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(72) Inventor: **Ben Hamida, Jamil**
3897, Foetz (LU)

(74) Representative: **Beissel, Jean et al**
Office Ernest T. Freylinger S.A.,
234, route d'Arlon,
B.P. 48
8001 Strassen (LU)

(71) Applicant: **Delphi Technologies, Inc.**
Troy, MI 48007 (US)

(54) Fan shroud and heat exchanger assembly

(57) The present invention relates to an assembly for a fan shroud (5) and a heat exchanger comprising at least one lower hook (3) on the heat exchanger; and at least one leg (1) on the fan shroud (5), the lower hook (3) having a slot (4) adapted for the insertion of the leg (1). According to an important aspect of the invention, the leg (1) further includes a blocking means (2; 2'; 2'')

arranged and shaped such as to allow a loose fit between the leg (1) and the lower hook (3) when the fan shroud (5) and the heat exchanger are in the process of being assembled together and to cause a tight fit between the leg (1) and the lower hook (3) when the fan shroud (5) and the heat exchanger are in their final assembled state.

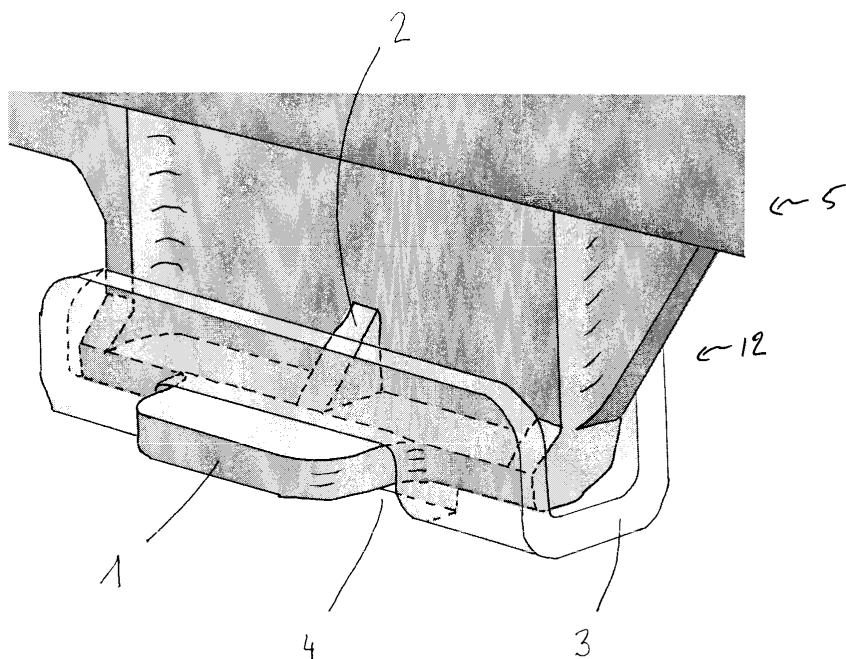


Fig. 3

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Description

FIELD OF THE INVENTION

[0001] The present invention relates in general to a fan shroud and heat exchanger assembly and in particular to an improved assembly or mounting of a fan shroud to a heat exchanger in an automotive application.

BACKGROUND OF THE INVENTION

[0002] In automotive applications the fan shroud is fixedly mounted on the heat exchanger. Generally four connection points are provided, two at the top and two at the bottom of the fan shroud, and conventionally the fan shroud is fastened by means of respective screws to respective threaded openings of the heat exchanger. The above arrangement provides a strong and robust connection between the fan shroud and the heat exchanger. However, the process, per se, of mounting of the fan shroud is relatively time consuming.

[0003] Another known way of assembling or mounting a fan shroud to a heat exchanger in an automotive application, as taught by US-A-4 685 513, is to provide two legs at the lower end of the fan shroud and corresponding recesses at the lower end of the heat exchanger, the legs and recesses forming two bottom connection points. During the mounting process, the legs are simply engaged in a respective recess and respective top ends of the fan shroud and the heat exchanger are tightened by means of two screws. The latter solution allows for a much faster mounting of the fan shroud to the heat exchanger. However, the recesses act only as a retainer in a horizontal direction. Thus, the whole load of the fan shroud is carried by the upper end of the heat exchanger which can suffer damage and can break.

[0004] Yet another fan shroud / heat exchanger assembly is disclosed in US-A-5 219 016, wherein a fan shroud is provided with four tabs having respective long legs which are accommodated for assembly into four respective fingers provided on a heat exchanger. The fingers are sized such that the long legs of the tabs snugly slide into the fingers. Nevertheless, the solution of US-A-5 219 016, while allowing a relatively fast mounting, still does not provide for sufficient stability to the assembly of the fan shroud with the heat exchanger.

[0005] Another known assembly for a fan shroud with a heat exchanger is known from US-B-6 315 034, wherein two blocks at the bottom of a fan duct are vertically engageable in corresponding housings of a first manifold of a heat exchanger and wherein two spring clips at the top of the fan duct are equipped with respective apertures suitable for letting through a lug projecting from a second manifold of the heat exchanger. However, in a similar manner to US-A-4 685 513, the block/housing retainer acts only in a horizontal direction. Therefore, again, the whole load of the fan shroud is carried by the

upper end of the heat exchanger which can suffer damage and can break.

