The invention relates to a filter system for extracting particles and/or drops of liquid from the air flowing through the filter device. Said filter system consists of a filter layer arranged in a plane and a cyclone collector which is arranged in the edge region of the filter layer. Said cyclone collector is provided with means which, compared with the filter layer, create a higher flow speed and stronger vortexing of the circulating air. The cyclone collector can be produced from horizontal cyclone elements, curved, horizontal elements or from expanded metal.
Abstract

The invention relates to a filter system for extracting particles and/or drops of liquid from the air flowing through the filter device. Said filter system consists of a filter layer arranged in a plane and a cyclone collector which is arranged in the edge region of the filter layer. Said cyclone collector is provided with means which, compared with the filter layer, create a higher flow speed and stronger vortexing of the circulating air. The cyclone collector can be produced from horizontal cyclone elements, curved, horizontal elements or from expanded
Filter System for a Range Hood

The present invention relates to a filter system for a range hood that is used to separate particles and/or liquid droplets, which can be used, in particular, in kitchens above a cooking point.

Filter systems of this kind are already known. DE 27 20 201 C2 and US PS 39 10 782 describes filters that consist of a first row of profiles that are spaced apart and open in the direction of the gas flow, as well as of a second row of profiles that are spaced apart from one another and open in the opposite direction to the gas flow, the long edges of two profiles of one row that are adjacent to one another protruding into the interior spaces of an opposite profile of the other row.

In these separator meshes, the space between the two rows of profiles is such that the air flowing through them changes direction a number of times. Depending on the separator mesh -- Type 10 -- the unobstructed throughput cross section amounts to 30% of the total mesh surface. Because of this reduction of the cross section within the separator mesh, the velocity of the air flow is increased 3 to 10-fold. The separation effect achieved by the mesh is based on this increase in velocity, because of which the droplets of liquid and solid particles that are contained in the air are accelerated, as well as on the repeated changes in the direction of the air flowing through the mesh. The accelerated droplets of liquid and solid particles cannot follow these changes in direction and strike the inside surface of the profile of the second row. The droplets form a film of liquid on this surface and this gradually flows downward and passes through special openings in the
frame of the separated mesh and into a collector rail that is arranged beneath the separator mesh.

DE 298 11 00 U1 describes a grease trap filter in which two or more layers of a mesh are used, said mesh consisting of slot bridges that are made on both sides of a sheet by a punch process, the mesh being arranged within the filter in such a way that the slot bridges extend perpendicularly or obliquely downward and the mesh is held together by a common frame. An additional mesh, the slot bridges of which on arranged horizontally, can be located between every two meshes with slot bridges that are vertical or which extend obliquely downward.

Also known are grease filters consisting of several layers of expanded metal. Thus, DE 197 53 687 A1 describes a multi-layer cone shaped, expanded metal filter that has on the outside a shaped circular ring that ensures good seating on the filter frame.

One important disadvantage of these plate-like or conical grease filters, in which the air that is drawn in by a blower flows through the plates, is their reduced edge extraction.

In order to correct this disadvantage, DE 41 38 846 A1 proposes that, in a filter cassette through the filter surface of which the air that is to be filtered is drawn in, in the interest of improved edges extraction the filter surface be divided into areas through which the air flows, and areas that restrict the through-flow of the air, and that the areas that restrict the through-flow are made larger towards the middle of the filter surface. One disadvantage of this is that the filter surface as a whole is reduced in order to optimize the flow.
Also known from the industrial sector are transverse-flow plate-like separators that remove liquids, in particular oil mist, from a gas flow; vortexes elements, so-called X-shaped vortex elements, are used in these; these deflect the gas flow and thus separate the liquid out (DE 41 31 988 C2). Such transverse-flow, plate-like separators are not suitable for use in commercial kitchens or in domestic range hoods.

It is the objective of the present invention to create a filter system in which the air flows through a filter plane, and which provides for improved edge extraction.

This objective has been achieved with the distinguishing features set out in Claim 1; advantageous developments of the present invention are set out in the secondary Claims. Claim 48 describes a preferred application for the present invention.

The present invention makes provision such that the filter system for separating out particles and/or liquid droplets from the air that flows through the filter system consists of at least one filter layer that is arranged in one plane and an edge filter that is disposed in the edge area of the filter layer. It is preferred that the edge filter be provided with means which -- as compared to the filter layer -- bring about an increased flow velocity and increased turbulence.

