Aug. 16, 1955 A. D. MACKINTOSH ET AL 2,715,359

LABORATORY HOOD

Filed Oct. 30, 1950 4 Sheets-Sheet 1

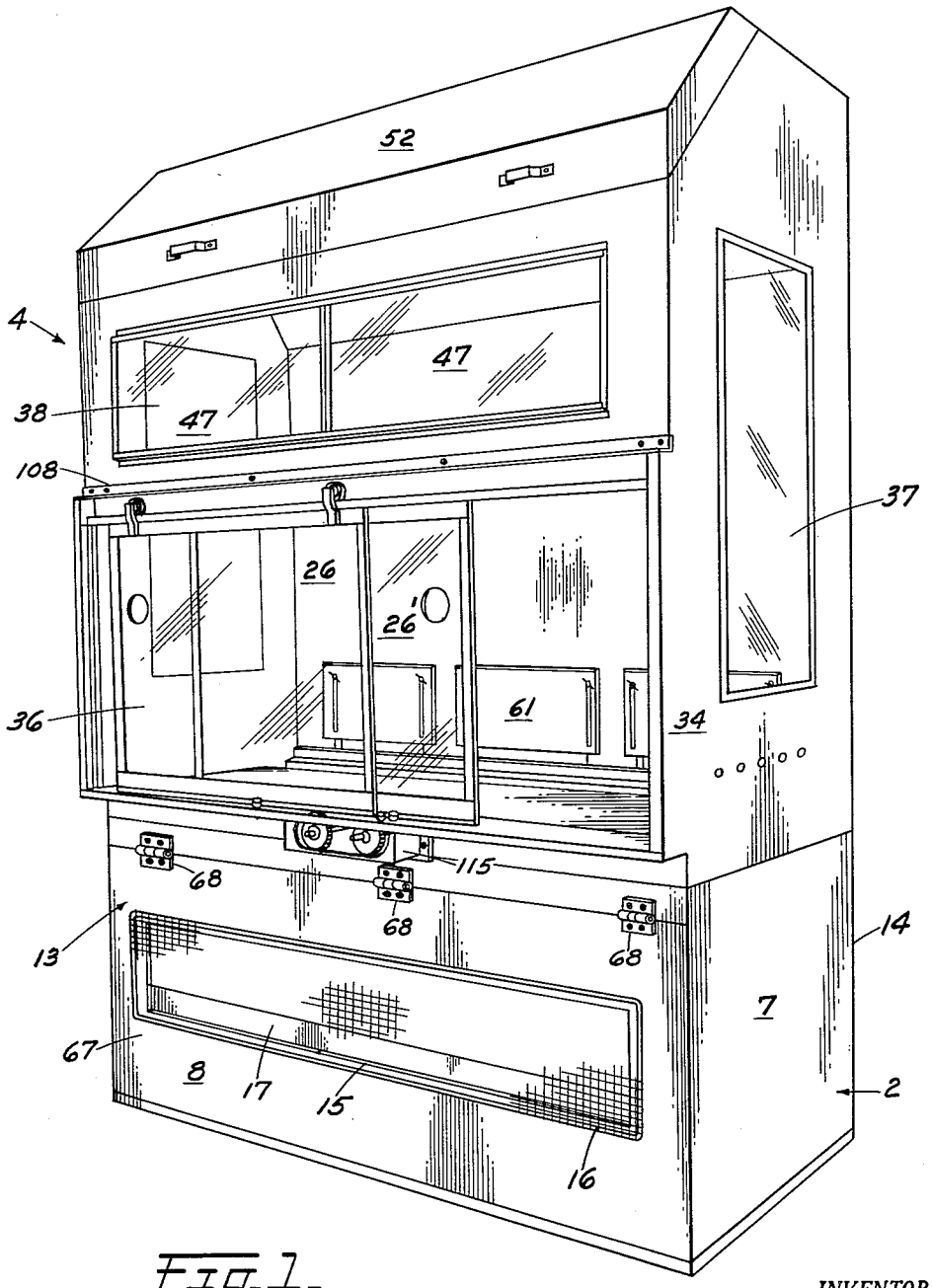


Fig. 1.

