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(54) **METHOD OF TREATING OILY SMOKE, FUMES, VAPOR OR ORDORS**

(76) Inventor: **Zongyan He**, Kendall Park, NJ (US)

Correspondence Address:  
**ZONGYAN HE**  
**20 Kady Lane**  
**Kendall Park, NJ 08824 (US)**

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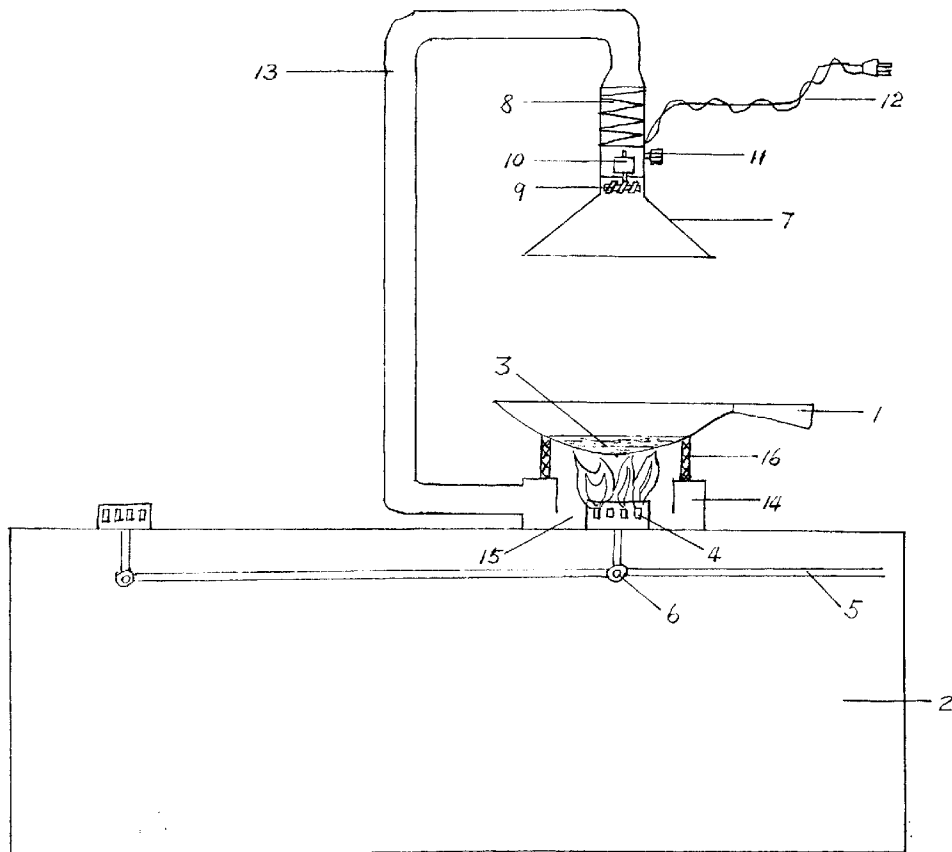
(51) **Int. Cl.<sup>7</sup> ..... F24C 15/32**

(52) **U.S. Cl. .... 126/299 D; 126/299 R; 126/21 R**

(57) **ABSTRACT**

The invention relates to a method for treating oily smoke, fumes, vapor or odors produced when cooking. According to this method, the oily smoke, fumes, vapor or odors coming from cookers placed over an oven will be drawn and mixed with a part of air to form gaseous mixture under the action of drawing fan. Then, the formed gaseous mixture will be forced to enter at least one preheating region. In the said

preheating region, the said gaseous mixture is preheated. After preheated, the said gaseous mixture is forced to enter at least one heating source region of the said oven. A part of thermal energy provided by the heating source located in the center of the said heating source region is used for preheating the said gaseous mixture filling in the said preheating region. In the heating source region the temperature of the preheated gaseous mixture will raise to a high enough level so that the pollutants contained in the said gaseous mixture can be decomposed and/or fully reacted with the oxygen in the gaseous mixture. A part of thermal energy provided by the said heating source is used for initiating and/or accelerating the decomposition and/or oxygenation of the pollutants. Then, the products of the said decomposition and/or oxygenation reactions and the un-reacted matter contained in the said gaseous mixture are discharged from the said heating source region by passing through at least one filter. In the present invention, the said heating source can be a gas, fuel oil, electric or coal range. When the heating source is gas, fuel oil or coal range, the oxygen contained in the said gaseous mixture can accelerate and improve the combustion of gas, fuel oil or coal. On the other hand, the oxygenation of pollutants contained in oily smoke, fumes, vapor and odors can also have some contribution to maintain the high temperature of the said heating source region because their oxygenation reactions are all exothermal reactions.



