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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, wherein one of the lateral sides of the first wall (1) forms a multilayer nose (4) by means of consecutive folds compounded towards the second wall (2), the lateral side (6) of the second wall (2) being bent to cover said multilayer nose (4), wherein the folds are at least partially displaced laterally towards the inner side of the tube with respect to the first bending point (20) of said lateral side of the first wall (1).

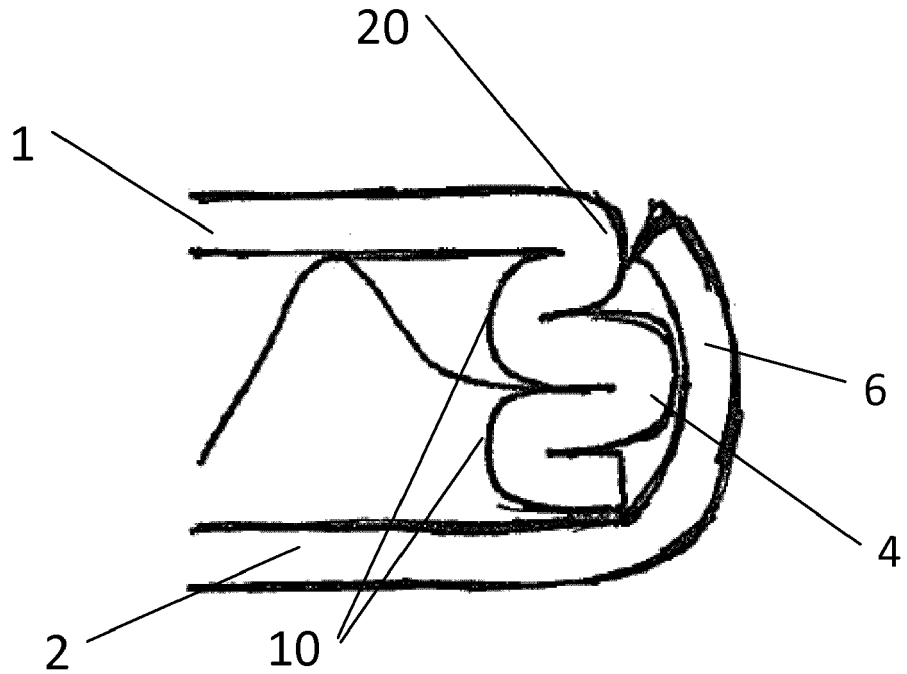

Fig. 2

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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 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 forms a multilayer nose by means of consecutive folds compounded towards the second wall, the lateral side of the second wall being bent to cover said multilayer nose, wherein the folds are at least partially displaced laterally towards the inner side of the tube with respect to the first bending point of said lateral side of the first wall.

[0006] Preferably, the inner facing arched portions of the folds laterally precede the first bending point of the multilayer nose.

[0007] Preferably, the lateral side of the second wall, bent over the multilayer nose, is also double walled.

[0008] Preferably, the lateral side of the second wall, bent over the multilayer nose, consists of one layer.

[0009] 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].

[0010] Another object of the invention is a heat exchanger comprising a described tube.

[0011] 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 a first example,

Fig. 3 presents a tube according to a second example.

[0012] 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.

[0013] Fig. 2 shows a first example of the flat 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. The fin is however optional. One of the lateral sides of the first wall 1 forms a multilayer nose 4 by means of consecutive folds compounded towards the second wall 2. The lateral side 6 of the second wall 2 is bent to cover said multilayer nose 4. The folds are at least partially displaced laterally towards the inner side of the tube with respect to the first bending point 20 of said lateral side of the first wall 1. This means that there is at least one cross-section of the tube in which the multilayer nose is constituted by flat portions of first and second walls 1, 2 and multiple layers of the multilayer nose 4. Preferably, the inner facing arched portions 10 of the folds laterally precede the first bending point 20 of the multilayer nose 4.

[0014] Preferably, the folds of the multilayer nose 4 are substantially parallel to the first and second walls. In other words, planes of the folds are parallel to planes of the first wall 1 and the second wall 2.

[0015] The respective end of the second wall 2 is bent around the multilayer nose 4 so that it encompasses it. In this example, this end consists of a single layer. In other words, the lateral end of the second wall 2 forms a side wall 6, which covers the multilayer nose 4 of the first wall 1. This further strengthens the tube. At the same time it protects the multilayer nose 4 and enables the tube to have a unitary, unobtrusive shape.

[0016] Fig. 3 shows the second example of the tube. In this example, the side wall 6 is also double walled. This fold extends along the circumference of the multilayer nose 4.

[0017] The examples present folds of certain lateral length. The lateral length of folds of the multilayer nose 4 is dependent on the lateral length of the walls of the multilayer nose 4. The longer the folds, the more resistant the nose of the tube, as the thicknesses of the multilayer nose 4 and the side of the second wall 6 compound at longer distance.

[0018] 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.

[0019] 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) forms a multilayer nose (4) by means of consecutive folds compounded towards the second wall (2), the lateral side (6) of the second wall (2) being bent to cover said multilayer nose (4), wherein the folds are at least partially displaced laterally towards the inner side of the tube with respect to the first bending point (20) of said lateral side of the first wall (1).

