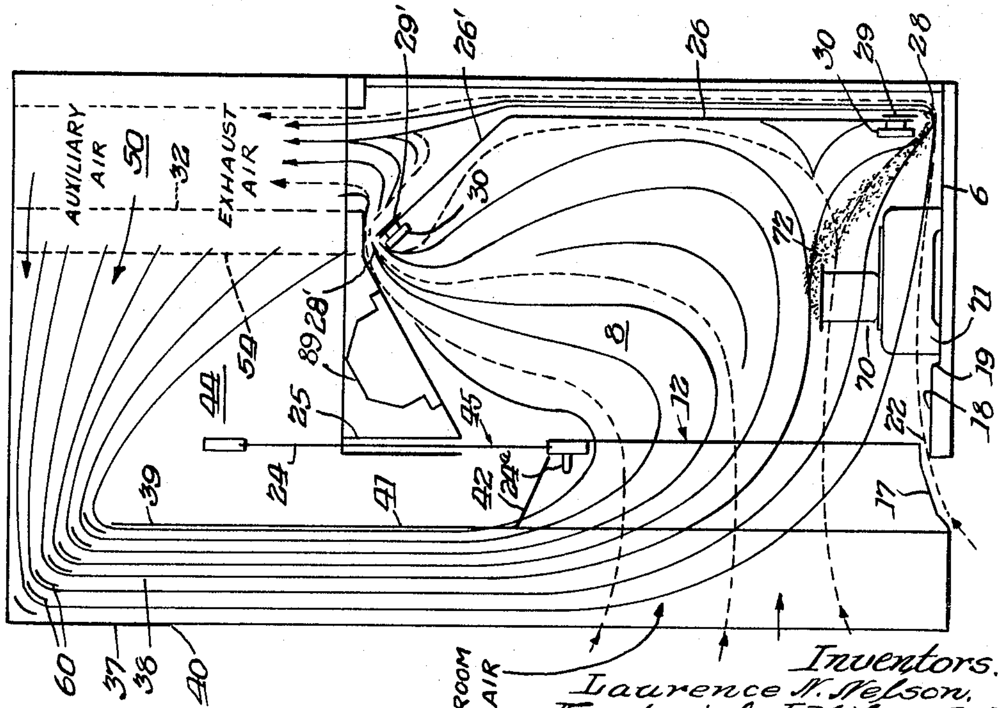


Fig. 13



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United States Patent Office

3,318,227

Patented May 9, 1967

3,318,227
FUME HOOD

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Filed Mar. 10, 1965, Ser. No. 438,501
15 Claims. (Cl. 98—115)

Our invention relates to an improved fume hood for use wherever found applicable, and is an advancement in auxiliary air fume hoods for use in air-conditioned laboratories and buildings, and which is especially desirable for the handling of radioactive isotopes and other uses in which hazardous chemical reactions may be carried out and heat, dust, toxic, vapors and gases which are highly odoriferous removed providing sanitary, safe and healthy working conditions for laboratory personnel, and is an improvement over the fume hood as disclosed and claimed in the U.S. Letters Patent No. 2,702,505 of Laurence N. Nelson granted Feb. 22, 1955 and assigned to a common assignee, Kewaunee Manufacturing Company, Adrian, Mich.

Our invention is also considered to be an improvement over earlier forms of fume hoods as disclosed and claimed with respect to features of the Fume Hood of Angermueller U.S. Patent No. 2,549,042 granted Apr. 17, 1951; the Fume Hood of Snow et al., U.S. Patent No. 2,649,727 granted Aug. 25, 1953; the Fume Hood of Morrow, U.S. Patent No. 2,627,220 granted Feb. 3, 1953; the Laboratory Fume Hood of McNeil et al., U.S. Patent No. 2,819,666 granted Jan. 14, 1958; and the Laboratory Hood of Mackintosh et al., 2,715,359 of Aug. 16, 1955.

In fume hoods of more recent type as manufactured by the assignee and known as auxiliary-air type air flow fume hoods and which use a ratio of 50% room air from the building air-conditioning system and 50% auxiliary air, the room air is air from the laboratory which is either heated or cooled depending upon outside weather conditions. The greatest savings obtained by the use of auxiliary air is in the reduced load on the room air-conditioning (cooling) system during warm weather. There is also a reduced requirement for heated room air during cold weather, but in most cases the colder auxiliary air will have to be tempered to room temperature or above, so there will be no actual savings in total heating costs. These auxiliary-air type air flow fume hoods operate at a minimum face velocity of 50 f.p.m., with all of the air exhausted entering the hood face from the room. Face velocities of less than 50 f.p.m. are not adequate to overcome the tendency of fumes to escape through the hood face under normal operating conditions. When this type of fume hood operates at the minimum face velocity of 50 f.p.m., only 50% of the air used is taken from the room. However, the entire quantity of air exhausted (25 c.f.m. of room air per square foot of hood opening and 25 c.f.m. of auxiliary air per square foot of hood opening) is virtually 100% effective in sweeping fumes away from the hood face back to the baffle exhaust openings. The hoods of the assignee use 50% less room air than standard Airflow Fume Hoods, and use 65%–70% less room air than conventional type fume hoods. This large reduction in room air requirements is accomplished by substituting auxiliary air for room air, but the total volume of air exhausted is the same as for standard Airflow Fume Hoods. Performance-wise these auxiliary-air type airflow fume hoods of assignee operate with the same high efficiency as do standard Airflow Fume Hoods.

The fundamental difference in concept between assignees' auxiliary-air type airflow fume hoods and competitive and competitive types is this: assignees' auxiliary-air type hoods provide 50 f.p.m. face velocity versus 25

f.p.m. face velocity offered by competitive types. The total amount of air taken from the building air-conditioning system is the same, and the total amount of auxiliary air required is less. Assignees' auxiliary-air type airflow fume hoods provide a safety factor of double the face velocity of competitive types.

In the improved fume hood construction of our invention over prior fume hoods of assignee as set forth above, our improved airflow fume hood is preferably used in air-conditioned laboratories. This improved fume hood draws100% of the air exhausted by the hood through the hood face. Up to 70% (in some cases higher) of the total quantity of air exhausted can be auxiliary air, which enters a chamber at the top of the hood from a separate blower and duct system and is flowed down the outside front of the hood. The auxiliary air mixes with the conditioned room air and the total quantity of air is drawn through the hood face back to the rear baffle exhaust openings by the exhaust blower.

To reduce the possibility of cross drafts, or other disturbances in front of the hood from creating turbulence in the incoming auxiliary air and room air, wings are provided on each side of the hood opening. These wings have the effect of partially isolating the hood opening from the room, and improve hood performance substantially. In the improved fume hood of our invention as will be more particularly described, the hood may operate with the sash in both the raised and closed positions, and when the sash is in the closed position, the auxiliary air enters the hood interior through a bypass.

Our invention has generally among its objects, the production of an efficient fume hood for the handling of gases and the eradication of fumes and air-borne particles at a low velocity of air, with the elimination of all possible turbulence in the hood.

A further object is a fume hood adapted to provide or direct a smooth, uniform flow or blanket of air over the entire face opening toward the rear of the hood including the working surfaces of the hood and along the surfaces of the ends and other surfaces of the hood.

The invention has particularly as an object the production of a more efficient fume hood having improved exhaust openings, improved air foil vanes at the sash posts, and a directional vane across the front edge of the bottom at the front opening to the hood, the hood being particularly adapted for use where fumes, dangerous to health or life, are present. The vanes cause the air streams to sweep over the ends and bottom of the hood without eddies or turbulence.

Another object of the invention is the providing of means to prevent back currents along the front of the working surface out at the front of the hood. The front edge of the pan or working surface is so formed that the air stream created by the air foil directional vane at the front of the opening will follow this formation downwardly and sweep the bottom of the hood.

