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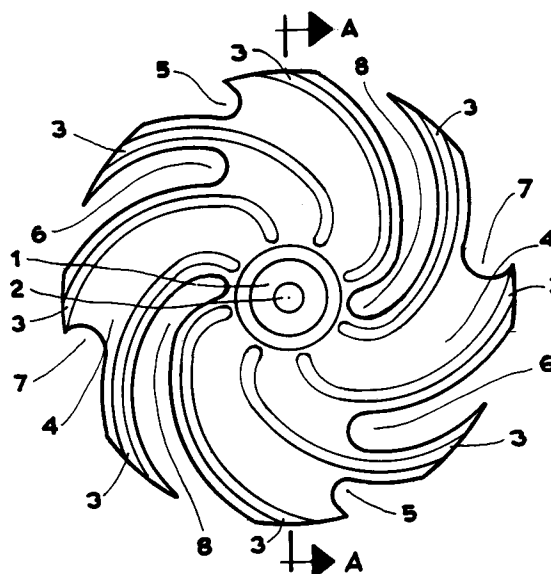
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I-20122 Milano (IT)(54) **Rotor for spray nozzle for cooling tower.**

(57) A rotor mounted on a stand (10, 15) and placed under the outlet section of a spray nozzle (11) for cooling tower is described, which uniformly distribute the water which goes out from said outlet section.

The substantially conical rotor rotates by the action of the water which goes out from said outlet section urging a series of fins (3) present on its surface; the rotor main body (4) is provided, starting from the external edge, with one or more series of equidistant cavities (5, 6, 7, 8) having different depth and an arc profile similar to the fins one.

**FIG 1****EP 0 654 649 A2**

FIELD OF THE INVENTION

The invention consists of a rotor improving the performances of a spray nozzle for water to be cooled in a cooling tower, since it allows an uniform distribution of the water coming out from the nozzle outlet on the inner section of the tower and in particular on the upper surface of the heat exchange element normally contained in a cooling tower in order to increase the water/air contact surface and then the cooling efficiency.

PRIOR ART

A cooling tower is a particular cooling plant used in numerous fields of technics and industry (thermoelectric, petrochemical etc.) to dissipate the heat present in the cooling water.

In the cooling towers the water to be cooled is sprayed on the tower top and during its falling it meets an air stream to which it transfers a heat quantity by partially vaporizing.

Said air stream may be generated by one or more sucking fans placed on the tower top and/or by one or more blowing fans placed on the cooling tower bottom, or this air stream could be generated by the natural draught due to air density differences.

The evaporation allows to cool the water to a temperature lower than the air inlet temperature. In order to increase the air/water contact surface, and then the cooling tower efficiency, the tower casing is at least partially filled with one or more layers of a "honeycomb" material (or of another equivalent material) which foresees an upper chamber where a plurality of spray nozzles are placed and a lower chamber where a sink for collecting the cooled water is placed.

Cooling towers provided with spray nozzles having means suitable for more uniformly distribute water which has to be cooled on the whole inner section of the tower are known in the art.

In a possible embodiment (e.g. as described in US-A-5 143 657) said distributing means comprises at least a disk-shaped mobile element, showing a plurality of fins on both sides, which is rotated by the water to be cooled coming out from the nozzle and urging the fins present on one side; in this case the centrifugal force spreads out said water on a larger surface. Said known distributing elements are quite expensive and complicated since for instance the mobile element is kept by means of a fixed element receiving a part of the water to be cooled through a hole placed in the center of the mobile element. In this case, a part of the water urging the fixed element is further dispersed and the balance is deviated towards the fins present on the other side of the mobile element; these fins

spread out the coming water by means of the centrifugal force.

The fixed element is kept in its housing by a tension rod passing through the hole present in the mobile element and it is fixed to a stand present in the inner side of the spray nozzle. Said stand and the relative fixing means to the nozzle must be strong enough to bear the action of the water which has to be cooled coming out from the nozzle and they reduce the nozzle free section and the hole section present on the mobile element.

According to a further embodiment of the known distributing means (easier to realise than the previously described embodiment), the water to be cooled coming from the nozzle passes through the hole present on the mobile element and urges a slightly curved plate (which constitutes the fixed element) which deviates it towards the fins present on the correspondent side of the mobile element, said fins rotating the mobile element which spreads out the water to be cooled by centrifugal force.

By using the known distributing elements which perform an essentially radial distribution, the water to be cooled can not properly wet the part of the heat exchange element immediately underlying each nozzle; in this case, around a third of the surface affected by each spray nozzle is wet by the water to be cooled in an inadequate manner.

Moreover, the mobile element of the known distributing elements can be stopped by foreign bodies and/or by scales of the mineral salt normally present in the water for industrial purposes used as cooling water in the plant comprising the cooling tower, said foreign bodies and/or scale being removable only by cutting off the cooling tower and disassembling the distributing elements.

An object of the present invention is a rotor suitable for a spray nozzle for cooling tower which allows to overcome the foresaid drawbacks shown by the known distributing means.

SUMMARY OF THE INVENTION

Object of the present invention is a rotor for a spray nozzle working in a cooling tower which is substantially conically shaped and has its vertex directed towards the outlet section of the spray nozzle.

The water coming out from the outlet section urges a multiplicity of fins realized on the rotor surface causing the rotation of the rotor itself around a pin fixed to the external wall of the nozzle.

In the main body of the rotor, starting from the external edge, one or more cavities are provided, which are equidistant, and have a profile equal to the one of the fins. Each cavity is realised on a part of the rotor main body comprised between two adjacent fins.

LIST OF FIGURES

The invention will be better understood with reference to a non-limiting embodiment shown in the enclosed drawings, where :

- Figure 1 shows a top view of a rotor according to the present invention;
- Figure 2 shows a cross-section along plane A-A of Figure 1 of the above rotor ;
- Figure 3 shows a lateral view of the rotor shown in Figure 2 mounted on a stand projecting from the nozzle supporting it from the top;
- Figure 4 shows a lateral view of the rotor shown in Figure 2 mounted on a stand able to support it from the bottom.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Figure 1 shows a top view of the rotor according to the present invention, whereas Figure 2 shows a cross-section along a plane A-A of the above rotor. In said Figures it is possible to see the hub 1 showing a through hole 2 receiving a pin 9 (Figures 3 and 4) which constitutes the rotor rotation axis and eight fins 3, equidistant each other, shaped as arcs of circumference till the rotor edge.

The fins 3 have constant height and thickness and are connected to the rotor hub 1, which therefore is shaped as a cone gradually transformed into a multiplicity of identical curvilinear arms.

The eight fins 3 divided the main body 4 of the rotor in eight parts, in each of them, starting from the rotor external edge, a cavity is provided. The eight cavities may be grouped in two groups of four cavities 5, 6, 7, 8 of different depth, uniformly disposed on the rotor; in this case, two identical cavities appear perfectly symmetric as regards the rotor hub 1.

The water coming out from the rotor outlet urges and rotates the rotor, generating a distribution cone which may be schematically decomposed into four concentric parts, each part being created by the water passing through the cavities of each series which are decreasingly deep, and into a fifth outer part concentric with the other ones created by the water which completely follows the fins 3 and is dispersed more distant from the nozzle by the centrifugal force. In particular, the water flowing through the deeper cavities 8 goes out the rotor action creating the central part of the distributing cone which wets the part underlying the nozzle, preventing the serious drawback of the known distributing devices.

Accordingly, a rotor according to the present invention works correctly even if no cavity is provided in some of the parts in which it is divided by

the fins 3 whereas it is necessary (or at least suitable) that at least a fin is present between two contiguous cavities: it is therefore necessary (or at least suitable) that the number of cavity realized in the rotor main body 4 is equal or at least not higher than the number of the fins 3.

A rotor according to the invention has also the advantage to be self-cleaning, since the action of the water jet, the absence of mobile parts around the rotor and the fact that the fins 3 are gradually linked to the hub 1 assure that a foreign body present in the water to be cooled does not stop on the rotor and that the rotor itself can not be stopped by scales of mineral salts normally present in the cooling water.

Figure 3 shows a lateral view of the rotor, where the rotation hub 9 is constituted by the terminal portion of a stand 10 (or it is fixed in any manner to said stand 10) which is cantileverly fixed to the external wall of the nozzle 11 and which supports the rotor from the top.

To deviate the water flow and to prevent the settlement of scale in the seat for the rotor hub 9, a protection cap 12 is provided above the rotor; furthermore, on the hub 9 washers 13, 14 are provided, these last ones being in a material having suitable frictional resistance and preferably of self-lubricating kind.

The stand 10, fixed out from the nozzle 11, does not need fixing means particularly strong, does not reduce the outlet section of the nozzle 11 and does not interfere with the free water flowing from the nozzle itself.

The Figure 4 shows a lateral sectional view of the rotor whose rotation hub 9 is supported by a stand 15 bearing the rotor from the bottom; the main body 4 of the rotor protects the seat of rotor receiving the hub 9 against foreign bodies and/or scale.

On the contact surface between the stand 15 and the rotor it is suitable to use washers 13, 14 in a material having a suitable frictional resistance and being preferably self-lubrificant. The cap 16 makes easier the water flowing along the main body 4 of the rotor; in this case, the stand is less stressed.

The rotor formerly described only as non-limiting example includes eight fins and two series of four cavities, however, without going out from the scope of the present invention, a skilled person may modify said rotor by realizing a different number of fins 3 and/or series of cavities and/or cavities for each series (anyway the number of the cavities must be equal or at least not higher than the fins number) and by including any further modification and improvement suggested by the normal experience and by the natural progress of the technics.

Claims

1. Rotor for spray nozzle for cooling tower, characterized in that it is substantially conically shaped with the vertex directed towards the outlet section of said nozzle (11), in that a plurality of fins (3) is present on its surface urged by the water going out from said outlet section, the action of said water on said fins (3) rotating said rotor around a pin (9) fixed to the external wall of said nozzle (11) and in that in the main body (4) of said rotor there are, starting from the external edge, at least a series of cavities (5-8) of different depth, equidistant each other, whose profile is similar to the fins (3) one, each of said cavities (5-8) being realized in a part of said main body (4) of said rotor comprised between two adjacent fins (3).

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2. Rotor according to claim 1, characterized in that said fins (3) having constant section and constant height are arc-shaped.

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3. Rotor according claim 1, characterized in that it comprises eight fins (3) and two series of cavities, each of them comprising four cavities (5, 6, 7, 8) of different depth.

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4. Rotor according claim 1, characterized in that it is supported from the top by said rotation pin (9) fixed to a stand (10) cantileverly fixed to the external wall of said nozzle (11).

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5. Rotor according claim 1, characterized in that it is supported from the bottom by said rotation pin (9) carried by supporting means (15) fixed to the external wall of said nozzle (11).

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6. Rotor according claim 1, characterized in that the number of said cavities is not higher than the number of said fins (3).

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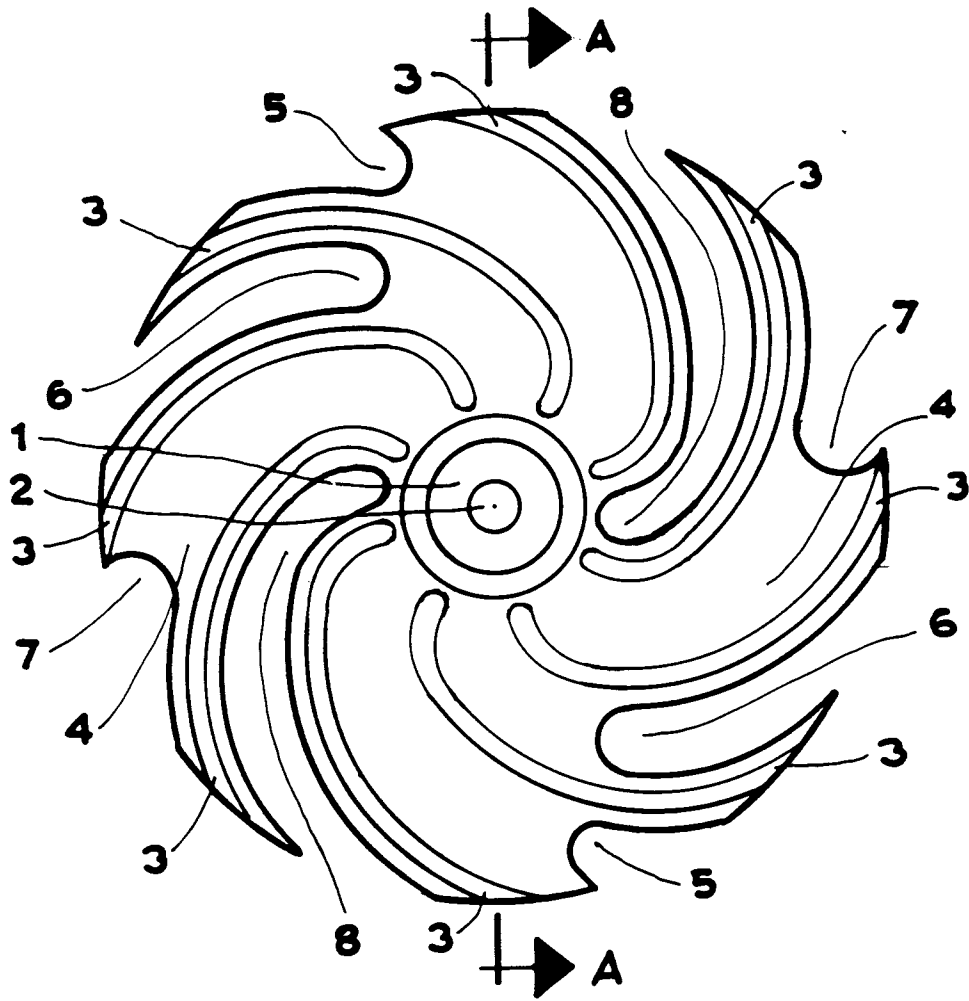


