

March 26, 1940.

G. W. MEYER ET AL

2,194,711

COOLING TOWER

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3 Sheets-Sheet 1

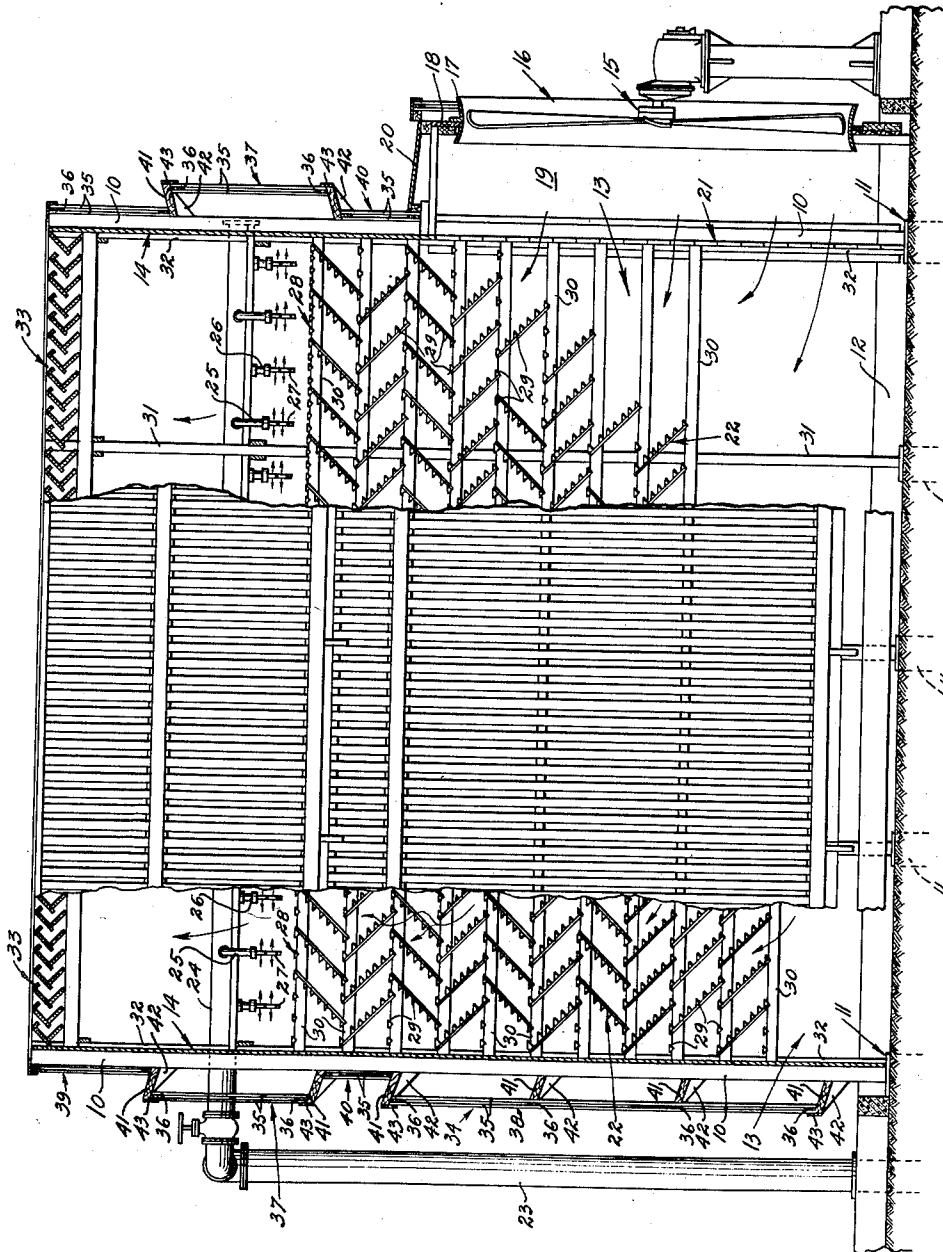


Fig. 1.

