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(54)

Fan guard and air heat exchanger provided with such fan guard

(57) A fan guard (4) for an air heat exchanger (2) and an air heat exchanger comprising such a fan guard is provided. The fan guard comprises a grid (8) arranged to enclose a fan (6) of the air heat exchanger and a first attachment means (18) arranged to engage with a second attachment means (38) of the air heat exchanger to attach the fan guard to the air heat exchanger. The second attachment means projects from a surface (44) of the air heat exchanger. The fan guard is characterized in that the first attachment means comprises a hook (22) having a first end (24) at which the hook is connected to the grid. The hook is arranged to just partially encircle

the second attachment means to attach the fan guard to the air heat exchanger. The hook has an opening (36) enabling the hook to move into partial encirclement of the second attachment means when the fan guard is rotated in relation to the air heat exchanger, around a center axis (C) of the fan guard, in a first rotation direction (D1), and out of partial encirclement of the second attachment means when the fan guard is rotated in relation to the air heat exchanger, around the center axis of the fan guard, in a second rotation (D2) direction which is opposite to the first rotation direction.

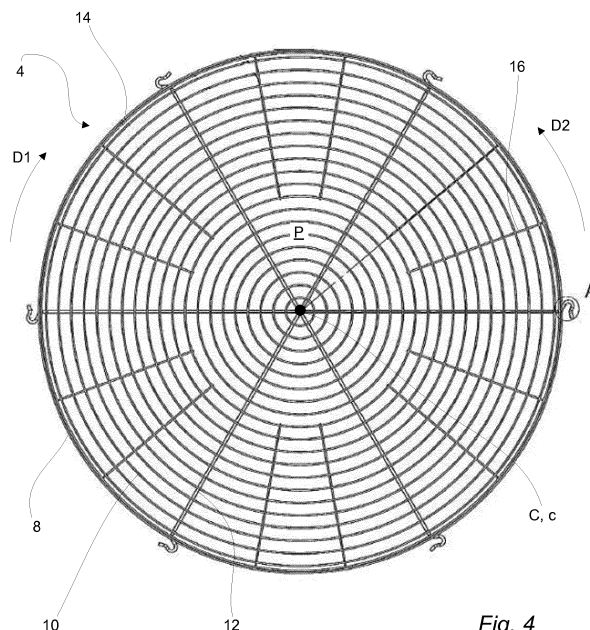


Fig. 4

Description

TECHNICAL FIELD

[0001] The invention relates to a fan guard for an air heat exchanger according to the preamble of claim 1. The invention also relates to an air heat exchanger provided with such a fan guard.

BACKGROUND ART

[0002] An air heat exchanger typically comprises a casing enclosing a great number of fins arranged in an aligned manner, one after the other, in a fin stock. The fins are each provided with a matrix of holes through which a plurality of tubes extend. The tubes extend back and forth through the fin stock, essentially perpendicularly to an extension plane of the fins. At one end the tubes are connected to a fluid inlet, and at the other end the tubes are connected to a fluid outlet, for feeding a fluid through the air heat exchanger. The air heat exchanger further comprises one or more fans arranged to draw air through the fin stock, i.e. through the parallel flow channels between the fins, to transfer heat between the fluid in the pipes and the air.

[0003] To prevent that external objects come into contact with the fan/fans, the air heat exchanger is typically provided with one or more fan guards, usually one fan guard per fan. One commercially available fan guard comprises a grid arranged to screen off the fan and a number of fastening eyes distributed along a periphery of the grid. The fan guard is attached to the air heat exchanger by means of bolts extending from an outside of the air heat exchanger through the fastening eyes and nuts screwed onto the bolts.

[0004] In connection with e.g. service of the fan or other components of the air heat exchanger, it may be necessary to remove the fan guard. In connection therewith, the nuts are screwed off the bolts before the fan guard is separated from the air heat exchanger. Thus, service of the air heat exchanger is sometimes associated with loose bolts and nuts. Naturally, such loose bolts and nuts are easily lost which may involve a risk of damaging the air heat exchanger, e.g. if a lost bolt or nut ends up in a moving part of the fan. The latter situation may also involve a risk of personal injury since such a loose bolt or nut can be ejected from the air heat exchanger when this again is operated after the service. Also, if a bolt or nut is lost, it may be hard to find a replacement bolt or nut. In such a situation, an assembler may be tempted to assemble the fan guard with the lost bolt and/or nut missing, which may impair the safety around the air heat exchanger.

SUMMARY

[0005] An object of the present invention is to provide a fan guard for an air heat exchanger that can be removed

from the air heat exchanger without resulting loose parts. The basic concept of the invention is construct the fan guard with open attachment means such that the fan guard can be assembled onto, and disassembled from, the air heat exchanger without having to remove any parts or components. Another object of the present invention is to provide an air heat exchanger provided with such a fan guard.

[0006] The fan guard and the air heat exchanger for achieving the objects above are defined in the appended claims and discussed below.

