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**COOKING APPARATUS VENTILATION SYSTEM.**

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## Description

Almost every cooking method, such as grilling, frying, boiling, etc., results in the production of smoke, vapors, steam or other by-products which must be removed when the cooking is done indoors. The common arrangement is to locate a hood above the cooking area which confines the smoke or vapors after they have risen. The hood is evacuated through some sort of venting system.

It is the popular style in many restaurants to prepare certain foods at the customer's table rather than in a separate kitchen. The usual arrangement has the customers sitting around three sides of a table, the other side of which contains a cooking surface, usually a griddle. A hood is situated well above the cooking surface to confine the smoke and vapors after they have risen. Because the hood must be placed high enough to be out of the line of sight of the customers, drafts in the restaurant can drive the smoke and vapors laterally before they reach the confines of the hood, often annoying the customers seated at the table. Also, the presence of a number of hoods throughout the restaurant is not aesthetically pleasing.

One solution to this problem is to provide a suction venting system at or near the cooking surface. A fan or similar means is used to withdraw air through openings at the rear or around the sides of the cooking surface. The smoke and vapors are drawn into the venting system and evacuated outside the room. Examples of these systems are taught in U.S. Patents no. 4,291,668 to Moeller, no. 4,562,827 to Cerola, no. 3,853,115 and no. 3,474,724 to Jenn, and no. 3,712,819 to Field.

The major problem with these systems is that the area of the cooking surface must be kept small enough so that smoke and vapors created in the center of the surface will still be entrapped by the suction of the venting system. It is impractical if not impossible to create venting systems with enough suction to draw in all the smoke and vapors created on a large cooking surface. For example, it is common to have restaurant grills as large as 1.5 meters by 1 meter, or even larger. With such a grill, smoke and vapors can be many centimeters from the nearest vent opening. This invention solves this problem by directing a horizontal flow of forced air above and across the cooking surface, thereby preventing the smoke and vapors from rising, as well as forcing them into the vent openings.

U.S. Patent no. 3,386,335 to Jensen suggests the use of an upwardly-angled mist-bearing airstream to entrain and remove fumes rising from a cooking surface. However, the Jensen apparatus has a bulky ducting arrangement extending well above the cooking surface. In particular, the upwardly-angled airstream requires a hood to receive the fume-laden air after its passage across the cooking surface. Such a

ducting arrangement is appropriate for use against a wall as is common in kitchens, but is too obtrusive and obstructive for use in restaurants at a customer's table.

The aforementioned U.S. Patent No. 4,291,668 to Moeller suggests directing a flow of forced air across a cooking surface towards vent openings, but only for the purpose of avoiding waste of conditioned air. Moeller was not concerned with removing fumes with this flow of air, so the efficacy of the Moeller device is questionable. Moreover, there is no clear teaching in Moeller as to the direction in which the air flows. However, it is presumed that the air flow would be angled upwardly as the vent openings are above the level of the surrounding table top, and the suggested location of a forced feed conduit is below the level of the table top. Moeller also has an obtrusive and obstructive duct arrangement extending above the cooking surface.

The prior art exemplified by Moeller discloses a cooking apparatus ventilation system mounted in or usable with means defining a horizontal surface such as a table top, comprising: a cooking surface situated below the horizontal surface; evacuation means including one or more venting channels adjacent to one or more sides of the cooking surface, the evacuation means being arranged to remove air from above the cooking surface and to exhaust this air away from the cooking apparatus; and forced air means arranged to direct a blanket of forced air across the cooking surface in the direction of the evacuation means, to entrap smoke and vapors rising from the cooking surface and to direct the smoke and vapors into the evacuation means.

The present invention is characterised in that the or each venting channel is situated below or level with the horizontal surface, in that the evacuation means is arranged to remove air downwardly from the region directly above the cooking surface, in that the forced air means is arranged to direct forced air horizontally or downwardly across the cooking surface, and in that, in use of the system, more air is evacuated through the evacuation means than is provided by the forced air means, so that all of the forced air is removed by the evacuation means.

