This invention relates to a ventilator of the type having means for removing grease particles from the vapors and fumes emitted from cooking operations in a kitchen so that such grease will not condense and accumulate in the main ventilating ducts to create a fire hazard.

The invention is an improvement on the Safety Ventilator Unit shown in my Patent No. 2,813,477, and the Kitchen Ventilating System shown in my co-pending application Serial No. 850,698, filed Nov. 3, 1959, now Patent No. 3,055,285.

The ventilator is equipped with a plurality of grease extracting baffles which define a tortuous course for the air stream so that the grease droplets impinge upon the battle surfaces and are thereby removed from the air stream. The baffles are arranged to drain the extracted condensation products into a main grease collecting trough or receptacle for convenient removal of the grease. Forced ventilation is maintained by an exhaust fan usually near the outlet of the duct and the inlet opening is usually equipped with some form of hood projecting at least partially over the various cooking devices to capture the vapors and fumes which may be emitted therefrom. A damper, which is preferably one of the baffles, is hinged to close the duct and stop the flow of air through the duct in case of fire.

The battle section of the duct is also equipped with a piping system having nozzles directed toward the heaviest grease collecting surfaces on the baffles and duct walls. This piping system is connected with a source of steam or hot water to perform a dual purpose. The normal function of the nozzles is to provide sprays for washing down the grease laden surfaces periodically to keep them clean and free of combustible material. In case of fire the sprays are operated to serve a fire extinguishing purpose. By closing the damper to shut off the supply of oxygen and turning on the sprays, any fire in the duct is quickly smothered and any combustible grease is washed away. The piping system is preferably incorporated into the baffles themselves in order to heat the baffles and melt any grease congealed thereon and to avoid unnecessary obstructions to the flow of air.

The ventilator structure is adaptable to different types of kitchens and equipment and the different types of cooking operations performed in a kitchen. The hood and other details of construction may be of various types to best collect the vapors and fumes from fryers, broilers, deep fat fryers, ovens, soup kettles and the like. In some cases the cooking units are arranged along a wall, permitting the ventilating ducts to rise vertically. In some arrangements an overhead hood connects with horizontal ceiling ducts. Island installations may have a down draft duct which continues under the floor.

The present invention relates principally to improvements in the grease extracting baffles, the mounting and arrangement of the spray pipes and nozzles for fluid cleaning and fire extinguishing purposes, and control mechanisms and systems for operating the damper and fluid sprays.

The objects of the invention are, therefore, to provide an improved arrangement of the baffle, pipe and nozzle system, to provide improved control systems and actuating mechanisms, to provide an automatic daily cleaning cycle, and to provide an electrical fail-safe system which will not be disabled by power failure.

The invention will be better understood and the foregoing and other objects and advantages will become apparent from the following detailed description of certain preferred embodiments of the invention illustrated in the accompanying drawings. Various changes may be made, however, in the construction and arrangement of parts and certain features may be used without others. All such modifications within the scope of the appended claims are included in the invention.

In the drawings:

FIGURE 1 is a perspective view, with parts broken away, showing a wall mounted kitchen ventilating system embodying the principles of the invention;

FIGURE 2 is an enlarged fragmentary perspective view of the drain end of the grease collecting trough shown in FIGURE 1;

FIGURE 3 is an enlarged fragmentary perspective view showing a portion of the structure illustrated in FIGURE 1 with the fire control box removed;

FIGURE 4 is a schematic view of the fluid washing and fire extinguishing system essentially as used in FIGURE 1 but with a slight modification;

FIGURE 5 is an elevation view of the nozzle arrangement employed in FIGURE 1;

FIGURE 6 is a sectional plan view, with parts removed, of the ventilator in FIGURE 1;

FIGURE 7 is an enlarged sectional view through the control box in FIGURE 1, showing the baffle damper in open position;

FIGURE 8 is a view similar to FIGURE 7 showing the baffle damper in closed position;

FIGURE 8A is a perspective view of the operating arm for the damper baffle in FIGURE 8;

FIGURE 9 is a schematic diagram of the control system for operating the mechanisms shown in FIGURES 1, 4, 7 and 8;

FIGURE 9A shows a modified control system;

FIGURE 10 is a perspective view of an island installation showing a modified form of the baffle section for a down draft duct;

FIGURE 11 is an elevation view of the control box shown in FIGURE 10 with one side plate removed;

FIGURE 12 is a view similar to FIGURE 7 but showing a modified form of control mechanism to provide a fail-safe system, with the baffle damper in open position;

FIGURE 13 is a view similar to FIGURE 12 showing the baffle damper in closed position; and

FIGURE 14 is a wiring diagram of the fail-safe system employed with the control mechanism shown in FIGURES 12 and 13.

FIGURES 1 to 8A

FIGURE 1 illustrates a typical restaurant installation having a row of cooking units 10 projecting forward from a back wall 11. The upper ventilating duct 12 is ordinarily equipped with a fan 13, shown in FIGURE 9, for drawing a strong current of air through the duct to withdraw from the kitchen the smoke, fumes, steam, vapor and cooking odors produced by the cooking units.
ator 9 just above a lower portion 14 which spreads out laterally to embrace the whole length of the array of cooking units as they are disposed along the wall. This enlarged lower portion of the duct has a back wall 15 and a front wall 16 as well as end walls 18 as shown in FIGURE 6. Extending forward from the lower end of front wall 16 is a shelf 17 projecting outward over the cooking units and forming a part of a hood to intercept the smoke, vapors, etc.