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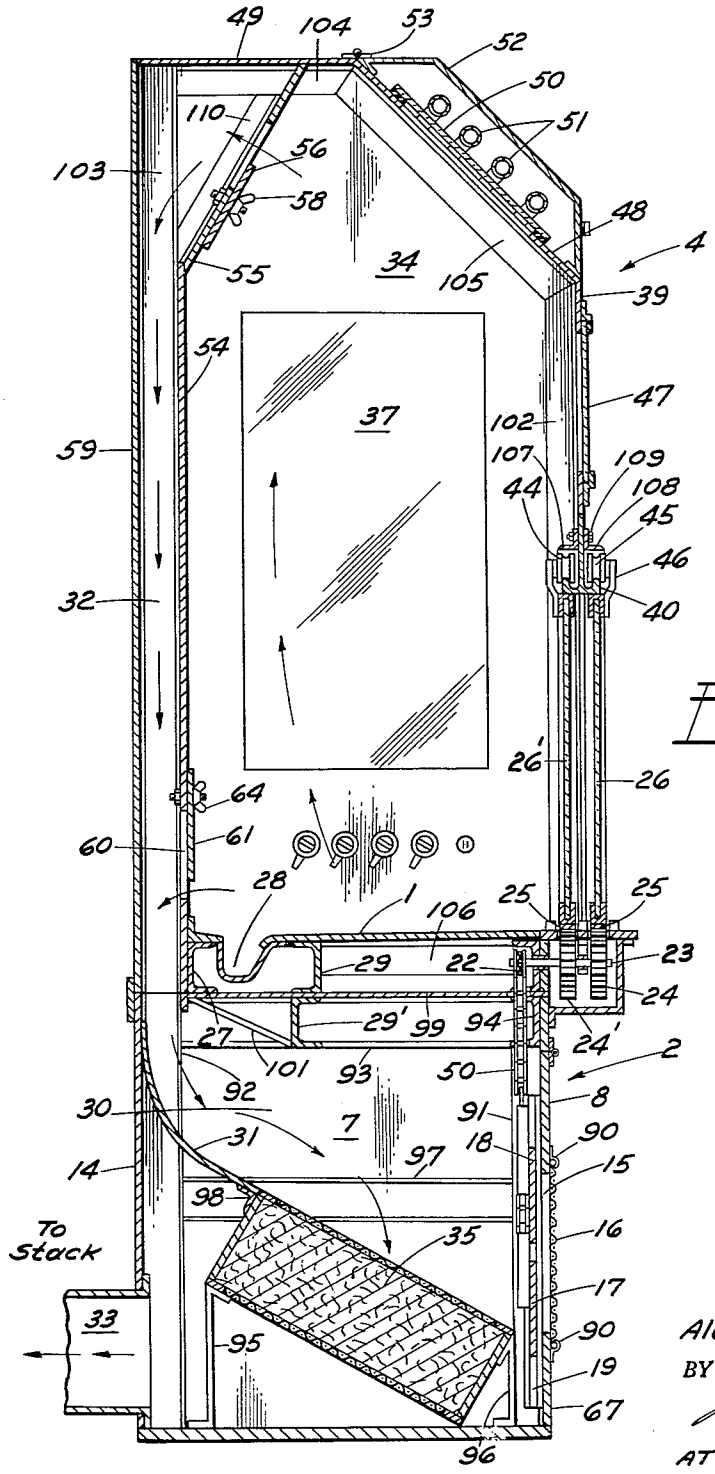


FIG. 2.