[0006] EP-A-291 021 discloses a fan shroud / heat exchanger assembly, wherein resilient hooks formed on the fan shroud engage behind webs of a support element mounted on a header tank of the heat exchanger. However, the assembly of EP-A-291 021 does not provide for sufficient stability and mechanical strength both in the horizontal and vertical directions. Thus, the heat exchanger can suffer damage and can break.

[0007] FR-A-2 713 754 also discloses a fan shroud / heat exchanger assembly, wherein the fan shroud is provided, at its lower side, with circular arched hooks which can be accommodated in corresponding arched slots at the lower side of the heat exchanger. Therefore, when the hooks are engaged into the slots, the fan shroud can be rotated into a vertical position and snap coupled, by a coupling provided at its upper side, to the upper side of the heat exchanger. However, yet again, the assembly of EP-A-2 713 754 does not provide for sufficient stability both in the horizontal and vertical directions. Thus, the heat exchanger can suffer damage and can break.

[0008] DE-A-42 44 037 discloses a fan shroud with a plurality of arms protruding in opposite directions for engaging and snapping into respective lower and upper side portions of a header tank of a cooling system. The assembly of DE-A-42 44 037, in a similar manner to the abovementioned prior art, does not provide for sufficient stability and mechanical strength both in the horizontal and vertical directions.

OBJECT OF THE INVENTION

[0009] Therefore, it is an object of the present invention to provide a fan shroud and a heat exchanger assembly which avoids the drawbacks of the discussed prior art and which provides for a sufficient stability of the assembly of the fan shroud with the heat exchanger in any direction, without decreasing the simplicity of mounting.

[0010] The above object is achieved by an assembly for a fan shroud and a heat exchanger as defined in claim 1.

SUMMARY OF THE INVENTION

[0011] The present invention relates to an assembly for a fan shroud and a heat exchanger comprising at least one lower hook on the heat exchanger and at least one leg on the fan shroud. The lower hook has a slot adapted for the insertion of the leg. According to an important aspect of the invention, the leg further includes a blocking means arranged and shaped such as to allow a loose fit between the leg and the lower hook when the fan shroud and the heat exchanger are in the process of being assembled together as well as to cause a tight fit between the leg and the lower hook when the fan

shroud and the heat exchanger are in their final assembled state. The loose fit allows for an easy and fast connection of the fan shroud and the heat exchanger prior to their final assembly. The tight fit completes the assembly by locking the two parts together. The tight fit results in a lack of play, thereby preventing any movement of the fan shroud with respect to the heat exchanger. The assembly has a bearing capacity for external constraints, such as the weight load.

[0012] Preferably, a gap is formed in the slot of the lower hook substantially corresponds to a thickness of the leg, such that, in the assembled state of the fan shroud and the heat exchanger, substantially no clearance is formed between the leg and the slot and such as to enable a pre-load of the leg in the slot.

[0013] Advantageously, the leg is substantially L-shaped, the lower hook is shaped complementary to the leg. The blocking means is shaped and sized such as to allow the fan shroud to be inserted at an angle from the vertical position with its legs into the slot of the lower hook, and then rotated until it is in a substantially vertical position.

[0014] According to a first embodiment of the present invention, the blocking means is formed as a wedge-shaped rib. The wedge-shaped rib comprises a blocking surface, which can e.g. be straight, concave or convex. The blocking means can also be formed of a plurality of ribs, thereby increasing strength of the leg. A lower angle of the fan shroud can be rounded, such as to facilitate the insertion and assembly of the legs into the slot of the lower hook.

[0015] According to a second embodiment of the present invention, the blocking means is formed as an eccentric, which is implemented as a circular cylinder comprising a rib protruding from the cylinder surface and adapted for insertion into a seating of the lower hook.

[0016] In a further preferred embodiment, the fan shroud is provided with at least one through hole so as to allow the passing of at least one stud or nut for attachment to a top bracket of the heat exchanger.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The foregoing and other objects, features, and advantages of the invention, as well as presently preferred embodiments thereof, will become more apparent from a reading of the following description, in connection with the accompanying drawings in which:

FIG. 1: is a view of a fan shroud according to a first embodiment of the present invention;

FIG. 2: is a partial view of a fan shroud of Fig.1 assembled with a condenser of a heat exchanger;

FIG. 3: is an enlarged view of the assembly between the fan shroud and a lower section of the heat

exchanger;

FIG. 4: is a side view of the fan shroud of Fig.1 prior to its assembly with the heat exchanger;

FIG. 5: is a side view of the fan shroud of Fig.1 after its assembly with the heat exchanger;

FIG. 6: is a perspective view of an assembly according to the present invention, wherein blocking means are implemented as a plurality of ribs;

FIG. 7: is a schematic side view of a number of some possible forms for the blocking means;

FIG. 8: is a perspective view of an assembly according to the present invention, wherein a lower angle of the fan shroud is rounded; and

FIG. 9: is a perspective view of an assembly according to a second embodiment of the present invention, wherein blocking means are implemented as an eccentric.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

[0018] With reference to figures 1 through 5, according to a first embodiment of the present invention, there is provided a fan shroud indicated with reference numeral 5 and a condenser 12 of a heat exchanger of an air conditioning system (for instance an automotive air conditioning system). As used in the following description and claims, the terms lower/upper, left/right and vertical/horizontal are only intended for illustrative purposes and are by no means conceived to limit the scope of the invention.