Air is drawn into the ventilating duct through a narrow throat 20 between the bottom of shelf 17 and a grease trough receptacle 21 mounted on the back wall 15. Trough 21 has a forward lip 22 spaced a short distance below the upper side of the shelf 17 which forms the ends of the ventilator. One of the end walls 23 is omitted in FIGURE 1 to show the internal structure of the ventilator. The walls 21 and 22 and the shelf 17 thereby from a hood to cause all of the smoke, fumes and cooking vapors from the cooking units 20 to be drawn into the narrow throat 20. After extraction of the condensation products, the air is expelled through the upper duct 12 into the outside atmosphere. Air leaves the throat 20 as deflected downward under the lower edge of damper baffle 25 mounted on a shaft 26 supported on the under side of shelf 17 (see FIGURES 7 and 8). When the damper baffle is in open position as shown in FIGURES 1 and 7, its lower edge 25a depends downward substantially into the trough 21 approximately on the level of lip 22 although the edge 25a may be slightly above or slightly lower than lip 22. A fixed baffle trough 27 projects forwardly into the air passage from the back wall 15 immediately above the trough 21 and on the approximate level of shaft 26. The trough 21, damper baffle 25 and baffle trough 27 extend the full length of the throat 20. Baffle troughs 28 are mounted on hinged panels 30 having handles 31. These panels are retained in place by catches permitting each panel with its integral trough 28 to be easily opened out as shown in FIGURE 3.

Incorporated into the baffle trough 27 is a spray pipe 35 having nozzle heads 36. Spray pipe 35 forms the projecting edge of the baffle trough, and, in the size relationship shown, forms the principal projecting part of the baffle for grease extracting purposes. Pipe 35 may be additionally supported by an underneath continuous sheet metal bracket 37, the pipe being spot welded to trough 27 and brackets 37 and the trough and bracket in turn being welded to the back wall 15. Above the baffle trough 28 is a second and smaller grease extracting baffle comprising a spray pipe 35a.

The numeral 38 in FIGURE 1 designates one or more temperature responsive switches preferably mounted in the duct section 12 immediately above the upper transition portion of section 14. These switches are far enough removed from the cooking units so that they are not affected by the heat of the various cooking operations but do respond to high temperature in the ductwork to close electrical circuits to certain control mechanism presently to be described.

The numeral 40 generally designates a control box containing a damper operating mechanism which, in the present installation, is mounted in the middle of the length of shelf 17 to open and close the damper baffle 25 by means of a lever arm 41. In the region of arm 41 the throat 21 is shielded from the air flow by a plate 42 on the lower end of the shelf 17 which projects slightly below the lower portion of the throat 20 when the damper is open as shown in FIGURE 7. The inner side of damper baffle 25 is equipped with a pair of graters 43 which slopes downwardly from opposite ends of the damper baffle to the lower edge thereof, leaving a narrow drip gap between the lower ends of the two graters. Products of condensation collected by the graters 43 drip from the ends thereof immediately behind the shield plate 42 so that the draining material will drop freely into the trough 21 and not be picked up and carried upward by the relatively high velocity air stream entering the throat 20.

Similarly, the baffle troughs 27 and 28 slope toward a drain point or points which are shielded from the rising current of air as described in my prior Patent No. 2,913,477. Pipe 35 is horizontal, however, and parallel with shaft 26 so that the lower edge of the damper baffle 25 may engage the under side of this pipe along the entire length of the damper baffle to close the duct against the entrance of air when the damper baffle is in its closed position, as shown in FIGURE 8. The primary purpose of baffle troughs 27 and 28, the damper baffle 25, is to provide a tortuous passage for the air stream in order to extract the objectionable products of condensation as explained in my prior patent. A secondary purpose of troughs 27 and 28 is to collect such products of condensation flowing down the back and front walls 15 and 16 and carry them away. In this trough 21 without exposing them to the air stream in such a manner as to cause them to be carried up and deposited at higher levels in the ventilating duct.

FIGURES 8 also illustrates a grease level detector which may be provided when desired. The numeral 56 designates an insulated shield 57 extending into the trough 21 just below the level of its front lip 22. When condensation materials accumulate in the trough 21 to a level L closely approaching the electrode 57, the change in capacitance between the trough and electrode produces a signal in the detector apparatus 58 in FIGURE 9 as will presently be described.

FIGURE 2 shows a drain pipe 45 for draining the products of condensation from trough 21. This pipe communicates with a depression or sump 46 at the low end of the trough which preferably slopes throughout its length toward this point. A branch pipe 47 from the spray pipe 35 has an end 48 directed through the sump 46 and toward the open end of drain pipe 45 so that when pipe 35 is connected with a source of steam or hot water, a stream of such fluid from the pipe 47 will flush out the sump and drain pipe and also heat these parts to melt any congealed material therein.

FIGURE 3 illustrates additional details of construction. The lower edges of removable panels 30 set down in a gutter 49 which is equipped with openings 50 to drain onto the inside surface of baffle damper 25. When the grease extracting baffles and the interior walls of the duct are washed down with steam or hot water, the liquid flows down into the baffle trough 28 without leaking out around the edges of panels 30. Behind the control box 40 a portion of the front wall 16 carries a baffle trough section 28a in continuation of the sections 28 on the panels 30.

