

[72] Inventor **Bernard J. Williams**
8131 Wenlock Circle, Huntington Beach,
Calif. 92646

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[54] **FIRE PREVENTION SYSTEM**
1 Claim, 6 Drawing Figs.

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[56]

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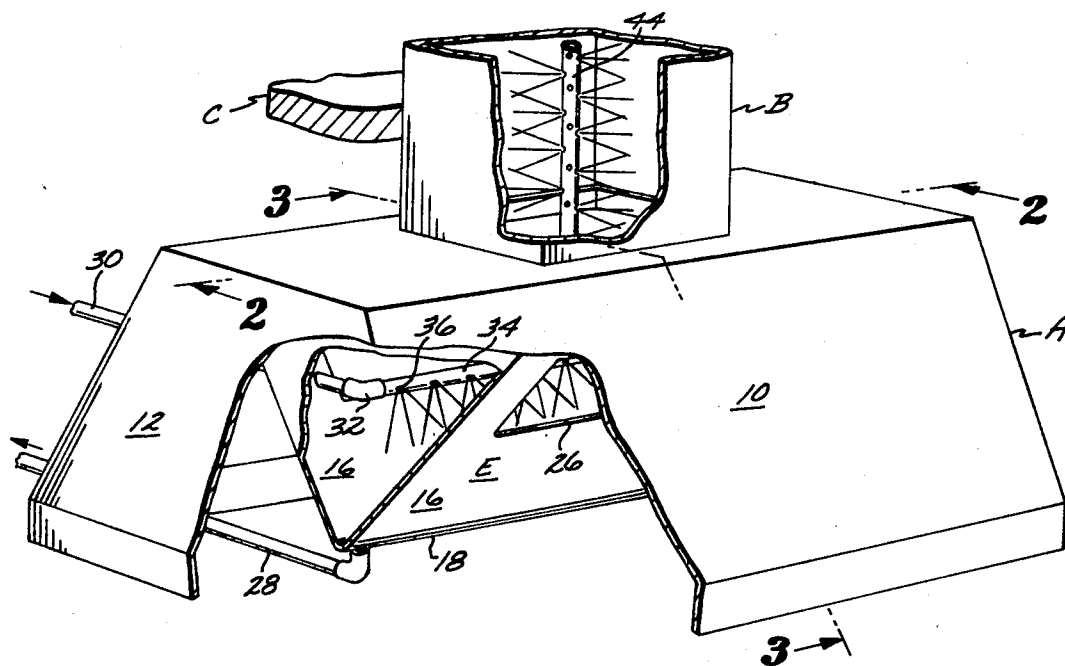
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Primary Examiner—Alvin H. Waring

Assistant Examiner—David L. Trafton

Attorney—William C. Babcock

ABSTRACT: Fire prevention system that may be installed in an existing or new hood to minimize the possibility of a grease fire therein by periodically and automatically spraying the interior of the hood with a heated aqueous detergent solution.



