

Nov. 30, 1954

W. L. McGRATH
COOLING TOWERS

2,695,773

Filed Nov. 2, 1949

2 Sheets-Sheet 1

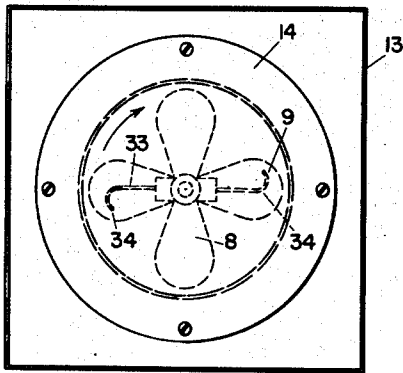


FIG. 3

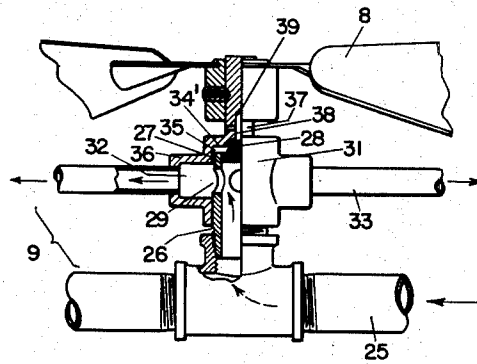


FIG. 4

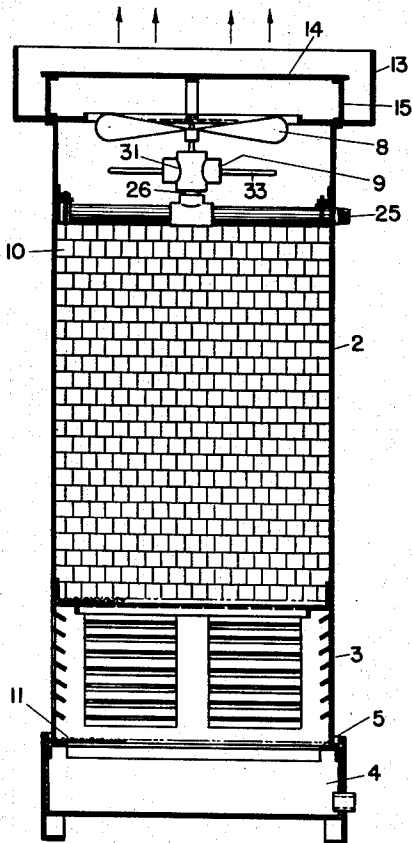


FIG. 2

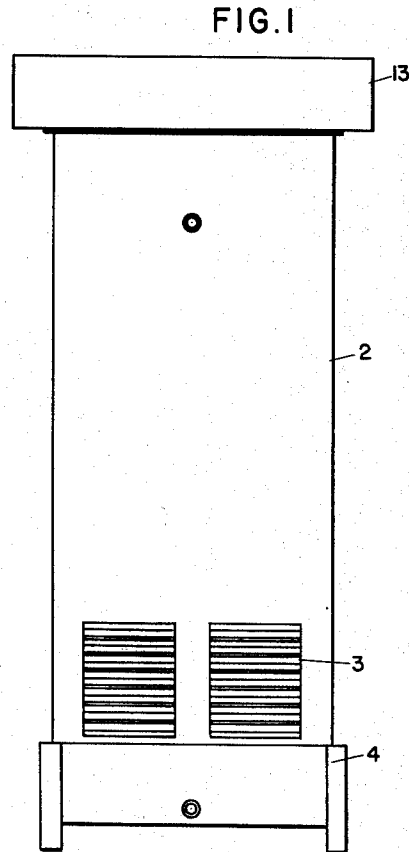


FIG. 1

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2 Sheets-Sheet 2

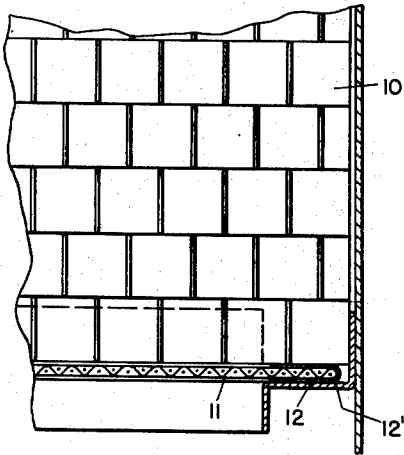


FIG. 5

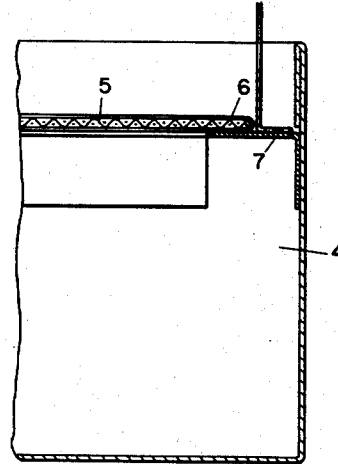


FIG. 6

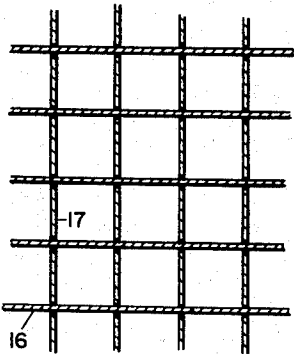


FIG. 7

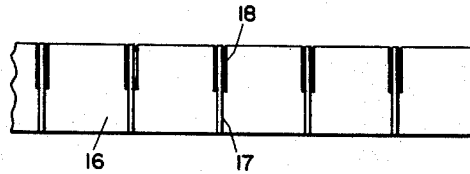


FIG. 8

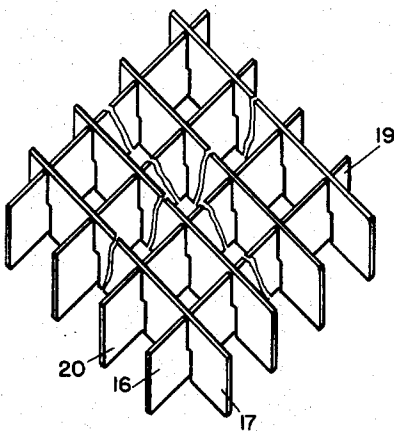


FIG. 9

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COOLING TOWER

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Application November 2, 1949, Serial No. 125,114

10 Claims. (Cl. 261—25)

This invention relates to cooling towers and, more particularly, to a cooling tower for cooling water designed to eliminate a separate fan motor and to assure adequate distribution of water over the decks of the cooling tower.

The chief object in the present invention is to provide a cooling tower inexpensive in initial cost, designed to assure adequate cooling of water distributed therein by heat exchange relation with air directed through the tower and to eliminate electrical service to the tower thereby reducing installation costs.

An object of the present invention is to provide simplified mechanism for distributing water in the cooling tower and to rotate the fan employed to direct air through the cooling tower.

A further object is to provide a cooling tower including decks of simplified construction which may be employed at low cost.

A still further object is to provide a cooling tower of simplified construction by the elimination of a fan motor. Other objects of my invention will be readily perceived from the following description.

