United States Patent

Ahlrich

[15] **3,645,194**

[45] **Feb. 29, 1972**

[54] BAFFLED VENTILATING HOOD

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[22] Filed: **Mar. 16, 1970**

[21] Appl. No.: **19,913**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 739,518, June 24, 1968, Pat. No. 3,513,766.

[52] **U.S. Cl.** **98/115**

[51] **Int. Cl.** **F23j 11/02**

[58] **Field of Search** ..... 98/115 K, 115 R, 115 LH, 36; 138/39

[56] **References Cited**

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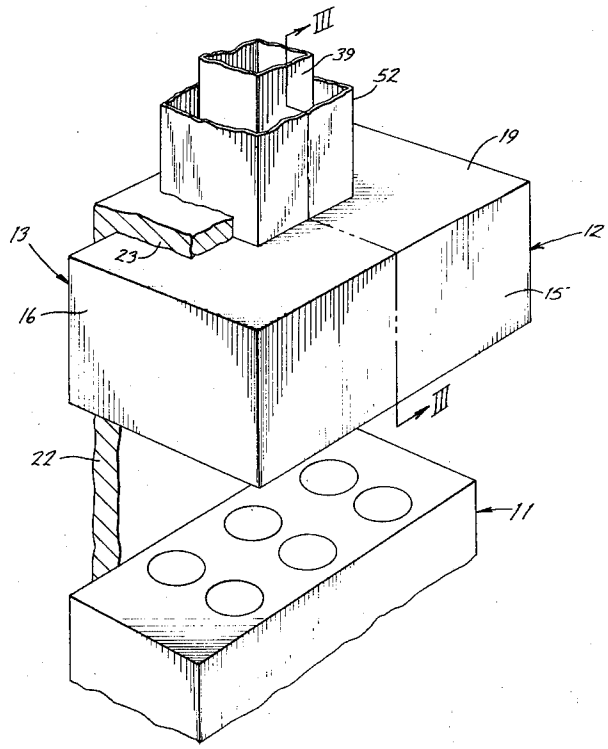
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[57] **ABSTRACT**

A hood structure for exhausting fumes and/or hot gases from food cooking below the hood structure, which includes an exhaust chamber connected to a gas-moving assembly for discharging the fumes. An air supply chamber is also connected to said gas-moving assembly for replacing the discharged air with relatively fresh air. The airflow and volume are carefully controlled to assure movement of the supply air and fumes in a pattern which will not adversely affect the temperature or other characteristics of the food being cooked, but will prevent the fumes from escaping into the room or space around the hood.

