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(54) A FLAT TUBE FOR A HEAT EXCHANGER AND A HEAT EXCHANGER

(57) Flat tube for a heat exchanger, with two open ends defining its longitudinal direction, comprising a first wall (1) and a second wall (2) which are flat and parallel to each other, thereby delimiting the inner space of the tube. One of the lateral sides of the first wall (1) comprises a double-walled nose (4). The walls of said double-walled nose (4) contact each other along a contact section (5), and the lateral side (6) of the second wall (2) is bent to cover said double walled nose (4). Said walls of the nose (4) have equal lateral length.

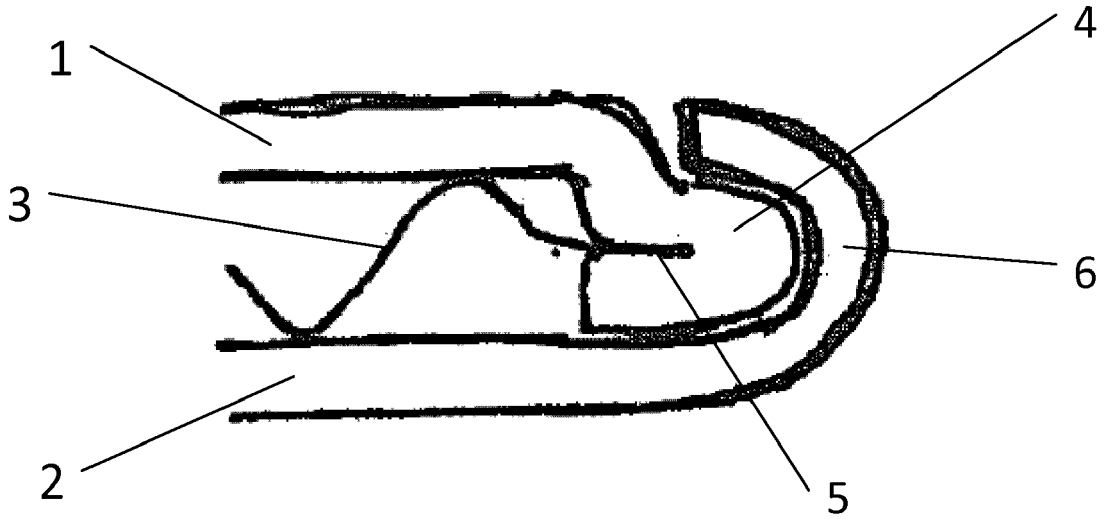

Fig. 2

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Description

[0001] The object of the invention is a flat tube for a heat exchanger and a heat exchanger.

[0002] There are known in the art tubes for heat exchangers, for example condensers, which are used to guide a fluid and enable its cooling.

[0003] Such heat exchangers can be implemented in vehicles, e.g. cars. These vehicles are directly exposed to debris such as stones or other objects, either when they are moving or when they are stationary. The stones can travel at significant speed and can impact the heat exchanger, which in most cases is situated in front of the car and is at least partly exposed or can be reached after passing through the radiator grill. Impact of such objects can cause damage to the elements of the heat exchanger, which may lead to leaks of the fluid flowing through them and/or to deterioration of their performance.

[0004] It is thus desirable to provide an improved tube for a heat exchanger, which would be more resistant to debris and consequently which would reduce a chance of leakage and/or decrease in performance.

[0005] The object of the invention is a flat tube for a heat exchanger, with two open ends defining its longitudinal direction, comprising a first wall and a second wall which are flat and parallel to each other, thereby delimiting the inner space of the tube, wherein one of the lateral sides of the first wall comprises a double-walled nose, the walls of said double-walled nose contacting each other along a contact section, and the lateral side of the second wall is bent to cover said double walled nose, wherein walls of the nose have equal lateral length.

[0006] Preferably, the contact section of the walls of the double-walled nose runs in parallel to planes of the first wall and the second wall.

[0007] Preferably, the lateral side of the second wall, bent over the double walled nose, is bent so that it contacts both walls of the double walled nose.

