Oct. 20, 1953 R. O. AYRES 2,656,168

COOLING TOWER UNIT

Filed Oct. 8, 1951

Fig. 1.

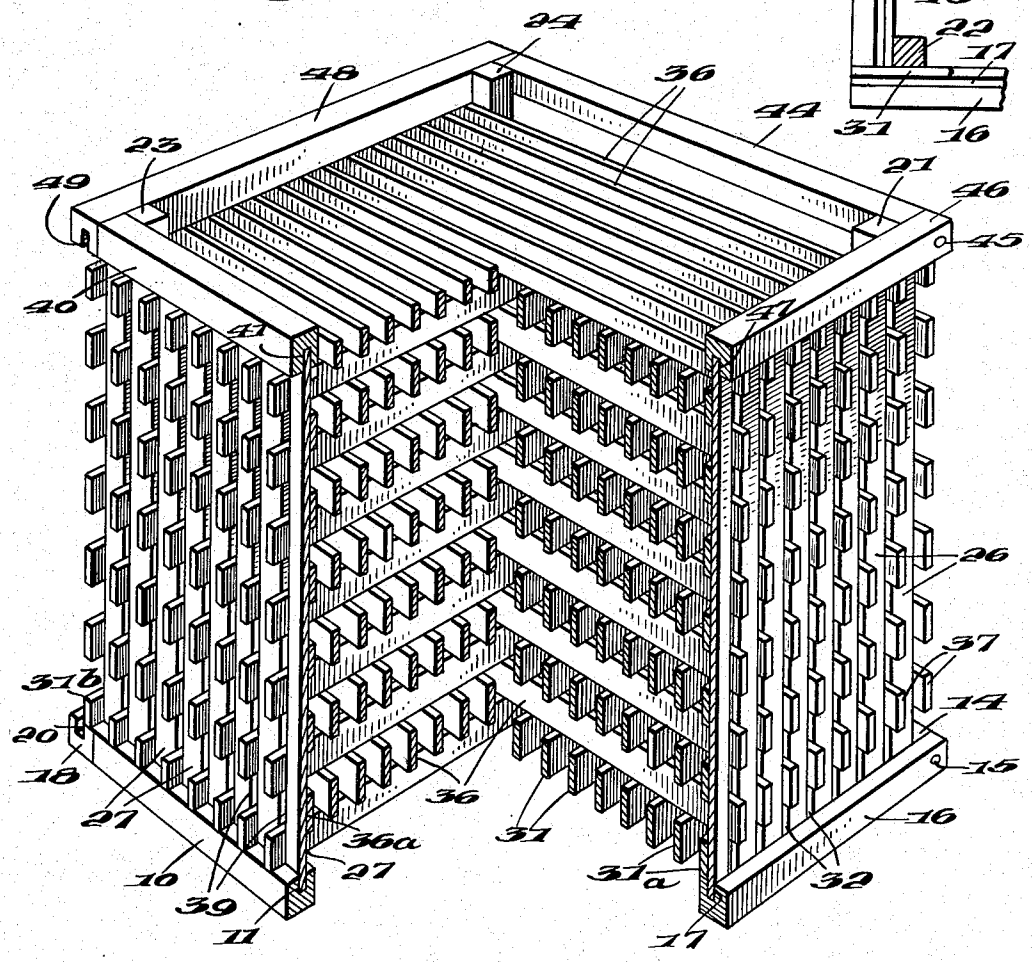


Fig. 4.

Fig. 2.

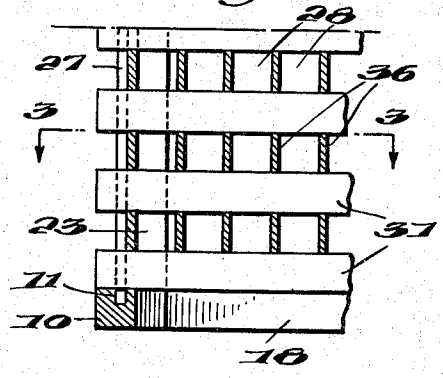
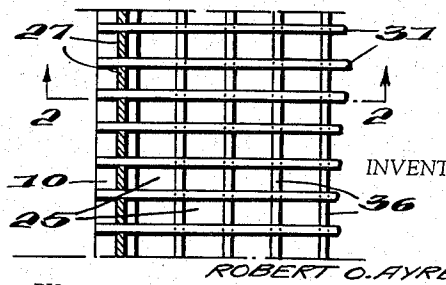


Fig. 3.