10 Claims, 7 Drawing Figures



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SHEET 1 OF 3

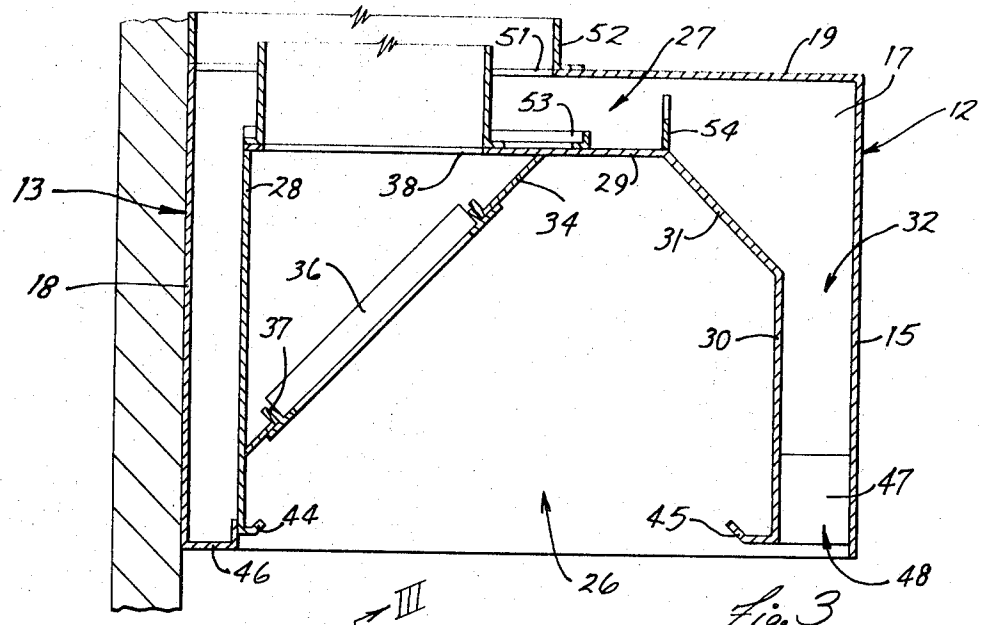


Fig. 3

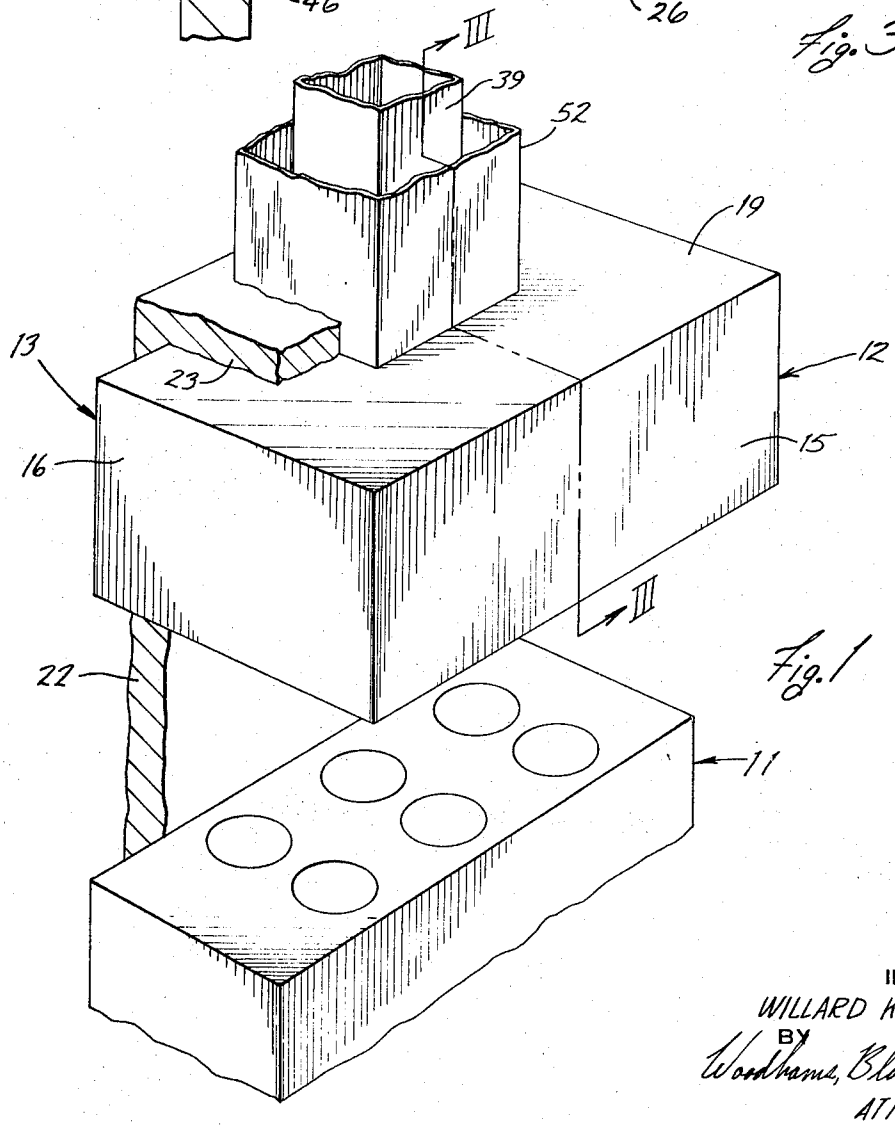


Fig. 1

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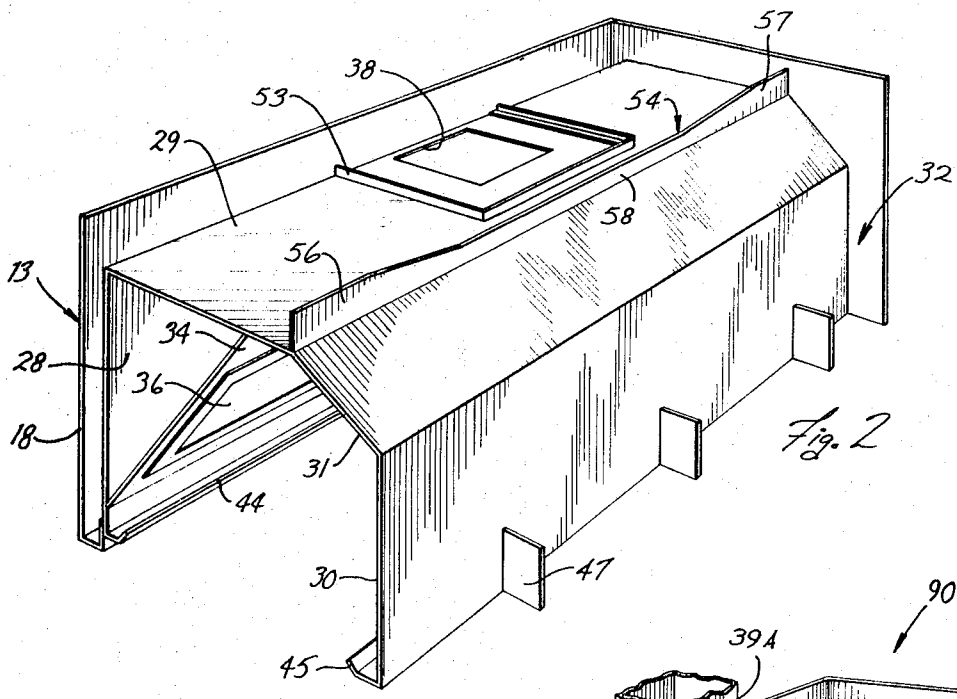


