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J. B. BAIRD ET AL
COOLING TOWER

2,631,022

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2 SHEETS—SHEET 1

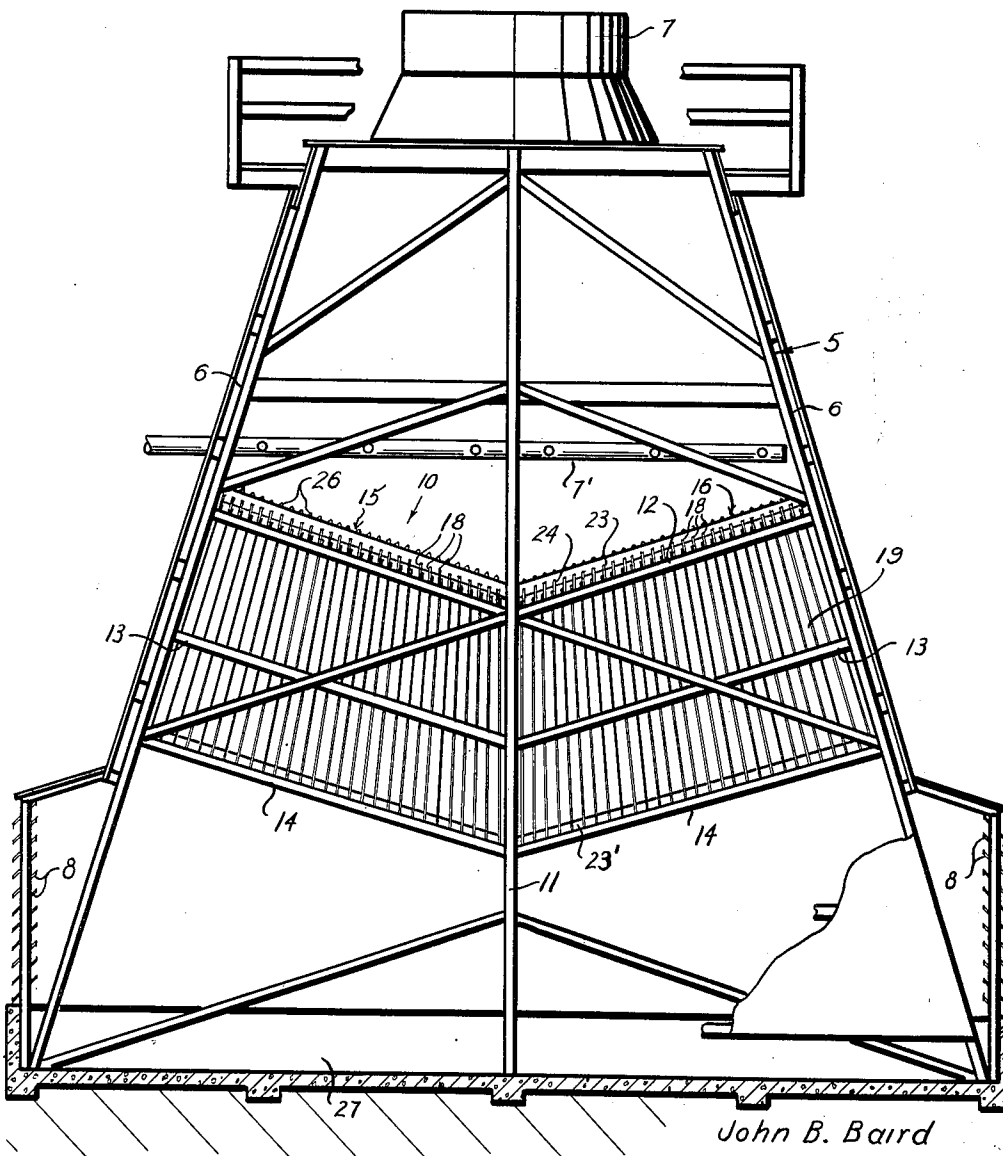


Fig. 1

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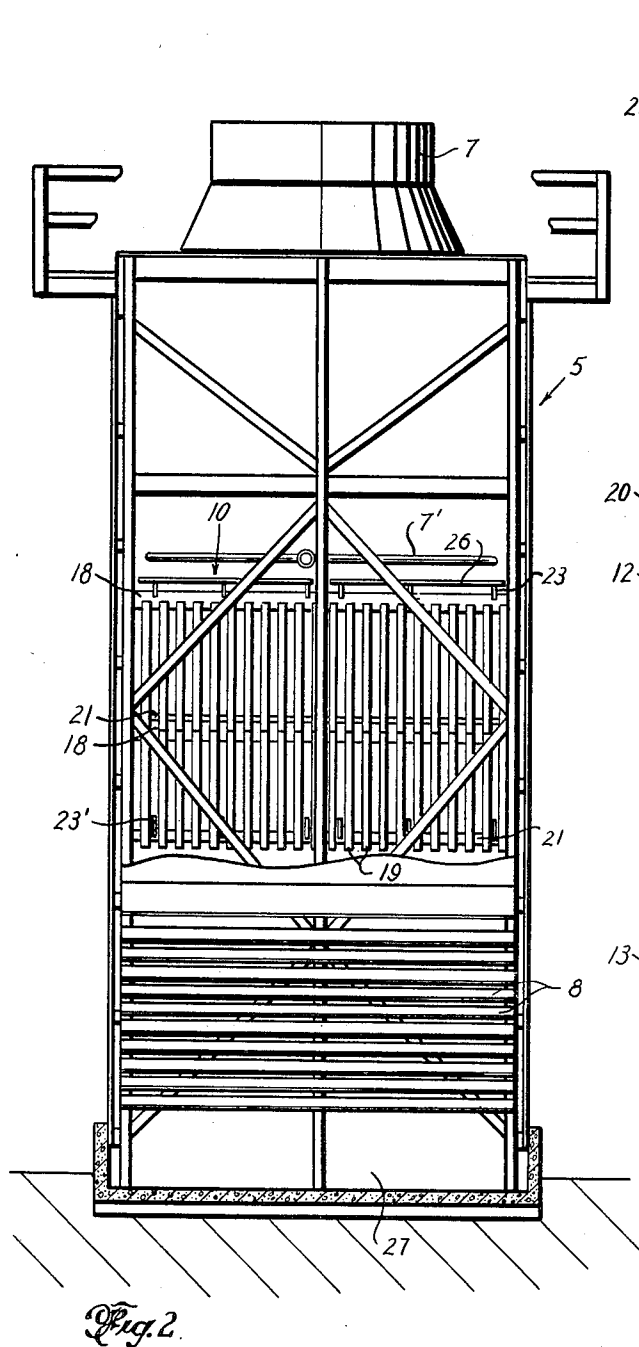
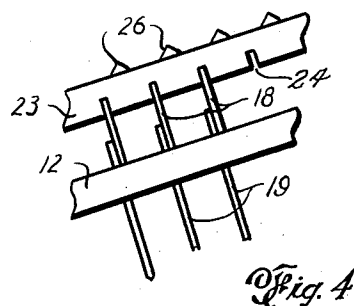
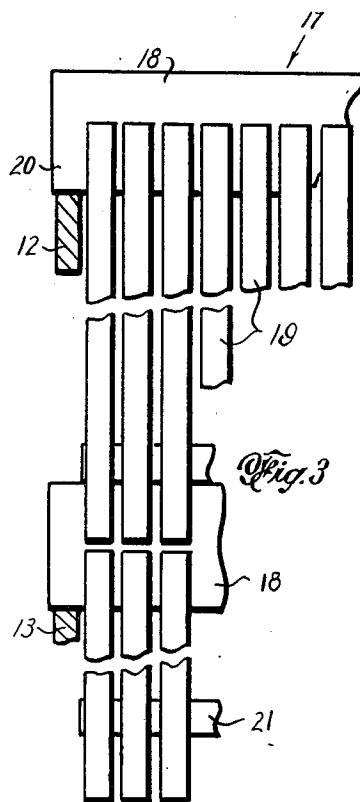
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2 SHEETS—SHEET 2



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COOLING TOWER

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This invention relates to improvements in cooling towers, and more particularly to improved slat-type, water-filming structure or packing therefor; the primary object of the invention being to provide the greatest possible water surface subject to efficient counter-current air flow.