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3 Sheets-Sheet 2

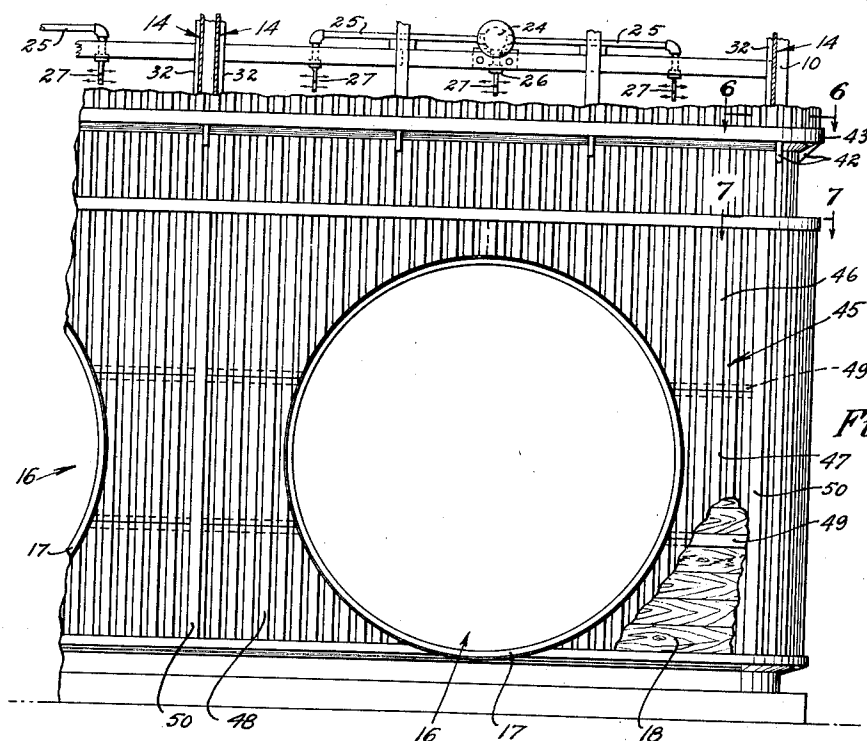


Fig. 2.

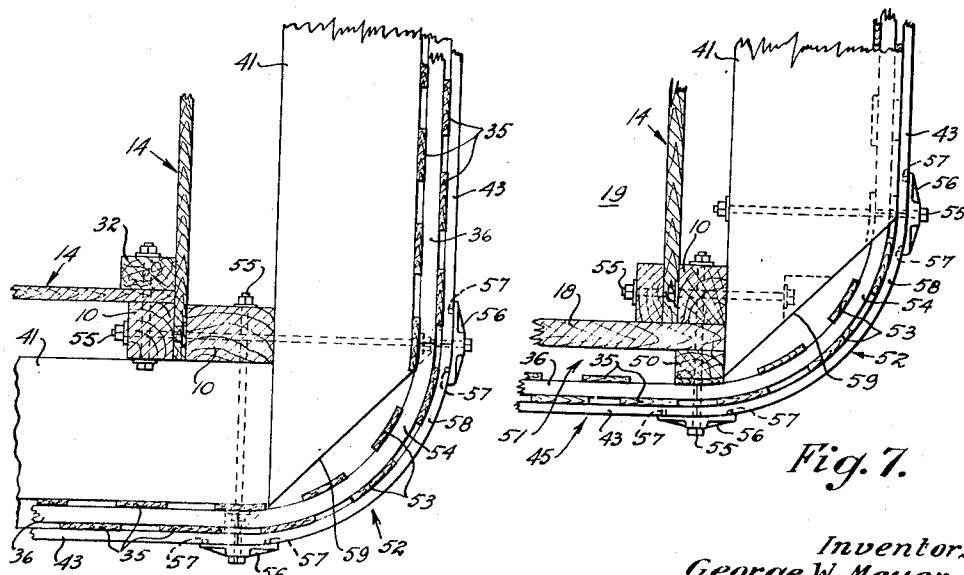


Fig. 6.