Fig. 2

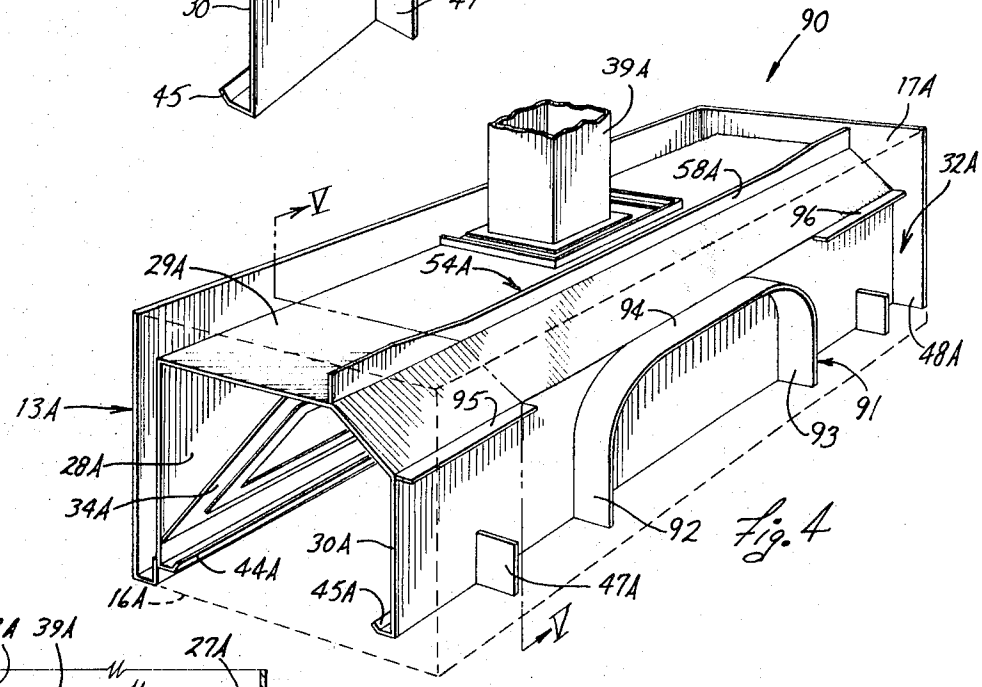


Fig. 4

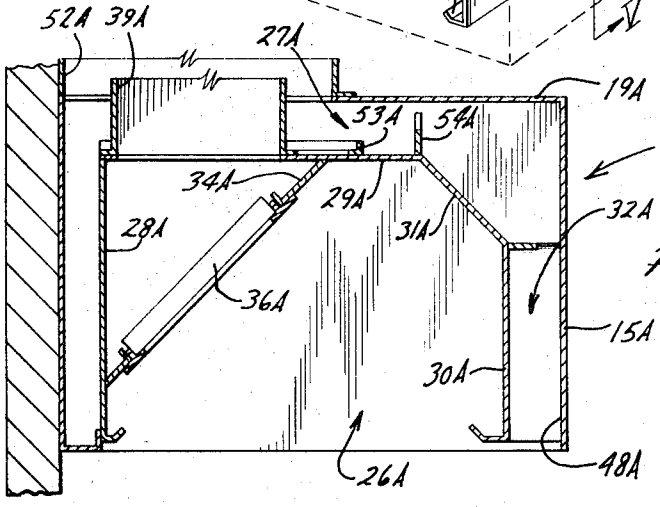


Fig. 5

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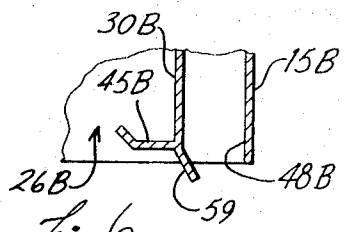


