

Nov. 19, 1968

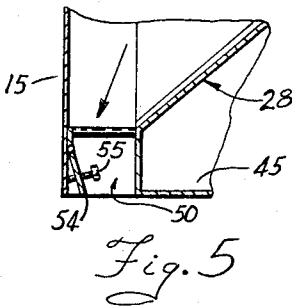
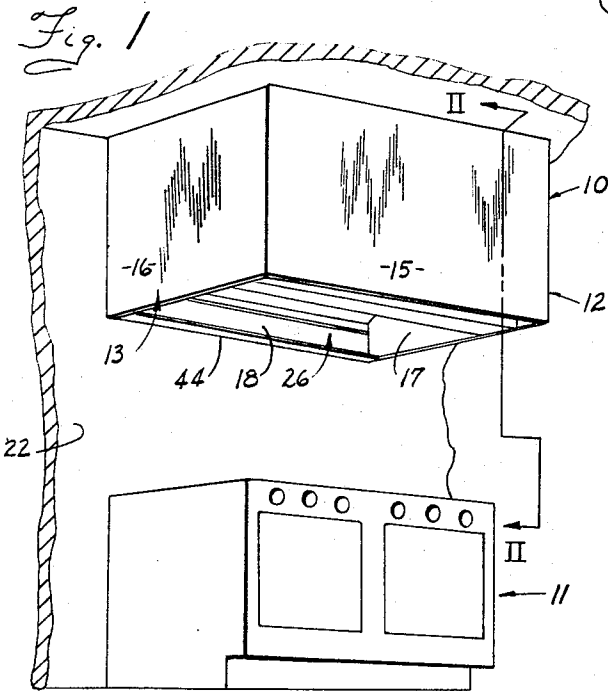
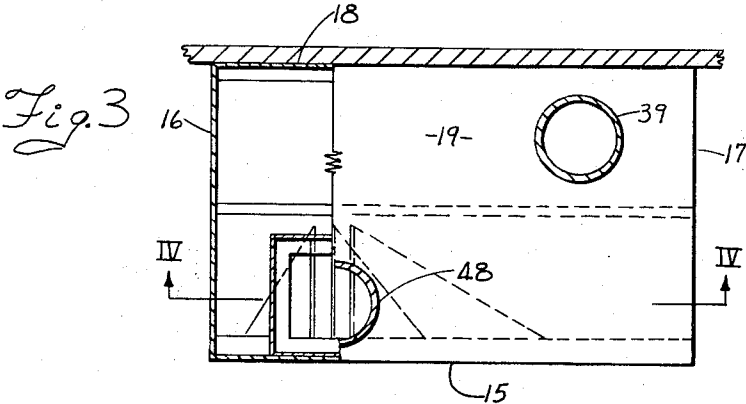
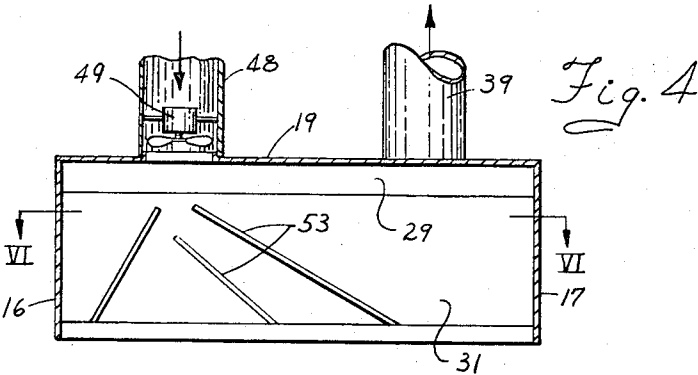
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3,411,428

