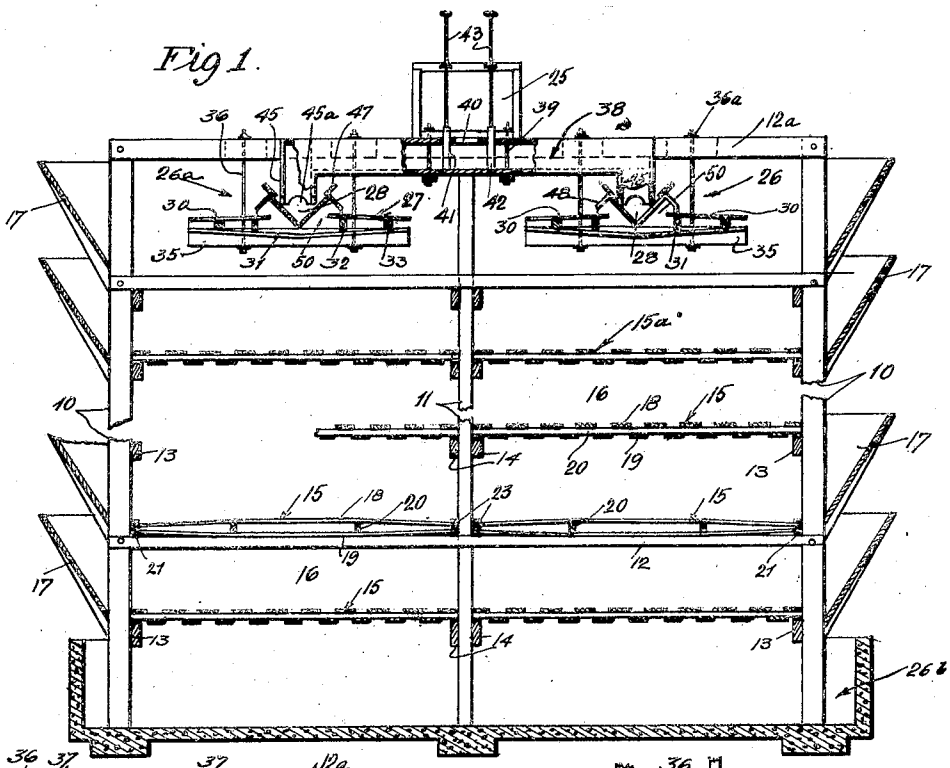
Aug. 30, 1932. G. T. MARTIN 1,874,020

ATMOSPHERIC COOLING TOWER

Filed May 2, 1930

Fig 1.