Fig. 7.

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3 Sheets-Sheet 3

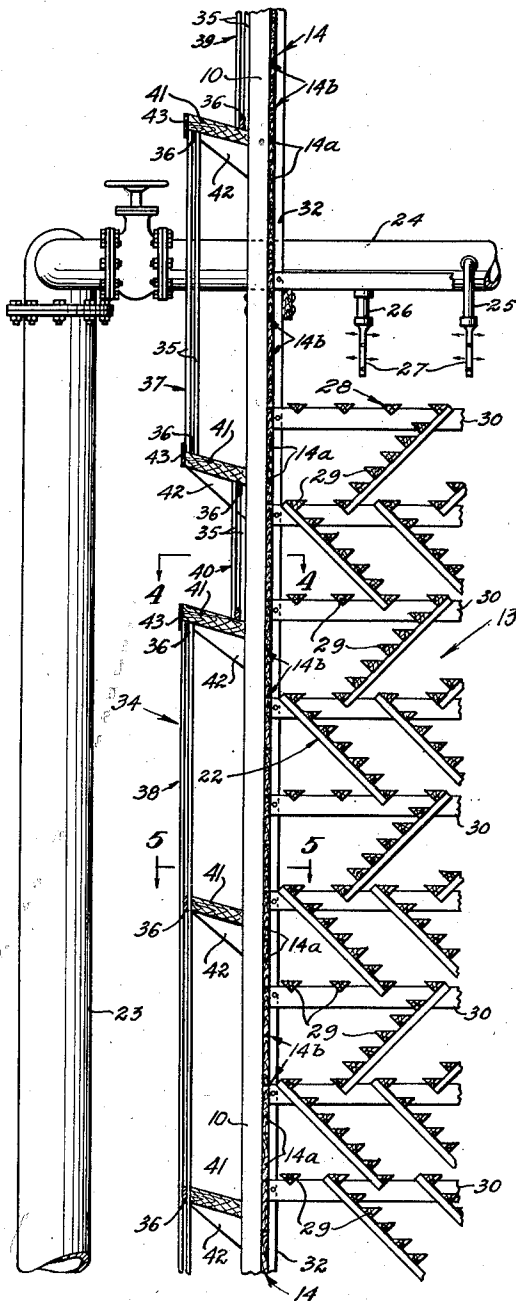


Fig. 3.

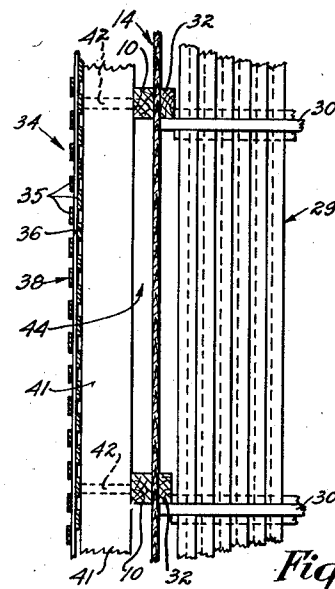
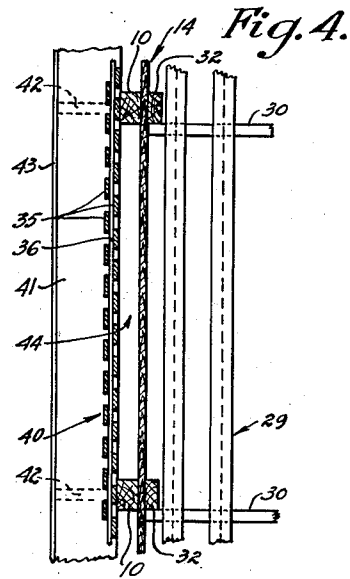


Fig. 5.

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UNITED STATES PATENT OFFICE

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COOLING TOWER

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15 Claims. (Cl. 261—30)

This invention has to do generally with water cooling towers, and is concerned particularly with improvements in cooling towers such as the forced draft type, in which the interior cooling zone has a substantially solid or continuous wall enclosure, as distinguished from an open arrangement of louvers or baffles characteristic of atmospheric cooling towers.

