United States Patent

Ferlise et al.

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[54] **RANGE HOOD UNIT WITH FIRE SAFEGUARD FAN CONTROL SYSTEM**

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

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

[58] **Field of Search** ..... 98/115 K; 236/11

[56] **References Cited**

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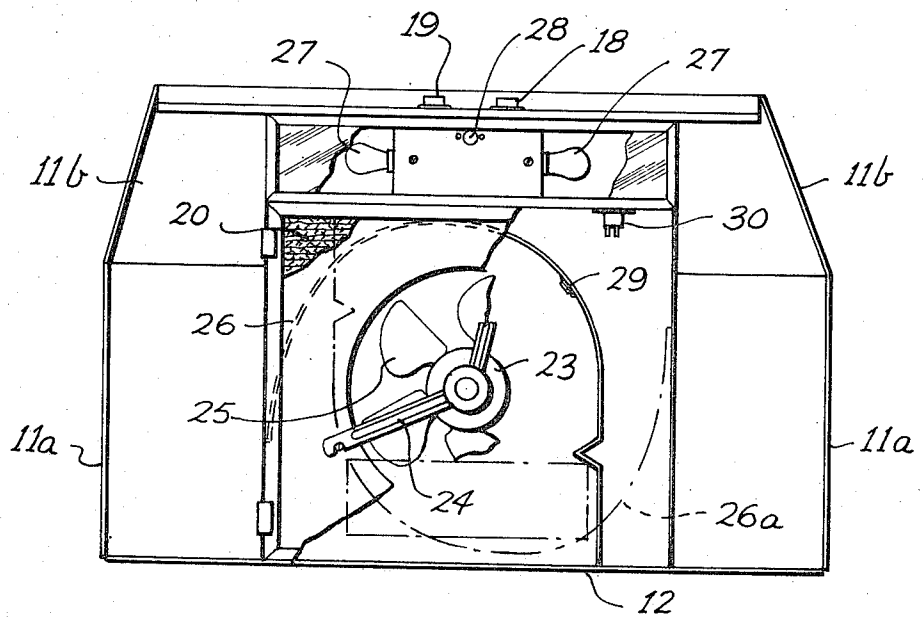
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Primary Examiner—Edward J. Michael
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[57] **ABSTRACT**

A range hood for use over a cook stove, which may be either ducted or ductless, and is provided with filters as required by its being ducted or ductless, respectively. An electric motor driven fan within the hood may be manually controlled, but additionally a safety circuit is provided to energize said fan motor automatically when cooking is being done even if said manual switch has not been actuated. Said safety circuit is also arranged automatically to shut off said fan motor, and if desired to energize a signal, in the event of a flash fire or the like. The automatic energization and de-energization of said fan motor is accomplished by means of self-resetting sensor-thermostats. The safety circuit does not interfere with fan speed control by means of said manual control.

6 Claims, 4 Drawing Figures



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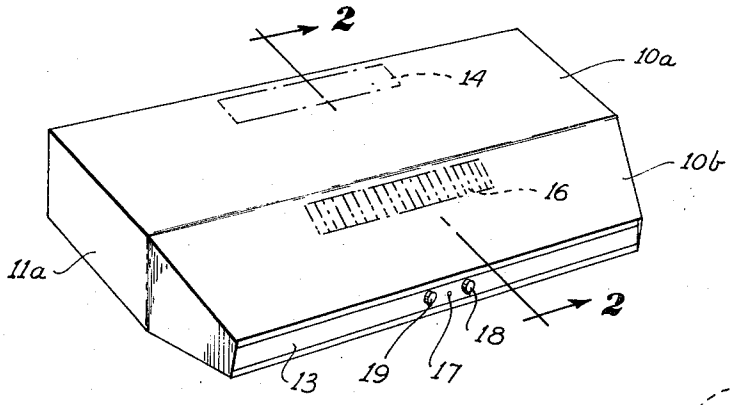
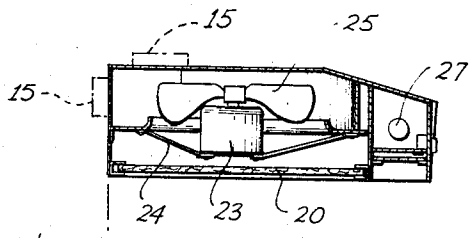