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COOLING TOWER UNIT

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4 Claims. (Cl. 261—108)

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The present invention relates to heat transfer apparatus and pertains to what is known as cooling towers wherein liquid to be cooled flows downwardly within the tower over a grid or lattice structure whereby the liquid is dispersed and upward movement of air removes heat from the downward moving liquid. The invention more specifically pertains to the structural features of a unit for such cooling towers.

An object of the invention is to simplify the structure of cooling towers so that the height and dimensions thereof may be readily altered without alterations in the overall design and to provide a unitary device which may be handled as a unit or as units and thus moved to the place where the apparatus is to be erected as a cooling tower.

A more detailed object of the invention resides in the provision of a plurality of juxtaposed filler blades which may be arranged at right angles to each other to form a central lattice structure over which the liquid to be cooled is delivered and by means of which the liquid is efficiently distributed to provide intimate contact with the air in the cooling tower and to provide means for maintaining the filler blades in spaced relationship within a framework without the necessity of nailing or otherwise securing the filler blades and the spacing elements to each other.

A still further object of the invention is to provide vertical spacing elements around the perimeter of a cooling tower unit which provide side walls for the cooling tower to prevent the escape of the downward moving liquid and at the same time to maintain the interlaced filler blades in erect and properly spaced relationship.

Other objects and features of the invention will be more apparent to those skilled in the art as the present disclosure proceeds and upon consideration of the accompanying drawing and the following detailed description wherein an exemplary embodiment of the invention is disclosed.

In the drawing:

Fig. 1 is a perspective view partly in section showing a cooling tower unit embodying the invention.

Fig. 2 is a fragmentary vertical section of a side portion of the unit at the bottom thereof and taken on the line 2—2 of Fig. 3.

Fig. 3 is a fragmentary sectional plan view taken on the line 3—3 of Fig. 2.

Fig. 4 is a fragmentary sectional plan view taken of one corner of the cooling tower with the vertical spacer elements omitted.

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A heat transfer device exhibiting the invention may be constructed of various types of material and when formed of wood the separate elements need not be finished and the frame and the filler blades along with the spacer elements may be used as they are obtained from a saw mill. The cell structure of the cooling tower does not require any fastening elements so that a material saving in labor is attained and the apparatus when assembled forms a unit which may be moved to the point of installation to further avoid labor in the erection of a cooling tower which may consist of one or more of the units hereinafter described.

Referring to the drawing there is shown at 10 a frame element which forms a part of the base of the structure. The member 10 may be regarded as a spacer carrier which may be of rectangular cross section as shown in Figs. 1 and 2. A groove 11 is provided in the upper face of the frame member 10 and this groove extends throughout the length of this frame element. A similar frame member 14 is arranged along the other side of the structure to form another of the base elements. The frame member 14 is provided with a groove (not shown) similar in dimensions and arrangement to that indicated at 11 in connection with the frame member 10. A frame member 16 is provided along the front of the apparatus and at the base of the structure as shown in Fig. 1. A groove 17 is provided in the upper face of the member 16. This groove 17 extends throughout the length of the frame member 16. The end portions of the frame member 16 may be secured to the abutting ends of the frame members 10 and 14 in any suitable manner such as by means of spikes or cap screws 15. A frame member 18 is arranged along the base of the apparatus at the rear thereof and this frame element is similar in shape and dimensions to the frame member 16. A groove 20 is arranged in the upper surface of the frame member 18 and this groove extends throughout the length thereof. The frame member 18 is secured to the abutting ends of the frame members 10 and 14 to complete a rectangular shaped base frame for the unit.

A post is provided at each corner of the apparatus. One of such posts is shown at 21. This post is substantially square in cross section and is secured to the inner faces of the frame members 14 and 16 at the juncture of these elements and the post 21 extends vertically upward from the base frame. The structural characteristics of this portion of the apparatus will be more

clearly understood from a consideration of Fig. 4 wherein another and similar corner post **22** is secured to the inner faces of the frame members **10** and **16**. The post **22** extends vertically upwardly from the base frame. A similar post **23** is secured in the rear corner of the apparatus and to the frame members **10** and **18** as illustrated in Figs. 1 and 2. A further corner post **24** is secured at its lower end to the frame members **14** and **18**. All of the corner posts have a cross section which is smaller than the spaces between the filler blades hereinafter described and the corner posts have equal lengths corresponding to the intended height of the cooling tower unit.