As is known from the prior art, the filter layer 3 can consist of one or a plurality of layers of expanded metal and/or non-woven fabric and/or paper, the edge filter being constructed as a turbulent-flow filter, a baffle filter, and/or as an expanded metal, non-woven fabric, or paper filter.
Greatly improved edge extraction can be achieved by this arrangement of a transverse-flow vortex separator. It is an advantage if the flow resistance of the edge filter be less than the flow resistance of the filter layer since, because of this, vapours in the edge area of the filter of system are prevented from leaving this edge area. In addition, the increased flow velocity that results from the lower flow resistance increases turbulence.

Because of this, the particles or liquid droplets are separated out better in the edge filter, in particular if the edge filter is configured as a vortex filter or as a baffle-type filter.

The edge filter, which is configured as a vortex separator, has at least one, preferably two, rows of devices that are arranged one behind the other to form vortices in the air flowing through the vortex separator. Since, for example, a range hood has an enclosing edge, it is advantageous if the whole of the edge incorporate an enclosing edge extractor so as to prevent vapours leaving the suction area of the range hood. For this reason, it is advantageous if the edge filter be arranged so as to encircle the edge area.

In addition, this configuration of the present invention makes provision such that the edge filter is arranged on the edge area and preferably perpendicular to the plane of the filter layer such that droplets of liquid that are separated out within the edge filter flow into the edge area of the filter layer, where they are collected.

If the filter layer, which consists of one or a plurality of layers of expanded metal and/or non-woven fabric and/or paper, is enclosed by a U-shaped frame, a further advantageous configuration the present invention provides that the upper arm of the frame be extended in order to accommodate the edge filter. In order to be able to drain off droplets of liquid
that are separated out within the edge filter here as well, in one preferred embodiment the edge filter has openings in the area of the edge filter that is arranged on it.

A vortex separator that has a row of X-shaped vortex elements, preferably two rows of X-shaped vortex elements that are arranged one behind the other, has proved itself as an edge filter. In the case of two rows of X-shaped vortex elements that are arranged one behind the other, their curved arms engage in one another so as to leave an air gap between them. If a transverse flow passes through the X-shaped vortex elements, vortices are formed so that the particles and/or droplets of liquid that are contained in the air strike the walls of the arms and are separated out.

In another advantageous embodiment, provision is made such that the filter layer with the edge filter or the filter layer with the vortex separator and the frame together form a cassette filter.

The filter system as such, and in particular in the configuration as a cassette, can preferably be inserted into the extraction opening of a range hood or vent that has an air-supply device for drawing off air through the extraction opening. In addition, this cassette can be made so as to be replaceable, and is thereby made easier to service.

In addition, the filter system makes it possible to arrange a screen on the edge filter, said screen extending radially outward beyond the edge of the filter system so as to guide vapour and steam to the filter system, in particular to the edge filter.

In another embodiment of the vortex separator that is configured as an edge filter, horizontal, rounded elements are used, these elements being so placed on the edge of the
filter system that the in-flowing air first encounters a form that is favourable for the flow. As the air then passes through the vortex separator it is deflected by at least one additional rounded element.

In a first configuration of the rounded element, this is configured as a C-shape. The convex "back" of the C-shape faces the filter edge. Unattached arms of an additional C-shaped rounded element fit into the concave "opening" of the C-shape. This causes a sharp deflection of the current of air, so that the droplets of grease or water are deposited on the surface of the vortex separator.

Additional configurations of the rounded elements are V-shaped, S-shaped, teardrop shaped, or dumbbell-shaped. This will be discussed in greater detail in the description of the drawings. According to the present invention, the vortex separator can consist of a combination of at least two different shapes.

If a plurality of rounded elements has to be installed, it is a disadvantage if these elements have to be installed individually. For this reason, it is advantageous if the rounded elements be arranged on a common base plate. This baseplate can be located above or below the rounded elements. However, it is advantageous if the base plate be arranged below, since residues of the grease or water condensate that run off the rounded elements then collect on the base plate, which can then be subjected to a cleaning process, for example in a dishwasher, in one piece with the rounded elements.

Is it also an advantage if the base plate extend along the edge of the filter layer. In this arrangement, the condensate and grease separated by the edge filter can then run off over the base plate and be absorbed or collected by the filter layer. It is an advantage if the
base plate be inclined toward the filter layer. If the base plate is not so inclined, the condensate is not forced to run from the edge of the filter system because the air flow constantly draws the condensate towards the middle of filter.

The rounded elements are not bounded on only one side by the base plate; there is an additional plate on the other side. These two plates together form a channel. It is advantageous if both plates form a gap that grows wider -- as viewed in the direction of the flow -- because these plates then form a type of nozzle, and this nozzle shape increases condensation.