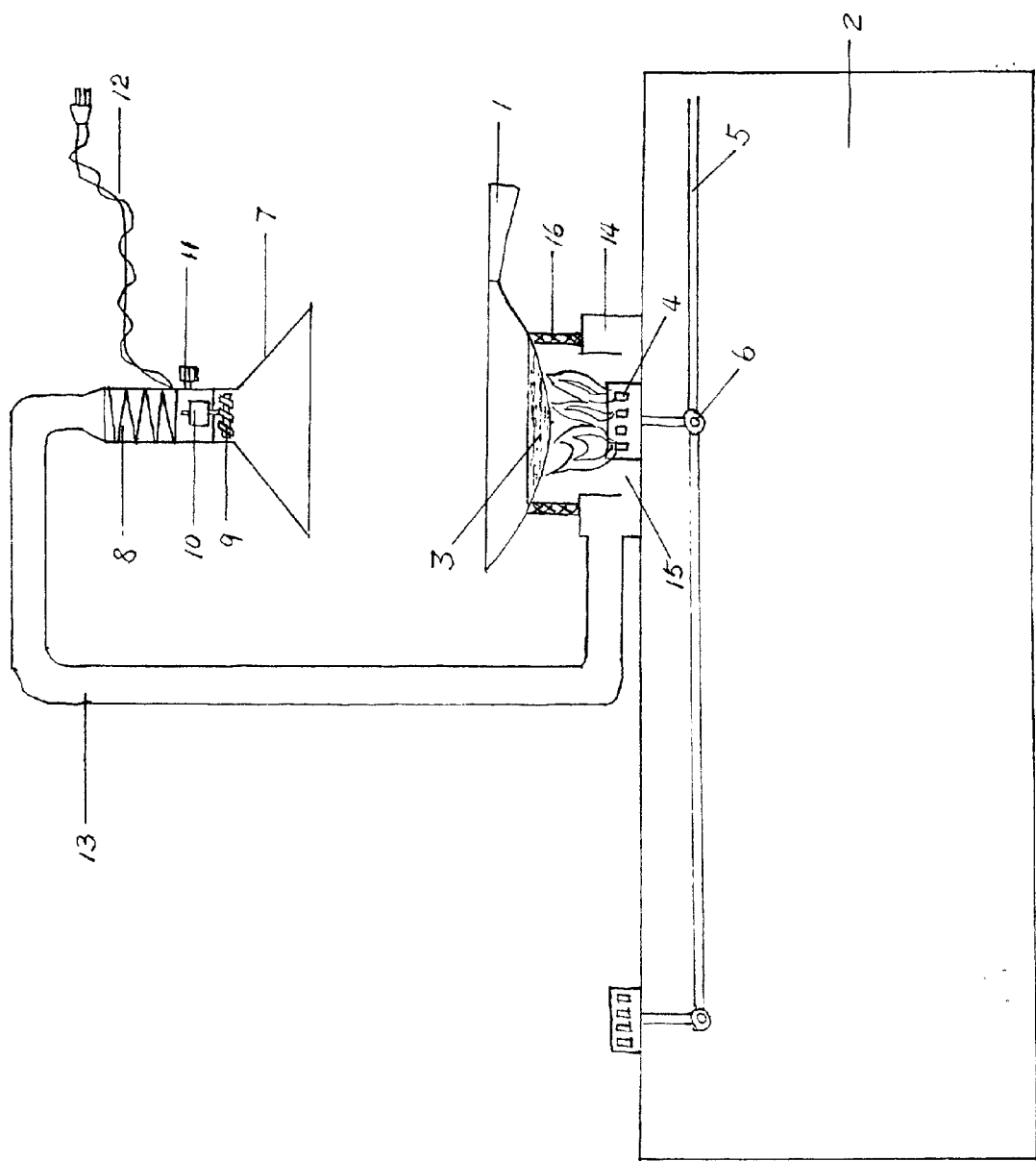


Figure 1

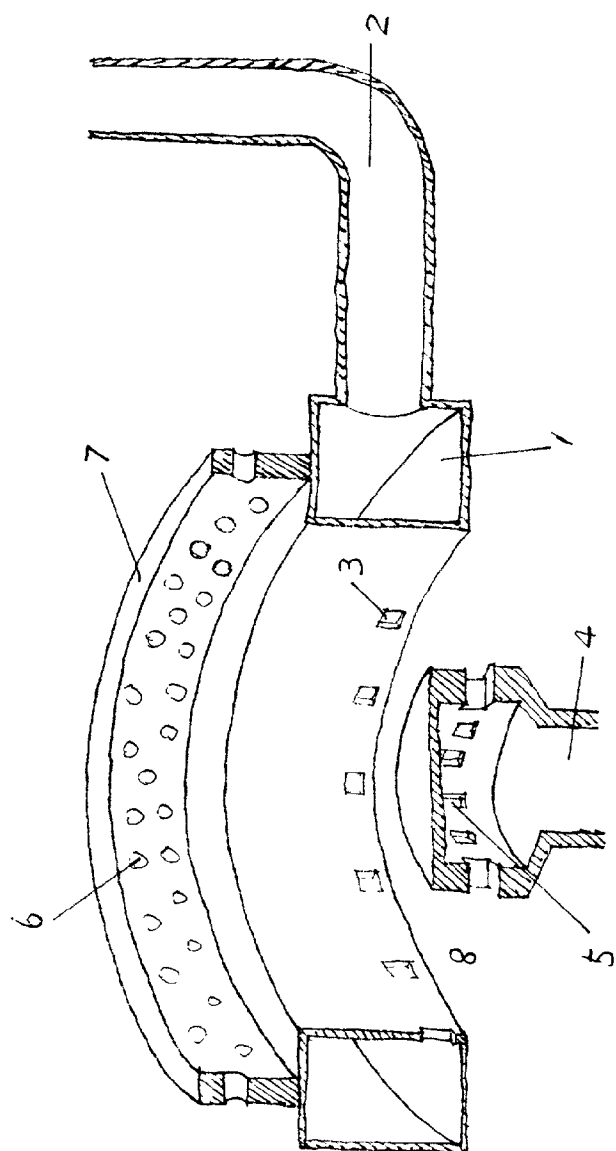


Figure 2

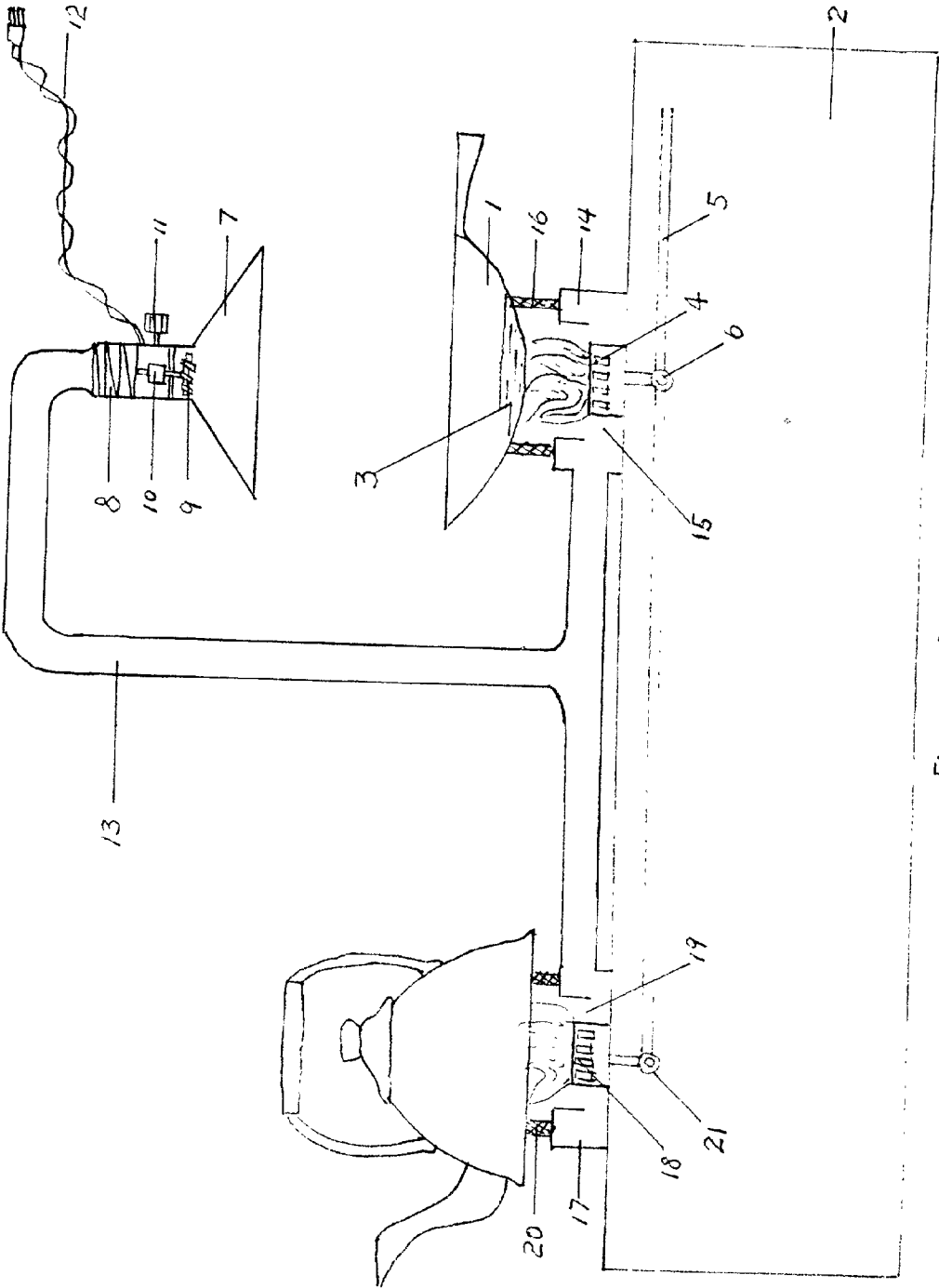


Figure 3

METHOD OF TREATING OILY SMOKE, FUMES, VAPOR OR ORDORS

CROSS-REFERENCE TO RELATED APPLICATION

[0001] REF-CITED: U.S. and French PATENT DOCUMENTS (please see Form P.T.O.-1449)

2,224,945	7/1937	*B. Ames	55#42
2,106,935	10/1972	*Damon Frede	F24f 13/00
4,235,220	11/1980	*R. J. Hepner	98/115R
4,929,258	5/1990	*Wang	55#86
5,027,790	7/1991	*Sheng	126#299R
5,154,742	10/1992	*William	55#26B
5,359,990	11/1994	*Hsu	126#299E
5,470,365	11/1995	*Jang	55#510
5,601,072	2/1997	*Hsu	126#299E

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not Applicable

REFERENCE TO A MICROFICHE APPENDIX

[0003] Not Applicable

BACKGROUND OF THE INVENTION

[0004] Most activities of humanity are carried out indoors. The pollution of indoor environment can cause many kinds of disease. Preventing indoor environment pollution has been paid great attention during the past decades around the world. Oily smoke, fumes, vapor or odors and organic foul gases are main indoor pollution sources.