The present invention thus provides a ventilation system for use with an indoor cooking apparatus. The cooking apparatus may be of any type that produces smoke or vapors during the cooking process, including grills, griddles, fryers or individual heating elements. Forced air may be produced by a fan or a compressor. A fan or other means is used to create a negative pressure in the venting channels such that the entire quantity of forced air, as well as some room air, is drawn into the venting channels and evacuated from the room in which the cooking apparatus is situated.

## BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an isometric view of the invention as contained in a table, with the forced air means and evacuation means represented by boxes.

Figure 2 is a cut-away view of a portion of the invention showing the relationship of the grill to the venting channels.

Figure 3 is a sectional view taken along line III-III of Figure 1, showing the forced air ingress means, the grill and the evacuation chamber.

Figure 4 is a sectional view similar to Figure 3, where a compressed air ingress means has been substituted for the forced air ingress means.

The particular cooking surface incorporated or used with the invention is not of importance. The term grill will be used throughout this specification to represent any cooking surface or device which produces smoke or vapors, including but not limited to grills, griddles, heating element or frying systems.

As shown in Figure 1, the invention is typically housed in a large table 90 such that three sides of the table can be used for individual dining. The invention may be placed within any horizontal surface, or may be utilized independently of a table. The invention comprises a grill cooking surface 80 bounded on three sides by two venting channels 70 and a receiving venting channel 72. The remaining side (a long side if the grill is not square) is bounded by the air ingress housing 60. Opposite of the air ingress housing 60, a deflector 71 is situated adjacent to the upper lip of the receiving venting channel 72. Preferably, the upper surface of the venting channels 70 and 72, and the air ingress housing 60 are level with the upper surface of table 90.

Forced air is supplied by a forced air means 50, which can be a fan, blower or compressor, represented by a box in Figure 1. Air is forced through inlet conduit 40 into the air chamber 41. The chamber 41 is connected to the bottom of air ingress housing 60. Smoke and vapors are removed by an evacuation fan 51 or similar means, represented by another box in Figure 1. The evacuation fan 51 draws air through outlet conduit 42 from evacuation chamber 30. Evacuation chamber 30 runs substantially the length of the receiving channel 72. In alternate design, the evacuation chamber 30 may be substantially shorter than the length of the receiving venting channel 72.

The relationship of the venting channels 70 and 72 to the grill 80 is better seen in Figure 2. The venting channels 70 perpendicular to the air ingress housing 60 are of a general "C" shape such that the short vertical leg becomes a support for the underside of grill 80. The upper horizontal leg forms a lip which creates an ingress channel along the entire edge of the grill 80 and the shape of the venting channel 70 is such that a hollow, extended chamber is formed. This chamber is connected to the evacuation chamber 30 by the re-

ceiving venting channel 72 opposite the air ingress housing 60. This receiving venting channel 72 forms the upper portion of evacuation chamber 30. The deflector 71 runs the length of receiving venting channel 72.

Referring now to Figure 3, grill 80 (shown with burner components 81) spans the distance between evacuation chamber 30 and air ingress housing 60. Air ingress housing 60 is an elongated chamber, closed on each end. Forced air is supplied through inlet conduit 40 and air chamber 41 into the central portion of air ingress housing 60. The only outlet for this forced air is through perforated plate 61, which runs the length of the air ingress housing 60. The perforations insure that the flow of forced air through plate 61 is equal over its entire length. The upper lip of air ingress housing 60 directs the air horizontally across the surface of grill 80, entrapping any smoke or vapor created during cooking. This air is then drawn into venting channels 72 and 70. Deflector 71 creates a larger receiving channel in the direction of the air flow. The smoke and vapors are drawn into evacuation chamber 30, through filters 31 and then through outlet conduit 42, where they are exhausted outside the room. The force, height and direction of the blanket of forced air is such that all of this air is directed at and into the suction region of the venting channels 70 and 72.

An alternate embodiment is illustrated in Figure 4. Instead of a forced air system created by a fan or blower, the blanket of air is created with compressed air. Inlet conduit 40 is replaced by inlet pipe 20 and the air supply means is a compressor. Inlet pipe 20 passes through the air ingress housing 60 and is joined to horizontal air pipe 21 to create a T-shape. Air pipe 21 runs the length of air ingress housing 60, parallel to and a slight distance above the surface of grill 80. Apertures or nozzles 22 are positioned at spaced intervals along air pipe 21. The compressed air is thus directed over the surface of the grill 80, entrapping any smoke or vapors and forcing them into the venting channels 72 and 70.