VENTILATING HOOD FOR FOOD COOKING DEVICE

Filed June 27, 1966

3 Sheets-Sheet 1



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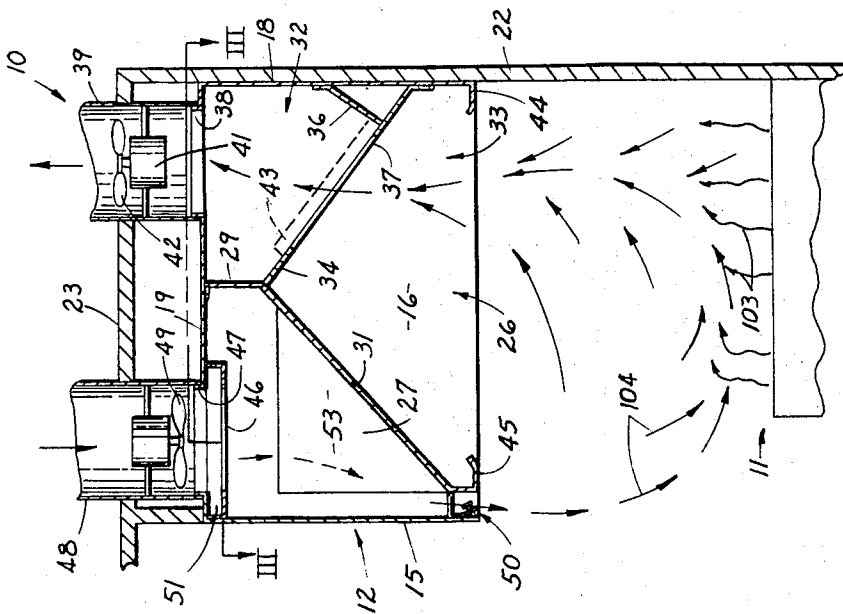
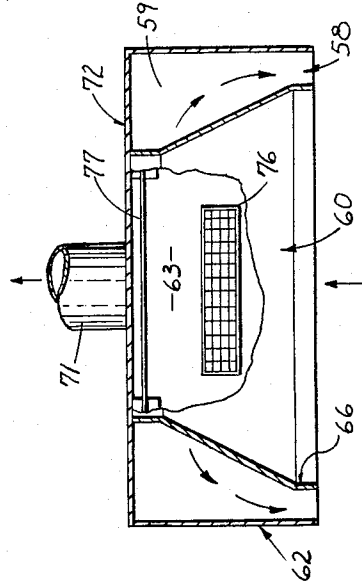
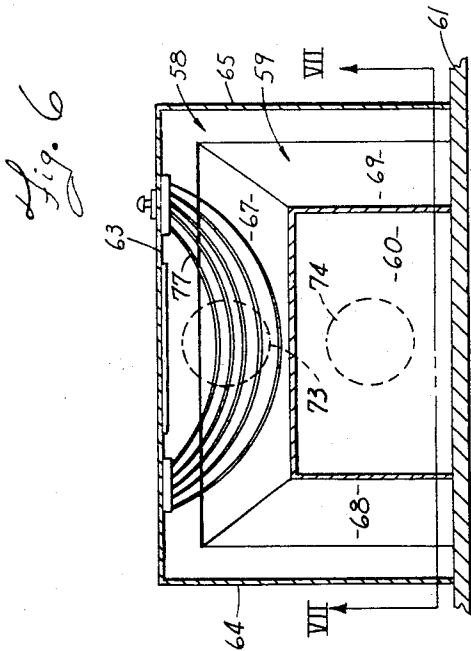
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VENTILATING HOOD FOR FOOD COOKING DEVICE

Filed June 27, 1966

3 Sheets-Sheet 2



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VENTILATING HOOD FOR FOOD COOKING DEVICE

