The present invention relates to a fume extraction hood (2) having an exhaust opening (4) for leading away exhaust air (A) and an inlet opening (6) for feeding inlet air (Z), disposed adjacent to the exhaust opening (4). In order to achieve an inlet air guide, by means of which cooking vapors can be effectively captured and fed to the exhaust opening (4). The invention proposes that the inlet opening (6) is disposed and implemented so that the inlet air flow (8) flowing out of the inlet opening (6) in a direction oriented opposite to the flow direction of an exhaust gas flow (10) flowing into the exhaust opening (4), and the exhaust air flow (10) is deflected sideways via an extraction path (F).
FUME EXTRACTION HOOD

[0001] The present invention relates to a fume exhaustion hood with an exhaust opening for leading away exhaust air and an inlet air opening, arranged adjacent to the exhaust opening, for supplying inlet air.

[0002] Fume exhaustion hoods have significant air conveying capacities in order to remove cooking fumes produced during cooking as completely as possible from the kitchen space. In order to capture all cooking fumes, it is not sufficient to only suck them in but several times the air volume corresponding to the cooking fumes must be conveyed away in conventional technology.

[0003] In order to prevent that during operation of the fume exhaustion hood an unnecessarily high quantity of heated or air-conditioned room air is removed from the building and/or in order to prevent that exhaust gases of heating systems are sucked into the interior of the building, it is known in the prior art to provide fume exhaustion hoods with inlet air openings through which exterior air and/or recirculated air can be blown into the kitchen space.

[0004] In order to assist in sucking the cooking fumes into the exhaust opening, it is known from the publication DE 199 50 817 A1 to blow the inlet air as an air curtain from a nozzle in the direction toward the exhaust opening and to entrain in this way the cooking fumes. In this fume exhaustion hood 80% of the exhaust air are comprised supposingly of inlet air volume and only 20% of the exhaust air is comprised of cooking fumes. In this solution, the cooking fumes are pushed by the strong inlet air flow away from the exhaust opening; only a fraction of the cooking fumes that are produced is actually removed.

[0005] The publication DE 102 09 735 A1 discloses guiding of inlet air along a guide surface in the direction of an exhaust opening in order to suck it away from there together with the exhaust air. In this context, there is also the problem that the inlet air flow captures and removes too little of the rising cooking fumes.

[0006] The publications DE 10 2006 023 718 A1 and DE 20 2007 012 005 U1 propose to supply inlet air from a position below the fume exhaustion device with a flow direction of the inlet air in the direction of the exhaust opening in order to assist in this way the cooking fumes being sucked into the exhaust opening. The disclosed inlet air systems are very complex and, because of the air induction and turbulence effects, still cannot ensure that the produced cooking fumes are reliably sucked away.

[0007] In the publications DE 10 2005 033 224 A1 and DE 10 2005 024 631, the positioning of inlet air openings spaced at some distance from the exhaust opening is disclosed. The directional arrows that illustrate the course of the flow of the inlet air are deflected directly from the inlet air opening in the direction toward the exhaust opening. The inlet air that is entering the kitchen space is in this way guided in a short-circuit operation directly into the exhaust opening so that it cannot be utilized in a meaningful way to enhance the removal of the cooking fumes.

[0008] All known air guiding systems for the inlet air and the exhaust air have in common that a significant energy expenditure must be provided in order to generate the inlet air and exhaust air quantities. The air guiding actions are not so optimized that the exhaust air quantity is reduced to a man-
exhaust air flow in which it flows directly toward the exhaust opening. In this way, sucking in room air into the exhaust air flow is limited spatially to a zone that is positioned at a certain distance from the fume exhaustion hood but is therefore closer to the cooking area.

[0015] By displacing the air intake into the area of the cooking area and intensifying it and by lateral shielding across the intake stretch of the exhaust air flow, the cooking fumes can hardly mix with the surrounding room air. The cooking fumes are thus very effectively removed. By means of the induction effects, the air quantity that is moved with the inlet air flow is increased and is also guided in a targeted fashion into the area of the cooking zone. Inasmuch as cooking fumes are even able to penetrate the inlet air flow, they are pulled back again into the exhaust air flow by means of the induced room air. By means of the conveying action of the inlet air flow produced by the air swirl, the conveying capacity can be improved and thus the energy consumption of the blower for producing the exhaust air flow can be reduced.