The efficiency of the device is determined by the relationship between the evacuation fan 51 and the forced air means 50. Both are designed to be adjustable so that each can be independently increased or decreased in response to the situation. In order to insure that all smoke and vapors are removed, the amount of air evacuated through the device is set to be greater than the amount of air forced across the grill 80. Thus all of the forced air will be drawn into the venting channels 70 and 72, as well as some of the ambient room air. The larger the grill 80, the greater is the evacuation required. For a grill size of two feet by three feet (6 meters by .9 meters), the evacuation fan 51 should be capable of evacuating 1400 cubic feet (40 cubic meters) of air per minute. For a grill of two feet by five feet (.6 meters by 1.5 meters), the

evacuation required is 2100 cubic feet (60 cubic meters) per minute.

Since the invention is designed for indoor use, environmental and energy considerations are important. The source of forced air should be external to the room, since the forced air will be exhausted after passing over the cooking surface. Likewise, the evacuated air should be exhausted externally. It is also beneficial to maintain the settings for the amount of air evacuated to be near the amount of air forced in, so that only so much of the air-conditioned internal air is evacuated as is necessary to maintain the efficacy of the system.

The design of the invention is such that a number of units may be connected to a single forced air means 50 and a single evacuation fan 51. Of course, the capacity of these must necessarily be increased to accommodate the multiple units.

It is also a matter of choice in which direction the air is forced across the grill 80 in relation to table 90; As ia illustrated, the air is forced away from the person cooking. It is also envisioned that the air can be forced toward the cook.

Another embodiment of the invention allows for the vertical adjustment of the air ingress housing 60 relative to the surface of grill 80. In circumstances where the smoke and vapors are produced a distance from the grill surface, for instance if pans or pots are utilized, the air ingress housing 60 can be raised and angled downward. In this way the smoke and vapors are still directed into venting channels 70 and 72 by the blanket of air.

In another alternative embodiment, a small portion of the evacuated air is recycled by a fan and duct arrangement back across the cooking surface, to provide a means of enhancing the flavor of the food being cooked. This is accomplished by connecting a duct or conduit between the evacuation chamber 30 and the inlet conduit 40. A small recycling fan may be used to draw roughly 20 percent of the air from the evacuation chamber 30 and direct it into inlet conduit 40, where it is directed back across grill 80. When compressed air is used as the forced air means, the recycling duct is connected to air ingress housing 60 such that the recycled air is admitted below the compressed blanket of air.

The invention has been described as an integral cooking unit comprising both the cooking apparatus and the ventilation system. Another embodiment of the invention has the cooking apparatus removable from the ventilation system. In this embodiment, various types of cooking surfaces can be interchanged by removing one cooking surface and replacing it with another cooking surface, such that the position of the second surface is properly situated with respect to the ventilation system.

## Claims

1. A cooking apparatus ventilation system, mounted in or usable with means (90) defining a horizontal surface such as a table top, comprising:
  - a cooking surface (80) situated below the horizontal surface;
  - evacuation means (51, 42, 30, 70, 72) including one or more venting channels (70, 72) adjacent to one or more sides of the cooking surface (80), the evacuation means (51, 42, 30, 70, 72) being arranged to remove air from above the cooking surface (80) and to exhaust this air away from the cooking apparatus; and
  - forced air means (50, 40, 41, 60) arranged to direct a blanket of forced air across the cooking surface (80) in the direction of the evacuation means (51, 42, 30, 70, 72), to entrap smoke and vapors rising from the cooking surface (80) and to direct the smoke and vapors into the evacuation means (51, 42, 30, 70, 72);
  - characterised in that the or each venting channel (70, 72) is situated below or level with the horizontal surface, in that the evacuation means (51, 42, 30, 70, 72) is arranged to remove air downwardly from the region directly above the cooking surface (80), in that the forced air means (50, 40, 41, 60) is arranged to direct forced air horizontally or downwardly across the cooking surface (80), and in that, in use of the system, more air is evacuated through the evacuation means (51, 42, 30, 70, 72) than is provided by the forced air means (50, 40, 41, 60), so that all of the forced air is removed by the evacuation means (51, 42, 30, 70, 72).
2. A ventilation system according to claim 1, wherein the evacuation means (51, 42, 30, 70, 72) further comprises an evacuation chamber (30) and an outlet conduit (42) situated below the horizontal surface.
3. A ventilation system according to claim 2, wherein the or each venting channel (70, 72) supports the cooking surface (80) around its perimeter.
4. A ventilation system according to claim 3, wherein the venting channels (70, 72) surround three sides of the cooking surface (80), the venting channels (70) facing each other being of a general "C" shape such that air is channelled into the venting channel (72) opposite the forced air means (50, 40, 41, 60), which venting channel (72) forms an upper portion of the evacuation chamber (30).
5. A ventilation system according to claim 4, further comprising a deflector (71) above the venting