[0007] A fan guard for an air heat exchanger according to the present invention comprises a grid arranged to enclose a fan of the air heat exchanger and a first attachment means. The first attachment means is arranged to engage with a second attachment means of the air heat exchanger to attach the fan guard to the air heat exchanger. The second attachment means projects from a surface of the air heat exchanger. The fan guard is **characterized in that** the first attachment means comprises a hook. The hook has a first end at which it is connected to the grid. The hook is arranged to just partially encircle the second attachment means to attach the fan guard to the air heat exchanger. The hook has an opening enabling it to move into partial encirclement of the second attachment means when the fan guard is rotated in relation to the air heat exchanger, around a center axis of the fan guard, in a first rotation direction. Further, the opening of the hook enables it to move out of partial encirclement of the second attachment means when the fan guard is rotated in relation to the air heat exchanger, around the center axis of the fan guard, in a second rotation direction which is opposite to the first rotation direction.

[0008] By the grid enclosing the fan is meant that the grid is arranged on the outside of, and at some distance from, the fan to hinder external access to the same. Alternatives to the term "enclose" could be "cover", "shield off" and "surround".

[0009] As used here, "grid" is meant to cover any kind of suitable structure which is pervious to air.

[0010] The hook could be connected to the grid, at its first end, directly or indirectly. Thus, the hook could be connected to a structure in turn being connected to the grid. Further, the hook could, but does not have to, be formed integrally with the grid, for example as an elongation of a component of the grid.

[0011] In that the hook has an opening to just, or only, partially (instead of completely) encircle the second attachment means, the second attachment means can be moved into and out of the hook through the opening, i.e. by relative movements parallel to an extension plane of the hook. Here, these movements result from rotation of the fan guard in relation to the air heat exchanger. Thus, even if threading of the hook onto or off the second attachment means, by lifting or lowering the fan guard in relation to the air heat exchanger, is hindered (would correspond to the above prior art case when the nuts are

screwed onto the bolts), the second attachment means can be moved into and out of the hook.

[0012] The fan guard may be such that the hook extends along a hook plane that is parallel to a main extension plane of the grid. Such a construction makes the fan guard more flexible, and it is associated with larger tolerances, than if the hook plane instead should be perpendicular to the grid main extension plane. The center axis of the fan guard is perpendicular to the main extension plane of the grid.

[0013] The first attachment means may comprises a guide means, the hook and the guide means being connected at a second end of the hook and a first end of the guide means. Further, a first smallest distance between the first end of the guide means and the grid may be smaller than a second smallest distance between a second end of the guide means and the grid. Such a guide means may increase a "catchment area" of the first attachment means and facilitate reception of second attachment means in the hook, as will be further described hereinafter.

[0014] The hook and the guide means may extend along one and the same plane. Such a configuration is relatively easy to realize, flexible and mechanically uncomplicated.

[0015] The hook may extend from its first end along a first imaginary line, an angle from a second imaginary line, which extends between the center axis of the fan guard and the first end of the hook in a plane parallel to the first imaginary line, to the first imaginary line, in the first rotation direction being larger than 90 degrees and smaller than 180 degrees. Such a configuration may enable easy access to the first and second attachment means. Even more specified, the above angle may be between 110 and 120 degrees.

[0016] The hook may be essentially U-shaped to enable a relatively strong engagement between the hook and the second attachment means in a relatively straightforward way.

[0017] An air heat exchanger according to the invention comprises a fan and is provided with a fan guard as specified above. The second attachment means has a first state in which it, as a whole, engages with the air heat exchanger. In the first state it is possible for the hook to move into and out of partial encirclement of an inner portion of the second attachment means when the fan guard is rotated in relation to the air heat exchanger around the center axis of the fan guard. Further, the second attachment means has a second state in which it, as a whole, engages with the air heat exchanger and with the hook to prevent the hook from moving into and out of partial encirclement of the inner portion of the second attachment means by rotation of the fan guard.

[0018] Thus, the state of the second attachment means determines whether the fan guard can be removed from the air heat exchanger or not. Further, the second attachment means remains engaged to the air heat exchanger in either state which means that a removal of the fan

guard does not have to involve any loose parts.

[0019] The expression that the second attachment means as a whole engages with the air heat exchanger is used here to address also an embodiment where the second attachment means comprises several cooperating parts, such as a bolt and a nut in accordance with prior art. In such a case, all the parts remains engaged, directly or indirectly, to the air heat exchanger in either state. More particularly, the above expression is used to specify that no part of the second attachment means must be disconnected from the air heat exchanger.

[0020] The air heat exchanger may be so constructed that the inner portion of the second attachment means is arranged closer to the surface of the air heat exchanger than an outer portion of the second attachment means. Further, the outer portion may be arranged to at least partly extend beyond an inner contour of the hook and be positioned outside the hook, whereby the outer portion is arranged to engage with the hook in the second state of the second attachment means.

[0021] In that the outer portion is arranged to extend at least partly beyond an inner contour of the hook, the outer portion is prevented from moving through the hook in a direction perpendicular to the extension plane of the hook. In accordance therewith, the outer portion of the second attachment means is arranged to lock the fan guard to the air heat exchanger a normal direction of said surface of the air heat exchanger.

[0022] The inner portion of the second attachment means may be arranged to be accommodated within the hook and a third imaginary line drawn between the first and second ends of the hook. Such an embodiment means that the hook is "deep" enough to receive the complete inner portion of the second attachment means which enables a strong engagement between the hook and the second attachment means.

