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WASTE GAS PURIFIERS

The present invention relates to waste gas purifiers, in particular for purifying hot gases from cooking.

The waste gases in kitchens, especially in restaurants e.g. Chinese restaurants, and canteens, are often hot, filthy and smell unpleasant and consequently kitchens become difficult to clean, unhealthy and unpleasant.

Thus, it is desirable to remove the waste gases from a cooking area and introduce fresh air in their place. Rather than simply using an air extractor e.g. a fan, in the cooking area a more effective system is required to ensure that waste gases are both removed and unable to return and which minimises the pollution by such gases of the atmosphere outside the kitchen and maintains the kitchen hygienic and agreeable. It is therefore necessary to clean the waste gases before their removal.

The waste gases from cooking generally contain some or all of heat, oil, dirt, steam and smoke and a system is needed which can eliminate these effectively. A system is required for this which is conveniently servicable. The parts which become dirty should preferably be easily accessible for cleaning, repair and replacement.

According to this invention, we propose a waste gas

purifier for purifying waste gas from cooking, comprising water and detergent supply means and a housing, which firstly has an inlet for waste gas, which secondly houses one or more jets oriented so so as to eject a continuous curtain of water and detergent in a
5 direction substantially towards said inlet to emulsify oil in incoming waste gas, at least one angularly movable baffle to receive the treated waste gas, and means for directing the treated waste gas onto the or each angularly movable baffle to separate remaining impurities and the used water from the treated waste gas in order
10 to produce a purified waste gas, and which thirdly also has a first outlet for separated impurities and the used water and a second outlet for the purified waste gas.

We also propose a method of purifying waste gas from cooking, comprising within a housing ejecting from one or more jets a continuous
15 curtain of water and detergent in a direction substantially towards a housing inlet and onto an inflow therethrough of waste gas from cooking to emulsify the oil in the oncoming waste gas, and then directing the treated waste gas onto at least one angularly movable baffle to separate remaining impurities and the used water from
20 the treated waste gas.

An embodiment of this invention is described by way of example and with reference to the drawings, in which:

Fig 1 shows a pumping system of an exhaust gas purifier according to this invention;

25 Fig 2 in a sectional view through a ventilator of the purifier.

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Figure 3 shows the ventilator shown in Figure 2 and pipe lines associated therewith;

Figures 4 and 4b show in detail a baffle of the ventilator;

5 Figure 5 shows in detail a spray nozzle of the ventilator;

Figures 6 to 13 show the electrical circuitry for the system;

10 Figure 14 shows another ventilator having a double inlet;

Figure 15 shows the system in use.

A waste gas purifier according to this invention has a ventilator 1 and a control unit 10. The ventilator housing 1, as shown in Figures 2 and 3 is made of stainless steel 304 and has an access door 2. The ventilator 1, houses one or more rotary baffles 3 as shown in Figure 4 surrounded by partition plates 30 so as to leave space for the entry of waste gas acted on by water and detergent from one or more jets 4. The jet or spray nozzle as shown in Figure 5 is fitted to a square pipe via a mounting and a O-ring. Pipes to the water inlet and from a water outlet 6, as shown in Figure 3, are connected to the control unit. A water-collecting reservoir, an overflow and drain port with a mesh strainer are located in a bottom corner of the ventilator.

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The ventilator also has a waste gas inlet 8, as shown in Figure 2 and a flange is provided for connection thereto of an waste gas outlet duct 9. In an alternative ventilator as shown in Figure 14 the ventilator has a second inlet 8a which has a gap of about 1cm's width. This second inlet can improve the extraction of the oily air by as much as 33%.

The ventilator is securely hung from the ceiling in a kitchen usually over a cooker. The preferred height for the ventilator above a cooking surface is 1070 - 1170 mm.

The control unit 10 shown in Figure 1, comprises a cabinet, also made of stainless steel and having dimensions 720 mm wide, 400 mm deep, 430 mm high, may be fixed to a wall or a floor in the cooking area. It has a panel of control on/off switches with indicators for controlling the system. The cabinet houses a detergent reservoir with a hinged access door and the reservoir has a minimum capacity of two gallons of detergent.

The control unit also houses a pumping system for circulating a mixture of cold water and detergent to the spray nozzle in the ventilator. The control unit also houses a connection to the mains water supply and a control circuit connected to the mains electricity supply which supplies the electricity required for the operation of the system.

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The pumping system comprises firstly a cold mains water inlet line with a water inlet 15 which is actuatable by means of a solenoid-operated valve 6. A reducing valve 7 and a primary pressure indicator 18 together with a mesh, water strainer 9 are located between the solenoid valve and the inlet 11.