[0005] When cooking temperature is over 130° C., oily smoke will be formed from either animal oil or vegetable oil. The oily smoke can fill the air and harm the human respiratory system and circulatory system. Especially, when the cooking temperature reaches 230° C.-280° C., some carcinogens will produce from vegetable oily smoke. In Taiwan and Chinese mainland, housewives have much bigger possibility of lung cancer and esophagus cancer than occupational women do. The reason is that housewives often cook and most Chinese families like stir-fried foods, for which the vegetable oil must be heated to a higher temperature. So a great quantity of oily smoke and fumes can be formed and inevitably absorbed by the housewives. The irritative vapor or odors produced from pepper, Chinese prickly ash or other flavorings is also harmful to the housewives.

[0006] In order to remove the oily smoke, fumes, vapor or odors produced when cooking, the conventional method is drawing them with a powerful exhaustor assembled above the cooker, then discharging them into outdoor atmosphere or into sewers. This method has several shortages.

[0007] First, in order to discharge the oily smoke, fumes, vapor or odors into outdoor atmosphere or sewers a complex pipe system connecting exhaustor and chimney or sewer needs to be designed and built when building a new house, which must increase the cost of the house. If purchasing a house without the pipe system, the host has to rebuild it spending a lot of time and money. If renting this kind of house, the tenant either change his or her dietary habits,

which is very uncomfortable for Chinese, Vietnamese, Thailand or other Asia people who like fried foods, or endures the suffering caused by oily smoke, fumes, vapor or odors.

[0008] Second, in order to decrease the harm of oily smoke, fumes, vapor or odors, doctors suggested that the height from the drawing fan to the cooker should be as small as possible (not over 40 cm) in order to exhaust the oily smoke, fumes, vapor or odors more completely. However a so small height must hinder the cooking operation. A good idea is that the height can be changed very easily. In other words, at the beginning of cooking when a great quantity of oily smoke, fumes, vapor or odors occurs, we can let the exhaustor very close to the cooker. After pouring foods into the cooker, we can raise the exhaustor for the convenient operation because the quantity of oily smoke, fumes, vapor or odors at that time has been reduced very much. Unfortunately, the height of existing oily smoke exhaustors can not be changed after installed and connected with the pipe system.

[0009] Thirdly, a great quantity of oily smoke, fumes, vapor or odors discharged from kitchens and restaurants will result in serious air and water (if the smoke is discharged from sewers) pollution. Especially, the oily smoke, fumes, vapor or odors may enter the windows or balconies of neighbors' houses.

[0010] Finally, the whole pipe system and the drawing machine will inevitably be polluted by residual oily liquid. After using for a period of time, in general, four or five weeks, the users had to ask professionals to dismount the system and machine in order to clean them, then assemble the same. This work is obviously time-consuming, labor-some and expensive.

[0011] In order to solve the latter two problems as above mentioned, many inventors proposed a variety of methods. U.S. Pat. No. 4,929,258 disclosed a method used to purify oily smoke pollution, according to the method the smoke pollutant can be introduced to several hollow tanks filled with plenty of water droplets, then contact with these water droplets to condense inside tanks and can be purified without smoke and odor. U.S. Pat. No. 5,027,790 described an oil-removal structure for range hoods, in which a water container formed integrally with an air-guiding case receiving two fans. At least one electric thermal element downwardly passes a top house and extends into the water container to heat the water. The oily residual can be melted and drop down to a collector. U.S. Pat. No. 5,154,742 described an oil mist and a smoke collector, from which the contaminated air is driven against a planar impingement plate arranged to be struck with a glancing blow of such force as to remove a substantial portion of the contaminates by impact. U.S. Pat. No. 5,359,990 proposed a similar oily smoke treating and exhaustive device for cooking equipment. It has an upper smoke housing, two vertical passage-ways formed by three vertical plates extending down and up from the housing for oily smoke produced in cooking to be showered with water to let oil in the smoke be mixed with water and drop down into a separating tank. U.S. Pat. No. 5,470,365 disclosed a smoke exhaustor. A filtration member is disposed in the exhaustor to purify the fume so as to reduce the discharge of the air pollutant into the atmosphere. U.S. Pat. No. 5,601,072 suggested an atomizing device for oily smoke. Oil contained in the oily smoke can be separated

into oil particulate when passing through several atomizing plates mounted in the passage. A water tube is disposed above the atomizing plates for absorbing the oil particulate, then, the oil becomes liquefied oil that is drained.

**[0012]** If using the above methods to reduce the pollutants contained in the oily smoke, one has to add some complex equipment, such as the cooling condenser system and the atomizing device described in U.S. Pat. No. 5,601,072. So the cost and maintenance charge must increase greatly. When using these methods shown in U.S. Pat. No. 4,929,258, U.S. Pat. No. 5,027,790, U.S. Pat. No. 5,154,742, U.S. Pat. No. 5,359,990 and U.S. Pat. No. 5,601,072, although one does not need to mount specially complex devices, only part of the pollutants contained in the discharged oily smoke can be removed. If using the filtering methods described in U.S. Pat. No. 5,470,365, the flow of oily smoke driven by the exhauster will decrease greatly, so more powerful drawing fans will be necessary. The cost of product and the maintenance fee can also rise. In especial, all of the above mentioned methods can not solve the first two problems of existing oily smoke exhauster, i.e. the complex pipe system and the unchangeable height from the cooker to the drawing fans. Besides, the noise caused by the exhauster is still a problem. As we all know, the longer and more complex the pipe system is, the more powerful the exhauster should be, the bigger the noise must be.