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3 Sheets-Sheet 3

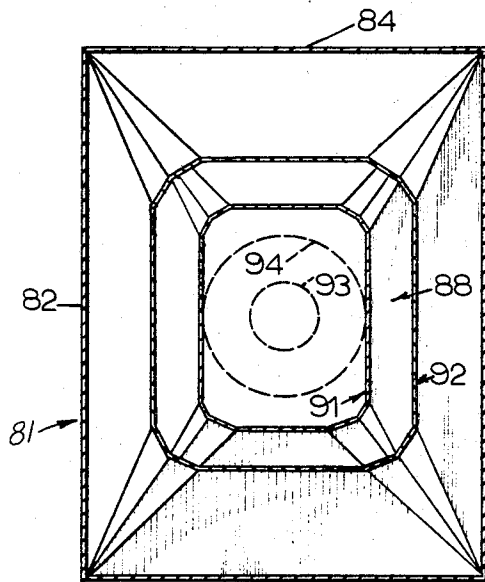


Fig. 10

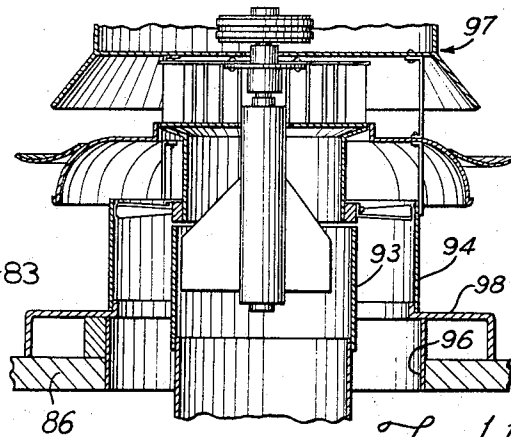


Fig. 11

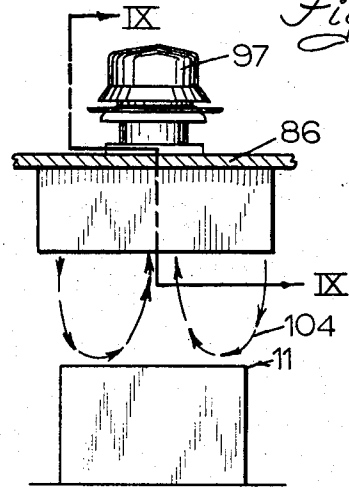
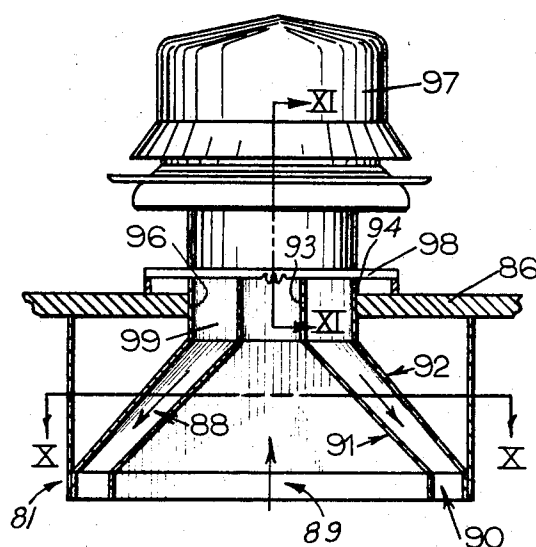


Fig. 8



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3,411,428 VENTILATING HOOD FOR FOOD COOKING DEVICE

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Filed June 27, 1966, Ser. No. 560,401
4 Claims. (Cl. 98—115)

ABSTRACT OF THE DISCLOSURE

A hood structure for exhausting fumes from a food-cooking device located below the hood structure. An exhaust chamber is connected to a gas-moving assembly to withdraw the fumes released from the food on the cooking device, and an air supply chamber is also connected to said gas-moving assembly for replacing with relatively fresh air most of the air and the fumes which are withdrawn. The air flow velocity and volume are maintained at levels assuring movement of the supply air and fumes in a pattern which will remove the fumes without adversely affecting the temperature or other characteristics of the food being cooked.

This invention relates in general to apparatus for collecting fumes and hot gases which are produced by a heating unit, for example, and would otherwise move into and circulate around the room in which the unit is disposed.

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 existing hoods and methods of using same have not been satisfactory. The ventilation 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 this 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

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window, into the room will flow out of the opening and thereby draw 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, the flow of air could be fed uniformly into all sides of the zone to entrain the fumes and thereby move them to the exhaust unit.

