United States Patent

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[54] APPARATUS AND METHOD FOR REMOVING FUMES FROM THE SPACE ABOVE A COOKING APPLIANCE

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[73] Assignee: **Gausewitz, Carr & Rothenberg,** a part interest

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[52] **U.S. Cl.** ..... **98/115 K**
[51] **Int. Cl.** **F23j 11/00**
[58] **Field of Search** ..... 98/115 K

[56] **References Cited**

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[57] **ABSTRACT**

A self-contained, mass-producible fume hood or canopy for mounting in the space above a cooking appliance, so that fumes which pass upwardly into the hood will be removed from the room. Supply air from the exterior of the room is supplied to the hood and is fed through a baffle and throat apparatus toward filter and exhaust means, such baffle and throat apparatus being horizontally, vertically and angularly adjustable. The direction of supply air flow from the baffle and throat apparatus is caused to be substantially perpendicular to the filter, and the supply air first strikes the filter at an intermediate region as distinguished from the upper and lower regions. The relationships are caused to be such that some of the supply air passes directly through the filter, whereas other supply air rolls or vortexes (swirls) upwardly and downwardly. Upper and lower deflector means are provided to cause the upwardly and downwardly rolling supply air to return to the filter means for exhaust therethrough. The upper vortex is caused to be very large, whereas the lower is small. Means are provided to direct part of the supply air horizontally below the adjustable baffle and throat apparatus, thus entraining fumes and directing the same toward the filter means. Inclined means are provided to deflect fumes into the region above the lower deflector means. Trough and heater means are provided to receive grease from the filter, and means are provided to remove condensed water. The method of the invention relates to the critical air velocities, directions, and paths adapted to effect a substantially 100 percent removal of fumes from the region above the cooking appliance, with very little removal of cooled or heated air from the room.

46 Claims, 8 Drawing Figures

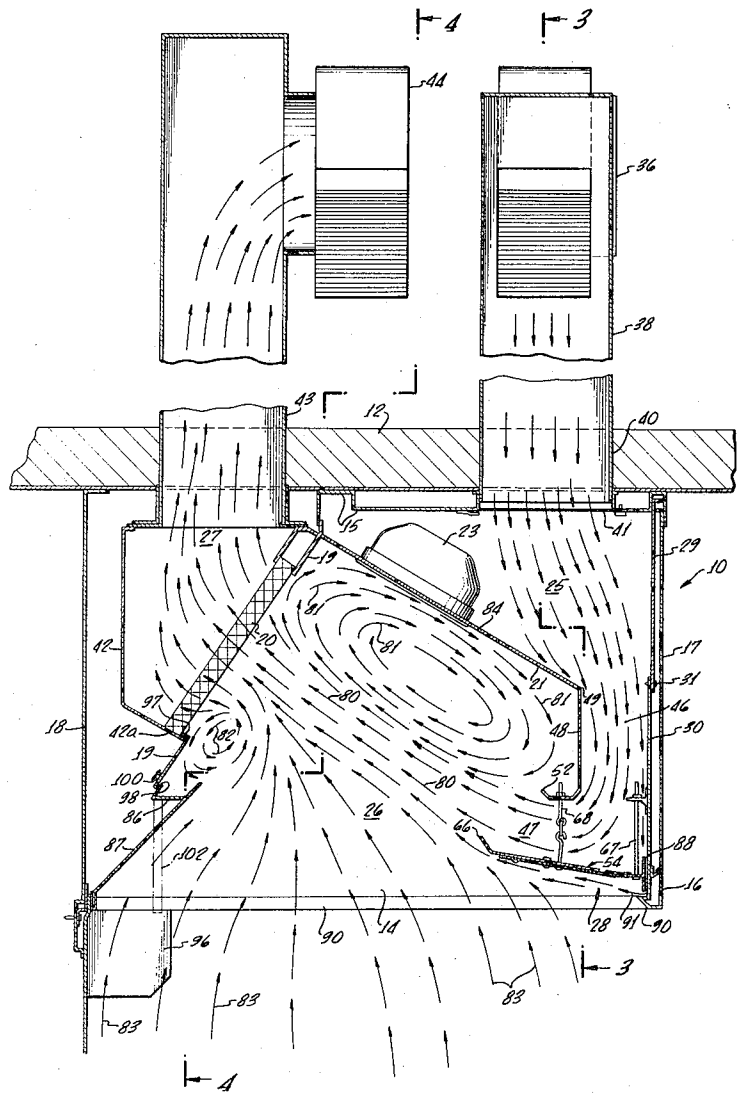

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FIG. 1.

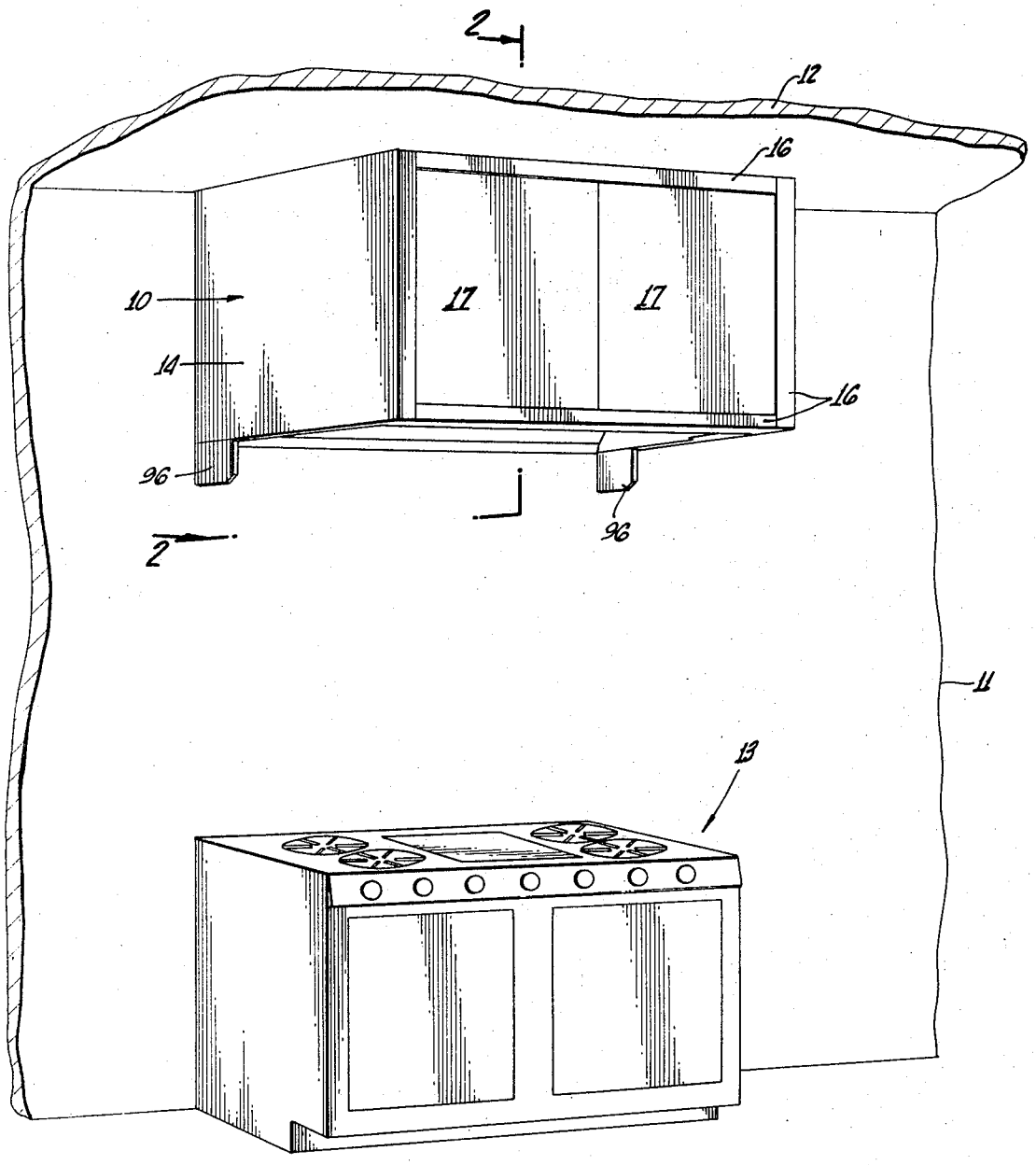

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FIG. 2.

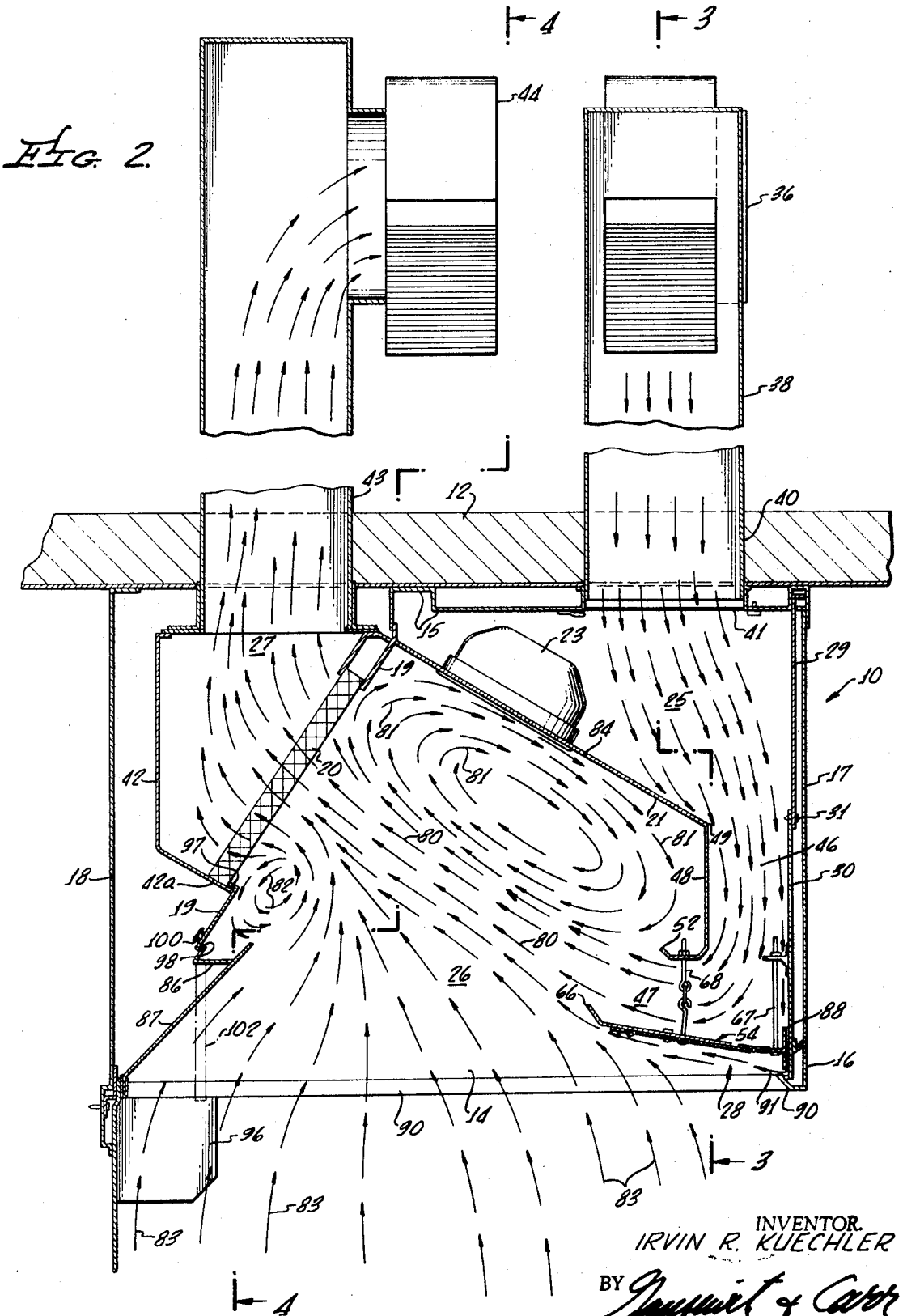

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FIG. 3.