**[0013]** U.S. Pat. No. 4,235,220 mentioned another cooking stove exhaust system, in which an activated charcoal filter was used to purify air contained oily smoke. An electric heat element was used to activate the charcoal at selective intervals of time, but not for treating the oily smoke directly. U.S. Pat. No. 2,224,945 described a cooker, in which an electrically energized source of glowing radiant energy was located in the upper part of the cooking chamber. The radiant heat coming from the electric element was used for cooking. On the other hand, the radiant heat within the cooking chamber was also used to clean the odor, fumes or smoke producing from cooking. The cooker has a complex construction and a special electric element with a high power (should be over 1,000 Watt for reaching 1500 to 1700 F), which may cause safety problems. Especially, the cooking operation, such as mixing food, frying other side of a fish, is very difficult by using this cooker. When opening the cover of the chamber for cooking operation, we will endure the oily smoke and the cooker will lose its self-cleaning function. Since the chamber must be closed when cooking, another shortage of this invention is obvious. It is that the oxygen in the chamber is not enough for oxygenating the oily smoke and odor even though the temperature in the chamber may be very high. If the oxygen is not enough, a certain amount of carbon monoxide may produce, which is very harmful to the operator.

**[0014]** French patent 2,106,935 described a device for evaporating fumes, vapor, gas or odors directly or through a ventilation pipe. The drawn fumes, vapor, gas and odors are forced to pass through a high temperature region, in which the high temperature is maintained by an extra electrically heating element. Therefore, the device needs an extra heating energy source. In order to obtain a better cleaning effect, the temperature maintained in the said region must be high enough, the electrically heating source must have a higher power, in general, higher than 1,000 Watt. It is energy consuming and may cause some safe problems. Another

problem is the said heating region must long enough. Because the decomposition or oxygenation of fumes, vapor, gas and odors can not be finished in a short time. The long and hot pipe may cause other problems, such as mounting, space limitation, thermal pollution and safety.

#### BRIEF SUMMARY OF THE INVENTION

**[0015]** The present inventor has noticed the above mentioned annoying problems when using existing oily smoke exhausters to remove indoor pollution, and come up with a solution by designing a novel method and related devices used to effectively purify oily smoke, fumes, vapor or odors.

**[0016]** The invention relates to a method for treating oily smoke, fumes, vapor or odors produced when cooking. According to this method, the oily smoke, fumes, vapor or odors coming from cookers placed over an oven will be drawn and mixed with a part of air to form a gaseous mixture under the action of drawing fan. Then, the formed gaseous mixture will be forced to enter at least one preheating region. In the said preheating region, the said gaseous mixture is preheated. After preheated, the said gaseous mixture is forced to enter at least one heating source region of the said oven. In general, the heating source of the said oven is surrounded with the said preheating region, through which the said heating source region can be formed between the said heating source and the said preheating region. A part of thermal energy provided by the said heating source located in the center of the said heating source region is used for preheating the said gaseous mixture filling in the said preheating region. After enter the said heating source region the temperature of the said gaseous mixture will raise to a high enough level so that the pollutants contained in the said gaseous mixture can be decomposed and/or fully reacted with the oxygen contained in the said gaseous mixture. A part of thermal energy provided by the said heating source is used for initiating and/or accelerating the decomposition and/or oxygenation of the pollutants. Then, the products of the said decomposition and/or oxygenation reactions and the un-reacted matter contained in the said gaseous mixture are discharged from the said heating source region by passing through at least one filter.

**[0017]** In the present invention, the said heating source can be a gas, fuel oil, electric or coal range. When the heating source is gas, fuel oil or coal range, the oxygen contained in the said gaseous mixture filling in the said heating source region can accelerate or improve the combustion of gas, fuel oil or coal. On the other hand, the oxygenation of pollutants contained in oily smoke, fumes, vapor and odors can also have some contribution to maintain the higher temperature of the said heating source region because these oxygenation reactions are all exothermal reactions. The higher the power of the heating source is, the higher the temperature of the cooker will be, the more the quantity of oily smoke, fumes, vapor or odors will be, thereby, the more the thermal energy contribution produced from these oxygenation reactions must be.

**[0018]** The first object of the present invention is to provide a simple method for treating oily smoke, fumes, vapor or odors. As compared with existing methods and devices, it can omit the complex pipe system mounted for connecting the exhauster with chimney or sewers describing in the above mentioned patent documents. The pollutants

contained in the oily smoke, fumes, vapor or odors can be decomposed and/or oxygenated during passing through the said heating source region of the oven. The products of these reactions and un-reacted matters can be discharged directly from the said heating source region without any need of pipe system or special outlet.