A further object is the production of a hood constructed with a hood interior work space and including a back baffle in the hood which should have at least two openings, one at the intersection of the baffle and the bench-top and the second opening at the interesection of the baffle and the hood face or top; and the slot openings should run substantially the full length of the hood, and the area should be such as to properly control the air discharged from the hood interior. It is within the scope of our invention that the slot velocity should be within the range of from 1000 to 1500 f.p.m. Adjustable slides may be used with these baffle openings to provide the desired uniformity of air flow in the face after installation whereupon the slides may be permanently set for the conditions under which the hood may operate. Face velocities for fume hoods are usually expressed in linead feet-per-minute (FPM) to the hood opening or "hood face." Suggested minimum face velocities may vary considerably even for a given application and a minimum face velocity of 50 f.p.m. for certain types of fume hoods and 100 f.p.m. for improved conventional fume hoods. Metallurgical laboratories which generate abnormal heating conditions in fume hoods require substantially 100–125 f.p.m. in most instances; perchloric acid fume hoods have a greater air requirement and require a minimum face velocity of 100 f.p.m. and 100–125 f.p.m. for conventional perchloric acid fume hoods, and the use of radiochemicals in fume hoods could increase the volume of air required to insure the safety of the laboratory technician so that a minimum face velocity of 70–100 f.p.m. is recommended for fume hoods within the range of 100–140 f.p.m. for conventional type fume hoods. Fume hood exhaust blowers should be preferably placed at the end of the exhaust duct system so that the air is pulled rather than pushed through the duct. It is usually satisfactory to assume a static pressure of 3/8" when fume hoods have less than 25 feet or equivalent duct length, and a maximum duct outlet velocity of approximately 1800 r.p.m. Static pressure of 1/2" is normally assumed when duct is over 25 feet long or a fume hood has two exhaust outlets, and a maximum duct outlet velocity of approximately 1800 f.p.m.

A further object of the invention is to make the same adapted for air-conditioned rooms where the hoods are used to exhaust the air from the room and a positive amount of conditioned air is forced into the room, in which case it is desirable that an auxiliary opening be provided into the hood to exhaust the conditioned air from the room when the hood is closed, as well as to prevent excessive air velocities through the face of the hood when the sash has been almost closed.

A still further object of the invention is to provide a fume hood in which all air exhausted is drawn through the face of the hood and wherein up to 70% of this air may be uncooled auxiliary air, but only the remaining 30% being cooled room air, and all of the air exhausted by this type of hood is effectively utilized in moving fumes and contaminants away from the hood face back to the baffle exhaust opening.

A further feature of our invention is to insert at the upper edge of the deflector plate two suitably dimensioned quarter-round screens across so that the screens are tangent to the side and top deflector plate of the supply channel and open towards the center of the channel.

Still another feature of our invention is to provide a row of small diameter holes, suitably spaced in a suitable conduit mounted under part of bottom air foil, but suitably located under the air foil from bench edge for air entrainment, and the air discharged from the holes should be directed above the bench edge, and the air required for these jets is obtained from the main supply plenum upstream of the main diffuser plate by connecting each end of the air foil pipe-jet section to the blocked-off sections of the ends of the diffuser plate using one or more inch diameter pipes.

Still another feature of our invention is to provide similarly side (verticle) air-jets or equivalent with small diameter holes suitably spaced apart in a relatively small diameter pipe mounted adjacent the inside wall behind the sash and which are also connected to the main upstream supply plenum using suitably dimensioned pipe or the equivalent; said jets discharging air directed horizontally and parallel to the sides of the hood; and it is within the scope of our invention that other means may be used to convey the air from the supply plenum to the pipe jets.

There are many other objects and advantages of the fume hood herein shown which will be obvious to those familiar with the handling of gases, and especially those gases which must be handled with the greatest of care in order to avoid injury to the laboratory worker.

To this end our invention consists in the novel construction, arrangement and combination of parts herein

shown and described, and more particularly pointed out in the claims.

In the drawings, wherein like reference characters indicate like or corresponding parts:

FIG. 1 is a front elevation of an embodiment of the improved fume hood in perspective, particularly illustrating one form of fume hood construction using up to substantially 70% auxiliary air with the remaining 30% being cooled room air and a cabinet base therefor;

FIG. 2 is a front view in elevation of the fume hood of FIG. 1 with the window sash therefor in its closed position;

FIG. 3 is an enlarged cross-sectional view of the fume hood of FIG. 2 taken along line **3—3** of FIG. 2 and looking in the direction of the arrows;

FIG. 4 is a vertical sectional view taken along the centerline of the fume hood of FIG. 2 and looking toward the left end of the fume hood of FIG. 2;

FIG. 5 is an enlarged horizontal sectional view taken along line **5—5** of FIG. 2, looking in the direction of the arrow illustrating the facia and side extension and the perforations in the window sash for directing auxiliary air into the hood space of the fume hoods;

FIG. 6 is an enlarged cross-sectional view taken along line **6—6** of FIG. 2, looking in the direction of the arrows, illustrating the construction of a side extension of the fume hoods;

FIG. 7 is a vertical sectional view similar to the fume hood of FIG. 4, illustrating a light housing construction for illuminating the interior of the work space but without the side extensions of the embodiment of FIG. 4;

FIG. 8 is a cross-sectional view taken along line **8—8** of FIG. 7 and looking in the direction of the arrows;

FIG. 8A is an enlarged sectional view of the conduit connection for connecting the conduit for the auxiliary air to the vertical and horizontal air jets from the auxiliary air plenum chamber;

FIG. 9 is a vertical view taken along line **9—9** of FIG. 7, looking in the direction of the arrows, illustrating the air vane assembly, the screen deflector and the adjustable damper;

FIG. 10 is a perspective view of the bottom foil air jet construction detached from the front edge of the bottom of the fume hood;

FIG. 11 is an enlarged sectional view of the conduit connection for the auxiliary air hose to the air jet construction of FIG. 7;

FIG. 12 is a sectional view similar to FIG. 11 of a welded conduit connection to the plenum foil air jet construction;

FIG. 13 is a schematic view in cross-section illustrating the air flow pattern for the room air, the auxiliary air and the exhaust air with the fume hood sash in its natural raised position; and,

FIG. 14 is a schematic view similar to FIG. 13 illustrating the flow of the auxiliary air, the room air and exhaust air in its closed position.

Referring to the drawings, particularly FIGS. 1–6 of one embodiment of our invention of an auxiliary-air type airflow fume hood assembly **1**, which preferably comprises a fume hood superstructure **2**, a steel cabinet understructure **3** for use in air-conditioned laboratories, and the steel base cabinet understructure is conventional in form including oppositely open doors **4** and **4'** permitting access to storage shelves. The fume hood superstructure includes a bank of service fixtures **5** for supplying gas, steam, cold water and air and it is also within the scope of the invention that a cold water outlet with a gooseneck may be utilized. Suitable cutouts in the hood end for the piping for these fixtures are provided for all hoods including this embodiment. The fume hood comprises a bottom pan constituting a work surface which may be provided with reinforcements such as disclosed in the Nelson aforementioned U.S. Patent 2,702,505 granted Feb. 22, 1955. The fume hood is provided with a back wall 7, end walls 8 and top 9. There are also provided exterior end walls 10 which extend forwardly of the fume hood to provide wings 11. The wings 11 are provided on each side of the hood to reduce the possibility of cross drafts or other disturbances in front of the fume hood creating turbulence in the incoming auxiliary and room air. These wings 11 have the effect of partially isolating the fume hood opening 12 from the room in which the fume hood assembly is installed and improved fume hood performance is obtained. The wings 11 are formed from end wall extensions 10′ and oppositely formed channels 13. The oppositely formed panels 13 may be integrally formed with vertical streamlined facia 14, the connecting portions 14 providing substantially directional vanes for directing the air entering the fume hood as will be more fully explained hereinafter. The walls 8 and 10 are shown connected by stays 15 and spacer extensions 16 which serve as stiffeners and spacers. At the front edge of the fume hood, an air foil or vane 17 is provided which is mounted approximate the bottom 6. As clearly shown in FIGS. 3 and 4, the bottom 6 is raised at the front edge 18 above the bottom of the bottom head 19 joining the portion 18 preferably at a suitable angle or juncture surface, the bottom providing a water-tight pan for supporting the apparatus within the fume hood. As illustrated in FIGS. 3 and 4, the pan is sufficiently depressed to retain any fluids which may be spilled on the pan construction enabling it to be suitably drained away if necessary to a drain connection (not shown). If desired, a suitable trough may be provided at the rear or inner edge of the bottom or pan 6 and constructed to connect to a drain-type extending to waste such as disclosed in the aforementioned patent to Nelson. The vane 17 or air foil is provided with an inclined member 20 formed as shown in FIG. 4 providing a bottom facia air jet plenum chamber 21. It will be noted by referring to FIG. 4 that the inner edge of the vane or air foil 17 is slightly spaced above the outer edge of the bottom or pan 6 for movement of the cooled room air which may be drawn within the fume hood through the elongated air passage 22 extending the width of the sash opening and also of the uncooled auxiliary air provided through the bottom facia air jet plenum chamber 21.