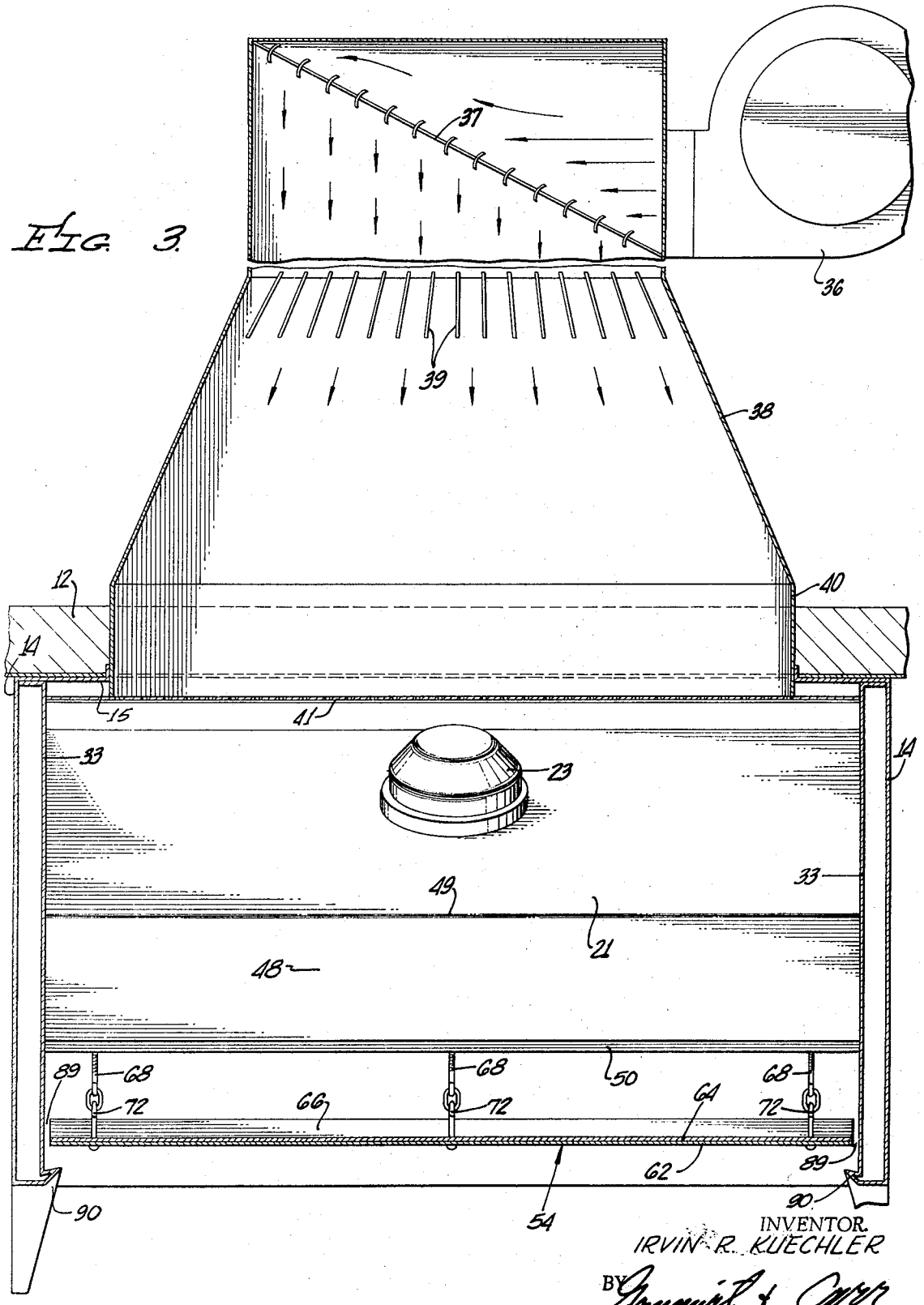

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FIG. 4.

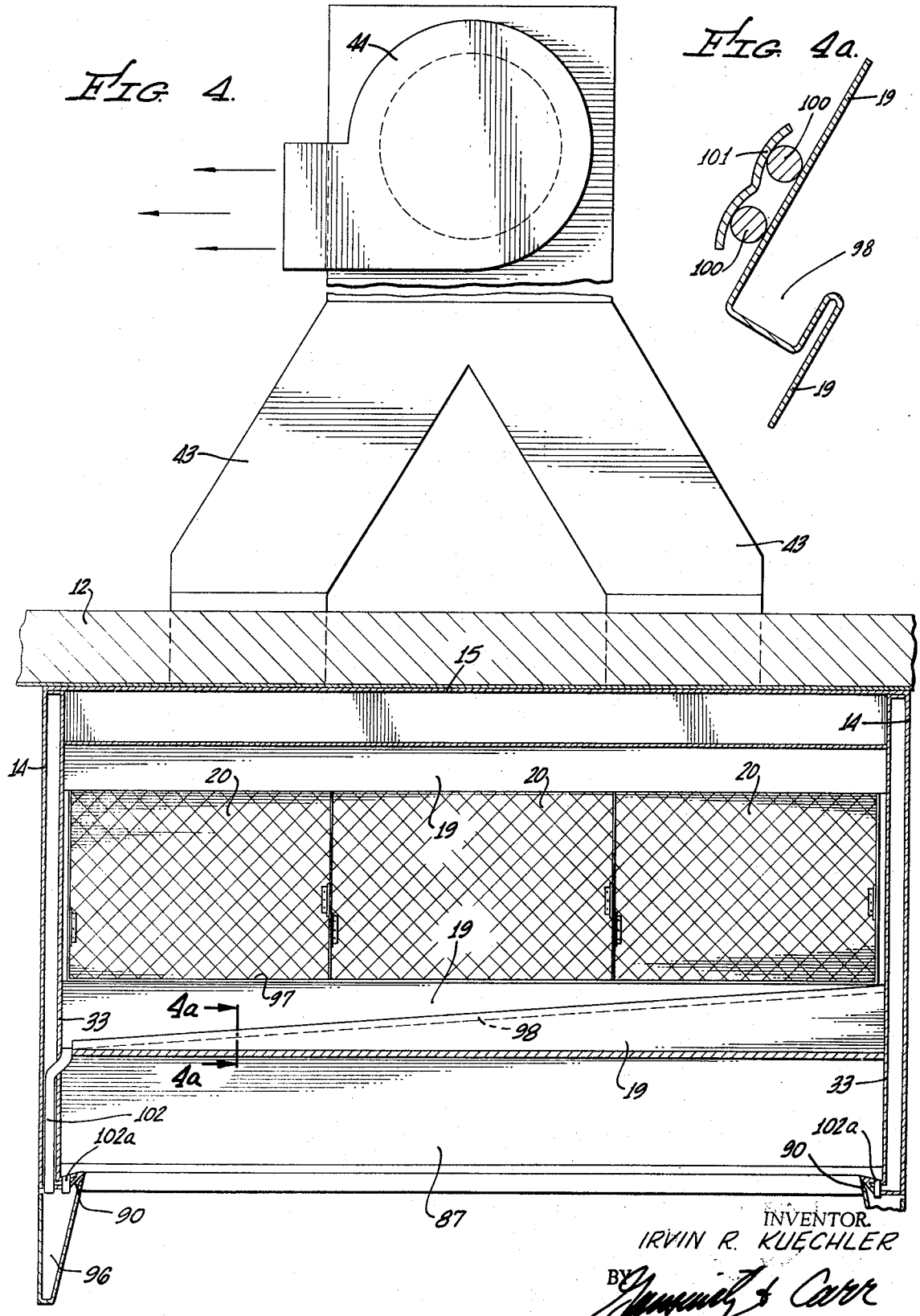

FIG. 4a.

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FIG. 5.

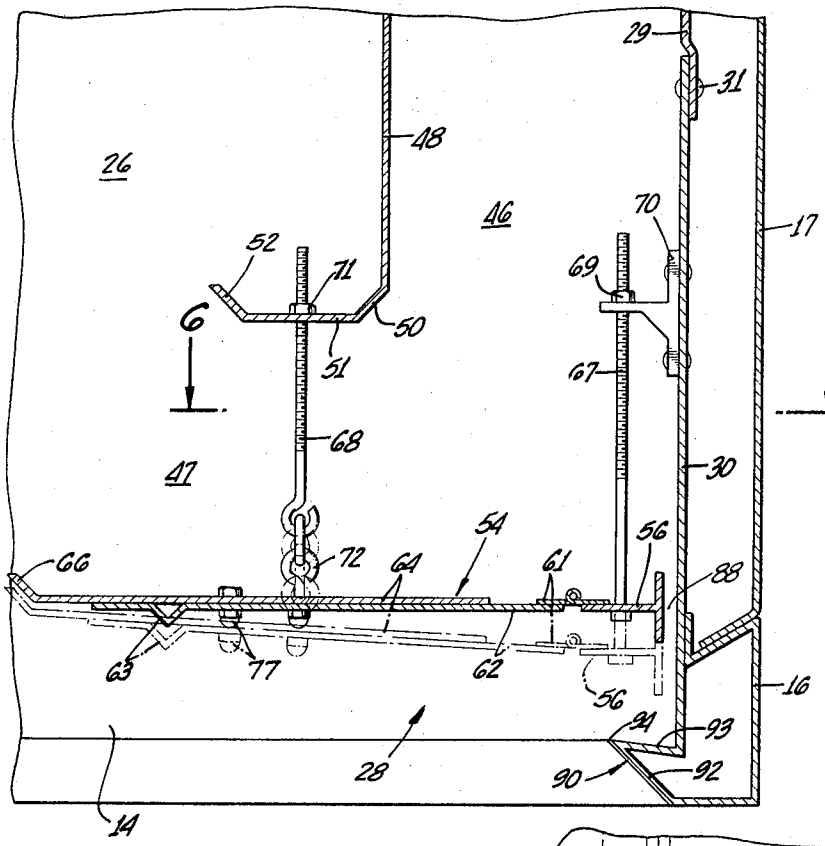


FIG. 6.