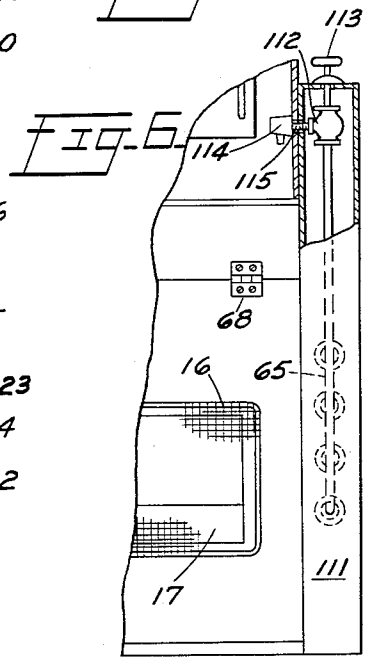


FIG. 6.

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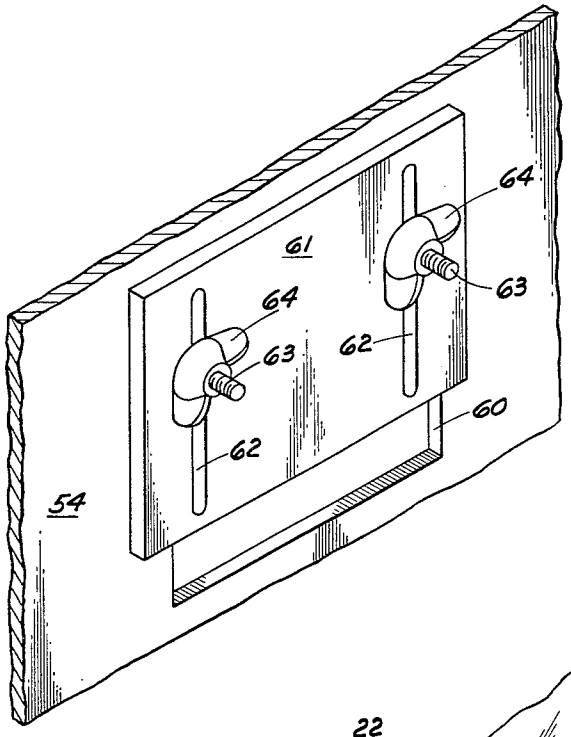


Fig. 3.

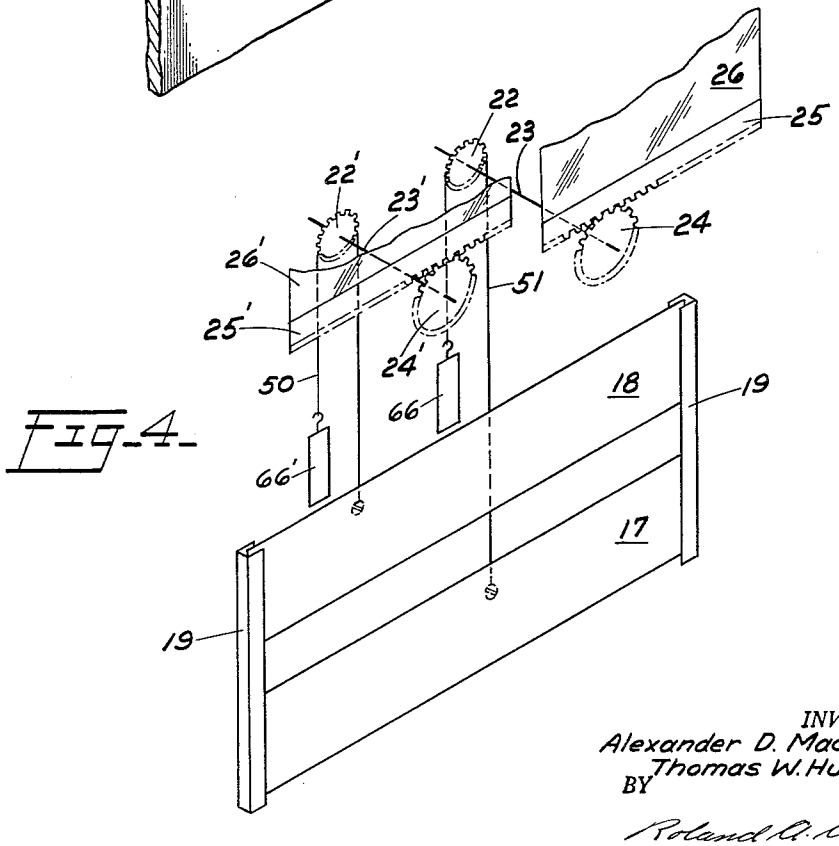


Fig. 4.