FIGURE 4 is a schematic diagram of the fluid cleaning and fire extinguishing system showing a variation in the drain flushing arrangement. The drain pipe section 45 leads into the open upper end of a vertical drain pipe 51, and the nozzle end 48a of fluid cleaning branch pipe 47a is directed downward toward pipe 51 to keep this pipe free and clear of congealed material. The numeral 52 designates a hot water or steam supply pipe which is equipped with a manual valve 53 and a solenoid valve 54. Connected with this supply pipe is a detergent supply 55 feeding through a check valve 56.

FIGURE 5 illustrates a preferred nozzle arrangement on the supply pipes for washing and fire extinguishing purposes. The lower pipe 35 extends through one of the end walls 18 of the duct section 14 for connection with the source of supply, and the upper pipe 35a is supplied through a vertical branch pipe 35b. The nozzle 36 on both pipes are directed parallel with the pipes and in opposite directions away from the center. In order to equalize the washing action, two of the nozzles 36 are
mounted on the branch connecting pipe 35b, these nozzles being turned in the opposite direction from the adjacent nozzles on pipes 35 and 35a. Each nozzle has a single outlet orifice to catch plate 35 which is arranged to discharge a 90° conical spray obliquely against the baffles and both opposite wall surfaces as indicated diagrammatically at 36a in FIGURE 5. These sprays overlap each other so as to wash all surfaces exposed to the fumes and grease passing through the duct section. A plurality of the duct sections 14 are adapted to be connected together in side by side relation as described in said application Serial No. 850,698 with the pipes 35 of each section connected together in series.

FIGURES 7 and 8 illustrate the construction and operation of the mechanism in control box 40 for opening and closing the damper baffle 25. Lever 41 projects upwardly through slots 59 in the shelf 17 and the bottom wall of the control box for connection with a slide rod 60 having a manual operating handle 61. Lever 41 is channel-shaped in cross section with its web portion provided with a vertical slot 58 as shown in FIGURE 8A to receive the rod 60. Attached to the back side of this web portion is a spotted spring tongue 62. A pivotal connection is effected between lever 41 and rod 60 by means of pins 63 and 64 in the rod, the former engaging tongue 62 and the latter engaging the inside of the channel web. This connection is enclosed in a chamber 65 having a front wall 66 provided with an opening 67 which forms a rear bearing support for the rod 60. The front end of rod 60 terminates at 68 within a tube 69 forming a part of the handle 61. Tube 69 is supported for sliding movement in an opening at 70 through the front wall of the control box. This arrangement provides a telescopic lost motion connection between rod 60 and handle 61. Just the movement of the handle relative to the rod 60 is limited by the inner end 68 of the rod, and outward movement of the handle from the front wall of box 40 is limited by a circular latch release plate 71 on the inner end of tube 69. Connected with the rod 60 is a catch plate 72 having a lower extension 73 equipped with a roller 74 to roll on the bottom wall of the box 40 and prevent the rod from rotating. The purpose of this is to maintain the pins 63 and 64 horizontal and at right angles to the lever 41 and to hold catch plate 72 upward-right. The rod 60 carries a compression spring 75 confined between the stationary wall 66 and latch plate 72. When the latch plate is released as shown in FIGURE 8, this spring holds the damper baffle in closed position with its lower edge bearing against the under side of pipe 35 of the baffle indicated generally at 27.

The damper baffle 25 is normally latched in open position as shown in FIGURE 7 by a latch bar 80 which is pivotally mounted on a pin 81 in a bracket 82 on the wall 66. The under side of the latch bar is provided with a notch 83 to receive the catch plate 72, the forward edge of this notch being equipped with a cylindrical bearing member 84 to reduce the release friction when the latch bar is lifted to disengage the catch plate. At its outer end the lower edge of the latch bar is provided with outer and inner cam faces 85 and 86 to cooperate with release plate 71. Another cam face 87 is disposed outward from the notch 83.

Mounted above the outer end of latch bar 80 is a solenoid 90 having a movable core or plunger 91 pivotally mounted on a trip link 92. The lower end of trip link 92 is equipped with a pin 94 which extends through a vertical slot 95 in the latch bar. When damper baffle 25 is latched in open position as shown in FIGURE 7, energization of solenoid 90 will lift the latch bar 80 to disengage catch plate 72 and allow spring 75 to project rod 60 downward to close the damper baffle. Slot 95 allows the solenoid core to travel upward for a distance to gain momentum whereby pin 94 strikes the upper end of slot 95 with sufficient impact to overcome the static friction of catch plate 72 against the cylindrical bearing 84. This arrangement permits the use of a solenoid of relatively small size which would not have sufficient attractive force to lift the latch bar against frictional resistance of the catch plate 72.

The damper baffle may also be released to close by spring action from its FIGURE 7 position by merely pulling outward manually on the knob 61. The lost motion connection between knob 61 and rod 60 allows the knob to move outward relative to the rod so that release plate 71 will engage cam surface 86 to lift the latch bar. The damper baffle is manually opened from its FIGURE 8 position by merely pushing in on the handle 61. When the handle abuts the end 68 of bar 60, the bar 60 then moves inward with the handle until catch plate 72 becomes latched in the notch 83. During this inward movement solenoid 90 must be deenergized so that the latch bar rests in its lowermost position except as it is raised by release plate 71 passing along the cam surface 85 and catch plate 72 passing along the cam surface 87.