[0016] A further advantage of the inlet air guiding action in accordance with the invention is based on a large portion of the supplied inlet air not mixing with the room air but first circulating in the air swirl and then exiting again directly by means of the exhaust air from the kitchen space. The room air is not heated or cooled unnecessarily by the inlet air but remains unaffected to a large degree within the kitchen space. Energy losses are thus limited to a minimum. Otherwise possible unpleasant draft effects in the kitchen space are also significantly reduced.

[0017] The shape and size of the inlet air opening should be matched to the desired shape and size of the inlet airflow. In most cases, a slot-shaped rectangular configuration of the inlet air opening should be sufficient. Depending on the desired design and effect of the inlet air shield generated by the inlet air flow, other designs can also be selected.

[0018] According to one embodiment of the invention, the blowing direction, the blowing volume and the blowing speed of the inlet air are matched to the exhaust air flow such that at a spacing to the fume exhaustion hood during its operation a standing air swirl is formed whose rotational direction is oriented from the exterior toward the exhaust air flow. Matching of the shape and other technical data of the inlet air flow to the shape and technical data of the exhaust air flow depends also on the shape and size of the fume exhaustion hood itself as well as the air conveying capacities that are to be attained in the exhaust airflow. For matching the respective sizes to each other it is also important how far the standing air swirl is to be spaced from the fume exhaustion hood and how large it should be.

[0019] According to one embodiment of the invention, the exhaust air flow has several inlet air openings by means of which an inlet air flow can be generated. When the fume exhaustion hood is a wall-mounted hood or built-in hood, it may suffice to shield the exhaust airflow only with respect to the room side relative to the room air because the back wall already provides a fixed limitation and via the sides only minimal quantities of cooking fumes will be lost to the exhaust action. In front of the back wall, a second inlet air flow may be provided for enhancement. In particular in case of freely suspended hoods it is possible to shield several sides by an inlet airflow, respectively. In case of round fume exhaustion hoods, it is possible to generate a round standing air swirl at a spacing from the fume exhaustion hood.

[0020] According to one embodiment of the invention, the inlet air flow is guided at least section wise along a lateral wall. In such a section, the inlet air flow is not designed to blow freely into the space but is limited laterally. In this way, the reach of the inlet air flow can be increased because at the wall side no induction effects are produced by means of which the air flow would be slowed down and the inlet air flow is precisely oriented toward a point. The lateral wall can shield the inlet air flow as desired relative to the room air or to the exhaust air flow. The wall can be embodied to be adjustable in order to be able to influence in a targeted fashion the direction of the inlet air flow and/or to match it to different volume quantities.

[0021] According to one embodiment of the invention, the lateral wall has an orientation that is oriented with regard to the outflow direction of the inlet air out of the inlet air opening toward the exhaust air flow. In this way, the space through which the inlet air flow passes is fanning out. By means of the Coanda effect the inlet air flow has the tendency to flow along the lateral wall. Between the outflow direction of the inlet air and the spatial position of the lateral wall an angle up to 45 degrees may exist without this causing the inlet air flow to separate from the wall.

[0022] According to one embodiment of the invention the fume exhaustion hood has at a spacing from the inlet air opening a deflection surface by means of which the inlet air flow is deflectable in the direction toward the exhaust air flow. The curved course of the inlet air flow can be generated or enhanced at a location in a targeted fashion by the deflection surface. The deflection surface is positioned at an angle of incidence relative to the incoming inlet air flow. It can be designed to be continuous or interrupted. When the deflection surface has a break-away edge, the admixture of room air into the inlet air flow can be increased by it.

[0023] According to one embodiment of the invention, the duct walls of the inlet air conveying duct in front of the inlet air opening can have a shape by means of which the outflow direction of the inlet air flow is oriented opposite to the flow direction of the exhaust air flow. In order to keep the flow losses and pressure losses within the fume exhaustion hood as low as possible and to keep the inlet air flow exiting from the inlet air opening as free as possible of turbulence, it is advantageous to orient the inlet air flow already within the fume exhaustion hood as uniformly as possible in the desired flow direction. Within the context of orientation of the inlet air flow, a transverse distribution of the inlet air across the opening width of the inlet air opening can also be provided in order to make the inlet airflow more uniform.