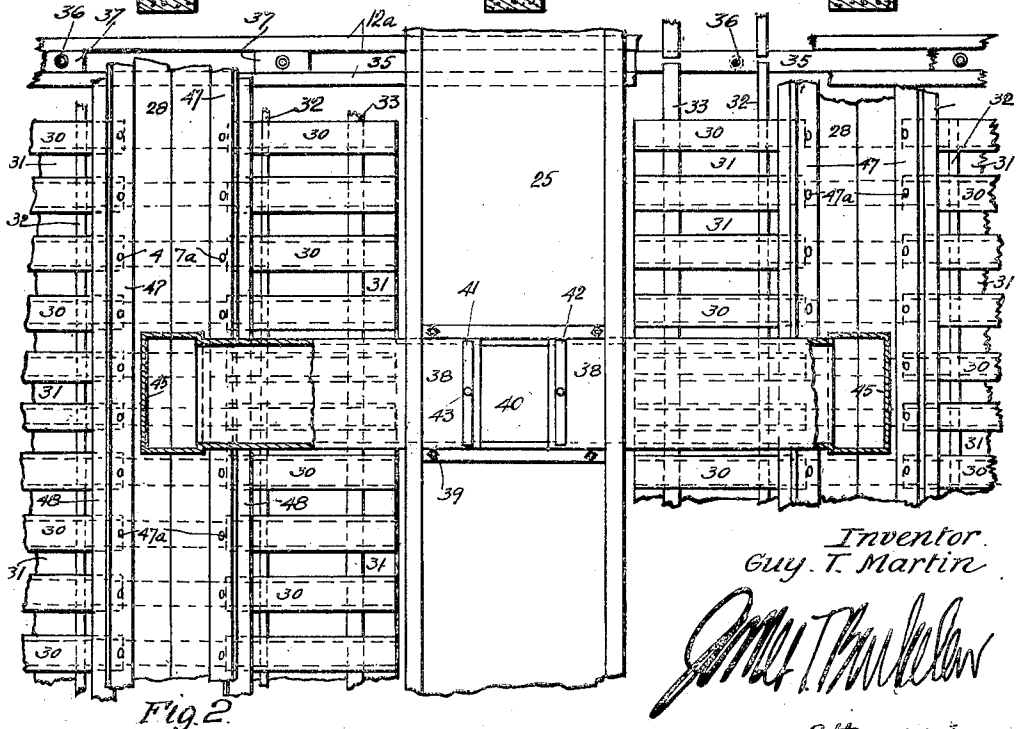


Fig 2.

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UNITED STATES PATENT OFFICE

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ATMOSPHERIC COOLING TOWER

Application filed May 2, 1930. Serial No. 449,201.

This invention relates generally to atmospheric cooling towers, and has to do particularly with distributing systems for spreading or distributing water evenly over the horizontal interior section of the tower at the beginning of its flow downwardly therethrough.

Cooling towers of the present type may be characterized generally as comprising a plurality of vertically spaced and apertured decks which define a vertical series of cooling chambers through which the liquid is showered after passing through the decks. Atmospheric air currents are directed so as to flow horizontally through the cooling chambers, by means of louver walls enclosing the series of decks. According to the usual construction, water to be cooled is delivered to a main flume extending longitudinally on top the tower, and the water from the flume is delivered to and distributed evenly over the uppermost apertured deck of the tower by means of a distributing system interposed between the deck and the flume. And as mentioned, such systems comprise the subject matter of the present application.

It is one object of the invention to provide a distributing system in which the water is delivered from the main flume extending longitudinally on top of the tower, to distributing troughs extending below and substantially parallel with the main flume, as distinguished from the usual distributing system in which the troughs taking water from the main flume extend transversely relatively thereto. By delivering the water from the main flume to overflow troughs extending longitudinally of the tower, a much greater length of the tower can be supplied with water through a single valve controlled outlet from the flume, than in cases where the overflow troughs extend transversely of the tower and are therefore necessarily limited in length by the width of the tower. In accordance with my preferred construction I provide two overflow troughs below and at opposite sides of the flume, although any suitable number of such troughs may be used, and provide separate distributing decks beneath each trough.

It is the further object of the invention to provide an improved construction for the cooling decks below the distributing system, whereby the difficulty commonly encountered in that the decks have tendency to sag after the tower has been in use for some time, is obviated.

Other objects of the invention as well as the various details of a typical and preferred embodiment thereof, will be described to best advantage without further preliminary discussion, in the following detailed description. Reference is had throughout the description to the accompanying drawing, in which:

Fig. 1 is a transverse and vertically contracted sectional elevation of the tower, illustrating the distributing system and also my improved deck construction; and

Fig. 2 is an enlarged fragmentary plan view in Fig. 1 showing a portion of the distributing system in one longitudinal section of the tower.

Referring to the drawing, the tower frame work comprises a series of outside columns 10 arranged in transverse pairs at intervals longitudinally of the tower, the portions of the tower between the successive pairs of columns 10 being termed "sections." For the present purposes, it will not be necessary to make a detailed showing of a tower including a number of such sections, since this construction is common in cooling towers of the present type, and will be readily understood by those familiar with the art. Between and in line with columns 10, as shown in Fig. 1, is a series of interior columns 11 spaced longitudinally of the tower at intervals corresponding to the spacing of columns 10. Alternate decks, hereinafter described, are supported on transverse chords 12 joined to columns 10 and 11, the remaining alternate decks being supported by chords 13 and 14 extending longitudinally of the tower and joined to columns 10 and 11, respectively, as indicated.

A series of vertically spaced and apertured cooling decks, generally indicated at 15, are supported on the described horizontal frame members, the decks defining a vertical series of cooling chambers 16 through which the water is showered downwardly as it passes through the decks. Mounted on columns 10

opposite each chamber 16 is a tier of louvers 17, each tier surrounding the tower and partially enclosing its respective cooling chamber. The construction and function of the louvers are well known, and since they comprise no part of the invention, no further description of the louvers need be given.