[0023] The air heat exchanger may be such that a third smallest distance between the grid and a point on the inner portion of the second attachment means being located furthest away from the grid is larger than a fourth smallest distance between the second end of the hook and the grid. Such a construction enables a "snap-locking", i.e. a firm engagement, between the hook and the second attachment means, which will be further described below.

[0024] Still other objectives, features, aspects and advantages of the invention will appear from the following detailed description as well as from the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The invention will now be described in more detail with reference to the appended schematic drawings, in which

Fig. 1 is a schematic side view of an air heat exchanger provided with a fan guard,

Fig. 2 is an enlargement of a portion B of Fig. 1 illus-

trating a first attachment means of the fan guard and a second attachment means of the air heat exchanger, the second attachment means being in a second state,

Fig. 3 is essentially similar to Fig. 2 with the exception that the second attachment means here is in a first state,

Fig. 4 is a top plan view of the fan guard of Fig. 1,

Fig. 5 is an enlargement of a portion A of Fig. 4 illustrating the first attachment means, and

Fig. 6 is essentially similar to Fig. 5 with the exceptions that the second attachment means, in cross-section through an inner portion thereof, is also illustrated here and that some details have been omitted for clarity, and

Fig. 7 is essentially similar to Fig. 5 with the exceptions that it is an enlargement and that the inner portion and an outer portion of the second attachment means are also illustrated here.

DETAILED DESCRIPTION

[0026] With reference to Fig. 1 an air heat exchanger or AHE 2, provided with a fan guard 4, is illustrated. The AHE 2 comprises a fan 6, a portion of which is schematically illustrated by a continuous/broken thick line in the figure. The fan 6 is arranged to draw outside air through the AHE 2, as is illustrated by the arrows. A brief description of an air heat exchanger was given by way of introduction, and since the present invention is not focused on the AHE 2 itself, it will not be described in further detail herein.

[0027] The fan guard 4 is further illustrated in Figs. 2-7. It comprises a grid 8 arranged to be positioned on the outside of the fan 6 to shield it from the surroundings. The grid 8 is made of steel wires formed into circles 10 of different sizes arranged concentrically around a center axis C of the fan guard 4, which axis C is perpendicular to a figure plane of Fig. 4. The circles 10 are arranged in different parallel main extension planes P of the grid 8, which are parallel to the figure plane of Fig. 4, which gives the grid a slight cone-shape. The circles 10 are connected by steel spokes 12 extending radially from a center point c to a periphery 14 of the grid 8. The steel spokes 12 are actually halves of diametrically extending bars. Further, the circles 10 are connected by steel rods 16 extending from the periphery 14 of the grid in a radial direction towards, but not all the way to, the center point c of the grid. The spokes 12 and rods 16 are evenly distributed such that an angle between each pair of spokes, rods or spoke and rod is similar.

[0028] The fan guard 4 further comprises a number of first attachment means to attach the fan guard to the AHE 2. Hereinafter, the first attachment means denoted 18 will be described in further detail. However, since all the first attachment means are similar, the description given is just as valid for the rest of the first attachment means.

[0029] The first attachment means 18 is formed inte-

grally with one of the spokes 12, a bend 20 (Fig. 3) defining the border between the first attachment means 18 and the spoke 12. The first attachment means 18 comprises a hook 22, which has a first end 24 and a second end 26, and a guide means 28, which has a first end 30 and a free second end 32, see especially Fig. 6. The hook 22 and the guide means 28 are integrally formed, the second end 26 of the hook 22 being connected to the first end 30 of the guide means 28. The first end 24 of the hook 22 is connected to an end 34 of the spoke 12.

[0030] The hook 22 extends, as is clear from Figs. 1-4, along a hook plane H, that is parallel to the main extension planes P of the grid 8. The hook 22 bends, as seen from its first end 24 in a direction X indicated in Fig. 5, essentially 180 degrees around a reference point R encircled by the hook, in a first rotation direction D1, here clockwise direction. Thereby, the hook 22 is essentially U-shaped and its first and second ends 24 and 26, respectively, are separated to define an opening 36 of the hook.

Further, the hook 22 is "tilted" in relation to the periphery 14 of the grid 8. More particularly, as is illustrated in Fig. 6, the hook 22 extends, from its first end 24, along a first imaginary line L1. The spoke 12 extends along a second imaginary line L2, which in turn extends between the center axis C of the fan guard 4 and the first end 24 of the hook 22 in a plane parallel to the first imaginary line L1, i.e. a plane parallel to the hook plane H. As seen in the direction X, an angle α measured from the second imaginary line L2 to the first imaginary line L1 in the first rotation direction D1 is equal to 115 degrees. Thereby, the hook 22 is "moved out" somewhat from the periphery 14 of the grid 8 (as compared to if α was equal to 90 degrees) which makes it (and thus also the second attachment means to be described below) more accessible which is advantages in connection with assembly and disassembly of the fan guard 4.

[0031] The guide means 28 extends along the same plane as the hook 22, i.e. along the hook plane H. The guide means 28 points away from the grid 8 such that a first smallest distance y1 (Fig. 7) between the first end 30 of the guide means 28 and the periphery 14 of the grid 8 is smaller than a second smallest distance y2 between the second end 32 of the guide means 28 and the periphery 14 of the grid 8. Thus, the guide means 28 increases the "catching area" of the first attachment means 18.