It is advantageous if the vortex separator with the rounded elements can be manufactured by injection molding. This results in lower costs for mass production despite the complex shape of the vortex separator. It is particularly cost effective to produce them from plastic. However, a vortex separator that is manufactured by injection molding from a light metal is also suitable for mass production. In addition, it is more resistant to cleaning -- which is sometimes aggressive -- than a vortex separator that is of plastic. Aluminum has been found to be particularly suitable for manufacturing a vortex separator from a light metal.

If an edge filter is disposed on a least one long side of the filter layer, then the edge filter can also replace this part of the filter-layer frame. This obviates the need to use metal for this part of the frame.

In another configuration of the vortex separator, it is part of a range hood. Because of this design proximity to a range hood a number of functions can be configured so as to be more convenient. This will be dealt with in greater detail below.
As has already been discussed, the edge filter, which is preferably configured as a vortex separator, is located in the edge area of a filter system. As has also been discussed, it is important that the edge area of the filter arrangement can be well evacuated so that stray vapours cannot leave the effective area of the filter. For this reason it is advantageous if the edge filter have an inlet opening for the flow that is oriented downward.

A edge filter that is proximate to the vapours and exposed can possibly hinder handling during the cooking process. For this reason, it is advantageous that the edge filter be configured so as to fold, so that it is only deployed when required. Further to this, it is advantageous if the edge filter can be so configured that it can be activated or deactivated, since if there are only a few vapours then it will be sufficient if these are drawn through the middle area of the filter layer. This can result in a savings of energy costs. The filter can be activated and deactivated manually in a very simple manner. However, it is also possible to do this automatically. The automatic system required to do this is controlled by means of a sensor that can be configured as a pressure sensor.

Since the edge filter can become very heavily soiled, it is advantageous if this can be very easily removed. This can be effected, for example, by means of this simple plug and snap connection.

In addition to the embodiments of the vortex separator that is configured as an edge filter, as an X-shaped vortex elements, or as horizontal, rounded elements, according to the present invention there is also an edge filter that is of the expanded metal. Expanded metal is known in many forms, even in the domain of kitchen filters. However, in order that a vortex separator that is of expanded metal can also fulfil the requirements of lower
flow resistance for the edge area of the filter layer, the expanded metal must permit easier passage of air than a filter layer. Important in this configuration is the fact that condensate can move from the expanded metal to the filter layer. For this reason, in a vortex separator that is of expanded metal, the surface of the expanded metal is inclined toward the filter layer.

In one configuration of the present invention, the expanded metal of the edge filter and the expanded metal of the filter layer is formed in one piece. In order to ensure that the air can pass easily through the edge filter there is only a single layer of expanded metal in the area of the edge filter.

The expanded metal for the edge filter can however be a separate component. This entails the advantage that the edge filter is a less bulky component, and for this reason is easier to handle when it has to be cleaned.

Even though no shapes worthy of note are required in the case of an edge filter that is of an expanded metal -- as is the case, for example, with rounded elements -- it is nevertheless advantageous that the edge filter be surrounded by a component that is manufactured by injection molding. This advantage is clear if one produces the oblong "housing" of an edge filter from extruded material so that the cross section of the material is constant over its total length. If, for example, local variations in the thickness of the material -- as viewed over the length of the material -- are required, this is not possible if extruded materials are used. However, injection molding can be used to realize a bore or a nozzle bead.
Extruded profiles that include an edge filter in the longitudinal direction can be held in their desired position very simply by a cap that is applied to the face end. To this end, the end caps have appropriate recesses on the side that is proximate to the extruded profiles.

It can happen that the edge filter that is preferably of expanded metal releases drops of condensate before they reach the filter layer. In this case, it is an advantage that the inflow opening for the vapours -- on the underside of the edge extraction -- be provided with an inside edge. This means that the droplets cannot flow back through the inflow opening. This edge also entails the advantage that the inflow opening becomes a nozzle that enhances condensation of the vapours.

The effect of more intensive edge extraction can be enhanced still further if two filter layers, each of which has edge extraction at least on one edge, are disposed so as to be adjacent to each other. This results in more powerful and moderate extraction.

In areas where stronger vapours are generated, for example in large kitchens or in other areas where a great deal of cooking takes place, it can be advantageous that there be a collector channel in the range hood to accommodate the increased amount of condensate that is formed. The condensate that is trapped can then either revapourize in the case of a small amount of condensate, or can be removed through a drain.