Fig. 6

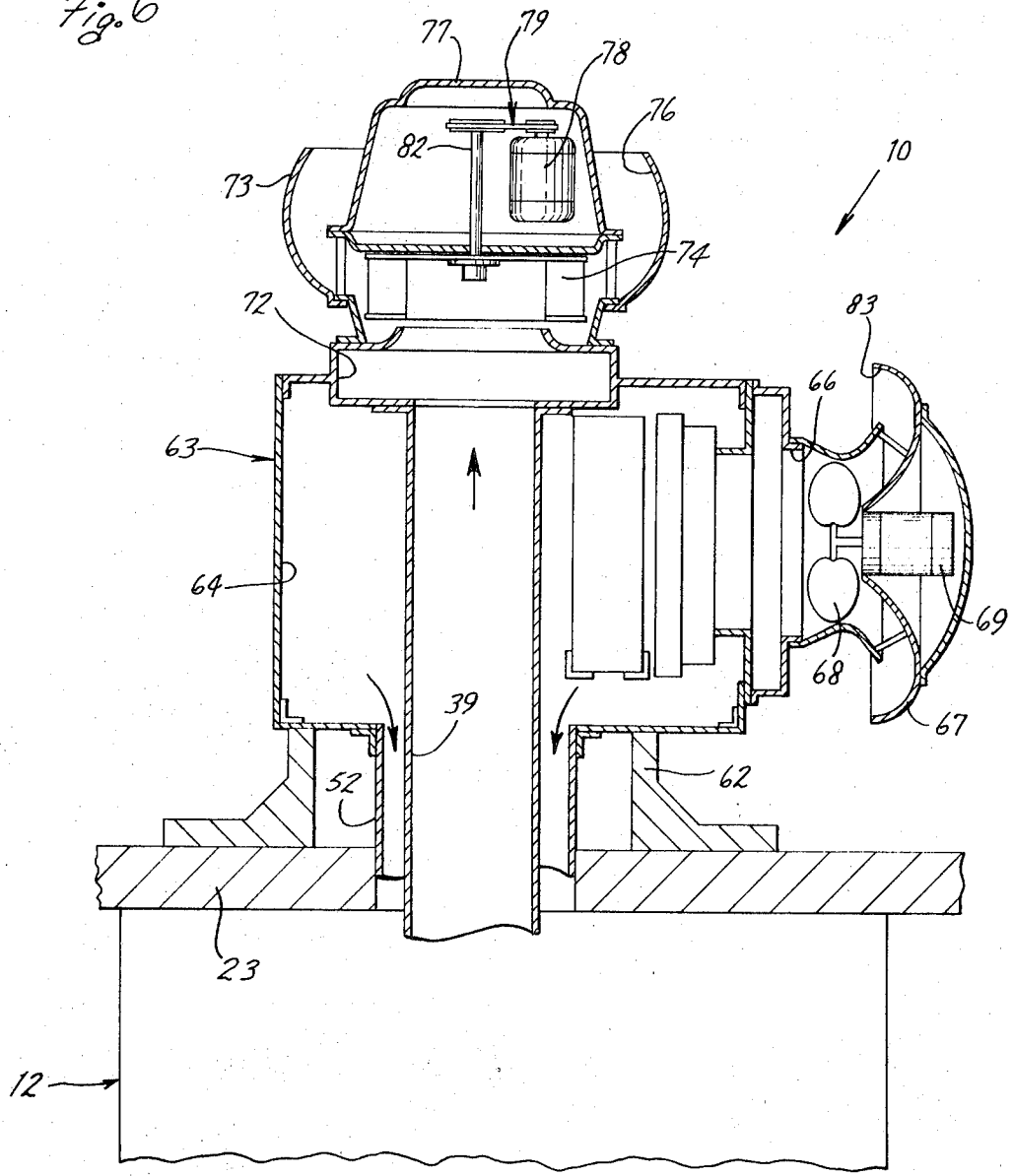


Fig. 7

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BAFFLED VENTILATING HOOD

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of my copending application Ser. No. 739,518 filed June 24, 1968, now U.S. Pat. No. 3,513,766, and entitled "Ventilating Hood".

FIELD OF THE INVENTION

This invention relates in general to a hood structure for collecting fumes and/or hot gases which are produced as the result of cooking food, for example, and thereby preventing such fumes and gases from circulating around the room in which the hood structure is disposed.

BACKGROUND OF THE INVENTION

Specific reference will be made hereinafter to the use of the apparatus of the invention in association with a cooking stove or the like, primarily because it was out of this background that the invention was developed. However, it will be recognized that the apparatus can be adapted for other purposes, such as the control or removal of noxious gases developed during an experiment being performed in a chemical laboratory, for example.

Fume collecting or ventilating hoods have been used for many years in association with both domestic and commercial cookstoves, for example. However, it has been quite evident to any person capable of detecting odors that most existing hoods have not been satisfactory.

The ventilating hoods, with which I am familiar, have been operated as though the fumes from a specific source, such as a cookstove, located within a closed space, such as a kitchen, could be removed by connecting a strong exhaust fan to the room and then opening a window or door into the room to replenish the air removed by the fan. However, this approach to the problem of fume removal has been based upon three erroneous assumptions.

In the first place, the average exhaust fan capable of use in a hood is completely unable to develop a suction pressure which draws the air from all directions. Thus, at best, the air flow will tend to channelize between the fan and the supply opening into the room. Accordingly, substantial amounts of the fumes are relatively free to migrate away from the source because they are not influenced by the channels of air flow. It was also discovered that the volume of air introduced into the room is usually neither controlled nor consistent with the amount required. That is, the volume is either too large or too small and thereby defeats the purposes of the ventilating system.

In the second place, air flow currents produced by convection and/or by movements of people in the vicinity of the source of fumes will often disrupt the channeled air flow so that the fumes are actually moved away from the exhaust fan.

In the third place, the temperature within the room may be such that air adjacent the opening, such as a window, into the room will flow out of the opening and thereby draw at least some of the fumes into the room toward such opening.

While studying this problem, I discovered that a supply of gas, such as air, could be introduced into the zone between the source of fumes and adjacent the exhaust unit without spreading the fumes into the room. Moreover, a curtain of air could be caused to move along the sides of the zone in a predetermined pattern, to entrain the fumes adjacent the curtain and thereby move them to the exhaust unit.

Some structures previously developed by me to embody the foregoing principles are disclosed in U.S. Pat. No. 3,411,428 and U.S. Pat. application Ser. No. 739,518, filed June 24, 1968. However, in the course of trying to improve upon these structures, I discovered that better control over air flow could be obtained, especially with large units, by locating baffles of particular shapes and sizes at strategic locations within the air supply chamber.