[0032] The AHE 2 further comprises a number of second attachment means arranged to cooperate with the first attachment means 18 of the fan guard 4 to attach the fan guard to the AHE 2. Hereinafter, the second attachment means denoted 38 will be described in further detail with reference to Figs. 1-3 and 6-7. However, since all the second attachment means are similar, the description given is just as valid for the rest of the second attachment means.

[0033] The second attachment means 38 is composed of an inner portion in the form of a threaded bolt 40 and an outer portion in the form of a threaded nut 42, the nut

42 being screwed onto the bolt 40. The bolt 40 is attached to the AHE 2 and projects from a surface 44 thereof. The bolt 40 and the hook 22 of the AHE 2 and the fan guard 4, respectively, are so positioned that the bolt 40 extends through the hook 22 when the fan guard 4 is properly assembled onto the AHE 2. Arranged like that, the hook 22 encircles the bolt 40, but just partially because of the opening 36 of the hook 22. The bolt 40 is so dimensioned that it fits within the hook 22 and a third imaginary line L3 drawn between the first and second ends 24 and 26 of the hook, as is clear especially from Fig. 6. Further, the nut 42 has outer dimensions exceeding inner dimensions of the hook 22. In other words, the nut 42 is so dimensioned that it extends beyond an inner contour 48 (Fig. 5) of the hook 22. Thus, when the hook 22 encircles the bolt 40, the nut 42 prevents removal of the fan guard 4 from the AHE 2 in a direction parallel to the center axis C of the fan guard.

[0034] The second attachment means 38 has a first state, illustrated in Fig. 3, in which the nut 42 is arranged on a distance z_1 from the surface 44 of the AHE 2, where $z_1 > h$, h being a height of the hook 22. Further, the second attachment means 38 has a second state, illustrated in Fig. 2, in which the nut 42 is arranged on a distance z_2 from the surface 44 of the AHE 2, where z_2 is essentially equal to h .

[0035] The fan guard 4 is assembled onto the AHE 2 when the second attachment means 38 is in its first state. Then, the fan guard 4 is arranged on the surface 44 of the AHE in such a way that the second attachment means 38 is aligned with the first attachment means 18. Thereafter, the fan guard 4 is rotated around its center axis C in relation to the AHE 2 in the first direction D1 until the bolt 40 is received in the hook 22 through its opening 36, as is illustrated in Fig. 6. Subsequently, the nut 42 is tightened so as to transfer the second attachment means 38 to its second state. In the second state, the nut 42 engages with the hook 22 so as to prevent rotation of the fan guard and lock the fan guard to the AHE. In connection with disassembly of the fan guard 4, the nut 42 is loosened so as to transfer the second attachment means 38 to its first state. Then, the fan guard 4 is rotated around its center axis C in relation to the AHE 2 in a second direction D2, which is opposite to the first direction D1, until the bolt 40 has left the hook 22 through its opening 36 and passed the guiding means 28. Thereafter, the fan guard 4 can be removed from the AHE 2.

[0036] Thus, the second attachment means 38 may remain, in its entirety, attached to the AHE 2 at all times. Thus, the problem that the prior art fan guards are associated with, i.e. the presence of loose parts in connection with fan guard assembly and disassembly, is not present in connection with the fan guard according to the present invention.

[0037] It is clear, especially from Fig. 7, that a part of the bolt 40 is arranged more distant from the grid 8 than an inside of the second end 26 of the hook 22. In other words, a third smallest distance y_3 , which is measured

between the grid periphery 14 and a point 50 on the bolt 40 arranged most distant from the grid periphery, is larger than a fourth smallest distance y_4 , which is measured between the grid periphery 14 and the second end 26 of the hook 22. If the guiding means 28 had not existed, the bolt 40 had not been received in the hook 22 upon clockwise rotation of the fan guard in relation to the AHE in the above described way since the bolt 40 would collide with the second end 26 of the hook 22. The guiding means 28 "catches" the bolt 40 and forces it through the hook opening 36. In connection therewith, the hook 22 flexes somewhat in that the second end 26 thereof is slightly displaced in a direction from the grid 8 to enable passage of the bolt. After the bolt passage the hook returns to its "unflexed" state. Thus, the first attachment means 18 has a built-in snap-locking function that prevents, to some extent, rotation of the fan guard in relation to the AHE once the bolt has been received in the hook irrespective of the state of the second attachment means 38.

[0038] The above described embodiment of the present invention should only be seen as an example. A person skilled in the art realizes that the embodiment discussed can be varied in a number of ways without deviating from the inventive conception.

[0039] As an example, the fan guard could be so constructed that the hook instead extends along a hook plane that is perpendicular to a main extension plane of the grid.

[0040] The grid need not have the above described steel wire structure but may have any suitable structure and be made of any suitable material. As an example, the grid could be a perforated sheet of plastic. Further, the grid need not have a circular form but could have essentially any form. Moreover, the grid need not be cone-shaped but could instead be flat. Also, the first attachment means could be made of other materials than steel.

[0041] The first attachment means could be constructed less complex than described above. As an example, it could be composed of a U-shaped hook with an angle $\alpha = 90$ degrees.

[0042] The hook does not have to comprise a bend of 180 degrees; it could be more or less bent. Further, the hook does not have to be U-shaped but can have any suitable form. As an example it could have the form of a V or a truncated rectangle.