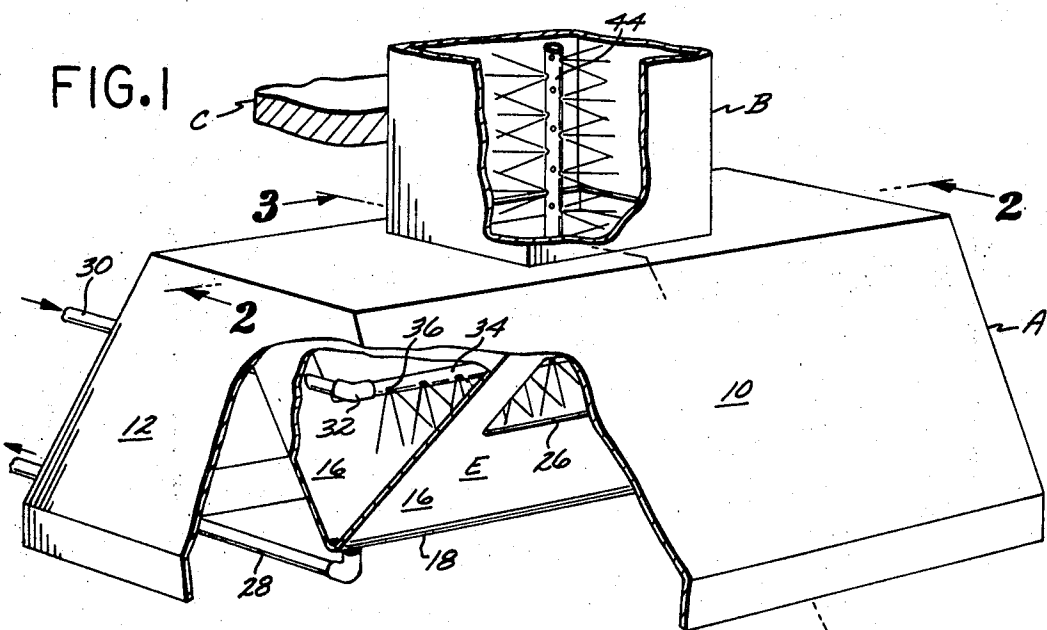
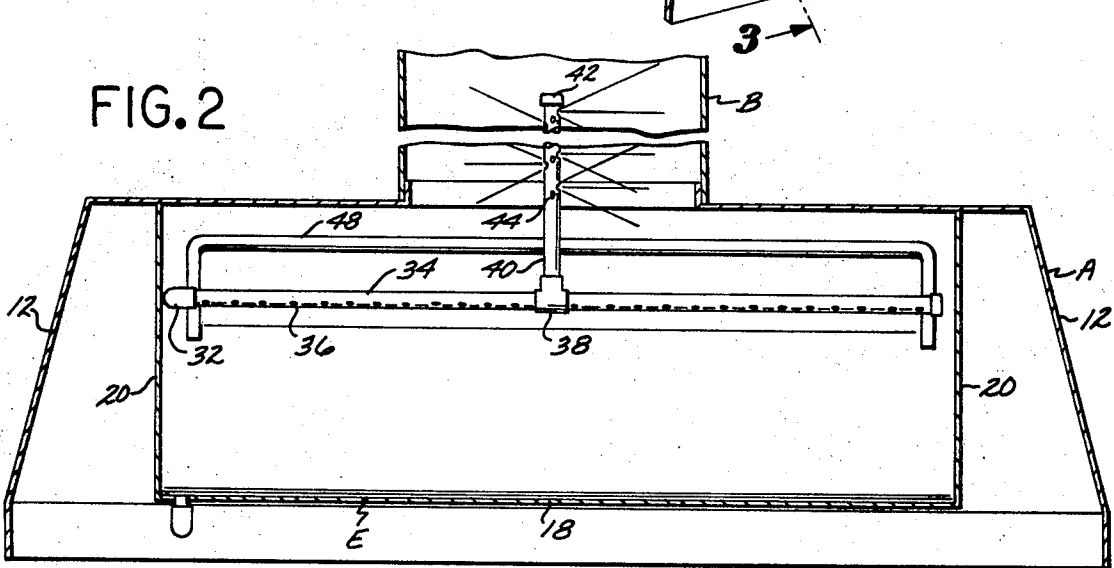
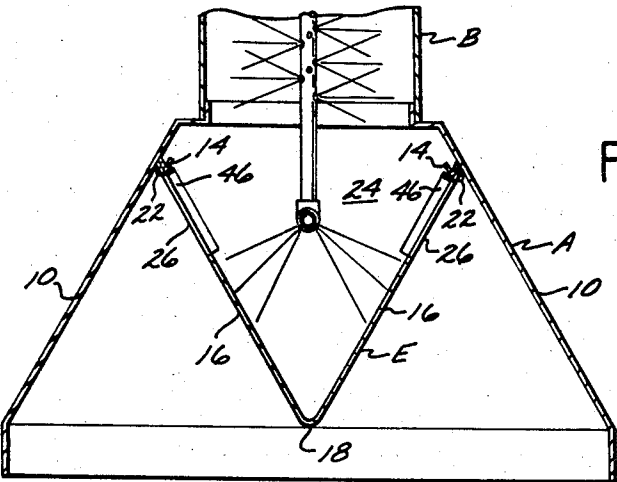
