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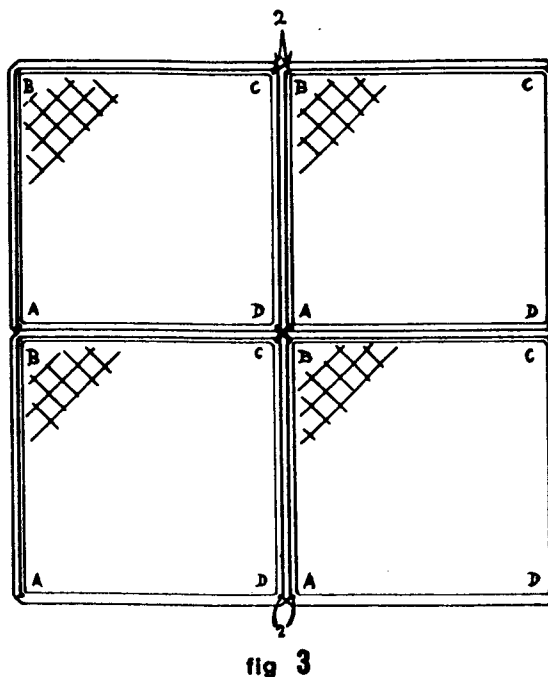
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BE DE ES FR GB IT(71) Applicant: **SPIG INTERNATIONAL, Societa per
Impianti Generali S.p.A.**
Via Lunigiana, 23
I-20125 Milano(IT)(72) Inventor: **Mosiewicz, Jerzy**
Viale Restelli, 49
I-20124 Milan(IT)(74) Representative: **Gervasi, Gemma**
NOTARBARTOLO & GERVASI Srl Viale
Bianca Maria 33
I-20122 Milan(IT)(54) **Packing grid for water cooling towers.**

(57) Packing grid members for water cooling tower having a honeycomb lattice structure and a rectangular, in particular square, outline as well as ridges on two adjacent sides AB and BC slightly below the level of the other two sides CD and DA. Therefore, the ridge of one grid member can be placed on the ridge of the adjacent grid member, which assures a perfect grid deck planarity in the tower. Supports are placed at the convergence of four vertices of adjacent grid members.

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This invention concerns an apparatus for contacting a gas with a liquid, consisting of a vertical chamber in which the liquid flows downward by gravity and, on hitting the packing material, is broken up into fine droplets. In flowing through the chamber upward, namely countercurrently, the gas contacts the descending liquid broken up into fine droplets. This invention also concerns an apparatus for contacting a gas with a liquid, in which the liquid fine droplets descend vertically by gravity and the gas passes horizontally through the chamber (cross-flow).

In particular, this invention concerns packing grids for water cooling towers in which the cooling gas is air in open circuit, the air flow through the tower being created either by a natural draft or by a forced draft supplied by a suction or a blower fan. Various types of packing grids constructed of materials with an adequate resistance at the working conditions are already known: in particular, thermoplastic synthetic polymers, such as polypropylene, polyethylene, polystyrene, polyester and polyvinyl resins are fit for the purpose.

As far as this field of application is concerned, the aforesaid materials show excellent characteristics, being inalterable and combining lightness with a fairly good mechanical resistance. Furthermore, the grid manufacturing process based on said materials, especially by injection moulding, is simple and economical.

Grid decks of known type have a structure consisting of variously sized rectangular or square members; in case, they are provided with reinforcement ribs, should the ridges of the single members be very thin and have a conformation inadequate for making the grid as mechanically resistant and dimensionally stiff as required.

The horizontal area of the ridges of the single grid deck members as well as of the reinforcement ribs is to be maintained within optimal limits in respect of the air flow area.

On the one hand, the pressure drop of the upward air flow is to be maintained within very low values while, on the other hand, the overall packed area must secure an adequate impact for the water falling from the top by gravity. This is one reason why the grid decks, which are arranged one over the other, are staggered one with respect to the other, and vertically spaced as required. European Patent Application No. 0 311 794 by the Applicant describes a packing grid member for water cooling towers having a rectangular, in particular equilateral, outline and a honeycomb lattice structure, i.e. consisting of hexagonal cells: the said grid assures optimal working conditions of the cooling tower as far as thermal exchange efficiency and air flow pressure drop are concerned.

A schematic drawing of the grid member is

shown in Fig. 7: the external peripheral outline is square with sides of standard size, which allows the member installation, with a horizontal arrangement, also in existing cooling towers. Every grid deck in the tower consists of a large number of members that are to be put together ridge on ridge.