In forced draft towers of the usual wooden construction, it is customary to enclose the cooling zone in which downwardly showered water is contacted with upwardly flowing air, within solidly boarded walls, the outer surfaces of which are openly exposed to the atmosphere. Being directly exposed also to the cooling zone, the enclosing wall becomes water soaked while the tower is in operation, and in time water also leaks through the wall at openings or cracks that develop between the wall boards largely as a result of outside weathering of the wall from direct exposure to the sun. This gives rise to a number of objectionable conditions discussed briefly in the following, which have been overcome by the improvements contemplated by the invention.

In the first place, there is a tendency for the outer surface of the wall to dry excessively in direct sunlight, with the result that the wall boards warp and open large cracks and seams for the water to leak through. Fungus growths, such as algae that usually appear in moist interiors of cooling towers, also develop on the outer surface of the wall due to its normally wet condition and the open exposure to sunlight that promotes algae growth. In a short time the tower takes on an unsightly appearance which cannot be improved by practicable means, as by painting, since obviously the wetted wall surface under the described conditions is not suited to painting, and in any event the continued algae growth would soon restore the wall to its objectionable appearance.

The principal object of this invention is to obviate the above mentioned difficulties by providing, in conjunction with the usual inner and substantially continuous wall, an outer apertured wall that will shield and at the same time permit air circulation against the surface of the inner wall. By this means it is possible to eliminate the objectionable conditions resulting from direct and open exposure of the wall, i. e., excessive drying and warping, and algae growth, and at the same time provide sufficient air circulation against the wall to prevent wet rot and other difficulties that might result from lack of or inadequate aeration of the wall. By shading and

at the same time permitting air circulation against the inner wall, it is possible to keep the wall substantially cooler and consequently to avoid transferring some heat from the atmosphere to the cooling chamber. This advantage is of particular importance in forced draft towers since the latter frequently are in operation only periodically, and by reason of the wall exposure in the conventional designs, the tower becomes abnormally heated by exposure to the sun when not in operation. The use of the apertured outer wall is of further importance in that it provides an exposed surface which because of its dryness will remain in relatively clean condition, and which, moreover, may be so designed as to greatly improve the appearance of the entire cooling tower structure.

All the above mentioned features and objects of the invention, as well as the details of a typical and illustrative embodiment thereof, will be understood more fully from the description to follow. Throughout the description reference is had to the accompanying drawings, in which:

Fig. 1 is a transverse section through the tower, a portion of the forward end wall being shown in elevation;

Fig. 2 is a fragmentary side elevation as viewed from the right of Fig. 1;

Fig. 3 is an enlargement in vertical section showing the details of the side wall construction;

Figs. 4 and 5 are fragmentary plan sections taken on lines 4—4 and 5—5 respectively, of Fig. 3;

Fig. 6 is a corner plan section on line 6—6 of Fig. 2; and

Fig. 7 is a similar section showing the corner at the top of the blower chamber in plan, the roof of the blower chamber being broken away to show the frame structure.

Referring first to Fig. 1, the cooling tower structure comprises a frame structure including side and end rows of aligned vertical columns having footings at the base of the tower. The interior cooling zone of the tower is enclosed by a substantially continuous boarded wall, which ordinarily is built of sheathing applied to the inner faces of the columns along both the sides and ends of the tower so as to enclose the cooling zone. Forced air circulation into and upwardly through the cooling zone is maintained by one or a series of blowers, depending upon the number of longitudinal sections or cells in the tower, one blower being provided for each sec-

tion. Each blower is positioned within an annular opening 16 defined by a ring 17 mounted in the outwardly offset continuous wall 18 of the blower chamber 19. The latter is enclosed at the top by a continuous roof 20 which may be formed of sheathing like that used in the described inner wall 14 enclosing the cooling zone. As indicated by the arrows, air is forced by the blower 15 from chamber 19 through an opening at 21 in the adjacent side wall of the cooling zone, into and upwardly through the cooling zone wherein the air is brought into intimate contact with water being showered downwardly over the system of decks or baffles indicated generally at 22.

