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(54) **HEAT TRANSFER PIPE**

(57) Problem to be resolved: Creating an interface between two heat-conducting media with sufficient thermal conductivity for transferring large amounts of heat between the media.

Solution to the problem: The heat transfer pipe (1) makes up the interface between heat-conducting media

while allowing a sufficient amount of heat transfer due to the fins (2) which form an enlarged heat transfer surface and also due to the existence of heat-conducting paths between the heat exchange pipe (1) and the base (3) of the fins (2).

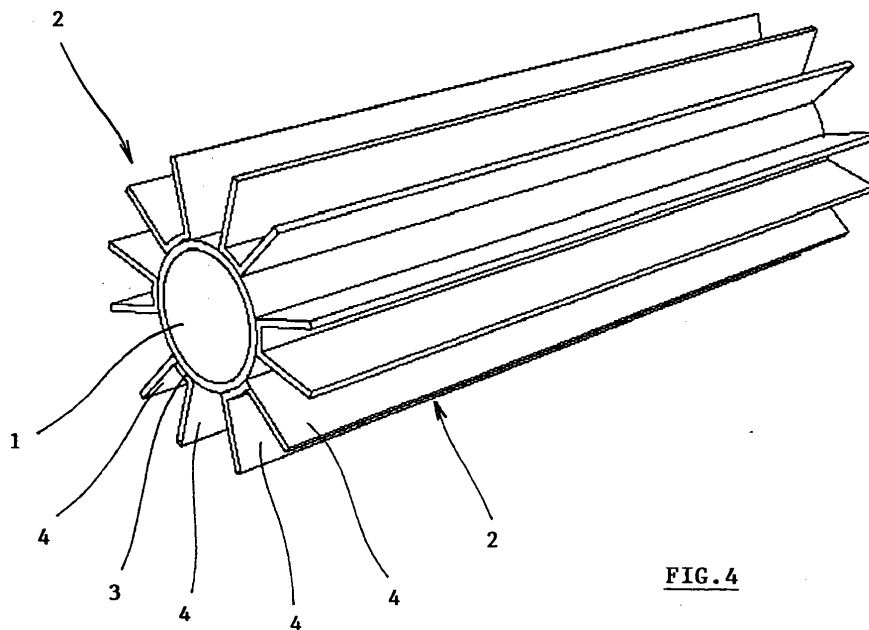


FIG. 4

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Description

Field of the invention

[0001] The invention relates to a heat transfer pipe designed in particular for use in heat exchangers.

Background of the invention

[0002] Heat exchange between two media separated by a dividing barrier occurs through the absorption of heat from a warmer environment to the dividing barrier and through the emission of heat from the dividing barrier to a cooler environment. The most widely used materials for making the dividing barrier are metals or their alloys which have, either naturally or after modification, the suitable physical and chemical parameters to separate the two environments from each other and for the function of heat transfer between the two environments.

[0003] To improve the amount of transferred heat, the absorption or emission surface of the dividing barrier is maximized as much as possible, like for example in the Czech utility model CZ 15487 U1. The utility model describes a divided radiator which is mounted on a pipe with a flowing heat exchange medium, hot water. The radiator is bipartite and each part is formed by a semicircular base from which the heat exchange surfaces radially protrude into the space. The semicircular bases have a larger radius than the radius of the pipe. The parts of the radiator pipe grip between themselves and the parts are joined with screws. The heat from the pipes is radiated to the bases of the split radiator, from where heat travels through heat-conducting metal paths to the heat transfer surfaces. The heat transfer surfaces efficiently radiate heat into the surrounding space. The disadvantages of this design consist in the fact that the halves of the split radiator do not abut on the pipe, particularly in the event of unevenness, and this limits the transfer of heat from the pipe to the base of the radiator. If there is a layer of paint on the pipe before installation of the radiator, the radii of the base of the split radiator may not suit the size of the pipe. If the physical parameters of the material of the pipe and radiator are substantially different, there may occur a twisting of the assembly due to the different thermal expansion of the materials. The radiator may move along the heating pipe, or it may fall off in the event of a failure of the connecting bolts of the opposite halves of the split radiator.