This invention relates to a cooling tower comprising a casing including a plurality of lattice-work decks composed of impregnated fibrous material, each deck being off-set from its contacting decks to increase the amount of surface for water distribution. In the casing, turbo-spray mechanism is provided to distribute water over the decks. The turbo-spray mechanism rotates a fan connected thereto to pass air through the casing in counterflow relation with water distributed over the decks. A sump is disposed in the bottom of the casing to receive water falling from the decks. Openings are provided in the casing at the bottom thereof, above the sump, to permit air to be drawn within the casing. An eliminator is placed at the top of the casing to assist in the diffusion of air drawn through the casing and to prevent any substantial amount of water being carried off with the discharged air stream.

The attached drawings illustrate a preferred embodiment of my invention, in which

Figure 1 is a view in elevation of the cooling tower of my invention;

Figure 2 is a sectional view of the cooling tower shown in Figure 1;

Figure 3 is a plan view of the cooling tower shown in Figures 1 and 2;

Figure 4 is a view partly in elevation and partly in section of the water distributing mechanism;

Figure 5 is a fragmentary sectional view illustrating the manner in which the decks are supported in the casing;

Figure 6 is a fragmentary sectional view illustrating the manner in which the sump screen is supported in the casing;

Figure 7 is a plan view partially broken away to illustrate the staggered construction of the lattice-work decks;

Figure 8 is a view in elevation of a deck section; and

Figure 9 is an isometric view of the lattice-work deck.

Referring to the drawings, there is shown a cooling tower, including a casing 2 having a plurality of openings of louvers 3 adjacent the lower portion of the casing to permit exterior air to be drawn within casing 2 and a sump 4 formed in the lower portion of casing 2 to receive water distributed within the casing in heat

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exchange relation with air drawn therein. Sump 4 is below louvers 3 and preferably has a screen 5 thereover to prevent leaves and the like being drawn through louvers 3 and falling into sump 4. Screen 5 (refer to Fig. 6) is supported in a metal frame 6 which rests upon a bracket 7 secured to the wall of sump 4.