FIG. 1



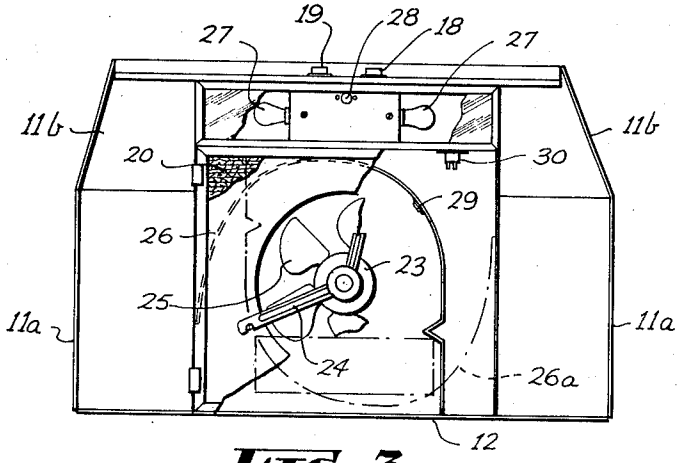


FIG. 3

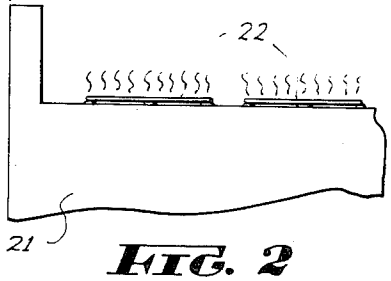


FIG. 2

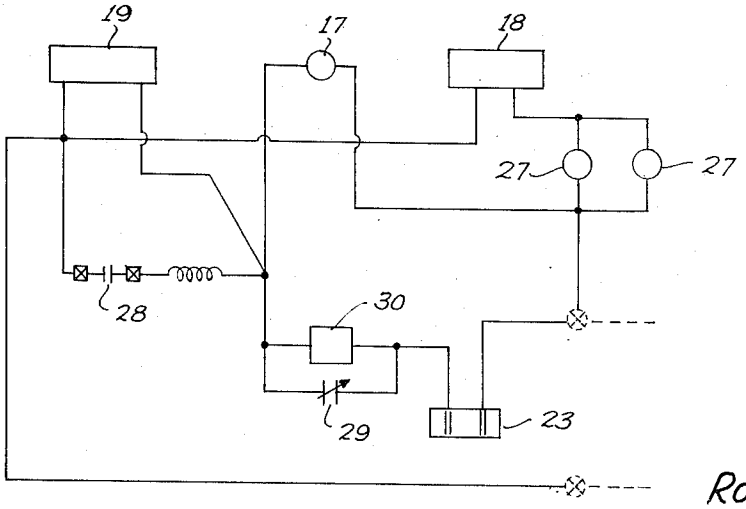


FIG. 4

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RANGE HOOD UNIT WITH FIRE SAFEGUARD FAN CONTROL SYSTEM

This invention relates to a prefabricated metal range hood unit which is provided with control devices that greatly enhance the fire safety of the range hood and the cooking stove over which it is installed, thus reducing the hazard of home kitchen fires that may cause damage to equipment and furnishings and severe personal injury to the housewife and others in the home.

The term range hood as used in this application means a box-like ventilating shield (open at the bottom), usually fabricated from sheet steel, which is designed to be installed in a horizontal position, spaced above a cooking stove, for the purpose of removing the heated air, water vapor or steam, smoke particles, grease particles and volatile fat vapors, as well as the odors that result from many food cooking operations.

The range hood also serves to present staining and heat discoloration of the ceiling above, and the wall surface behind and above the stove, caused by smoke and grease particles that are produced in cooking, frying and broiling of food on the top burners.

An essential component of any range hood is a fan or blower, powered by a small electric motor, which provides an induced draft of air movement to draw the heated air and other volatile products of the cooking operation from the space above the burners into the hood. This removal of the heated air and other volatiles prevents their accumulation in the stove area and thereby results in cooler comfort conditions for the housewife. The blower motor is usually controlled by a manually operated off-and-on switch, having either one "on" position, or a low and a high speed "on" position, or low, medium, and high "on" positions.

There are two basic types of range hoods for home kitchens: ducted and ductless. The ducted hood is provided with an outlet orifice on the discharge side of the blower which is connected to a duct that discharges the heated air and other volatile and airborne products that are carried in the airstream to the air outside the kitchen. When the cooking range is in a kitchen location that does not afford convenient access to a wall in which a duct to discharge the heated air outside the building may be installed, the ductless type of range hood can be used. With the ductless hood the heated air from the cooking operation is first thoroughly filtered to remove grease, smoke and fine food particles and to absorb cooking odors, and is then returned to the upper air of the room through a vent at the top of the hood, overhead and away from the cooking area. The main disadvantage of the ductless range hood as compared with a ducted hood is that the heated air and steam from food cooking are not removed from the kitchen, and consequently the cooling effect provided by the ducted hood is not obtained.