Decks 15 are made up of series of vertically spaced and relatively staggered slats 18 and 19, which are spaced apart by means of supporting members 20 extending between and substantially at right angles with the slats. Between the ends of the upper and lower series of slats 18 and 19 are spacers 21 to which the slats are nailed, and which it will be noted are somewhat narrower than supporting members 20 so that the upper and lower deck slats are caused to bow in opposite directions. A detailed discussion of the purposes and advantages of the deck construction described thus far need not be entered into in the present application, since this feature comprises the subject matter of Patent No. 1,632,397, issued June 14, 1927 to John Simon Fluor, wherein the effectiveness of this type of deck in breaking up and causing exposure of the downwardly flowing water, is fully described.

In accordance with the invention, I have made certain improvements in the deck construction whereby the decks are supported in a manner such that they are prevented from sagging. Heretofore the decks have been supported within the tower with their ends at spacers 21 resting on the horizontal frame members, no support being given the decks intermediate these ends. As a result, there has been in some cases a tendency for the decks to sag as the slats become water soaked. To obviate this difficulty, I provide cleats 23 extending across the ends of the slats and on opposite sides of spacers 21, the thickness of the cleats being such that the thickness of the deck will be the same at its ends as at its intermediate bowed portion between supports 20. As a result, the decks are enabled to be supported on a flat surface, the bottom cleats 23 serving to support the ends of the deck. As shown in Fig. 1, the decks are alternately supported on transverse chords 12 and longitudinal chords 13 and 14, the deck slats in each case extending parallel with the supporting members and with the bottom end cleats 23 and the outermost lower slats resting on the upper edges of the supporting members. Thus the decks are not only supported at their ends, but also at intermediate points by means of members 20, the result being that the slats are prevented from sagging by their intermediate supports. Any suitable number of supporting members 20 and any suitable spacing therebetween, may of course be provided.

The water to be cooled is delivered by suitable piping, not shown, to a main flume 25 extending centrally and longitudinally on top the tower, the flume resting on the uppermost transverse frame members 12*a*. From flume 25, the water is conducted over a distributing system comprising a pair of distributing units 26 and 26*a* mounted below and at opposite sides of the flume. Upon flowing over the distributing system, the water is caused to be distributed horizontally in a manner such that it is showered downward evenly over the uppermost deck 15*a*, from whence it passes downwardly through the series of cooling chambers and becomes cooled by the transverse flowing air currents. The cooled water is collected in a basin 26*b* at the base of the tower, from whence it is taken for further use.

The distributing units 26 and 26*a* each comprise a distributing deck 27, preferably of the slatted type hereinafter described, adjustably suspended from the top transverse frame member 12*a* of the tower. As will later be seen, the distributing decks are made up in sections or units, the length of which, that is their extent longitudinally of the tower, corresponds substantially to the length of the tower sections, or the distance, longitudinally of the tower, between columns 10. Although in the broader aspects of the invention, any suitable means may be provided for delivering water from the main flume to the distributing decks, I prefer the hereinafter described water delivery system comprising overflow troughs 28 which are fed from the main flume by lateral conduits, and which extend longitudinally of the tower, substantially parallel with the main flume.

Distributing decks 27 are made up of vertically spaced and relatively staggered slats 30 and 31 which are nailed to the upper and lower sides of transverse supporting members 32 and 33. Supporting members 32 are of somewhat greater width than members 33, so as to cause the upper slats 31 to slope gradually outward toward their ends, and the lower slats to slope inward toward their centers. The central portions of the upper slats 30 are cut away to enable troughs 28 to be set down within the decks as will be later described more fully.

The distributing decks 27 are suspended from the uppermost transverse frame members 12*a* by means of hangers at each end of the decks. Any suitable form of suspension means or hanger may be provided. The typical form of hanger shown herein comprises a deck supporting beam 35 carried on the lower ends of rods 36, which extend at their upper ends through blocks 37, see Fig. 2, placed between frame members 12*a*. Rods 36 are supported by nuts 36*a* threaded on their upper ends and bearing downwardly on blocks 37. The upper ends of the rods are threaded throughout a length sufficient to permit the decks to be leveled by means of

nuts 36*a*. The leveling operation is obviously simple, since the adjustments can be made from readily accessible parts on top the upper frame members.