The filter system according to the present invention will be described in greater detail below on the basis of the drawings appended hereto. These drawings show the following:

Figure 1: A filter system that is in the form of a cassette filter;
Figure 2: An arrangement of an edge filter in the form of a vortex separator;

Figure 3: A frame with a filter layer and vortex separators;

Figure 4a-4e: Various basic shapes of the vortex separator in the form of rounded elements;

Figure 5: A range hood with the vortex separator with the C-shaped elements removed from it;

Figure 6: A section of a vortex separator with C-shaped elements;

Figure 7: A cross section through an edge filter with an air delivery device;

Figure 8: A cassette filter with a vortex separator with C-shaped elements;

Figure 9: A cross section corresponding to Figure 8;

Figure 10: A cross section through an edge filter that is of expanded metal;

Figure 11: A cassette filter with an edge filter housing that is an extruded profile;

Figure 12: A cross section corresponding to Figure 11 (installed);

Figure 13: A range hood with a plurality of filter systems that are arranged adjacent to each other.

Figure 1 shows a filter system 1 that is used to separate particles and/or droplets of liquid from the air flowing through the filter system 1, with the least one filter layer 3 that is disposed in a plane and an edge filter that is configured as a vortex separator and is
arranged so as to enclose the edge area 4 of the filter layer 3. The filter system 1 is in the form of a cassette filter. The filter layer 3 is enclosed by a U-shaped frame 5 on which a vortex separator 6 is arranged. The filter system 1 is located beneath a range hood 2.

The filter system 1 is so designed that the flow resistance of the vortex separator 6 that is in the form of an edge filter is less than the flow resistance of the filter layer 3, so that good edge extraction is achieved.

This is additionally enhanced by the screen that is arranged on the vortex separator 6 and which extends outwards beyond the edge of the filter system 1 and conducts vapours and steam to the filter system 1, in particular to the vortex separator 6.

Figure 2 shows that the vortex separator consists of two rows of X-shaped vortex elements 7, 8 that are disposed one behind the other. The inner arms 7.1, 8.1 of the two rows of X-shaped vortex elements 7, 8 fit into each other so as to leave an air gap, so that air flows transversely through the X-shaped vortex elements. This generates vortices, with the result that the particles and/or droplets of liquid that are contained in the air impinge on the walls of the arms 7.1, 8.1 and are separated out of the air thereby.

The rows of the X-shaped vortex elements 7, 8 that form the vortex separator 6 are disposed on the edge area 4 and perpendicular to the plane of the filter layer 3 so that droplets of liquid that are separated out can flow into the edge area 4 of the filter layer, where they collect.

In the embodiment shown in Figure 2, the filter layer is enclosed by a U-shaped frame 5.

The X-shaped vortex elements are disposed in such a way that their outer arms are flush
with the front edge of the frame. However, condensate can also form on the outside surfaces of the X-shaped vortex elements 7 that face the edge of the filter system 1. In order to ensure that this condensate does not drip beyond the edge of the frame 5, it is advantageous that the frame 5 incorporate drain elements that conduct the condensate to the filter layer.

If the X-shaped vortex elements 7, 8 are simply installed on the filter layer 3 without being fixed in position, they could slip, when the gap between their arms 7.1, 8.1 would be of an undefined shaped. For this reason, it is advantageous that the frame 5 be adjacent to the X-shaped vortex elements 7, 8 and for this reason makes it possible to join the X-shaped vortex elements 7, 8 to the frame 5. This is best effected by means of screws.

Figure 3 shows a section of a U-shaped frame 5 with a lower frame arm 11 and an upper frame arm 10, the upper frame arm 10 being extended in order to accommodate the X-shaped vortex elements 7, 8. If there is no frame 5, the X-shaped vortex elements 7, 8 and 6 can be screwed directly to the filter layer 3, given that the filter layer 3 is a rigid enough to permit this.

It is also shown that the frame 5 incorporates openings 9 in the area of the X-shaped vortex elements 7, 8 that the disposed upon it; these openings 9 drain off the liquid that runs off from the X-shaped vortex elements 7, 8.

The filter system 1 that is proposed is particularly well-suited for separating grease and droplets of grease, or water and water droplets, from the air that flows through the filter system 1, although it is not restricted to this.
Figure 4a to Figure 4e show different shapes of the so-called "horizontal, rounded" elements 12 in plan view. These elements on an important component in a vortex separator 6 that functions as an edge filter. When air 13 that is drawn in encounters the edge area 4 of a range hood 2, it strikes the shape (rounded or pointed) of the elements that are directed outwards and which is favourable for the flow. For this reason, the flow resistance is slight and induction of the vapours is not significantly hindered as a result.