As will be understood, we may employ any suitable water distributing system and means for bringing the downflowing water and rising air stream into intimate contact within the cooling zone, and since the invention is not directly concerned with these features, a brief description of the typical water distributing system and deck arrangement will suffice. Water to be cooled is delivered to the tower through a main line 23 having one or more horizontal header connections 24 (depending upon the number of sections or cells of the tower), from which extend a series of pipes 25 and 26, see Fig. 2, through which the water is delivered to the sprayheads or nozzles generally indicated at 27. The water is sprayed onto a top deck 28 and is then subjected to continued division and surface exposure in flowing down over a series of staggered and inclined decks or baffles 29. As illustrated, the inclined decks 29 are supported on transchords 30 mounted on vertical supports 31 and 32, the latter being applied to the wall 14 directly opposite the columns 10. The air leaving the cooling zone passes upwardly through the usual drift eliminators 33 at the top of the tower, the latter serving to remove water entrainment and reduce water losses from the tower.

The construction described thus far is conventional in cooling towers of the forced draft type. It has, however, and particularly with respect to the condition of the wall 14 after the tower has been in operation over a period of time, the disadvantages mentioned in the introductory part of the description. As stated, the sheathing 14 normally is openly exposed around the outside of the tower, and receives direct sunlight which, after the wall has become water-soaked through exposure to the cooling zone, tends to dry excessively the outer surface of the wall, causing the individual boards 14a to warp and open cracks at the seams or joints 14b. Water then seeps through the joints and runs down the outside of the wall producing not only an unsightly appearance, but creating a condition, excessive moisture and direct sunlight, most conducive to algae formation. In accordance with the invention, we have been able to eliminate the disadvantages that have been characteristic in this type of forced draft tower, by enclosing the continuous inner wall 14 by an outer apertured wall which not only shields the inner wall but also provides for free air circulation against the surface of the latter, a feature of particular importance for the maintenance of the inner wall in proper condition.

Referring particularly to Figs. 3 to 5, the outer wall assembly generally indicated at 34, is intended in the broad aspects of the invention to comprise any suitable foraminous or apertured wall structure that will amply shield the inner wall 14 and permit air circulation against

its outer surface. In its preferred form, the outer wall 34 is of slatted construction, comprising two or more parallel rows of spaced, relatively offset vertically extending wooden slats 35, the slat rows being held apart by transverse spacers 36. Also preferably, the outer wall assembly is formed in relatively offset sections 37, 38, 39, and 40, each of which is made up in panels of the described slatted construction. Outer sections 37 and 38 are applied by cleats 43 to vertically spaced members or girts 41, extending horizontally along the side and end walls of the tower at the outside of the columns 10 and attached thereto by supporting brackets 42. The horizontal girts also constitute bracing and reinforcing members in the tower structure, increasing substantially its strength and rigidity. The inwardly offset sections 39 and 40 are applied directly to the outer faces of the columns 10, section 40 being placed between the horizontal girts 41 at the top and bottom of sections 38 and 37 respectively, as shown. As illustrated in Fig. 4, sections 39 and 40 are spaced from the inner wall 14 at 44 a distance corresponding to the thickness of columns 10, sections 37 and 38 being spaced an additional distance corresponding to the horizontal width of the girts 41.

The arrangement of relatively offset, spaced slats in the outer wall completely shields the inner wall, thus preventing an excessive drying through direct exposure to the sun, and at the same time permitting free circulation of air to cool the inner wall and maintain it in a proper condition of dryness. The horizontal girts 41 preferably are inclined toward the cooling zone, as illustrated, in order that if for any reason water should enter the spaces at the inside of the outer sections 36 and 37, as during rainy periods, the water will drain through the spaces at 44 into the water collecting basin 12 at the base of the tower. As will be seen from Figs. 1 and 2, the outer wall structure greatly improves the appearance of the tower and also provides an exposed wall that will resist deterioration by reason of its dryness and constant aeration.