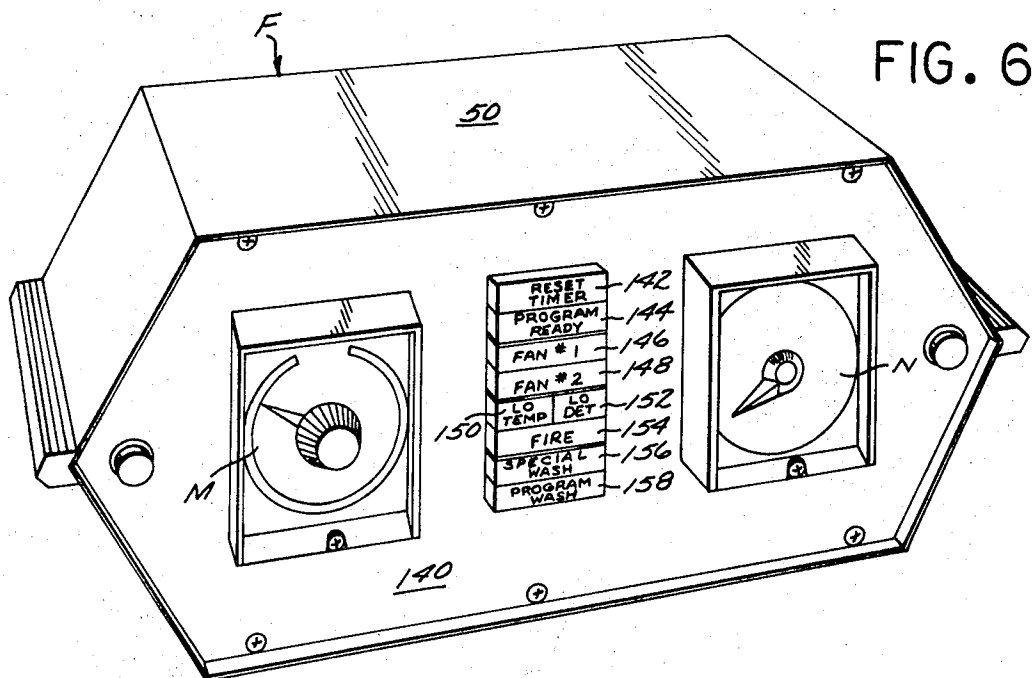
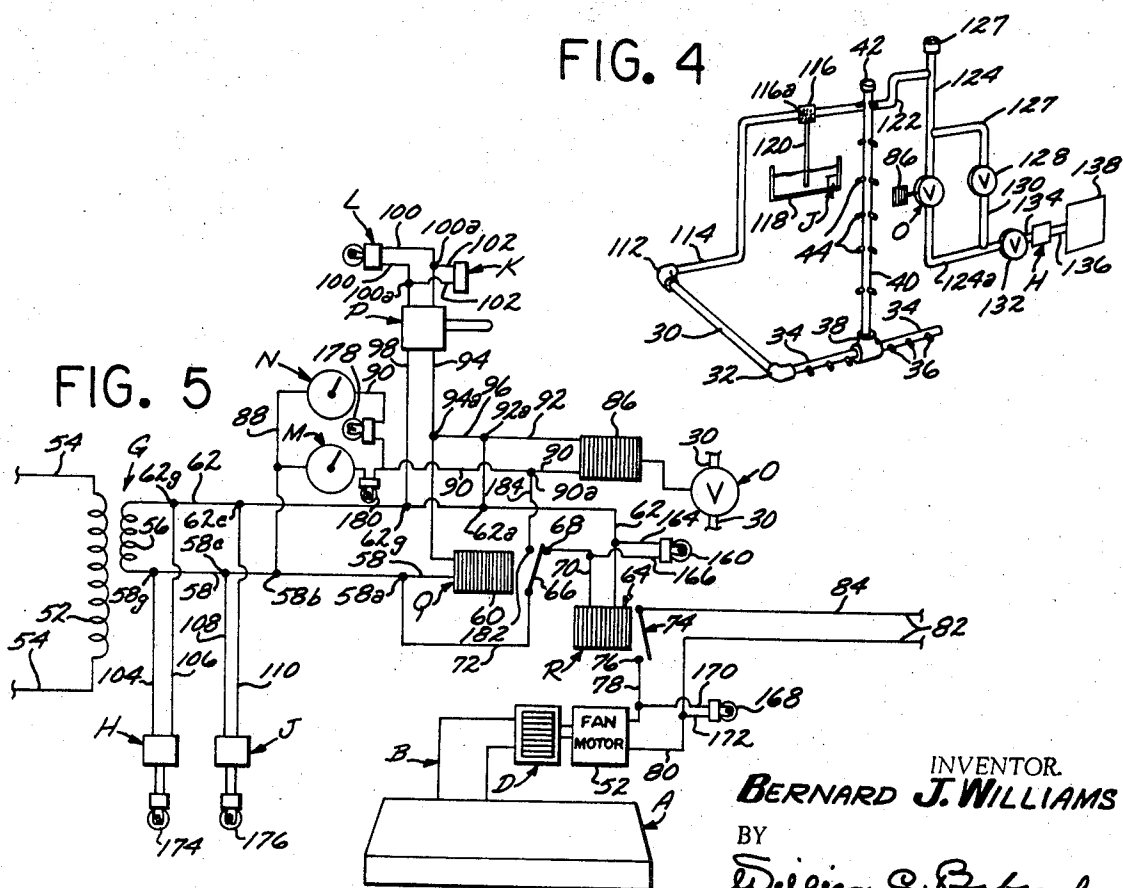