Further on, the air encounters at least one additional element 12. Because of the tortuous paths between the elements 12, the partial flows of air are forcibly deflected. Droplets of grease or water that are contained in the air flow strike the walls of the elements 12, where they are precipitated. Common to the elements that are shown in Figure 4a to Figure 4e is the fact that it is always two identically shaped elements 12 (even with partially opposite orientation) that function together when deflecting the air and during the separation process. This must not necessarily be so; however, the element shapes that have been selected as examples display this type of shape matching so that together they form narrow and sharply deflecting channels.

The elements shown in Figure 4a can be designated as C-shaped or U-shaped. Figure 4b shows V-shaped elements 12. In the example shown in Figure 4c these are S-shaped or wave-shaped elements 12. The elements 12 shown in Figure 4d (tear-drop shaped) and 4e (dumbbell-shaped) are bulky elements. In order to save material, these elements can also be configured so as to be hollow. There is no danger of condensate collecting in the resulting spaces if the hollow spaces are closed off by means of a cover plate, which then functions simultaneously a guide baffle for the air.
Figure 5 shows a range hood 2 with a vortex separator 6 that is configured as an edge filter removed from the front, the filter layer (not shown herein). The vortex separator 6 has two rows of C-shaped elements 12. In the front row, the "Cs" lie with their "backs" toward the outside. The "C-elements" of the inside row have their arms in the concave area of the "C-elements" of the front row.

Figure 6 shows in detail the vortex separator 6 that serves as an edge filter, with the C-shaped elements 12. The air that is drawn in moves from below through an inlet opening 16 into a collector channel 17. Here, the air flow splits into individual partial flows that then flow between the C-shaped elements 12, and subsequently recombine to form a single air flow. The C-shaped elements 12 are disposed on a base plate 14. Together, the base plate 14 and its C-shaped elements 12 formed a unit that is produced by injection molding. When installed, the top of the vortex separator 6 is covered.

The edge filter 6 can be made so as to fold. Thus, when necessary, it can be folded out, and when not in use it does not detract from the appearance of the apparatus.

The edge filter can be provided with a catch (not shown herein). If necessary, the edge extraction of the edge filter 6 can be activated. Thus, there are two operating states: one being extraction only by way of the filter layer 3, and the other extraction by way of the filter layer 3 and the edge filter 6. Activating and deactivating the edge filter can be effected manually and/or automatically or by a motor, preferably by way of a flap (not shown herein) or a slide (not shown herein), that can be disposed upstream or downstream from the edge filter.
Automatic activation or deactivation of the edge filter 6 can also be controlled by a sensor, preferably as a function of the quantity of air that is to be cleaned.

The activation and deactivation of the edge filter can be effected automatically, preferably in that a spring loaded flap (not shown herein) is provided, this flap opening and closing automatically as a function of the pressure difference between the outside of the filter system (upstream) and the low pressure side of the filter system (downstream), preferably as a function of the selected blower stage. Such a flap can also be referred to as a dynamic-pressure flap.

For additional clarification, Figure 7 shows a cross section through a vortex separator that serves as an edge filter, this having rounded elements 12. The air 13 that is drawn in moves through the inflow opening 16 into the collector channel 17 where, because of the large radius of curvature, it is gradually routed towards the middle of the range hood. During this time it flows through the rounded elements 12, when condensate 19 is precipitated out. In this drawing, the elements 12 are not shown in cross section. Because of the inclined baseplate 14, the condensate runs onto the surface of the filter layer 3, where it is caught and/or collected. In this drawing, it can be seen clearly that the base plate 14 together with a panel of the range hood body that is disposed above it forms a nozzle that grows wider. The vortex separator 6 is secured to the range hood housing by a snap fastener 18 (attachment device). If this snap fastener 18 is released then, as shown in this example, the vortex separator together with the filter layer (which is configured as a cassette) can be removed.
Figure 8 shows a filter layer 3, which is configured as a filter cassette, that has been removed. The vortex separator 6 is arranged on the front edge. Above the vortex separator 6 there is a counterpiece that is clamped to the vortex separator 6 and is thus fixed in position on a front part of the frame 5 of the filter cassette. A handle recess 20 is disposed in the rear area of the filter cassette so that it does not disrupt the air flow and degrade the filtering process thereby.

Figure 9 is similar to Figure 7 except that in Figure 9 the filter layer is configured as a cassette filter. The frame 5 of the filter cassette and the vortex separator 6 are clamped together. On its right-hand outer side, the vortex separator has a catch 18 with which it can be snapped into position on the housing of the range hood 2 (not shown herein).

Figure 10 to Figure 13 show an additional design solution for an edge filter 6. This is an edge filter 6 with at least one layer of expanded metal.