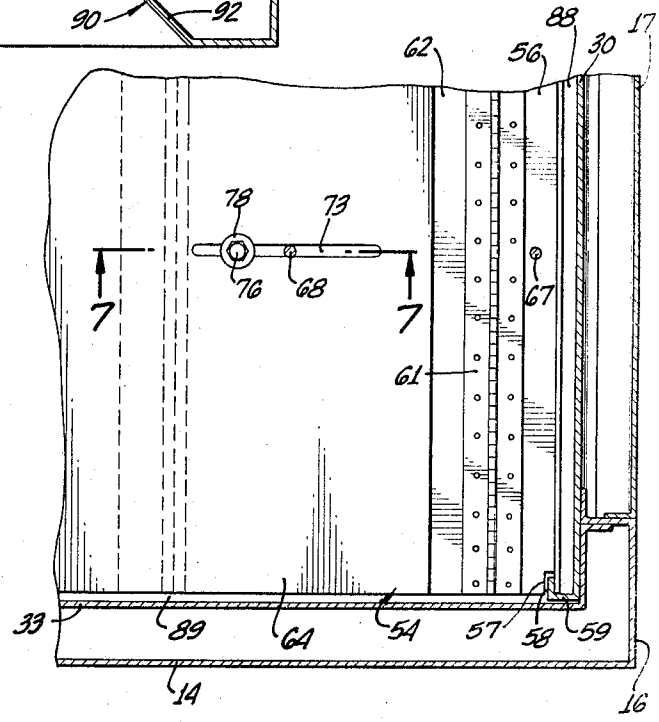
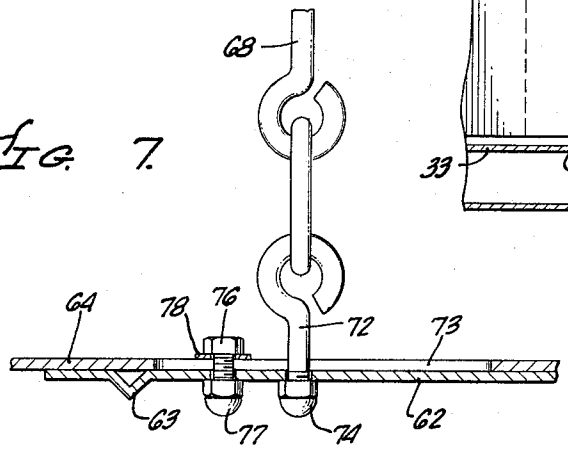


FIG. 7.



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APPARATUS AND METHOD FOR REMOVING FUMES FROM THE SPACE ABOVE A COOKING APPLIANCE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to the field of apparatus and methods for removing fumes from the regions above cooking appliances, and more particularly to such an apparatus (and method) which does not exhaust substantial quantities of air-conditioned or heated air from the room.

2. Description of the Prior Art

Codes frequently require that the hoods employed above commercial cooking appliances exhaust large volumes of air. For example, the Uniform Mechanical Code requires that such hoods exhaust 100 cubic feet per minute of air for each square foot of hood area. Since an exemplary hood area is 40 square feet, this represents 4,000 cubic feet per minute or 240,000 cubic feet per hour. Conventionally, such air which passes through the hood is supplied from the room itself. This places an extreme load upon the air-conditioning or heating equipment employed to create the desired temperature in the room. In addition, it creates substantial drafts which frequently render the occupants of the room uncomfortable. Particularly in relatively small "franchise" restaurants, the fume hood may empty the room of heated or air-conditioned air in a very few minutes. Thus, the cost of heating or air-conditioning the room is multiplied.

Because of the major problem indicated in the preceding paragraph, it has been proposed to supply to the fume hood some of the air withdrawn therefrom, such supply air coming from the exterior of the building instead of from the room. This substantially reduces the amount of withdrawal of room air through the fume hood. However, such devices have not heretofore been successful and/or capable of mass production.

One general class of prior-art devices directs curtains of supply air upwardly from the vicinity of the cooking appliance into the hood (or downwardly from the hood to the appliance, then back up to the hood). This is unsatisfactory for various reasons, including: (a) The volume of supply air cannot be closely balanced to the volume of exhaust air, (b) food frying on the cooking appliance is cooled, and sometimes contaminated, by the supply air, thus interfering with the cooking process, (c) the cooks are subjected to extreme air currents, (d) when the cooks pass their arms through the air curtains, it interferes with the air flow process, (e) supply air in cold-climate regions must be heated in order to prevent excessive chilling of the food and the cooks, and (f) great care must be taken, for sanitation reasons, that the supply air does not come from (for example) the vicinity of a vent from a rest room, chimney, etc.

The present applicant, and one company which derived the basic concept from applicant, have previously constructed and sold small numbers of hoods wherein most or all of the force-fed supply air is contained within the hood itself, and is not passed upwardly from the vicinity of the cooking appliance, or passed downwardly to such appliance. However, such prior apparatus had at least three major defects, including: (a) They could not exhaust fumes satisfactorily without exhausting excessive volumes of air-conditioned or heated air from the room, (b) they were not sufficiently effective in removing the fumes from the room, and/or (c) they were not capable of mass production and installation in a practical, commercial manner making possible widespread commercial manufacture and sale.

SUMMARY OF THE INVENTION

The invention comprises an apparatus and method whereby air from the exterior of the room is directed at high velocity and generally perpendicularly toward the filter means, following which a certain amount of such air is rolled (vortexed) upwardly and another proportion is rolled (vortexed) downwardly. The upwardly and downwardly rolled air then loses velocity and, due to the operation of deflector means, passes through the filter means, having first entrained fumes from the cooking appliance disposed therebeneath. The supply air which is perpendicularly directed against the filter is caused to strike the central region thereof, as distinguished from the upper and lower regions. The upper roll or vortex of air is caused to be large, whereas the lower is caused to be small. The invention further comprises a self-contained adjustable baffle and throat means which permits vertical, horizontal and angular adjustment in order to effect the desired directing of the incoming air and at the desired velocity. The invention additionally comprises apparatus and method whereby a portion of the incoming air is passed below the adjustable baffle and throat apparatus and is directed generally horizontally toward the filter means, thus entraining an additional amount of fumes from the cooking appliance. In addition, the invention comprises an inclined baffle for deflecting convected fumes to the region above deflector means for the downwardly rolled air. Means are provided to remove grease and condensed water.

The present apparatus and method are such that an economically mass-producible self-contained unit, even when installed by a relatively unskilled person as distinguished from an air-conditioning engineer, will exhaust fumes in a highly satisfactory manner even when the incoming and outgoing air flows are close to "balance" relative to each other. Thus, for example, the present invention permits the volume of supply air (from outside the room) to be only slightly greater than the volume of air exhausted through the hood, so that there is not excessive depletion of heated or cooled (air-conditioned) room air.

The apparatus and method of the invention free the air-conditioning engineer or operator of all worries related to the exhaust of heated or cooled room air through the fume hood. At his discretion, he may operate the fume hood close to balance, or he may so operate it that desired volumes of room air will exhaust through the hood (for example, in order to permit flow of enough outside air to replenish the oxygen supply in, or to cool, the room). In many cases, at least where the room or restaurant is a relatively small one, the present hood will be so operated that the difference between supply air volume and the exhaust air volume will be about 100 cubic feet per minute, whereas such difference in prior-art apparatus is much greater than 100 cubic feet per minute.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view illustrating the apparatus of the invention as mounted in a room and with a typical cooking appliance disposed therebeneath;

FIG. 2 is an enlarged sectional view taken on line 2—2 of FIG. 1, and showing the adjustable baffle and throat apparatus in a normal operating position;

FIGS. 3 and 4 are sectional views taken, respectively, on lines 3—3 and 4—4 of FIG. 2;

FIG. 4a is an enlarged fragmentary sectional view taken on line 4*a*—4*a* of FIG. 4;

FIG. 5 is an enlarged showing of the lower right portion of FIG. 2, and illustrating the adjustable baffle and throat apparatus in several positions different from the normal operating position shown in FIG. 2;

FIG. 6 is a fragmentary horizontal sectional view taken on line 6—6 of FIG. 5; and

FIG. 7 is a vertical fragmentary sectional view taken on line 7—7 of FIG. 6.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The word "fume" is employed broadly in the present specification and claims to comprehend not only gaseous but also particulate by-products of the cooking process. The most common "fume" is smoke containing particulate grease.

Referring first to FIG. 1, the fume hood or canopy of the present invention is illustrated as comprising a generally rectangular housing 10 suitably mounted on a vertical wall 11 of a room and/or on the horizontal ceiling 12 thereof, and/or on some other support means. It is of importance that the housing 10 and all components therein are self-contained, so that they may be mass-manufactured at the factory and then merely mounted and adjusted at the job site.

Housing 10 is mounted in spaced relationship above a cooking appliance 13 which may comprise a range, brazier, griddle, French-fryer, etc. The upper surface of the illustrated range is conventionally about 3 feet above the floor, whereas the lower edge of housing 10 should be mounted about seven feet from the floor. Thus, the lower portion of the housing 10 is preferably located approximately 4 feet above the upper surface of the cooking appliance. Preferably, housing 10 is sufficiently large that it overhangs the upper surface of cooking appliance 13 by about 1 foot at the front and at each side, and this amount of overhang is required by some building codes.

If the ceiling 12 is excessively high, the housing 10 may be mounted lower and spacer put between the housing and the ceiling for decorative purposes.

The fumes (smoke, etc.) emitted from the cooking surfaces and foods at the upper portion of appliance 13 rise upwardly into the housing 10 by natural thermal (convective) effects, and by the exhaust effects of relatively low-pressure regions created within housing 10. The fumes are then conveyed to the atmosphere due to the entrainment thereof in controlled air paths within the housing 10 and as described below.