A ducted range hood could be operated without a filter, since the heated air, steam and other volatiles are discharged outside the building. However, such operation is unsatisfactory because grease and food particles tend to collect on the fan blades and in the discharge duct which then becomes unsanitary and also involves a fire hazard. The ducted hood therefore requires a grease filter for satisfactory, safe operation. The grease filter is an open-mesh, framed panel, installed within the range hood below the blower, so that all the heated air drawn into the hood by the fan first passes through

the filter which collects virtually all of the grease and other food particles or spatter carried in the air stream. The grease filter is usually constructed from a non-corrodible metal, such as aluminum, usually in the form of coarse expanded mesh made from thin sheet aluminum. This expanded mesh is of open structure so as not to restrict appreciably the air flow induced by the fan. Also, it is preferably coated or chemically treated so as to increase its ability to adhere to and retain grease and other food particles in the air stream and to improve ease of cleaning the filter. An especially effective coating material for an aluminum mesh grease filter is "Teflon-S" (a polyfluorocarbon product of the DuPont Company), but various other synthetic grease-resistant coating materials may be used. Polymerized fluorocarbons, such as polytetrafluoroethylene and fluorinated ethylene-propylene, are the preferred coating compositions, due to their chemical inertness, resiliency, resistance to moisture and steam, wide range of service temperatures, heat resistance up to 500° F. without carbonization, and resistance to embrittlement. Because substantial quantities of grease accumulate in the filter interstices from continued use of the range hood, the framed filter panel is installed so as to be easily removable for cleaning. The grease accumulation is easily removed by light agitation of the filter mesh with a detergent solution and the filter panel, after drying, may be re-installed in the hood for another period of service.

The ductless type range hood also requires a grease filter of the same kind as used with the ducted hood. In addition, the ductless hood is usually provided with a granulated, activated charcoal filter to absorb cooking odors; it may also have a filter of spun glass fiber that may be chemically treated or coated to enable it to absorb smoke particles and also any fine grease particles that may not have been trapped by the aluminum mash grease filter. The activated charcoal filter and the glass fiber filter are inexpensive and are intended to be replaced after a period of use, before they become clogged and ineffective.

It is obvious that there is a fire safety hazard associated with the cooking of food over an open gas flame such as the burner of a gas range, and also to a lesser degree with electrical resistance burners. This hazard is especially present in the frying of fat meat such as bacon, the broiling of steaks, deep fat frying, etc. due to the high combustibility of fats, both of animal and vegetable origin. Many disastrous home fires have started in the kitchen with a "grease fire" on the cooking stove as the cause.

The ducted range hood is a very desirable adjunct to a cooking range because it removes the heated air, steam, smoke, volatile fat vapors and grease particles from the cooking area, thereby improving the comfort conditions in the kitchen. When the cooking operation is properly managed by the housewife, the hood does not increase the natural hazards involved in cooking food. However, the range hoods previously available have depended on manual setting of the switch for starting and for control of the fan blower speed, and thus require continuous attention to the cooking operation. The previous range hoods have lacked any automatic fire safeguard devices.

It is evident that if the blower fan in the range hood is not started when cooking begins, the grease particles and fat vapors produced will tend to accumulate in the heated air above the burners, which may result in a flash fire. Therefore, the blower should always be in operation when cooking is being done, otherwise the range hood cannot perform the function for which it is intended. On the other hand, if a flash fire occurs in the cooking area and the blower is in operation, it will draw the flames into the hood and into the discharge duct where there may be some grease accumulation if the grease filter has been overloaded and not cleaned as often as necessary. Such conditions may result in a serious fire in the duct and ignite adjacent combustible structural materials. In any event, such a fire would do extensive damage to the range hood itself. Study of the various factors involved clearly indicated that to prevent such an occurrence, the range hood must be equipped with an independent, automatic, fire safeguard system which will insure that the blower operates when cooking is being done, but is shut off if and when a flash fire occurs.

BRIEF SUMMARY OF THE INVENTION

The chief purpose of this invention is to provide a prefabricated range hood unit that has greatly improved fire safety as compared with any range hood previously available, such that the cooking operation may be left unattended for a reasonable time without thereby appreciably increasing the fire hazard.