Armature link 92 is equipped with a switch-actuating finger 100. Finger 100 has a spring 101 arranged to lift the switch arm 102 of a switch 103 when solenoid 90 is energized. Mounted on the bottom of the box is a spring opening switch 105 having an actuating plunger 106 which is adapted to close the switch when the plunger is engaged by plate 73 as shown in FIGURE 7.

FIGURE 9

FIGURE 9 is a schematic diagram of the control system for the apparatus in FIGURES 1–8. The control system is energized from a pair of supply wires 110 and 111. The third wire 109 provides a three wire supply for the fan motor 13. Solenoid 90, which is normally deenergized, is connected to wire 110, and a wire 112 which may be energized from wire 111 by the closing of either one of the thermostatic switches 38 or a manual push button switch 113. Switch 113 is preferably mounted somewhere in the kitchen at a distance from the cooking units so as to be readily available in case of a fire on the cooking units. Additional thermostats connected in parallel with those shown may be mounted in either the upper or lower duct sections as desired and additional push button switches may also be provided if desired. If the push button switch is not actuated promptly, the fire will be drawn into the ventilator causing automatic operation of the thermostatic switches. When any one of these switches closes, solenoid 90 is energized to lift the latch bar 80 in FIGURE 8 and permit spring 75 to close the damper baffle 25. During normal operation, switch 105 is held closed by plate 73 as shown in FIGURE 7 and switches 38 and 113 are open.

One branch of supply wire 111 is connected to a contact switch 103 which has a contact bar 116 adapted to connect this supply wire with a wire 117 leading to a twenty-four hour time clock C. This circuit is normally open as shown, at switch 103. A contact bar 120 in the time clock normally connects wire 117 with a circuit wire 118 leading to the solenoid spray valve 54 and detergent pump 55. The other terminals of this solenoid and motor are connected with supply wire 110. In the normally deenergized condition of wire 118, spray valve 54 is spring closed and detergent pump motor 55 is not operating. If the detergent supply is maintained under sufficient head that a detergent pump is not needed, then the numeral 55 in FIGURE 9 may designate a solenoid valve, making the check valve 56 in FIGURE 4 unnecessary.

Contact bar 120 forms a single pole, double throw switch blade and is arranged to be shifted at a designated time and for a predetermined interval to connect the wire 118 with the supply wire 111, as indicated in broken lines. The full line position of contact bar 120 is its normal daytime position and the broken line position is a wash cycle position which occurs at night when the kitchen is not operating.
Valve 119 is a gas valve controlling the gas supply to the burners of the cooking units. This is a spring opened valve which may be closed by the energization of its solenoid as will presently be explained. This solenoid is connected to wire 112 and supply wire 110.

Fan 13 is operated from the supply wires 109, 110 and 111 under the control of a relay switch 122. This relay switch is a spring opening switch which is normally held closed during operation of the ventilator by the armature of a solenoid 124. Similarly, while the fan is operating, the oxygen generator 9 is energized directly from the fan circuit. Valve 122 may be energized from supply wire 111 by a solenoid relay switch 128 on the occasion of a signal from the grease detector electrode 57. When the grease detector signals an excessive accumulation of grease in the trough 21, its mechanism 58 operates to energize the solenoid of relay 128 and close the circuit to wire 112.

Relay switch 122 also has a pair of holding circuit, or interlock, contacts 125 one of which is connected to wire 123 and the other being connected to a wire 126 leading to normally open push button start switch 130. Wire 131 connects this switch with switch 105. Switch 130 may be mounted at any convenient location in the kitchen. Push button stop switch 142 has a moveable contact 143 which normally connects wire 131 with supply wire 110.

Dampener baffle 25 is open as shown in FIGURE 7, closing switch 105, and fan 13 and oxygen generator 9 are started by momentarily closing start switch 130. This energizes relay solenoid 124 through wires 126, 131 and contact 143. When the relay closes and switch 130 opens, a holding circuit for solenoid 124 is established through contacts 125, wire 123, switch 105, wire 131 and contact 143. The starting switch is inoperative when the damper baffle is closed because the holding circuit through wire 123 is open at switch 130; the damper baffle must be opened before actuating starting switch 130.

Solenoid switch 128 remains normally open. Solenoids 54 and 119 and detergent pump 55 are all deenergized whereby the normally closed spray valve 54 remains closed and the normally open gas valve 119 remains open. Solenoid 90 is deenergized and switch 103 is open. The deenergization of all of these devices results from wire 112 being deenergized by normally open switches 38, 112 and 122.

If the drain 51 should clog and grease should be allowed to accumulate in trough 21, grease detector 57 will operate to energize solenoid switch 128 causing this switch to close and energize wire 112. This closes the gas valve, shuts down the ventilator and turns on the sprays to clear the drain. Wire 112 energizes solenoid 90 closing damper baffle 25. The closing of damper baffle 25 opens switch 105 to deenergize solenoid 124 and open relay 122 stopping the fan 13 and oxygen generator 9. Wire 112 also energizes solenoid 119 to close the gas valve. The energization of solenoid 90 lifts armature 91 and latch bar 80 which in turn lift the actuating arm 102 of switch 103, pivoting this arm about its fulcrum 101 to close contact bar 116. The latter energizes wires 117 and 118 to open spray valve 54 and start detergent pump 55. However, if the grease trough and drain are cleaned daily as intended, the grease detector is not necessary and may be omitted from the system.