Housing 10 and components therein are formed primarily of sheet metal, the individual sheet-metal elements being connected together as by welding, soldering, riveting, etc. The housing has opposed vertical side walls 14, a generally horizontal upper wall 15, and a front frame 16 which defines a rectangular opening in which are mounted front panels 17. Housing 10 also has a rear wall 18 indicated in FIG. 2, and which abuts room wall 11 (shown in FIG. 1 only).

Referring to FIGS. 2 and 4, a rear liner 19 is mounted in inclined relationship in housing 10, and extends for the entire distance between the side walls 14. Such rear liner 19 lies in a single plane and has an upper edge which is preferably connected to upper wall 15. An elongated rectangular opening is provided in rear liner 19 throughout substantially the entire width thereof in order to receive a plurality of rectangular grease-filter elements 20 (FIGS. 2 and 4) adapted to remove grease from the air passed therethrough. The manner of mounting of each filter 20 is such that it may be readily removed for cleaning or replacement, and is also such that the exposed planar surface of the filter is generally coplanar with the rear liner 19. The exposed planar surface of each filter (the right surface in FIG. 2) may be termed the "inner face."

The vertical dimension of each filter element 20 is sufficiently great that the filters occupy a major portion of the entire rear liner 19. The filters are, however, disposed in spaced relationship from both the upper edge of rear liner 19 and the lower edge thereof.

Each filter is an impingement-type grease filter which meets fire and other safety regulations. It should be of a deep-cell type well known in the trade, with honeycomb or triangular cells. The thickness of each filter may be 2 inches. Such filters require at least a minimum velocity of air flow, such as 300 feet per minute, in order to achieve the degree of impingement necessary to filter grease successfully. One exemplary grease filter 20 is the Airsan Type W Viro-Crimped Grease Filter made by Burke & Company of Los Angeles, Cal.

Rear liner 19 preferably lies at an angle of about 55° from the horizontal, and at an angle of about 95° relative to an inclined front liner 21. The front liner is also planar and intersects the rear liner at the upper edge thereof. Front liner 21 lies at an angle of about 30° from the horizontal and, like the rear liner, extends for the entire distance between side walls 14 of housing 10.

The front liner serves, as discussed below, as part of a deflector means for upwardly rolling supply air which strikes the filters 20. Mounted on the upper surface of front liner 21, at an opening (not shown) therein, is a suitable lamp 23 adapted to illuminate the cooking surface of appliance 13.

The rear and front liners 19 and 21, and the filters 20, aid in dividing the housing 10 into three air chambers, namely, a supply chamber 25, a capture and entrainment chamber 26 and an exhaust chamber 27. Supply air from outside the room is delivered to the supply chamber in a certain manner, thereafter passes through and below adjustable baffle and throat apparatus 28 (described in detail below) to the capture and entrainment chamber 26, and thereafter passes through the filters 20 to exhaust chamber 27 and thus to an exhaust means. While passing below the apparatus 28, and through the capture and entrainment chamber in a predetermined manner set forth in detail subsequently, the supply air captures and entrains fumes which pass upwardly from the cooking appliance 13.

The supply air chamber 25 is further defined by an inner panel (FIGS. 1 and 5) which is parallel to front panels 17 and has upper and lower portions 29 and 30. Lower portion 30 is permanently mounted between the side walls of the housing, whereas upper portion 29 is removable and is secured to the lower portion by means of screws indicated at 31. Suitable gasket and seal means are provided to minimize escape of air from the supply chamber 25 (except through and below apparatus 28).

The front panels 17 are removably mounted to the front frame 16 as indicated in FIG. 2, so that upon removal thereof the screws 31 may be removed in order to permit removal of upper inner panel section 29 to thus achieve access to the supply chamber 25.

The dead air space between front panels 17 and inner panel portions 29 and 30 provides insulation tending to minimize transfer of heat from cold (or hot) air in chamber 25 to the outer surfaces of front panels 17, so that condensation of atmospheric moisture on the panels is minimized. In like manner, and as shown in FIGS. 3 and 4, inner portions 33 are permanently secured parallel to outer portions of housing side walls 14, being spaced inwardly from such outer portions. Thus, dead air spaces are provided to thus minimize condensation of water on the exterior surfaces of the side walls 14. If desired, in those situations where the present apparatus is installed in an extremely cold climate, insulation may be provided in the specified dead air spaces.

It is important that supply air be delivered from the exterior of the building to supply chamber 25 in a uniform, even manner so that there will be a uniform flow throughout substantially the entire space between the inner panel portions 33 (walls 14). This may be accomplished in various ways, one of which will now be described in connection with FIGS. 2 and 3. A supply blower 36 (located, for example, on the roof of the building) connects to an air turn 37 which feeds air in uniform manner into a downwardly diverging duct portion 38. Air from the air turn 37 is fed uniformly into all portions of such duct portion 38 by means of a series of deflectors 39. The divergent duct portion 38 connects with a rectangular duct portion 40 which extends downwardly through ceiling 12 and has mounted on the lower end thereof a grid 41 (FIG. 2). The grid 41 may be, for example, perforated metal formed by ¼-inch diameter holes staggered on ¼-inch centers, the holes being provided evenly over the entire area.

Air is thus delivered uniformly and vertically downwardly to the upper region of supply chamber 25, following which a part of the incoming air strikes the lower-right portion (FIG. 2) of front liner 21, and is thereby deflected forwardly (to the right in FIG. 2) into the apparatus 28 described below.

Not only is air delivered uniformly to the supply chamber 25 as described above, but air is withdrawn relatively uniformly from exhaust chamber 27. Such chamber 27 is formed by inner wall means 42 (FIG. 2) which define a plenum chamber extending for the full width of housing 10. One wall of plenum

or exhaust chamber 27 is formed by the filter means 20 so that air withdrawn through the filter means fills the plenum or exhaust chamber 27 and passes upwardly through duct means 43 (FIGS. 2 and 4) to an exhaust blower 44. Such blower 44 exhausts to the exterior of the room, being preferably located on the roof as is supply blower 36. Because the supply air never leaves the fume hood, the blowers 36 and 44 may be located close to each other. Stated otherwise, at least some recirculation of fume-laden air may be tolerated.

The blowers may be built into the housing 10, for example at the upper ends of chambers 25 and 27, so that the roof blowers may be eliminated. In such event, conduits are passed upwardly through ceiling 12 to suitable vents to the atmosphere.

As shown in FIG. 4, there are two legs of the duct means 43 in order to provide relatively uniform withdrawal of air from the plenum or exhaust chamber 27, thus assuring that the flow of air through filters 20 will be uniform throughout the entire width of the apparatus between side walls 14. As described below, however, the air flow is not uniform between the upper and lower portions of the filters.

Suitable baffle and/or other means, not shown, may be provided in chamber 27 or conduits 43 to insure that exhaust air flow will be uniform throughout the entire width of the housing 10.

ADJUSTABLE BAFFLE AND THROAT APPARATUS 28

It is important that supply air be directed into the capture and entrainment chamber 26 in a particular manner and in a particular direction. Because of numerous variables, for example relating to differences in air densities in different parts of the country, in the construction of the supply conduit and blower means, in the operation of the blower 36, etc., the adjustable baffle and throat apparatus 28 is provided and may be readily regulated to compensate for the indicated (and other) variables. Such baffle and throat apparatus is adjustable vertically, horizontally, and angularly, and is fully self-contained within the housing 10 (as distinguished from certain prior-art apparatus which required a pivotal vertical curtain independently suspended from ceiling 12).

The apparatus 28 includes a vertical throat portion 46 (FIGS. 2 and 5) communicating with a horizontal throat portion 47, the latter having an adjustable bottom wall which permits the operator to make variations in flow velocity and direction. The vertical throat portion 46 is illustrated as being fixed in size, and is defined between inner panel portion 30 and a vertical wall 48. Such wall 48 extends vertically downwardly from the lower edge 49 of front liner 21, such lower edge being beneath a portion of grid 41.

The lower edge of vertical wall 48 is bent rearwardly and downwardly at 50, FIG. 5. Portion 50, in turn, meets a horizontal throat wall portion 51 the rear end of which has an upwardly and rearwardly inclined lip 52.

An adjustable baffle plate or member 54 (the above-indicated adjustable bottom wall of throat 47) is mounted a substantial distance below throat wall portion 51 and transverse to the lower end of vertical throat portion 46. Thus, such plate or member 54 deflects the downwardly flowing air (from vertical throat 46) rearwardly through the horizontal throat portion 47. The latter throat portion causes the air flow to be regular and generally laminar, creating an air curtain in chamber 26. Due to the particular construction of the elements 51, 52 and of the adjustable plate 54, the discharge of supply air from throat portion 47 is at the desired velocity and in the desired direction as set forth below.

Proceeding next to a description of the apparatus for adjusting the baffle plate 54, and referring particularly to FIGS. 5–7, inclusive, this comprises a Tee-sectioned member 56 the ends of which are notched as shown at 57 (FIG. 6). The notches 57 receive in-turned edges 58 of the lower part 30 of the inner panel, such in-turned edges being spaced from the body of the panel portion 30 by runners indicated at 59. The relationship whereby edges 58 fit in notches 57 maintains the Tee-sectioned member 56 in parallel relationship to panel portion 30, while permitting vertical adjustment of the Tee-sectioned member and associated parts.

It is to be understood that the construction at the other (unshown) end of Tee-sectioned member 56 (and the other ends of the associated elements) is identical to what is shown in FIG. 6.

The web of Tee 56 is horizontal (as distinguished from the flange of the Tee which is vertical) and is connected along the full length thereof to a piano hinge 61. Such hinge, in turn, connects to a lower plate 62 which extends rearwardly to an edge located rearwardly of lip 52, there being a Vee-shaped depression 63 formed in the lower plate 62 to stiffen the same.

Lower plate 62 cooperates with an upper plate 64 in forming the above-indicated adjustable baffle plate or member 54. Such upper plate 64 is supported on the major portion of the lower plate and extends rearwardly a substantial distance from the lip 52. The rear edge of the upper plate is bent upwardly and rearwardly at an angle in order to provide a deflector lip 66. Such lip 66 is bent at a 45° angle relative to plate 64.

In addition to the adjustment means thus far described, baffle plate 54 is adjusted by a pair of forward bolts 67 and a pair of rear bolts 68 all of which extend vertically. The forward bolts 67 extend upwardly and rotatably through openings in the web of Tee 56 and are threaded through nuts 69 which are welded to brackets 70 on panel portion 30 (FIG. 5). Turning of the bolts 67 may be accomplished by an operator outside the fume hood or canopy (by means of a wrench inserted upwardly to the region of the bottom of Tee 56), thus raising or lowering the Tee 56 as desired.