[0019] The fan shroud 5 is provided, at the lower part thereof, with substantially L-shaped legs 1 (the illustrated embodiment shows two such legs) and at the upper part thereof with through holes 6 (the illustrated embodiment shows two such holes). On the other hand, the heat exchanger is provided, at the lower part thereof, with lower hooks 3 (the illustrated embodiment shows two such hooks), each hook 3 being formed with a respective slot 4 adapted for the insertion of a respective leg 1 of the fan shroud 5 that has to be attached to the heat exchanger and each hook 3 being shaped complementary to its respective leg 1.

[0020] As best seen from figures 4 and 5 the fan shroud 5 is inserted at an angle (Fig. 4) with its legs 1 into the respective slot 4 of the lower hook 3 of the condenser 12, and then rotated (Fig. 5) until it is in an essentially vertical position.

[0021] According to a particularly advantageous aspect of the present invention the vertical extension of a gap 10 formed in each slot 4 of the lower hook 3 of the heat exchanger substantially corresponds to the thick-

ness of the leg 1 and preferably has no clearance to enable a pre-load, as indicated by arrows 11 in Fig. 5, of the leg 1 in the slot 4. This ensures a tight contact with the lower hook 3 and avoids any movement in the vertical direction.

[0022] According to the invention, a blocking means is provided for tightly connecting the fan shroud 5 to the lower hook 3. According to a first embodiment of the invention, the blocking means is represented by a rib 2. Once the fan shroud 5 is in its vertical position (i.e. parallel to the heat exchanger) the rib 2 causes a tight fit between the leg 1 of the fan shroud 5 and the lower hook 3 of the heat exchanger. The wedge-shaped form of the rib 2 allows to further eliminate play in the vertical direction and, due to friction, allows to eliminate movement in any horizontal direction.

[0023] To finish off the assembly, the upper end of the fan shroud 5 is fixed to a top bracket (not shown) of the heat exchanger e.g. by means of studs and nuts (also not shown). The through holes 6 which are provided in the fan shroud 5 allow passing the studs therethrough.

[0024] Fig. 6 is a perspective view of an assembly according to the first embodiment, wherein blocking means are implemented as a plurality of ribs 2', each shaped as the rib of the first embodiment. The plurality of ribs improves the stability and mechanical strength of the assembly.

[0025] Fig. 7 shows is a schematic side view of some possible shapes of the ribs. The tight fit is mainly obtained by means of the blockings surface 13, which can e.g. be a) straight, b) concave or c) convex.

[0026] According to another advantageous aspect of the present invention, the lower angle 15 of the fan shroud 5 at the L-shaped legs 1 can be rounded, as shown in fig. 8, in order to facilitate the insertion and assembly of the legs 1.

[0027] According to a second embodiment of the invention, as shown in Fig. 9, the blocking means can be achieved by an eccentric 22 which is implemented, for instance, as a circular cylinder 22' comprising a rib 22" protruding from the cylinder surface. The rib 22" is inserted into a seating section 3' of the hook 3 in a substantially vertical manner, as shown by the broken line eccentric, and then rotated until it wedges tight the seating section 3'.

[0028] As will be appreciated from the foregoing description, the present invention fully achieves its objects by the provision of the blocking means in the lower connection points. In fact, according to the present invention, the lower hooks 3 are caused to contribute to a better load distribution, wherein the blocking means forbids any movement in any direction.

[0029] Furthermore, the fan shroud and the heat exchanger can be quickly and easily assembled due to hooks at lower end and screws at top end, when compared to systems with screws at both the lower and top ends.

[0030] Due to the blocking means, the rigidity of the

assembly is similar to the screw system. Some of the load is taken off the top connection points. The lower hooks retains the fan shroud in the two vertical directions and furthermore, the tight fit (due to blocking means) retains the fan shroud in the four directions of the horizontal plane.

[0031] The foregoing description of the invention, including a preferred embodiment thereof, has been presented for the purpose of illustration and description. It is not intended to be exhaustive nor is it intended to limit the invention to the precise form disclosed. It will be apparent to those skilled in the art that the disclosed embodiments may be modified in light of the above teachings. In particular, a person skilled in the art will readily understand that the number and the shape of the ribs can be varied.

[0032] The embodiments described are chosen to provide an illustration of principles of the invention and its practical application to enable thereby one of ordinary skill in the art to utilize the invention in various embodiments and with various modifications as are suited to the particular use contemplated. Therefore, the foregoing description is to be considered exemplary, rather than limiting, and the true scope of the invention is that described in the following claims.