[0024] According to one embodiment of the invention, the volume of the inlet air flow is maximally 40% of the exhaust air flow volume. Because of the smaller volume of the inlet air flow, it can be enlarged by induction effects by proportions of the room air that, together with the inlet air, flow towards the exhaust opening through the air swirl that is being formed. For a reliable removal of cooking fumes, in this connection the air conveying capacity of the fume exhaustion hood as a whole can be lowered relative to known fume exhaustion hoods. For an inlet air volume that is too large, the generation of the advantageous air swirl is impaired.

[0025] According to one embodiment of the invention, the shape and/or size of the inlet air opening is adjustable. Because of the adjustability that also may include the complete closure of individual areas of the inlet air opening, it is possible to focus the inlet air shield to certain cooking field
zones or to adjust it to different blower stages. Also, an adaptation may be required when the inlet air or the exhaust air conveying quantity is to be increased or lowered.

According to one embodiment of the invention, by means of a valve a proportion of the exhaust air volume flow can be conveyed in the fume exhaustion hood to the inlet air opening. The valve can be designed to be fixed or adjustable. As a valve, for example, an air gap in a housing wall is conceivable through which a portion of the exhaust air flow is deflected and supplied to the inlet air opening. In this way, a proportion of the exhaust air flow is guided in circulating operation. In this way, the fresh air proportion in the inlet air can be reduced, for example, in order to avoid that the interior is heated or cooled too much. Moreover, a separate inlet air blower can possibly be eliminated which causes additional cost and energy expenditure.

Also, odor or pollen loading by supplied fresh air can be reduced. It is proposed to separate the exhaust air volume flow once it has passed a grease separation and/or an active carbon filter because only purified exhaust air can be recirculated in this way.

It is shown in:

- FIG. 1 the air guiding schematic of a wall-mounted hood;
- FIG. 2 the inlet air flow and exhaust air flow for the wall-mounted hood according to FIG. 1;
- FIG. 3 an illustration of the air flows by means of directional vectors;
- FIG. 4 the air guiding schematic for an island hood;
- FIG. 5 the inlet air flow and exhaust air flow of the island hood according to FIG. 4;
- FIG. 6 the inlet air flow and exhaust air flow for a round hood;
- FIG. 7 a cross-sectional view from above onto a round hood;
- FIG. 8 an illustration of the air flows at the bottom side of a round hood;
- FIG. 9 a perspective view of the inlet air flow and exhaust air flow of a round hood.

In FIG. 1 in a schematic side view a fume exhaustion hood 2 is illustrated that is mounted on a wall. The fume exhaustion hood 2 comprises an exhaust opening 4 and an inlet air opening 6. While through the inlet air opening 6 the inlet air Z enters the kitchen space, the exhaust air A is exhausted through the exhaust opening 4 from the kitchen space. Already in the schematic side view it can be seen that the inlet air Z and the exhaust air A are oriented in opposite directions.

In the schematic side view of FIG. 2 it is illustrated in detail how the inlet air flow 8 and the exhaust air flow 10 behave. In the illustration of FIG. 2 it can be seen that the inlet air flow 8 exits from the inlet air opening 6 and flows approximately opposite to the direction of the exhaust air flow 10. From here the inlet air flow 8 moves opposite to the flow direction of the exhaust air flow 10, namely along the wall 14 that is present in the embodiment, until the inlet air flow 8 reaches the area of the deflection surface 16. From here, the inlet air flow 8 turns against a bend of approximately 180 degrees in order to subsequently extend approximately parallel to the exhaust air flow 10. After a brief parallel flow stretch, the inlet air flow 8 turns however rather inwardly in order to rotate in an air swirl 12 about a swirl core 20. In this way, a standing air roll is created that forms in upward direction a flow boundary for the exhaust air flow 10 and therefore guides it in a across a protected conveying stretch 22 through the air swirl 12.