Arranged at the front side or wall 23 of the fume hood is a sash or closure 24, preferably of glass or any equivalent which is arranged to slide in guides or sash posts 25 at each side, a stop (not shown) may be provided as disclosed in the aforesaid patent to Nelson for normally limiting the raising of the glass panel 24. The streamlined facia 14 forming directional vanes are connected to the sash posts 25. As disclosed in the aforesaid patent to Nelson, the stop may be moved inwardly to permit the raising of the panel or sash 24, the same normally being maintained in operative stopping position by means of a spring (not shown) or the equivalent as disclosed in the aforementioned Nelson patent. The front panel or closure 24 may be provided with counterbalances (not shown) arranged at either side as disclosed in the Nelson patent and suitably connected to the panel by means of cables or their equivalents, not shown in detail, or any other suitable type of movable panels may be employed if desired.

Referring to FIGS. 1, 3 and 4, the bottom or pan 6 is extended at the rear as at 26 as it joins the back wall 7 and the bottom or pan being disposed across the length of the fume hood. A back baffle 26 is positioned substantially 2″ in front of the rear wall 7 and extends across the width of the fume hood being affixed to the back walls 8 as illustrated in FIG. 3, preferably at the location of the rear stays 15 and rear spacer extension 16. The upper end 26′ of the back baffle 26 is inclined forwardly and upwardly as shown in FIG. 4 forming the exhaust plenum chamber 27 which extends across the fume hood at the upper end thereof. A back baffle 26 in the fume hood should have at least two openings, a bottom opening 28 and a top opening 28′, the bottom opening at the intersection of the back baffle 26 and the bench-top 6 and the second opening 28′ at the intersection of the inclined portion 26 of the back baffle and the fume hood top 9, FIG. 4. It is within the scope of the invention, if found desirable, to provide an intermediate opening between these two openings if under certain conditions it is found desirous to improve the airflow pattern. It is preferred that these slot openings 28 and 28′ run the full length of the fume hood, and preferably each should have the same open area. In order to adjust the area of these openings 28 and 28′, a bottom slide damper 29 and a top slide damper 29′ may be provided (FIGS. 1 and 4) which are adjustable by laterally spaced knobs 30 adjustably mounted in complementally formed slots 30*a* and similarly the upper slide damper 29′ is adjusted by laterally spaced knobs 30′ adjustable in complementally formed slots 30*a*. The slots 30*a* for the bottom slide damper 29 and the upper slide damper 29′ are formed respectively in the lower end of the back baffle 26 and the upper end of the upwardly inclined baffle 26′. Referring to FIGS. 1 and 4, the slot openings 28 and 28′ preferably run the full length of the fume hood and it is preferred that each should have substantially the same open area. The cross-sectional area of the bottom opening 28 and the top opening 28′ should be substantially ½ the plenum cross-sectional area, and after the air flow has been adjusted through the fume hood, the bottom slide damper and the upper slide damper may be firmly secured in its final adjusted position only to be readjusted when it is found desirable to change the air flow pattern through the fume hood. The air velocity through the bottom opening 28 and the top opening 28′ in the final adjusted position preferably should be within the range of from substantially 1000 to 1500 f.p.m. The adjustable slide dampers 29 and 29′ are preferably used as described with the respective bottom and top openings 28 and 28′ to establish a preferred uniformity of the air flow pattern at the face of the fume hood after installation in air-conditioned rooms where preferably 70% of the air exhausted by the hoods can be uncooled auxiliary air and the remaining 30% through the face of the fume hood is cooled room air. The fume hood exhaust plenum chamber is preferably constructed so that the majority of the air flow resistance occurs in a bottom opening 28 and the top opening 28′.

At the upper end of the fume hood, and located on the centerline of the fume hood (FIG. 2), a flue or stack 32, FIGS. 2 and 4, extends from the exhaust plenum chamber 27 to the exterior of the fume hood structure and may be connected to suitable duct work extending to wherever desired for the discharge of the gases, vapors, etc. A fan (not shown) of suitable capacity and with suitable driving means, for example, an electric motor (not shown) is arranged to draw the air and gases from the exhaust plenum chamber 27 through the flue or stack 32 to waste. It is preferred that each fume hood should have its own fan exhausting to an individual stack and the exhaust fan should be located outside of the building in which the fume hood is installed so that all the ducts leading to the fan will preferably be under negative pressure. In certain situations, fan speed and size may then be changed easily to meet changing requirements. Normally, plenums and the use of exhaust fans to exhaust several hoods are considered to be undesirable primarily because of the inflexibility of the exhaust system and its waste for exhaust capacity. Additional fume hoods of this invention may be accommodated for a building equipped for exhausting using a plenum exhaust system even at limited exhaust and supply capacity if the fume hoods are placed on an off-on operation using electrically controlled dampers. In such operation, the dampers would open into the plenum system only when the fume hood is turned on. With the use of multiple fume hoods, the fans therefor should preferably be controlled near the hood face with an on-off switch which may be mounted on the facia at the front of the fume hood. Two-speed fan operation, if found desirable, may be accomplished by a two-speed motor for most fans, and in some instances by a reversing switch or some type of centrifugal fans.

Referring to FIGS. 2 and 4, the flue or stack **32** at the bottom is affixed to a collar **33** mounted in a complementally formed hole in a horizontal extension **9***a* of the top **9**, FIG. 4. The stack **32** is affixed to an upper collar **34** through which the stack **32** extends and the collar **34** is affixed to a top panel **35**, FIG. 4, and the top panel **35** extends across the entire top of the fume hood and is affixed to a back wall extension panel **36**. Referring to FIG. 4, the downturned edges of the top panel **35** may be suitably formed in a brake as is well understood by those skilled in the sheet metal working art and may be affixed to the back wall extension panel **36** by riveting or spot welding and similarly affixed to the front upper panel **37**, FIGS. 1, 2 and 4. A vertical downward auxiliary air supply channel **38** is formed between the front upper wall panel and a rear supply channel panel **39**. This auxiliary air supply channel **38** is outside and above the fume hood face opening. The dimension of the auxiliary air supply channel is preferably 8″ deep from the front upper panel **37** to the rear supply channel panel **39** by the sash width. The discharge opening **40** should be substantially 7′ above the floor. The rear supply channel panel **39** is in alignment with a front extension **41** of a top streamlined facia **42**. The front extension panel **41**, the top streamlined facia **42** and the oppositely formed vertical panels **13** of the wings **11** and the opposite streamlined facia **14** direct the auxiliary air discharged from the discharge opening **40** through the fume hood opening when the sash or closure **24** is in its full raised position or in any intermediate open position of the sash **24**. With the sash **24** closed as shown in FIG. 4, the auxiliary air discharges downwardly through the opening **43** and the auxiliary air outlet plenum chamber and the auxiliary air may be directed over the top of the inclined top **9** so that the auxiliary air discharges through the transverse opening **45** formed by the bottom edge of the top **9** and the upper edge **46** of the sash **24**. In the event of a breakdown of the exhaust motor and/or fan (not shown), auxiliary air which also may be conducted will flow down the face of the hood to provide an air curtain which will tend to prevent any noxious fume or particles being discharged into the room housing the fume hood. The sash **24** from its various positions in FIG. 1 to its lowermost position in FIG. 24, and in any intermediate position is manipulated by the handles **24***a* and the sash is held in its uppermost position by a suitable stop and in its intermediate position by a suitable spring or its equivalent as set forth above and as disclosed in the aforementioned Nelson patent.

Referring to FIG. 2, FIG. 4, FIG. 7, FIG. 8 and FIG. 9, the auxiliary air supply plenum chamber and auxiliary supply air outlet plenum chamber and associated structures increasing the efficiency of the auxiliary air supply to the fume hood will be particularly described. In the modern laboratory, as more and more toxic and radioactive materials are being used it is required that the work shall be done in laboratory fume hoods of improved construction. Since laboratory fume hoods require from 75 to 100 lineal feet of air through the face to insure proper operation, this requires that a large amount of make-up air be supplied to the laboratories. In an air-conditioned laboratory, to supply this large requirement of air, this air-conditioned air becomes quite expensive and, of course, requires a large investment in air cooling equipment, the advantage of supplying a large part of this make-up air as air-conditioned auxiliary air becomes self-evident. However, for the laboratory fume hood to work properly, this air must be so supplied that it will be entrained with the conditioned air going into the fume hood and pass through the hood face. Further to prevent disturbing the comfort of the laboratory workers, the flow of the un-airconditioned air must be confined to the area immediately adjacent to the front of the fume hood.