FIG. 3

INVENTOR.
BERNARD J. WILLIAMS
BY
William C. Babcock
ATTORNEY



INVENTOR.
BERNARD J. WILLIAMS
 BY
William Q. Babcock
 ATTORNEY

FIRE PREVENTION SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention is a fire prevention system that may be installed in an existing hood, and with the control unit for the system being self-contained in a small compact cabinet that may be disposed at any convenient location relative to the hood. The system is preferably controlled by low voltage electricity, and consequently the wiring installation is relatively inexpensive.

2. Description of the Prior Art

In restaurants, it has been a common practice for many years to install hoods over the cooking ranges, with smoke and fumes being discharged from the hoods through ducts that extend upwardly therefrom. Normally, an exhaust fan is associated with each duct to assure that smoke and fumes from the kitchen are discharged as rapidly as possible into the ambient atmosphere.

In the cooking of certain foods, particularly meats, substantial quantities of grease are vaporized, with the vaporized grease condensing as it rises through the hood and duct associated therewith. The condensed film or layer of grease on the interior surface of a hood and exhaust duct is highly flammable. When such a film or layer is inadvertently ignited, and a fan is drawing a stream of air upwardly through the duct, an ideal environment for a viscous fire is provided.

Time and again it has been demonstrated that grease fires in restaurant ducts and hoods may get out of control in an extremely short period of time, endangering the lives of kitchen personnel and the restaurant patrons, as well as causing substantial property damage.