In the cross section view shown in Figure 10, on the left-hand side there is a filter layer 3 with a regular number of layers. These layers can be different expanded metal layers or combinations of paper layers and/or layers of non-woven fabric. As is indicated by the shaded portions, the filter layer extends into the area of the edge filter 6. Here, however, the number of layers in the edge filter 6 is reduced compared to the filter layer 3, and the effective layer is manufactured from expanded metal. This reduction in the number of layers is necessary in order to keep flow resistance low in the area of the edge filter 6. On the other hand, the designer must ensure that a sufficient number of expanded metal mesh rods is available so that droplets of grease and/or water can be sufficiently deflected and can be deposited on the obstacle represented by an expanded metal mesh rod. The
condensate then remains adhering to the expanded metal in the area of the edge filter 6. Because of the slope of the expanded metal, the condensate 19 gradually migrates to the filter layer 3, where the condensate is absorbed and/or collected.

The edge filter 6 is disposed in a housing 21. In Figure 10, this housing is shown as being a one-piece injection molded plastic part. Within the left-hand area of the housing 21 there is a fork-shaped clamp with which the expanded metal edge filter is secured to the filter layer 3. Within the right-hand area of the edge filter 6 there is a catch 18 that is attached to a U-shaped spring part. Of particular importance is the lower area of the edge filter 6, where there is a round inflow opening 16. Additional inflow openings 16 are located behind and in front of the section plane. The inflow opening 16 can also be configured as a slot that extends across the whole edge side. In order that the inflow opening 16 cause very low flow resistance, it is rounded off in the induction area. The inflow opening 16 also extends into the space beneath the expanded metal. This space is also referred to as the collector space 22. This collector space 22 ensures that any condensate that may drop of the expanded metal cannot drain off down through the inflow opening 16. This would be detrimental to hygiene in a cooking area. When condensate collects in the collector space 22, this condensate can be revapourized and carried away if the range code is being operated when not much condensate forms. Should condensate still be present, it can be emptied when the vortex separator 6 is removed, for example to be cleaned.

In Figure 11 and Figure 12, the edge filter 6 is accommodated by two elongated extruded parts. An upper part 23, a lower part 24, and two end caps 25 form a housing for an edge filter 6 which, as in Figure 10, is configured as an elongated, thin, expanded metal filter
of the filter layer 3. Figure 11 is a perspective exploded view of this arrangement. When assembled, the edge filter 6 holds a cassette filter without the need for any additional fasteners on the frame 5. In order that the end caps 25 can be installed on the parts 23 and 24, there must be suitable slots on the sides of the end caps 25 that face the parts 23 and 24. If the slots are made sufficiently narrow, this results in good clamping forces, so that a high level of mechanical stability is imparted to the edge filter 6.

Figure 12 shows an assembled edge filter 6 in cross section. The upper part 23, the lower part 24, and the expanded metal of the edge filter 6 enclose an edge filter 6 that is essentially configured as an expanded metal filter. Here, one end cap 25 lies behind the plane of section. The parts 23 and 24 clamp the filter layer 3 and thus fix the edge filter 6 in position on the filter layer 3. The inflow opening 16 is formed by the gap where the ends of parts 23 and 24 meet. Because of the fact that the parts 23 and 24 are extruded parts, the inflow opening 16 is in the form of a slot. The upward curving lower edges of the parts 23 and 24 not only form a nozzle 15, as can be seen in Figure 10, but they also form two collector spaces 22 for any condensate that may drip down.

The lower part 24 is inclined at outward and downward. Because of this, any vapour that builds up beneath the filter layer 3 of a range hood 2 is prevented from leaving the extraction area of the hood. It is then advantageous that the inflow opening 16 face this area where the vapour may accumulate.

Figure 13 a shows a range hood 2 with three filter elements, which are in the form of truncated pyramids, arranged adjacent to each other. Each of these filter elements is provided with a filter layer 3 and edge extraction. The edge extraction is located mostly
in an area of the inclined sides of the truncated pyramid. Behind the inflow openings there is at least one layer of expanded metal that forms the edge filter. It is preferred that the expanded metal of the edge extraction cause less flow resistance than the expanded metal at the midpoint of the filter layer. Because of the edge extraction that is realized thereby, in conjunction with the adjacent arrangement, there is advantageous large-area extraction, even in the middle area of a range hood. In the case of a range hood with a large extraction surface, as is shown in Figure 13, this results in increased condensation. For this reason, it can be advantageous if, in the case of a range hood constructed as shown, there be an additional collector for the condensate. A large filter surface is made available because of the configuration of the filter system as a truncated pyramid.
Patent Claims

1. Filter system (1) for a range hood that is used to separate particles and/or droplets of liquid from the air flowing through the filter system (1), with at least one filter layer (3) that is arranged in one plane and with an edge filter (6) that is arranged in at least an edge section of the filter layer (3), characterized in that the edge filter is configured as a vortex separator.