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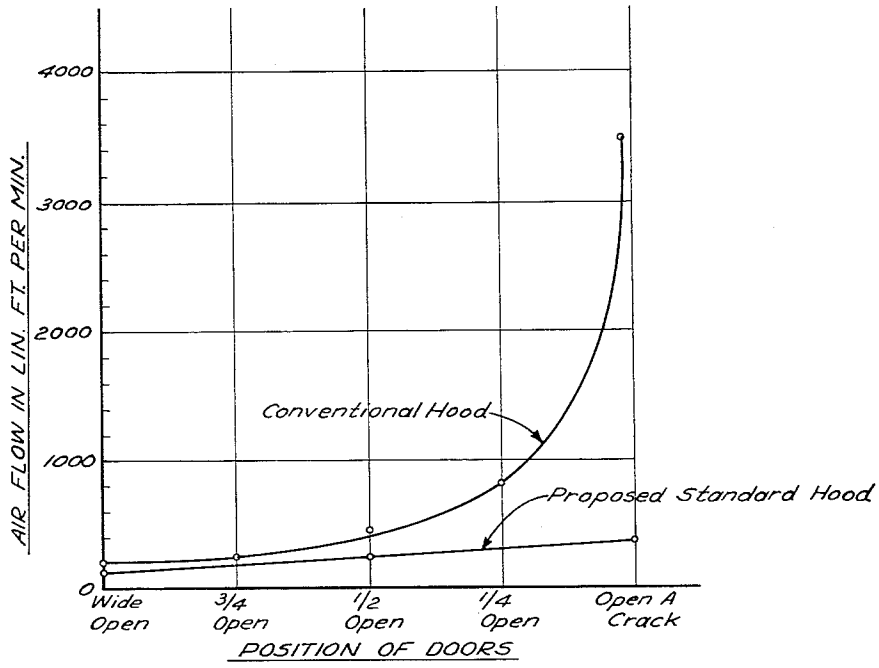


Fig. 5

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LABORATORY HOOD

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6 Claims. (Cl. 98—115)

Our invention relates to chemical hoods and more particularly to a cabinet type hood having substantially uniform air requirements, and which is suitable for general use in chemical laboratories including both radiochemical use and cold operations.

Heretofore, in the prior art, it has generally been the practice to construct each chemical hood for the place where it has to be located and to meet the particular requirements of the operations it was desired to carry out therein. These hoods did not generally meet the problems of balanced pressures, and insure a substantially even flow of conditioned air to the hood. With appreciable changes in the requirements of air for the units, particularly where there were a number of them in each laboratory, it became necessary in some instances to provide complicated and expensive controls, dampers, and by-passes in order to maintain the necessary pressure differentials between the laboratories and other parts of the building. This uneven pressure distribution was aggravated where the hoods in one laboratory were closed and those in another were open. Since air was supplied to the hoods by opening them, movement of the door to a slightly open position would result in a strong draft or rush of air through the working space of the hood which would carry papers and light materials with it and extinguish the flames of burners used therein. Furthermore, the use of vertically moving doors resulted in very large volumes of air flow through the hood when such doors were open, thereby producing excessive demands upon the source of air supply. In addition, the illumination for the hood was located in its upper interior so that access thereto for replacement or repair was available only from the inside through the vertical door. Also, in the conventional hoods of the prior art, the upper portions thereof were customarily enclosed so that instruments located therein could not be viewed from the exterior. This required the operator in making readings to place his head in the hood and look up, thus subjecting him to the harmful effects of any vapors contained therein. Examples of the structures of the prior art may be found in the patents to Liptay 1,968,532 and 1,934,808, and in Buckel 1,972,917.