[0043] The hooks need not be arranged aligned with the spokes. Further, the number and position of the hooks, spokes and rods can be varied in an endless number of ways.

[0044] Instead of being arranged to draw outside air through the AHE, the fan may be arranged to blow outside air through the AHE. Accordingly, the fan, and thus the fan guard, may be arranged on the opposite side of the AHE.

[0045] Finally, the second attachment means need not be composed of bolt and nut pairs but could comprise a large number of different locking means. As an example, the second attachment means could comprise a hinged

catch, pin or bracket arranged to be folded down around the hook to lock the fan guard to the AHE.

[0046] It should be stressed that the attributes first, second, third, etc. is used herein just to distinguish between species of the same kind and not to express any kind of mutual order between the species.

[0047] It should be stressed that a description of details not relevant to the present invention has been omitted and that the figures are just schematic and not consistently drawn according to scale. It should also be said that some of the figures have been more simplified than others. Therefore, some components may be illustrated in one figure but left out on another figure.

Claims

1. A fan guard (4) for an air heat exchanger (2) comprising a grid (8) arranged to enclose a fan (6) of the air heat exchanger and a first attachment means (18) arranged to engage with a second attachment means (38) of the air heat exchanger to attach the fan guard to the air heat exchanger, said second attachment means projecting from a surface (44) of the air heat exchanger, **characterized in that** the first attachment means comprises a hook (22) having a first end (24) at which the hook is connected to the grid, the hook being arranged to just partially encircle the second attachment means to attach the fan guard to the air heat exchanger, wherein the hook has an opening (36) enabling the hook to move into partial encirclement of the second attachment means when the fan guard is rotated in relation to the air heat exchanger, around a center axis (C) of the fan guard, in a first rotation direction (D1), and out of partial encirclement of the second attachment means when the fan guard is rotated in relation to the air heat exchanger, around the center axis of the fan guard, in a second rotation (D2) direction which is opposite to the first rotation direction.
2. A fan guard (4) according to claim 1, wherein the hook (22) extends along a hook plane (H) that is parallel to a main extension plane (P) of the grid (8).
3. A fan guard (4) according to any of the preceding claims, wherein the first attachment means (18) comprises a guide means (28), the hook (22) and the guide means being connected at a second end (26) of the hook and a first end (30) of the guide means, and wherein a first smallest distance (y1) between the first end of the guide means and the grid (8) is smaller than a second smallest distance (y2) between a second end (32) of the guide means and the grid.
4. A fan guard (4) according to claim 3, wherein the hook (22) and the guide means (28) extend along one and the same plane.
5. A fan guard (4) according to any of the preceding claims, wherein the hook (22) extends from its first end (24) along a first imaginary line (L1), an angle (α) from a second imaginary line (L2), which extends between the center axis (C) of the fan guard and the first end (24) of the hook in a plane parallel to the first imaginary line, to the first imaginary line, in the first rotation direction (D1) being larger than 90 degrees and smaller than 180 degrees.
6. A fan guard (4) according to claim 5, wherein said angle (α) between the first and second imaginary lines (L1, L2) is between 110 and 120 degrees.
7. A fan guard (4) according to any of the preceding claims, wherein the hook (22) is essentially U-shaped.
8. An air heat (2) exchanger comprising a fan (6) and provided with a fan guard (4) according to any of claims 1-7, wherein the second attachment means (38) has a first state in which it, as a whole, engages with the air heat exchanger and it is possible for the hook (22) to move into and out of partial encirclement of an inner portion (40) of the second attachment means when the fan guard is rotated in relation to the air heat exchanger around the center axis (C) of the fan guard, and a second state in which it, as a whole, engages with the air heat exchanger and with the hook to prevent the hook from moving into and out of partial encirclement of the inner portion of the second attachment means by rotation of the fan guard.
9. An air heat exchanger (2) according to any of claims 8, wherein the inner portion (40) of the second attachment means (38) is arranged closer to the surface (44) of the air heat exchanger than an outer portion (42) of the second attachment means, the outer portion being arranged to at least partly extend beyond an inner contour (48) of the hook (22) and be positioned outside the hook, whereby the outer portion is arranged to engage with the hook in the second state of the second attachment means.
10. An air heat exchanger (2) according to any of claims 8-9, wherein the inner portion (40) of the second attachment means (38) is arranged to be accommodated within the hook (22) and a third imaginary line (L3) drawn between the first and second ends (24, 26) of the hook.
11. An air heat exchanger (2) according to any of claims 8-10, wherein a third smallest distance (y3) between the grid (8) and a point (50) on the inner portion (40) of the second attachment means (38) being located

furthest away from the grid is larger than a fourth smallest distance (y4) between the second end (26) of the hook (22) and the grid.