[0019] The second object of the present invention is to provide a simple method for removing oily smoke, fumes, vapor or odors. Based on this method, an adjustable remover can be designed, when using it the distance between the cooker and the drawing fan can be adjusted easily for various needs. When a great quantity of oily smoke, fumes, vapor or odors, such as deep-frying fishes, the drawing fan can be adjusted to close the cooker. For common frying, the fan can be raised to keep a bigger distance from the cooker for the convenient operation.

[0020] The third object of the present invention is to provide an effective method to more thoroughly remove the pollutants contained in oily smoke, fumes, vapor or odors through chemical decomposition and/or reaction not physical methods, such as those shown in the above mentioned patent articles. The products of these reactions and un-reacted matter discharged from the said heating source region contain little pollutants and have little harm to user's family and his or her neighbor.

[0021] The fourth object of the present invention is to provide a simple method for treating oily smoke, fumes, vapor or odors. By using it the heavy work of cleaning the complex pipe system can be avoided. The device design based on this method can be disassembled easily for clean.

[0022] The fifth object of the present invention is to provide a convenient method for treating oily smoke, fumes, vapor or odors. According to this method any cooking operation will not be affected. The device designed based on the method can be moved to different ovens or heating sources very easily. Compared with the method and device described in U.S. Pat. No. 2,224,945, the present method and device do not need any cover for closing the cooker. Therefore, the cooking operation will be convenient.

[0023] The further object of the present invention is to provide a safe, noiseless and energy-saving method for treating oily smoke, fumes, vapor or odors. It does not need any special or extra heating source to treat these pollutants as that shown in French Pat. No. 2,106,935.

#### BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

[0024] FIG. 1 is a perspective view of one of the devices designed based on the present invention, which is used to purify the oily smoke, fumes, vapor or odors produced from a cooker placed over an oven. The gaseous mixture of air and oily smoke, fumes, vapor or odors is drawn by a drawing fan and sent to the preheating region, then enter the heat source region of the oven for decomposition and/or oxygenation. After cleaned, the said gaseous mixture is discharged from the said heating source region through a filter. In this case, the said heating source of the oven is a gas range. Therefore, the said heating source region is, in fact, a gas combustion region.

[0025] FIG. 2 is a 3-D section view of the heating source region shown in FIG. 1, in which the said heating source is a gas range and the said heating source region is, in fact, a gas combustion region.

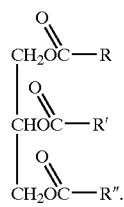
[0026] FIG. 3 shows a perspective view of another design based on the present invention, which is used to purify the oily smoke, fumes, vapor or odors produced from a cooker placed over an oven. In this design the said gaseous mixture of air and oily smoke, fumes, vapor or odors is drawn by a drawing fan, then enter two preheating regions for preheating, and then enter two heating source regions for decomposition and/or oxygenation. After cleaned, the said gaseous mixture is discharged from the said heating source region through filters. In this case, both of the heating sources are gas ranges, the said heating source regions are two separate gas combustion regions.

#### DETAILED DESCRIPTION OF THE INVENTION

[0027] As shown in FIG. 1, the principle of the present invention can be described as follows. Cooker 1 is placed over oven 2. Edible oil 3 is heated in the cooker 1. The cooker 1 is heated by gas flame. The gas is provided by gas range 4 through gas pipe 5 and valve 6. The oily smoke, fumes, vapor or odors and a part of air will be mixed to become a gaseous mixture and drawn into hood 7, then entered flexible pipe 8 under the action of drawing fan 9. The drawing fan is driven by electric motor 10 and controlled by switch 11. The needed electric power is provided through power cord 12. After passing through pipe 8, the said gaseous mixture is forced to enter pipe 13. After passing through pipe 13, the said gas mixture is forced to enter the preheating region 14. The gas range 4 is surrounded by the preheating region 14, through which the heating source region, i.e. the gas combustion region 15 is formed between the gas range and the preheating region. After preheated in the said preheating region, the said gaseous mixture is forced to enter the said gas combustion region 15. In the said gas combustion region a higher temperature can be maintained due to the combustion of gas. A part of combustion thermal energy can be used to preheat the said gaseous mixture filling in the preheating region 14. A part of combustion thermal energy can be used to initiate and/or accelerate the decomposition and/or oxygenation of the pollutants contained in the said gaseous mixture. If the temperature of the said gaseous mixture filling in the said gas combustion region 15 is high enough, the decomposition and/or oxygenation of pollutants can be carried out fully and completely. Then, the harmless products of these reactions and un-reacted matters contained in the said gaseous mixture, such as nitrogen, will be discharged from the said gas combustion region 15 by passing through filter 16. After finishing the cooking, the gas pipe valve 6 will close and the combustion of gas will stop. However, the drawing fan 9 will continue to work for a while to draw the remains of oily smoke, fumes, vapor or odors coming from cooker 1. When the said remains enter the said gas combustion region 15, the after-heat in the region will continue to help the decomposition and/or oxygenation of the remains. Finally, the electric power switch 11 will turn off and the drawing fan 9 will stop.