In the laboratory fume hood construction of our invention, the un-airconditioned or auxiliary air **47** is discharged under pressure through the air intake duct **48** supported by the collar **49** on the top panel **75** into a plenum chamber **50** above a diffuser construction **51**. The diffuser construction preferably comprises an inclined expanded metal diffuser plate **52** and oppositely positioned triangular-shaped expanded metal diffuser members **53** and **53′**. The function of the diffuser construction is to break up the flow of the incoming auxiliary air so that it fills up the plenum chamber **50**. The diffused auxiliary air is restricted in its flow because of a perforated panel **54**. The perforated panel extends across the width of the fume hood and to the height of the plenum chamber **50**, and between the plenum chamber **50** and the auxiliary air outlet plenum chamber **44**, FIGS. 4 and 7. The small area of the holes **55**, FIG. 8, restricts the flow of air and a static pressure of about ⅜″ of water results. This pressure tends to make the flow of air uniform over the face of the perforated panel **54**. In front of this perforated panel **54**, filters **56** are removably mounted in oppositely positioned upper channel **57** and lower channel **58** so that the filters **56** may be inspected, cleaned and/or replaced when necessary.

Referring to FIGS. 4, 7, 8, and 9, an air vane assembly **59**, having seven vanes **60**, is mounted diagonally at an angle of substantially 45° across the upper end of the vertical and downward auxiliary air supply channel **38**. in the air vane assembly 59′ of FIGS. 7, 8 and9, five vanes may be used. Similarly the air vane assembly **59′** of FIGS. 7, 8 and 9, comprises vanes **60′** shaped as illustrated in cross-section in FIG. 7 and from the same material of the air vanes **60** and are also tack welded to the end plate **61′**. It is to be understood that it is within the scope of the invention that the vanes may be formed in any manner such that they may be suitably affixed to the end plates to form a rigid air vane assembly. The length of the air vane assembly extends across the supply channel **38** which is the width of the fume hood. The air vanes **60′** have substantially the same curvature as the air vanes **60** but in addition have the tangential portions **61″**, FIG. 7.

Expanded metal or other suitable arcuate deflectors **62**, FIGS. 4, 7, 8 and 9 are provided at the opposite ends of the vertical and downward auxiliary air supply channel **38** at the upper end thereof and contiguous to the lower end of the air vane assembly **59** and **59′** of the two embodiments as shown. The expanded metal deflectors **62** are riveted to the opposite end walls **8′**, the extension of the fume hood end walls **8**, and the curved or arcuate portion extends into the supply channel **38**. The purpose of the expanded metal deflectors is to break up the flow of air at the ends of the air vanes so that the air is uniformly distributed across the air supply channel **38**. A damper or deflector plate **63** is hingedly mounted on hinges **64** to the front upper panel **37** as illustrated. The position of the deflector plate **63** is adjusted by a set screw construction **65**. The function of the deflector plate **63** is to compensate for temperature differential of the incoming auxiliary air supply with respect to the temperature of the room air supply. Once the deflector plate **63** has been adjusted for the operating conditions for the fume hood, further adjustment is unnecessary unless the temperature of the supply air and room air may be changed. In the operation of the laboratory fume hood, when the sash **24** is in the up position as shown in FIGS. 1 and 7, and referring to FIG. 13 wherein the auxiliary air is shown in the solid lines, and the room air is shown in the dash lines, the auxiliary air flows forward and down through the turn vane **60** located at the top front of the fume hood. The extreme front of the auxiliary air is given a slight inward velocity by the hinged damper **63**, this damper **63** not being shown in FIG. 13 or FIG. 14. This damper **63** as described above may be adjustable to compensate for temperature changes of the auxiliary air. A series of directional jets of air are directed through perforations **66**, FIGS. 2, 5, to be more particularly described later and which are located along the vertical sides of the hood opening, and also a series of directional jets of air directed through perforations **67**, FIGS. 4, 7, 10, 11 and 12 under the bottom hood deflector vane **17**, prevents any reverse flow of air at these critical surfaces. Air for these jets is bled out of the pressurized plenum **50**, FIGS. 4, 7, 8, 13 and 14 in back of the perforated panel **54** through piping or tubing **68**, FIGS. 2, 4, 8 and the tubing **69**, FIG. 10, to be described in greater detail later.

When the sash **24** is closed, FIGS. 2, 3, 4 and 14, the bypass opening or transverse opening **45** above the sash **24** and in back of the front facia panel **41** is open, and the auxiliary air is drawn directly into the fume hood. Air is still drawn under the front deflector vane **17** to sweep the fume from the hood working surface **6**, and the remainder of the room air is drawn up through the turn vane **60** and into the fume hood through the bypass **45**. This arrangement maintains the volume of room air drawn into the fume hood at a constant volume and also provides full amount of air flowing into the fume hood to carry away fumes. In the schematic illustration of FIG. 13 and FIG. 14, a beaker **70** of liquid is being heated by a suitable hot plate **71** and fumes **72** are illustrated as being given off from the beaker and being drawn into the air stream of the auxiliary air and room air as the mixture of auxiliary air and room air is being discharged through the bottom opening **28** and the top opening **28'**, both respectively controlled by glide dampers **29** and **29'**, and exhausting into the exhaust flue **32**.

Referring to FIG. 1, this embodiment of an air flow fume hood assembly, auxiliary air referring to FIGS. 5 and 6 is discharged through vertically spaced air deflectors having a plurality of vertical vanes **75** operatively mounted on the oppositely formed panels **13** and operatively connected to vertical plenum chambers **76** of FIGS. 3 and 6 operatively connected to the auxiliary air outlet plenum chamber **44** so that the auxiliary air discharged through the perforated panel **54** into the auxiliary air outlet plenum chamber **44** discharges downwardly through the vertical plenum chamber and outwardly through the vertically spaced air outlet openings **73** and **74** and directed by the deflector vanes **75** into the laboratory fume hood with the window sash **24** in its raised position, the auxiliary air flowing across the streamlined facia **14**. In the closed position of the window sash the auxiliary air is discharged through the bypass opening or transverse opening **45** though there may be a slight discharge of auxiliary air against the window sash **24** though substantially all of the auxiliary air in the closed position of the sash **24** discharges spherically into the fume hood through the bypass opening **45**.

Although auxiliary air may be brought to the oppositely positioned vertical plenum chamber **76** and which is discharged through the vertical space air outlets **73** and **74**, it is preferred in this embodiment to position duct nozzles (not shown) at the location of the brace member **77**. The duct nozzle tapers in diameter from the bottom to the top. To the bottom opening is attached a flexible duct which is preferably connected to the pressurized plenum chamber **50** at a conduit or flexible duct connection **78** at opposite sides of the plenum chamber **50** as illustrated in FIG. 4. The duct nozzles (not shown) have a tapered discharge opening formed by out-turned edges from the metal forming the tapered duct nozzle which is held in adjusted position by machine screws adjustably connected to the tack nuts. The duct nozzle construction of the embodiment of FIG. 1 has been preferably superseded by the expanded metal diffuser construction **51** including the diffuser plate **52** and the triangular-shaped expanded metal diffuser member **53**.