Third position in the closed position is not watertight but allows the hot water or condensed steam to run into trough 21 to clear the trough and drain of grease. If the water tends to back up above the damper baffle, its weight will force the damper baffle open sufficiently to pass the water. With no ventilation in the kitchen, the personnel of the kitchen are thereby compelled to clean the grease trough if this is not accomplished satisfactorily by the steam or hot water sprays.

When the trough 21 has been cleared of grease, relay 75 switch 128 opens and deenergizes wire 112. This deenergizes solenoid 90, dropping latch bar 80 and returning switch 103 to its normal open position shown in FIGURE 9. This shuts off the sprays and detergent. After opening damper baffle 25, the fan 13 and oxygen generator may be restarted by switch 130.

Each time the predetermined time after the kitchen has been shut down, the twenty-four hour clock C shifts the contact bar 120 to its broken line position for a short interval and then returns it to its full line position. When contact 120 is in its broken line position, wire 118 is connected with supply wire 111 to energize the solenoid valve 54 and detergent pump 55. Such energization starts the cleaning sprays. After a predetermined washing interval, this wash circuit is deenergized by the movement of contact bar 120 back to its solid line position. Thus, the lowering ventilating section, the grease trough 21 and its drain are all washed automatically every night without any attention on the part of the kitchen personnel. The oblique angles of impingement of the jets against and along the grease covered surfaces effectively cover substantially all portions of such surfaces and effectively remove the grease, dust and lint clinging thereto so that much needed operations start with a clean grease extracting section.

In case of fire while the ventilator is in operation, one of the thermostatic switches 38 will close or else the manual switch 113 may be closed. This energizes wire 112 and solenoids 90 and 119 as previously described in connection with the energization of switch 128 by relay switch 132. The energization of solenoid 90 lifts latch bar 80 to release damper baffle 25, allowing the damper baffle to move to closed position under the action of spring 75 and opening switch 105. The lifting of latch bar 80 also raises the actuating arm 102 of switch 103 in FIGURE 8 close to contact bar 116 and energizes solenoid valve 54 and detergent pump 55. Thus, operation of the fire switches turns on the fire extinguishing spray and detergent and closes the gas valve 119 to extinguish the cooking unit burners.

It is not necessary for manual switch 113 to be held closed until the fire has been extinguished nor is it necessary for one of the thermostatic switches 38 to remain closed until the fire is completely extinguished. In some cases, initiation of the fire extinguishing spray will cool the actuated thermostat or quench the fire in the immediate vicinity of the actuated thermostat while a fire may still be burning in some other part of the ventilator. In order to prevent premature shutting off of the fire extinguishing spray, the switch 103 is equipped with a time delay mechanism which prevents it from reopening until a predetermined interval of time has elapsed. Thus, after the solenoid 90 has been deenergized by the opening of the switch 38 or 113 which was closed, the switch 103 will remain closed to maintain the fire extinguishing spray for a time ordinarily sufficient to extinguish all the fire in the duct and cool the parts down below the flash point of the grease. In the event that some fire still remains, it will either become extinguished for lack of oxygen by reason of the closed position of damper baffle 25 or it will spread until it again actuates one of the thermostatic switches 38. This will then repeat the cycle, restarting the fire extinguishing spray as before.

A preferred switch 103 is sold under the trademark "Agaswitch," by Elastic Stop Nut Corporation of America at Elizabeth, New Jersey. The time delay mechanism in this switch may be adjusted to delay its opening, after release of its actuating arm 102, for any desired interval of time from a few seconds to fifteen minutes. For the present purpose a delay of about five minutes is preferred. When the spray is hot water, the delay interval for cleaning purposes depends upon the temperature of the water and other factors inherent in the particular installation.

Actuating stop switch 142 breaks the holding circuit.
moved from the system. Also, as in FIGURE 9, the damper baffle must be manually opened by knob 61 before depressing the start button 130, in order to close switch 105 and complete the holding circuit for relay solenoid 124. This holding circuit is broken at switch 105 when the damper baffle is open as shown in FIGURE 7.

An important feature of FIGURE 9A is that actuation of stop switch 129 initiates a wash cycle every time when the ventilator is shut down. The opening of contact 132 breaks the holding circuit for relay switch 122, stopping the fan and ozone generator and leaving the damper baffle open. Contact 133 energizes relay solenoid 136 directly from supply line 111, closing contact bar 116a and starting the sprays. The wash cycle continues until the time delay device in relay 115 lifts contact bar 116a to break the spray circuit through wire 117. Thus, the grease collecting portions of the ventilator are cleaned daily automatically without any special attention.

FIGURES 10 and 11

FIGURES 10 and 11 illustrate the application of the invention to an island-type installation having a down-draft ventilating duct. In this case the cooking unit or units 10 are ventilated by the downdraft duct 150 through which air is drawn by the usual suction fan. Over the cooking units the shelf 151 and end wings 23 form a hood similar to the shelf 17 and end wings 23 in FIGURE 1.