The present invention substantially eliminates the possible occurrence of a serious fire in a kitchen hood or duct associated therewith by periodically spraying the interior surface thereof with a detergent solution to remove accumulated grease, and in the event of a fire, immediately breaking the electric circuit to the fan and spraying the interior surfaces of the hood and duct with the solution until the temperature within the hood and duct is lowered below the ignition temperature of grease.

SUMMARY OF THE INVENTION

A fire prevention system for kitchen hoods and ducts associated therewith that may be mounted in existing or new installations, which system includes a separate control unit that may be disposed at any desired location relative to the hoods and ducts the system protects. The system is electrically energized by low voltage electricity to minimize the cost of electrical wiring in the installation of the system.

A major object of the prevention system described when installed, is to provide automatic and periodic spraying of the interior surfaces of the hood, duct, and combined grease extractor and water receptacle to minimize the possibility of a fire originating therein.

Another object of the preventive system is to make it possible in the event a fire does start in a hood, duct, or extractor-receptacle to automatically shutoff the electrically driven fan or blower associated with the duct, and electrically energize a normally closed, solenoid controlled water valve to open and cause water to be sprayed on the interior surfaces of the hood, duct, and extractor-receptacle until the temperature thereof is lowered below the ignition temperature of grease.

A still further object of the prevention system is to provide one which, after automatically spraying the interior surfaces of the hood, duct, and extractor-receptacle with which it is associated, ceases to so spray after a predetermined length of time or after a fire is extinguished as the case may be, with the fan or blower operatively associated with the duct being electrically energized after termination of said spraying.

Yet another object of the prevention system is to provide one in which the operative condition thereof is visually apparent at all times, and which sounds an audible alarm in the case of a fire in the hood, duct, or extractor-receptacle.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a kitchen hood and duct in which the system is installed, with a portion of the hood being broken away to show the combined water receptacle and grease extractor that is also protected by the system;

FIG. 2 is a longitudinal cross-sectional view of the hood, duct, and extractor-receptacle, taken on the line 2-2 of FIG. 1;

FIG. 3 is a transverse cross-sectional view of the hood, duct, and extractor-receptacle, taken on the line 3-3 of FIG. 1;

FIG. 4 is a diagrammatic view of the plumbing used with the system;

FIG. 5 is a diagrammatic view of the wiring and electrical components used in the system; and

FIG. 6 is a perspective view of the program control unit used with the system.

BRIEF DESCRIPTION OF THE PREFERRED EMBODIMENT

A typical hood A such as used in restaurant kitchens over a range or grill (not shown) is illustrated in FIGS. 1-3. A smoke and fumes exhaust duct B extends upwardly from hood A, in which the duct passes through a roof C into the ambient atmosphere as illustrated in FIG. 1. Air, smoke and fumes are drawn upwardly through the duct B by a fan or blower D that is powered by an electric motor E.

In existing installations the hood A normally has downwardly and outwardly tapering sidewalls 10 and end walls 12 as shown in FIGS. 1-3. The temperature of the interior surfaces of the sidewalls 10 and end walls 12 is below that of vaporized grease, whereby the grease tends to condense thereon as a film (not shown). Such a film of grease is highly flammable and in the past has been the source of numerous disastrous restaurant fires. When the system of the present invention is used, as will hereinafter be described, grease is not allowed to accumulate to such an extent as to constitute a fire hazard.

Prior to installation of the fire prevention system, the interior surfaces of the hood A and the duct or ducts B extending upwardly therefrom are cleansed of all foreign material and scraped down to the bare metal. Duct seams are water proofed and the interior surface of the duct B is then etched. After etching, the interior surface of the duct B is sprayed with a fire retardant coating that will withstand heat up to 800° F. A number of such fire retarding coating materials are commercially available.