2. Filter system (1) for a range hood that is used to separate particles and/or droplets of liquid from the air flowing through the filter system (1) with at least one filter layer (3) that is arranged in one plane and with an edge filter (6) that is arranged in at least an edge section of the filter layer (3), characterized in that the edge filter offers less of flow resistance than the filter layer (3).

3. Filter system as defined in Claim 1 or Claim 2, characterized in that it is preferred that the edge filter (6) be configured in particular as a vortex separator or baffle filter; and in that the vortex separator (6) have at least one row, preferably two rows arranged one behind the other, of devices for generating vortices in the air flowing through the edge filter (6).

4. Filter system as defined in one of the Claims 1 to 3, characterized in that the edge filter (6) is arranged around the edge area (4) of the filter layer (3).

5. Filter system as defined in one of the Claims 1 to 4, characterized in that the edge filter (6) is arranged on the edge area (4) of, and preferably perpendicular to, the
plane of the filter layer (3) such that droplets of liquid separated out in the edge filter (6) flow into the edge area (4) of the filter layer (3), where they are collected.

6. Filter system as defined in one of the Claims 1 to 5, characterized in that the filter layer (3) has one or a plurality of layers of expanded metal and/or non-woven fabric and/or paper.

7. Filter system as defined in one of the Claims 1 to 6, characterized in that the filter layer (3) is enclosed in a U-shaped frame (5) that has a lower frame arm (11) and an upper frame arm (10), the upper frame arm (10) being extended in order to accommodate the edge filter (6).

8. Filter system as defined in Claim 7, characterized in that in the area of the edge filter (6) that is arranged on it, the frame (5) incorporates openings (9) for draining off liquid that runs off the edge filter (6).

9. Filter system as defined in Claim 7 or Claim 8, characterized in that the filter layer (3) with the edge filter (6) or the filter layer (3) with the edge filter (6) and with the frame (5) forms a cassette filter.

10. Filter system as defined in one of the Claims 1 to 9, characterized in that the flow resistance of the edge filter (6) is less than the flow resistance of the filter layer (3) and the edge filter (6) permits a higher flow velocity than the filter layer (3).

11. Filter system as defined in one of the Claims 1 to 10, characterized in that a screen is arranged on the edge filter (6), said screen extending radially outwards beyond
the edge of the filter system (1) in order to guide vapour and steam to the filter system (1), and in particular to the edge filter (6).

12. Filter system as defined in one of the Claims 1 to 11, characterized in that the filter system (1) can be used to separate grease and droplets of grease or water and droplets of water from the air passing through the filter system (1).

13. Filter system as defined in one of the Claims 1 to 12, characterized in that the edge filter (6) has a row of X-shaped vortex elements (7), preferably two rows of X-shaped vortex elements (7, 8) that are arranged one behind the other, the curved arms (7.1, 8.1) of the X-shaped vortex elements (7, 8) fitting into one another so as to leave an air gap, so that air passes transversely through the X-shaped vortex elements (7, 8), which generates vortices, so that particles and/or droplets of liquid contained in the air impinge on a wall of the arm (7.1, 8.1) and are separated out.

14. Filter system as defined in Claim 13, characterized in that the outer row of the X-shaped vortex elements (7) in the outer edge area is aligned with the edge of the filter layer (3) or of the frame (5) that encloses them.

15. Filter system as defined in Claim 13 or Claim 14, characterized in that the X-shaped vortex elements (7, 8) with the filter layer (3) and/or of the frame (5) that encloses them, are joined, preferably screwed, to the frame arm (10).

16. Filter system as defined in one of the Claims 3 or 13, characterized in that the vortex separator (6) consists of an arrangement of horizontal rounded elements
(12), the inflowing air (13) first encountering the rounded elements (12) that are of a shape that is favourable from the standpoint of the flow and then, in conjunction with the least one additional rounded element (12), undergoes at least one deflection.