Another object is the provision of a cooling tower in which air flowing through the tower will be able to take its most natural paths of flow and will meet the least possible resistance, but in which the liquid will be interrupted in its fall to provide the maximum area of liquid surface for contact with the air.

Another object is the provision of a tower of a shape susceptible of more economical and stronger construction, offering less wind resistance and much more stable under wind pressure, providing a minimum of "dead" space in the tower, and providing for a natural path of flow of air therethrough.

Another object of the invention is the provision of a lath- or slat-type filming structure or packing of the above-indicated character involving the use of banks of vertically arranged filming lath, wherein the lower ends of the banks are spread out and breaker baffles are used above and between the upper ends of adjacent laths, whereby the water falling upon the baffles is splashed uphill over the upper ends of the laths and prevented from falling directly between the laths without contacting them, thereby providing a break of the water in addition to that occurring at the spray heads above the deck, in a manner to assure filming of all water at the upper ends of the slats.

Another object of the invention is to provide a water-filming structure of the character indicated above wherein the increased efficiency of the supporting members permits the use of short and cheaper slats or laths in an economical construction.

Another object of the invention is the provision of filming structure or packing construction of the above-indicated character wherein the bank of slats are made up of units each consisting of a hanger beam or bar to which the upper ends of the slats are secured to depend therefrom in edge-spaced relation, the units being arranged in side-by-side relation and removably rested on inclined cross-members extending between and at the sides of the cooling tower framework.

Another object of the invention is to provide a filming structure or packing construction as above-described, for a cooling tower of the type having an upwardly tapering framework, wherein

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the banks of filming slats and the slats thereof are angulated with respect to the perpendicular, to conform to the taper of the tower framework and the cross-section thereof.

Other objects and advantageous features of the invention will be apparent from the following description and accompanying drawings wherein, merely for present purposes of illustration, a specific embodiment of the invention is set forth in detail.

In the drawings:

Fig. 1 is a vertical longitudinal section taken through a cooling tower having a shape and filming structure or packing in accordance with the present invention;

Fig. 2 is a vertical transverse section;

Fig. 3 is an enlarged fragmentary longitudinal section showing the structure of an end of the upper part of one of the filming units and its association with a supporting member of the tower framework; and

Fig. 4 is a fragmentary view upon an enlarged scale illustrating the mounting of the packing decks and the spacers therefor.

Referring in detail to the drawings, wherein like numerals designate like parts throughout the several views, the numeral 5 generally designates the framework of a cooling tower having upwardly converging sides 6, 6, an updraft fan ring 7 on its upper end with the usual fan or blower therein, water spray pipes 7' spaced below the upper end of the framework, air inlet louvers 8 in the lower part of the framework, with the improved filming structure or packing 10 supported immediately beneath the spray pipes 7' and above the louvers 8. In the vertical space between the spray pipes 7' and the louvers 8 the framework has parallel upper, intermediate and lower cross-members 12, 13 and 14, respectively, along the front and back sides of the framework. These cross-members decline toward the middle upright 11, and support and position the packing 10.