It is, therefore, an object of this invention to provide 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 a hood construction for supplying air and removing gases from a source and thereby eliminating the need for a supply opening elsewhere in the room containing the source.

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

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:

FIGURE 1 is an oblique view of a hood embodying the invention positioned over a source of fumes, such as a stove.

FIGURE 2 is a sectional view of the hood taken along the line II—II in FIGURE 1.

FIGURE 3 is a sectional view taken along the line III—III in FIGURE 2.

FIGURE 4 is a sectional view taken along the line IV—IV in FIGURE 3.

FIGURE 5 is an enlarged fragment of FIGURE 2.

FIGURE 6 is a sectional view substantially as taken along the line VI—VI in FIGURE 4 and showing a modified hood structure.

FIGURE 7 is a broken sectional view taken along the line VII—VII in FIGURE 6.

FIGURE 8 is a side elevational view of another modified hood structure embodying the invention.

FIGURE 9 is a sectional view taken along the line IX—IX in FIGURE 8.

FIGURE 10 is a sectional view taken along the line X—X in FIGURE 9.

FIGURE 11 is a sectional view taken along the line XI—XI in FIGURE 9.

General description

The above-mentioned objects and purposes have been met by providing apparatus for collecting fumes from a source by introducing a supply of air through the hood which exhausts the fumes. Said hood comprises panel means defining an exhaust chamber opening toward said source and an exhaust fan connected to the chamber for drawing the fumes into the chamber. The hood also includes panel means defining 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.

Certain terminology is used in the following description for convenience in reference, only, and will not be limiting. The terms "upper," "lower," "front," "rear" and words of similar import will have reference to the appa-

ratus of the invention as appearing in FIGURE 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.

Detailed description

The ventilating apparatus 10 (FIGURE 1) for collecting fumes from a source 11, such as a stove, located under the hood 12, comprises panel means defining a vertical front wall 15, two vertical side walls 16 and 17, a rear wall 18 and a top wall 19. The hood 11 can be secured to a vertical wall 22 or the ceiling 23 or both as indicated in FIGURE 2. The hood could also be mounted on a support structure (not shown) surrounding the source, or it could be suspended from the ceiling.

The interior of the hood 11 (FIGURE 2) 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 back wall 29, which extends lengthwise between the side walls 16 and 17, and downwardly from the top wall 19. Said wall 29 has a lower section 31 which converges downwardly with the front wall 15 to form a discharge slot or opening 50 between the lower ends of each. The edges of the walls in the hood 11 may, where required, be held together by soldering, rivets, or the like.

The exhaust chamber 26 is divided into upper and lower parts 32 and 33, respectively, by a panel member 34 extending downwardly and rearwardly from the upper end of the wall section 31 to the rear wall 18 and is secured thereto by means including a stiffening member 36. An opening 37 is provided in the panel member 34 to interconnect the upper and lower parts of the exhaust chamber.

The top wall 19 has an opening 38 between chamber 32 and exhaust duct 39 in which an exhaust fan 42 is mounted and driven by an electric motor 41.

A filter 43 (FIGURE 2) may be placed over the opening 37 to filter particulate material from the fumes that come from the source 11 and which would otherwise coat the walls of the upper chamber 32, exhaust duct 39 and exhaust fan 42.

The lower edges of the rear wall 18 and the lower wall section 31 have integral flanges 44 and 45 which extend inwardly toward each other and stiffen the hood.

An opening 47 (FIGURE 2) is provided in the top wall 19 to connect the supply chamber 27 with a supply duct 48 having a supply fan 49 mounted therein and driven by an electric motor.

Angle members 46 are secured to the top wall 19 and extend downwardly therefrom adjacent and below the opening 47 to support a filter 51 across the opening 47.

The chamber 27 is provided with air guide vanes 53 which are secured to the upper side of the wall 31, as by welding, to distribute the air supply evenly through the supply chamber 27 and thence through opening 50 along the full length thereof. In this embodiment, there are three guide vanes 53, but more or less may be used.