[0008] Preferably, the lateral side of the second wall, bent over the double walled nose, is also double walled.

[0009] Preferably, the lateral side of the second wall, bent over the double walled nose, consists of one layer.

[0010] Preferably, the thickness of the reinforced tube nose in lateral direction is in the range [0.5 x tube height ; 1.5 x tube height] and preferentially in the range [0.5 x tube height; tube height].

[0011] Another object of the invention is a heat exchanger comprising a described tube.

[0012] The object of the invention has been presented by means of a drawing, in which:

Fig. 1 shows a general shape of a flat tube,

Fig. 2 presents a tube according to the first example,

Fig. 3 presents exemplary path of stones impacting the tube.

Fig. 4 presents a tube according to the second example,

Fig. 5 presents a tube according to the third example,

Fig. 6 presents a tube according to the fourth example.

[0013] Fig. 1 presents a general shape of a flat tube which is an object of the invention. The invention specifically regards tube nose, which is depicted in detail in the following figures. The tube is defined by reference to general directions: longitudinal and lateral. These are presented in Fig. 1, as y axis and x axis, respectively. The reinforced tube nose can be located on the front area of the heat exchanger (e.g. condenser), e.g. facing the road.

[0014] Fig. 2 shows first example of the tube. The tube comprises a first wall 1 and a second wall 2, which are flat and parallel to each other. Together they delimit the inner space of the tube. The tube has two opened ends, which define a longitudinal direction of the tube and a general path for the fluid flow. The tube can further comprise an inner fin 3. The presence of fin 3 is however optional. One of the lateral sides of the first wall 1 is folded to form a double-walled nose 4 along the longitudinal direction. The double-walled nose 4 comprises a contact section 5 facing the delimited space inside the flat tube. This contact section 5 is constituted by two substantially parallel walls of the double-walled nose 4.

[0015] The double-walled nose 4 can be formed in the middle between the first wall 1 and the second wall 2, so that the contact section 5 will also be in the middle between the first wall 1 and the second wall 2. This facilitates a substantially identical resistance from both sides of the tube, i.e. the resistance will be improved substantially identically with respect to stones impacting from the side of the first wall 1 and from the side of the second wall 2, as illustrated in Fig. 3.

[0016] It is also envisaged to position the double-walled nose 4 (and consequently the contact section 5) at another distance with respect to the first or second walls. For example, the double-walled nose 4 located closer to the first wall 1 will contribute more to its resistance from the side of said first wall 1. Similarly, the double-walled nose 4 located nearer the second wall 2 will contribute more to its resistance from the side of said second wall 2. In other words, the contact section 5 (plane of the contact section) of the double-walled nose 4 can be displaced towards the plane of the first or second wall 1, 2. By term "plane" it is meant a general plane of the flat portion. Such feature may be advantageous in case of an unorthodox arrangement of the tubes, e.g. oriented an angle with respect to driving direction or at angle corresponding to statistically more probable angle of stone impact.

[0017] Preferably, the contact section 5 is substantially parallel to the first and second walls. In other words, plane of the contact section 5 is parallel to planes of the first

wall 1 and the second wall 2.

[0018] The respective end of the second wall 2 is bent around the double-walled nose 4 so that it encompasses it. In other words, the lateral end of the second wall 2 forms a side wall 6, which covers the double-walled nose 4 of the first wall 1. This further strengthens the tube. At the same time it protects the double-walled nose 4 and enables the tube to have a unitary, unobtrusive shape.

[0019] Fig. 4 shows the second example of the tube. In this example, the side wall 6 is also double walled. This double wall extends along the circumference of the double-walled nose 4. This provides a more resistant side wall 6, because it is layered and consequently harder to damage, bend etc.

[0020] Fig. 5 shows the third example of the tube. In this example, the lateral side of the first wall 1 further comprises secondary folds 7, before and after (above and below) the double-walled nose 4 with contact section 5. These secondary folds 7 improve resistance of the tube at lateral side.