channel (72) opposite the forced air means.

6. A ventilation system according to claim 4, wherein the forced air means (50, 40, 41, 60) comprises a fan (50). 5
7. A ventilation system according to claim 4, wherein the forced air means (50, 40, 41, 60) comprises a compressor. 10
8. A ventilation system according to claim 4, wherein the evacuation means (51, 42, 30, 70, 72) comprises an adjustable fan (51). 15
9. A ventilation system according to claim 4, wherein the forced air means (50, 40, 41, 60) is vertically adjustable relative to the cooking surface (80). 20
10. A ventilation system according to claim 4, wherein the cooking surface is interchangeable. 25
11. A ventilation system according to claim 1, further characterised by recycling means (55) arranged to remove a portion of the air removed by the evacuation means (51, 42, 30, 70, 72) and to direct that portion horizontally or downwardly across the cooking surface (80) within or below the blanket of forced air. 30
12. A ventilation system according to claim 11, wherein the recycling means (53, 55) includes a duct (55) connecting the evacuation means to the forced air means (50, 40, 41, 60). 35
13. A ventilation system according to claim 12, wherein the recycling means (53, 55) further comprises a fan (53). 40
14. A ventilation system according to claim 13, wherein the recycling means (53, 55) is arranged to direct approximately twenty percent of the removed air back into the forced air means (50, 40, 41, 60). 45

#### Patentansprüche

1. Kochgerät mit Entlüftungsvorrichtung, welche angeordnet ist in oder angewendet wird mit Mitteln (90), die eine horizontale Fläche, etwa wie eine Tischfläche ausbilden, umfassend: eine Kochfläche (80), die unterhalb der horizontalen Fläche gelegen ist; Absaugmittel (51, 42, 30, 70, 72) umfassend einen oder mehrere Lüftungskanäle (70, 72) angrenzend an eine oder mehrere Seiten der Kochfläche (80), wobei die Absaugmittel (51, 42, 30, 70, 72) angeordnet sind, um Luft über der Koch-

fläche (80) abzusaugen und diese Luft aus dem Kochgerät abzusaugen; und Gebläseluftmittel (50, 40, 41, 60), angeordnet um eine Gebläseluftschicht über die Kochfläche (80) in Richtung der Absaugmittel (51, 42, 30, 70, 72) zu leiten, um von der Kochfläche (80) aufsteigende Dünste und Dämpfe zu umschließen und die Dünste und Dämpfe in die Absaugmittel (51, 42, 30, 70, 72) zu steuern; dadurch gekennzeichnet, daß der oder jeder Lüftungskanal (70, 72) unterhalb oder in einer Ebene mit der horizontalen Fläche angeordnet ist, daß die Absaugmittel (51, 42, 30, 70, 72) angebracht sind, um Luft abwärts aus dem Bereich unmittelbar über der Kochfläche (80) abzusaugen, daß die Gebläseluftmittel (50, 40, 41, 60) eingerichtet sind, um Gebläseluft horizontal oder abwärts über die Kochfläche (80) zu leiten, und daß während des Gebrauchs der Vorrichtung mehr Luft durch die Absaugmittel (51, 42, 30, 70, 72) abgezogen wird, als durch die Gebläseluftmittel (50, 40, 41, 60) abgegeben wird, so daß die gesamte Gebläseluft durch die Absaugmittel (51, 42, 30, 70, 72) entfernt wird.

2. Entlüftungsvorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Absaugmittel (51, 42, 30, 70, 72) weiter eine Absaugkammer (30) und eine Auslaßleitung (42) umfassen, die unterhalb der horizontalen Fläche gelegen sind.
3. Entlüftungsvorrichtung nach Anspruch 2, dadurch gekennzeichnet, daß der oder jeder Lüftungskanal (70, 72) die Kochfläche (80) an ihrem Umfang stützt.
4. Entlüftungsvorrichtung nach Anspruch 3, dadurch gekennzeichnet, daß die Lüftungskanäle (70, 72) drei Seiten der Kochfläche (80) umgeben, wobei die Lüftungskanäle (70) einander im wesentlichen C-förmiger Anordnung so zugekehrt sind, daß die Luft in den Lüftungskanal (72) gegenüber den Gebläseluftmitteln (50, 40, 41, 60) geführt wird, der einen oberen Teil der Absaugkammer (30) bildet.
5. Entlüftungsvorrichtung nach Anspruch 4, dadurch gekennzeichnet, daß sie weiter eine Leiteinrichtung (71) über dem Lüftungskanal (72) gegenüber den Gebläseluftmitteln umfaßt.
6. Entlüftungsvorrichtung nach Anspruch 4, dadurch gekennzeichnet, daß die Gebläseluftmittel (50, 40, 41, 60) ein Gebläse (50) umfassen.
7. Entlüftungsvorrichtung nach Anspruch 4, dadurch gekennzeichnet, daß die Gebläseluftmittel

(50,40,41,60) einen Kompressor umfassen.

8. Entlüftungsvorrichtung nach Anspruch 4, dadurch gekennzeichnet, daß die Entlüftungsmittel (51,42,30,70,72) ein einstellbares Gebläse (51) umfassen. 5
9. Entlüftungsvorrichtung nach Anspruch 4, dadurch gekennzeichnet, daß die Gebläseluftmittel (50,40,41,60) relativ zu der Kochfläche (80) vertikal verstellbar sind. 10
10. Entlüftungsvorrichtung nach Anspruch 4, dadurch gekennzeichnet, daß die Kochfläche auswechselbar ist. 15
11. Entlüftungsvorrichtung nach Anspruch 1, weiter gekennzeichnet durch Rückführmittel (55), die eingerichtet sind, um einen Teil der durch die Entlüftungsmittel (51,42,30,70,72) entfernten Luft abzusaugen und diesen Teil horizontal oder abwärts über die Kochfläche (80) in oder unter die Gebläseluftschicht zu leiten. 20
12. Entlüftungsvorrichtung nach Anspruch 11, dadurch gekennzeichnet, daß die Rückführmittel (53,55) eine Leitung (55) umfassen, die die Absaugmittel mit den Gebläseluftmitteln (50,40, 541,60) verbindet. 25
13. Entlüftungsvorrichtung nach Anspruch 12, dadurch gekennzeichnet, daß die Rückführmittel (53,55) weiter ein Gebläse (53) umfassen. 30
14. Entlüftungsvorrichtung nach Anspruch 13, dadurch gekennzeichnet, daß die Rückführmittel (53,55) ausgelegt sind, um annähernd 20% der abgeleiteten Luft in die Gebläseluftmittel (50,40, 41, 60) zurückzuführen. 35

## Revendications

1. Système de ventilation pour appareil de cuisson, monté sur ou utilisable avec des moyens (90) définissant une surface horizontale telle qu'un dessus de table, comprenant : 45
  - une surface de cuisson (80) située en dessous de la surface horizontale,
  - des moyens d'évacuation (51, 42, 30, 70, 72) comportant un ou plusieurs canaux de ventilation (70, 72) adjacents à un ou plusieurs côtés de la surface de cuisson (80), les moyens d'évacuation (51, 42, 30, 70, 72) étant conçus pour prélever de l'air d'au-dessus de la surface de cuisson (80), et pour évacuer cet air de l'appareil de cuisson, et 50
  - des moyens de pulsation d'air (50, 40, 41,