As shown in Fig. 2, supporting members 32 and 33 project somewhat beyond the ends of the deck and rest upon beams 35. The width of the latter is sufficient to accommodate the projecting ends of supporting members of two adjacent decks, thereby obviating the necessity of providing separate supports at the ends of the decks.

Water is conducted from main flume 25 to the distributing units 26 and 26*a*, by means of conduit 38 supported on the under side of the flume by hangers 39. The water flows from the main flume into conduit 38, through openings 40 in the bottom of the flume. Within the laterally extending conduit 38 at opposite sides of opening 40 are valves 41 and 42 having operating rods 43 extending upwardly through the flume, the valves serving to selectively control the flow of water to the distributing units. Thus valves 41 and 42 will be adjusted so as to permit the delivery of a greater amount of water to one side of the tower than the other, such as may be desirable under conditions of high wind velocity, in order to compensate for subsequent lateral displacement of the water in passing downwardly through the tower.

At the end of conduit 38 of down spouts 45 through which the water is discharged into trough 28. The ends of the spouts may be notched as at 45*a* in order to permit ready flow therefrom into the troughs. The latter may be of any suitable construction, but preferably they are of the V-type comprising the subject matter of Patent No. 1,593,325, issued July 20, 1926 to J. S. Fluor, on atmospheric cooling tower. The V-shaped troughs 28 are provided with side extensions 47 having overflow openings 47*a*, and laterally projecting aprons 48 extending substantially at right angles with the sides of the troughs. As previously mentioned, the upper slats 30 of the distributing decks are cut away at the central portions of the deck to enable the overflow troughs to be set down within the deck, whereby projecting aprons 48 are brought immediately above the upper slats of the decks. Although should it be desired, the troughs may be rested directly from the decks, I have shown them in the present instance to be supported on notched blocks 50 which rest upon beams 35.

By virtue of troughs 28 extending longitudinally of the tower and overlapping the series of distributing decks, the necessity is obviated for providing a valve controlled conduit for delivering water from the main flume to the troughs, at each longitudinal section of the tower. Thus sufficient water may be delivered to the overflow troughs at one section of the tower to supply a number of sections. This is in distinction to certain common types of distributing systems which necessitate the provision of a valve controlled outlet from the flume for each tower section, due to the fact that in such types, the overflow troughs extend laterally instead of longitudinally of the tower.

In operation, water delivered to the distributing system units through conduit 38, overflows through openings 47*a* in the upper extensions 47 of the troughs onto decks 27. A portion of the overflow water retained in the upper deck slats 30 will be carried outwardly away from the trough and distributed over the outer areas of the transverse sections of the tower, due to the outward slope of the upper slats. Another portion of the water overflowing onto lower deck slats 31 is carried in a reverse manner inwardly toward the central portion of the transverse tower sections, due to the reverse slope of the lower deck slats. Thus the decks serve to carry or distribute a portion of the water outwardly and away from the troughs, and also to cause a portion to flow inwardly beneath the troughs, the general result accomplished being to bring about even distribution of the water over the uppermost cooling deck 15*a* of the tower.

I claim:

1. In an atmospheric cooling tower, a plurality of vertically spaced apertured decks, and a water distributing system above said decks comprising; a main flume extending longitudinally of the tower, an overflow trough below and extending substantially parallel with said flume, means for delivering water from the flume to said trough, and a slatted distributing deck below said trough for distributing water overflowing the trough, over the uppermost of the first mentioned decks, said distributing deck comprising vertically spaced and relatively staggered slats extending substantially at right angles with said trough, the upper slats sloping outwardly toward their ends, and the lower slats sloping inwardly toward their longitudinal centers.

2. In an atmospheric cooling tower, a plurality of vertically spaced decks each comprising a plurality of vertically spaced parallel and relatively staggered slats, and a water distributing system above said decks comprising; a main flume extending longitudinally of the tower, an overflow trough below and extending substantially parallel with said flume, means for delivering water from the flume to said trough, and a slatted distributing deck below said trough comprising vertically spaced and relatively staggered slats extending substantially at right angles relative to said trough and to the slats in the uppermost of the first mentioned decks.