It is, therefore, an object of this invention to provide an apparatus for collecting fumes adjacent their source by positively pressurizing the zone adjacent the source of the fumes and entraining them in the flow of air from the pressurized zone to an exhaust unit.

It is a further object of this invention to provide for installation in a room a hood construction for supplying air to and removing gases from a zone in the room and thereby eliminating the need for a supply opening elsewhere into the room.

It is a further object of this invention to provide a hood construction, as aforesaid, which is easy to install, substantially conventional in appearance, capable of use with conventional exhaust and supply fans, adaptable to various applications and operable by any person capable of operating existing exhaust fans and/or hoods.

It is a further object of this invention to provide a hood construction, as aforesaid, which includes baffles strategically located to control the flow of supply air.

It is a further object of this invention to provide a hood construction, as aforesaid, which can be easily connected to an improved fan assembly of the penthouse type having both supply and exhaust fans mounted therein.

Other objects and purposes of this invention will become apparent to persons familiar with this type of equipment upon reading the following descriptive material and examining the accompanying drawings, in which:

FIG. 1 is a perspective view of a hood embodying the invention positioned over a source of fumes, such as a stove.

FIG. 2 is a perspective view of said hood with part of the casing and the ducts removed.

FIG. 3 is a sectional view of the hood taken along the line III—III in FIG. 1.

FIG. 4 is a perspective view of part of a modified hood structure embodying the invention.

FIG. 5 is a sectional view taken along the line V—V in FIG. 4.

FIG. 6 is an enlarged fragment of FIG. 3 illustrating a modification of the hood.

FIG. 7 is a central cross-sectional view of a fan assembly adapted for use with the hood of the invention.

For convenience of description, the terms "upper", "lower", "front", "rear" and words of similar import will have reference to the apparatus of the invention as appearing in FIG. 1 which discloses the front and left sides of a hood. The words "inner", "outer" and derivatives thereof will refer to directions toward and away from, respectively, the geometric center of the hood and parts associated therewith.

SUMMARY OF THE INVENTION

The above-mentioned objects and purposes have been met by providing a hood structure above a source of fumes and introducing a supply of air through the hood which also exhausts the fumes. Said hood has an exhaust chamber opening toward said source and connected to an exhaust fan for drawing the fumes into the chamber. The hood also includes a supply chamber adjacent the exhaust chamber and having a discharge opening along at least one of the edges of the exhaust opening. A supply fan moves air from the supply chamber through the supply opening and toward the source.

DETAILED DESCRIPTION

The ventilating apparatus **10** (FIG. 7) for collecting fumes from a source (FIG. 1), such as a stove **11**, located under the apparatus **10**, comprises a hood **12** having a casing **13** defined by a front wall **15**, a left sidewall **16**, a right sidewall **17** (FIG. 3), a rear wall **18** and a top wall **19**. The hood **12** can be secured to the wall **22** or the ceiling **23** of a building, as indicated in FIG. 1. The hood **12** can also be mounted on a support structure (not shown) adjacent the stove **11**, or it could be suspended from the ceiling **23**.

The interior of the hood **12** (FIG. 3) is divided by panel means into two chambers hereinafter referred to as the exhaust chamber **26** and the supply chamber **27**. The exhaust chamber **26** has an upright rear wall **28**, which extends lengthwise between the sidewalls **16** and **17**, and downwardly

from the top wall 19. The rear wall 28 and top wall 29 of the chamber 26 are both spaced from the rear wall 18 and top wall 19 of the casing 13 which walls define the rear and upper limits of the supply chamber 27.

The front wall 30 of the chamber 26 has an upper section 31 converging downwardly with the front wall 15 to form the entrance to a discharge slot 32 which also serves as the lower end of the supply chamber 27 between the walls 15 and 30. The engaging edges of the walls in the hood 12 may, where required, be held together by soldering, rivets, or the like.

The exhaust chamber 26 is divided into side-by-side, elongated compartments by a partition wall 34 extending downwardly and rearwardly from the central part of the top wall 29 to the lower end of the rear wall 28 and is secured thereto by convenient means such as welding. An opening 37 is provided in the wall 34 to interconnect the two compartments of the exhaust chamber 26.

A filter 36 (FIGS. 2 and 3) may be placed over or in the opening 37 to catch particulate material from the fumes that come from the source 11 and which would otherwise coat and/or contaminate those walls of the exhaust chamber 26 and exhaust duct 39 downwind of the wall 34. The filter 36 may be supported for easy removal and replacement by structure similar to that disclosed in said copending application Ser. No. 739,518.

The top wall 29 has an opening 38 with which the lower end of the exhaust duct 39 communicates in substantially airtight engagement with the adjacent edges of the wall 29.

The lower edges of the rear wall 28 and the lower wall section 30 have integral flanges 44 and 45 which extend inwardly toward each other to stiffen the hood and serve as a drip trap, where necessary.

The lower end of the space between the rear walls 18 and 28 (FIG. 3) is closed by a panel 46 to provide a deadair space for heat insulating between said walls 18 and 28. This space communicates at its upper end with the supply chamber 27.