Applicants with a knowledge of these problems in the prior art have for an object of their invention the provision of a chemical hood having substantially uniform air flow requirements.

Applicants have as another object of their invention the provision of a chemical hood having an air by-pass for substantially eliminating the draft or rush of air through the working space as the hood is opened.

Applicants have as another object of their invention the provision of a chemical hood having an air by-pass synchronized for closing with the opening of the hooc to overcome drafts or rushes of air through the working space.

Applicants have as another object of their invention the provision of a chemical hood illuminated from the upper exterior through panels or walls which pass the light into the hood while permitting ready access to the lighting equipment from the exterior without exposure to harmful vapors from the hood.

Applicants have as another object of their invention the provision of a chemical hood having transparent, removable, or slidable panels in the upper portions thereof to permit viewing and/or adjustment of instruments and other equipment located or extending into those portions.

Applicants have as a further object of their invention the provision of a chemical hood having doors movable horizontally for reducing the open space of the hood and eliminating front corner or center posts which may serve to create or build up back eddy currents or vapors within the working space with the danger of their escaping into the laboratory or other portions of the building and increasing the hazards of operation.

Applicants have as a still further object of their invention the provision of a chemical hood having a work surface slanting rearwardly to a drain in order to facilitate cleaning and decontamination, and constructed along standardized and reproducible lines which facilitates detachment and removal of the upper cabinet portion for decontamination, repair or replacement, and permits use of the lower portion of the hood as a bench without the enclosure.

Applicants have as a still further object of their invention the provision of a chemical hood with a protective arrangement for preventing the accidental displacement of the doors of the hood.

Other objects and advantages of our invention will appear from the following specification, and accompanying drawings, and the novel features thereof will be particularly pointed out in the annexed claims.

In the drawings, Fig. 1 is a perspective of our improved chemical hood, with the end cases omitted for purposes of clarity. Fig. 2 is a longitudinal sectional elevation of the same chemical hood showing our novel arrangements for controlling air flow and reducing hazards. Fig. 3 is a fragmental detail showing a vent cover and mounting for controlling the draft inside the hood. Fig. 4 is a schematic of the operating arrangement for controlling the movable doors or panels to regulate air flow. Fig. 5 is a graph of air flow plotted against door positions contrasting the performance of our improved chemical hood and the conventional type of hood. Fig. 6 is a fragmental sectional elevation of our improved hood showing one of the closures for the services for said hood.

Referring to the drawings in detail, **2** designates generally a bench which supports a cabinet **4** projecting upwardly from and enclosing the space above the work surface of the bench. The bench portion **2** includes a housing while the cabinet portion **4** carries an upper work surface **1**, preferably of stainless steel, which slants from front toward the back, so as to drain into a gutter or trough **28** located in the lower rear portion of the cabinet portion. The housing of the body of the bench is rectangular and is defined by front wall **8**, end walls **7**, **13** and rear wall **14**. In the front wall **8** of the bench is formed a longitudinal opening or window **15** extending substantially entirely across such wall. This window may be covered by a protecting screen **16** in order to keep large objects or trash from entering the body of the bench through the window. This screen may be held in position on the front wall **8** by clamps **90** mounted on the wall or by other suitable mounting means such as tacks. Window **15** may be closed by a pair of slidable shutters or panels **17**, **18** which are guided and restricted in their vertical movements by conventional guides **19**, **19** which provide longitudinal grooves for the reception

of the end edges of the shutters or panels 17, 18. Shutters or panels 17, 18 with their adjacent side edges in abutting relationship close the by-pass window 15, and are manipulated towards and away from each other through the force of gravity and the action of supporting chains 51 and 50, or other suitable flexible means which serve to suspend such shutters individually from sprockets 22, 22', respectively, carried by shafts 23, 23' and driven by pinions 24, 24', which are separately operated by toothed racks 25, 25' meshed with the teeth of the pinions and carried on the lower edges of the horizontally slidable doors 26, 26' of the cabinet, as indicated schematically in Fig. 4.