[0004] An improved transfer of heat between two media is also resolved by the German utility model DE 202006009431 U1 which describes a sleeve attachment to the heating or cooling pipe. The attachment is made from a thin-walled base which is applied to at least part of the outer housing of the heating pipe. In the attachment there is an assembly of lengthwise parallel openings into which the heat exchange plates are inserted. The heat exchange plates are bent at the base so that they are substantially in the shape of the letter "L" wherein the

horizontal arm is much shorter than the vertical arm. The plates pass through holes in the base until they are stopped by a bent portion of the base. The bent portion abuts the housing of the heating pipe. The base is fixed to the pipe by tightening rings which are on the edges of the base. The disadvantages of this design consist in the fact that the heat transfer surfaces bend out from the holes in the base, that the detachable connection with the heating pipes may loosen, and that the transfer of heat from the heating pipes into the heat exchange surfaces occurs over the shorter arm of the heat exchange surface formed by the bend and which forms a small contact area resting on the heating pipe. Simultaneously, the abutting arm is straight, so that it is not adjacent to the heating pipe along its entire surface and the contact surface, due to the radius of the heating pipe, is even more reduced.

[0005] The objective of the invention is to create a heat transfer pipe which would remedy the aforementioned drawbacks, which would have an increased overall heat transfer area with the added heat transfer area, and at the same time would have it irremovably fixed to the heat exchange pipe, which would have, between the added heat transfer surface and the heat exchange pipe, a sufficient contact area for the transmission of heat and for the support of the formation of heat conducting paths.

Summary of the invention

[0006] This object is resolved by creating a heat exchange pipe according to the following invention.

[0007] The invention relates to a heat transfer pipe designed to guide the heat exchange medium. The heat exchange pipe comprises at least one added heat transfer surface. The added heat transfer surface is arranged on the outer surface of the heat exchange pipe and is used for better heat transfer between the heat transfer medium and the environment around the heat exchange pipe. The added heat transfer surface is formed by at least one pair of oppositely established fins welded to at least a part of the heat pipe. Each of the fins has a cross section substantially in the shape of the letter "U" with a base and two sides.

[0008] The essence of the invention lies in the fact that simultaneously the base of each fin is provided with a radius for the adjacent connection of the base of the fin on the heat transfer pipe, wherein the relationship between the size of the radius of the base of the fin and the size of the outer diameter of the heat transfer pipe is given by:

$$R = D/2,$$

where R is the size of the radius of the base and D is the size of the outer diameter of the heat transfer pipe.

[0009] The base of the fin provided with a radius is

preferred because it completely adheres to the pipe and enables the formation of heat-conducting paths between the material of the heat transfer pipe and the added heat transfer surface formed by the fins. The heat-conducting paths are terminated in the sides of the fins, from which radiates heat, or heat is received, depending on whether the warmer heat transfer medium is led through the pipe or whether the warmer environment is around the heat exchange pipes. The heat-conducting paths are not interrupted by the effect of thermal expansion or of corrosion between the base and the outer surface of the heat exchange pipes, because the fins are non-detachably arranged on the heat transfer pipe, thereby forming a single rigid unit with the heat exchange pipe.

[0010] In another preferred embodiment of the heat transfer pipes according to the invention, the sides of the fins are divergent in the direction away from the heat transfer pipe. The divergence of both sides of the fins is advantageous for the transfer of heat between the surrounding environment and the fins. Heat is radiated in a direction perpendicular to the surface from where it was emitted, and through the divergence of the sides of the fin, the area of the surrounding environment is covered by thermal radiation.