Referring to FIGS. 2, 3, 4, 5, 7, 8, 10, 11 and 12 there will be particularly described the improved embodiments of our invention for delivering pressurized air from the auxiliary air plenum chamber to vertically extending plenum chambers **79**, FIGS. 2, 3, 4, formed contiguous to the guides or sash posts **25**, and also to the bottom facia air jet plenum chamber **21**, FIGS. 2, 4, 7, 10, 11 and 12. Referring to FIG. 4, pressurized auxiliary air from the plenum chamber **50** is discharged through openings **78** in the end walls **8**, FIG. 4, through 1" diameter flexible tubing or conduits **68** with the tubing connected through hose connections **80** formed from thin wall tubing and welded to the end walls **8** as illustrated in FIG. 8 of the plenum chamber **50**. The tubing **68** extends forwardly in the chamber between the walls **8** and **10** toward the front of the fume hood and downwardly as shown in FIG. 8 to be suitably affixed to the vertical plenum chamber **79** at opposite sides of the plenum chamber contiguous to the sash posts **25** as illustrated in FIG. 5. The plenum chamber **79** is constructed from a portion of the streamlined facia **14** and a vertically extending member **81** formed as illustrated in FIG. 5. The plenum chamber **79** is provided with suitable end caps (not shown) to which are suitably affixed hose connections for connecting the end of the hose **68** to the upper end of the plenum chamber **79**. An edge of the sash post **25** is formed with vertically spaced holes **66**. The flexible tubing **68** may be of Saran or thin rubber and the connection for the flexible tubing is preferably connected to thin wall conduit at the upper ends of the plenum chambers **79**. Similarly formed conduit connections are formed at the bottom ends of the plenum chambers **79** for connecting flexible hose or tubing **69** to conduit connections **81** as illustrated in FIG. 10 of the inclined member **20** of the bottom facia air jet plenum chamber **21**. Referring to FIGS. 4, 7, 10, 11 and 12, spaces holes **67** extend along the width of the vertical portion **20a** of the inclined member **20** to direct jets of pressurized air beneath the air vane **17** and throughout the length of the elongated air passage **22**, FIGS. 4 and 7. The vertically spaced air jets of the vertically extending plenum chambers **79** in the raised position of the sash **24** direct jets of auxiliary air into the fume hood along the sides of the fume hood and induce the room air to flow from the room into the fume hood and these jets of auxiliary air under pressure prevent the formation of eddy currents of the entering room air within the fume hood. With the sash hood **24** in its closed position, the auxiliary air under pressure being discharged through the jet **66** being under pressure in the event any fumes from within the fume hood to discharge outwardly into the room. Also the horizontal jets of air discharged under pressure from the horizontal plenum chamber **21** beneath the air vane **17** also serve to induce room air to the fume hood through the opening **22** in either the open or closed position of the window sash **24** so that at all times the room air is entering through the passageway **22** and is streamlined and any eddy currents are broken up. Also in cases of breakdown of the fan and motor for the exhaust stack, room air can flow through the horizontally extending passageway **22** under natural draft and prevent any back-up of fumes from within the hood into the room.

Referring to FIGS. 10 and 11, the bottom facia air jet plenum chamber **21** is supported by brackets **82** positioned as shown in FIG. 10 in which the upper portion of the bracket is welded to the underneath side of the air foil vanes **17** and the other angle portion **82a** of the brackets **82** is provided with suitable slots through which securing means such as stove bolts **83** may be suitably affixed to the front edge of the fume hood bottom **6**, FIG. 11. In the embodiment of FIG. 11, a thin wall conduit nut is tack welded to the inclined member **20** for suitably affixing a hose connection **81** as shown in FIG. 10 for connecting the flexible hose **69**. In the embodiment of FIG. 12, 1″ thin wall conduit **81′** shaped as shown is seam welded about a hole in the inclined member **20** to which flexible hose **69** at each end of the plenum chamber **21** may be connected.

Referring to FIGS. 10, 11 and 12, the holes **81** and **81′** are substantially identical with the exception of the conduit nut **84** of FIG. 11 to which the hose connection **81** is connected. In the embodiment of FIGS. 10 and 12, the hose connection **81′** is formed as illustrated in FIG. 12, and the end of the conduit is affixed by welding as at **85** to the inclined member **20**. Other forms of hose connections **81** and **81′** will suggest themselves to those skilled in the art within the scope of the invention.

Referring to FIG. 7, in order to provide for inspection of the damper or deflector plate **63**, the expanded metal deflector **62**, the air vane assembly **59′**, the front upper panel **37** may be suitably hinged at **86** to the top panel **35**. The hinged front upper panel **37** may also provide for inspection of the filters **36** for cleaning and replacement. It is also within the scope of the invention that suitable inspection openings may be provided where desirable.

Referring to FIG. 7, the back baffle **26** and the upper inclined baffle **26′** may be so assembled in the fume hood as to be removable for cleaning and inspection and replacement. It may also be desirable to provide an expanded metal shield **87** having a 2½″ radius and a ¾″ flange as illustrated and positioned across the bottom exhaust opening **28** in order that the various equipment used within the laboratory fume hood may not be placed sufficiently close to the exhaust opening **28** to prevent the fumes from exiting through the exhaust opening **28**. It may also be desirable that the fume hood bottom **6′** may be provided with a cup sink **88** connected to suitable drain connections (not shown).

Referring to FIG. 4, it is also within the scope of the invention that the front edge **18** of the bottom **6** of the fume hood may be raised as shown to prevent beakers and other equipment from extending too close to the sash opening and to obstruct the horizontal jets of air issuing from the perforations **67** through the elongated air passage **22** from becoming obstructed and to set up turbulence in the incoming air not only through the air passage **22** but upon opening of the window sash.

It is also within the scope of our invention that suitable washdown nozzles such as disclosed in the aforementioned patent to Nelson may be connected by suitable piping to a source of wash water or like supply, and may be preferably provided so that the various walls of the hood may be washed down from time to time as necessary, the water flowing over the walls. There may be any desired number of nozzles, control valves, etc., arranged as desired, this being dependent upon the desire of the user.

Although as described above the front upper panel **37** has been described as being hinged, it may also be removable. It is also within the scope of the invention that removable end panels shall be provided for the installation of air, gas, cold water and vacuum piping and electrical service for 110 volt A.C. and 220 volt A.C. circuits, and for light switches blower switch and warning light or other suitable accessories that may be desired by the user.

Referring to FIG. 7 there may also be provided a housing **89** within which may be arranged fluorescent bulbs or tubes **90**, the inner side of the housing having a transparent inner wall **91**, thus providing for the lighting of the interior of the hood as desired. The lighting fixture or housing **89** is suitably mounted in the top **9′** of the fume hood.

Referring to FIGS. 13 and 14, there is illustrated a relationship of the lighting fixture **89** with respect to the flow of auxiliary air and room air in the open position of the sash **24** of FIG. 13 and in the closed position of the sash in FIG. 14.

As shown in FIG. 1 and as disclosed in the aforementioned Nelson patent, the fume hood is preferably provided with electrical outlets **92** for use when required and with nozzles **93** controlled by respective valve handles **94** through which air, gas, water or other fluids may be admitted to the interior of the hood, and if desired connecting through hose or piping to desired apparatus. Obviously, the gases or fluids may be admitted to the nozzles through suitable piping as is well understood in the art. A suitable switch **95** may be used for the control of the fluorescent lighting fixture **89**.

It is to be understood that auxiliary air fume hoods of our invention meet the design criteria that have been established by research and engineers familiar with fume hoods and which are found in the auxiliary air hoods such as disclosed and claimed in our invention. It is essential that only air that will keep fumes from escaping out the face of the hood is that flowing into the hood through the face of the hood. Air entering the face of the hood should carry the fumes directly to the back of the hood. Flow of air that carries fumes parallel to the face of the hood or reverse flows of air that carry fumes toward the face of the hood should be avoided. Auxiliary air ducts should not be connected directly to the hood interior. If this is done and the quantity of exhaust air is materially decreased or stopped, the fumes from the interior of the hood are blown out of the hood and into the room. A constant volume of room air should be exhausted from the room at all sash settings. Maximum velocities of air should be kept low to prevent tipping over light glassware or disturbing the use of Bunsen Burners. Exhaust slots in the baffle should be adjustable to allow the relative amount of air drawn through, each to be adjusted to compensate for the effects of heat or density of exhaust vapors. Static pressure of auxiliary air should be kept low and noise level controlled.

The airflow hood of our invention meets all these design criteria without restricting in any way the full usage of the hood interior. Auxiliary air flows down the face of the hood to be entrained into the flow of room air entering the face of the hood to provide maximum safety of operation on any given amount of air. This is shown schematically in FIGS. 13 and 14. The air flows directly to the rear of the hood carrying the fumes back and out of the hood. Experiments have shown that if fumes are drawn to within six inches from the face of the hood, they are readily drawn out through the face of the hood by movement of laboratory personnel or adverse room air movements. In our laboratory fume hood, there are no high velocity flows of air directly into the hood interior that can cause turbulence that can carry fumes forward to within this critical area. The automatic bypass **45** insures a constant flow of air through the hood at all times to insure proper operation of air conditioning equipment and adequate dilution for exhaust fumes. By carefully controlling the flow of auxiliary air, the conditioned area distributed by the auxiliary air is confined to just that area directly in front of the hood with only a negligible amount escaping into the room proper. Because velocities are kept low, no disturbing air noise or pulsation is created.

It is to be understood that it is within the scope of our invention that auxiliary air fume hoods of our invention may be assembled in groups and connected to a common exhaust and duct work for furnishing auxiliary air to the group of fume hoods.