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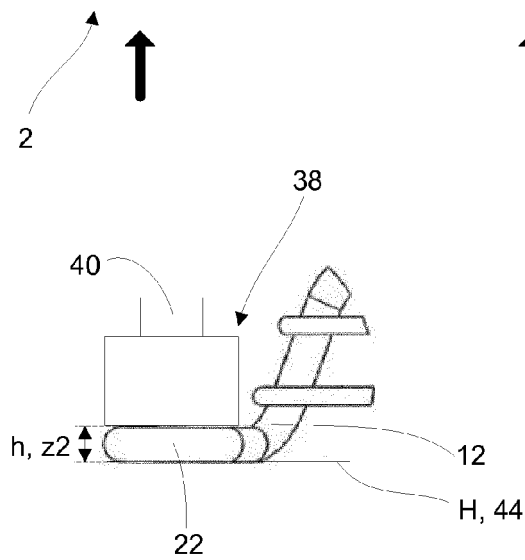
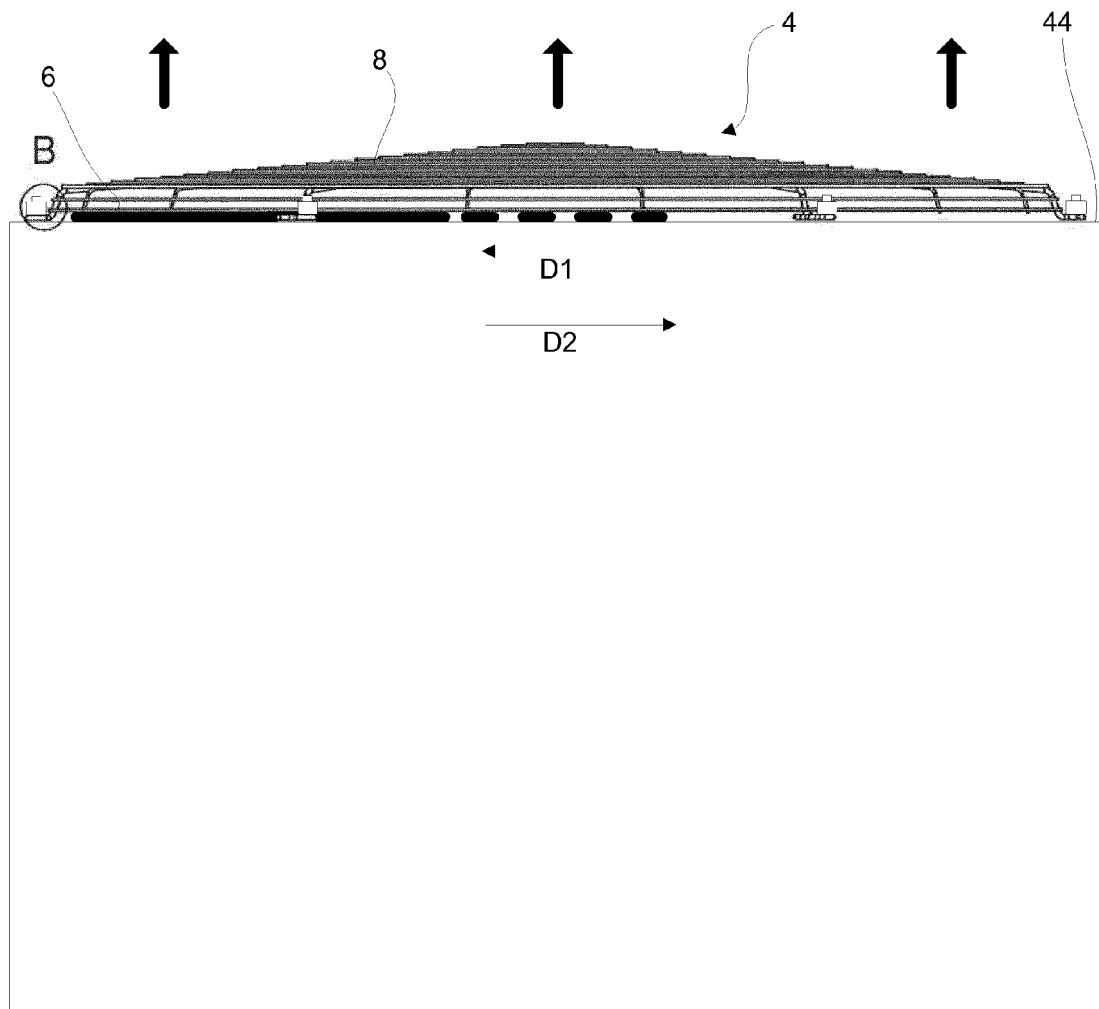