A further object is to provide the range hood with an auxiliary automatic, thermostatically controlled system for operation of the blower fan, such that when the temperature of air in the space above the burners rises to a point substantially above normal ambient temperature, say 140° F., the fan will start, and remove the heated air and other volatile products of the cooking operation, even if the housewife forgets to start the blower when the burners are first lighted.

Another object is to include in the automatic control system for operation of the blower fan a sensor-thermostat which will stop the fan motor and blower if the temperature of the air above the burners becomes excessively high, say 240° F., and which will at the same time actuate an audible alarm such as a buzzer. Such a high temperature in the cooking space usually is the result of a flash fire involving fat or grease.

A general object of the invention is to provide the range hood unit with a dual electrical system for control of the blower fan operation. The primary system is manually controlled by the housewife; an auxiliary, interconnected automatic system is controlled by sensor-thermostats, which are set for selected temperatures to insure safe operation of the blower if the housewife is absent or inattentive, and if excessively high temperatures or a flash fire occur. Thus there is provided an effective fire safeguard for the unit.

An incidental purpose is so to arrange the electrical circuitry of the dual blower fan control system that the auxiliary automatic system does not interfere with manual control of the fan speeds when that is desired.

A further purpose is to provide the auxiliary automatic fan control system with sensor-thermostats which, after the high temperature thermostat has been actuated and has shut off the fan blower motor, will reset the system for continued safeguard operation when the temperature has returned to the normal operating range below 200° F.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a complete assembled range hood unit embodying the features of this invention, showing the control panel for the blower fan and lights.

FIG. 2 is a cross sectional view of the range hood taken from front to back, showing the locations of motor, fan, filters, duct orifice, and the spacing of the hood above the cooking stove top burners.

FIG. 3 is a view of the range hood from below, with the grease filter removed, showing locations of the sensor-thermostats for 140° F. and 240° F. automatic control of the blower fan operation, in relation to the blower intake, fan and motor.

FIG. 4 is a schematic representation of the complete electrical wiring diagram for the range hood unit of this invention showing the electrical connections for the fan motor, the manual control solid state variable speed fan switch, the senso-thermostats for 140° and 240° F., choke coil, alarm buzzer, etc.

DETAILED DESCRIPTION OF THE INVENTION

This invention will be described as embodied in a range hood unit, either ducted or ductless, having a grease filter, and constructed with the arrangement of the parts as illustrated in FIG. 1, FIG. 2, and FIG. 3. It is to be understood, however, that the dimensions, arrangement and assembly of the parts shown in this typical example could be changed in various ways, or the range hood could have multiple filters, and the concept of the invention would still be effective as a fire safeguard for the range hood. The range hood of the typical example of this invention is 36 inches long, 19 inches wide from front to back, and 6 inches maximum depth from bottom to top and is adapted for use with a 36 inch domestic range.

In FIG. 1 the range hood is shown as comprising a prefabricated sheet metal box-like structure open at the bottom, having a top **10***a*, **10***b*, and sides **11***a* and **11***b* (FIG. 3), a back **12** (FIG. 3) and a front panel **13**. The numeral **14** indicates a knock-out panel for attachment of a duct adapter **15** (FIG. 2). A similar knock-out panel is provided in the back wall **12**. If the hood is to be ductless, the knock-out panels are left intact, and a vent grille is provided as shown in broken lines at **16**. On the front panel are provided a pilot light **17**, an on-off light switch **18**, and a solid state fan speed control switch **19**.

As best seen in FIG. 2, a grease filter **20** is provided, and it will be understood that a smoke filter and an odor filter may also be provided immediately adjacent the grease filter **20**, between the latter and the blower. The location of the hood with respect to the stove **21** and its burners **22** is shown in this Figure. The bottom of the hood is suitably spaced about 18 inches to 24 inches above the tops of the burners, for effective performance of its functions.

FIGS. 2 and 3 show the location of the various components within the hood. An electric motor **23** is mounted on a bracket support **24**, and drives the fan **25**. A volute housing **26** surrounds the fan **25** to direct

the air to the duct adapters **15**. It will be clear that only one knockoout panel and one duct adapter will be used, depending on whether the ducting is to be upward or to the rear. The two adapters shown in broken lines in FIG. **2** are used alternatively. Of course if the hood is to be ductless, the position of the volute **26** must be reversed as shown at **26*a*** to blow the air out through the vent grille **16** provided for a ductless hood.

At the front portion of the hood, one or more lights are provided as at **27**, and these are actuated by the on-off switch **18**.