Within casing 2 adjacent to the top thereof is a fan 8 to draw air through louvers 3 into the casing and to discharge the air from the casing. Water distributing mechanism 9 is disposed below fan 8 and serves to distribute water in a desired pattern over a plurality of lattice-work decks 10, supported in the casing by means of a screen 11 held in a metal frame 12 and resting upon a Z angle 12' secured to the wall of casing 2 (refer to Figure 5). If desired, reinforcing means for screen 11 may be provided although this is not generally necessary.

At the top of casing 2 adjacent to the opening therein, there is disposed a pan-like member 13, secured to casing 2 so as to form in effect a continuation thereof. A disk-like member 14 is supported in pan 13 over the opening in the casing and is spaced from the opening in the casing. Fan 8 discharges the air stream after its passage in heat exchange counterflow relation with water in the casing against disk 14; the air stream striking against disk 14 permits moisture carried thereby to collect on the disk 14 and to drain into pan 13 and to return to casing 2 over the lattice-work decks therein. In addition, disk 14 serves to diffuse to some extent the force of the discharged air stream, by slowing down the air stream and converting velocity into static pressure thereby increasing the efficiency of the tower. Disk 14 may be supported by means of brackets 15 secured to the wall of pan 13 wherein desired to casing 2.

The lattice-work decks 10 are best illustrated in Figs. 7, 8, and 9. Each lattice-work deck is formed of a plurality of impregnated fibrous strips 16, extending in a desired direction, and a second series of impregnated fibrous strips 17, extending at a right angle to the first series of strips. Each strip is provided with a series of spaced slots 18, extending from a longitudinal edge thereof. The slots are spaced equal distances apart. The slot adjacent one end 19 of each strip is spaced a less distance from that end of the strip than the distance between the slot at the opposite end 20 of the strip and the opposite end of the strip. These slots are so spaced in order to permit a series of decks to be assembled with the strips of each deck in staggered relation, one deck being turned at a right angle to its contacting deck to off-set the strips in one deck from the strips in the second deck, thereby increasing the amount of surface afforded to place water in heat exchange relation with air passing through the casing. The decks are formed by reversing strips of the second series in order that the slots may be disposed adjacent to one another to form the deck. Each slot preferably has a width substantially equal to the thickness of a strip in order that the strips may be fractionally interlocked to hold the deck as a unit. It is important in my invention that the width of the strips 16 and 17 be disposed in the directions of air flow and water flow to increase the heat exchange between the air and the water. The strips themselves by such disposition are used as heat exchange surface thus eliminating splash decks. The air passing in counterflow relation with the water being cooled is being broken continuously into separate streams by striking the edges of the strips thereby greatly increasing the heat exchange effect between the air and the water.

The strips, 16 and 17, may be formed of any suitable fibrous material which is substantially water repellent. I have found that such strips may be formed from a water-laid organic fiber sheet saturated with a pressure still asphalt having a melting point of about 170° Fahrenheit. The water-laid organic fiber sheet may be prepared by forming the same on a paper machine, pressing and drying the sheet on the paper machine; then transferring the sheet to a saturating tank wherein at least an equal amount of asphalt is incorporated into the fibrous sheet by dipping the sheet into a bath of asphalt at a temperature of about 400° Fahrenheit. The saturated sheet is removed from the asphalt bath, partially

cooled, rewound, and die cut to form the strips 16 and 17. While, preferably, the strips 16 and 17 are single-ply, if desired, a two-ply strip may be employed. In such a case, the sheet described may be laminated by applying a film of oxidized asphalt having a melting point of about 222-235° Fahrenheit to one sheet and securing it to a second sheet by means of rolling pressure. The two-ply sheet may be cooled and then cut to shape as described.

It will be appreciated, of course, any suitable fibrous material may be employed for this purpose. The various fiber strips need only be sufficiently strong to support the weight of decks placed thereon. If desired, saturated roofing felt may be employed.

The water distributing mechanism 9 includes a supply pipe 25 connected to a source of water it is desired to cool. A pump (not shown) supplies water under pressure to pipe 25. A second pipe 26 extends upward from pipe 25 and serves in effect as a shaft for the water distributing sprays. Pipe 26 has its end closed as shown in 27 and terminates in a rounded knob or seat member 28 for a purpose hereinafter explained. Opening 29 is provided in pipe 26, connecting the interior of the pipe 30 with a chamber in a spinner head 31 surrounding pipe 26.