FIG 1

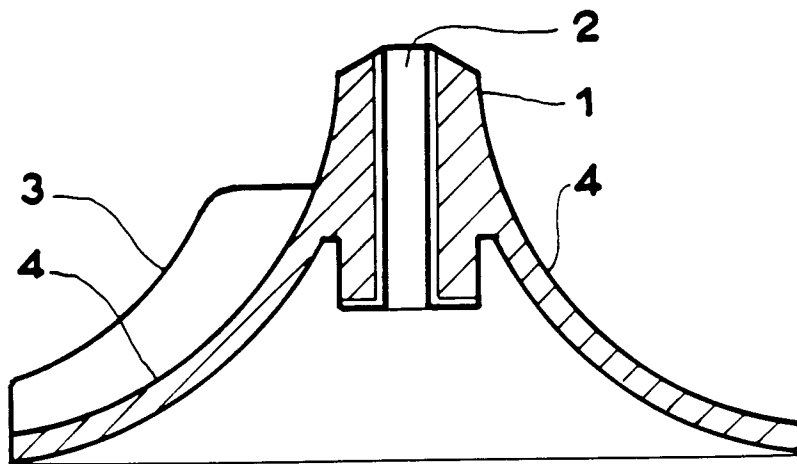


FIG 2

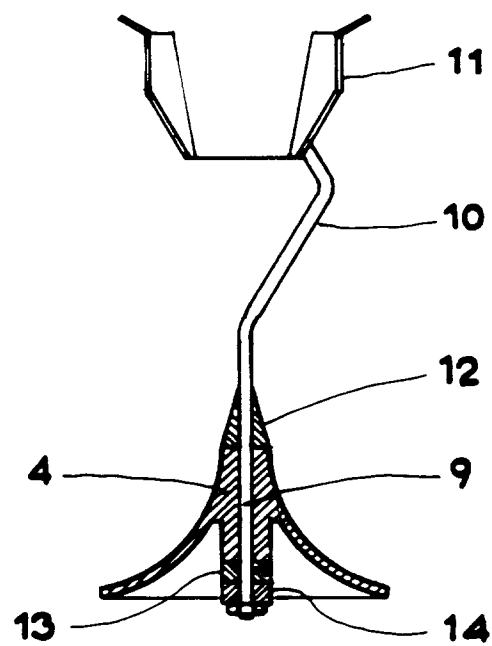


FIG 3

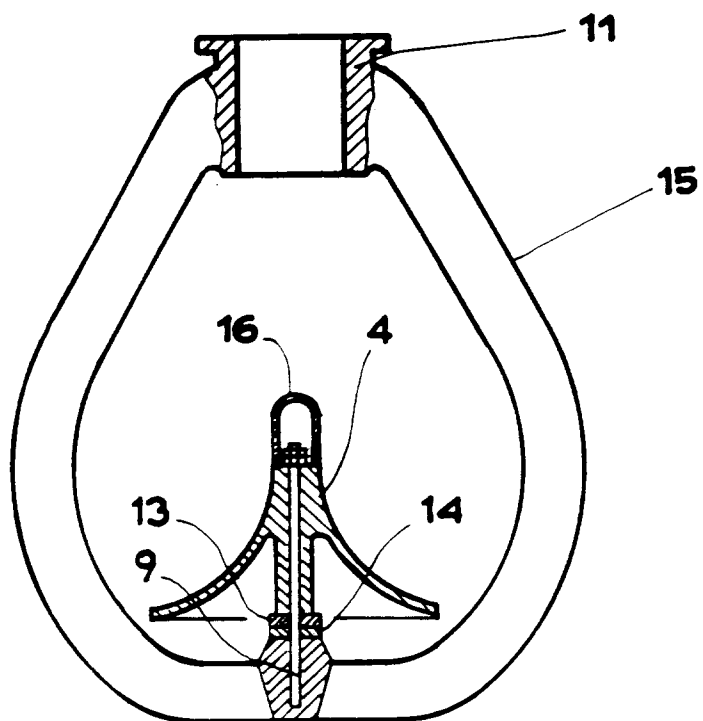


FIG 4