[0033] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included just for the sole purpose of increasing intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

Claims

1. An assembly for a fan shroud (5) and a heat exchanger comprising:

at least one lower hook (3) on the heat exchanger and

at least one leg (1) on the fan shroud (5),

the lower hook (3) having a slot (4) adapted for the insertion of the leg (1),

characterized in that

the leg (1) further includes a blocking means (2; 2'; 22") arranged and shaped such as

to allow a loose fit between the leg (1) and the lower hook (3) when the fan shroud (5) and the heat exchanger are in the process of being assembled together and

to cause a tight fit between the leg (1) and the lower hook (3) when the fan shroud (5) and the heat exchanger are in their final assembled state.

2. The assembly according to claim 1, wherein a gap (10) is formed in the slot (4) of the lower hook (3) and substantially corresponds to a thickness of the leg, such that, in the assembled state of the fan shroud (5) and the heat exchanger, substantially no clearance exists between the leg (1) and the slot (4) and such as to enable a pre-load (11) of the leg (1) in the slot (4). 5

3. The assembly according to claims 1 or 2, wherein the leg (1) is substantially L-shaped, the lower hook (3) is shaped complementary to the leg (1), and the blocking means (2; 2'; 22") is shaped and sized such as to allow the fan shroud (5) to be inserted at an angle from the vertical position with its legs (1) into the slot (4) of the lower hook (3), and then rotated until it is in a substantially vertical position. 10 15

4. The assembly according to one or more of claims 1 to 3, wherein the blocking means is formed as a wedge-shaped rib (2). 20

5. The assembly according to claim 4, wherein the wedge-shaped rib (2) comprises a blocking surface (13), the blocking surface (13) being straight, concave or convex. 25

6. The assembly according to one or more of claims 1 to 5, wherein the blocking means is formed of a plurality of ribs (2'). 30

7. The assembly according to one or more of claims 1 to 6, wherein a lower angle (15) of the fan shroud (5) is rounded, such as to facilitate the insertion and assembly of the legs (1) into the slot (4) of the lower hook (3). 35

8. The assembly according to one or more of claims 1 to 3, wherein the blocking means is formed as an eccentric (22) which is implemented as a circular cylinder (22') comprising a rib (22") protruding from the cylinder surface and adapted for insertion into a seating (3') of the lower hook (3). 40

9. The assembly according to one or more of claims 1 to 8, further comprising at least one through hole (6), which is provided in the fan shroud (5) to allow the passing of at least one stud or nut for attachment to a top bracket of the heat exchanger. 45 50

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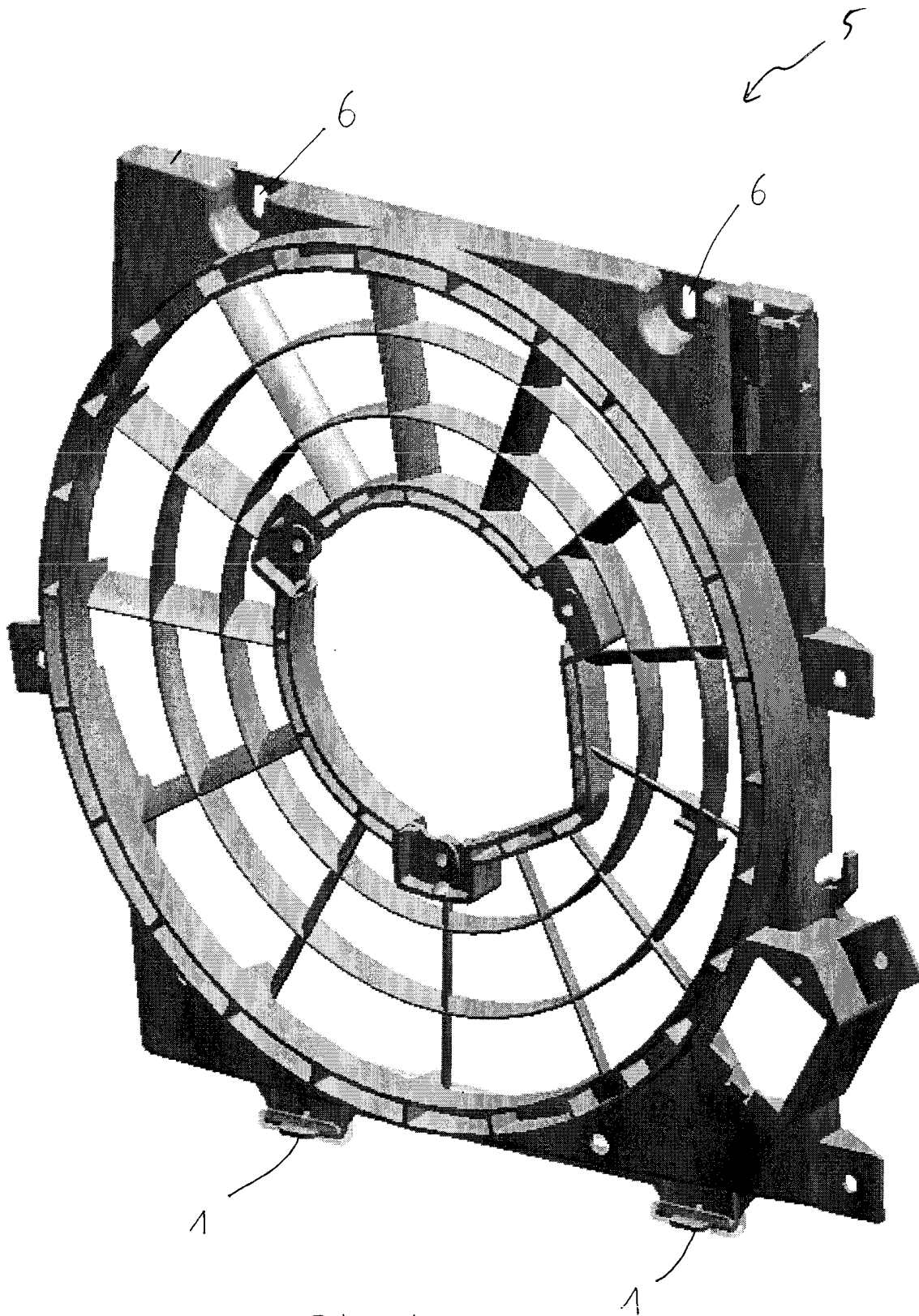