The airflow fume hoods of our invention are particularly adapted for use in air conditioned laboratories. Their construction as disclosed and claimed enables them to draw 100% of the air exhausted by the hoods through the hood face, but up to 70% of this air can be auxiliary air with only the remaining 30% being cooled room air. All of the air exhausted by these fume hoods is effectively utilized in moving fumes and contaminants away from the hood face and back to the baffle exhaust opening. This is schematically illustrated in the air flow diagrams of FIGS. 13 and 14.

With the air bypass construction of our invention, excess air velocities through the face of the hood when the sash has been nearly closed is prevented. With an exhaust fan in the waste stack capable of drawing ¼″ or more of static pressure of air, the velocity through the face of the hood will steadily increase as the sash is closed and that depending upon the original face velocity of the hood would increase to a point 250′ per minute lineal velocity or more, which would be sufficient to sweep paper or light glassware back along the working surface of the hood. Such action would frequently ruin experiments or break glassware containing valuable test samples so that it is desirable that it be eliminated if at all possible. This action of the automatic bypass shown prevents this since it provides an auxiliary opening **45** through which the air can pass, thus preventing the air velocity from exceeding approximately 200° or more when the sash or closure is closed.

Likewise, since this auxiliary air fume hood is preferably used in air conditioned rooms where the hoods are used to exhaust the air from the room, a positive amount of conditioned air is forced into the room, it is necessary that an auxiliary outlet of air from the room shall be provided to exhaust the conditioned air from the room when the hood is closed. This bypass accomplishes this by allowing the air to pass into the hood when the sash is in a more or less closed position, thus providing a uniform flow of air from the room and allowing uniform air conditioning.

The bypass as illustrated is self-actuating as the sash is lowered uncovering the bypass. If the sash is closed and a slight increase in static pressure occurs within the hood, the bypass opening operates to allow the air to bypass the sash opening. In either the raised or lowered position of the sash, auxiliary air is still being supplied through the jet openings contiguous to the vertical edges of the sash as well as jets of air being furnished along with the room air through the opening underneath the bottom edge of the sash when the sash rests upon the inner edge of the bottom facia.

We have endeavored to show in FIGS. 13 and 14, the sweeping action of the auxiliary air and room air over the bottom and ends at the interior of the hood and these air currents wipe over the hood walls and bottom in substantially a uniform sweep. This has been amply demonstrated in tests of the completed hoods in accordance with the hood performance tests as described above.

Having thus described our invention, it is obvious that various immaterial modifications may be made in the same without departing from the spirit of our invention; hence, we do not wish to be understood as limiting ourselves to the exact form, construction, arrangement and combination of parts herein shown and described or uses mentioned.

What we claim as new and desire to secure by Letters Patent is:

1. In a fume hood for providing substantially 70% auxiliary air and 30% room air, the combination of a housing having a bottom wall providing a work surface, a rear wall, side walls, a movable closure cooperable when in closed position with the housing structure to operatively enclose the work surface or to expose said surface when in open position, a back baffle, said housing having an air exhaust opening adjacent the bottom of the back baffle communicating with the housing interior adjacent said work surface for receiving exhaust air flowing rearwardly across the latter, said housing having a second air exhaust opening adjacent the top of the back baffle for receiving exhaust air flowing upwardly and rearwardly in said housing, air directional vane means adjacent the front edge of said work surface and the side walls for directing the flow of air entering the hood rearwardly along such surface and side walls, vertically disposed air jet means at opposite sides of said housing for discharging auxiliary air along the vane means at the side walls thereof into said housing, and horizontally disposed air jet means extending across said housing for discharging auxiliary air therein, exhaust means including an exhaust duct and operatively communicating with said air openings for receiving exhaust air flowing therethrough.

2. In a fume hood for providing substantially 70% auxiliary air and 30% room air, the combination of a housing having a bottom pan providing an interior work surface, a front wall, a rear wall, a movable closure for the front wall cooperable when in closed position with the housing structure to operatively enclose the work surface or to expose said surface when in open position, a back baffle, said housing having an air exhaust opening adjacent the bottom of the back baffle communicating with the interior adjacent said work surface for receiving exhaust air flowing rearwardly across the latter, said housing having a second air exhaust opening adjacent the top of the back baffle for receiving exhaust air flowing upwardly and rearwardly in said housing, exhaust means including an exhaust plenum chamber and an exhaust duct operatively communicating with said air exhaust openings for receiving exhaust air flowing therethrough, vertically disposed air jet means at opposite sides of said housing for discharging auxiliary air into said housing along the side walls thereof, and horizontally disposed air jet means extending across the housing arranged for discharging auxiliary air therein.

3. In a fume hood for providing substantially 70% auxiliary air and 30% room air and in combination, a housing open at the front and including a bottom wall, a rear wall, a top including an upper auxiliary air outlet plenum chamber for discharging the auxiliary air into the housing, a back wall and end walls, an exhaust duct operatively connected to an exhaust plenum chamber and the housing, and a closure including sash posts at the front of the housing providing an enclosed working chamber, a back baffle spaced from the rear wall and provided with openings operatively connected to the exhaust plenum chamber, the exhaust duct, the lower end of the back baffle extending down to proximate the bottom wall and providing an opening to a passageway provided by the rear wall and the baffle, the upper end of the baffle including an inclined portion spaced from the top and providing an opening operatively connected to the exhaust plenum chamber, the front edges of the closure sash posts at either end of the housing converging inwardly and providing a directional vane at each side of the housing, vertically disposed jet means at opposite sides of said housing for discharging auxiliary air along the respective directional vanes into the housing, the bottom wall of the housing extending from the rear to the front and elevated adjacent the front face of the housing, an air foil directional vane disposed at the front edge of the bottom wall and curved outwardly and downwardly with the inner edge spaced from the bottom wall providing an elongated air passageway, and horizontally disposed jet means for discharging jets of auxiliary air through the elongated air passageway together with room air to the housing over the bottom wall.

4. In a fume hood for providing substantially 70% auxiliary air and 30% room air and in combination, a housing open at the front including a pan-shaped bottom wall, a top including an upper auxiliary air outlet plenum chamber, a back wall and end walls, an exhaust duct operatively connected to an exhaust plenum chamber and contiguous to the housing at the rear thereof, and a closure including sash posts at the front of the housing providing an enclosed working chamber, a back baffle spaced from the rear wall and an inclined baffle portion providing the exhaust plenum chamber, the lower end of the back baffle extending down to proximate the bottom

wall and with the back wall providing an opening to a passageway provided by the rear wall and the baffle, the front edges of the closure sash posts at either end of the housing converging inwardly and providing a directional vane at each side of the housing, vertically disposed jet means at opposite sides of the housing operatively connected to the auxiliary air outlet plenum chamber for discharging jets of auxiliary air along the respective directional vanes into the housing, the bottom wall of the housing extending from the rear to the front and slightly elevated adjacent the front face of the housing, and an air foil directional vane disposed at and slightly spaced above the front edge of the bottom wall and curved outwardly and downwardly with the inner edge spaced from the bottom wall providing an elongated air passageway, for discharging room air to the housing over the bottom wall.

5. In a fume hood for providing substantially 70% auxiliary air and 30% room air and in combination, a housing providing an enclosed working chamber having an opening at the front side thereof and having a movable closure for the opening arranged at the front side of the housing, an auxiliary air chamber overlying the working chamber, a back wall, said housing provided with an exhaust duct communicating with an exhaust plenum chamber adjacent the back wall of the housing and arranged contiguous to the upper rear corner part of the housing, said exhaust plenum chamber operatively connected to the exhaust duct, a back baffle arranged within the housing and an inclined portion of the back baffle together with the back wall providing the exhaust plenum chamber, and said exhaust plenum chamber operatively connected to the exhaust duct and with the lower end of the back baffle disposed slightly above the bottom of the housing adjacent thereto providing a lower opening at the lower end of the baffle connecting a passageway formed by the back baffle and back wall, to the exhaust plenum chamber, an upper opening formed at the upper end of the inclined baffle, dampers operatively mounted at the lower opening and the upper opening for controlling the passage of auxiliary air and room air through the working chamber, the bottom of the housing providing a working table extending forwardly from adjacent the lower end of the back baffle toward the front end of the housing with the front portion of the bottom sloping upwardly toward the front edge thereof, the front side edges of the opening in the housing at the front thereof being outwardly curved, and an air foil directional vane arranged at the exterior of the housing and extending between the side curved edges with its inner edge adjacent the front edge of the bottom and spaced slightly thereabove providing an elongated air passageway for discharging room air and auxiliary air over the bottom wall, and said air foil directional vane including a bottom facia air jet plenum chamber operatively connected to the auxiliary air chamber for discharging auxiliary air through the elongated air passageway along with room air.