The body of the bench is supported by a framework consisting of vertical posts located at the four corners thereof. The front posts 91, 91 are of angle iron while the rear posts 92 are of channel iron. Bridging the upper extremities of the posts are a pair of end channel irons 93, a front channel iron 94 and an intermediate channel iron 29'. The framework and walls of the bench define a chamber 30 for the reception of vapors from the hood and air from window 15. Extending diagonally upward from the lower portion of the bench 2, and engageable with a flue wall 31 and supported by brackets 95, 96, is a conventional filter 35 which serves as the sole means of communication between the duct 32, extending up into the cabinet 4 of the hood, and the vent or stack channel 33. Bridging the front posts 91 and rear posts 92 are intermediate braces 97 of channel iron which are joined to the ends of cross support 98, preferably of angle iron, for the flue wall 31. This support 98 also aids in positioning the filter 35. Positioned above the channel irons 29', 94 is a working surface 99 which extends to the flue 32 and is supported along its ends by channels 93 and along its rear extremity by a diagonal support 101 carried by channel iron 29'.

The cabinet 4 of the hood, which is removably mounted on the bench, rests upon and extends upwardly from the working surface 99 of the bench. It is preferably of rectangular configuration with end walls 34, 36 having visual panels 37, 38, preferably of glass or plastic, removably secured thereto by clamps, screws, or other suitable means. The walls of the cabinet 4 are secured to and supported by a framework including a pair of spaced vertical posts 102 of angle iron construction positioned at the opposite front corners, and a pair of spaced vertical posts 103 of channel iron construction positioned at the opposite rear corners. These front and rear posts are bridged at their upper extremities by horizontal and diagonal braces 104, 105. Extending along the lower extremities of the sides are angle irons 106 bridged by channel irons 27, 29 which serve to support working surface 1 and the walls of the trough 28.

The front wall 39 has a large opening accessible to the working surface of the hood, which is customarily closed by overlapping, horizontally slidable doors 26, 26' of transparent material, such as glass or plastic. If desired, such doors may have frames enclosing their outer peripheries. The doors, as indicated above, carry toothed racks 25, 25' along their lower edges which mesh with the teeth of pinions 24, 24'. Joined to the upper edge of the opening and extending horizontally therealong is a beam 40 of steel or other suitable material, having a lower transverse flange with upwardly projecting or curled edges for defining a pair of spaced tracks over which sets of spaced rollers 44, 45 are adapted to traverse. These rollers are joined to their respective doors through angular brackets 46, 46 and serve to suspend and carry the doors in their movement along the tracks. Positioned above the rollers 44, 45 and spaced from them are a pair of retaining strips 107 and 108 which take the form of angle iron. They preferably extend the entire length of the front of the cabinet and are secured to the front wall of the cabinet and to each other by bolts 109. Positioned in the front wall 39 of the hood, above the doors 26, 26, are visual panels 47, 47 to permit viewing of instruments located in the upper

part of the hood. The front wall 39 of the cabinet merges into a slanting wall 48 which bridges the front wall and the top 49. Wall 48 has a relatively large panel 50 of diffused glass extending substantially its full length. Positioned on the outer surface of the slanting wall, and in alignment with the panel 50 are a series of spaced fluorescent lights 51, 51 for illuminating the fume collecting chamber and work space of the hood. These lights are enclosed in a case 52, hinged at 53 on slanting wall 48 to swing upwardly and provide access to the lamps for repair or replacement purposes.