The rear bolts 68 extend upwardly and rotatably through openings in throat wall portion 51 (FIG. 5), being threaded through nuts 71 which are welded to the upper surface of such portion 51. The lower ends of bolts 68 are eye-shaped, and have linked thereto (by chain links, FIG. 7) corresponding eyebolts 72. The shanks of eyebolts 72 extend downwardly through slots 73 in upper plate 64 and through openings in lower plate 62, such slots 73 being perpendicular to panel portion 30.

Nuts 74 are welded or otherwise fixedly secured to the lower ends of the shanks of eyebolts 72, so that rotation of the nuts 74 by the operator turns the lower eyebolts 72 and thus the rear bolts 68, causing threading of the latter relative to the nuts 71 whereby to raise or lower the baffle plate 54 by pivoting the same about piano hinge 61. The universal-joint relationship between the interconnected (linked) eyes at the lower ends of bolts 68 and the upper ends of bolts 72 permits the indicated pivotal movement of baffle plate 54 without causing binding of bolts 68.

As noted heretofore, the plate positions shown in FIG. 5 are not normal ones, whereas FIG. 2 shows a normal (properly adjusted) position of plate 54. The position, width and angle of the plate 54 are adjusted in such manner as to achieve the proper velocity and direction of air flow into capture and entrainment chamber 26.

Horizontal adjustment of the upper plate 64, in order to increase the effective width of baffle plate 54, is effected by sliding such upper plate 64 forwardly or rearwardly relative to lower plate 62. This is permitted by the slots 73 (FIGS 6 and 7). The plates 62 and 64 are locked at any desired positions relative to each other by means of lock bolts 76 and associated nuts 77 and washers 78. The lock bolts 76 extend through the same slots 73 as do the eyebolts 72, and also extend through suitable openings in lower plate 62.

In the described manner, therefore, the baffle plate 54 may be raised while maintained in the same angular position by turning both sets of bolts 67 and 68 substantially the same amount. Baffle plate 54 may also be pivoted about hinge 61 by turning the rear bolts 68 more than the forward bolts. In addition, the effective width of the baffle plate 54 may be readily adjusted by loosening the lock bolts 76, sliding upper plate 64 forwardly or rearwardly relative to lower plate 62, and then retightening the lock bolts.

When the baffle plate **54** is raised, the vertical dimension of horizontal throat **47** is decreased to thus increase the velocity of supply air leaving the adjustable baffle and throat apparatus **28** in its travel toward filters **20**. Thus, vertical adjustment of the baffle plate can compensate for variations in the speed of supply blower **36**.

Raising and lowering of baffle plate **54** also changes the portions of filters **20** struck by the main portion of the supply air. Primarily, however, the directing of the supply air is effected by pivoting the baffle plate **54** about hinge **61**.

Very importantly, the supply air is caused to flow rearwardly and upwardly through chamber **26** in a well-defined stream or air curtain which is formed in throat **47**. The stream or curtain is directed upwardly because (a) baffle **54** is normally inclined upwardly as shown in FIG. **2**, and (b) the lip **66** provides a deflecting action which causes the lower sheet of air to act upwardly against an intermediate sheet of air and direct the entire air stream upwardly. In addition, an upward deflecting action is caused by the lip **52** on upper throat wall portion **51**, due to a pressure drop which occurs on the lower side of such lip.

The lip **66** permits the desired upward and rearward direction of air flow through chamber **26**, without requiring an excessive narrowing of throat **47** and consequent excessive flow velocity.

As shown by arrows **80** in FIG. **2**, the main air stream or curtain through chamber **26** is substantially perpendicular to filters **20** (and to the inner faces thereof) and is directed against the central regions of such filters (as distinguished from the lower or upper regions thereof). A large portion of the supply air indicated by arrows **80** passes immediately through filters **20** due to the action of exhaust blower **44** (as well as the supply blower). However, much of the air does not pass directly through the filters **20** but instead swirls (vortexes) upwardly and downwardly to regions above and below the filters **20**. The upwardly swirling or rolling air is directed clockwise as shown in FIG. **2** and is indicated by the arrows **81**, whereas the downwardly swirling air is directed counterclockwise as shown in FIG. **2** and as shown by the arrows **82**. The upper swirl, roll or vortex (arrows **81**) is very large, and extends clear back to lip **52**. The lower vortex is small.

When the supply air swirls upwardly and downwardly as indicated at **81** and **82** in FIG. **2**, it loses velocity and then passes back to the filters **20** where it is drawn therethrough by the exhaust blower **44**. The swirls **81** and **82** are formed not only by supply air from throat **47**, but also by fumes which pass upwardly from cooking appliance **13** and which are indicated by the arrows **83**. Such fumes strike the same air stream or curtain **80** and are drawn thereby against the filters **20**. Some of the fumes then pass directly through the filters, whereas others swirl or roll upwardly and downwardly with the supply air as indicated at **81** and **82**.

The area of the filters **20** is far greater than the cross-sectional area of the horizontal throat **47** in the adjustable baffle and throat apparatus **28**. Thus, all of the supply air passed through the throat **47** may be passed through the filters **20** despite the fact that the velocity of the air passing through the filters **20** is less than the velocity of the air in throat **47**, as discussed below under the description of the method of the invention.

The baffle plate **54** is part of what may be termed a "-director means" for directing supply air, in the desired manner, into capture and entrainment chamber **26**. It is emphasized that the various adjustments described above (width, angular position and elevation of baffle plate **54**) are relatively independent of each other.

DEFLECTOR MEANS FOR THE AIR AND FUMES IN SWIRLS 81 and 82 (FIG. 2), AND ALSO FOR THE REARMOST ONES OF FUMES 83

What may be termed the "upper deflector means," for deflecting back to filters **20** the air and fumes in upper swirl or vortex **81** (FIG. **2**), is formed by front liner **21**, by vertical throat wall **48**, and by elements **50–52** (FIG. **5**). The low-pressure region adjacent lip **52** is significant in aiding the vortex action represented by arrows **81**.

The swirl or vortex **81** is very extensive, and operates to absorb much of the energy (velocity) present in the air stream emanating from throat **47**, so that the air which deflects upwardly of filters **20** will return to and through such filters instead of bouncing down and out of the hood.

The "lower deflector means," for deflecting the air which rolls, swirls or vortexes downwardly as indicated at **82** in FIG. **2**, is formed by a wind ledge **86** in the form of a horizontal flange provided at the lower edge of rear liner **19**. In addition, such lower deflector means for the air in swirl **82** is formed by the upper edge of an inclined deflector plate **87**, such plate extending upwardly and forwardly from the rear wall **18** of housing **10**. Thus, the wind ledge **86** and the inclined upper edge of plate **87** catch the air which swirls downwardly from filters **20** and insure that such air passes upwardly in the swirls **82** and back to the filters **20**, instead of being blown downwardly out of the fume hood. The wind ledge **86** is disposed a very substantial distance above the lower edge of the housing **10** of the fume hood or canopy.

As noted above, the lower roll or vortex **82** of air and fumes is small. It is also low in energy in comparison to upper vortex **81**.

The inclined deflector plate **87** is preferably mounted at approximately a 45° angle relative to the horizontal or vertical, and extends upwardly and forwardly for a very substantial distance from wall **18**. The lower edge of plate **87** is at the same elevation as the lower edge of the hood. Such inclined plate **87** is important in deflecting those portions of the fumes **83** which pass upwardly along the wall **11** (FIG. **1**) of the room. If the plate **87** were horizontal instead of inclined, some of such fumes adjacent wall **11** would tend to move laterally and out from beneath the fume hood or canopy.

With the present construction, the fumes which pass upwardly along the lower surface of inclined plate or deflector **87** are immediately caught by the downwardly and rearwardly swirling air **82** (FIG. **2**) and thus carried upwardly for passage through the filters **20**. Because the plate **87**, ledge **86**, etc., are disposed far up in the hood or canopy, there is a minimum possibility that the convected fumes will flow sideways instead of being entrained in the air stream **80**.

THE INLET AND LEDGE MEANS ASSOCIATED WITH ADJUSTABLE BAFFLE AND THROAT APPARATUS 28

As described above, the inclined deflector plate **87** is important relative to those fumes **83** which pass upwardly adjacent the rear portion of the apparatus, normally along a vertical wall as indicated at **11** in FIG. **1**. There will next be described the air flow and air deflector means for those fumes **83** which pass upwardly below the adjustable baffle plate **54**. Such air flow and air deflector means are important in permitting the fume hood or canopy to have a minimum cross-sectional area in a horizontal plane, with consequent minimized production and shipping costs, etc.

Referring particularly to FIGS. **5** and **6**, a gap or port **88** is formed between the lower panel portion **30** and the vertical web of Tee **56**. This gap may be, for example, approximately one-half inch in width. In addition, and as best shown in FIGS. **3** and **6**, gaps **89** are formed between the inner panels **33** and the ends of baffle plate **54**. These gaps **89** are preferably about one-fourth inch in width. Thus, a portion of the downwardly flowing air in vertical throat portion **46** does not strike the baffle plate **54** but instead passes downwardly along the panels **30** and **33**, through gaps or ports **88** and **89**, to regions beneath baffle **54**.

Ledge means are provided on the lower edge of housing **10**, at all portions except the rear thereof, as indicated generally at **90**. Such ledge means serve to catch the air which passes downwardly through gaps **88** and **89**, and to deflect such air generally horizontally toward the capture and entrainment chamber **26**. The ledge means **90** cause a sharp or sudden change in the direction of air flow, with consequent creation of relatively low-pressure peripheral regions tending to draw fumes **83** into the hood.

As indicated by the arrows **91** in FiG. **2**, air which passes downwardly through gap or port **88** strikes the forward ledge means **90** and is deflected rearwardly and (as described below) upwardly, following which such air passes generally horizontally below the deflector plate **54** and then into the capture and entrainment chamber **26**. The air flow indicated at **91** in FIG. **2** serves to entrain fumes **83** which are relatively remote from wall **11**, that is to say, relatively adjacent the front of the fume hood or canopy.

Air which passes through gaps **89** is deflected inwardly by the side ledge means **90**, and is then entrained in the air flow **91** and thus (together with entrained fumes) conducted to the chamber **26**.

The simultaneous passing of supply air above and below the baffle plate **54**, as described above, provides a very effective action whereby the distance between the front and rear walls **17** and **18** of the housing **10** may be minimized, yet there will be no escape of fumes from the region of the fume hood below the baffle plate.

As shown in FIG. **5**, the ledge means **90** has an upwardly and inwardly inclined lower surface **92** adapted to deflect fumes inwardly. In addition, the ledge means **90** has an upper surface **93** which inclines somewhat downwardly away from the apex edge **94**. The downward incline of surface **93** performs a double function of directing the deflected air somewhat upwardly, and also preventing any condensate which moves downwardly along the vertical panel surfaces from dripping over the edge **94**. Instead, the condensate drains along the surfaces **93** to portions of the ledge means which are relatively adjacent the rear of the housing, following which the condensate drips into catches **96** adapted to receive grease and condensate as described hereinafter.