[0021] Fig. 6 shows the fourth example of the tube. This example comprises a secondary fold 7, before (above) the double-walled nose 4 with contact section 5. This secondary fold 7 improves resistance of the tube at lateral side. In this example, the side wall 6 is also double walled. This double wall extends along the circumference of the double-walled nose 4. This provides a more resistant side wall 6, because it is layered and consequently harder to damage, bend etc.

[0022] The examples present a contact section 5 of certain lateral length. The lateral length of contact section 5 of the double-walled nose 4 is dependent on the lateral length of the walls of the double-walled nose 4. The longer the contact section 5, the more resistant the nose of the tube, as the thicknesses of the double-walled nose 4 and the side of the second wall 6 compound at longer distance.

[0023] The tube according to the invention may be a tube made of a single sheet of material. It can also be made of two sheets of material, constituting for example separately its first and second walls. Consequently, the disclosed nose of the tube can be present on one lateral side of the tube, or both lateral sides of the tube. The thickness of the reinforced tube nose can be in the range [0.5 x tube height ; 1.5 x tube height] and preferentially in the range [0.5 x tube height; tube height]. The tube height here is defined along an axis perpendicular to longitudinal and lateral directions.

[0024] These tubes can be produced by roll forming, similar to the process for currently known tubes with bends or folds.

Claims

1. A flat tube for a heat exchanger, with two open ends defining its longitudinal direction, comprising a first wall (1) and a second wall (2) which are flat and parallel to each other, thereby delimiting the inner space of the tube, wherein one of the lateral sides of the first wall (1) comprises a double-walled nose (4), the walls of said double-walled nose (4) contacting each other along a contact section (5), and the lateral side (6) of the second wall (2) is bent to cover said double walled nose (4), wherein walls of the nose (4) have equal lateral length.

2. The tube according to claim 1, wherein the contact section (5) of the walls of the double-walled nose (4) runs in parallel to planes of the first wall (1) and the second wall (2).

3. The tube according to any preceding claim, wherein the lateral side of the second wall (2), bent over the double walled nose (4), is bent so that it contacts both walls of the double walled nose (4).

4. The tube according to any preceding claim, wherein the lateral side of the second wall (2), bent over the double walled nose (4), is also double walled.

5. The tube according to any of claims 1-3, wherein the lateral side of the second wall (2), bent over the double walled nose (4), consists of one layer.

6. The tube according to any preceding claim, wherein the thickness of the reinforced tube nose in lateral direction is in the range [0.5 x tube height ; 1.5 x tube height] and preferentially in the range [0.5 x tube height; tube height].