2. The tube according to claim 1, wherein the inner facing arched portions (10) of the folds laterally precede the first bending point (20) of the multilayer nose (4).

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

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

5. 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].

6. A heat exchanger comprising a tube according to any of claims 1-5.

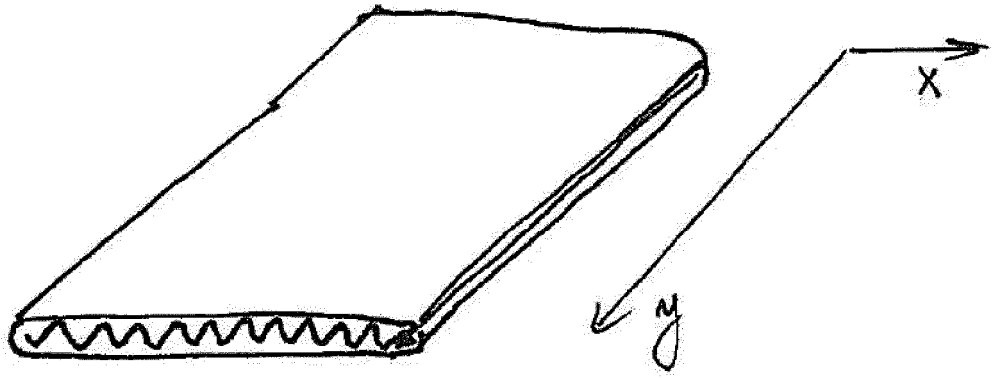

Fig. 1

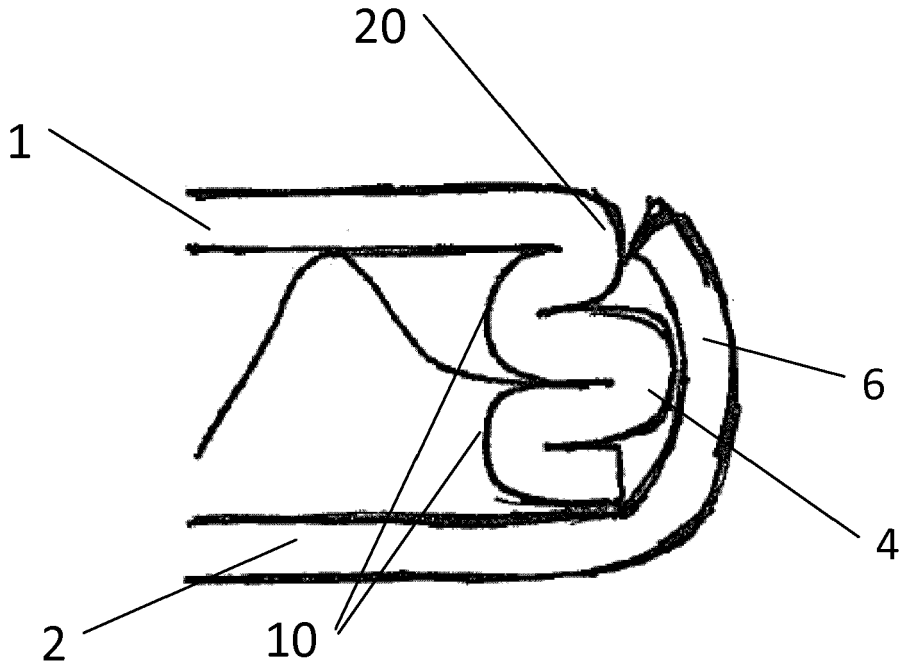

Fig. 2

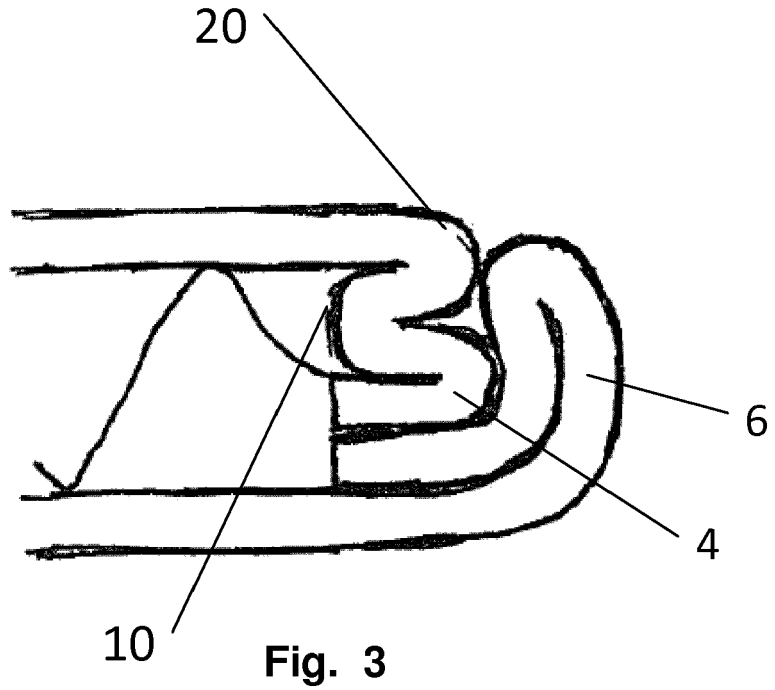

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 17 16 9136

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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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