Referring now to Fig. 2, the outer continuous wall 18 of the blower chamber 19 is similarly protected by an outer spaced foraminous wall, generally indicated at 45. The latter may be made of the same slatted construction as the sections of the previously described outer wall 34, although for convenience in constructing the wall about the blower opening 16, we prefer to build the wall 45 of preformed sections 46, 47, and 48, fitted into position, as illustrated. These sections may be mounted on suitable supporting members 49 and 50 applied to the outer face of wall 18, and maintaining the walls in suitably spaced relation as indicated at 51.

Another feature of the invention is the provision of an improved corner construction for cooling towers having an exposed outer wall of the described slatted type. Referring particularly to Fig. 6, the standard corner construction comprises a curved section 52 made up of inner and outer rows of relatively offset slats 53 applied to curved spacers 54, the ends of which are brought into alignment with spacers 36, so that the corner section 52 forms a smoothly curved continuation of the side sections. The corner 70 section 52 may be supported on the girts 41 in any suitable manner, as by means of bolts 55 carrying enlarged heads or brackets 56, each having parallel spaced lugs 57 projecting within correspondingly spaced openings in cleats 43 and 75

58 to tie together the corner and side sections of the outer wall. As illustrated, at each corner one of the girts may be cut diagonally as at 59 to provide clearance for the corner section. The details of the corner section construction and mounting at the corner of the blower chamber as shown in Fig. 7, will be apparent from the foregoing and need not be further described.

It will be understood that the drawings are to be regarded merely as illustrative of the invention in one of its typical and preferred forms and that various changes and modifications may be made without departure from the invention in its intended spirit and scope.

We claim:

1. In a cooling tower, a substantially continuous, vertically extending inner wall exposed to an enclosed zone in which water is cooled by contact with air, a horizontally extending and outwardly projecting member at the outside of said inner wall, and an apertured outer wall attached to and vertically supported by said horizontally extending member and spaced from the inner wall, said outer wall shading the inner wall and permitting air circulation through the outer wall and against the surface of the inner wall.

2. In a cooling tower, a plurality of aligned vertically extending columns, a substantially solidly boarded inner wall at the inside of and supported by said columns, said inner wall being exposed to a cooling zone in which water is cooled by contact with air, and an apertured outer wall supported by said columns at the outside thereof, said outer wall shading the inner wall and permitting air circulation through the outer wall and against the surface of the inner wall.

3. In a cooling tower, a plurality of aligned vertically extending columns, a substantially solidly boarded inner wall at the inside of and supported by said columns, said inner wall being exposed to a cooling zone in which water is cooled by contact with air, and an apertured outer wall comprising a section supported directly adjacent the outside of said columns and an outwardly offset section supported by said columns, said outer wall shading the inner wall and permitting air circulation through the outer wall and against the surface of the inner wall.

4. In a cooling tower, a plurality of aligned vertically extending columns, a substantially solidly boarded inner wall at the inside of and supported by said columns, said inner wall being exposed to a cooling zone in which water is cooled by contact with air, a plurality of horizontally extending members supported by said columns and projecting outwardly therefrom, and an apertured outer wall mounted on said members, said outer wall shading the inner wall and permitting air circulation through the outer wall and against the surface of the inner wall.

5. In a cooling tower, a plurality of aligned vertically extending columns, a substantially solidly boarded inner wall at the inside of and supported by said columns, said inner wall being exposed to a cooling zone in which water is cooled by contact with air, a plurality of horizontally extending members supported by said columns and projecting outwardly therefrom, and an apertured outer wall comprising an outwardly offset section mounted on said members and an inwardly offset section supported directly adjacent the outside of said columns, said outer wall shading the inner wall and permitting air circulation through the outer wall and against the surface of the inner wall.