MEANS FOR RETRIEVING GREASE AND CONDENSATE

In the present specification, the work "condensate" refers to condensed water, which water may condense (particularly in cold climates) due to the passage of air in large volumes through the fume hood or canopy. It is a feature of the invention that there is no need to heat or cool the supply air.

As shown in FIG. **2**, the lower edges of filters **20** rest on a portion **42***a* of the inner wall **42** forming plenum or exhaust chamber **27**. The extreme forward edges of the filters (the lower regions) seat against a lip **97** which is formed at the upper edge of the lower portion of rear liner **19**. Grease trapped by filters **20** runs down over lip **97** and into a grease groove or trough **98** (FIGS. **4** and **4***a*).

Referring to FIG. **4**, the grease groove **98** is inclined and extends from one side of the fume hood to the other. It is, as shown in FIG. **4***a*, manufactured by making appropriate bends (brakes) in the lower portion of rear liner **19**. Thus, the region of rear liner **19** below groove **98** is in a plane offset forwardly from the liner region above such groove. It has been found that the indicated offset does not adversely affect the operation of the ledge and deflector means **86** and **87** relative to the downwardly swirling air indicated by arrows **82** in FIG. **2**, particularly since the groove **98** is small (such as one-half inch) in width.

Also as shown in FIG. **4***a*, heater means (for example, electric heat tubes **100** connected to a suitable power supply and thermostat means, and held in position by a clamp **101**) is provided inwardly adjacent the grease groove **98** in order to maintain the grease therein in liquid, flowing condition, despite the cooling action produced by the downwardly swirling air.

The grease which flows downwardly from the inner surfaces of filters **20** passes over lip **97** into groove **98**, and then flows laterally (being maintained hot by the heat tubes) to the extreme left end of groove **98** (FIG. **4**). When the grease reaches such end, it passes downwardly through a tube **102** into one of the catches **96**. Tube **102** is also adapted to receive grease from wind ledge **86**.

Other tubes **102***a* (FIG. **4**) are provided to receive condensate from the ledge means **90**, and to pass such condensate into catches **96**. Thus, the grease and the condensed moisture are effectively conducted to one or both of the grease catches **96** (which are adapted to be removed and emptied when desired).

The catches **96** perform an additional function in insuring that relatively cooled fumes which pass upwardly adjacent room wall **11** will not shift laterally from beneath the hood, but instead will flow upwardly into the capture and entrainment section **26**.

METHOD OF THE INVENTION

Stated generally, and referring to FIG. **2**, the method of the invention comprises directing a relatively well-defined and nonturbulent (laminar) air stream or curtain **80** upwardly and rearwardly toward inclined filters **20** and generally perpendicularly to such filters. The stream is caused to strike (substantially perpendicularly) the filter region at an intermediate elevation, as distinguished from the upper and lower filter regions. In addition, the method comprises creating a large-size upper vortex of supply air which deflects off filters **20**, and creating a small-size lower vortex of such deflected air.

The velocity of the supply air in curtain **80** is caused to be much greater than the velocity of the air passing through filters **20** (whereas the area of the filters is caused to be much greater than the cross-sectional area of supply-air throat **47**). Accordingly, not all of the supply air which strikes the filters **20** passes immediately therethrough, some supply air instead rolling (deflecting) upwardly as shown at **81** in FIG. **2** and other supply air rolling (deflecting) downwardly as shown in **82**, thus creating the specified vortexes. The upwardly and downwardly rolling air loses velocity and then passes through the filters **20** to exhaust blower **44**.

The method further comprises passing air beneath the main air inlet (beneath the baffle plate **54** of FIG. **2**), and deflecting such air toward the capture and entrainment chamber **26**. The method also comprises deflecting fumes into the lower roll or vortex **82**.

The method includes passing a total volume (cubic feet per minute, cfm) of supply air and fumes through filters **20** which exceeds the total volume (cfm) of supply air in vertical throat **46** by the following amount only: (a) the volume of fumes which pass upwardly from cooking appliance **13** plus (b) whatever volume, if any, the operator may wish to exhaust from the room for any purpose.

Stated otherwise, the speeds of supply blower **36** and exhaust blower **44** are adjusted until the number of cfm of air and fumes exhausted from the room through elements **20**, **27** and **44** is greater than the number of cfm of air supplied thereto (through elements **36**, **25**, **46**, etc.) by the amount stated in the previous paragraph. Such amount is frequently as low as a few hundred cfm, or even 100 cfm, which is very much less than in prior-art apparatus of the present general type. This amount is termed the "differential" (the difference between the supply volume and the exhaust volume).

In addition, the blower speeds, and the adjustable baffle plate **54**, are so adjusted and regulated that the air stream or curtain **80** has a high velocity. Such velocity is caused to be sufficiently high to obtain numerous benefits, including: (a) achievement of the minimum desired differential between supply air volume and exhaust volume, (b) creation of effective rolls or vortexes **81** and **82**, (c) creation of effective peripheral flow streams **91**, etc., (d) uniform distribution of air throughout the full width of the housing, and (e) minimization of the amount of grease deposited on liner **21**, wall **48**, etc. The blower speeds and the baffle plate **54** are also so adjusted that the air and fumes passing through filters **20** will be traveling at a velocity sufficient to achieve effective grease-filtering action, it being remembered that filters **20** are impingement-type filters. The average velocity of the air in throat **47** is, to achieve the above and other advantages, caused to be in the range of about 1,000 feet per minute (fpm) to about 1,500 fpm (or somewhat higher, but higher velocities waste power

and create excessive noise). The flow of air and fumes through filters **20** is caused to be in a range of about 300 fpm to about 900 fpm. The velocity of air and fumes passing through the lower portions of filters **20** is much lower than the velocities at the center and upper portions thereof (the velocity at the center being highest).

Relative to benefit (a) indicated in the previous paragraph, applicant has found that lower velocities than those specified (relative to flow velocities in throat **47**) require a greater differential (between inlet cfm and exhaust cfm) in order to achieve proper venting of fumes **83** from the room.

After the velocities, flow directions, etc., are adjusted as indicated above, by adjusting the baffle **54**, the blower speeds, etc., the present apparatus will operate properly unless there is a variation in the speed of blower **36** (and/or blower **44**), or other factors, to change the rate of flow of supply air. In such event, and within a relatively small acceptable range relative to the drawing of room air into the hood, adjustments may be made from time to time in the adjustable baffle plate **54** so that the relatively difficult procedure of adjusting the speed of blower **36** need not be repeated. In other words, the baffle plate **54** provides the user with a continuous adjustment means rendering it unnecessary to rely upon the installer. As but one example, if the supply blower **36** slows down, baffle **54** may be raised to thus decrease the area of throat **47** and bring the curtain velocity up to the desired amount.

There has thus been described the first grease-filter apparatus which will operate to effectively withdraw fumes from the room, over a cooking appliance, without withdrawing any major amount of room air with attendant waste of cooling or heating capacity. The apparatus is practical and commercial, and may be mass manufactured and installed. Major benefits are achieved because the supply air never exits from the hood and enters the room.

The foregoing detailed description is to be clearly understood as given by way of illustration and example only, the spirit and scope of this invention being limited solely by the appended claims.

I claim:

1. A method of removing fumes from the region of a room above a cooking appliance, without depleting the room of more than a desired amount of air, which method comprises:

providing in vertically-spaced relationship above said cooking appliance an open-bottomed fume hood having a grease filter therein,

drawing air from said hood through said filter by means of an exhaust blower which discharges to a region exterior to said room,

conducting supply air through conduit means to said hood from a region exterior to said

2. The invention as claimed in claim **1**, in which said method further comprises employing as said grease filter a filter having an inner face which lies generally in a single plane, and causing said stream of supply air to initially strike said inner face while traveling in a direction generally perpendicular to such face.

3. The invention as claimed in claim **1**, in which said method further comprises employing as said grease filter a filter having an inner face which lies in a single plane, causing said stream of supply air to initially strike said inner face while traveling in a direction generally perpendicular to such face, and causing said stream of supply air to initially strike said inner face at an intermediate elevation lower than the upper edge portion of said filter and higher than the lower edge portion thereof.

4. The invention as claimed in claim **1**, in which said method further comprises preventing any substantial amount of said supply air from passing out of said hood and into said room.

5. The invention as claimed in claim **1**, in which said method further comprises causing the vortex of said upwardly rolled supply air to be large in size, and causing the vortex of said downwardly rolled supply air to be small in size.

6. The invention as claimed in claim **1**, in which said method further comprises causing the average velocity of said stream of supply air, at the region where such stream enters the portion of said hood which first receives fumes from said cooking appliance, to be in the range of about 1,000 fpm to about 1,500 fpm.

7. The invention as claimed in claim **1**, in which said method further comprises employing as said grease filter an impingement-type filter, and causing the velocity of air and fumes passing through said filter to be in the range of about 300 fpm to about 900 fpm.

8. The invention as claimed in claim **1**, in which said method further comprises causing the average velocity of said stream of supply air, at the region where such stream enters the portion of said hood which first receives fumes from said cooking appliance, to be much higher than the velocity of the air and fumes passing through said filter.

9. The invention as claimed in claim **1**, in which said method further comprises directing said stream of said supply air through said hood in an upward direction at an incline to the horizontal and into engagement with said filter, and causing said stream of supply air to first strike the inner face of said filter while traveling in a direction substantially perpendicular to such inner face.

10. The invention as claimed in claim **1**, in which said method further comprises so balancing said supply blower relative to said exhaust blower that the number of cfm of air supplied to said hood from said region exterior to said room is less than, but not over a few hundred cfm less than, the number of cfm of air and fumes which pass through said filter.

11. The invention as claimed in claim **1**, in which said method further comprises so balancing said supply blower relative to said exhaust blower that the number of cfm of air supplied to said hood from said region exterior to said room is about 100 cfm less than the number of cfm of air and fumes which pass through said filter.

12. The invention as claimed in claim **1**, in which said method further comprises effecting said directing of said stream of supply air by means including a baffle disposed in the lower portion of said hood, and additionally passing part of said supply air into the region beneath said baffle and in a direction toward said filter.

13. The invention as claimed in claim **1**, upwardly off which said method further comprises employing as said grease filter a filter having an inner face which lies in a single plane, causing said stream of supply air to initially strike said inner face while traveling in a direction generally perpendicular to such face, and causing said stream of supply air to initially strike said inner face at at an intermediate elevation lower than the upper edge portion of said filter and higher than the lower edge portion thereof, in which said method further comprises causing the vortex of supply air which rolls upwardly off said filter to be large in size, and causing the vortex of supply air which rolls downwardly off said filter to be small in size, and in which said method further comprises preventing any substantial amount of said supply air from passing out of said hood and into said room.