The lower ends of the front walls 15 and 30 are interconnected by a plurality of vertical, parallel and spaced vanes 47 which also serve to straighten the air departing through the discharge opening 48 at the lower end of the slot 32. The vanes 47 may be curved if turning of the air is desired. The top wall 19 (FIG. 3) has an opening 51 through which the exhaust duct 39 extends, said duct being spaced on all sides from the adjacent edges of the top wall 19 defining said opening. A supply duct 52 communicates at its lower end with the opening 51 and is connected in substantially airtight engagement to the portion of the top wall 19 around the opening 51. Supply duct 52 is preferably spaced laterally on all sides from the exhaust duct 39. Up to this point, the hood 12 may be similar, if not identical, to the hood disclosed in FIG. 9, and described in the specification, of said copending application Ser. No. 739,518.

As shown in FIG. 2 of this application, the opening 38, hence the lower end of the exhaust duct 39 (FIG. 3), is surrounded on the front side and both ends by a rectangular and substantially concentric baffle 53 which may be comprised of plural angle members welded to the top wall 29. In a situation where the exhaust duct was of substantially square cross section and approximately 11 inches across, the baffle 53 was advantageously 1 inch high and spaced 5 inches from said opening 38 when the space between the walls 19 and 29 was 4 inches. In this particular adaptation, the opening in the lower end of the exhaust chamber was approximately 71 inches long by 36 inches wide, the width of the slot 32 was 4 inches and the cross-sectional dimensions of the supply duct 52 were both approximately 19 inches. Moreover, air was normally removed through the exhaust chamber 26 in the range from 1,200 c.f.m. to 2,000 c.f.m. and supply air was furnished in the range from 1,000 c.f.m. to 1,600 c.f.m.

A lengthwise baffle 54 extends lengthwise of the supply chamber 27 and projects upwardly from the junction between the top wall 29 and the converging section 31 in this particular embodiment. The end portions 56 and 57 of the baffle 54, which were approximately 6 inches long in one embodiment, project upwardly approximately 3 inches from the top wall 29 so that they are spaced downwardly from the top wall 19. The central portion 58 of the baffle 54 projects upwardly 2 inches and there are intermediate sections of the baffle 54 which slope upwardly from the central portions 58 thereof to the end portions 56 and 57 thereof. Thus, it will be apparent that at least some supply air can pass between the upper edge of the baffle 54 and the lower surface of the top wall 19, but the constriction is greater near the opposite ends of the baffle 54. The specific dimensions mentioned hereinabove are for illustrative purposes and may be changed to adapt the apparatus to specific needs.

FIG. 6 is a fragment of the lower right corner of FIG. 3 showing a modified front wall 30B for the exhaust chamber 26B. Specifically, the wall 30B has a lower extension 59 which projects below the flange 45B. Also, said extension 59 projects slightly below and converges with the lower portion of the front wall 15B of the casing. Thus, supply air passing through the discharge opening 48B is deflected frontwardly by said extension 59 and, accordingly, sweeps lower at the same outlet velocity before it moves into the low pressure zone. The angle of discharge can be adjusted by changing the angle of the extension 59 relative to the wall 30B. This adjustment permits accurate adaptation of the hood to various perpendicular distances between the upper surface of the stove and the lower side of the hood.

FIG. 7 illustrates a fan assembly mounted in a penthouse and connectable to a hood 12 (FIG. 1) according to the invention. More specifically, the exhaust duct 39 and supply 52 extend through the roof curb 62, which supports a casing 63 defining a chamber 64 which communicates with the upper end of the supply duct 52. The casing 63 has a side opening 66 adjacent to which the shroud 67 of an axial flow impeller 68 is mounted upon the casing 63. The impeller 68 is supported by the shaft of a motor 69 which is secured to the shroud 67. Impeller 68 can be replaced by a centrifugal wheel as shown in Ser. No. 739,518.

The casing 63 has an opening 72 in the upper wall thereof through which the upper end of the discharge duct 39 communicates with the in-line housing 73 containing a centrifugal impeller 74. The housing 73 has an upwardly directed, axial discharge opening 76 which encircles a motor housing 77 supported upon the fan housing 73. A motor 78 is supported within the housing 77 and connected by drive means 79 to a vertical shaft 82, the lower end of which is connected to the back plate of the centrifugal impeller 74.

From the foregoing, it will be seen that the centrifugal impeller 74 draws air from the duct 39 and discharges it axially through the opening 76. The axial flow impeller 68 draws air through the opening 83 defined by the shoud 67 and discharges it into the chamber 64 from which it can move into the supply duct 52.

MODIFICATION

The hood 90 (FIGS. 4 and 5) may be substantially identical with the hood 12 (FIG. 2) except for the arrangement of vanes and baffles between the front walls 15A and 30A, as discussed hereinafter. Accordingly, those parts of the hood 90 which have corresponding parts in the hood 12 will be identified by the same numerals in addition to the suffix A.

More specifically the hood 90 (FIG. 4) has an exhaust chamber 26A bounded by the rear wall 28A, the top wall 29A and said front wall 30A. The supply chamber 27A of hood 90 has said front wall 15A, a top wall 19A and a rear wall 18A. Ducts 39A and 52A communicate respectively with the chambers 26A and 27A.