This invention concerns some improvements on the packing grids described in said European Patent Application No. 0 311 794. The essential improvement concerns the grid members joining, for which purpose each grid member is provided with two adjacent ridges slightly below the level of the other two ridges. As shown in Fig. 2, sides AB and BC are below the level of sides CD and DA. Fig. 1 shows the upper outline of the grid deck (P), the cross section of the ridge at a higher level (E), and the cross section of the ridge at a lower level (F).

Grid members installation in the tower is carried out by placing the higher ridge of one grid member on the lower ridge of the adjacent grid member. The grid member joining, in the minimum combination of four grid members, is shown in Fig. 3: in practice, grid members are put together ridge on ridge with a constant orientation (defined by the reciprocal positions of higher and lower ridges).

In this way, for grid member installation in the tower, two adjacent grid member ridges are superimposed and the planarity of all grid members forming the tower grid deck is maintained.

As shown in Figs. 2 and 3, the four square corners of each grid member have been cut (chamfered) to allow a perfect and easy joining of four adjacent grid members and to leave a small free space for the insertion of the supporting element and the passage of the four-grid member assembly carrying cable.

The grid deck support is provided by the supporting elements described above passing at the vertices of each group of four adjacent grid members. Of said supporting elements, Fig. 4 shows the side view, Fig. 5 the part vertical view, and Fig. 6 the top view. The supporting elements are upheld by carrying cables passing through the support central opening, and are inserted with spring collets (1) in the openings (2) made in proximity of the grid member vertices.

The figures attached hereto concern the implementation of this invention with square grid members; obviously, also the implementation with rectangular grid members falls within the scope of this invention, all the other characteristics of this invention remaining unchanged.

The usual square grid member dimensions are as follows: side length in the order of 600 mm, superimposable ridge width of about 15 to 20 mm.

The grid deck constructed with grid members as per this invention meets the fundamental requirement of a grid packed structure: the horizontal packed area, i.e. the impact surface hit by the water droplets falling from the top by gravity, is 20% to 30% of the total area and, preferably, in the order of 25%.

Furthermore, this invention offers the following advantages: one is that, on assembling, no clearance is created between the ridge of one grid member and the ridge of the adjacent grid member, i.e. the free passage area is neither too large nor arranged in a way other than the optimal one.

On the other hand, the opposite situation is also avoided, i.e. that the flanked ridges of two adjacent grid members might create a too large packed area, which would result in a non-optimal operation as concerns the air flow pressure drop and the dispersion of the falling water fine droplets.

Ridge superimposition increases the mechanical resistance of the whole structure: therefore, the grid member ridges can also be very thin.

Ridge superimposition allows a close joining of four grid members at their vertices as well as the implementation of a supporting element having a small size and, at the same time, a high mechanical resistance.

In practice, grid members with superimposable ridges as per this invention assure maximum heat exchange, as a result of a high dispersion of the liquid in the form of very fine droplets and, at the same time, a very low pressure drop of the air flow.

The dimensions of a grid member as per this invention are reported by way of example: honeycomb lattice structure (Figs. 7 and 8) with hexagon side of 35 mm; distance between reinforcement ribs: $l = 155$ mm and $l' = 145$ mm; thickness (width) of the borders forming the hexagon sides $s = 4$ mm (Fig. 8); thickness (width) of the reinforcement ribs $s = 4$ mm (Fig. 8); grid member side exclusive of the ridge = 612 mm; width of the superimposable ridge = 15 mm.

Claims

1. Horizontally arranged packing grid members for water cooling tower in which water flows countercurrent to the upward air flow, or for cross-flow type towers in which flows travel in an orthogonal direction, characterized by a rectangular, in particular equilateral, outline, by a honeycomb lattice structure, and by ridges on two adjacent sides AB and BC of each grid member slightly below the level of those on the two other sides CD and DA; this last characteristic allows the superimposition of the ridges of adjacent grid members during grid member assembling to form a grid deck in the

tower.

2. Grid members as per claim 1 provided with an opening (2) in proximity of each grid vertex for the insertion of a supporting element bearing four contiguous grid members.
3. Grid members as per claim 1 with chamfered square corners allowing ridge superimposition and free passage of the carrying cable.