The duct walls 18 that are provided upstream of the inlet air opening 6 in the flow direction are designed such that the inlet air flow 8 is guided at least approximately in the desired flow direction. In the embodiment, the inlet air flow 8, after exiting from the inlet air opening, is deflected by a few degrees away from the exhaust air flow because the wall 14 has an orientation that, relative to the outflow direction of the inlet air from the inlet air opening 6 is oriented so as to point away from the exhaust air flow 10. The inlet air flow 8 orients itself in the flow direction as a result of the Coanda effect relative to the extension of the wall 14 which in the embodiment causes the inlet air flow 8 to extend, displaced by approximately 30 degrees in upward direction, in deviation to the exhaust air flow 10. In this way, the air space is enlarged in which an air swirl can form and remain. In the embodiment, the air swirl formation is enhanced by the deflection surface 16 by means of which the inlet air flow 8 is deflected in the direction toward the exhaust air flow 10. The wall 14 and the deflection surface 16 therefore do not serve in a fume exhaustion hood 2 according to the invention to suck in exhaust air and to guide the sucked-in exhaust air into the blower but the wall 14 and the deflection surface 16 can be closed surfaces that have the sole purpose to pre-determine and enhance the flow direction of the inlet air flow 8 and to promote the formation of an air swirl 12.

In FIG. 3, the flow conditions of the inlet air flow 8 and the exhaust air flow 10 are illustrated with the aid of flow vectors. In the view it can be seen clearly that the quantity of the inlet air Z is smaller than the quantity of the exhaust air A. Also, the course of the flow of the inlet air flow 8 up to the deflection surface 16 and the following begin of rotation of the inlet air flow 8 can be seen very well. In the induction area it can be seen that, as a result of the induction, room air is entrained by the air swirl 12 and conveyed in the direction of the exhaust opening 4. In this way, the volume of the inlet air flow 8 is increased that forces the produced cooking fumes as an exhaust flow in downward direction and from there, parallel displaced in the direction of the exhaust opening 4, flows at a slant in upward direction. As a result of the air flows, it is not possible for the exhaust air A to penetrate the air swirl 12 in upward direction. The exhaust air flow 10 remains instead below the inlet air flow 8 and the air swirl 12 and reaches then the area of the exhaust opening 4 that is arranged directly adjacent to the inlet air opening 6 in the fume exhaustion hood 2.

The illustration of FIG. 3 shows clearly that the cooking fumes that are rising from the indicated cooking surface are entrained by the predetermined flow conditions mandatorily from the exhaust air flow 10 and conveyed in the direction of the exhaust opening 4.

In FIG. 4 a fume exhaustion hood 2 that is designed as an island hood is illustrated. Since in case of the island hood according to FIG. 4 the lateral boundary in the form of a wall of the exhaust zone that is acted on by the fume exhaustion hood 2 is lacking, the island hood has on opposite sides of the exhaust opening 4 an inlet air opening 6, respectively. In the embodiment the fume exhaustion hood 2 also has two walls 14 that adjoin the respective correlated inlet air opening 6, respectively.

The effect of this configuration of the double inlet air openings 6 on the air flows is schematically indicated in
the schematic side view of FIG. 5. After exiting from the inlet air opening 6, the inlet air flows 8 also move here first substantially in opposite direction to the flow direction of the exhaust air flow 10 wherein the flow direction is slightly angled by means of the wall 14 wherein the inlet air flow 8 turns after passing a flow stretch in an approximately semicircular flow downwardly and then toward the exhaust opening 4 in order to then reach a standing swirl 12. In this schematic cross section view it also can be seen clearly that the two air swirls 12 force the exhaust air flow 10 in an outer area about it in downward direction while closer to the exhaust air opening 4 they flank the protected conveying stretch 22 in which the exhaust air flow 10 moves toward the exhaust opening 4.

[0045] In FIG. 6 a schematic view of a round fume exhaustion hood is shown in a side view. Here, the inlet air is laterally deflected by plate 24. In the central area of this plate there is the exhaust opening 4 into which the exhaust air flow 10 passes. Here, air swirls 12 are formed also that laterally limit the exhaust air flow 10.