6. In a cooling tower, a plurality of aligned vertically extending columns, a substantially solidly boarded inner wall at the inside of and supported by said columns, said inner wall being exposed to a cooling zone in which water is cooled by contact with air, a plurality of horizontally extending members supported by said columns and projecting outwardly therefrom, and an apertured outer wall comprising an outwardly offset section mounted on said members and an inwardly offset section supported directly adjacent the outside of said columns, said outer wall sections comprising vertically extending spaced and relatively offset members shading the inner wall and permitting air circulation through the outer wall and against the surface of the inner wall.

7. In a forced draft cooling tower, a substantially continuous, vertically extending inner wall having a blower opening therein through which air is discharged into a cooling chamber, and an apertured outer wall at the outside of said inner wall about the blower opening and permitting air circulation through the outer wall and against the surface of the inner wall.

8. In a forced draft cooling tower, a substantially continuous, vertically extending inner wall having a blower opening therein through which air is discharged into a cooling chamber, and an apertured outer wall at the outside of said inner wall and permitting air circulation through the outer wall and against the surface of the inner wall, said outer wall comprising individual sections positioned about said blower opening.

9. In a forced draft cooling tower, a substantially continuous, vertically extending inner wall having a blower opening therein through which air is discharged into a cooling chamber, and an apertured outer wall at the outside of said inner wall and permitting air circulation through the outer wall and against the surface of the inner wall, said outer wall comprising individual sections including vertically extending spaced and relatively offset members and said sections being positioned about said blower opening.

10. In a forced draft cooling tower, a substantially continuous, vertically extending inner wall exposed to an enclosed cooling zone in which water is cooled by contact with air, means for forcing a stream of air through said zone, and an apertured outer wall at the outside of said inner wall, said outer wall shading and extending substantially the height of the inner wall and permitting air circulation through the outer wall and against the surface of the inner wall independently of the air stream passing through said cooling zone.

11. In a forced draft cooling tower, a substantially continuous, vertically extending inner wall exposed to an enclosed cooling zone in which water is cooled by contact with air, means for forcing a stream of air through said zone, and an apertured outer wall spaced from the outside of said inner wall to provide a vertically extending air space between the walls, said outer wall shading and extending substantially the height of the inner wall and permitting air circulation through the outer wall and against the surface of the inner wall independently of the air stream passing through said cooling zone.

12. In a forced draft cooling tower, a vertically extending inner wall structure including frame members and a substantially continuous wall exposed to an enclosed zone in which water is

- cooled by contact with air, means for forcing a stream of air through said zone, and an apertured outer wall at the outside of said inner wall structure, means for vertically supporting said outer wall on the inner wall, said outer wall shading at least the greater portion of the inner wall surface and permitting air circulation through the outer wall and against the surface of said continuous wall.
- 10 13. In a forced draft cooling tower, a vertically extending inner wall structure including frame members and a substantially continuous wall exposed to an enclosed zone in which water is cooled by contact with air, means for forcing a stream
- 15 of air through said zone, and an apertured outer wall at the outside of said inner wall structure, means for vertically supporting said outer wall on the inner wall, said outer wall comprising spaced relatively offset members shading at least the
- 20 greater portion of the inner wall surface and permitting air circulation through the outer wall and against the surface of said continuous wall.
14. In a forced draft cooling tower, a vertically
- 25 extending inner wall structure including frame members and a substantially continuous wall ex-

posed to an enclosed zone in which water is cooled by contact with air, means for forcing a stream of air through said zone, and an apertured outer wall at the outside of said inner wall structure and extending substantially the height thereof, said outer wall comprising vertically extending spaced and relatively offset members shading the inner wall and permitting air circulation through the outer wall and against the surface of said continuous wall.

15. In a forced draft cooling tower, a vertically extending inner wall exposed to an enclosed zone in which water is cooled by contact with air, means for forcing a stream of air through said zone, an apertured outer wall comprising vertically extending, horizontally offset sections positioned at the outside of said inner wall, and vertical frame columns between and vertically supporting both of said walls, said outer wall shading the inner wall and permitting air circulation through the outer wall and against the surface of the inner wall.

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