The rear wall 54 of the cabinet extends upwardly and merges into a slanting partition which bridges the top 49 and the rear wall and is supported by angle iron 110. Formed in the slanting partition 55 are a series of spaced openings which may be closed by adjustable covers 56 having slots therein for the reception of the shanks of bolts carried by the partition for coaction with wing nuts 58 to maintain the covers in adjusted position and permit the restriction or closing of the openings. This arrangement is similar to that shown in detail in Fig. 3. The openings in the partition 55 bring the upper portions of the fume collecting chamber of the hood into communication with the exhaust duct 32 formed by the rear wall 54 and outside closure plate 59. In addition, spaced openings 60, shown in detail in Fig. 3, are formed in the rear wall 54 just above the working surface 1. These openings may be closed or restricted by adjustable covers 61 having slots 62, 62 for the reception of shanks 63, 63 of bolts carried by the wall and for cooperation with wing nuts 64, 64 which permit the covers to slide with respect to the shanks and to be maintained in adjusted position by tightening the wing nuts 64. The latter openings bring the lower part of the fume chamber into communication with duct 32 and remove fumes therefrom.

The services, such as gas, compressed air, vacuum, water, etc., are brought into the hood through lines or pipes 65, 65 which extend upwardly from the floor on either side of the hood and are enclosed in closure 111 adjacent the ends of the hood. They terminate in right angle valves 112 with stems projecting upwardly through the closures to carry handles 113. Outlets 114 located on the inside of the cabinet 4 carry nipples 115 which project through the walls of the cabinet and are threaded into valves 112. Valves 112, 112 which are interposed in the lines and which have their stems extending upwardly through the top walls of the cases or closures 111 carry handles 113, 113 which permit adjustment of the individual valves from the exterior of the hood.

In the operation of our improved chemical hood, the vent channel 33 is coupled to an exhaust fan, stack or other source of suction pressure. With the covers 56, 56 and 61, 61 in proper adjustment, fumes or gases evolved from reactions in the hood are removed through the exhaust duct 32 to chamber 30, and then through filter 35, which serves to filter out particles of material including radioactive decontamination, into the exhaust channel 33 connected to the stack or exhaust fan (not shown). If the horizontally slidable doors 26, 26' are in closed position, the shutters 17, 18 will be held apart by the action or position of the chains 50, 51, and the weights 66, 66' permitting air to be drawn into the chamber 30 through the opening 15, thereby reducing the draft in duct 32, and in turn on the hood. When the doors 26, 26' are moved towards open position, they act through racks 25, 25' to rotate pinions 24, 24', and in turn sprocket wheels 22, 22'. Since chains 50 and 51 pass over separate sprockets and have their links meshed with the teeth thereof, rotation of one or both of the sprockets will serve to move either or both of the chains 50 and 51. However, the chains 51, 50 pass over the sprockets 22, 22' in such a direction that rotation of a sprocket 22' on opening of the door 26' will serve to pay out the chain 50 towards the shutter 18 thereby lowering it, while rotation of the other sprocket 22 on opening of another of the doors 26 will move chain

51 to raise shutter 17. Although the opening of doors 26, 26' serves to close the shutters 17, 18 and reduces the air flow through by-pass opening 15, it will be apparent that the cracking or opening of the doors slightly will not cause a rush of air to flow from the laboratory or room into the cabinet in such a manner as to cause flames to be extinguished or light materials to be blown about in the hood, since the by-pass window 15 is almost entirely open and serves to by-pass the principal flow of air into the duct, thereby reducing its draft upon the hood. On the other hand, when the doors are fully open, the draft requirements in the cabinet 4 increase in order to prevent escape of vapors into the laboratory. This is provided for by the closing of shutters 17, 18 thereby placing the full suction pressure of the exit vent or stack upon the duct 32 and the fume chamber of cabinet 4.

From the foregoing, it is apparent that as the draft requirements of the hood increase or decrease by the opening and closing of the doors, the suction pressure is regulated through the control of the action of the by-pass. This results in an almost uniform air flow characteristic for the hood of our invention and contrasts with the poor characteristic of the conventional hood as indicated by the curves of Fig. 3 wherein air flow has been plotted against door position of these hoods.