The inlet line 11 is connected with firstly a water return and a detergent injection line 12, and secondly a motor pump 13 which has a detergent injector pipe 20 controlled by a solenoid valve in connection via a hose with the detergent reservoir and with an inlet downline from the water return inlet 21 from the water outlet 6 of the ventilator 1. Between the water return inlet and the detergent inlet is sequentially a check valve 22 and a bypass valve 23 for controlling inflow of the water return via a mesh strainer in the ventilator.

The water return and detergent injection line 12 is connected with an outlet line 14 and outlet 24 to the spray nozzle in the ventilator 1 via sequentially a bypass valve 25, an outlet from the pump 26, a secondary pressure indicator 22 and a pressure control 28.

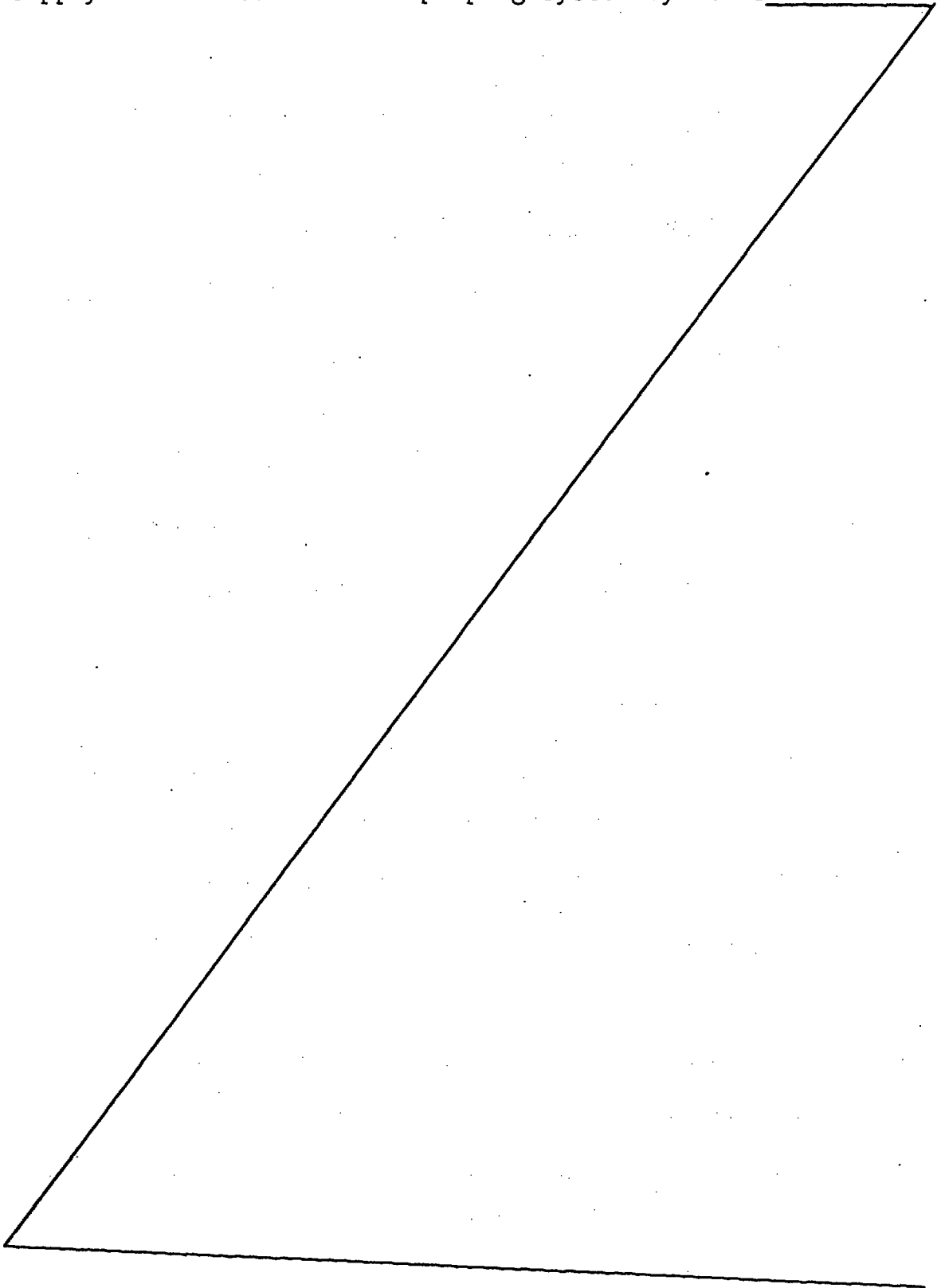
The detergent is in liquid form to combine with the water. It is a non-foam type to avoid foaming, non-corrosive to prevent the interior walls of the pipes being corroded, and it is able to emulsify oil in the waste gas to remove the oil and to prevent the oil fouling the interior walls of the pipe system.