The packing 10, which in this case is a filming structure, comprises oppositely angulated banks 15 and 16 which are of substantially similar construction and arrangement relative to the framework 5. Each bank comprises a plurality of units 17, each comprising an upper hanger beam 18, to one side of which wooden or other suitable lightweight material laths or slats 19 are secured, as by nailing. As shown in Fig. 3, the upper ends of the laths 19 are spaced below the upper edge of the beam 18, and the adjacent edges of the laths are relatively closely spaced and are parallel, the end laths being substantially spaced from

the adjacent ends of the beam 18 to provide an overhang 20 to rest upon the angulated framework cross-members 12, 12, and 13, 13, respectively, with the beams extending from front to rear in Fig. 1, and from side to side in Fig. 2.

The laths or slats 19 are all of the same length and may be short lengths in which case two of the units 17 are used together as illustrated.

As shown in Fig. 2, the lower ends of the laths in each unit are spaced and connected by a lower beam 21, narrower than the upper beam 18 and spaced upwardly from the lower ends of the slats 19. Thus two units 17 may be readily fitted together by placing the ends of slats 19 projecting below beam 21 of the upper unit 17 in overlying relation to the upper portion of beam 18 of the lower unit 17. This beam 18 also extends outwardly from the main body of the composite unit to rest upon support 13. The units 17 merely rest in place upon the frame members 12 and may be removed and replaced at will.

Affording proper transverse spacing of adjacent units 17 are spacer bars 23 and 23', notched as indicated at 24, to receive the edges of the upper and lower beams 18 and 21. The notches of the lower spacer bar 23' are spaced apart a somewhat greater distance than the notches of the upper spacer bar, in order to gradually increase the spaces between the adjacent transverse rows of slats 19 from top to bottom.

It will be appreciated that while slats arranged as described are preferred, filming surfaces of fabric or cords or breakers of slats differently arranged may be employed, but in accordance with this invention should be arranged to provide waterfall interrupters with their major surfaces disposed substantially parallel to the natural flow paths for air through the tower.

Supported transversely upon the upper spacer bars 23 and over the space between each pair of adjacent transverse rows of slats or waterfall-interrupting members—that is, between each pair of adjacent units 17—are triangular breaker baffles 26. These breaker baffles constitute a water break in addition to the spray pipes 7 and are so located above the upper ends of the rows of slats as to splash water falling upon the baffles uphill and over the upper ends of the rows of slats, thereby preventing any water from falling downwardly into the spaces between the rows of slats without effective filming contact therewith, substantially at the top ends of the slats, thus ensuring filming of all of the water at the upper ends of the slats and more even and uniform flow of the water over the filming surfaces.

The water after cooling collects in sump 27 and may be withdrawn therefrom.

Because of the nature of this construction and the arrangement of the slats, it has been found practical to build and use together two units employing four-foot long slats instead of one unit using six-foot long slats formerly used, without substantially increasing the board feet of framing required for the units. Since the four-foot long slats are far cheaper than the six-foot slats, the cost of the presently disclosed structure is much less than that heretofore employed.

It will be observed that in the above-described arrangement not only is the falling water confined to definite and uniform paths of downward movement between the rows of slats and filmed to provide large surface areas for contact with air, but the air moved upwardly through the filming structure 10 by the fan 7 is also confined to these paths, and that as a result there

is obtained a true countercurrent contact of the water and the air. Since the air flows along natural flow paths and without substantial obstruction, adequate volume and movement of air can be produced with less power, and hence at lower cost.

Important advantages are also to be gained by the shape of the tower. Thus, this shape being structurally more rigid and stronger than a rectangular tower, it has been found that for a given size tower 4" x 4" corner frame members are adequate, whereas in conventional towers of rectangular shape but of corresponding size, these members must be at least 4" x 6". Furthermore, the shape offers less resistance to winds. Such wind pressure as is exerted on the tower has a definite and substantial downward component, thereby tending less to overturn the tower and more to hold it against the ground. In this shape of tower the "dead" and practically useless spaces at the upper corners of a rectangular tower are eliminated. The shape of the tower with the air inlet openings at the lower ends of the sloping walls also provides for a natural inclined flow path for air from each such inlet to the fan, a path which crosses the vertical natural falling path for water. With the water-deflecting slats arranged with their flat sides in planes parallel to this air path, they permit substantially unobstructed flow of air yet prevent free falling of water and force it to film over the slats to provide large surface areas in direct contact with the freely flowing air.