14. The invention as claimed in claim **13**, in which said method further comprises causing the average velocity of said stream of supply air, at the region where such stream enters the portion of said hood which first receives fumes from said cooking appliance, to be in the range of about 1,000 fpm to about 1,500 fpm, and in which said method further comprises employing as said grease filter an impingement-type filter, and causing the velocity of air and fumes passing through said filter to be in the range of about 300 fpm to about 900 fpm.

15. A fume hood or canopy adapted to be mounted in a room in spaced relationship above a cooking appliance, which comprises:

a housing defining an open-bottomed capture and entrainment chamber adapted to receive fumes from said cooking appliance,

grease filter means mounted in said housing and exposed to said capture and entrainment chamber,

exhaust conduit and blower means to draw exhaust air and fumes through said filter means from said capture and entrainment chamber for discharge to a region exterior to said room,

supply conduit and blower means connected directly to said housing to pump supply air directly to said housing from a region exterior to said room,

director means to direct at least the major part of said supply air in a stream through said capture and entrainment chamber to said filter means, without leaving said housing,

said director means being related to said capture and entrainment chamber, to said filter means, and to said housing in such manner that said stream strikes said filter means and then divides into three portions,

the first of such stream portions passing directly through said filter means to said exhaust conduit and blower means,

the second of such stream portions rolling upwardly, and the third of such stream portions rolling downwardly,

first deflector means to deflect said second stream portion back to said filter means for passage therethrough to said exhaust conduit and blower means, and

second deflector means to deflect said third stream portion back to said filter means for passage therethrough to said exhaust conduit and blower means,

whereby fumes which pass upwardly from said cooking appliance into said capture and entrainment chamber are effectively withdrawn through said filter means and discharged by said exhaust conduit and blower means.

16. The invention as claimed in claim **15**, in which the face of said filter means which is exposed to said capture and entrainment chamber is substantially planar, and in which said director means is so related to said face that said stream when passing through said capture and entrainment chamber from said director means to said face is substantially perpendicular to said face.

17. The invention as claimed in claim **15**, in which the face of said filter means which is exposed to said capture and entrainment chamber lies in an inclined plane and faces downwardly, and in which said director means passes said stream upwardly at an incline and directly into engagement with said face substantially perpendicularly thereto.

18. The invention as claimed in claim **15**, in which the supply blower means is balanced relative to the exhaust blower means in such manner that the number of cfm of exhaust air and fumes which pass through said filter means from said capture and entrainment chamber is greater than, but not over a few hundred cfm greater than, the number of cfm of supply air delivered to said capture and entrainment chamber by said supply conduit and blower means.

19. The invention as claimed in claim **15**, in which said second deflector means includes a baffle plate which deflects fumes from said cooking appliance upwardly into the region adjacent said filter means, the entire lower surface of said baffle plate being inclined at a large angle relative to the horizontal.

20. The invention as claimed in claim **15**, in which means are provided to pass a portion of said supply air downwardly from said supply conduit and blower means to the region immediately beneath said director means, and to cause such portion to flow beneath said director means toward said capture and entrainment chamber whereby to entrain fumes which pass upwardly from said cooking appliance into said region beneath said director means.

21. The invention as claimed in claim **16**, in which means are provided to pass a portion of said supply air downwardly to the region immediately beneath said director means, and to cause such portion to flow beneath said director means toward said capture and entrainment chamber whereby to entrain fumes which pass upwardly from said cooking appliance into said region beneath said director means, in which said face lies in an inclined plane, and in which said director means is so related to said face that said stream initially strikes said face at an intermediate elevation below that of the upper edge of said face, and above that of the lower edge of said face.

22. A self-contained fume hood adapted to be mounted in a room over a cooking appliance, which comprises:

a rigid rectangular housing having a front wall, a rear wall, and parallel side walls,

means to define a capture and entrainment chamber in said housing,

the portion of said housing beneath said chamber being open whereby to permit convection of fumes upwardly from said cooking appliance into said chamber,

a grease filter mounted in said housing remote from said front wall thereof and exposed to said chamber,

exhaust conduit and blower means to draw air and fumes through said filter from said chamber and to exhaust said air and fumes to a region exterior to the room in which said housing is mounted,

supply conduit and blower means to pump supply air from a region exterior to said room to a portion of said housing exterior to said chamber and adjacent the upper region of said front wall of said housing,

means provided in said housing to direct said supply air downwardly from said housing portion,

wall means provided in said housing to define the upper region of a generally horizontal throat,

a baffle plate disposed in said housing in spaced relationship below said wall means and transverse to the downwardly flowing supply air,

said baffle plate defining the lower region of said horizontal throat,

said baffle plate and said wall means cooperating with each other to cause said supply air to enter said capture and entrainment chamber in relatively laminar manner for flow to said filter,

hinge means provided relatively adjacent said front wall of said housing to effect pivotal mounting of the forward edge of said baffle plate,

means to effect vertical adjustment of said hinge means whereby to raise and lower said forward edge of said baffle plate, and

means to pivot said baffle plate upwardly and downwardly relative to said hinge means,

said means for vertically adjusting said forward edge of said baffle plate, and said pivot means, cooperating to change the cross-sectional area of said horizontal throat, and also cooperating to change the direction at which said supply air enters said capture and entrainment chamber.

23. The invention as claimed in claim **22** in which said baffle plate comprises first and second overlapping parallel plate portions, and means to secure such plate portions together with different degrees of overlapping whereby to change the effective dimension of said baffle plate in a direction perpendicular to said front wall of said housing.

24. The invention as claimed in claim **22**, in which said means to vertically adjust said hinge means comprises upwardly extending fastener means threadedly associated with a fixed support, and in which said means to pivot said baffle plate comprises an upwardly extending member threadedly associated with a fixed support, and means to provide a universal connection between said last-mentioned member and said baffle plate.

25. The invention as claimed in claim **22**, in which ledge means are provided on said housing beneath said baffle plate and adjacent said rear wall of said housing, said ledge means projecting rearwardly toward said capture and entrainment chamber, and in which passage means are provided between said rear housing wall and said forward edge of said baffle plate whereby to permit a portion of the supply air to pass downwardly through said passage means into engagement with said ledge means, such supply air portion then being

deflected by said ledge means forwardly and beneath said baffle plate into said capture and entrainment chamber, thus entraining fumes which pass upwardly into the region of said housing beneath said baffle plate and causing such fumes to enter said capture and entrainment chamber.

26. The invention as claimed in claim 22 in which an upwardly inclined lip is provided on the rear edge of said baffle plate.

27. The invention as claimed in claim 22, in which ledge means are provided on said housing beneath said baffle plate and adjacent said rear wall of said housing, said ledge means projecting rearwardly toward said capture and entrainment chamber, and in which passage means are provided between said rear housing wall and said forward edge of said baffle plate whereby to permit a portion of the supply air to pass downwardly through said passage means into engagement with said ledge means, such supply air portion then being deflected by said ledge means forwardly and beneath said baffle plate into said capture and entrainment chamber, in which additional ledge means are provided on said housing below the ends of said baffle plate, and in which additional passage means are provided between said baffle ends and said side walls of said housing, whereby other portions of the supply air may pass downwardly through said last-mentioned passage means for deflection by said last-mentioned ledge means in directions away from said side walls, and for subsequent entrainment in said first-mentioned supply air portion.

28. The invention as claimed in claim 22, in which said upper region of said horizontal throat, and said baffle plate, are so constructed and adjusted that the supply air entering said capture and entrainment chamber from said horizontal throat passes through said capture and entrainment chamber in an upwardly inclined direction, and in which said filter is substantially perpendicular to such upwardly inclined direction whereby said supply air strikes said filter substantially perpendicularly.

29. A fume hood adapted to be mounted in a room above a cooking appliance therein, which comprises:

an open-bottomed rectangular housing having parallel front and rear walls and parallel side walls,

said housing incorporating means to define an open-bottomed capture and entrainment chamber adapted to receive fumes passing upwardly from said cooking appliance,

said last-named means to define said chamber including a grease filter lying in an inclined plane,

means to supply air to said housing from a region exterior to said room and to direct at least a major portion of such supply air through said capture and entrainment chamber toward said filter in an upwardly inclined stream or curtain,

means to draw air and fumes through said filter from said capture and entrainment chamber and to exhaust such air and fumes to a region exterior to said room,

a lower deflector disposed beneath the lower edge of said filter, and

an inclined deflector plate extending from a region adjacent said rear wall of said housing to a region above said lower deflector,

said inclined deflector plate being inclined at a very substantial angle to the horizontal and serving to deflect upwardly and into the vicinity of said filter the fumes which pass upwardly into the region of said housing relatively adjacent said rear wall thereof.

30. The invention as claimed in claim 29, in which said inclined deflector plate has an upper edge portion which engages the forward edge of said lower deflector and cooperates therewith in deflecting upwardly to said filter air and fumes which roll downwardly therefrom.

31. The invention as claimed in claim 29, in which said lower deflector is a generally horizontal flange which extends rearwardly from an inclined liner lying in generally the same plane as said filter and extending downwardly therefrom, and in which said deflector plate lies at approximately a 45° angle from the horizontal.

32. The invention as claimed in claim 29, in which said lower deflector extends outwardly from a liner which lies in generally the same plane as said filter and extends downwardly therefrom, and in which exposed groove means are provided in said liner to receive grease which drips downwardly from said filter, said groove means being inclined and communicating with catch means for said grease.

33. The invention as claimed in claim 32, in which means are provided to heat said groove means to maintain in liquid condition the grease therein.

34. A fume hood for mounting in a room above a cooking appliance disposed in such room, which comprises:

a housing adapted to be mounted in said room above a cooking appliance therein,

said housing having formed therein an open-bottomed capture and entrainment chamber adapted to receive fumes passing upwardly from said cooking appliance,

filter means exposed to said capture and entrainment chamber and adapted to filter grease,

exhaust blower means to draw through said filter means air and fumes from said chamber, and to discharge said air and fumes to a region exterior to said room,

supply blower means connected to said housing to supply air from a region exterior to said room to a portion of said housing outside said chamber,

first inlet means to conduct supply air from said housing portion to said chamber for flow therethrough to said filter means, and

second inlet means to pass a portion of said supply air from said housing portion to the vicinity of the bottom of said housing and below said first inlet means, and to direct such supply-air portion toward said chamber for flow therethrough to said filter means,

said second inlet means serving to entrain fumes which pass to the region below said first inlet means and to cause such entrained fumes to enter said chamber.