[0011] In a further another preferred embodiment of the heat transfer pipe according to the invention, there applies, for the thickness of the wall of the fin, the relationship $t = 0.05 \text{ to } 0.1 T$, where T is the wall thickness of the heat exchange pipe. The thick wall of the heat transfer pipe ensures the durability of the pipe and a long service life. Furthermore, the heat is effectively distributed through the thick wall to the individual fins. Thin fin walls enable intense radiation or heat absorption.

[0012] In another further preferred embodiment of the heat exchanger pipe according to the present invention, there is arranged, on the heat transfer pipe, an n -number of fins, where n is a value in the interval from 2 to 16 fins, and the fins are arranged on the heat transfer pipe in regular angular spacings.

[0013] The advantages of the heat exchange pipe consist in the fact that the added heat transfer surface formed by the fin is rigidly arranged to the heat exchange pipe, that the heat-conducting paths between the heat exchange pipe and the fin are continuous, and that the fins radiate and absorb the heat effectively and intensively.

Description of the drawings

[0014] The invention will be further illustrated by the following drawings, in which Fig. 1 illustrates a cross sectional view of the heat exchange pipe with six fins, Fig. 2 illustrates a cross sectional view of a pipe with two fins, Fig. 3 illustrates a cross sectional view of a fin, and Fig. 4 illustrates an axonometric view of the heat transfer pipe.

Examples of the preferred embodiments of the invention

[0015] It is understood that the hereinafter described

and illustrated specific examples of the realization of the invention are presented for illustrative purposes and not as a limitation of the examples of the realization of the invention to the cases shown herein. Experts who are familiar with the state of technology shall find, or using routine experimentation will be able to determine, a greater or lesser number of equivalents to the specific realizations of the invention which are specifically described here. These equivalents shall also be included into the scope of the claims.

[0016] The heat transfer pipe 1 is designed for the transfer of heat from one environment to another. In the example of the embodiment, the first environment is formed by cold water at 0°C which forms the heat transfer medium led by the heat exchange pipe 1 while the second environment is formed by hot steam at 120°C surrounding the heat transfer pipe 1 and the added heat transfer surface formed by the fins 2. The typical area of practical application of the heat transfer pipe 1 is e.g. cooling steam in power plants.

[0017] Fig. 1 shows a heat transfer pipe 1 with six fins 2 for more efficient heat transfer. The fins 2 are divided into three pairs in a regular angular spacing, wherein in each pair the fins 2 are oppositely disposed. The heat transfer pipe 1 is made of steel. The length of the heat transfer pipe 1 is much larger in proportion to the remaining dimensions of the heat transfer pipe 1. The fin 2 is also made of the same type of stainless steel and is welded to the heat transfer pipe 1 along its entire length.

[0018] The fin 2 is welded to the heat transfer pipe 1 by resistance seam welding.

[0019] Fig. 2 shows the opposing establishment of one pair of fins 2 to the heat transfer pipe 1 which has an outer diameter of D . The wall of the heat transfer pipe 1 is thicker than the wall of the fin 2.

[0020] Fig. 3 shows the fin 2 itself which is substantially in a letter "U" shape. The fin 2 has the base 3 provided with a radius R for adjacent establishment on the heat transfer pipe 1. The walls 4 of the fin 2 diverge away from the heat transfer pipe 1 into the surrounding space.

[0021] The number of fins 2 is dependent on the specific application of the heat exchange pipes.

[0022] The dimensions of the heat transfer pipes 1 provided with six fins 2 in one of the possible embodiments are as follows: the length of heat transfer pipe 1 is 1320 mm, the outer diameter of the heat transfer pipe 1 is 16 mm, the total outer diameter of the heat transfer pipe 1 with the fins 2 is 33 mm, the angle between the sides 4 of a fin 2 is 32° , the wall thickness of the heat transfer pipe 1 is 16 mm, and the thickness of the walls 4 of the fins 2 is 0.8 mm.

Industrial applicability

[0023] The heat transfer pipe according to the invention will find use in heat exchangers of coal-fired power plants, nuclear power plants, and other industrial heat exchangers and boilers which require the long-term and

safe transfer of large amounts of heat.