Spinner head 31 includes a chamber 32 connected to the interior of pipe 26 by openings 29 and a plurality of curved arms 33 terminating in nozzles 34. Water under pressure from chamber 32 flows into arms 33 and strikes the corners in the passages therethrough, causing the spinner head 31 to rotate. Rotation of arms 33 permits water to be discharged from the nozzles over the lattice-work decks 10 in a directed path of distribution thereby eliminating distributing decks and spray nozzles.

Spinner head 31 includes an upper portion 34' which rests on seat 28. A chamber 35 is formed between portion 34' and the closed end 27 of pipe 26. Chambers 35 and 32 are connected since water may pass between the exterior wall of pipe 26 and the interior walls 36 of spinner head 31. Spinner head 31 terminates in a shaft-like portion 37 on which is mounted fan 8. A vertically extending opening 38 in shaft 37 is closed by seat 28 when the mechanism is at rest. Horizontally extending openings 39 extend from opening 38 in shaft 37 to the exterior surface of the shaft for a purpose hereinafter explained.

When water under pressure enters chamber 32, it immediately is forced therefrom through the passages between the interior wall 36 of spinner head 31 and the exterior wall of pipe 26 into chamber 35. Such water pressure is sufficiently great to raise the spinner head from seat 28 and to cause immediate rotation of the spinner head. In order to prevent such pressure being so great as to raise spinner head 31 to permit its release from pipe 26 the openings 38 and 39 are provided to permit water in chamber 35 to bleed off during operation of the device. Such water may be returned in the casing over the lattice-work decks 10. As the water pressure lifts the spinner head 31, the vertical passage 38 in shaft 37 is opened, permitting water to flow therethrough and through openings 39 automatically releasing a portion of the water pressure in chamber 35. Pressure in chamber 35 is thus maintained in an amount sufficient to compensate for thrust forces, weight of the spinner head and fan, etc. so that the device always operates on a film of water thus greatly reducing friction during rotation of the nozzles and the fan.

In operation, water to be cooled passes under pressure thru the supply pipe 25 and is forwarded to the spinner head 31. Water under pressure passing through the arms 33 of spinner head 31 strikes the corners of the passages and causes the spinner head 31 to rotate, thus distributing water through the nozzles over the lattice-work decks 10. At the same time such pressure raises the spinner head to reduce friction and to permit ready rotation. Fan 10 is connected to spinner head 31 and rotates therewith. Rotation of fan 8 draws air through the inlet 3 into the casing and directs such air in counterflow heat exchange relation with the water dripping from the various decks 10. The air is discharged against eliminator 14 which serves to remove moisture being carried off with the discharged air stream and to return it to the decks 10 and also to diffuse the air stream.

The cooling tower provided by the present invention may be constructed inexpensively due primarily to the construction of the lattice-work decks and to the elimination of a fan motor. The lattice-work decks are com-

posed of comparatively inexpensive material which may be easily assembled and arranged in place in the tower, thus decreasing the cost of assembly and material.

The water distributing mechanism adequately distributes water over the decks and also serves to rotate the fan thereby eliminating a separate fan motor, and decreasing the cost of construction. My invention permits the elimination of so-called splash decks and spray nozzles since the construction provided distributes the water in a predetermined pattern of distribution. It will be observed a simple, novel bearing construction is provided to reduce friction during rotation of the water distributing mechanism and fan.

While I have described a preferred embodiment of my invention, it will be understood my invention is not limited thereto since it may be otherwise embodied within the scope of the following claims.

I claim:

1. A lattice-work deck for a cooling tower comprising a series of rectangular strips of asphalt impregnated organic fiber material extending in a first direction and a second series of similar rectangular strips of impregnated organic fiber material extending at an angle to strips in the first series and frictionally interlocked therewith by means of spaced slots extending from longitudinal edges of the strips, the slot at one end of each strip being spaced a greater distance from that end of the strip than the distance between the slot at the opposite end of the strip and the opposite end of the strip, the deck being adapted to be disposed with the edges of the strips opposed to the air passing through the cooling tower.

2. In a cooling tower the combination of a casing, lattice-work decks in the casing, each deck comprising a series of impregnated organic fiber strips extending in a first direction and a second series of impregnated organic fiber strips extending at an angle to the strips to the first series and interlocked therewith, lattice-work in one deck being offset from lattice-work in a contacting deck, means to support the decks in the casing, a fan for passing air through the casing, means for distributing water over lattice-work decks in the casing, said distributing means comprising a spinner head rotatably mounted in the casing, nozzles connected to the spinner head to distribute water over the decks, pressure of water entering the spinner head in nozzles rotating the same, the fan being connected to the spinner head whereby rotation of the spinner head rotates the fan to draw air through the casing in heat exchange relation with water being cooled said fan being disposed in the upper portion of the casing adjacent and opening therein, an eliminator disposed above the casing opening spaced therefrom to eliminate water from the discharged air stream and to diffuse the air stream, and means for supporting the eliminator in predetermined position.