A plurality of vertical spacer elements **26** have their lower ends seated in the groove **17** of the frame member **16**. These spacer elements **26** may be formed of boards having a thickness slightly less than the width of the groove **17**. The vertical spacer elements **26** may vary in width and have dimensions varying from one inch to two or more inches so that the distance between the side edges may be varied. A plurality of similar shaped vertical spacer elements **27** are arranged with their lower ends within the groove **11** of the frame member **10**. The spacer elements **27** extend vertically upward and are provided for the purpose of maintaining the filler blades which extend in the opposite direction in properly spaced relationship. A group of similar shaped and dimensioned vertical spacer elements **28** have their lower ends seated within the groove **20** in the frame member **18** arranged along the rear of the apparatus as shown in Figs. 1 and 2. Additional vertically disposed spacer elements of similar shape and construction are arranged in the groove provided in the top of the frame member **14** and extend upwardly therefrom. All of the vertically disposed spacer elements may be formed of unfinished lumber and are of such length as to extend for the full intended height of the cooling tower unit.

A plurality of horizontally disposed filler blades **31** are arranged to extend transversely of the apparatus as shown in Fig. 1. The filler blades **31** constitute the first or lower tier and the ends thereof extend into the spaces between the vertical spacer elements **27** and similar spacer elements extending upwardly from the frame member **14**. The filler blade **31***a* at the front of the apparatus lies in face-to-face engagement with the inner surfaces of the spacer elements **26** and also rest on the upper surface of the frame member **16** inside the groove **17**. The opposite ends of the front filler blade **31***a* extend outside the corner posts **21** and **22** as will be apparent from a consideration of Fig. 4. Thus the spaces **32** between the spacer elements **26** are virtually closed by the filler blade **31***a* lying along the inner faces of the spacer elements **26**. The rearmost filler blade **31***b* also lies outside the corner posts **23** and **24** and close the spaces between the vertical spacer elements **28**.

The next course of filler blades is represented at **36** and these members extend at right angles to the first course of filler blade **31**. The front ends **37** of the filler blades **36** extend into the spaces **32** between the vertical spacer elements **26**. The rear ends of the filler blades **36** extend into the spaces between the vertical spacer elements **28**. The outer face of the filler blade **36***a* which extends along one side of the apparatus lies in engagement with the inner faces of the spacer elements **27** and substantially closes the spaces **39** between the vertical spacer elements **27**. A similar arrangement is provided along the opposite side of the cooling tower unit to substantially close the spaces between the vertical spacer elements which extend upwardly from the base frame member **14**. Such a right angle disposition of the filler blades provides a cell structure which is continued upwardly to provide a cooling tower unit of the desired height. It will be appreciated that the vertical spacer elements maintain the filler blades, in vertical positions and the alternate right angle disposition of the filler blades provide rectangular shaped openings **25** therebetween as the cell structure is viewed in plan in Fig. 3.

A frame member **40** is provided at the top of the cell structure along one side of the apparatus as shown in Fig. 1. This frame member is of similar construction to the frame member **10** and is provided with a groove **41** facing in a downwardly direction. The groove **41** is provided for receiving the upper ends of the vertical spacer elements **27**. A similar frame member **44** is provided along the other side of the apparatus having a groove (not shown) in the lower face thereof for receiving the upper ends of the vertical spacer elements at the associated side of the cell. A frame member **46** is provided across the front of the apparatus at the top. The frame member **46** is provided with a groove **47** for receiving the upper ends of the spacer elements **26**. The abutting ends of the frame elements **40** and **44** may be secured to the frame member **46** in any suitable manner such as by large nails or screws **45**. The post **21** is also secured in the corner between the adjacent ends of the frame members **44** and **46**. The corner post **22** is secured to the frame members **40** and **46** at the confluence of these elements. A frame member **48** is arranged along the back of the apparatus at the top thereof. This frame member is provided with a groove **49** for receiving the upper ends of the vertical spacer elements **28**. The frame member **48** may be secured to the abutting ends of the frame members **40** and **44** in any suitable manner. The corner posts **23** and **24** are secured respectively to these top frame members. The top course of the filler blades **36** extend under the frame members **46** and **48** as will be apparent from a consideration of Fig. 1. Thus these filler blades are prevented from moving upwardly and the entire cell structure is held in an assembled relationship forming a unitary structure which may readily be moved to the place where the cooling tower is to be erected.