Underneath the shelf 151 is a grease collecting trough 152 with its forward edge or lip spaced a short distance beneath the shelf to form an inlet throat 153 for the cooking fumes and vapors. In order to place this inlet throat under the shelf, the front edge of trough 152 is preferably spaced behind the front edge of the shelf so that a substantial portion of the shelf overhangs the trough. The back edge of the trough is connected with the front wall 154 of the downdraft duct 150. The upper edge of wall 154 is spaced below the underside of shelf 151 to provide for the flow of the air stream through inlet throat 153, thence through the trough 152 and into the duct 150.

Preferably, the major portion of shelf 151 comprises a panel 155 which is hinged at its back edge 156 so as to lift up and provide access to the trough 152. The underside of this panel is equipped with a depending grease extracting baffle 157 which is spaced behind the inlet throat 153 and extends into, or substantially into, the trough 152. Behind the baffle 157 is a second grease extracting baffle 160 which is upstanding from the bottom of the trough 152. The upper edge of this baffle comprises a spray pipe 355 equipped with nozzles 36.

The shaft 26a of damper baffle 25a is mounted in suitable bearings on the underside of shelf 151 some distance behind the baffle 160. When this damper baffle is in open position as shown in FIGURE 10, the air stream is drawn in a circuitous path around the three baffles whereby grease droplets and other products of condensation are extracted from the air stream by the action of centrifugal force. The air stream after entering throat 153 is deflected downward around the lower edge of baffle 157 then upward across the upper edge of baffle 160 then again downward under the lower edge of baffle damper 25a and then upward over the upper edge of front duct wall 154 following which the air stream flows downward through duct 150 relatively free of all grease particles which might otherwise condense on the duct walls and create a fire hazard in the ventilator.

Nozzles 36 in FIGURE 10 are arranged to spray the baffles and the trough periodically with hot water or steam for the purpose of removing adhered grease so as to keep the parts clean and free of material which might constitute a fire hazard. Trough 152 is equipped with a drain, not shown, similar to the drain arrangement shown in FIGURES 1 and 2 or 4. The nozzles...
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36 also serve a fire extinguishing function as explained in connection with FIGURE 1, and for this purpose the damper baffle 25a is arranged to rotate counterclockwise in FIGURE 10 until it engages the duct wall 154 to close the entrance to the duct 150 and keep any fire out of the main duct system. The mechanism for operating damper baffle 25a is contained in a control box 40a similar to the control box 40 in FIGURES 1, 7 and 8. The essential difference is that the shaft 26a of the damper baffle and its operating arm 41a are positioned above the control rod 60 making it necessary to interconnect these two members with the slotted lever arm 156. Lever 156 is pivoted at 157 for operation by a pin 158 in the inner end of rod 60. Similarly, the upper end of lever 156 is slotted to engage a pin 159 in the lower end of arm 41a. The view in FIGURE 11 is from the opposite side of the control box from that which appears in FIGURE 10, the damper baffle being in open position in both views. When latch bar 80 is raised either by pulling out on the manual knob 61 or by the energization of solenoid 50, the catch plate is released from notch 83 allowing spring 75 to push the rod 60 to the right in FIGURE 11, the same as in FIGURES 7 and 8. This swings the arm 41a and damper baffle 25a rearward and holds the damper baffle in firm engagement with the duct wall 154 as above described. In all other respects the control mechanism in FIGURE 11 operates the same as in the system of FIGURE 9 as the control mechanism in FIGURES 7 and 8. The thermostats 38 may be located wherever desired in FIGURE 10.

The control system of FIGURE 9A may be used in FIGURES 10 and 11 by substituting time delay relay 115 for switch 103 in the control system and omitting switch 103 in the control box.

FIGURES 12 to 14

FIGURES 12 to 14 illustrate a modification of the control mechanism and system to provide a fail-safe system. The damper baffle 25, control rod 60, manual knob 61 and latch bar 80 all operate the same as in FIGURES 7 and 8 but the solenoid trip mechanism is different. In this case the bracket 82 has a pair of up-standing legs 170 spanned by a pin and roller 171 to support the outer end of a wedge-shaped armature 172 in a horizontal solenoid 173. The nose of the armature is disposed under a similar pin and roller 174 in the upper end of a stirrup member 175 on the latch bar. Thus, the wedge end of the armature rides on roller 175 and is between the two legs of bracket 170 and passes between the two legs of stirrup member 175 with slight clearance below roller 174 when the armature is held in retracted position as shown in FIGURE 12 by the energization of solenoid 173.

A spring 176 is mounted on a guide pin 177 with the spring in compression between the back wall of the control box and the rear end of the armature. When the solenoid is deenergized, spring 176 thrusts the armature forward under the roller 174 to lift the latch bar and release the damper baffle to swing to closed position under the action of spring 75 as shown in FIGURE 13. As long as solenoid 173 remains deenergized, the damper baffle cannot be latched in open position. Latch bar 80 may be released manually by pulling out on knob 61 as in FIGURES 7 and 8, and the damper baffle may be closed manually opening by pushing in on knob 61, provided solenoid 173 remains deenergized.

FIGURE 14 is a schematic diagram of the fail-safe control system. Circuit components identical with those in FIGURES 9 and 9A bear the same reference numerals. Thermostats 38a and push button fire switch 113a are similar to switches 38 and 113 except that they are normally closed and are constructed to open or be opened in case of fire. These switches are connected in series between supply line 111 and a wire 180. One branch of wire 180 normally energizes the solenoid of a relay switch 181 while another branch normally energizes the solenoid 173. When solenoid 173 is energized, its armature 172 is retracted as shown in FIGURE 12 whereby switch 105 is held closed by plate 73 on control rod 60 which is latched in damper-open position by latch bar 80 in its lower position.