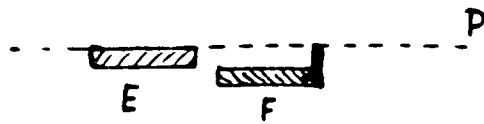


fig 1

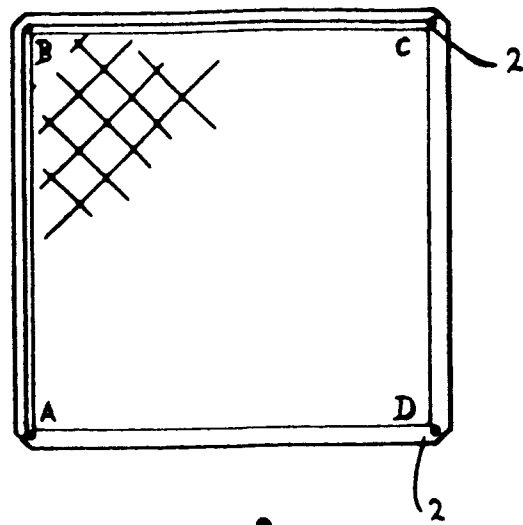


fig 2

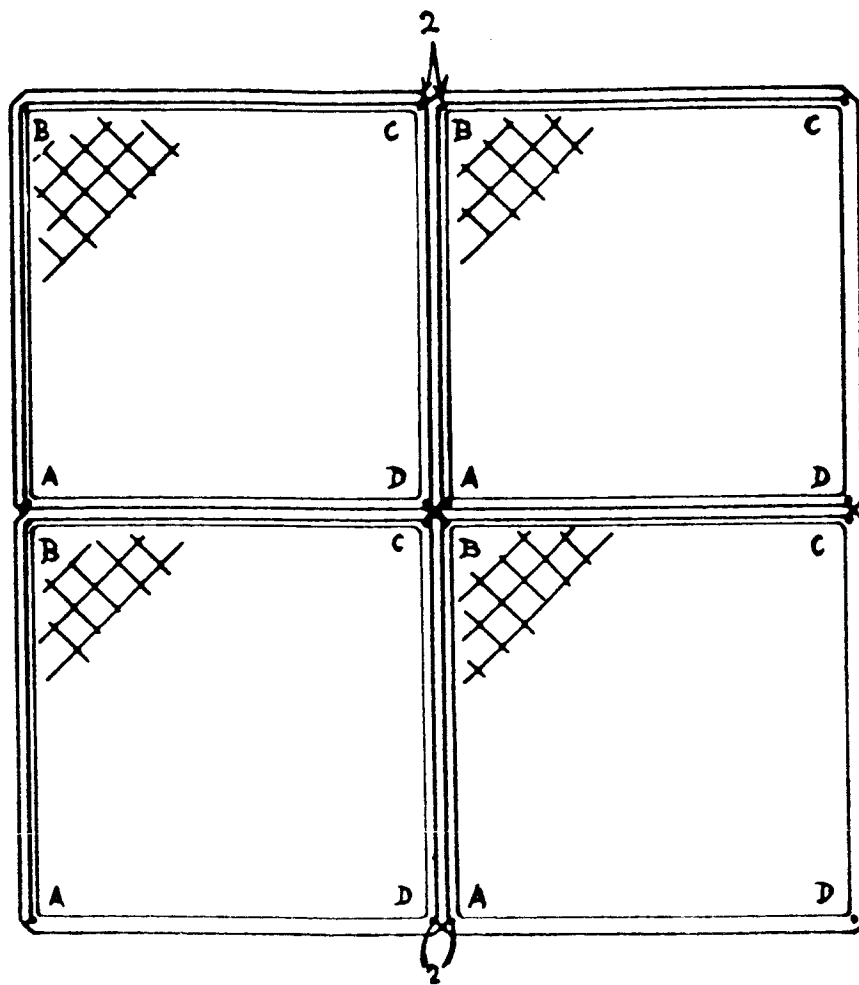


fig 3

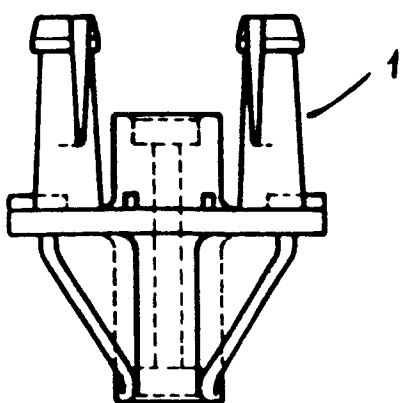


fig 4

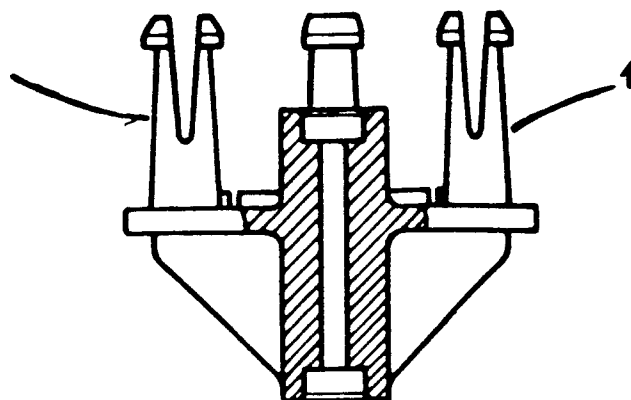


fig 5

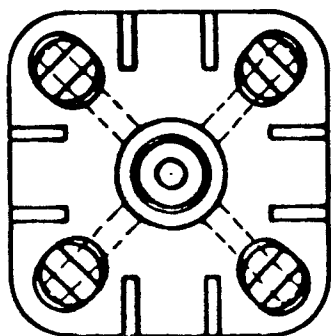


fig 6

FIG 7