35. The invention as claimed in claim 34, in which said first inlet means includes a horizontally elongated plate extending from the vicinity of a front wall of said housing toward a rear wall of said housing, and in which said second inlet means effects flow of said supply-air portion below said plate and generally parallel thereto toward said chamber.

36. The invention as claimed in claim 35, in which gaps are provided around the edges of said plate, said gaps forming said second inlet means, and in which inwardly extending ledge means are provided around the lower region of said housing, said ledge means serving to deflect inwardly and toward said capture and entrainment chamber the air which passes downwardly through said gaps.

37. The invention as claimed in claim 34, in which said second inlet means includes ledge means which extend inwardly from the lower portion of said housing, said ledge means having an upper surface adapted to deflect air toward said capture and entrainment chamber and also adapted to receive condensate, said ledge means communicating with a catch means for said condensate.

38. A fume hood for mounting in a room over a cooking appliance therein, which comprises:

a housing defining an open-bottomed capture and entrainment chamber,

a grease filter mounted in said housing and exposed to said chamber,

blower means to draw air and fumes through said filter from said chamber and to discharge such air and fumes to a region exterior to said room,

blower means to supply air to said housing from a region exterior to said room and to direct such air through said chamber to said filter,

an inclined liner mounted in said housing below said filter and exposed to said chamber,

the upper edge of said liner being close to the exposed face of said filter whereby grease from said filter drips along the exposed face of said liner,

exposed groove means provided at said liner to receive grease which flows downwardly along the exposed face thereof,

said groove means being at an incline to the horizontal whereby grease therein will flow downwardly into a suitable catch means, and

heating means provided on the side of said liner remote from said chamber,

said heating means serving to maintain the grease in said groove means warm despite the continuous passage of supply air through said chamber to said filter.

39. A fume hood or canopy for mounting in a room above a cooking appliance therein, which comprises:

wall means to define a generally rectangular housing having an open bottom,

said housing having generally parallel front and rear walls and generally parallel side walls,

a front liner provided in said housing and lying in an inclined plane,

said front liner extending for the entire distance between said side walls,

a rear liner mounted in said housing and extending downwardly at an incline from the upper edge of said front liner,

said rear liner extending the entire distance between said side walls,

said front and rear liners being transverse to each other,

a planar filter means mounted in said rear liner and adapted to filter grease,

said filter means extending substantially the entire distance between said side walls,

the upper edge of said filter means being spaced from the intersection between said rear and front liners, the lower edge of said filter means being spaced from the lower edge of said rear liner,

said rear and front liners, and said filter means, cooperating with the side walls of said housing to define an open-bottomed capture and entrainment chamber adapted to receive fumes from said cooking appliance,

blower and exhaust means to draw air through said filter means from said capture and entrainment chamber and to discharge such air to a region exterior to said room,

supply conduit and blower means to supply air from a region exterior to said room to the region of said housing between said front liner and said front wall of said housing,

vertical throat means to conduct supply air downwardly from said last-mentioned housing region to the vicinity of the lower portion of said housing, generally horizontal throat means to receive such supply air and to direct the same into said capture and entrainment chamber in a generally laminar stream or curtain,

said horizontal throat means being so directed that said stream or curtain passes directly through said capture and entrainment chamber, in an upward and rearward direction, and strikes said filter means generally perpendicularly thereto,

whereby a portion of said supply air which strikes said filter means rolls or vortexes upwardly into engagement with said front liner and then back downwardly for flow through said filter means, and

whereby another portion of said supply air which strikes said filter means rolls or vortexes downwardly, and

lower deflector means provided in said housing below said filter means to deflect said last-mentioned air upwardly to said filter means.

40. The invention as claimed in claim **39**, in which said horizontal throat means includes a lower baffle plate which extends for substantially the entire distance between said side walls, and in which means are provided to effect substantially independent horizontal, vertical and pivotal adjustments of said baffle plate.

41. The invention as claimed in claim **39**, in which means are provided to pass a portion of said supply air downwardly into the region below said horizontal throat means, and to effect flow of such air rearwardly beneath said horizontal throat means and into said capture and entrainment chamber, such air serving to entrain fumes which pass upwardly to a region below said horizontal throat means.

42. The invention as claimed in claim **39**, in which a steeply inclined baffle is provide beneath said lower deflector means and extends downwardly at an incline to the vicinity of the rear wall of said housing, said baffle deflecting upwardly into said capture and entrainment chamber fumes which pass upwardly and relatively adjacent said rear wall.

43. The invention as claimed in claim **39**, in which said horizontal throat means is so located and directed that said stream or curtain strikes said filter means at an intermediate elevation spaced downwardly from the upper edge of said filter means, and spaced upwardly from the lower edge thereof, and in which said supply conduit and blower means is adapted to effect laminar flow of air into said housing region formed between said front liner and the front wall of said housing.

44. The invention as claimed in claim **39**, in which the area of said filter means is much greater than the cross-sectional area of said horizontal throat means.

45. A fume hood or canopy for mounting in a room above a cooking appliance therein, which comprises

wall means to define a generally rectangular housing having an open bottom,

said housing having generally parallel front and rear walls and generally parallel side walls,

a front liner provided in said housing and lying in an inclined plane,

a rear liner mounted in said housing and extending downwardly at an incline from the upper edge of said front liner,

said front and rear liners being transverse to each other,

a planar filter means mounted in said rear liner and adapted to filter grease,

said rear and front liners, and said filter means, cooperating with the side walls of said housing to define an open-bottomed capture and entrainment chamber adapted to receive fumes from said cooking appliance,

blower and exhaust means to draw air through said filter means from said capture and entrainment chamber and to discharge such air to a region exterior to said room,

supply conduit and blower means to supply air from a region exterior to said room to the region of said housing between said front liner and said front wall of said housing, vertical throat means to conduct supply air downwardly from said last-mentioned housing region to the vicinity of the lower portion of said housing,

said vertical throat means being defined in part by a generally vertical plate which extends downwardly from said front liner, and

generally horizontal throat means to receive such supply air and to direct the same into said capture and entrainment chamber in a generally laminar stream or curtain,

said horizontal throat means being so directed that said stream or curtain passes directly through said capture and entrainment chamber, in an upward and rearward direction, and strikes said filter means,

whereby a portion of said supply air which strikes said filter means rolls upwardly into engagement with said front liner, then flows forwardly down said front liner, then passes downwardly along said vertical plate, and then passes rearwardly across said capture and entrainment chamber back to said filter means, said flow of said portion of supply air constituting a very large-diameter vortex.

46. A self-contained fume hood adapted to be mounted in a room over a cooking appliance, which comprises:

a rigid rectangular housing having a front wall, a rear wall, and parallel side walls,

means to define a capture and entrainment chamber in said housing,

the portion of said housing beneath said chamber being open whereby to permit convection of fumes upwardly from said cooking appliance into said chamber,

a grease filter mounted in said housing remote from said front wall thereof and exposed to said chamber,

exhaust conduit and blower means to draw air and fumes through said filter from said chamber and to exhaust said air and fumes to a region exterior to the room in which said housing is mounted,

supply conduit and blower means to pump supply air from a region exterior to said room to a portion of said housing exterior to said chamber and adjacent the upper region of said front wall of said housing,

means provided in said housing to direct said supply air downwardly from said housing portion and thence rearwardly across said capture and entrainment chamber to said grease filter in a substantially laminar curtain into which fumes from said cooking appliance are entrained,

a large part of the air in said curtain, and the fumes entrained therein, passing directly through said filter, and

means to cause another large part of the air in said curtain to roll upwardly off said filter, thence forwardly across the upper part of said chamber, thence downwardly to the upper part of said curtain, and thence rearwardly to said filter,

said flow effected by said last-named means being a large vortex located above said curtain.

* * * * *

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,664,255 Dated May 23, 1972

Inventor(s) Irvin R. Kuechler

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 14, line 69 (line 3 of claim 25), cancel "rear" and substitute --- front ---;
line 72 (line 6 of claim 25), cancel "rear" and substitute --- front ---.
Column 15, line 1 (line 10 of claim 25), cancel "forwardly" and substitute --- rearwardly ---;
line 11 (line 3 of claim 27), cancel "rear" and substitute --- front ---;
line 14 (line 6 of claim 27), cancel "rear" and substitute --- front ---;
line 18 (line 10 of claim 27), cancel "forwardly" and substitute --- rearwardly ---;
line 74 (line 3 of claim 31), cancel "rearwardly" and substitute --- forwardly ---.

Signed and sealed this 10th day of December 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

PO-1050
(5/69)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,664,255 Dated May 23, 1972

Inventor(s) Irvin R. Kuechler

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 11, line 50 (line 11 of claim 1), after "said" insert --
room and by means of a supply blower,
said last-named step including causing said conduit means to communicate directly with said hood, whereby said supply air from said supply blower does not pass through the room in which said cooking appliance is located,
directing a stream of said supply air through said hood and toward said filter in such manner that a first portion of the air in said stream passes directly through said filter for conduction to said exhaust blower, a second portion of the air in said stream does not pass directly through said filter but instead rolls or vortexes upwardly, and a third portion of the air in said stream does not pass directly through said filter but instead rolls or vortexes downwardly,
deflecting said upwardly rolled air back to said filter for withdrawal therethrough, and
deflecting said downwardly rolled air back to said filter for withdrawal therethrough,
whereby fumes which rise from said cooking appliance and into the open bottom of said hood are entrained in said stream and pass therewith through said grease filter. ---

Column 12, line 41 (line 1 of claim 13), cancel "upwardly off" and insert -- in -- before "which".

Column 13, line 20 (line 28 of claim 15), after "and" the word "the" should start a newly-indented subclause, and beginning with line 19, should read:
--- the second of such stream portions rolling upwardly,
and
the third of such stream portions rolling downwardly, ---.

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(5/69)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,664,255 Dated May 23, 1972

Inventor(s) Irvin R. Kuechler

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 17, line 36 (line 22 of claim 39), after the comma (,) the word "the" should start a newly-indented subclause, and beginning with line 36, should read as follows:

--- intersection between said rear and front liners,
the lower edge of said filter means being spaced from the lower edge of said rear liner, ---;

line 52 (line 38 of claim 39), after the comma (,), the word "generally" should start a new main clause, and beginning with line 52, should read as follows:

--- the lower portion of said housing,
generally horizontal throat means to receive such supply air and to direct the same into said capture and entrainment chamber in a generally laminar stream or curtain, ---.

Column 18, line 12 (line 2 of claim 42), cancel "provide" and substitute --- provided ---;

line 53 (line 25 of claim 45), after the comma (,) the word "vertical" should start a new main clause, and beginning with line 53, should read as follows:

--- ing,
vertical throat means to conduct supply air downwardly from said last-mentioned housing region to the vicinity of the lower portion of said housing, ---.

Signed and sealed this 20th day of March 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents