



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11)

EP 1 586 841 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
19.10.2005 Bulletin 2005/42

(51) Int Cl.7: **F28D 5/02**

(21) Application number: **04380078.8**

(22) Date of filing: **01.04.2004**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IT LI LU MC NL PL PT RO SE SI SK TR**
Designated Extension States:
AL HR LT LV MK

(72) Inventor: **Sanchez, Julio, c/o C/ Plata 3
28500 Arganda del Rey (Madrid) (ES)**

(74) Representative:
**Primo de Rivera y Urquijo, Jose A.
General Martinez Campos, 51
28010 Madrid (ES)**

(30) Priority: **01.04.2004 ES 200300768**

(71) Applicant: **Torres Intercal S.A.
28500 Arganda del Rey (Madrid) (ES)**

(54) **Tubular heat exchange battery for closed circuit evaporative cooling towers**

(57) The inlet and outlet manifolds (4) are situated outside of the casing (1) and have a demountable character, such that by removing said manifolds (4), "in situ" cleaning and maintenance tasks of the tubular battery are possible, as well as the temporary closing off of any of said tubes (3) which is broken down, by closing the ends (10) thereof by means of respective caps, and the

extraction of the broken down tubes, for the replacement thereof, through the side opposite to the manifolds (4) is also possible after the unwelding of the two connections and as a result of the existence of special cross-bars (13-14) which, suitably fixing the tubes (13) inside the framework (16), are shaped and positioned so as to not constitute stops interfering in said transverse shifting of the tubes.

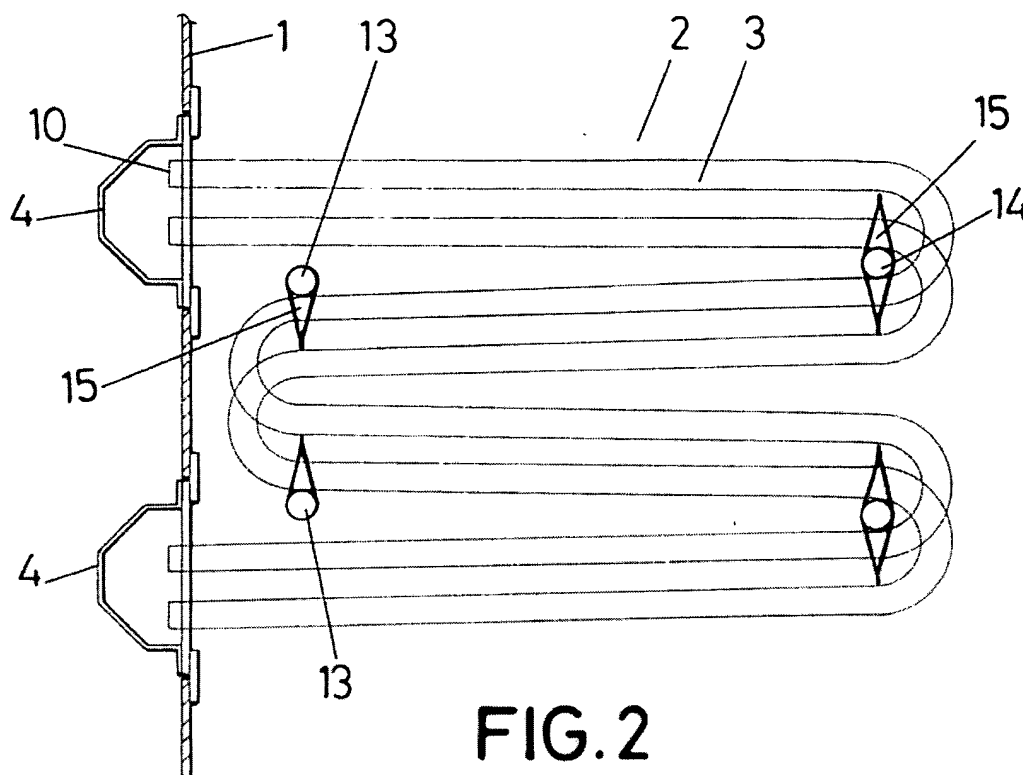


FIG. 2

EP 1 586 841 A2

Description

OBJECT OF THE INVENTION

[0001] The present invention refers a tubular heat exchange battery, of those used in evaporative cooling equipment, and more specifically in closed circuit evaporative cooling towers.

BACKGROUND OF THE INVENTION

[0002] Technology in the field of exchange batteries for closed circuit evaporative cooling towers has evolved very little in its basic features since its origin, such that galvanized, mono-block, welded, sealed, inaccessible and irreparable tubular batteries are still used, constituting elements which are maintained untouched in their worksite while they are operative, having to be demounted, rejected and replaced, in spite of their considerable weight, volume and cost, when a tube is damaged by accident or by early corrosion.

[0003] The working conditions supported by these batteries immersed in environments saturated with humidity due to a permanent humectation-aeration, together with a universally adopted design of tubes bent in the shape of coils, inseparably welded to two manifolds situated at the frontal portion of the battery, and all the previous elements anchored within a framework, have conditioned the manufacture thereof since the beginning. Said conditions and features condition their manufacture in the following manner:

- The battery must be manufactured with welded, and at times annealed, steel tube, enabling the continuous bending with very small radii and in a cost-effective manner,
- The battery must be welded in an sealed manner, with strong fixings, by means of multiple crosspieces, to an airtight framework enabling the indispensable subsequent outer galvanizing, and
- The assembly must be externally galvanized by means of the immersion of the battery in a melted zinc bath, said immersion being forced by a powerful pusher, requiring strong fixings to prevent the shifting of the battery components in the zinc bath, and also requiring a perfect sealing.

[0004] The mentioned production conditions have until now prevented the appearance of novel solutions to the existing disadvantages of use in this type of batteries for the previously mentioned closed circuit evaporative cooling towers, the main disadvantage being the impossibility of repair, replacement or closing off of any of the tubes in the event of a breakdown thereof, preventing the "in situ" repair of the battery and obliging to move or reject the battery.

[0005] In the state of the art, batteries for closed circuit evaporative towers and coil-shaped tubes providing so-

lutions to the aforementioned drawbacks are not known.

[0006] To solve the previous drawbacks, two important obstacles must have had to be overcome:

- To carry out the outer galvanizing of the framework of the tubular battery maintaining the manifolds open, preventing the introduction of zinc inside the tubes, and
- To obtain strong fixings of the coil tubes, which enable the outer galvanizing, without preventing future extractions and replacements of the tubes.

[0007] Therefore, it is an object of the present invention to achieve that each one of the coil-shaped tubes forming the tubular heat exchange battery for closed circuit evaporative cooling towers be easily extractible from inside the framework in the worksite of the cooling tower, enabling its "in situ" replacement and repair due to the new fixing elements of the tubes on the inside thereof, and to the external character of the manifolds.

[0008] It is a second object of the invention to achieve in said battery for cooling towers that the liquid inlet and outlet manifolds are flange-mounted and are easily demountable for enabling the inspection, internal cleaning, sealing tests and individualized provisional closing off of each tubular plane in the event of breakdown, said manifolds furthermore being positioned outside of the enveloping casing of the tower to facilitate all the more said operations.

DESCRIPTION OF THE INVENTION

[0009] The tubular battery for closed circuit evaporative cooling towers proposed by the invention, based on the moderate working pressure it must support, implies a new concept structured in order to solve the drawbacks set forth above.

[0010] The tubular heat exchange battery for closed circuit evaporative cooling towers object of the invention allows the individualized extraction of the unusable tubular planes due to the design of the framework, which is provided with special crossbars, each tubular plane being formed by a coil tube. Said extraction can be carried out without needing to move the battery from its location.

[0011] Due to this feature, the battery is no longer irreparable, allowing the temporary, fast and individualized closing off of the damaged tubular planes, as well as the possible replacement of said extractible planes, and replaced from the open rear portion of the framework.

[0012] The battery object of the present invention likewise enables the inspection, internal cleaning and individualized performance of watertightness tests for each tubular plane without needing to move or break the battery as a result of the introduction of demountable manifolds flanged to the enveloping casing containing the framework and located at the liquid inlet and outlet, and

not included in the framework body. Thus, the battery is no longer mono-block and airtight.

[0013] By situating the flange-mounted manifolds on the outer part of the framework enclosure by means of removable fixing means, the battery is no longer inaccessible, linking the design to a system for the easy opening of the opposite part of said framework and casing, leaving all the tubular planes uncovered.

[0014] To achieve establishing the previously detailed design, it is necessary to subject the manufacturing process to two modifications, such as:

- the use of collecting caps covering the access to the tubes during the galvanization process and which are subsequently rejected, and
- the use of a system of crosspieces or crossbars preventing the movement of the tubes during galvanization, but which subsequently enables the individualized extraction thereof in the worksite.

DESCRIPTION OF THE DRAWINGS

[0015] To complement the description being made and for the purpose of aiding to better understand the features of the invention according to a preferred embodiment thereof, a set of drawings is attached as an integral part of said description in which, with an illustrative and non-limiting character, the following has been shown:

Figure 1 shows, according to a schematic side elevational and sectional view, a tubular battery for closed circuit evaporative cooling towers carried out according to the object of the present invention.

Figure 2 shows an enlarged detail of the previous figure in which both the number of coil spans and the length of each one of them have been reduced for greater clarity and simplicity of the drawing.

Figure 3 shows, according to a similar representation to that in Figure 2, one of the manifolds decoupled from the rest of the battery.

Figure 4 finally shows, according to a perspective view, the usable crossbars for the fixing of the coils.

PREFERRED EMBODIMENT OF THE INVENTION

[0016] In view of the indicated figures, it can be seen how the tubular heat exchange battery for closed circuit evaporative cooling towers proposed by the invention is constituted, like any conventional battery, of an enclosure casing 1, of either polyester, metal or the like,, in the cavity 2 of which a plurality of heat exchange tubes 3 are arranged, duly protected externally by means of a framework 16, which are shaped as coils and more specifically tubular planes, wherein said tubes 3 include fluid inlet and outlet manifolds 4.