The rate of air flow from the supply chamber 27 through the opening 50 is regulatable by a gate 54 (FIGURE 5), which is positioned within the opening 50 and which is hingedly affixed to the front wall 15. A screw 55 is threadedly received through the gate 54 and is in contact with the front wall 15, so that the width of the opening 50 can be altered by turning the screw 55, which may be a thumbscrew.

Modification

The above-discussed embodiment has a discharge opening 50 only along the front side of the hood 12. The modified embodiment shown in FIGURES 6 and 7 has a discharge opening 58 from the supply chamber 59 extending along the front and both side edges of the exhaust chamber 60.

More particularly, the hood 62 comprises a substantially vertical front wall 63 and two side walls 64 and 65 which are both secured to each other and mounted upon a wall 61 or other support structure. The exhaust chamber 60 is defined by the inner housing 66 which has a front wall 67 and two side walls 68 and 69 spaced inwardly from the front wall 63 and side walls 64 and 65, respectively, and connected to the top wall 72. The lower portions of the front wall 67 and the side walls 68 and 69 converge downwardly with the corresponding walls 63, 64 and 65 of the hood 62 to define the U-shaped discharge opening 58 therebetween.

The top wall 72 (FIGURE 7) is provided with a pair of openings 73 and 74 shown in broken lines in FIGURE 6. Opening 73 connects the supply chamber 59, defined between the inner housing 66 and the outer housing 62, to a supply duct (not shown) having a supply fan mounted therein, substantially as shown in FIGURE 2 with respect to the apparatus 10. Opening 74 connects the exhaust chamber 60, defined between walls 61, 67, 68 and 69, to an exhaust duct 71 (FIGURE 7) having an exhaust fan (not shown) mounted therein, substantially as shown in FIGURE 2.

The front wall 63 of the outer housing 62 is provided with a grilled opening 76 which connects the supply chamber 59 to ambient air. The purpose of this opening will be explained later.

Heating coils 77 are placed in the supply chamber 59 adjacent the opening 73 to heat the supply of air before it is discharged from the supply chamber 59. The heated air may also discharge through the opening 76 into the adjacent space, or the ambient air may be aspirated through the opening 76 by the downward flow in the chamber 59.

In the modified construction shown in FIGURES 8, 9, 10 and 11, the hood is comprised of a substantially rectangular outer housing 81 having vertical side walls 82 and 83 and vertical end walls 84 and 85 depending from a support structure or ceiling 86. A pair of conically shaped, inner and outer funnels 91 and 92 are positioned substantially concentrically within the housing 81. An exhaust passageway or chamber 89 is defined within the inner funnel 91, and a supply passageway 88 is defined between the two funnels. The two funnels 91 and 92 are preferably similar and symmetrical.

The lower free ends of the inner and outer funnels 91 and 92 are spaced to define a discharge opening 90 which preferably extends completely around the exhaust chamber 89 and is substantially uninterrupted.

The upper ends of the inner and outer funnels 91 and 92 (FIGURE 10) are connected to the spaced and concentric ducts 93 and 94 which extend upwardly through an opening 96 in the ceiling or support wall 86 and are preferably part of the dual flow fan assembly 97 (FIGURE 11). The inner duct 93 (FIGURES 9 and 10) connects the exhaust chamber 89 to the exhaust fan section and the outer duct 94 connects the supply chamber 88 to the supply fan section of the fan unit 97. A shroud 98 is positioned around the junction of the duct 94 and the ceiling 86 to prevent water seepage. Other details of a fan assembly capable of the desired performance can be found in Patent No. 3,122,307.

Operation

Although the operation of the apparatus and method of the invention are at least broadly disclosed in the foregoing description, the following discussion may be helpful in understanding the invention.

The several hood structures disclosed hereinabove operate on the same principles. That is, the fan means 42, 49 and 97, for example, are energized so that air is simultaneously supplied to replace that which is exhausted. More particularly, the supply fan 49 draws ambient air through the supply duct 48 into the supply chamber 27 and then discharges said air through the opening 50 as indicated by the arrows 104 in FIGURE 2.