The circuit for the solenoid of relay switch 181 is completed by wire 188 and a normally closed push button switch 189. When relay 181 is energized, its contact bar 182 closes a circuit between a wire 183 from switch 105 and a wire 184 in series with a normally closed push button stop switch 115. The latter circuit further includes the contact bar 187 which is held closed by the relay solenoid 190, the latter being energized by the grease detector device 58. The circuit through wire 184 and contact bar 187 is completed by a wire 191 connected with one of the holding circuit contacts 125 of fan relay 122. The other relay contact 125 is connected by a wire 192 with push button start switch 193 which is normally open. The closing of this switch connects wire 192 with supply wire 111. Supply wire 111 is further connected to a back contact in the relay switch 181 for connection with a wire 195 when the relay is deenergized.

Thus, it is apparent that solenoids 173 and 181 must be kept energized to maintain the ventilating system in operation. In the event of electrical failure, the deenergization of these solenoids results in the release of armature 172 to its spring-actuated position shown in FIGURE 13 which releases the damper baffle 25 to closed position. This makes the ventilating system inoperative and thereby warns the personnel of the existence of a fault in the system. Relay 181 is an “Agastat” relay as described above except that the delay occurs in responding to energization whereby the reclosing of an opened switch 38a, 113a or 189 does not immediately stop the sprays and detergent.

If the electrical failure is in the source of power supply, of course the fan will stop also and the ventilation system will be entirely dead. In case the electrical failure is in the thermistor circuit, the deenergization of solenoid 173 will result in the opening of switch 105 which is in the holding circuit for fan relay solenoid 124 whereby the fan and ozone generator will likewise be shut off when the damper baffle closes.

In normal operation the ventilating system is started by first pushing in knob 61 and momentarily closing switch 183. Pushing in knob 61 momentarily releases the roller 25 and causes it to be latched open because solenoid 173 is energized through the two normally closed switches 38a and 113a whereby armature 172 is held retracted as in FIGURE 12. Pushing in knob 61 also closes switch 105. Then, when start switch 193 is closed, relay switch 122 is closed by the energization of solenoid 124, starting the fan and ozone generator. After the release of push button start switch 193, the energization of solenoid 124 is maintained by relay holding circuit contacts 125 and a holding circuit through wire 191, normally closed contact bar 187, wire 184, normally closed switch 185, contact bar 182 of the energized relay 181, wire 188 and switch 105 which is connected to supply wire 111. When it is desired to stop the fan and ozone generator, this holding circuit is broken by opening push button stop switch 185 to deenergize relay solenoid 124.

In case of fire the opening of switch 38a or 113a deenergizes solenoid 173 and stop switch 185 of the former closes the damper baffle and opens switch 105 in the holding circuit of relay switch 122 to shut off the fan and ozone generator. Deenergization of relay solenoid 181 causes contact bar 182 to move and connect spray circuit wire 193 with supply wire 111. This turns on the sprays and detergent to operate. Also, after the opened switch 38a or 113a re-closes, a time delay device in relay 181 holds the contact bar 182 in its upper posi-
tion for a predetermined interval before allowing it to restult in the close of solenoid 181 immediately upon the re-closing of switches 38e and 113e. This allows extra time for any fire remote from the thermostat to be extinguished and for the duct section to cool down below the flash point of the grease. In other words, the relay 181 has delayed response to the energization of its solenoid. At the end of the delay interval, contact bar 182 moves to its FIGURE 13 position and then, when the baffle damper is re-opened by knob 61 to complete the holding circuit for relay solenoid 124, the fan and ozone generator may be re-started by closing start switch 193.

The ventilator is washed for daily cleaning by using push button switch 189 to open the circuit to relay solenoid 181. This turns on the spray and detergent pump and shuts off the fan and ozone generator but does not energize solenoid 173 to close the damper baffle. Energization of the latter is maintained through the normally closed switches 38e and 113e. The cleaning interval is timed by relay 181.

In case of drain stoppage resulting in an accumulation of grease in trough 21, the grease detector circuit will de-energize relay solenoid 190 allowing contact bar 187 to break the holding circuit for relay solenoid 124. This stops the fan and ozone generator but does not turn on the spray or detergent and does not energize solenoid 173 to close the damper baffle.

The push button daily cleaning feature in the systems shown in FIGURES 9A and 14 make the time clock and grease detector unnecessary in most installations and so the time clock and grease detector may be omitted from these systems as above mentioned. These additional safeguards are included because they may sometimes be desired. Also, it is to be understood that the control mechanisms and systems herein disclosed are not limited to baffle-type grease extractors. They are equally applicable to washable filters and any other grease extracting means employed in kitchen ventilators.

Having now described my invention and in what manner the same may be used, what I claim as new and desire to protect by Letters Patent is:

1. In a kitchen ventilator having a ventilating duct with grease extracting means, a fan in said duct, cleaning and fire extinguishing spray means in said duct arranged to spray all the surfaces in said duct with water for suppression of heavy grease accumulation, a thermostat in said duct, a time delay switch arranged to control the operation of said spray means, means responsive to said thermostat to stop said fan and operate said switch for fire extinguishing purposes and independent means to stop said fan and operate said switch for cleaning purposes, the time delay action of said switch maintaining the operation of said spray means for both purposes for a predetermined interval of time after the operation of said switch by said thermostat or said independent means.