A 140° F. sensor-thermostat is located at **28**, so as to be actuated by heated air rising from the burners. The 240° F. sensor-thermostat is shown at **29**, within the sheet metal volute chamber **26** so as to be actuated by excessive heat or flame from a grease fire drawn into the intake opening of the fan.

A buzzer alarm is indicated at **30**. When the stove burners are lighted, the temperature of the air in the space above them immediately begins to increase. This heated air rises into the range hood and flows over the exposed surface of the 140° F. sensor-thermostat **28**. If the fan motor has not been started the temperature will continue to rise due to the trapping of the heated air below and inside the hood. When the temperature at the sensor surface reaches 140° F. the thermostat (normally open) is actuated and closes the auxiliary power circuit to the fan motor which then operates the fan at low speed. The time interval before the sensor-thermostat is actuated will vary somewhat, depending upon the number of burners that are lighted and whether the burners are operating at high or low heat, but under average cooking conditions the sensor-thermostat will start the fan motor in about 3 minutes.

The fan will continue to operate and ventilate the space above the burners while the air temperature remains in the normal cooking temperature range of about 140° – 200° F.; but when the burners are shut off and the air temperature at the sensor surface falls below about 125° F. the bimetal thermostat disc will return to its normal open position. This breaks the auxiliary electrical power circuit, stops the fan motor, and automatically re-sets the sensor-thermostat for its next exposure to cooking temperatures. The housewife thus can do many normal cooking operations without using the manually controlled fan speed switch. If a higher fan speed is desired this is provided by a suitable manual setting of the fan speed switch **19**, which is not affected by the auxiliary safeguard fan control.

If a flash fire occurs in the cooking area, due to combustible fat vapors, spatter or spills being ignited by the burner flame or heat, the hot air and flame will be drawn upwardly by the air stream toward the fan intake of the range hood. There the flame or high temperature air will come into direct contact with the sensor surface of the 240° F. thermostat **29** which is mounted with the sensor exposed on the inner surface of the volute, as shown in FIG. **3**. The 240° F. sensor thermostat is normally closed, but when exposed to this temperature by the flame or heat it is actuated to open the electrical contact and break the circuit to the fan motor. This thermostatic action also energizes the electrical circuit to the audible warning signal **30** at the same time that the fan is stopped. In the range hood of the typical example, above described, a buzzer is used as the warning device, but other signals such as a bell, horn, or flashing light could be used.

After the grease fire has been extinguished and the air temperature on the surface of the 240° F. sensor-thermostat **29** at the fan intake has dropped below about 200° F. the bimetal thermostat will return to its normal closed position and restore the electrical circuit to the fan motor. It should be pointed out that the 240° F. sensor-thermostat will operate to stop the fan motor when the range hood is being used either with the manually operated solid state speed control switch or with the auxiliary, thermostatically controlled safeguard fan system. Thus, an effective safeguard against an extensive fire in the range hood, duct or adjacent combustible structural materials is provided.

While any suitable thermostatic devices may be used, disc thermostats have been found eminently suitable for these purposes. These devices include a bimetal disc which responds to the specific temperature for which it is calibrated, within a small plus or minus tolerance. The thermostat may be constructed so as to be either open or closed at normal temperatures and will then make or break the electrical contact when the design temperature is reached. The bimetal disc functions both as the thermostat and as the temperature sensor and may be either exposed directly to the air stream or enclosed with a metal cap to shield the sensor face from accumulations of dust, moisture, or grease. The contact action of the bimetal disc in opening or closing the electrical circuit is positive as the disc "snaps through" at the calibrated temperature. The moving parts are completely enclosed in a dust-free metal chamber.

The sensor-thermostats used in the range hood of the typical example are of the disc thermostat type and are provided with protective metal caps. Their temperature response tolerances are plus or minus 6° F. for both the 140° F. thermostat and the 240° F. thermostat. The 140° F. thermostat opens the electrical contact and re-sets itself when the air temperature drops to 125° F., plus or minus 5° F. The 240° F. thermostat closes the electrical contact and re-sets itself when the air temperature drops to 200° F., plus or minus 8° F.

These thermostats have been tested and approved and are listed by Underwriters' Laboratories, Inc. for use in temperature control with ventilating fans.