[0028] The function of the high temperature in the said heating source region is to initiate, guarantee or promote the decomposition and/or oxidizing reactions of the pollutants. The higher the temperature is, the more completely the reactions will be carried out, and the bigger the reaction rates will be. In general, the temperature in the region should not be lower than about 200° C. As we all know that the main composition elements in many organic substances, including

all kinds of edible oils, are hydrogen, oxygen and carbon. The general formula of pure nature edible oil can be written as



[0029] Here R, R' and R" denote different hydroxyl groups composed of carbon and hydrogen atoms. Therefore, the oil smoke, fumes, vapor, odors or other pollutants produced from the heated edible oil and all intermediate products of the decomposition reactions of edible oil are all composed of carbon, hydrogen and oxygen atoms. If these substances can be oxidized completely in the said heating source region, the final resultants discharged from the said heating source region will be water and carbon dioxide. The un-acted nitrogen contained in the said gaseous mixture will also be discharged at the same time. The basic oxidation reaction formula of these substances can be written as

$$\text{C}_x\text{H}_y\text{O}_z + (x+y/4)(\text{O}_2 + 3.76\text{N}_2) = x\text{CO}_2 + y/2\text{H}_2\text{O} + (3.76x+0.94y)\text{N}_2 \tag{1}$$

[0030] Here x, y and z denote the numbers of carbon, hydrogen and oxygen atoms in the organic substance respectively. The above reaction is an exothermic reaction. The thermal energy provided from the reaction is helpful to keeping the high temperature in the said heating source region. However, if the oxygen is not enough, a certain amount of carbon monoxide may produce based on the following reaction.

$$\text{C}_x\text{H}_y\text{O}_z + [(x+w)/2 + y/4](\text{O}_2 + 3.76\text{N}_2) = (x-w)\text{CO}_2 + w\text{CO} + y/2\text{H}_2\text{O} + [1.88(x+w) + 0.94y]\text{N}_2 \tag{2}$$

[0031] in which w denotes the molar number of the carbon monoxide. Carbon monoxide is very harmful, by using powerful drawing fan the present invention can guarantee the full supply of oxygen. A great quantity of oxygen entered the heating source region can also accelerate and improve the combustion of gas, fuel oil or coal when the heating source of the oven is gas, fuel oil or coal range.

[0032] A series of composition analyses on the air near the inlet of hood 7 and the outside of the said filter 16 have been done. The results show that the purification effect depends mainly on the temperature T of the said gas combustion region, the duration t that the gaseous mixture keeping in the region and the relationships between T and t. For example, if the cooker is larger, the amount of the edible oil is more or the temperature of the oil is higher, the amount of the oily smoke must be more than that when using a smaller cooker containing little oil with a lower temperature. Thus more powerful drawing fan is needed to draw the more oily smoke efficiently. However, due to the faster flow speed of the gaseous mixture, t will be shortened. In order to guarantee a complete purification of oily smoke, T should be higher, for which the gas valve 6 should open bigger. In general, the more the amount of the oily smoke, fumes, vapor or odors is, the bigger the gas flow should be, the higher power of the

drawing fan should be and the higher the temperature T will be. Experiments show, provided having the suitable T and t, the gaseous mixture discharged from the heating source region contains little oil smoke, fumes, vapor, odors, or other pollutants. However, if the flow of the gaseous mixture in pipe 13 is too bigger and the flow of gas in gas pipe 5 is too small, the combustion will not be good because the combustion of gas will be interfered even the flame can be distinguished by the bigger flow coming from the preheating region 14. Therefore, controlling the flow of gas and the power of drawing fan is important. The following Table (1) shows several experimental results corresponding to various drawing fan powers.

TABLE (1)

Edible oil	pure corn oil	pure corn oil	pure corn oil
Oil temperature	120° C.	135° C.	155° C.
Motor power	10 W	15 W	20 W
Temperature of heating source region	>200° C.	>235° C.	>250° C.
Concentration (mol/cm <sup>3</sup> ) of substances containing in the discharged gaseous mixture:			
Oil vapor	1.1 × 10 <sup>-5</sup>	2.7 × 10 <sup>-5</sup>	0.5 × 10 <sup>-5</sup>
Carbon monoxide	0	0	0
Oxides of nitrogen	0	0	0
Other pollutants	0	0	0

[0033] In this design, the pipe 13 has an extra function. It can be used as a supporting arm to support the weight of hood 7, drawing fan 9, motor 10, switch 11 and the flexible pipe 8. The said flexible pipe 8 can be lengthen and shorten easily to adjust the height of hood 7 for suiting various cooking operations.

[0034] Based on the above principle and experiments, the present invention has the following advantages compared with existing oily smoke exhausters. First, it is not necessary to assembly a pipe system for connecting the exhauster with chimney or sewer. The gaseous mixture purified by the device designed based on the present invention can be discharged indoors, which is very convenient to Chinese, Vietnamese, Thailand or other Asian people who like fried food when they design, purchase or rent houses. Second, due to the omission of the pipe system, the distance from the drawing fan to the cooker can be adjusted by hand very easily. So the oily smoke, fumes, vapor or odors can be drawn more completely. Also, the cooking operation will not be affected according to the present invention. The third advantage is that the serious air and water pollution caused due to using the existing exhausters can be avoided by using the present invention. One does not worry whether the oily smoke or irritative gases will enter his or her neighbors' houses. Due to without complex pipe system, the device design based on the present invention can be moved to different oven easily. Due to without the long and complex pipe system, the drawing fan can be designed having a lower power, so the noise caused by the drawing fan can be reduced greatly. Especially, most of oily smoke can be oxidized into carbon dioxide and water. Only the internal surface of the said hood needs to be cleaned after the device was used for a period. But the hood can be dismantled and assembled so easily that the users can do the work themselves and do not ask professional people to help them. So the clean work is no longer time-consuming, labor-some and expensive when using the present invention. Finally, the

present invention provides a safe and energy-saving method for treating oily smoke, fumes, vapor or odors. It does not need any special or extra heating source. In fact, the combustion of gas, fuel oil or coal of ovens can be improved if we can provide a suitable power of drawing fan and a suitable flow of gas or fuel oil.