Fig. 1

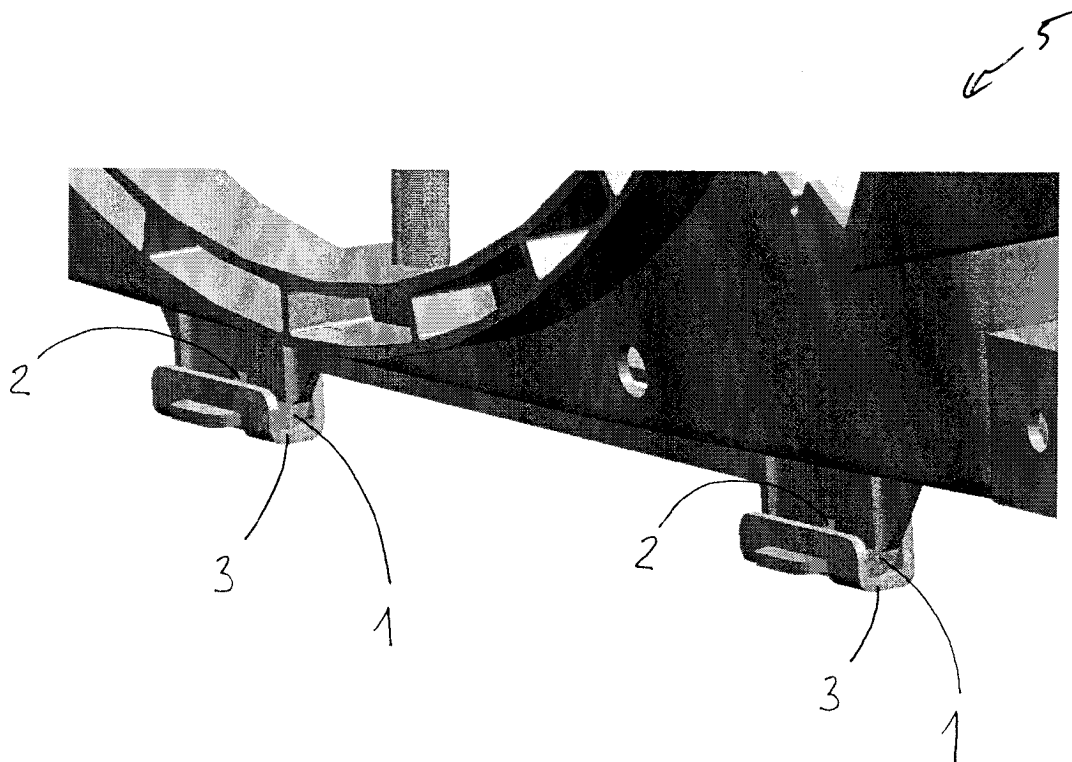


Fig. 2

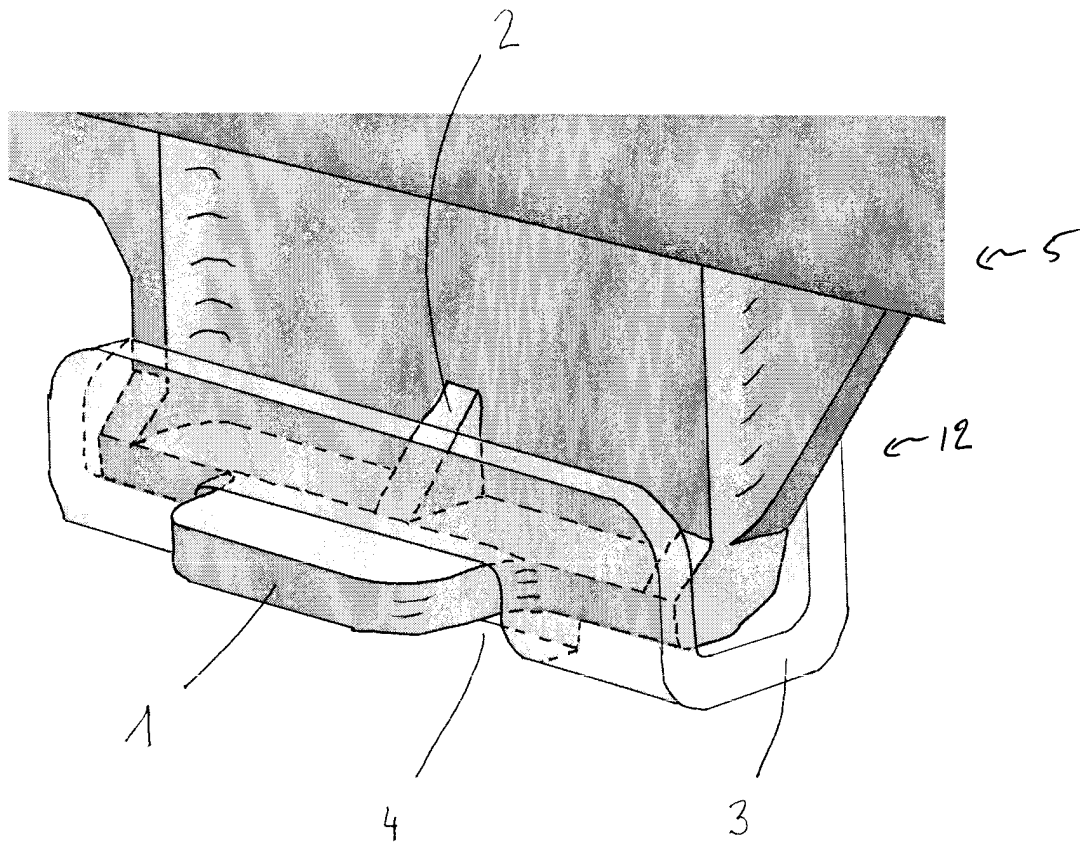