After the interior surface of the hood A has been cleansed of foreign material, a number of clips 14 are secured to the interior surfaces of the sidewalls 10. Clips 14 serve as a support for a grease extractor and water receptacle E that is shown in FIGS. 1-3. The extractor-receptacle E is shorter in length than the hood A, and is defined by two downwardly and inwardly tapering sidewalls 16 that intersect to define a longitudinally extending apex 18. End pieces 20 of generally triangular shape close the ends of sidewalls 16. The sidewalls 16 are secured to clips 14 by conventional fastening means 22, such as screws, bolts, or the like. Extractor-receptacle E defines a confined space 24 into which spray water, grease, and foreign material may discharge.

A number of longitudinally spaced smoke and fumes discharge openings 26 are formed in the sidewalls 16 a substantial distance above the apex 18. The combined cross-sectional areas of openings 26 should not be smaller than the cross-sectional area of duct B. The lower portion of the extractor-receptacle E has a drain line 28 connected thereto for water and grease. The drain line 28 extends to a grease trap (not shown) and then proceeds to suitable waste facilities such as a sewer or the like.

A line 30 is provided that is connected to a source of hot water (not shown). Line 30 extends through the rearwardly disposed sidewalls 10 and 16, and in the confined space 24 is connected to a tubular ell 32. The ell 32 is connected to a pipe 34 which extends longitudinally in confined space 24, and lon-

gitudinally spaced spray nozzles 36 project from the lower portion of this pipe.

The pipe 34 and nozzles 36 are so disposed, relative to apex 18, that water spraying from the nozzles will strike the interior surface of sidewalls 16 below the openings 26 therein. Intermediate the ends of pipe 30 a tubular tee 38 is provided therein from which a vertical pipe 40 extends upwardly in substantially the center of duct B. The upper end of pipe 40 is closed by a cap 42. A number of vertically and circumferentially spaced spray nozzles 44 are supported from pipe 40 and in communication with the interior thereof.

The openings 26 preferably are provided with shields 46 extending inwardly from the upper and side edges thereof to prevent water from flowing outwardly through the openings. The pipe 34 is of substantial length, and held in a horizontal plane by suitable rigid reinforcing 48, as shown in FIG. 2.

A programmer F shown in FIG. 6 controls the periodic discharge of spray water through the nozzles 36 and 44 to cleanse grease from the interior surface of hood A and duct B, as well as the spraying of water from the nozzles in case of a fire. The programmer F includes a cabinet 50 in which the major portions of the components shown in FIG. 6 are contained.

The electrical system shown in FIG. 5 includes a transformer G that serves to reduce a 110 volt domestic current to a lower voltage, preferably 24 volts that is used in energizing the system. The system also includes a visual, low temperature water sensing unit H which indicates when the water supplied to the spray nozzles 36 and 44 is below a predetermined temperature. Also, included in the system is a visual low detergent level indicator J, an audible alarm K to signal the presence of a fire in the hood A or duct B, and a red alarm light L that is also energized in the case of a fire.

The system further includes a first electrically driven timer M that periodically and automatically causes a spray to be discharged from the nozzles 36 and 44, and a second timer N which may be manually set to cause a spray of water for a predetermined length of time. Control of water to the line 30 is effected by a normally closed solenoid operated valve O. A normally open thermostat P located in the duct B closes when the temperature in the duct rises above a predetermined maximum, with the thermostat together with a first relay Q, causing the valve O to open and to permit water to thereafter discharge through the nozzles 36 and 44 until the temperature in the hood and duct is below that at which grease ignites. The first relay Q, in cooperation with a second relay R and thermostat P, serves to break the circuit to a motor 52 that drives fan D during the time that the thermostat P is in a closed position.

Transformer G includes a primary 52 that is connected by two conductors 54 to a source of domestic electric power. The transformer G is provided with a secondary 56, with one terminal of the secondary being connected to a conductor 58 that extends to a solenoid 60 forming a part of first relay Q. The other terminal of secondary 56 is connected to a conductor 62 that extends to a solenoid 64 forming a part of second relay R.