7. A heat exchanger comprising a tube according to any of claim 1-6.

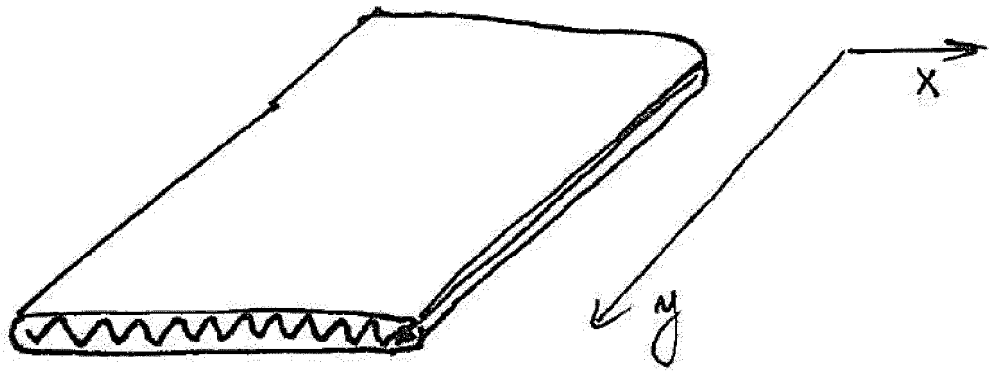

Fig. 1

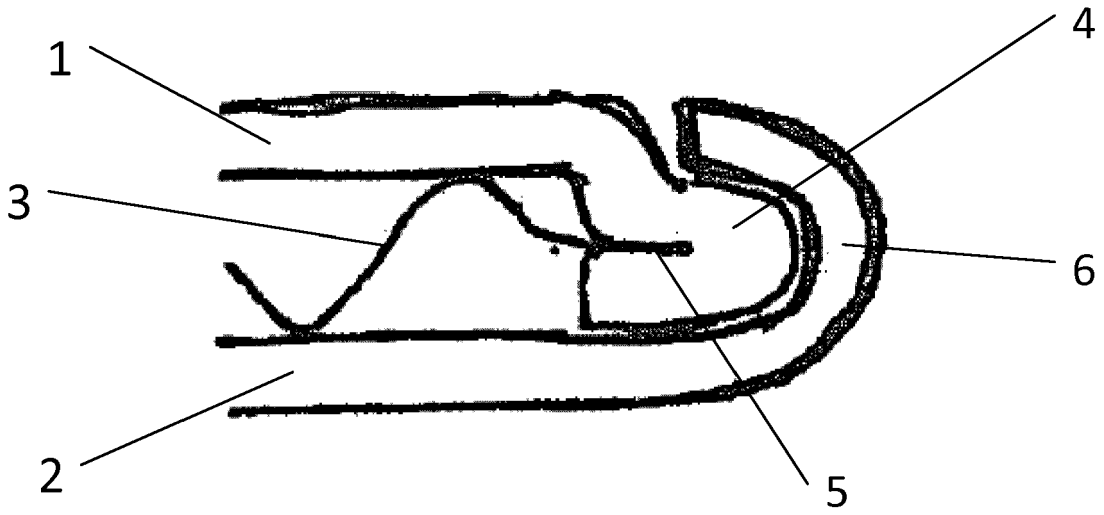

Fig. 2

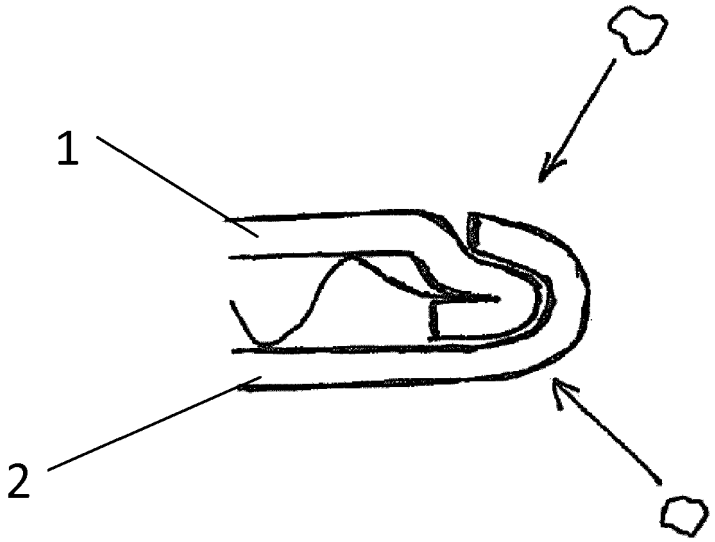

Fig. 3

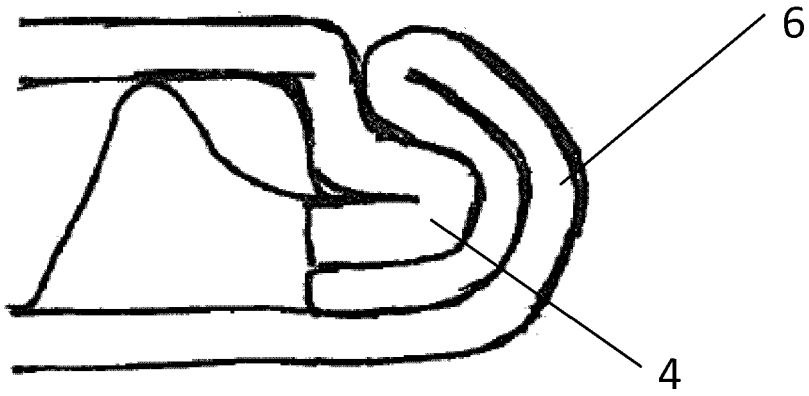

Fig. 4

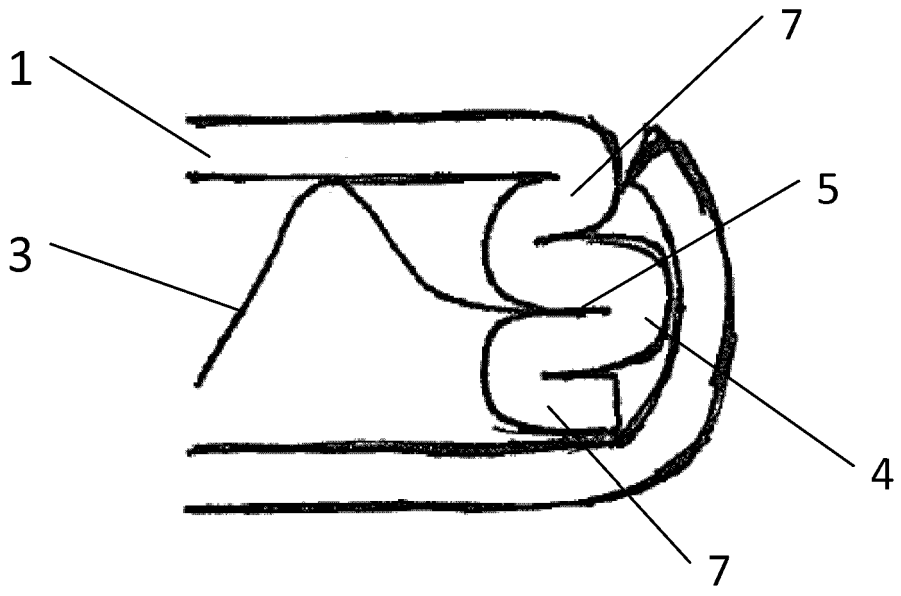

Fig. 5

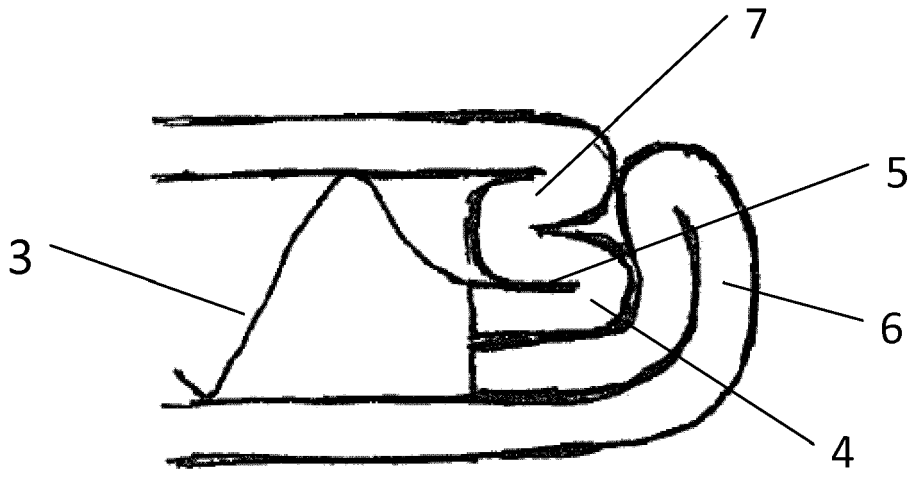

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 17 16 9138

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 10 2006 016711 A1 (MODINE MFG CO [US]) 11 October 2007 (2007-10-11) * page 3; figure 3 *	1-7	INV. F28D1/03 F28F1/02
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A	* columns 2-3; figures 2-4 *	4	
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TECHNICAL FIELDS SEARCHED (IPC)
F28D
F28F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	7 November 2017	Merkt, Andreas

CATEGORY OF CITED DOCUMENTS

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