6. In a low velocity hood for providing substantially 70% auxiliary air and 30% room air for exhausting gases formed therein, the combination of a housing having top, bottom, side and front walls, said front wall having an opening and a closure therefor, of means for controlling an air stream through the hood to provide a uniform velocity over the entire face of the hood when the opening in the front wall is at working height comprising means for directing the auxiliary air and a part of the room air into said opening, streamlined facia formed in the side walls contiguous to the opening in the front wall, an air foil directional vane contiguous to the opening in the front wall and spaced above the bottom wall, a portion of said bottom wall contiguous to the opening in the front wall being inclined downwardly toward the rear of the hood, and duct means for discharging auxiliary air between said air foil directional vane and the bottom wall into said housing whereby a part of the auxiliary air and room air stream entering the hood passes over the top of the air foil directional vane and beneath it along the bottom wall.

7. A laboratory fume hood comprising a housing having a bottom wall providing a work surface, a rear wall, side walls and a top wall, a movable closure cooperable when in closed position with the housing structure to operatively enclose the work surface or to expose said surface when in open position, a back baffle, said housing having an air exhaust opening adjacent the bottom of the back baffle communicating with the housing interior adjacent said work surface for receiving exhaust air flowing rearwardly across the latter, said housing having a second air exhaust opening adjacent the top of the back baffle for receiving exhaust air flowing upwardly and rearwardly in said housing, air directional vane means adjacent the front edge of said work surface and the side walls for directing the flow of air entering the hood rearwardly along such surface and side walls, an air plenum chamber positioned above the housing for receiving auxiliary air, an auxiliary air outlet plenum chamber contiguous to the air plenum chamber, a perforated panel between said air plenum chamber and said auxiliary air outlet plenum chamber, a vertical downward auxiliary air supply channel extending across the front of the auxiliary air outlet plenum chamber and operatively connected thereto, an air vane assembly extending across the upper end of the vertical downward auxiliary air supply channel for directing air from the auxiliary air outlet plenum chamber into said auxiliary air supply channel, oppositely formed hollow panels extending vertically from the air supply channel and outwardly from the front of the housing, said oppositely formed hollow panels provided with deflector grille openings for directing air toward the fume hood opening, and means operatively connecting a plenum chamber for auxiliary air to the oppositely formed hollow panels contiguous to the grille deflector vanes of the oppositely formed hollow panels, whereby in the open position of the movable closure auxiliary air supply channel inducing room air into the fume hood together with auxiliary air under pressure supplied through the grille deflector vanes of the oppositely formed hollow panels, a bypass opening extending transversely across the upper end of the fume hood contiguous to a top wall thereof so that in the closed position of the movable closure, auxiliary air is discharged into the fume hood from the auxiliary air outlet plenum chamber together with room air drawn upwardly through the auxiliary air supply channel through the air vane assembly mixing with the auxiliary air and the room air and auxiliary air discharging through the bypass opening into the fume hood.

8. A laboratory fume hood comprising a housing having a bottom wall providing a work surface, a rear wall, side walls and a top wall, a movable closure cooperable when in closed position with the housing structure to operatively enclose the work surface or to expose said surface when in open position, a back baffle, said housing having an air exhaust opening adjacent the bottom of the back baffle communicating with the housing interior adjacent said work surface for receiving exhaust air flowing rearwardly across the latter, said housing having a second air exhaust opening adjacent the top of the back baffle for receiving exhaust air flowing upwardly and rearwardly in said housing, air directional vane means adjacent the front edge of said work surface and the side walls for directing the flow of air entering the hood rearwardly along such surface and side walls, vertically arranged air jet means and horizontally arranged air jet means, an auxiliary air plenum chamber operatively mounted above the top wall and extending across the upper rear end of the fume hood, means operatively connecting the respective air jet means with said auxiliary air plenum chamber, an auxiliary air outlet plenum chamber extending across the top of the fume hood ahead of the auxiliary air plenum chamber, a bypass opening contiguous to a front edge of the top wall and the upper edge of the movable closure so that in the closed position of the movable closure auxiliary air is discharged within the housing, and in the raised position of the movable closure, the bypass opening is closed.

9. A laboratory fume hood comprising a housing having a bottom wall providing a work surface, a rear wall, side walls and a top wall, a movable closure cooperable when in closed position with the housing structure to operatively enclose the work surface or to expose said surface when in open position, a back baffle, said housing having an air exhaust opening adjacent the bottom of the back baffle communicating with the housing interior adjacent said work surface for receiving exhaust air flowing rearwardly across the latter, said housing having a second air exhaust opening adjacent the top of the back baffle for receiving exhaust air flowing upwardly and rearwardly in said housing, air directional vane means adjacent the front edge of said work surface and the side walls for directing the flow of air entering the hood rearwardly along such surface and side walls, vertically arranged air jet means and horizontally arranged air jet means, an auxiliary air plenum chamber operatively mounted above the top wall and extending across the upper rear end of the fume hood, means operatively connecting the respective air jet means with said auxiliary air plenum chamber, an auxiliary air outlet plenum chamber extending across the top of the fume hood ahead of the auxiliary air plenum chamber, a bypass opening contiguous to a front edge of the top wall and the upper edge of the movable closure so that in the closed position of the movable closure auxiliary air is discharged within the housing, and in the raised position of the movable closure, the bypass opening is closed, a vertical downward auxiliary air supply channel extending across the front of the fume hood in front of the auxiliary air outlet plenum chamber whereby in the open position of the movable closure auxiliary air is discharged downwardly through the fume hood opening into the housing entraining room air, and in the closed position of the movable closure room air flows upwardly through the auxiliary air supply channel into the auxiliary air outlet plenum chamber through the bypass opening along with auxiliary air from the auxiliary air outlet plenum chamber into the housing.

10. A laboratory fume hood comprising a housing having a bottom wall providing a work surface, a rear wall, side walls and a top wall, a movable closure cooperable when in closed position with the housing structure to operatively enclose the work surface or to expose said surface when in open position, a back baffle, said housing having an air exhaust opening adjacent the bottom of the back baffle communicating with the housing interior adjacent said work surface for receiving exhaust air flowing rearwardly across the latter, said housing having a second air exhaust opening adjacent the top of the back baffle for receiving exhaust air flowing upwardly and rearwardly in said housing, air directional vane means adjacent the front edge of said work surface and the side walls for directing the flow of air entering the hood rearwardly along such surface and side walls, vertically arranged air jet means and horizontally arranged air jet means, an auxiliary air plenum chamber operatively mounted above the top wall and extending across the upper rear end of the fume hood, means operatively connecting the respective air jet means with said auxiliary air plenum chamber, an auxiliary air outlet plenum chamber extending across the top of the fume hood ahead of the auxiliary air plenum chamber, a bypass opening contiguous to a front edge of the top wall and the upper edge of the movable closure so that in the closed position of the movable closure auxiliary air is discharged within the housing, and in the raised position of the movable closure, the bypass opening is closed, a vertical downward auxiliary air supply channel extending across the front of the fume hood in front of the auxiliary air outlet plenum chamber whereby in the open position of the movable closure auxiliary air is discharged downwardly through the fume hood opening into the housing entraining room air, and in the closed position of the movable closure room air flows upwardly through the auxiliary air supply channel into the auxiliary air outlet plenum chamber through the bypass opening along with auxiliary air from the auxiliary air outlet plenum chamber into the housing, an air vane assembly diagonally mounted at the upper end of the auxiliary air supply channel for directing auxiliary air through the air vane assembly from the auxiliary air outlet plenum chamber into the auxiliary air supply channel with the movable closure in an open position closing the bypass opening and in the closed position of the movable closure room air flowing upwardly through the auxiliary air supply channel through the air vane assembly and discharging along with auxiliary air from the auxiliary air outlet plenum chamber through the bypass opening into the housing.

