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3,283,827

HOOD AND DUCT FIRE EXTINGUISHING SYSTEM

Filed Dec. 8, 1964

3 Sheets-Sheet 1

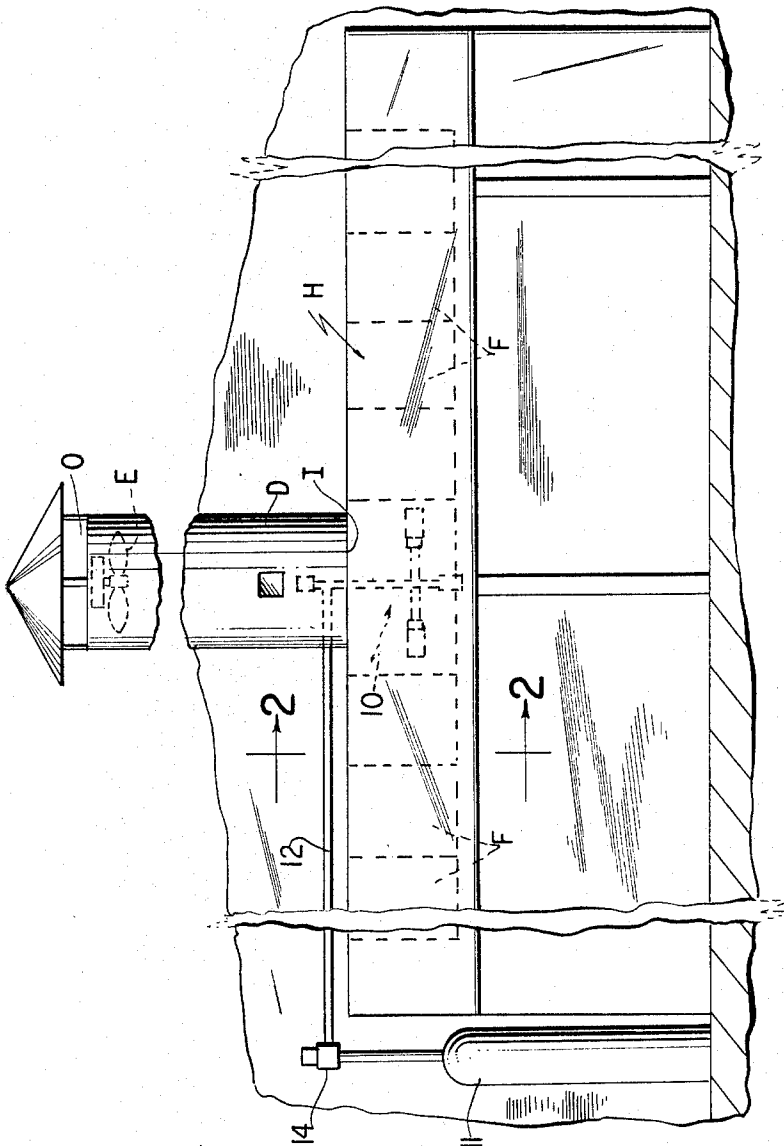


FIG. 1

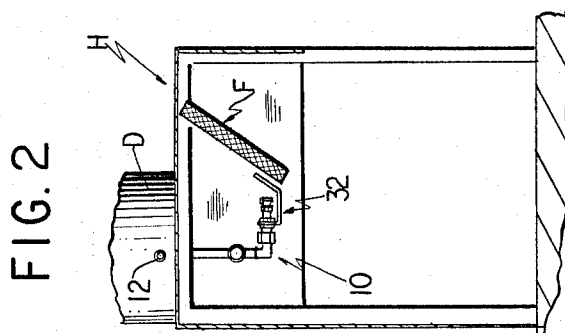