Overview of the positions used in the drawings

[0024]	5
1	heat transfer pipe
2	fin
3	base of the fin
4	side of the fin
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D	outer diameter of the heat exchange pipe
R	size of the radius of the base of the fin
t	thickness of the wall of the fin
T	thickness of the wall of the pipe
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Claims

1. A heat transfer pipe (1) for conducting a heat exchange medium that includes at least one added heat transfer surface arranged on the outer surface of the heat exchange pipe (1) and formed by at least one pair of oppositely established fins (2) welded to at least a part of the heat pipe (1); each of the fins (2) has a cross section substantially in the shape of the letter "U" with a base (3) and two sides (4), **characterized in that** the base (3) of each fin (2) is provided with a radius (R) adjacent to the establishment of the base (3) of the fin (2) on the heat transfer pipe (1), wherein for the size of the radius (R) of the base (3) of the fin (2) and the size of the outer diameter (D) of the heat exchange pipe (1) there applies the relationship:

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$$R = D/2.$$

2. A heat transfer pipe according to claim 1, **characterized in that** the sides (4) of the fin (2) diverge away from the heat exchange pipe (1).

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3. A heat transfer pipe according to any of claims 1 to 3, **characterized in that** for the thickness (t) of the wall fin (2) there applies the relationship: $t = 0.05$ to $0.1 T$, where t is the designation of the thickness (t) of the fin and T is the indication of thickness (T) of the wall of the heat exchange pipe (1).

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4. A heat transfer pipe according to any of claims 1 to 3, **characterized in that** on the heat transfer pipe (1) there is arranged an n-number of fins (2), where n is a value from the interval of 2 to 16, and the fins (2) are arranged on the heat transfer pipe (1) at regular angular spacings.

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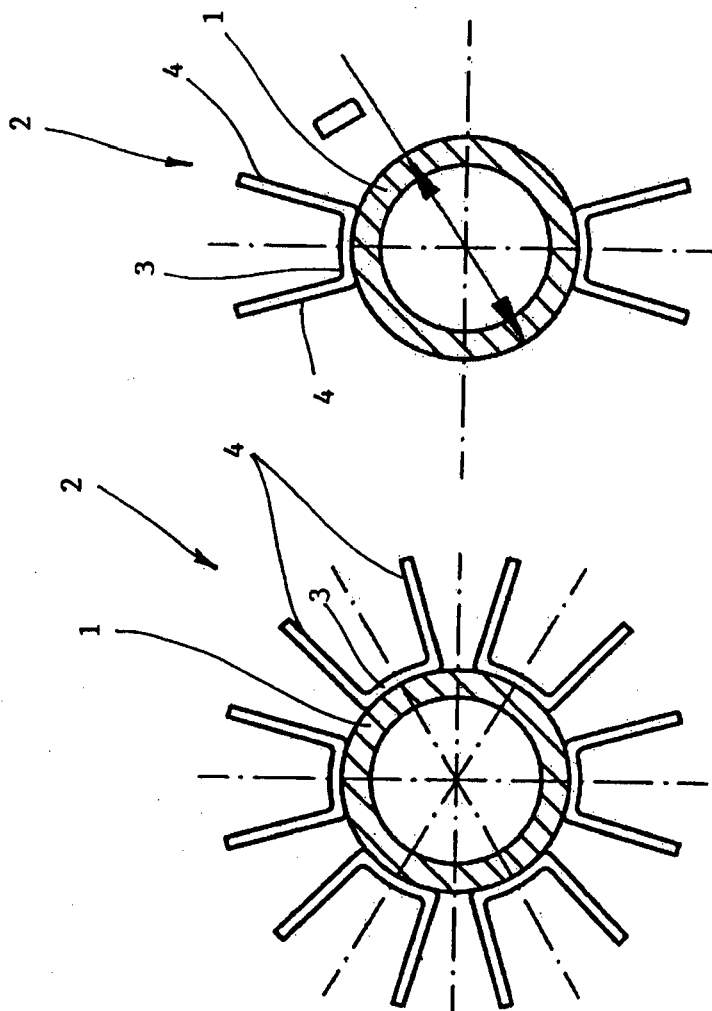