17. Filter system as defined in Claim 16, characterized in that the rounded elements (12), are C-shaped.

18. Filter system as defined in Claim 16, characterized in that the rounded elements (12) are V-shaped.

19. Filter system as defined in Claim 16, characterized in that the rounded elements (12) are S-shaped.

20. Filter system as defined in Claim 16, characterized in that the rounded elements (12) are tear drop-shaped.

21. Filter system as defined in Claim 16, characterized in that the rounded elements (12) are dumbbell-shaped.

22. Filter system as defined in one of the Claims 16 to 21, characterized in that the system of rounded elements (12) consists of a combination of at least two different shapes.

23. Filter system as defined in one of the Claim 16 to 22, characterized in that the rounded elements (12) are disposed on a common base plate (14).
24. Filter system as defined in Claim 16 to Claim 23, characterized in that the base plate (14) extends along at least one edge of the filter layer (3).

25. Filter system as defined in one of the Claims 16 to 24, characterized in that the baseplate (14) is inclined towards the filter layer (3).

26. Filter system as defined in one of the Claims 16 to 25, characterized in that above the rounded elements (12) there is a plate that, together with the base plate (14), forms a nozzle (15) that grows wider towards the filter layer (3).

27. Filter system as defined in one of the Claims 16 to 26, characterized in that the edge filter (6) is manufactured by injection molding.

28. Filter system as defined in Claim 27, characterised in that the edge filter (6) is manufactured from plastic.

29. Filter system as defined in Claim 27, characterized in that the edge filter (6) is of light metal.

30. Filter system as defined in Claim 29, characterized in that the edge filter is produced from aluminum.

31. Filter system as defined in one of the Claims 16 to 30, characterized in that the edge filter (6) is part of the frame (5) of the filter layer (3).

32. Filter system as defined in one of the Claims 16 to 30, characterized in that the edge filter (6) is part of a range hood (2).
33. Filter system as defined in one of the Claims 16 to 32, characterized in that an elongated collector channel (17) is associated with the edge filter (6), said channel incorporating an inflow opening (16) that it is oriented downward.

34. Filter system as defined in one of the Claims 16 to 33, characterized in that the edge filter is configured so as to fold out.

35. Filter system as defined in one of the Claims 16 to 34, characterized in that the edge filter (6) can be activated or deactivated by means of a slide or a flap.

36. Filter system as defined in Claim 35, characterized in that activation and deactivation are effected manually.

37. Filter system as defined in Claim 35, characterized in that activation and deactivation are effected automatically, preferably in that a spring loaded flap is provided that opens and closes automatically as a function of the pressure differential between the exterior of the system and the low-pressure side, preferably as a function of the blower stage that is selected.

38. Filter system as defined in Claim 37, characterized in that automatic activation and deactivation is controlled by a sensor, preferably as a function of the quantity of air that is to be purified.

39. Filter system as defined in one of the Claims 16 to 38, characterized in that the edge filter (6) is configured so as to be easily removed.
40. Filter system as defined in one of the Claims 1 to 39, characterized in that the edge filter (6) consists of expanded metal that is inclined towards the filter layer (3).

41. Filter system as defined in Claim 40, characterized in that the expanded metal of the filter layer (3) and of the edge filter (6) is configured so as to be in one piece or divided.

42. Filter system as defined in Claim 40 or Claim 41, characterized in that the expanded metal of the edge filter (6) incorporates fewer layers than the filter layer (3) in order to reduce the flow resistance of the edge filter (6) and to increase edge extraction.

43. Filter system as defined in one of the Claims 40 to 42, characterized in that the edge filter (6) is held in a housing (21), attachment elements being provided on the housing (21) to secure the filter system to the range hood.

44. Filter system as defined in one of the Claims 40 to 42, characterized in that the edge filter (6) is held by two parts (23, 24) that are preferably produced by extrusion.

45. Filter system as defined in Claim 44, characterized in that the two parts (23, 24) are held at their face ends by means of end caps (25).

46. Filter system as defined in one of the Claims 40 to 45, characterized in that the edge filter (6) has on its underside at least one nozzle (15) that is reflected inward.
47. Filter system as defined in one of the Claims 1 to 46, characterized in that a plurality of filter systems is arranged adjacent to one another.

48. Filter system as defined in one of the Claims 1 to 47, characterized in that at least one collector chamber (22) for the condensate that is separated out, in particular, in the edge filter (6), is associated with the filter system (1).

49. Filter system as defined in one of the Claims 1 to 47, characterized in that the filter system is configured as a block or as a truncated pyramid with an underside and four edge sides, the filter layer (3) being installed on the underside and an edge filter (6) being provided on at least one edge side.

50. Range hood (2) with a housing that incorporates an extraction opening, and an air delivery device for extracting air through the extraction opening, the extraction opening being provided with the filter system (1) as defined in one of the preceding Claims 1 to 49.