2. In a kitchen ventilator having a grease extracting section, a fan in said ventilator, cleaning and fire extinguishing spray means arranged to spray all the surfaces in said section which are subject to heavy grease accumulation, a thermostat arranged to shut off said fan and operate said spray means in case of fire in said section, a stop switch for said fan arranged to operate said spray means for cleaning said section each time the ventilator is shut down, and a time delay device arranged to continue the operation of said spray means for a predetermined interval of time after the operation of said thermostat or stop switch.

3. In a kitchen ventilator having a ventilating duct with grease extracting means, a fan in said duct, a cleaning and fire extinguishing spray pipe in said duct, a thermostat in said duct, a solenoid valve controlling the supply of fluid to said spray pipe, a push button start switch arranged to start said fan, a time delay relay controlling said valve, and a push button stop switch, both said thermostat and said stop switch being effective when actuated to stop said fan and operate said relay to open said valve, said relay having delayed response to close said valve a predetermined interval after said thermostat and stop switch have returned to pre-actuated positions so that sprays from said spray pipe will be continued for the duration of said delayed response.

4. In a kitchen ventilator having a grease extracting section, a fan in said ventilator, cleaning and fire extinguishing spray means arranged to spray all the surfaces in said section which are subject to heavy grease accumulation, detergent supply means connected with said spray means, a spray circuit controlling said spray means and detergent supply means, a time delay relay for energizing said spray circuit, a control circuit for operating said relay to energize said spray circuit, a thermostat in said ventilator connected in said control circuit for operating said relay and arranged to stop said fan in case of fire, a push button start switch arranged to start said fan, and a push button stop switch having a contact to stop said fan and a contact in said control circuit to operate said relay for initiating a cleaning cycle by said spray means when the ventilator is shut down, said relay having a time delay action to maintain the energization of said spray circuit for a predetermined interval of time after operation of the relay by said thermostat or said stop switch.

5. A fail-safe kitchen ventilator comprising a grease extracting section, a fan in said ventilator, cleaning and fire extinguishing spray means arranged to spray all the surfaces in said section which are subject to heavy grease accumulation, a time delay relay controlling the operation of said spray means, said relay being arranged to operate said spray means when de-energized and to shut off said spray means when energized, a normally closed push button stop switch and a normally closed thermostatic switch in said ventilator both in series in an energizing circuit for normally maintaining said relay energized, and means for stopping said fan when said circuit is de-energized, the delay action of said relay being arranged to continue the operation of said spray means for a predetermined interval of time after the re-energization of said circuit following its de-energization by said thermostatic switch or stop switch.

6. A fail-safe kitchen ventilator comprising a grease extracting section, a fan in said ventilator, a damper in said ventilator, cleaning and fire extinguishing spray means arranged to spray all the surfaces in said section which are subject to heavy grease accumulation, a time delay relay controlling the operation of said spray means, said relay being arranged to operate said spray means when de-energized and to shut off said spray means when energized, a normally closed push button stop switch and a normally closed thermostatic switch in said ventilator both in series in an energizing circuit for normally maintaining said relay energized, a solenoid energized by said thermostatic switch to hold said damper open, and means for closing said damper and stopping said fan when said solenoid is de-energized, the delay action of said relay being arranged to continue the operation of said spray means for a predetermined interval of time after the re-energization of said circuit following its de-energization by said thermostatic switch or stop switch.

7. In a kitchen ventilator having a grease extracting section, a fan in said ventilator, manual start and stop switches arranged to start and stop said fan, cleaning and fire extinguishing spray means arranged to spray the surfaces in said section which are subject to heavy grease accumulation, a thermostat having a switch arranged to shut off said fan and initiate operation of said spray means for fire extinguishing purposes in case of fire in said section, time delay means having a switch arranged to continue the operation of said spray means for a predetermined interval of time after operation of said initiating switch in said thermostat and then shut off said spray means, and a time clock having a switch arranged to initiate operation of said spray means for cleaning
purposes at a predetermined time in each twenty-four hour day and then shut off said spray means after a short interval.

References Cited by the Examiner

<table>
<thead>
<tr>
<th>Patent Number</th>
<th>Date</th>
<th>Inventor</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,232,865</td>
<td>7/17</td>
<td>Stevens</td>
<td>55—263</td>
</tr>
<tr>
<td>1,798,356</td>
<td>3/31</td>
<td>Roth</td>
<td>55—263</td>
</tr>
<tr>
<td>2,182,106</td>
<td>12/39</td>
<td>Ames</td>
<td>98—115</td>
</tr>
<tr>
<td>2,564,402</td>
<td>8/51</td>
<td>MacArthur</td>
<td>134—166</td>
</tr>
<tr>
<td>2,813,477</td>
<td>11/57</td>
<td>Gaylord</td>
<td>98—115</td>
</tr>
<tr>
<td>2,877,781</td>
<td>3/59</td>
<td>Lipp</td>
<td>134—166</td>
</tr>
<tr>
<td>2,948,013</td>
<td>8/60</td>
<td>Bearer</td>
<td>15—316.1</td>
</tr>
<tr>
<td>2,961,541</td>
<td>11/60</td>
<td>Graswich</td>
<td>98—115</td>
</tr>
</tbody>
</table>

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