3. A cooling tower according to claim 2 in which the eliminator includes a pan member disposed adjacent the opening in the casing, said pan having an opening therein through which the fan discharges air from the casing, and a disk disposed above the opening and spaced therefrom serving to eliminate water from the discharged air stream and to diffuse the air stream, the disk being mounted on brackets supported by the casing.

4. In a cooling tower, the combination of a casing, means for passing air through said casing, means for distributing water in said casing, a plurality of lattice-work decks superposed on one another, a sump in the lower portion of the casing to receive water falling from the lattice-work decks, a screen over said sump, and a second screen spaced from the first screen to support the lattice-work decks, said casing having a plurality of openings therein between said screens to permit ingress of air into the casing, the lattice-work being formed of impregnated organic fiber material, lattice-work in one deck being off-set from lattice-work in a contacting deck to increase heat exchange between the air and the water being cooled.

5. In a bearing construction for rotating mechanism the combination of a liquid supply pipe for liquid under pressure, a spinner head mounted on said supply pipe capable of rotating movement and of movement in a direction longitudinal of the supply pipe, the spinner head including a housing forming a chamber, curved arms extending from the chamber terminating in nozzles, openings in the supply pipe permitting passage of liquid into the housing chamber, pressure of water falling through

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the curved arms causing the rotation of the spinner head, said head having a shaft-like portion, a member to be rotated mounted on said portion, said portion having openings therein connected to the housing chamber whereby water under pressure penetrates between the housing and the supply pipe to raise the spinner head from the pipe to reduce friction, such water falling through the openings in the shaft-like portion to maintain a desired film of water between the head and the supply pipe.

6. In a cooling tower, the combination of a casing, a spray member for distributing water in the casing, pressure of water entering said member rotating the same, a fan connected to the spray member and rotated by rotation of said spray member, a plurality of lattice-work decks superposed on one another, lattice-work in one deck being offset from lattice-work in a contacting deck to increase the heat exchange between the water and air drawn into the casing by the fan, air and water passing through the casing being disposed in counterflow relation, means to support the lattice-work decks in the casing, said spray member comprising a supply pipe supported in the casing, second pipe extending therefrom, a spinner head mounted on the second pipe capable of rotating movement and of movement in a direction longitudinal of the second pipe, the spinner head including a housing forming a chamber, curved arms extending from the chamber terminating in nozzles, openings in the second pipe extending into the housing chamber, pressure of water flowing through the curved arms causing the rotation of the spinner head, said head having a shaft-like portion, a fan member secured on said portion, said portion having openings therein connected to the housing chamber whereby water under pressure penetrates between the housing and the second pipe to raise the spinner head from the pipes to reduce friction, such water flowing through the openings to maintain a desired film of water between the head and the second pipe.

7. A cooling tower according to claim 6 in which the shaft-like portion includes vertical and horizontal openings and the second pipe terminates in a portion on which the spinner head rests before water pressure is applied thereto, said portion serving to close the vertical opening in the shaft-portion before water pressure is applied.

8. In a cooling tower, the combination of a casing, means for distributing liquid in said casing, means for passing air through said casing in counterflow relation to the air, a plurality of lattice-work decks superposed on one another, the lattice-work in one deck being off-set from lattice-work in a contacting deck with the width of each

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deck disposed in the direction of movement of the air to separate continuously the air stream passing through the casing thereby increasing the heat exchange between the air and the liquid being cooled, said lattice-work in each deck being formed of a series of impregnated organic fiber strips extending in a first direction, and a second series of impregnated organic fiber strips extending at an angle to the strips of the first series and interlocked therewith, the edges of the strips facing the counterflow of the air and the liquid and means to support the lattice-work decks in the casing, each strip having a series of spaced openings extending from a longitudinal edge thereof, the opening at the end of the series being a greater distance from one end of the strip than the distance between the opening at the beginning of the series and the opposite end of the strip, lattice-work in one deck being turned at a right angle to lattice-work in a contacting deck to offset the strips in one deck from the strips in the second deck.

9. A cooling tower according to claim 8 in which the strips comprise organic fiber material impregnated with asphalt in at least an equal amount by weight.

10. A cooling tower according to claim 9 in which the openings in the strips are in the form of slots, each strip being identical in contour whereby strips of the second series may be reversed to form joints with strips of the first series, the slots in each strip having a width substantially the same as the thickness of the strip to assure frictional engagement between the interlocked strips.

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