Fig. 2

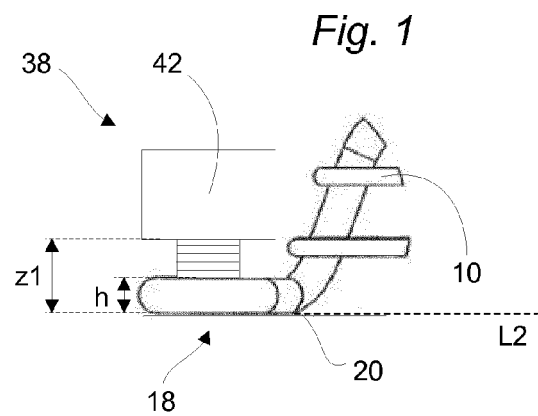
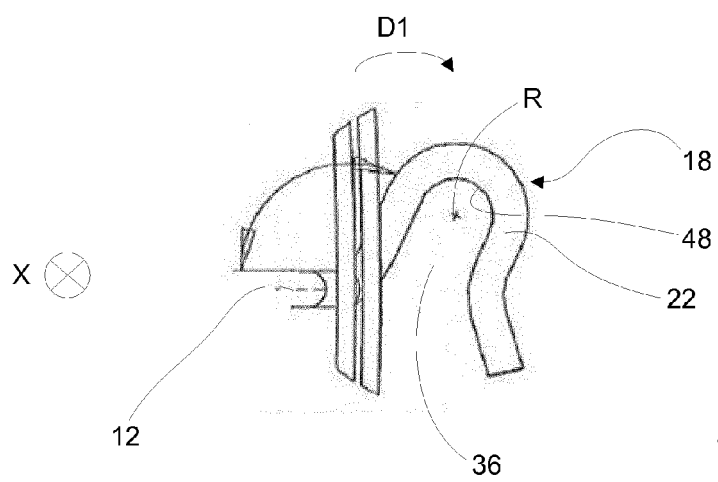
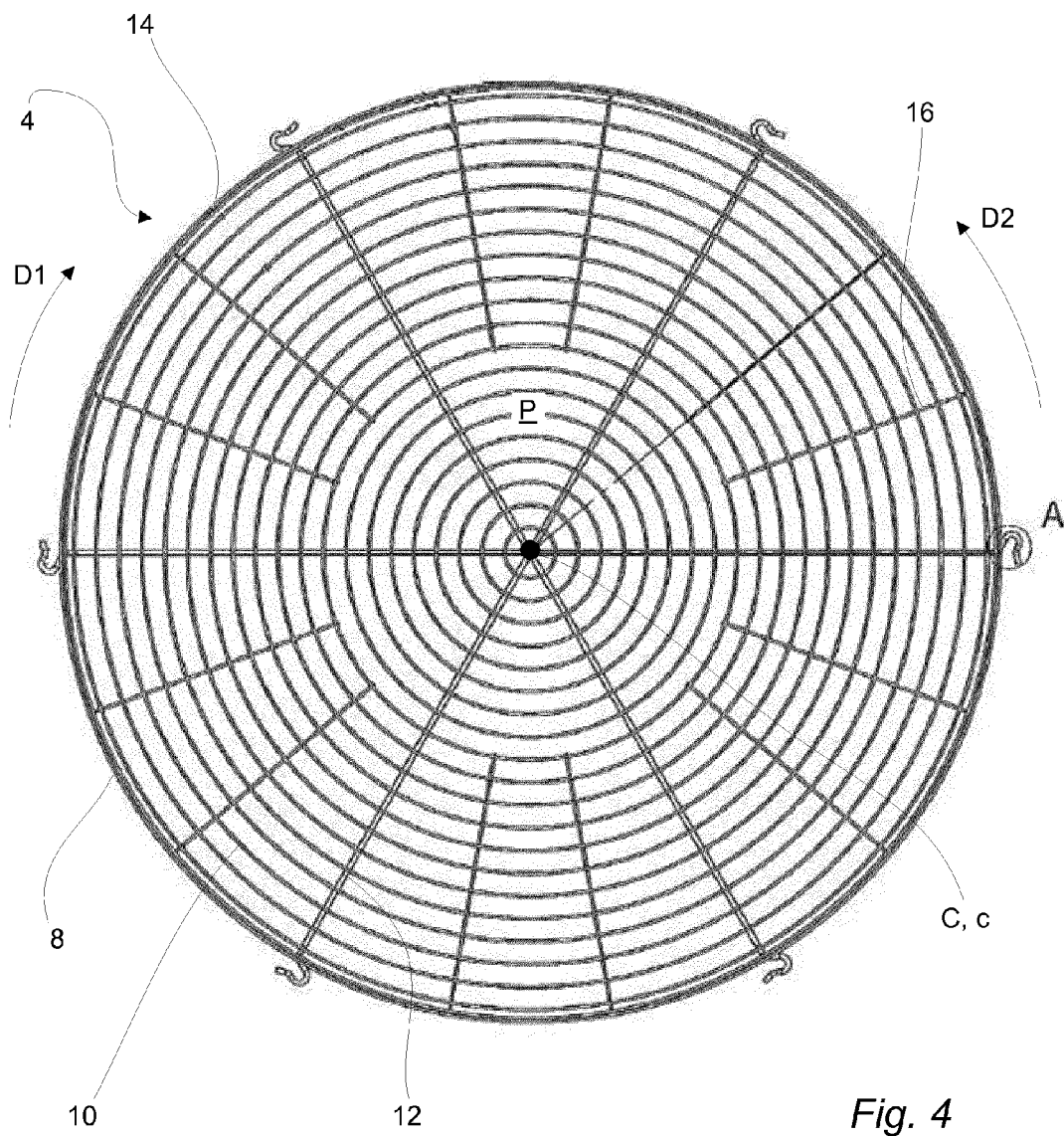