3. In an atmospheric cooling tower, a plurality of vertically spaced apertured decks,

and a water distributing system above said decks comprising; a main flume extending longitudinally and centrally of the tower, a pair of overflow troughs below and at opposite sides of the flume, said troughs being transversely spaced from and extending substantially parallel with the flume, conduits for delivering water from the flume to said troughs, said conduits extending transversely beneath said flume, valve means for controlling the flow of water through said conduits, and means below the troughs for distributing water over-flowing the troughs, over the uppermost of the first mentioned decks.

4. In an atmospheric cooling tower having a frame comprising vertical columns and vertically spaced transverse cross members joined to said columns, a plurality of vertically spaced decks arranged below the uppermost of said cross members, and a water distributing system comprising; a main flume extending centrally and longitudinally of the tower above the last mentioned cross members, separate water distributing means below the uppermost cross member and at each side of the flume, conduits for delivering water from the flume to the distributing means, and means for suspending said distributing means from the uppermost cross member.

5. In an atmospheric cooling tower having a frame comprising vertical columns and vertically spaced transverse cross members joined to said columns, a plurality of vertically spaced decks arranged below the uppermost of said cross members, and a water distributing system comprising; a main flume extending longitudinally of the tower above the last mentioned cross member, a pair of overflow troughs below said flume and at opposite sides thereof, means for delivering water from the flume to said troughs, separate water distributing decks below said troughs, and adjustable supporting means for said distributing decks.

6. In an atmospheric cooling tower having a frame comprising vertical columns and vertically spaced transverse cross members joined to said columns, a plurality of vertically spaced decks arranged below the uppermost of said cross members, and a water distributing system comprising; a main flume extending longitudinally of the tower above the last mentioned cross members, a pair of overflow troughs below said flume and at opposite sides thereof, means for delivering water from the flume to said troughs, separate water distributing decks below said troughs, and means for suspending said water distributing decks from said uppermost cross members.

7. In an atmospheric cooling tower, a distributing deck comprising, a plurality of parallel vertically spaced and relatively staggered slats, the upper slats sloping outwardly and the lower slats sloping inwardly, and an overflow trough extending at right angles with the deck slats and projecting downwardly within the deck to a point below the upper slats thereof, the sides of said trough extending above said upper slats.

8. In an atmospheric cooling tower, a horizontally extending upper frame member, a distributing deck below said frame member and consisting of a plurality of parallel vertically spaced and relatively staggered slats, the upper slats sloping outwardly and the lower slats sloping inwardly, means for suspending said deck from said frame member, and an overflow trough extending at right angles with the deck slats and projecting downwardly within the deck to a point below the upper slats thereof, the sides of said trough extending above said slats.

9. In an atmospheric cooling tower having a frame comprising vertical columns and vertically spaced transverse cross members joined to said columns, a plurality of vertically spaced decks arranged below the uppermost of said cross members, and a water distributing system comprising; a main flume extending centrally and longitudinally of the tower above the last mentioned cross members, an overflow trough below said uppermost cross members, extending substantially parallel with said flume and spaced transversely therefrom, valve controlled means for delivering water from said flume to said trough, and means below said trough for distributing water overflowing the trough, over the uppermost of said decks, said trough being supported by said distributing means.

10. In an atmospheric cooling tower having top transverse frame members, a plurality of vertically spaced apertured decks below said frame members, and a water distributing system above said decks comprising; a main flume extending longitudinally and centrally of the tower above said frame members, a pair of overflow troughs below and at opposite sides of the flume, said troughs being transversely spaced from and extending substantially parallel with the flume, transversely extending conduits for delivering water from the flume to said troughs, valve means for controlling the flow of water through said conduits, and separate laterally spaced distributing decks below said transverse frame members and supporting the troughs.

In witness that I claim the foregoing I have hereunto subscribed my name this 26th day of March, 1930.

GUY T. MARTIN.

CERTIFICATE OF CORRECTION.

Patent No. 1,874,020. August 30, 1932.

GUY T. MARTIN.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, line 84, claim 8, before "slats" insert the word "upper"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 27th day of December, A. D. 1932.

M. J. Moore,
Acting Commissioner of Patents.

(Seal)