Operation of the system is as follows. Rotation of the angularly movable baffle, which is electrically operated, should be started before the water is

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allowed into the system. The baffle must be run
continuously during the process. Cold water from the mains
supply is allowed into the pumping system by means



of the solenoid valve 16 and flows to the spray nozzle in the ventilator. The preferred primary indicator pressure reading is 2.5 kg/cm^2 during this stage and the pump is actuated at a preferred pressure of 1 kg/cm^2 (read from the secondary pressure indicator).

The water is allowed to spray in the ventilator for 60 seconds and is collected in the reservoir and returned to the pumping system. The water inlet solenoid valve 16 is closed after 60 seconds and the water supplied is then circulated in the system for a period of 1 hour. After the initial period of 60 seconds, the detergent is added for a period of 60 seconds on opening of the detergent solenoid valve. The preferred detergent volume feed rate is $4 \text{ cm}^3/\text{hr}$ per spray nozzle.

The periods for the stages of the cycle are controlled by an automatic timer and may be altered if desired but once the system is switched on by means of an on/off switch, the operation of the system is automatic.

The waste gas emitted from a cooking surface is collected in a chamber 29 in the ventilator and flows rapidly into the main interior of the ventilator. The spray nozzle provides a jet stream of water and detergent which forms a continuous curtain across the path of inflowing waste gas and when a stream of waste gas containing oil strikes against the water curtain at high speed, oil and other undesired matter in the waste gas are removed by centrifugation.

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After this the waste gas is directed by the partition plates 30 into the moving baffle/s and remaining impurities together with the detergent droplets from the spray nozzle are removed and the resulting purified waste gas passes out of the ventilator into the exhaust duct 9. The separated impurities are drained out of the ventilator from the port 7.

This 61 minute cycle is repeated as often as required and may be stopped using the on/off switch. Servicing of the system is carried out as follows.

Almost all oil in the waste gas is separated therefrom by the above process but some oil does accumulate in the equipment and hence, the parts must be regularly cleaned. The line strainer in the return line may be cleaned daily by washing. The inside of the ventilator, the spray nozzles and the rotary baffles and partitioning should be cleaned at least monthly. The reservoir should be cleaned at least weekly because impurities such as dust or metal particles would be likely to cause malfunction of the pump and solenoid valves. The ventilator should be checked daily to see that the spray nozzle, baffle and partitions are not malfunctioning or out of position. The end of each spray nozzle should be able to direct a water curtain across the inflowing waste gas.



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CLAIMS

1. A waste gas purifier for purifying waste gas from cooking, comprising water and detergent supply means and a housing, which firstly has an inlet for waste gas, which secondly houses one or more jets oriented so as to eject a continuous curtain of water and detergent in a direction substantially towards said inlet to emulsify the oil in incoming waste gas, at least one angularly movable baffle to receive the treated waste gas and means for directing the treated waste gas onto the or each angularly movable baffle to separate remaining impurities and the used water from the treated waste gas in order to produce a purified waste gas, and which thirdly also has a first outlet for separated impurities and the used water and a second outlet for the purified waste gas.
2. A waste gas purifier according to claim 1, having one or more plates to direct the waste gas onto the or each baffle.
3. A waste gas purifier according to claim 1 or 2, having means for automatically controlling the supply and recirculation of water and detergent.
4. A waste gas purifier according to claim 1, 2 or 3, wherein the first outlet includes means for collecting the used water and separated impurities.
5. A waste gas purifier according to claim 4, wherein in the collecting means comprises a mesh strainer.
6. A waste gas purifier according to any preceding claim, wherein the housing has a second inlet for the



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waste gas which is located above the first inlet and has a width of about 1 cm.

7. A waste gas purifier according to any preceding claim, wherein the housing has a door for gaining access to the interior of the housing.
8. A waste gas purifier according to any preceding claim, wherein the detergent is in the form of non-corrosive and non-foaming liquid.
9. A method of purifying waste gas from cooking, comprising within a housing ejecting from one or more jets a continuous curtain of water and detergent in a direction substantially towards a housing inlet and onto an inflow therethrough of waste gas from cooking to emulsify the oil in the incoming waste gas, and then directing the treated waste gas onto at least one angularly movable baffle to separate remaining impurities and the used water from the treated waste gas.
10. A method according to claim 9, wherein the water and detergent is re-circulated for a predetermined time.
11. A method according to claim 9 or 10, operating on a 61 minute cycle wherein the baffle rotates constantly, the water is supplied for the first minute, the detergent is supplied for the second minute and the water and detergent is recirculated for the remaining time.



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A method according to claim 9, 10 and 11, wherein the rate of supply of detergent is $4 \text{ cm}^3/\text{hr}$ per jet.

A waste gas purifier constructed and arranged substantially as herein described with reference to any of the figures

5 of the drawings.

A method of purifying waste gas from cooking substantially as herein described with reference to any of the figures of the drawings.