[0017] Said manifolds 4, extending along the width of the front portion of the casing, are situated outside of

the casing 1 and are assembled on the latter in a flange-mounted and demountable manner. More specifically, each manifold 4 is structured by means of two parts 4-4', of which parts part 4 is the one outside the casing 1 and extending into the corresponding inlet 5, whereas part 4' is joined to the casing 1 at an opening operatively made on the latter and has threaded holes 6 for fixing, with the cooperation of screws 7 and the placing of a seal 8, of the outer part 4 of the manifold, as especially seen in Figure 3.

[0018] The inner part 4' is traversed by the tubes 3 substantially projecting towards the inside of the manifold and which are fixed by means of weld beads 9, such that in the event of a possible breakdown in one of said tubes 3, the latter can be temporarily disabled by removing the outer flange 4 and blocking it with caps that can be coupled at its ends or entrances 10, said damaged tube 3 being able to be subsequently replaced by means of the extraction thereof through the side 11 of the casing 1 opposite to the manifolds 4, releasing it from the inner part 4' by means of cutting and unwelding the tube 3 in its end sector projecting with regard to part 4'.

[0019] To suitably stabilize the tubes 3 inside the framework 16 without the support means thereof interfering in the event of the possible need to extract it, the use of crossbars 13, 14 fixed to the frame, and preferably horizontal and perpendicular to the coil shaped tubes 3, has been provided for. Said crossbars 13 have short radial arms 15, oriented in the same direction, and the crossbars 14 have opposing radial arms 15, intended for acting as stops for the tubes 3, those crossbars which are most suitable in each case according to the span of the coil shaped tube they must support being used, as can be inferred from observing Figure 2. Likewise, said crossbars 13, 14 and radial arms 15 will not constitute stops preventing the transverse shifting of said tubes 3 within their own plane during the operation for the extraction thereof.

[0020] Said crossbars 13, 14 have a double function, such as, as previously mentioned, allowing the individualized extraction of the different coil shaped tubes 3 constituting the heat exchange battery, and in turn preventing the movement of the tubes 3 inside the framework 16 of the battery during the galvanizing process. Said movement of the tubes 3 inside the zinc bath is prevented since the transverse and perpendicular arrangement of the crossbars 13, 14 in relation to the tubes prevents the vertical movement inside the zinc bath thereof, whereas the radial arms 15 prevent the horizontal movement of said tubes 3 inside the framework 16.

[0021] Said framework 16 comprises the tubes 3 on the inside thereof, the framework being formed by an outer structure, preferably of steel, and horizontally traversed by the crossbars 13, 14 joined to the framework 16 and which support the coil shaped tubes 3. Likewise, the rear portion of said framework 16 is provided with a certain number of removable flat bars which, after being

removed, allow for the individual extraction of the tubes 3.

Claims

1. A tubular heat exchange battery for closed circuit evaporative cooling towers, of the type incorporating an enclosure casing (1) on the inside (2) of which and by way of a framework (16), a plurality of tubular heat exchange planes (3) are arranged, the tubes (3) of each plane being arranged between a pair of manifolds (4), one inlet manifold and one outlet manifold, and the tubes (3) being coil shaped, **characterized in that** said framework (16) has crossbars (13-14) provided with radial arms (15) which stabilize the tubes (3) in said framework (16) and allow for the independent extraction of each tube (3). 5 10 15 20
2. A tubular battery according to claim 1, **characterized in that** said manifolds (4) are outside the casing (1) and are removably assembled thereon. 25
3. A tubular battery according to claim 2, **characterized in that** the manifolds are flange-mounted with the cooperation of fixing means, preferably screws (7), and with the interposition of a sealing gasket (8), such that the tubes (3) are directly accessible for inspection, maintenance and cleaning by simply demounting the manifolds (4). 30 35 40
4. A tubular battery according to the previous claims, **characterized in that** the ends (10) of the tubes (3) project to the outside of the casing (1), specifically through a complementary part (4') of the corresponding manifold (4), the part (4') being traversed by the tubes (3) and to which the latter are fixed by means of weld beads (9) allowing the possible unwelding of the tubes (3). 45 50
5. A tubular battery according to claim 1, **characterized in that** the tubes (3) are extractible from the framework (16) through the side thereof opposite the manifolds (4). 55
6. A tubular battery according to claim 1, **characterized in that** the radial arms (15) of said crossbars (13) are oriented in a single direction. 50
7. A tubular battery according to claim 1, **characterized in that** the radial arms (15) of said crossbars (14) are oriented in two diametrically opposing directions. 55
8. A tubular battery according to the previous claims, **characterized in that** the manifolds (4) are flanges.

9. A tubular battery according to the previous claims, **characterized in that** said crossbars (13, 14) are arranged inside the framework (16) in a horizontal manner and perpendicularly to the tubes (3).

10. A tubular battery according to the previous claims, **characterized in that** the crossbars (13, 14) are joined to the framework (16).