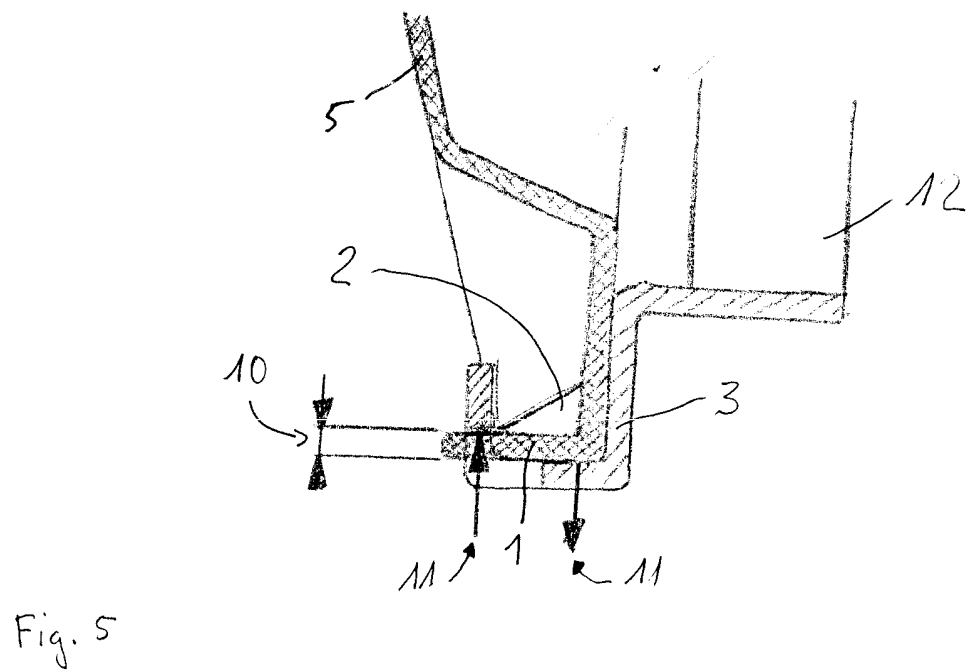
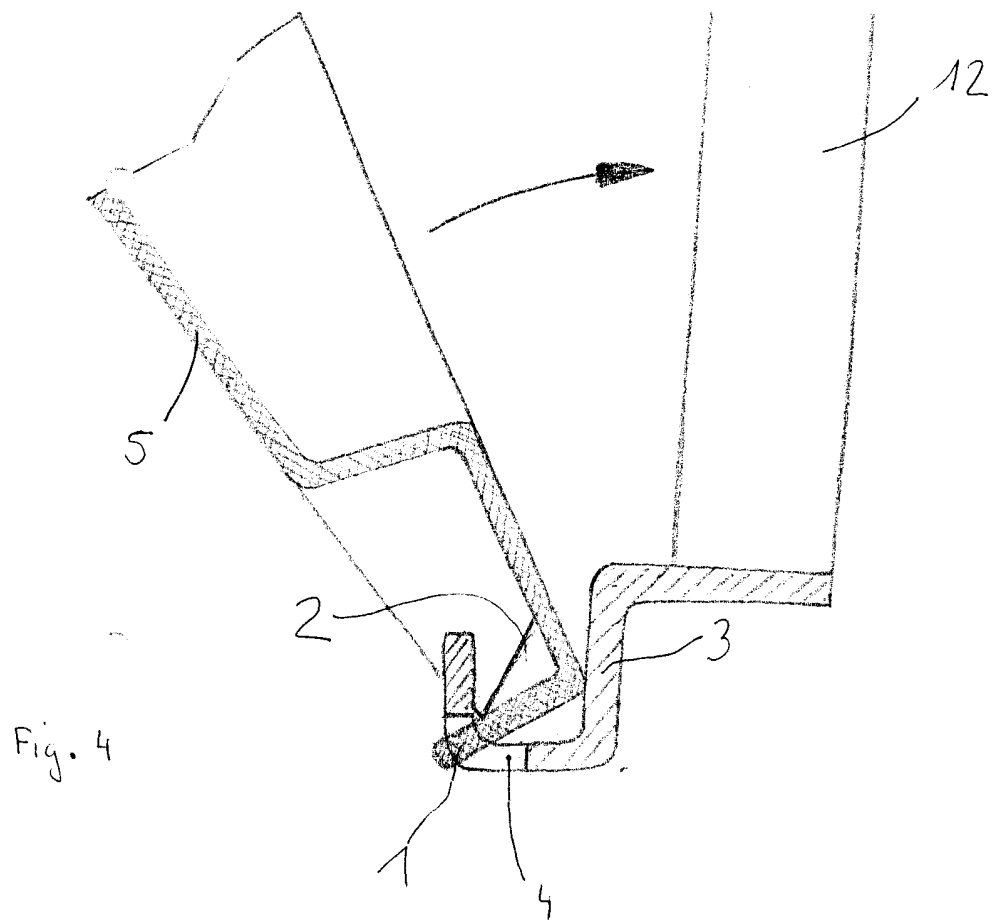