From the foregoing it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth together with other advantages which are obvious and which are inherent to the structure.

It will be understood that certain features and sub-combinations are of utility and may be employed without reference to other features and sub-combinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

The invention having been described, what is claimed is:

1. In a cooling tower having a vertical framework, an updraft fan on its upper end, and water spray pipe means below said fan, a water-filming structure within said framework below said spray pipe means, said filming structure comprising a bank of transverse rows of slats with their longitudinal dimension vertically arranged, the slats in each row being in parallel edge-spaced relation with their faces residing in two parallel planes and adjacent rows of slats being laterally spaced from each other, the spacing of adjacent rows of slats increasing gradually from the upper ends toward the lower ends of the slats.

2. In a cooling tower having a vertical framework, an updraft fan on its upper end, and water spray pipe means below said fan, a water-filming structure within said framework below said spray pipe means, said filming structure comprising a bank of transverse rows of slats with their longitudinal dimension vertically arranged, the slats in each row being in parallel edge-spaced relation with their faces residing in two parallel planes and adjacent rows of slats being laterally spaced from each other to provide uninterrupted straight

air flow passages therebetween, the spacing of adjacent rows of slats increasing gradually from the upper ends toward the lower ends of the slats, and breaker baffles positioned alternately with said rows of slats and above the upper edges thereof, each baffle having an upwardly facing surface disposed at an angle to the vertical for splashing water falling thereon from said spray pipe means onto the upper end of one of said rows of slats to prevent water falling directly through the spaces between the rows of slats without contact with the slats.

3. In a cooling tower having a vertical framework, an updraft fan on its upper end, and water spray pipe means below said fan, a water-filming structure within said framework below said spray pipe means, said filming structure comprising a bank of transverse rows of slats with vertically arranged longitudinal dimensions, the slats in each row being in parallel edge-spaced relation with the faces residing in two parallel planes adjacent rows of slats being laterally spaced from each other, the spacing of adjacent rows of slats increasing gradually from the upper ends toward the lower ends of the slats, and triangular breaker baffles having one angle facing upwardly positioned alternately with said rows of slats and above the upper edges thereof for splashing water falling thereon from said spray pipe means onto the upper ends of said rows of slats and prevent water falling directly through the spaces between the rows of slats without contact with the slats.

4. In a cooling tower, a vertical framework having two downwardly divergent sides, an updraft fan on the upper end of said framework, spray pipe means within said framework below said fan, and a water-filming structure within said framework below said spray pipe means, said filming structure comprising two banks of filming units, each unit comprising an upper beam having a multiplicity of slats secured at their upper ends to a side thereof and depending in parallel spaced edge-to-edge relation from said upper beam, a lower beam securing lower portions of said slats in place relative to each other, means spacing adjacent units apart in the banks, parallel cross members on said framework extending on two sides thereof between said converging sides comprising oppositely, laterally, inwardly, declining portions upon each of which a corresponding one of said banks is supported, said upper unit beams having projecting end portions removably resting upon said declining portions of said framework cross-members whereby said banks are supported with the slats of their units at substantially the same angle with the perpendicular as the converging sides of said framework.

5. A filming structure or packing for a cooling tower having a framework having two opposite upwardly converging sides, said filming structure comprising a multiplicity of transverse rows of slats, the slats in each row being in parallel edge-spaced relation with their faces residing in two parallel planes and with vertically arranged longitudinal dimensions, said rows supported in laterally spaced relation between the upwardly converging sides, said rows of slats being spread at their lower ends whereby successively, laterally outward rows of slats diverge progressively from the perpendicular toward the opposite, upwardly converging sides of said framework so that outer ones of said rows substantially conform to the angularity of said upwardly converging sides of said framework to provide uninterrupted

straight air flow passages between adjacent rows.