In order to facilitate access to the interior of the bench 2 for removal or replacement of the filter 35, or for other purposes, the front wall 13 is provided with a movable panel 67 hinged at 68. This panel 67 can be swung upwardly and the interior of bench 2 is made accessible. For the purpose of enclosing the operating mechanism for the shutters 17, 18, a flanged closure box 115 is mounted on the front wall directly above the movable panel by means of screws or other appropriate securing means.

While the door operated shutter form of air flow control has been shown in the preferred embodiment of our invention, it is apparent that the flow control may take many other forms. For instance, a rotatable shutter may be utilized. The motion of rotation may be activated by a motor which is controlled by a pressure differential between that within the hood and that in the room.

Having thus described our invention, we claim:

1. A chemical hood of the character described comprising a working surface, a normally closed enclosure for enclosing the working surface, a vacuum source for applying a suction pressure to the enclosure for removing fumes, a by-pass duct normally open to the atmosphere external to the enclosure communicating with said source for bringing the source into communication with the atmosphere when the enclosure is closed and limit the vacuum pressure applied thereto, and means responsive to the opening of the enclosure for closing said by-pass duct to increase the suction pressure applied by the source to said enclosure.

2. A chemical hood of the character described comprising a supporting bench, a cabinet forming an enclosure positioned on the bench, a door for closing the cabinet, a suction duct for communication with the enclosure to apply a vacuum pressure thereto for removing fumes therefrom, a by-pass means in the suction duct on the suction side of the hood communicating with the atmosphere in which the hood is located, and means responsive to the opening of the door for closing the by-pass duct and increasing the vacuum pressure applied to the enclosure.

3. A chemical hood of the character described comprising a working surface, a cabinet positioned above the working surface for enclosing it, a pair of overlapping slidable doors for opening and closing the cabinet, a suction duct for communication with the interior of the cabinet to apply a vacuum pressure thereto for removing fumes therefrom, a by-pass duct for communication with the suction duct at a point external to the cabinet to admit air thereto, said by-pass duct being normally open to the external atmosphere in which the hood is located, and means responsive to movement of the doors to closed position for progressively closing the by-pass duct to increase the suction pressure applied to said cabinet.

4. A chemical hood of the character described comprising a body, a working surface positioned in an intermediate portion of the body, a cabinet portion positioned above the working surface for enclosing the working surface to separate it from the atmosphere in which the hood is located, a suction duct extending into the lower portion of the body and communicating with the interior of the cabinet portion to apply a suction pressure for removal of fumes, a door for closing the cabinet portion, a by-pass duct positioned in the lower part of the body communicating with said atmosphere and with the suction duct at a point external to the cabinet for feeding air to the suction duct and limiting the suction pressure applied to the cabinet, and means for engagement with the door to close the by-pass duct when said door is in open position and increase the vacuum pressure applied to the cabinet.

5. A chemical hood of the character described comprising a body, a working surface in the body, a cabinet portion for enclosing the working surface to separate it from the external atmosphere in which the hood is located, a door for closing the cabinet portion, a duct communicating with the interior of the cabinet portion for applying a suction pressure thereto, an opening in said body communicating with said atmosphere for providing a by-pass for feeding air from the atmosphere to said duct at a point external to the cabinet, and means actuated by the opening of said door for progressively closing the opening and increasing the vacuum pressure applied to the cabinet portion.

6. A chemical hood of the character described comprising a body having an upper normally closed cabinet portion and a lower bench portion, a slidable door for opening and closing the cabinet portion, a duct passing through the bench portion and communicating with the interior of the cabinet portion for applying a vacuum pressure thereto for removing fumes therefrom, a window normally open to the atmosphere positioned in the bench portion and communicating with the duct at a point external to the cabinet for admitting air from the external atmosphere in which the cabinet is located to said duct and provide a by-pass, a closure for said window, and means engageable by the door and actuated by movement thereof to open position for progressively moving said closure across said window to close it to reduce the flow of air through the by-pass and increase the vacuum pressure applied to said cabinet.

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