FIG. 1

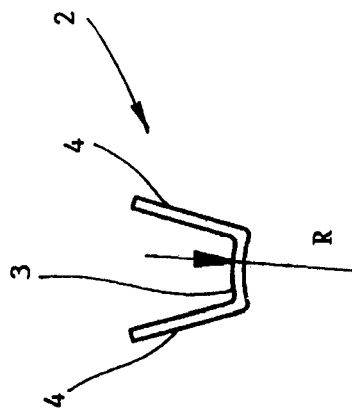
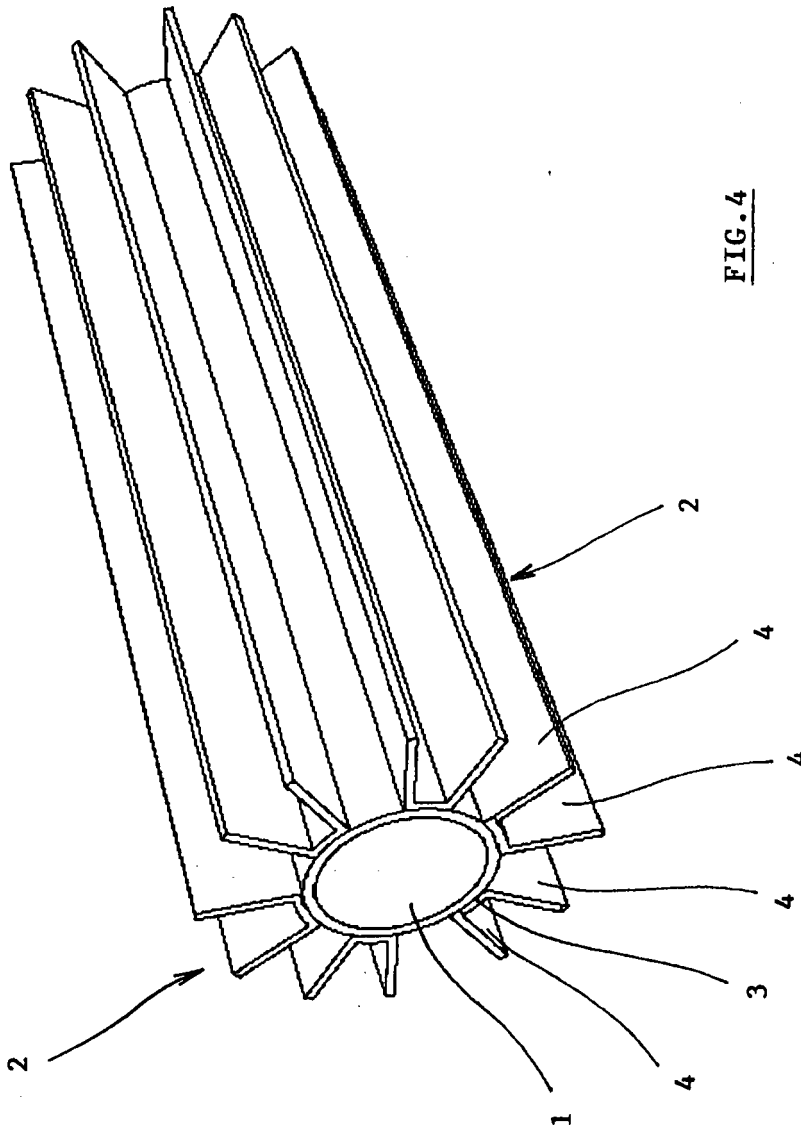


FIG. 3





EUROPEAN SEARCH REPORT

Application Number
EP 15 00 2407

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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 5 January 2016	Examiner Louchet, Nicolas
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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