The hood 90 is especially made and designed for use with two laterally spaced sources of fumes rising from the top of the stove. That is, for example, the centermost pair of heating elements is removed from FIG. 1. Thus, it becomes desirable to concentrate the discharge of supply air at the opposite ends of

the discharge opening 48A which is at the lower end of the discharge slot 32A. This is accomplished by placing a U-shaped baffle or diverter 91 in a downwardly opening position completely across the space between the front walls 15A and 30A.

The diverter 91 (FIG. 4) has substantially upright flanges 92 and 93 which are spaced from the opposite ends of the slot 32A, as required, depending upon the arrangement of heating elements on the stove 11 to which supply air should be furnished. The upper ends of the flanges 92 and 93 curve toward each other into the web 94 of the diverter to minimize obstruction to the movement of the air which impinges upon the web 94 and must thereafter move sidewardly before it can move downwardly through the divided parts of the slot 32A. The curvature between the flanges 92, 93 and the web 94 tends to cause this air to stay close to the diverter 91 in a well known manner.

The baffle 54A may be substantially the same as the baffle 54 except that the central section 58A thereof may be somewhat longer if it is necessary to lengthen the casing 13A. A pair of vanes 47A (FIG. 4) may be provided on opposite sides of the diverter 91 for the same reasons discussed above.

A pair of substantially horizontal baffles 95 and 96, which may be substantially identical, are secured to the front wall 30A and project frontwardly therefrom adjacent the upper edge thereof and adjacent the sidewalls 16A and 17A (FIG. 4), respectively. The baffles 95 and 96 extend approximately halfway between the front walls 15A and 30A so that supply air can move downwardly between the front edge of such baffles and the front wall 15A, but such movement is definitely restricted. The adjacent ends of the baffles 95 and 96 are spaced substantially from the flanges 92 and 93, respectively, of the diverter 91. With this arrangement, it has been found that supply air will move downwardly through the slot 32A and through the discharge opening 48A on opposite sides of the diverter 91 in a uniform pattern lengthwise of the opening 48A so that fumes from the cooking surface below the hood are entrained in a curtain wall of supply air movement and then removed through the exhaust chamber.

OPERATION

Although the operation of the above-described embodiments of the invention will be apparent to skilled persons from such description, the operation will be summarized hereinafter for convenience.

The hoods disclosed hereinabove operate on the same principles. That is, the fan assembly (FIG. 7) is energized so that air is simultaneously supplied to replace that which is exhausted. More particularly, the supply fan 68 moves ambient air through the supply duct 52 into the supply chamber 27 (FIG. 3) and then discharges said air through the opening 48.

The exhaust fan 74 (FIG. 7) draws adjacent air and fumes into the exhaust chamber 26 (FIG. 3) and moves it out through the exhaust duct 39, whereby a relatively low pressure zone is created near the source 11. Accordingly, the air being supplied through the opening 48 is drawn into said low-pressure zone. The flow of supply air is such that it sweeps inwardly adjacent the source 11 to entrain the fumes and then move them upwardly through the duct 39 in response to the action of the exhaust fan.

The discharge or outlet velocity of the air from the opening 48 is preferably in the range of between 4.2 and 13.5 feet per second. In preferred embodiments of the invention, the volume of air discharged per unit of time through opening 48 is in the approximate range from 75 percent to 90 percent of the volume moved through the duct 39 during the same unit of time. Accordingly, a low-pressure zone is continuously maintained between the source 11 and the superimposed hood 10, which tends to prevent migration of fumes from the zone until they can be entrained with the supply air and withdrawn from such zone.

The discharge velocity and volume ratio set forth above have been found satisfactory where the apparatus 10 is located in a typical room and the source 11 is a stove upon which food is cooked, so that excessive discharge velocities and/or volumes of supply air might cool excessively the food cooked on said stove. However, the ratio between the volume of air supplied and the volume of air exhausted, as well as the velocity of the air discharge through the opening 48, may be varied substantially while remaining within the scope of the invention.

Although a particular preferred embodiment of the invention has been disclosed above for illustrative purposes, it will be understood that the variations or modifications thereof which lie within the scope of the invention are fully contemplated.

I claim:

1. A hood structure for collecting fumes from a food-cooking device located below the hood, comprising:

a housing having first wall means defining an exhaust chamber with an intake opening facing downwardly toward said device and having second wall means defining a supply chamber adjacent to and outwardly of said exhaust chamber, said supply chamber having a discharge opening near an edge of said intake opening, said exhaust chamber and said supply chamber having spaced and substantially parallel top walls;

exhaust duct means communicating with said exhaust chamber;

supply duct means communicating with said supply chamber through the top wall thereof and spaced from the two ends thereof;

baffle means mounted on the top wall of said exhaust chamber and projecting upwardly toward the top wall of said supply chamber, said baffle means being spaced from the top wall of said supply chamber and being displaced laterally from the supply duct means;

said baffle means having a portion extending between the ends of said top wall of the exhaust chamber and projecting upwardly therefrom near the front wall of said exhaust chamber; and

an inverted, U-shaped diverter extending between and supported upon the front walls of said exhaust and supply chambers, said diverter having upright flanges spaced from the ends of the supply chamber and defining therewith a pair of spaced vertical passageways between said front walls.