6. A filming structure or packing for a cooling tower having a framework with two opposite, upwardly converging sides, said filming structure comprising a multiplicity of transverse rows of slats, the slats in each row being in parallel edge-spaced relation with their faces residing in two parallel planes and having their longitudinal dimensions arranged vertically, said rows supported in laterally spaced relation between said upwardly converging sides, said rows of slats being spread at their lower ends whereby successively, laterally outward rows of slats diverge progressively from the perpendicular toward the opposite, upwardly converging sides of said framework so that outer ones of said rows substantially conform to the angularity of said upwardly converging sides of said framework to provide uninterrupted straight air flow passages between adjacent rows, and breaker baffles positioned alternately with said rows of slats and at the upper ends thereof.

7. A cooling tower comprising a vertical framework having two downwardly divergent sides, means for providing an updraft of air through the framework, means for distributing a liquid to the upper interior of the framework, parallel cross members on said framework extending on two sides thereof between said converging sides, said cross members having oppositely, laterally, inwardly declining portions, a liquid filming packing including rows of slats arranged with their longitudinal dimensions extending substantially vertically, each of said rows including a plurality of slats arranged in parallel edge-spaced relation and each row of slats having parts extending laterally and removably resting upon the parallel cross members and spacer members maintaining substantially equal spacing between adjacent rows of slats.

8. A cooling tower comprising a vertical framework having two downwardly divergent sides, means for providing an updraft of air through the framework, means for distributing a liquid to the upper interior of the framework, parallel cross members on said framework extending on two sides thereof between said converging sides, said cross members having oppositely, laterally, inwardly declining portions, a liquid filming packing including rows of slats arranged with their longitudinal dimensions extending substantially vertically, each of said rows including a plurality of slats arranged in parallel edge-spaced relation and each row of slats having parts extending laterally and removably resting upon the parallel cross members and spacer members maintaining substantially equal spacing between adjacent rows of slats, said spacer members holding the lower ends of adjacent rows further apart than the upper ends whereby successively outward rows of slats diverge progressively from the perpendicular so that outer ones of said rows conform to the angularity of the diverging sides of said framework.

9. A cooling tower comprising a vertical framework substantially rectangular in shape at any horizontal cross-section, means for providing an updraft of air through the framework, means for distributing a liquid to the upper interior of the framework, parallel cross members upon two opposing sides of the framework, the portion of each cross member adjacent the intersected side of the framework extending substantially perpendicularly thereto, and liquid filming packing within the framework below the liquid distribut-

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ing means including rows of slats with their longitudinal dimensions extending downwardly, each of said rows including a plurality of slats arranged in parallel edge-spaced relation and said rows extending transversely of the cross members and having laterally extending parts removably engaging and supported by said cross members.

10. The tower of claim 9 wherein a plurality of spacer members, extending transversely of the rows of packing slats, maintain substantially equal spacing between adjacent rows of slats.

11. The tower of claim 9 wherein the two sides of the framework intersected by the cross members diverge downwardly and a plurality of spacer members, extending transversely of the rows of slats, maintain substantially equal spacing between adjacent rows of slats with the rows diverging downwardly to cover the space between the diverging sides.

12. In a cooling tower, a vertical framework having two downwardly divergent sides, an up-draft fan on the upper end of said framework, spray pipe means within said framework below said fan, and a water-filming structure within said framework below said spray pipe means, said filming structure comprising two banks of filming units, each unit comprising a multiplicity of slats secured in parallel spaced edge-to-edge relation with their faces in two parallel planes, means spacing adjacent units apart in the banks, parallel cross members on said framework extending on two sides thereof between said converging

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sides comprising oppositely, laterally, inwardly, declining portions upon each of which a corresponding one of said banks is supported, lateral extensions upon each unit removably resting upon said cross-members whereby said banks are supported with the slats of their units at substantially the same angle with the vertical as the converging sides of said framework.

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