First relay Q includes an armature 66 which, when solenoid 60 is not energized, is in engagement with a contact 68 from which a conductor 70 extends to solenoid 64 in second relay R. Armature 66 is connected by a conductor 72 to a junction point 58a in conductor 58.

Second relay R includes an armature 74 which, when solenoid 64 is energized, is in engagement with a contact 76 from which a conductor 78 extends to a first terminal of fan motor 52. The second terminal of fan motor 52 has a conductor 80 extending therefrom to a source of electric power 82. Power source 82 is connected by a conductor 84 to armature 74. From the above description it will be seen that fan motor 52 is energized so long as solenoid 60 is not electrically energized only when normally open thermostat P is closed by the elevated temperature of a fire in either duct B or hood A. Of course, if a fire should start in either duct B or hood A, it is

desirable to immediately break the electric circuit to motor 52 and thereby prevent a stream of air from being drawn up the duct to feed the fire.

The valve O that controls the flow of water through the line 30 includes a solenoid 86, which when electrically energized, places the valve in an open position. Timers M and N are connected in parallel by a first conductor 88 that extends to a junction point 58b in conductor 58. A second conductor 90 extends from the timers M and N to a first terminal of solenoid 86. The second terminal of solenoid 86 is connected by a conductor 92 to junction point 62a in conductor 62. When either of the timers M or N is in a closed position an electric circuit is completed to solenoid 86 to open valve O. During the time valve O is open, water discharges from the nozzles 36 and 44.

A second terminal of solenoid 60 of relay Q is connected by a conductor 94 to normally open thermostat P. A conductor 96 extends from junction point 92a in conductor 92 to junction point 94a in conductor 94. Due to the conductor 96, when either timers M or N completes a circuit to solenoid 86 to open valve O, an electric circuit is also completed to solenoid 60 to move armature 66 out of engagement with contact 68. Solenoid 64 is then deenergized, and the electric circuit to motor 52 is broken. It is, of course, undesirable to have fan D operating when water is being discharged from nozzles 36 and 44.

The second terminal of normally open thermostat P is connected by a conductor 98 to junction point 62b in conductor 62. When thermostat P closes due to an elevated temperature from a fire in either the duct B, hood A, or extractor-receptacle E, the solenoids 60 and 86 are energized to break the circuit to fan motor 52 and open valve O. Closing of thermostat P results in the completion of an electric circuit to fire alarm light L through conductors 100 and alarm K through conductors 102. Conductors 102 are connected to conductors 100 at junction points 100a.

The low temperature water sensing unit H is electrically energized through conductors 104 and 106 that extend therefrom to junction points 58g and 62g in conductors 58 and 62. Low detergent level indicator J is electrically energized through conductors 108 and 110 that extend therefrom to junction points 58c and 62c in conductors 58 and 62. From the above description, it will be seen that the valve O may be opened by either the action of timers M or N, or the thermostat P assuming the closed position. In both instances the electric circuit to the fan motor 52 is broken. It will be particularly noted in the above-described circuit that the alarms K and L are electrically energized only when the circuit to solenoid 60 is completed by the closing of thermostat P.

A typical plumbing installation for the invention is shown in FIG. 4. The line 30 is connected to a tubular ell 112 from which a line 114 extends to a valve fitting 116 in which a Venturi passage 116a is formed. A detergent solution is held in a tank 118 having the low level detergent indicator J associated therewith. Detergent solution is drawn from tank 118 through a tube 120 that is connected to the Venturi passage 116a.

The fitting 116 is connected to a line 122 that extends to a tubular riser 124 provided with a vacuum breaker 127 on the upper end thereof. Riser 124 has solenoid operated valve O therein. Line 126, manually operated valve 128, and line 130 provide a bypass around valve O, as shown in FIG. 4. An extension 124a of riser 124 extends to a second manually operatable valve 132. The valve 132, by means of a line 134, is connected to low temperature water sensing unit H. A line 136 extends from unit H to a source of hot water 138 as shown in FIG. 4.