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The exhaust fan 42 (FIGURE 2) draws adjacent air and fumes through the exhaust chamber 26 and moves it out through the exhaust duct 39, whereby a low pressure zone is created near the source 11. Simultaneously, a quantity of air is fed through the opening 50 into the region adjacent said low pressure zone. The flow of supply air, as indicated by arrows 104, is such that it sweeps inwardly adjacent the source 11 to entrain the fumes indicated by the arrows 103 and then move upwardly in response to the action of the exhaust fan. The air and fumes are then expelled through the duct 39.

The discharge or outlet velocity of the air from the opening 50 is in the range of between 4.2 and 13.5 feet per second.

In a preferred embodiment of the invention, the size of the discharge opening 50 (FIGURES 2 and 5) is controlled by the gate 54 so that the volume of air discharge per unit of time therethrough is approximately 75 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 discharged through the opening 50, may be varied substantially while remaining within the scope of the invention. For example, where the source 11 is a laboratory bench upon which chemicals or the like are being handled, velocities and volumes of substantially different values could be completely satisfactory.

If the apparatus 10 is located in a room or other enclosure in which a subatmospheric pressure exists, it may be desirable to use said apparatus to relieve this negative pressure. That is, the volume of supply air may actually exceed the volume of air exhausted through the duct 39. However, by proper design of the grilled opening 76, the volume of air discharged through the outlet opening 50 may be less than the volume exhausted through the duct 39. Thus, the relative low pressure is relieved in the space adjacent the apparatus 10 without disturbing the relative low pressure in the zone above the source 11.

Under normal circumstances, the supply air is obtained from an outside source and, therefore, may be relatively cold in northern latitudes. Thus, where the apparatus of the invention is being used in association with a cooking surface, it would be at least desired to raise the temperature of the supply air before it is discharged through the opening 50. Such preheating of the air can be accomplished by the coils 77 (FIGURE 6), or by other conventional means. Moreover, it is apparent that the heating means can be located in the inlet duct 48.

The operation of the ventilating apparatus discharge in FIGURES 6 and 8 will follow in general the operation described above with respect to the ventilating apparatus disclosed in FIGURE 1. However, the embodiments of FIGURES 6 and 8 are adapted to serve slightly different purposes.

Although particular preferred embodiments of the in-

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vention have been disclosed above for illustrative purposes, it will be understood that variations or modifications of such disclosure, which lie within the scope of the appended claims, are fully contemplated.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

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

a food-cooking device;

first wall means defining an exhaust chamber opening downwardly toward said device;

second wall means defining a supply chamber adjacent said exhaust chamber and having a discharge opening along the edge of said opening of said exhaust chamber;

first and second, substantially concentric duct means defining a pair of passageways communicating respectively with said exhaust and supply chambers;

casing means mounted above said exhaust chamber and connected to said duct means near said chambers;

shaft means rotatably mounted in said casing means concentric with said duct means;

second impeller means mounted upon said shaft means adjacent to and axially aligned with said second duct means and adapted to move supply air through said second duct means and said supply chamber and

first impeller means mounted upon said shaft means adjacent to and axially aligned with said first duct means and adapted to simultaneously draw fumes through said exhaust chamber and said first duct means, the volume of gas flowing through said discharge opening being between 60 percent and 100 percent of the volume of gas fumes drawn into the exhaust chamber, and the velocity of the gas flowing through said discharge opening being in the range from 4.2 feet per second to 13.5 feet per second.

2. A hood structure according to claim 1, where said discharge opening is relatively narrow and extends substantially completely around and closely adjacent the edge of said opening into said exhaust chamber.

3. A hood structure according to claim 1, wherein said supply chamber has a second discharge opening spaced upstream from the first-mentioned discharge opening; and including gas-heating means disposed in said supply chamber for heating said supply air.

4. A hood structure according to claim 1, wherein the volume of gas flowing through said discharge opening is in excess of approximately 80 percent of the volume of gas and fumes drawn into the exhaust chamber, said supply chamber having a second discharge opening spaced upstream from the first-mentioned discharge opening and communicating with ambient air.

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