Reference to the schematic wiring diagram of FIG. **4** shows that the primary fan control circuit is provided with a speed control switch **19**. This could be a conventional one-speed, two-speed or three-speed switch, but the preferred device for this control is a solid state speed control switch which provides infinitely variable speed settings between the low and high speed limits of the fan motor. Whatever the nature of this switch, when it is in operation it over-rides the auxiliary automatic fan speed control and the 140° F. sensor-thermostat control is inoperative. The electrical system therefore provides dual controls for the fan operation—a primary, manually controlled variable speed system and an auxiliary, thermostat-controlled, automatic safeguard system — neither of which interferes with the other performing its intended function.

Prefabricated domestic range hood units generally are made in lengths from 24 inches to 48 inches, for use with cooking ranges of various sizes, and the width

from back to front normally is from 16 inches to 24 inches so as to enable the hood to ventilate the heated air and cooking fumes from the front burners. The maximum depth of the hood, from bottom to top, is usually from 5 inches to about 8 inches. Range hoods are made in various shapes, partly for the sake of more attractive appearance, but they usually taper in depth from back to front for more efficient removal of the heated air by the fan, as shown in FIGS. 1, 2 and 3.

An important advantage of the dual control system for operation of the fan motor is that in the event of a failure of the primary manual speed control, such as might result from the solid state speed switch becoming defective or its electrical circuit being damaged, the range hood will continue to operate with the auxiliary automatic safeguard fan motor control system. In fact, the range hood could be used for many years without ever operating the manual fan speed switch, but of course only at the low fan speed provided by the safeguard control circuit.

It is obvious that the concept of this invention is adaptable to prefabricated domestic range hood units of varying sizes and shapes, to provide a thermostatically actuated fire safeguard system for the operation of the ventilating fan. Therefore no limitations on dimensions or shape of the novel range hood unit have been included in the following claims which define the invention.

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

1. A range hood unit for installation above a cooking stove to ventilate the heated air, steam and volatile products resulting from the cooking of food, comprising

a. an electric-motor-driven fan having an air intake and an exhaust opening, and a grease filter positioned in said air intake opening,

b. a first sensor-thermostat disposed within said hood and operative at about 140° F.,

c. a second sensor-thermostat disposed at the said intake opening and operative at about 240° F.,

d. and an electric circuit including said fan motor and said first and second-thermostats, arranged to energize said fan motor when the temperature immediately below said hood reaches about 140° F., and to de-energize said fan motor if the temperature of the air at the said intake opening reaches about 240° F.,

e. whereby said fan operates automatically when cooking is being done, but is shut off automatically in the event of a flash fire or the like in the cooking area.

2. The structure of claim 1, including a warning signal element in said circuit arranged to be energized upon actuation of said second sensor-thermostat.

3. A range hood unit for installation above a cooking stove to ventilate the heated air, steam and volatile products resulting from the cooking of food, comprising

a. an electric-motor-driven fan, having an air intake and an exhaust opening, and a grease filter positioned in said air intake opening,

b. a primary power circuit including said motor and a manually operated speed control switch for said motor,

c. an interconnected auxiliary safety power circuit including said motor and a first sensor-thermostat operative at about 140° F.,

d. said auxiliary circuit including also a second sensor-thermostat operative at about 240° F.,

e. said first sensor-thermostat being arranged to energize said motor when the temperature of the air immediately below said hood reaches about 140° F. if said manually operated switch is in the off position,

f. and said second sensor-thermostat being arranged to de-energize said motor if the temperature at said fan intake opening reaches about 240° F., regardless of the position of said manually operated switch or the action of said first sensor-thermostat,

g. whereby said fan may be controlled manually, but will operate automatically when cooking is being done even if said manually operated switch is off, and will be shut off automatically in the event of a flash fire or the like.

4. The structure of claim 3, wherein said exhaust opening is arranged to be connected to an exhaust duct, wherein said manually operated speed control switch is a solid state electronic switch having infinitely variable settings between its low and high speed limits, and wherein said auxiliary circuit also includes a warning signal element arranged to be actuated by said second sensor-thermostat.

5. The structure of claim 3, wherein said hood is provided with a vent orifice connected to said exhaust opening, through which air is returned to the room, a coated spun glass fiber filter, and an activated charcoal filter in said air intake opening to remove smoke, grease and food odors from the air before returning it to the room; wherein said manually operated switch is a solid state electronic switch having infinitely variable settings between its low and high speed limits, and wherein said auxiliary circuit includes also a warning signal element arranged to be actuated by said second sensor-thermostat.

6. The structure of claim 1, wherein said sensor-thermostats are of the self-resetting type, said first one resetting itself at about 125° F., and said second one at about 200° F.

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