The programmer F is shown in FIG. 6 and includes the cabinet 50, on a forward wall 140 of which the timers M and N are mounted in longitudinally spaced relationship. Situated between the timers M and N on wall 140 are a number of transparent or translucent panels that may be illuminated to indicate a particular event is transpiring. The panels are identified on the drawings by the following numerals and carry the following notations.

Numerals	Notations
142	Reset Timer
144	Program Ready
146	Fan 0 1
148	Fan 0 2
150	Lo Temp.
152	Lo DET
154	Fire
156	Special Wash
158	Program Wash

Illumination of each panel is by an incandescent bulb situated therebehind. The panel 144 is illuminated by a bulb 160 that is connected to conductors 62 and 70 by conductors 164 and 166, as shown in FIG. 5.

An incandescent bulb 168 is disposed behind panel 146, with the bulb being connected to conductors 170 and 172. In the installation as illustrated, there is but one fan, and panel 148 is not used.

Low temperature water sensor H and low detergent sensor J have incandescent bulbs 174 and 176 connected thereto that are illuminated when the sensors detect low temperature and low detergent level. Bulbs 174 and 176 are positioned behind panels 150 and 152.

When thermostat P assumes a closed position, the red alarm light bulb L is illuminated. Bulb L is located behind panel 154. An incandescent bulb 176 178 is wired in series in conductor 90 and is illuminated when timer N is used to initiate a wash cycle. Bulb 178 is situated behind panel 156. A bulb 180 is so connected to conductor 90 as to be illuminated when the wash cycle is initiated by the timer M. Bulb 180 is disposed behind panel 158. Contact 182 of first relay Q is connected by a conductor 184 to junction point 90a in conductor 90.

The use and operation of the invention has been explained previously in detail and need not be repeated. Programmer F, due to being a self-contained unit, may be disposed at any desired location, and is not restricted to being positioned in a kitchen adjacent the hood A and duct B with which it is associated.

I claim:

1. In combination with a hood that includes sidewalls and end walls of substantially the same height that merge on their upper ends into an upwardly extending duct;

a. a grease and water receptacle of V-shape transverse a cross section and of shorter length than said hood longitudinally disposed in a fixed position therein and extending

under said duct, said receptacle having a plurality of longitudinally spaced openings formed in the upper portion thereof through which air, smoke and fumes may flow to said duct, said openings having a total transverse area at least as great as the interior of said duct to permit a free flow of said smoke and fumes to said duct;

b. a first water spray pipe longitudinally disposed at a fixed position in said receptacle, said pipe adapted to spray water on the interior surfaces of said receptacle below said opening;

c. a second water spray pipe extending upwardly from said first pipe and positioned inside said duct, said second pipe adapted to spray water on the interior surface of said duct;

d. first means for supplying heated water to said first and second pipes;

e. second means for metering an aqueous detergent solution into said heated water prior to said water discharging from said first and second pipes;

f. a normally closed solenoid operated valve in said first means;

g. a normally open thermostat in said duct that closes at a temperature above that temperature normally encountered in said duct;

h. electrically driven timer means;

i. first and second relays;

j. at least one electric circuit connected to a source of power, said circuit including said solenoid operated valve, thermostat, timer means and first and second relays, with said thermostat when closed due to being subjected to an elevated temperature energizing said first relay and deenergizing said second relay in such a manner as to complete a portion of said circuit to said solenoid operated valve to open said valve for detergent containing water to be sprayed from said first and second pipes to extinguish any fire in said hood, duct or receptacle, said timer means periodically completing said portion of said circuit to said solenoid operated for a predetermined period of time, and said thermostat when subjected to a temperature less than said predetermined temperature and said timer means after one of said periods for which it is set returning said circuit to a condition where said solenoid valve is deenergized and said motor is energized to drive said blower; and

k. drain means connected to the lower portion of said receptacle through which water and grease flow by gravity to a location remote from said hood.