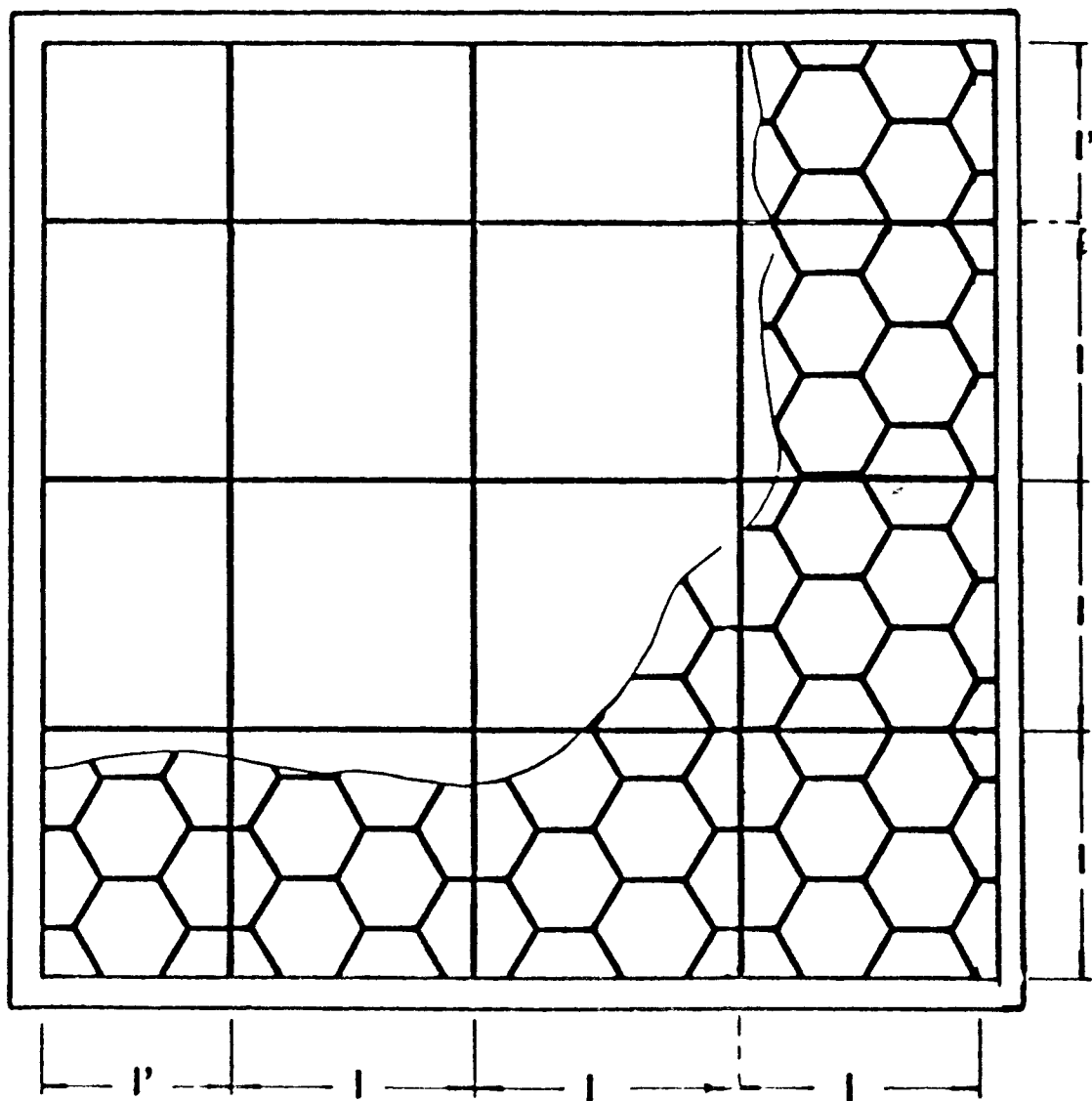
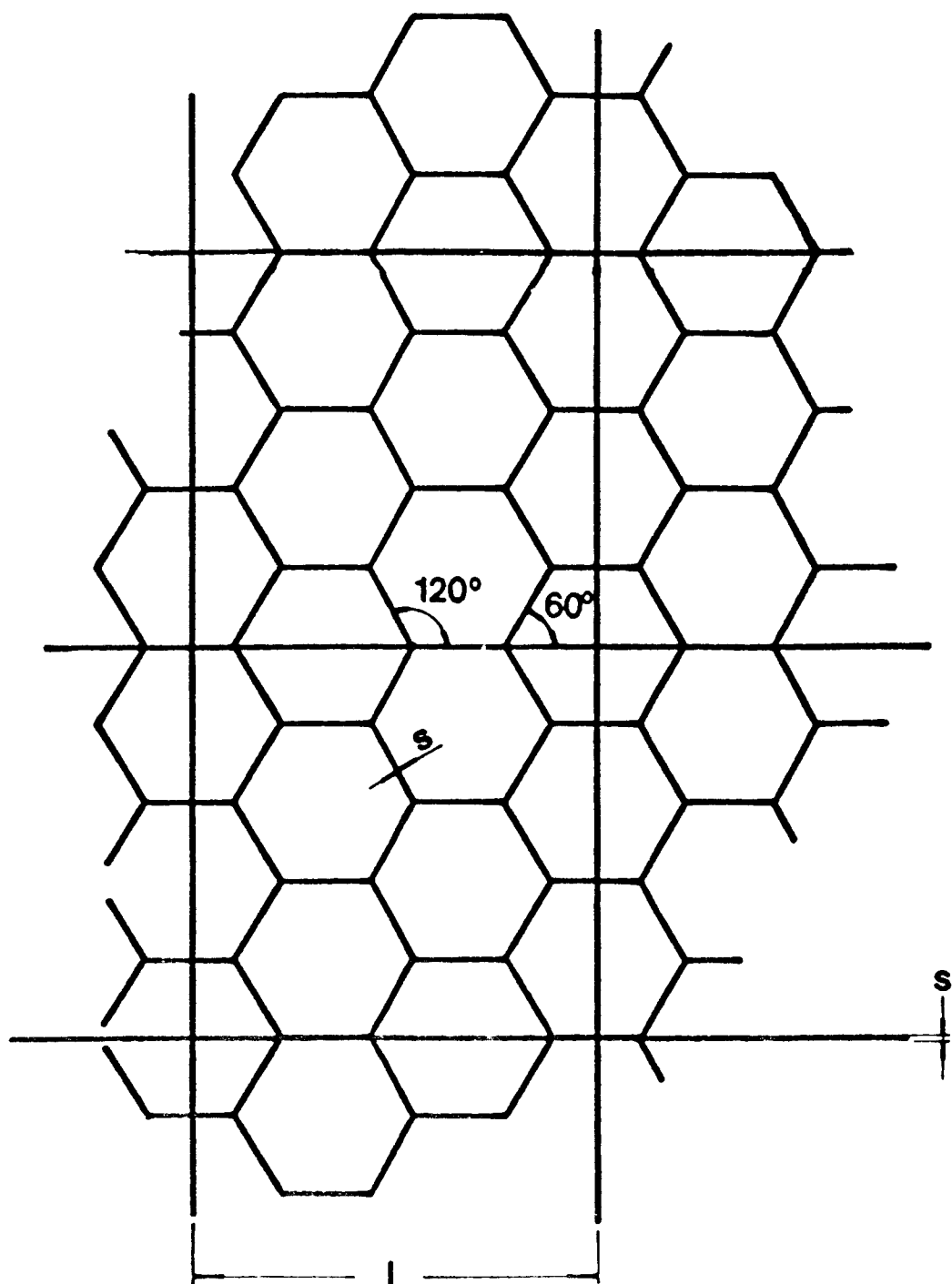


FIG 8





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EUROPEAN SEARCH REPORT

Application Number

EP 92 10 4038

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
D, A	EP-A-0 311 794 (SPIG) * the whole document *	1	F28F25/08
A	EP-A-0 371 475 (DF "VODOKANALINGENERING") * the whole document *	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			F28F B01J B01D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 09 JULY 1992	Examiner SMETS E, D, C.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			