Fig. 3



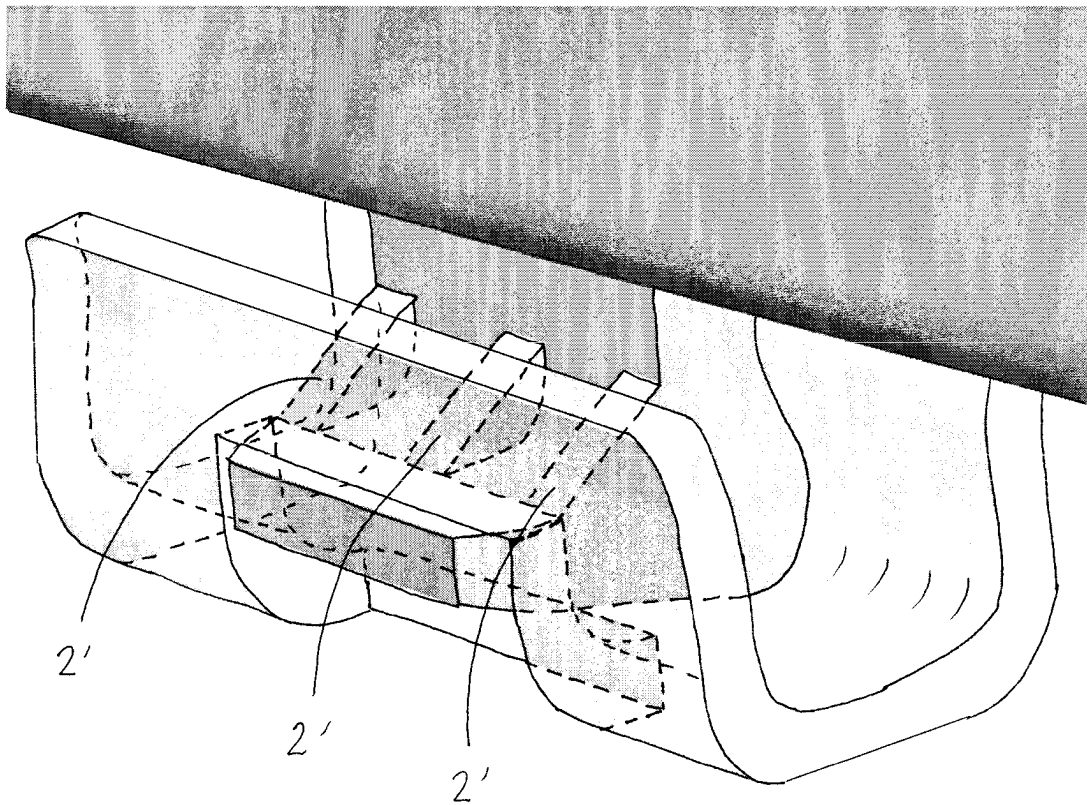


Fig. 6

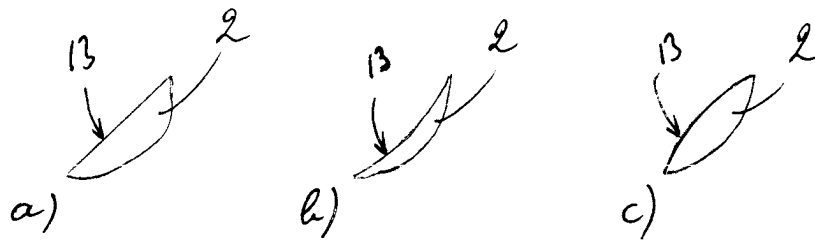


Fig. 7

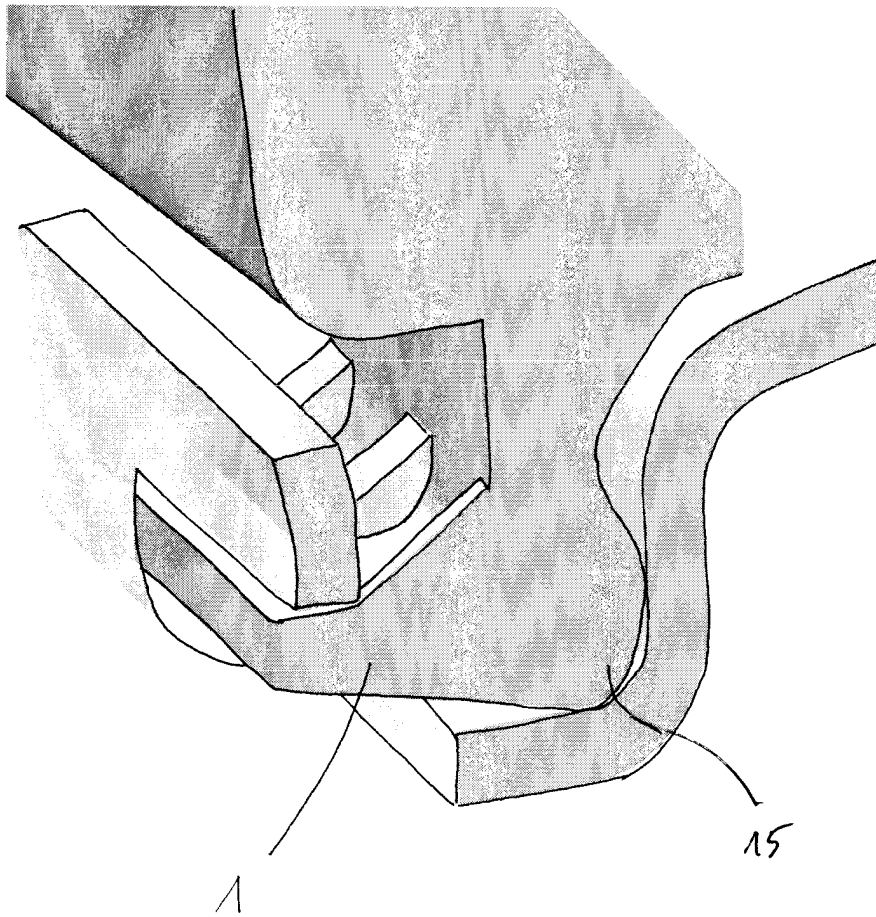


Fig. 8

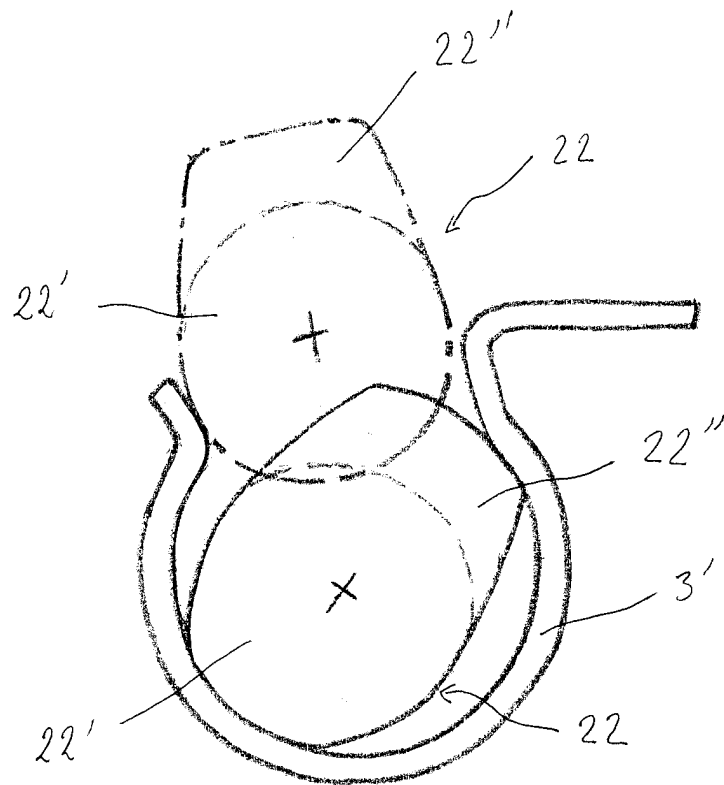


Fig. 9



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 04 10 0058

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			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			F28F F16B F04D
The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 26 May 2004	Examiner Mellado Ramirez, J
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EPO FORM 1503 03/02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 04 10 0058

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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