It will be appreciated that one of the units may be employed as a heat transfer mechanism or a plurality of the unit, such as shown in Fig. 1, may be arranged in a stacked relationship to provide a cooling tower of a desired height. The liquid to be cooled is released at the upper end of the unit or the upper end of one of the cells when a stacked group of units are employed and the liquid moves downwardly over the filler blades. The liquid is distributed over the cell structure by reason of the right angle disposition of the filler blades and the liquid is distributed over the cell structure. The heat released causes an upward movement of the air which is in counter flow to that of the movement of the liquid. Such an induced draft provides for the removal of heat from the presence of the liquid. The cooling tower may also be provided with means for providing a forced draft and upward movement of air through the tower.

It will be observed that the cell structure is maintained in proper assembled relationship as a unit without the necessity of nailing or otherwise securing the filler blades to each other or to the spacer elements or the framework. The vertical spacer elements are maintained in position without the necessity of nailing or securing these members to each other or to the frame. A unit may accordingly be assembled and erected by unskilled labor. The perimeter of the unit is substantially closed by means of the vertical spacer elements and the arrangement of the filler blades along the inner faces of the vertical spacer elements.

While the invention has been shown and described in connection with a particular structural arrangement it will be appreciated that changes may be made in the details as well as the general organization. Such modifications and others may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

What I claim and desire to secure by Letters Patent is:

1. A cooling tower unit comprising, a base including four carrier members providing a rectangular shaped frame, each carrier member having a groove in the upper face thereof, a plurality of flat elongated vertically disposed spacer elements having their lower ends seated in said grooves and extending upwardly therefrom, filler blades rectangular shaped in cross section horizontally disposed and arranged in parallel relationship and lying across opposite carrier members of the base frame with the ends of the filler blades extending between some of the spacer elements, filler blades rectangular shaped in cross section horizontally disposed and arranged in parallel relationship at right angles to the first filler blades and supported thereon with the ends of the second group of filler blades extending between the spacer elements at the other sides of the base frame, an upper rectangular shaped frame having grooves in the lower faces thereof for receiving the upper ends of said spacer elements, opposite side portions of said upper frame overlying ends of the filler blades, and means connecting the upper frame to the base frame.

2. In a cooling tower, a base frame including carrier members arranged at right angles to each other, said carrier members each having a groove in the upper surface thereof, a plurality of vertically disposed spacer elements having their lower ends seated in said grooves, a plurality of horizontally disposed filler blades arranged in parallel relationship and extending across the base frame with opposite ends thereof positioned between the spacer elements at opposite sides of the base frame, horizontally disposed filler blades arranged in parallel relationship above the first filler blades and at right angles thereto and having their opposite ends extending between the spacer elements at opposite sides of the base frame, an upper frame including members arranged at right angles to each other and provided with grooves in the lower faces for receiving

the upper ends of said spacer elements, opposite members of the upper frame resting on end portions of a top group of filler blades, and means tying the upper frame to the base frame.

3. In a cooling tower unit, a base frame including carrier members arranged at right angles to each other, said carrier members having a groove in the upper surface thereof, a series of vertically disposed spacer elements having their lower ends seated in said grooves, horizontally disposed filler blades arranged in parallel relationship and extending at opposite ends between the spacer elements at opposite sides of the base frame, horizontally disposed filler blades arranged in parallel relationship on the first filler blades and at right angles thereto and having their opposite ends extending between the spacer elements at opposite sides of the base frame, an upper frame including members arranged at right angles to each other and provided with grooves in the lower faces for receiving the upper ends of the spacer elements, opposite members of said upper frame overlying end portions of the filler blades, posts connecting the upper and lower frames at the corners thereof and arranged inside the members of said frames.

4. A cooling tower unit comprising, a base including four members providing a rectangular shaped frame, each member having a groove in the upper face thereof, a plurality of spacer elements having parallel side edges with their lower ends seated in said grooves and extending upwardly therefrom, filler blades horizontally disposed and arranged in parallel relationship and lying across two of said members at opposite sides of the base with ends of the filler blades extending between associated spacer elements, filler blades horizontally disposed and arranged in parallel relationship at right angles to the first filler blades resting on the first filler blades with the ends of the second filler blades extending between the spacer elements at the other sides of the base frame, an upper rectanglar shaped frame having grooves in the lower faces thereof for receiving the upper ends of said spacer elements, said upper frame overlying ends of the filler blades, corner posts connecting the upper frame to the base frame, and the filler blades along the sides of the unit lying outside said corner posts.

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