2. A hood structure according to claim 1, including a pair of spaced and substantially horizontal baffles secured to the front wall of the exhaust chamber substantially even with the upper end of the U-shaped diverter, said horizontal baffles being adjacent said ends of said supply chamber and being spaced from said front wall of said supply chamber.

3. A hood structure adapted for connection to air moving means for removing fumes from a source spaced below the hood, and for supplying air to entrain said fumes, comprising:

first wall means defining an exhaust chamber having an intake opening facing said source, said first wall means including a substantially horizontal top wall and a substantially vertical front wall fixedly interconnected to one edge of said top wall and extending downwardly therefrom;

exhaust conduit means connected to said first wall means and extending away therefrom for providing communication with said exhaust chamber;

second wall means disposed adjacent and spaced outwardly from said first wall means and defining a supply chamber therebetween, said second wall means including a substantially horizontal top wall and a substantially vertical front wall fixedly interconnected to one edge of the top wall and extending downwardly therefrom, the top and front walls of said second wall means being substantially parallel to and spaced upwardly and outwardly from the top and front walls of the first wall means, respectively,

for defining said supply chamber therebetween, the lowermost edges of said front walls being spaced apart and defining an elongated downwardly directed discharge opening extending along one edge of said intake opening;

supply conduit means connected to and extending away from said second wall means for providing communication with said supply chamber;

baffle means secured to said first wall means and projecting toward but being spaced from said second wall means, said baffle means including an elongated baffle member extending substantially longitudinally of said hood and being disposed to project into said supply chamber at a region located between said discharge opening and said supply conduit means; and

third wall means disposed between said exhaust chamber and connected to said first wall means for dividing said exhaust chamber into first and second compartments, said first compartment being in communication with said intake opening and said second compartment being in communication with said exhaust conduit means, said third wall means having removable filter means mounted thereon for permitting communication between said first and second compartments.

4. A structure according to claim 3, wherein said first wall means includes an inclined intermediate wall fixedly connected along one longitudinal edge thereof to said top wall and fixedly connected along the opposite longitudinal edge thereof to said front wall, said intermediate wall being inclined at a substantial angle to both said front wall and said top wall;

said elongated baffle member being fixedly secured to the top wall of said first wall means directly adjacent said one edge of said inclined intermediate wall; and

said supply conduit means being fixedly connected to the top wall of said second wall means for supplying fresh air to said supply chamber directly in the region between said spaced parallel top walls.

5. A structure according to claim 4, wherein said exhaust conduit means is disposed within and totally surrounded by said supply conduit means, said exhaust conduit means being fixedly secured to the top wall of said first wall means and extending vertically upwardly therefrom, and said supply conduit means being fixedly secured to the top wall of said second wall means and extending upwardly therefrom in surrounding relationship to said exhaust conduit means; and

said baffle means further including a substantially U-shaped baffle member fixedly secured to the top wall of said first wall means and projecting upwardly therefrom toward but being spaced from the top wall of said second wall means, said U-shaped baffle member being disposed in partial surrounding relationship to the lower end of said exhaust conduit means and being spaced laterally outwardly a substantial distance therefrom so that said U-shaped baffle member is also spaced laterally outwardly relative to an opening formed in the top wall of said second wall means by the lower end of said supply conduit means.

6. A structure according to claim 4, wherein said baffle means also includes a plurality of baffle plates disposed within said supply chamber directly adjacent said discharge opening, said baffle plates extending between and being fixedly connected to the front walls of said first and second wall means and being disposed laterally along the length of said discharge opening for dividing said discharge opening into a plurality of separate passageways.

7. A structure according to claim 4, wherein said elongated baffle member has a height adjacent the opposite ends thereof greater than the height in the center portion thereof to restrict the flow thereacross adjacent the opposite ends of the supply chamber.

8. A structure according to claim 4, wherein said first wall means includes a substantially vertical backwall fixedly secured to the opposite longitudinal edge of said top wall and disposed in substantially parallel relationship to said front wall so that said first wall means has a substantially downwardly directed channel-shaped configuration;

said second wall means including a substantially vertical back wall fixedly secured to the opposite longitudinal edge of said top wall and disposed substantially parallel to the front wall so that said second wall means has a substantially downwardly directed channel-shaped configuration, the back wall of said second wall means being spaced outwardly from the back wall of said first wall means whereby the inverted channel-shaped configuration of said second wall means is disposed in surrounding relationship to the inverted channel-shaped configuration of said first wall means; and

said supply conduit means and said exhaust conduit means being disposed in surrounding relationship to one another.

9. A hood structure according to claim 8, including a plurality of upright vanes secured to and extending between the front walls of said exhaust and supply chambers near the lower ends thereof.

10. A structure according to claim 3, wherein said air moving means comprises a centrifugal fan supported substantially coaxially with said discharge conduit means and an axial flow fan mounted for rotation around an axis substantially perpendicular to the central axis of said discharge conduit means; and

wherein said supply conduit means includes an enlarged chamber at the extended end thereof communicating with said axial flow fan.

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