60) disposés de façon à diriger une nappe d'air pulsé en travers de la surface d'évacuation (80), dans la direction des moyens d'évacuation (51, 42, 30, 70, 72), pour piéger la fumée et les vapeurs qui s'élèvent de la surface de cuisson (80) et pour diriger la fumée et les vapeurs dans les moyens d'évacuation (51, 42, 30, 70, 72),

caractérisé en ce que le ou chaque canal de ventilation (70, 72) est situé en dessous ou au niveau de la surface horizontale, en ce que les moyens d'évacuation (51, 42, 30, 70, 72) sont conçus pour évacuer l'air vers le bas à partir de la zone directement au-dessus de la surface de cuisson (80), en ce que les moyens de pulsation d'air (50, 40, 41, 60) sont conçus pour diriger l'air pulsé horizontalement ou vers le bas en travers de la surface de cuisson (80), et en ce que, pendant l'utilisation du système, on évacue plus d'air par les moyens d'évacuation (51, 42, 30, 70, 72) que l'on en fournit par les moyens de pulsation d'air (50, 40, 41, 60), de façon que tout l'air pulsé soit évacué par les moyens d'évacuation (51, 42, 30, 70, 72).

2. Système de ventilation selon la revendication 1, dans lequel les moyens d'évacuation (51, 42, 30, 70, 72) comprennent en outre une chambre d'évacuation (30) et un conduit de sortie (42) situé en dessous de la surface horizontale.
3. Système de ventilation selon la revendication 2, dans lequel le ou chaque canal de ventilation (70, 72) supporte la surface de cuisson (80) autour de son périmètre.
4. Système de ventilation selon la revendication 3, dans lequel les canaux de ventilation (70, 72) entourent trois côtés de la surface de cuisson (80), les canaux de ventilation (70) qui se font face étant en forme générale de C, de façon que l'air soit canalisé vers le canal de ventilation (72) opposé aux moyens de pulsation d'air (50, 40, 41, 60), ledit canal de ventilation (72) formant une partie supérieure de la chambre d'évacuation (30).
5. Système de ventilation selon la revendication 4, comprenant en outre un déflecteur (71) au-dessus du canal de ventilation (72) à l'opposé des moyens de pulsation d'air.
6. Système de ventilation selon la revendication 4, dans lequel les moyens de pulsation d'air (50, 40, 41, 60) comprennent un ventilateur (50).
7. Système de ventilation selon la revendication 4, dans lequel les moyens de pulsation d'air (50, 40,

41, 60) comprennent un compresseur.

8. Système de ventilation selon la revendication 4, dans lequel les moyens d'évacuation (51, 42, 30, 70, 72) comprennent un ventilateur réglable (51). 5
9. Système de ventilation selon la revendication 4, dans lequel les moyens de pulsation d'air (50, 40, 41, 60) sont réglables verticalement par rapport à la surface de cuisson (80). 10
10. Système de ventilation selon la revendication 4, dans lequel la surface de cuisson est interchangeable. 15
11. Système de ventilation selon la revendication 1, caractérisé en outre par des moyens de recirculation (55) conçus pour prélever une partie de l'air évacué par les moyens d'évacuation (51, 42, 30, 70, 72) et pour diriger cette partie horizontalement ou vers le bas en travers de la surface de cuisson (80), dans ou en dessous de la nappe d'air pulsé. 20
12. Système de ventilation selon la revendication 11, dans lequel les moyens de recirculation (53, 55) comportent un conduit (55) connectant les moyens d'évacuation aux moyens de pulsation d'air (50, 40, 41, 60) 25
13. Système de ventilation selon la revendication 12, dans lequel les moyens de recirculation (53, 55) comprennent en outre un ventilateur (53). 30
14. Système de ventilation selon la revendication 13, dans lequel les moyens de recirculation (53, 55) sont conçus pour rediriger approximativement 20% de l'air évacué, vers les moyens de pulsation d'air (50, 40, 41, 60). 35

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