FIG. 2

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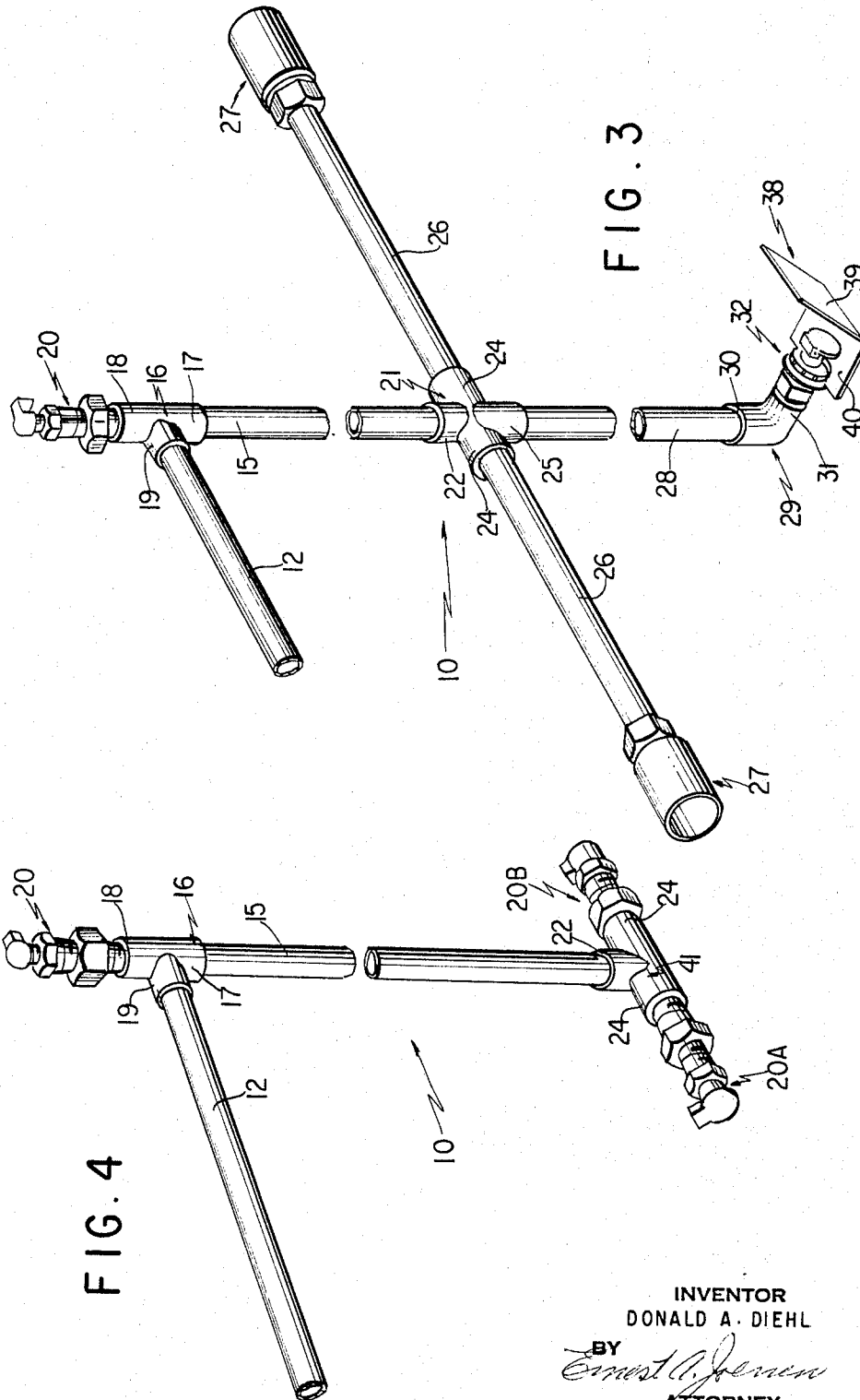
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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

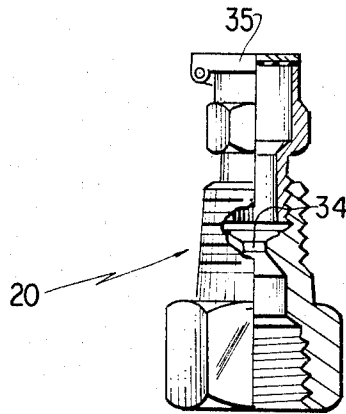


FIG. 5

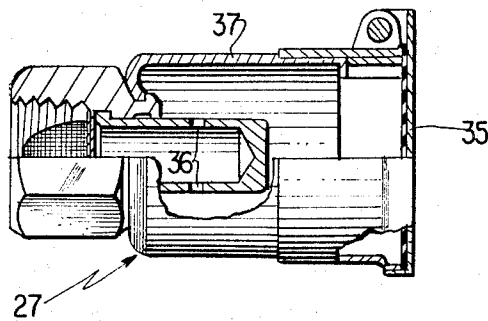


FIG. 6

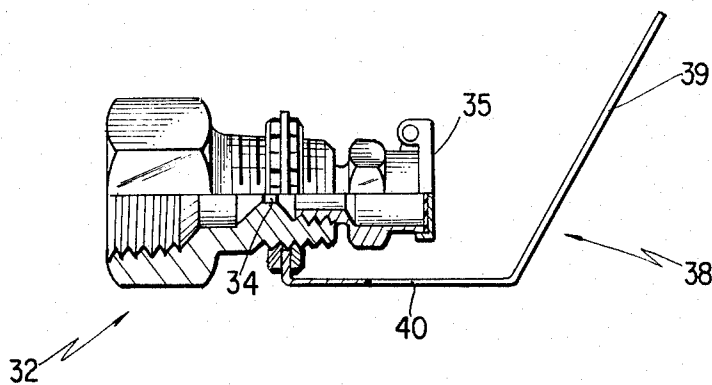


FIG. 7

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HOOD AND DUCT FIRE EXTINGUISHING SYSTEM

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5 Claims. (Cl. 169—2)

The present invention relates to fire extinguishing and, more particularly, to a fire extinguishing system for a restaurant kitchen hood and ventilating duct arrangement.

One form of such an arrangement comprises a hood extending lengthwise across the cooking appliance such as the kitchen range and for entraining heat and cooking odors, a ventilating duct equipped with an exhaust fan and having its inlet between the ends of the hood, and lengthwise extending filter sections depending from the roof of the hood and rearwardly through a vertical plane in which the duct is located whereby air passing upwardly and rearwardly through the hood passes through the filter sections to remove at least a portion of the greasy cooking vapors from the air. These filter sections thereby prevent most of the grease from condensing and being deposited in the duct to avoid a situation where a grease laden duct may cause a fire of a magnitude which is difficult to extinguish.

However, since the exhaust fan in the duct is most effective to entrain air at the inlet of the duct, the filter sections at the midpoint of the hood are saturated with grease more rapidly than the sections nearer the end of the hood and create a hazardous condition at the inlet of the duct.

Accordingly, an object of the present invention is to provide a system for effectively extinguishing fires in a hood and duct arrangement of the foregoing described type. Another object is to provide such a system which is readily installed in existing hood and duct arrangements.

Another object is to provide such a system wherein provision is made for preventing serious fires within the more hazardous zones of such an arrangement.

A further object is to provide such a system wherein the fire extinguishing medium is distributed within the hood and duct in a manner to extinguish a fire of maximum predictable magnitude with a minimum of fire extinguishing medium.

A still further object is to provide such a system which is simple, practical and economical in construction and is reliable in operation.

Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

In the drawings, FIG. 1 is a fragmentary schematic front elevational view of a hood and duct arrangement equipped with a fire extinguishing system in accordance with the present invention.

FIG. 2 is a sectional view taken along the line 2—2 on FIG. 1 illustrating the interior of the hood.

FIG. 3 is a perspective view of one form of fire extinguishing medium distributing head in accordance with the present invention.

FIG. 4 is a perspective view of another form of fire extinguishing medium distributing head in accordance with the present invention.

FIG. 5 is an elevational view partly in section of one form of nozzle for use in the distributing heads shown in FIGS. 3 and 4.

FIG. 6 is an elevational view partly in section of another form of nozzle for use in the distributing head shown in FIG. 3.

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other form of nozzle for use in the distributing head shown in FIG. 3.

FIG. 7 is an elevational view partly in section of a nozzle similar to the nozzle shown in FIG. 5, but provided with a deflector, for use in the distributing head shown in FIG. 3.

Referring now in detail to FIGS. 1 and 2 of the drawings, there is shown a conventional hood and ventilating duct arrangement for a restaurant kitchen which generally comprises a hood H extending across the cooking range or other cooking appliances (not shown), a duct D having an inlet I in the roof of the hood at about its midpoint and having an outlet O at the exterior of the kitchen for discharge of cooking odors to the atmosphere, an exhaust fan E in the duct withdrawing the odor laden air from under the hood, and filter sections F extending lengthwise within the hood for absorbing greasy vapors to minimize contamination of the hood and duct with grease.

The fire extinguishing system shown in FIG. 1 generally comprises a nozzle and conduit means arrangement such as a fire extinguishing medium distributing head 10 in the hood and in vertical alignment with the inlet of the duct, a source of fire extinguishing medium under pressure such as a container 11 of carbon dioxide, a pipe 12 connecting the outlet of the container 11 in fluid flow communication with the inlet of the head 10, and a valve 14 for controlling the discharge of the fire extinguishing medium from the container 11 to the head 10.

The head 10 shown in FIG. 3 comprises a first vertical pipe section 15; a first pipe fitting 16 such as a T having a downwardly facing outlet 17 connected to the upper end of the pipe section 15, an upwardly facing outlet 18 and a side inlet 19 connected to the pipe 12; a first nozzle 20 (FIG. 5) connected to the outlet 18 for directing fire extinguishing medium upwardly into the duct; a second pipe fitting 21 such as a cross having an upwardly facing inlet 22 connected to the lower end of the pipe section 15, a pair of side outlets 24 facing in opposite directions and a downwardly facing outlet 25; a pair of horizontal pipe sections 26 each connected to an outlet 24; second and third nozzles 27 (FIG. 6) each connected to the outer end of a pipe section 26 for directing fire extinguishing in a horizontal direction under the hood and across the inner face of the filter sections; a second vertical pipe section 28 having its upper end connected to the outlet 25 of the cross; and an elbow 29 having an upwardly facing inlet 30 connected to the lower end of the pipe section 28 and having a forwardly facing outlet 31; and a baffled fourth nozzle 32 (FIG. 7) connected to the outlet 31 for directing fire extinguishing medium upwardly and laterally across the inner face of the filter sections at the midpoint of the hood in the manner described hereinafter.

The pipe sections 26 and 28 are of a length to space the nozzles 27 and 32 a sufficient distance apart so that there is only a very slight overlap of the zones in which discharge of these nozzles takes place. Under optimum conditions, these zones cover the entire area of the inner face of the filter sections to effectively extinguish a fire at any point along the length of the filter sections.

The nozzle 20 as shown in FIG. 5 has an orifice 34 between the ends thereof for discharging the fire extinguishing medium directly through the outlet of the nozzle 20. A spring-hinged cover 35 is provided at the nozzle outlet which normally is closed to protect the orifice 34 against contamination or clogging and is opened by the pressure of the fire extinguishing medium during discharge thereof.

The nozzles 27 as shown in FIG. 6 have two diametrically opposite radially outwardly facing orifices 36, and

a tubular shield 37 surrounding the orifice 36 and open at one end for reducing the velocity of the stream of fire extinguishing medium to thereby minimize the entrainment of air into the hood which would otherwise lessen the effect of the fire extinguishing medium to establish an atmosphere incapable of supporting combustion. A hinged cover 35 is provided at the open outlet end of the shield 37.

The nozzle 32 shown in FIG. 7 is similar to the nozzle 20 shown in FIG. 5 except that its orifice 34 is smaller than the orifice 34 of the nozzle 20; and that it has mounted thereon a baffle or deflector plate 38 comprising a flat upwardly and forwardly inclined section 39 in front of the nozzle outlet, and a flat horizontal section 40 under the nozzle outlet for forming a dense fan-shaped stream or sheet of fire extinguishing medium which is directed upwardly and laterally across the filter sections but not downwardly.

Preferably, the orifices of all the nozzles are dimensioned to discharge the fire extinguishing at a predetermined rate at each nozzle.

As an illustrative embodiment, the nozzle orifices have the following dimensions:

Nozzle	Orifice	Diameter, in.	Area, sq. in.	Max. CO ₂ Flow Rate, 70° F., lbs./min.
20	34	0.213	0.0356	75
27	36 (2)	0.104	*0.0170	25
32	33	0.093	0.0067	12.5

*Combined area of two orifices.

In this manner, a sufficient concentration of fire extinguishing agent is supplied as required in the various zones of the hood and duct arrangement. For example, the nozzle 20 has a high flow rate and takes care of only the duct which constitutes one of the major hazards because greasy vapors are continually condensed therein particularly at its lower end near its inlet. Likewise, the nozzle 32 takes care of the filter sections facing the duct inlet which constitutes another major hazard because the effect of the fan to draw greasy vapors through the filter sections is greater at the sections nearest the duct inlet whereby such sections are more heavily saturated with grease than the sections approaching the ends of the hood. However, since this is a relatively small zone, a large amount of fire extinguishing medium is not required.

The nozzles 27 have a lower flow rate but provide sufficient fire extinguishing medium to establish an adequate concentration in relatively large zones between the duct inlet and the ends of the hood. Such concentration can decrease slightly in the direction approaching the ends of the hood because the filter sections also are progressively less greasy in that direction and provide decreasing hazardous conditions.

In operation, extinguishment may be effected while running the fan during initial discharge to create a flow pattern of the carbon dioxide within the hood, shutting down the fan until the fire is out, and then running the fan again to exhaust the hood and draw all of the carbon dioxide through the duct as a final purging precaution. Other tests indicated that extinguishment could be effected with the fan either shut down or running.

The distributor head just described was installed in a hood twenty feet long provided with a duct about seventy feet long. It was found that twenty pounds of carbon dioxide could extinguish a standard hood fire. However, the use of thirty five pounds of carbon dioxide is recommended which at about 70° F. discharged in about 18 seconds. This represents a very substantial saving in the cost of the carbon dioxide required and in the investment of equipment for storing and releasing the carbon dioxide because, according to the latest stand-

ard No. 12 published by the National Fire Protection Association and the National Bureau of Fire Underwriters, 150 pounds of carbon dioxide are required for a twenty foot hood and a sixty foot duct equipped with a more complicated nozzle system.

It is believed that such efficient extinguishment of hood and duct fires can be accomplished because the high flow rate and high velocity nozzle 20 temporarily floods the duct with a sufficient concentration of carbon dioxide to extinguish the fire and to keep the fire extinguished long enough to enable the duct to cool to a temperature which is below the ignition point of the grease. The flow of the carbon dioxide through the duct in effect sweeps out the fire. The nozzles 27 and 32 which have lower flow rates and lower velocities establish and maintain a non-combustion supporting atmosphere within the hood to prevent re-ignition. Thus, by subdividing the available carbon dioxide in this manner, the carbon dioxide is put to use in the most efficient manner.

The head 10 shown in FIG. 4 differs from the head shown in FIG. 3 in that a T 41 instead of a cross 21 has its inlet 22 connected to the lower end of the pipe section and has its outlets 24 directly connected to the second and third nozzles 20A and 20B which are of the same type as the nozzles 20 (FIG. 5); and in that the pipe section 28, the elbow 29 and the fourth nozzle 32 are omitted.

As an illustrative embodiment, the nozzle orifices may have the following dimensions:

Nozzle	Orifice	Diameter, in.	Area, sq. in.	Max. CO ₂ Flow Rate, 70° F., lbs./min.
20	34	0.213	0.0356	75
20A	34	0.125	0.0123	25
20B	34	0.125	0.0123	25

The nozzles 20A and 20B by being close to the midpoint of the hood and within the side edges of the duct inlet provide a sufficient concentration of fire extinguishing medium for the filter sections at the midpoint of the hood and for the zones approaching the ends of the hood in a case where the hood is of substantially lesser length than twenty feet. For example, such a head is effective to extinguish a standard fire in a twelve foot hood with twenty pounds of carbon dioxide which at about 70° F. discharged in about 12 seconds.

From the foregoing description, it will be seen that the present invention provides a novel and improved fire extinguishing system for kitchen hood and duct arrangements or similar installations which system is greatly simplified and uses much less fire extinguishing medium as compared with existing approved systems.

As various changes may be made in the form, construction and arrangement of the parts herein, without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in any limiting sense.

I claim:

1. In a fire extinguishing system for a kitchen hood and ventilating duct arrangement wherein the inlet of the duct is spaced between the ends of the hood and the hood has lengthwise extending filter sections therein, the combination of a first nozzle having its outlet positioned for discharge of fire extinguishing medium upwardly directly into the duct inlet, the second and third nozzles below said first nozzle each having its outlet positioned for discharge of fire extinguishing medium in an opposite horizontal direction within the hood towards one end wall of the hood and across the filter sections, conduit means interconnecting the inlets of all of said nozzles for fluid flow communication, a source of fire extinguishing medium under pressure, a pipe connecting said source to

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said conduit means in fluid flow communication, and means for controlling the discharge of the fire extinguishing medium from said source to said conduit means, whereby a considerable amount of fire extinguishing medium is distributed between the ends of the hood before entering the ventilating duct.

2. In a fire extinguishing system according to claim 1, wherein said nozzles are dimensioned to discharge fire extinguishing medium at predetermined rates.

3. In a fire extinguishing system according to claim 1, including a fourth nozzle below said second and third nozzles and having its inlet connected to said conduit means for fluid flow communication and having its outlet positioned to face forwardly within the hood, said fourth nozzle including means for fanning out fire extinguishing medium upwardly and forwardly under the hood and against the filter sections facing the duct.

4. In a fire extinguishing system according to claim 3,

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wherein said nozzles are dimensioned to discharge fire extinguishing medium at predetermined rates.

5. In a fire extinguishing system according to claim 3, wherein said second and third nozzles each include circumferentially spaced, radially outwardly facing orifices and a tubular discharge directing shield surrounding said orifices for reducing the velocity of the discharged fire extinguishing medium to minimize the entrainment of air.

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