[0046] In FIG. 7, in a view of a round fume exhaustion hood 2, it is indicated by arrows for the inlet air Z pointing in radial direction that the inlet air flow 8 moves in radial direction away from the inlet air opening 6. Such a flow can be generated by an appropriate configuration of the duct walls 18 when viewed in the flow direction in front of the inlet air openings 6, or also by the conveying duct delimited by the plate 24 along the bottom side of the fume exhaustion hood 2.

[0047] In an alternative embodiment in which the inlet air flows in tangential direction out of the inlet air opening 6, a flow scheme indicated in FIG. 8 by the illustrated flow vectors is produced. In this way, a type of rotary flow is produced that flows concentrically about the exhaust opening 4.

[0048] In the side view of the flow conditions illustrated in FIG. 9, it can be seen that also in this case air swirls 12 result in an annular arrangement that, as in the embodiments described before, guide the exhaust air flow 10 to flow about them toward the exhaust opening 4.

[0049] All of the afore described embodiments have in common that the inlet air flow 8 first is blown out from the inlet air opening 6 in a direction that is at least substantially opposite to that of the exhaust air flow 10 wherein the inlet air flow 8, by lateral walls, is deflected by a few degrees away from the general flow direction of the exhaust air flow 10 so that between the inlet air flow 8 and the exhaust air flow 10 across a conveying stretch a pocket is formed in which the inlet air flow 8 can form an air swirl 12 that in its outer area induces room air by the standing rotation, in this way supplements the exhaust air flow 10, and guides it in the direction of the exhaust opening 4.

[0050] The afore described embodiments only serve for illustrating the subject matter of the invention; the invention is not limited to the disclosed embodiments. It will be easy for a person of skill in the art to adapt the embodiments in a way that appears suitable to him to concrete application inasmuch as this appears to be expedient to him.

What is claimed is:

1.-10. (canceled)
11. A fume exhaustion hood comprising:
an exhaust opening that exhausting exhaust air;
an inlet air opening that supplies inlet air and is arranged adjacent to said exhaust opening;
wherein said inlet air opening is arranged and configured such that an inlet air flow exiting from said inlet air opening is oriented in a direction that is opposite to a flow direction of an exhaust air flow flowing toward said exhaust opening and laterally flanks the exhaust air flow across a conveying stretch.
12. The fume exhaustion hood according to claim 11, wherein a blowing direction, a blowing volume, and a blowing speed of the inlet air flow is matched to the exhaust air flow such that, in operation of the fume exhaustion hood at a spacing to the fume exhaustion hood, a standing air swirl is formed that has a rotational direction in which is oriented from an exterior of the fume exhaustion hood toward the exhaust air flow.
13. The fume exhaustion hood according to claim 11, comprising several of said inlet air opening to produce the inlet air flow.
14. The fume exhaustion hood according to claim 11, comprising a lateral wall, wherein the inlet air flow is guided at least sectionally across said lateral wall.
15. The fume exhaustion hood according to claim 14, wherein said lateral wall has an orientation that, in relation to an outlet direction of the inlet air flow from said inlet air opening, is oriented so as to point away from the exhaust air flow.
16. The fume exhaustion hood according to claim 11, comprising a deflection surface positioned at a spacing from said inlet air opening, wherein said deflection surface directs the inlet air flow in a direction toward the exhaust air flow.
17. The fume exhaustion hood according to claim 11, comprising an inlet air conveying duct with duct walls ending at said inlet air opening, wherein said duct walls are shaped in front of said inlet air opening such that an outlet flow direction of the inlet air flow from said inlet air opening is oriented opposite to the flow direction of the exhaust air flow.
18. The fume exhaustion hood according to claim 11, wherein the volume of the inlet air flow is maximally 40% of the volume of the exhaust air flow.
19. The fume exhaustion hood according to claim 11, wherein a shape and a size of said inlet air opening is adjustable.
20. The fume exhaustion hood according to claim 11, wherein a shape of said inlet air opening is adjustable.
21. The fume exhaustion hood according to claim 11, wherein a size of said inlet air opening is adjustable.
22. The fume exhaustion hood according to claim 11, comprising a valve that conveys a portion of the volume of the exhaust air flow to said inlet air opening.

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