[0035] FIG. 2 shows some details of the preheating region, gas combustion region and gas range of the device shown in FIG. 1. It is a longitudinal section view. The gaseous mixture of air, oily smoke, fumes, vapor or odors is forced to enter the preheating region, i.e. preheating pipe 1 after passing through pipe 2. There are a series of holes (one of them is marked with 3) located uniformly on the wall of the said preheating pipe. After preheated in pipe 1, the said gaseous mixture will enter the gas combustion region 8 by passing through the holes 3. The gas provided by gas range 4 will enter the said gas combustion region 8 by passing through the gas holes (one of them is marked with 5), and then burn in the said gas combustion region. Under the high temperature, the pollutants contained in the said gaseous mixture can be decomposed and/or oxygenated in the said gas combustion region, the products of these reactions and un-reacted matter contained in the gaseous mixture will be discharged from the said gas combustion region by passing through a number of small holes (one of them is marked with 6) which are located on the wall of a metal supporting ring 7. The said supporting ring has two functions. One is for supporting the cooker. Another one is for filtering the said gaseous mixture discharged from the said gas combustion region. Therefore, the said supporting ring is also a filter. In this design, the said preheating pipe 1 has three functions. First, it can be used to transfer the thermal energy coming from the heating source for preheating the gaseous mixture filling in the said preheating pipe. Secondly, it can be used to provide a uniform distribution of the gaseous mixture flow when entering the gas combustion region. Finally, most of the said gaseous mixture can be guaranteed to enter the said gas combustion region not leak out.

[0036] FIG. 3 shows another design based on the present invention. Compared with FIG. 1, the only difference in this design is that the said gaseous mixture drawn by the drawing fan 9 from the cooker 1 will be forced to enter two preheating regions 14 and 17 by passing through pipe 8 and pipe 13. The two preheating regions surround two gas ranges 4 and 18 separately to form two gas combustion regions 15 and 19 on oven. As shown in FIG. 1, the pollutants contained in the preheated gaseous mixture can be decomposed and/or oxygenated in the two gas combustion regions. Then, the cleaned gaseous mixture is discharged from the two gas combustion regions by passing through filter 16 and 20 separately. The pollutants contained in the said gaseous mixture can be removed more completely by using two heating source regions, but the construction of the device will be more complex. In this design, the gas range 18 can be used for heating water or other cooking operations without oily smoke, fumes, vapor or odors.

What I claimed as my invention is:

1. A method for treating and removing oily smoke, fumes, vapor, or odors. According to this method, the oily smoke, fumes, vapor or odors produced from at least one cooker placed over an oven are drawn by at least one drawing fan and mixed with a part of air to become at least one gaseous mixture under the action of the said drawing fan. Then, the said gaseous mixture of air and oily smoke, fumes, vapor or odors is forced to pass through at least one passage and then enter at least one preheating region. In the said preheating region, the said gaseous mixture is preheated. After preheated, the said gaseous mixture is forced to enter at least one heating source region of the said oven. A part of thermal energy provided by the heating source located in the said heating source region is used for preheating the said gaseous mixture filling in the said preheating region. A part of thermal energy provided by the said heating source is used for initiating and/or accelerating the decomposition and/or oxygenation of the pollutants contained in the said gaseous mixture filling in the said heating source region. Then, the products of the said decomposition and/or oxygenation reactions and the un-reacted matter contained in the said gaseous mixture are discharged from the said heating source region by passing through at least one filter.

2. A method for treating and removing oily smoke, fumes, vapor, or odors as claimed in claim 1, wherein the said heating source is a gas range and the said heating source region is a gas combustion region.

3. A method for treating and removing oily smoke, fumes, vapor, or odors as claimed in claim 1, wherein the said heating source is a fuel oil range and the said heating source region is a fuel oil combustion region.

4. A method for treating and removing oily smoke, fumes, vapor, or odors as claimed in claim 1, wherein the said heating source is a coal range and the said heating source region is a coal combustion region.

5. A method for treating and removing oily smoke, fumes, vapor, or odors as claimed in claim 1, wherein the said heating source is an electric range and the said heating source region is an electrically heating region.

6. A method for treating and removing oily smoke, fumes, vapor, or odors as claimed in claim 1, wherein the said passage is a pipe, through which the said gaseous mixture of air and oily smoke, fumes, vapor or odors drawn by the said drawing fan can enter at least one said preheating region.

7. A method for treating and removing oily smoke, fumes, vapor, or odors as claimed in claim 1, wherein the said heating source is surrounded with the said preheating region. The said heating source region is formed between the said heating source and the said preheating region.

8. A method for treating and removing oily smoke, fumes, vapor, or odors as claimed in claim 7, wherein the said heating source region and said preheating region are connected through a series of holes.

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