11. A laboratory fume hood comprising a housing having a bottom wall providing a work surface, a rear wall, side walls and a top wall, a movable closure cooperable when in closed position with the housing structure to operatively enclose the work surface or to expose said surface when in open position, a back baffle, said housing having an air exhaust opening adjacent the bottom of the back baffle communicating with the housing interior adjacent said work surface for receiving exhaust air flowing rearwardly across the latter, said housing having a second air exhaust opening adjacent the top of the back baffle for receiving exhaust air flowing upwardly and rearwardly in said housing, air directional vane means adjacent the front edge of said work surface and the side walls for directing the flow of air entering the hood rearwardly along such surface and side walls, vertically arranged air jet means and horizontally arranged air jet means, an auxiliary air plenum chamber operatively mounted above the top wall and extending across the upper rear end of the fume hood, means operatively connecting the respective air jet means with said auxiliary air plenum chamber, an auxiliary air outlet plenum chamber extending across the top of the fume hood ahead of the auxiliary air plenum chamber, a bypass opening contiguous to a front edge of the top wall and the upper edge of the movable closure so that in the closed position of the movable closure auxiliary air is discharged within the housing, and in the raised position of the movable closure, the bypass opening is closed, a vertical downward auxiliary air supply channel extending across the front of the fume hood in front of the auxiliary air outlet plenum chamber whereby in the open position of the movable closure auxiliary air is discharged downwardly through the fume hood opening into the housing entraining room air, and in the closed position of the movable closure room air flows upwardly through the auxiliary air supply channel into the auxiliary air outlet plenum chamber through the bypass opening along with auxiliary air from the auxiliary air outlet plenum chamber into the housing, an air vane assembly diagonally mounted at the upper end of the auxiliary air supply channel for directing auxiliary air from the auxiliary air outlet plenum chamber into the auxiliary air supply channel with the movable closure in an open position closing the bypass opening and in the closed position of the movable closure room air flowing upwardly through the auxiliary air supply channel through the air vane assembly and discharging along with auxiliary air from the auxiliary air outlet plenum chamber through the bypass opening into the housing, arcuate shaped and expanded metal deflectors affixed to the opposite end walls of the auxiliary air supply channel at their upper ends and with the curved inner ends extending into the auxiliary air supply channel for breaking up the flow of auxiliary air through the air vane assembly into the air supply channel in the open position of the movable closure, and breaking up the flow of room air

flowing upwardly through the auxiliary air supply channel through the air vane assembly in the closed position of the movable closure.

12. A laboratory fume hood comprising a housing having a bottom wall providing a work surface, a rear wall, side walls and a top wall, a movable closure cooperable when in closed position with the housing structure to operatively enclose the work surface or to expose said surface when in open position, a back baffle, said housing having an air exhaust opening adjacent the bottom of the back baffle communicating with the housing interior adjacent said work surface for receiving exhaust air flowing rearwardly across the latter, said housing having a second air exhaust opening adjacent the top of the back baffle for receiving exhaust air flowing upwardly and rearwardly in said housing, air directional vane means adjacent the front edge of said work surface and the side walls for directing the flow of air entering the hood rearwardly along such surface and side walls, vertically arranged air jet means and horizontally arranged air jet means, an auxiliary air plenum chamber operatively mounted above the top wall and extending across the upper rear end of the fume hood, means operatively connecting the respective air jet means with said auxiliary air plenum chamber, an auxiliary air outlet plenum chamber extending across the top of the fume hood ahead of the auxiliary air plenum chamber, a bypass opening contiguous to a front edge of the top wall and the upper edge of the movable closure so that in the closed position of the movable closure auxiliary air is discharged within the housing, and in the raised position of the movable closure, the bypass opening is closed, a vertical downward auxiliary air supply channel extending across the front of the fume hood in front of the auxiliary air outlet plenum chamber whereby in the open position of the movable closure auxiliary air is discharged downwardly through the fume hood opening into the housing entraining room air, and in the closed position of the movable closure room air flows upwardly through the auxiliary air supply channel into the auxiliary air outlet plenum chamber through the bypass opening along with auxiliary air from the auxiliary air outlet plenum chamber into the housing, an air vane assembly diagonally mounted at the upper end of the auxiliary air supply channel for directing auxiliary air from the auxiliary air outlet plenum chamber into the auxiliary air supply channel with the movable closure in an open position closing the bypass opening and in the closed position of the movable closure room air flowing upwardly through the auxiliary air supply channel through the air vane assembly and discharging along with auxiliary air from the auxiliary air outlet plenum chamber through the bypass opening into the housing, arcuate shaped and expanded metal deflectors affixed to the opposite end walls of the auxiliary air supply channel at their upper ends and with the curved inner ends extending into the auxiliary air supply channel for breaking up the flow of auxiliary air through the air vane assembly into the air supply channel in the open position of the movable closure, and breaking up the flow of room air flowing upwardly through the auxiliary air supply channel through the air vane assembly in the closed position of the movable closure, a damper deflector plate hinged to the front upper panel of the air supply channel, means for adjusting the position of the deflector plate for adjusting the size of the discharge opening of the air supply channel for compensating for the temperature differential between the auxiliary air and the room air.

13. A laboratory fume hood for providing 70% auxiliary air and 30% room air comprising a housing having a bottom wall providing a work surface, a rear wall, side walls, a top wall, a movable closure cooperable when in closed position with the housing structure to operatively enclose the work surface or to expose such surface when in open position, a back baffle, said housing having an air exhaust opening adjacent the bottom of the back baffle communicating with the housing interior adjacent said work surface for receiving exhaust air flowing rearwardly across the latter, said housing having a second air exhaust opening adjacent the top of the back baffle for receiving exhaust air flowing upwardly and rearwardly in said housing, air directional vane means adjacent the front edge of said work surface and the side walls for directing the flow of air entering the hood rearwardly along such surface and side walls, oppositely arranged sash posts for operatively mounting the vertical movable closure, vertically extending plenum chambers provided with vertically spaced perforations for discharging auxiliary air within the sash posts, a bottom facia air jet plenum chamber for discharging jets of auxiliary air through horizontally spaced perforations into the housing through an elongated air passage below the bottom air directional vane means adjacent the front edge of the work surface, exhaust means including an exhaust duct operatively connected to an exhaust plenum chamber operatively connected to the air exhaust opening adjacent the bottom of the back baffle and to the second air exhaust opening adjacent the top of the back baffle, an auxiliary air plenum chamber, an auxiliary air duct operatively connected to the auxiliary air plenum chamber, diffuser means operatively mounted within the auxiliary air plenum chamber beneath the auxiliary air duct for diffusing the auxiliary air within the auxiliary air plenum chamber, an auxiliary air outlet plenum chamber, a perforated panel permitting auxiliary air to flow from the auxiliary air plenum chamber into the auxiliary air outlet plenum chamber, an auxiliary air supply channel including an air vane assembly, expanded metal deflectors at opposite ends of the auxiliary air supply channel and a deflector plate for compensating for temperature changes of the auxiliary air, said top wall inclined forwardly providing a bypass opening above the upper edge of the movable closure in the closed position thereof, damper means for the bottom opening and top opening formed by the back baffle, conduit means operatively connecting the auxiliary air plenum chamber to the vertically extending plenum chambers contiguous to the sash opening, and additional conduit means operatively connecting the vertically extending plenum chamber to the bottom facia air jet plenum chamber, whereby in the open position of the movable sash, auxiliary air is discharged downwardly through the auxiliary air supply channel through the fume hood opening into the housing together with auxiliary air discharged from the vertically extending plenum chambers at opposite sides of the fume hood opening into the housing and auxiliary air discharged from the bottom facia air jet into the housing together with room air entering through the fume hood opening along with the auxiliary air and room air entering into the housing along with the auxiliary air being discharged across the bottom wall of the housing.

14. A laboratory fume hood for providing 70% auxiliary air and 30% room air as set forth in claim **13**, said movable closure being in the closed position, whereby auxiliary air from the auxiliary air outlet plenum chamber discharges through the bypass opening into the housing, auxiliary air discharged through the vertically extending plenum chamber being discharged against the vertical edges of the movable closure preventing the fumes within the housing from discharging outwardly through the fume hood opening, room air flowing upwardly through the auxiliary air supply channel into the auxiliary air outlet plenum chamber to be discharged with the auxiliary air through the bypass opening into the housing, and auxiliary air discharged from the bottom facia air jet plenum chamber discharging into the housing along the bottom wall together with room air flowing through the same elongated air passage above the front edge of the bottom wall.

15. A laboratory fume hood for providing 70% auxiliary air and 30% room air as set forth in claim **13**, including wings provided on each side of the fume hood opening whereby the wings are adapted to reduce the possibility of cross drafts, or other disturbances in front of the laboratory fume hood from creating turbulence in the incoming auxiliary air and room air and further operate to partially isolate the fume hood opening from the room in which the laboratory fume hood is operatively positioned and also to improve the laboratory fume hood performance.

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