Fig. 3

Fig. 1



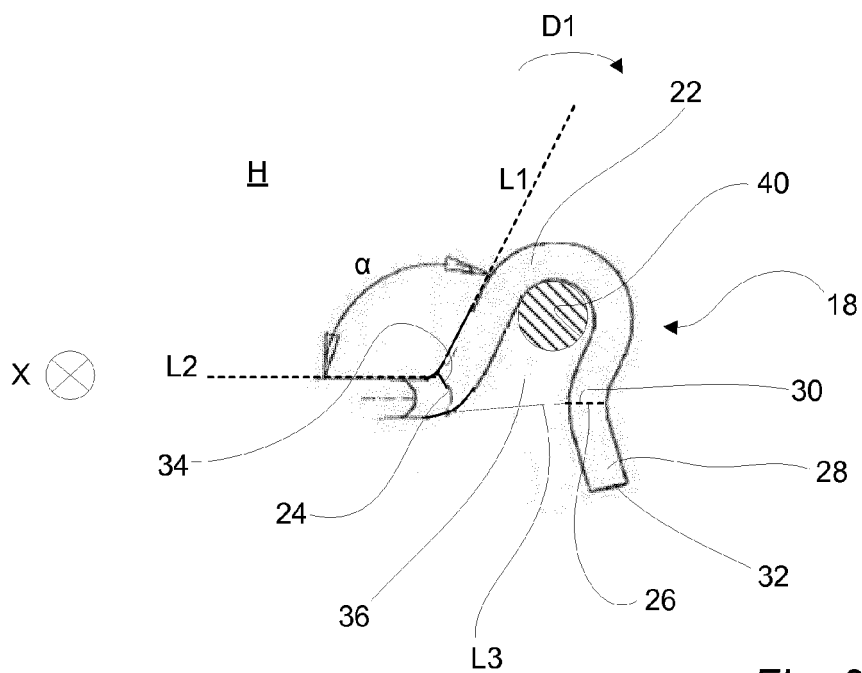


Fig. 6

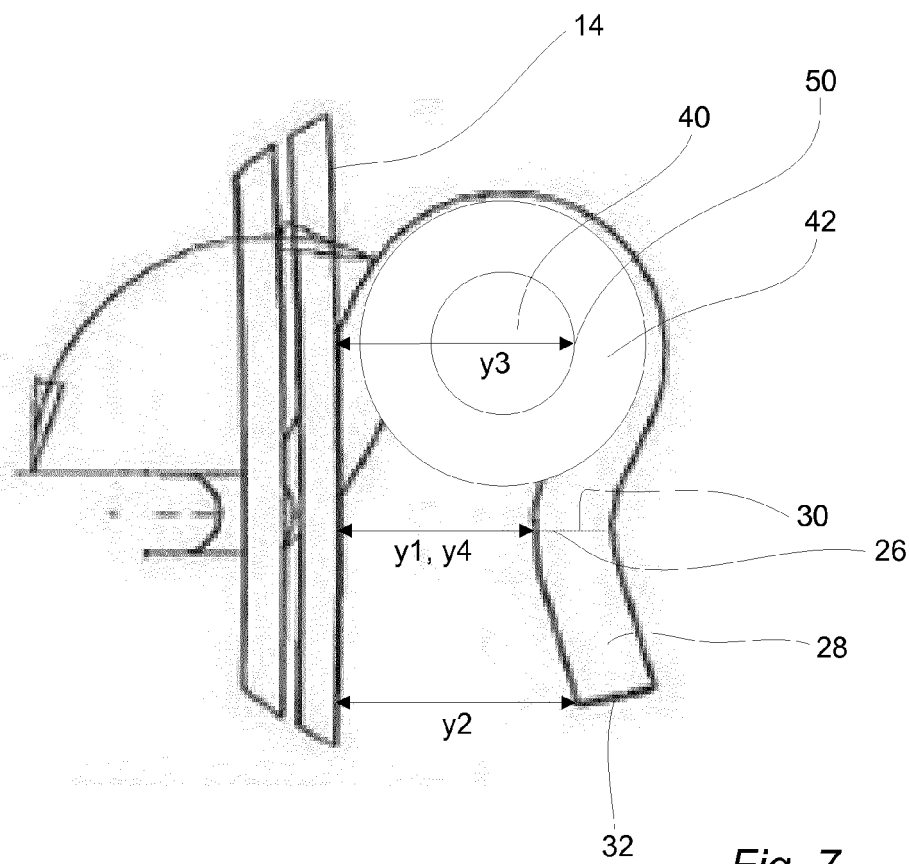


Fig. 7



EUROPEAN SEARCH REPORT

Application Number
EP 13 17 7596

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	JP 2000 055410 A (MITSUBISHI HEAVY IND LTD) 25 February 2000 (2000-02-25) * abstract; figures 1-3 * -----	1-11	INV. F04D29/70 F24F1/56 F24F13/08
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A	JP H01 189438 A (MATSUSHITA SEIKO KK) 28 July 1989 (1989-07-28) * abstract; figures 1-4 * -----	1,8	
A	JP S63 129230 A (MATSUSHITA SEIKO KK) 1 June 1988 (1988-06-01) * abstract; figures 1-4 * -----	1,8	
A	US 5 575 622 A (ZIMMERMAN LEON S [US] ET AL) 19 November 1996 (1996-11-19) * column 3, line 1 - column 4, line 35; figures 1-8 * -----	1-11	
A	DE 10 2007 017875 A1 (SEW EURODRIVE GMBH & CO [DE]) 16 October 2008 (2008-10-16) * paragraphs [0037] - [0046]; figures 1-4 * -----	1	TECHNICAL FIELDS SEARCHED (IPC) F28F F04D F24F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 29 August 2013	Examiner Leclaire, Thomas
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