E. BURHORN.

COOLING TOWER.

APPLICATION FILED DEC. 4, 1915.

1,234,444. Patented July 24, 1917.

Fig. 1.

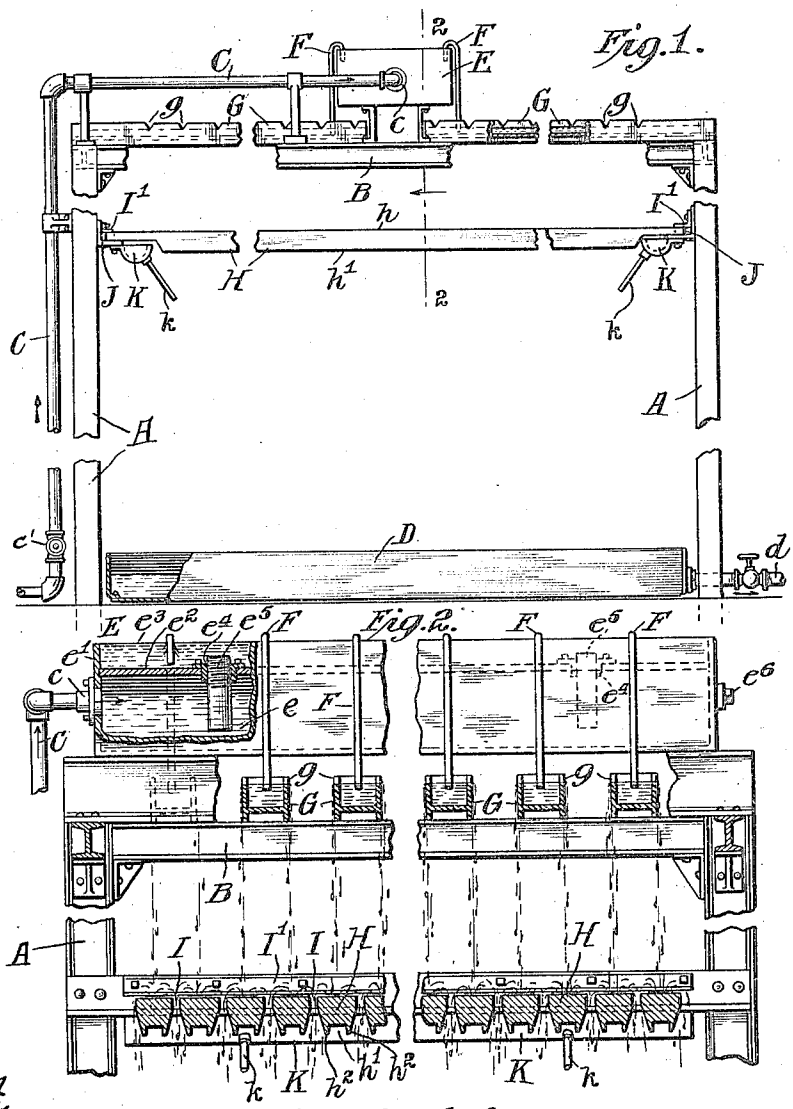
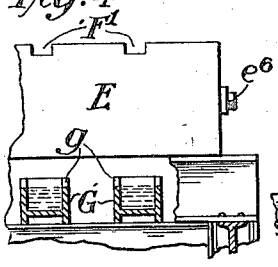


Fig. 2.

Fig. 4



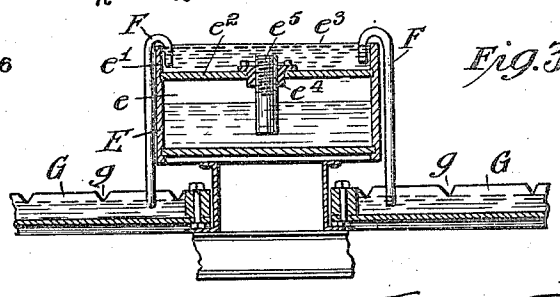


Fig. 3.

Attest:

E. Bernhardt

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his Attys.

UNITED STATES PATENT OFFICE.

EDWIN BURHORN, OF HOBOKEN, NEW JERSEY.

COOLING-TOWER.

1,234,444. Specification of Letters Patent. Patented July 24, 1917.

Original application filed September 6, 1912, Serial No. 718,857. Divided and this application filed December 4, 1915. Serial No. 64,965.

To all whom it may concern:

Be it known that I, EDWIN BURHORN, a citizen of the United States, residing at Hoboken, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Cooling-Towers, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention relates to cooling towers, or that class of apparatus the purpose of which is to lower the temperature of water which has been heated in the operation of a condensing steam engine, or otherwise.

The objects of the present invention are increased efficiency, durability, ease of cleansing and keeping in repair, inexpensiveness of construction, and more particularly, a complete, uniform and fine distribution of the liquid.

The invention hereof consists in the novel devices, features, arrangements and combinations hereinafter set forth and illustrated, and more particularly, the novel distributing means at the top of the frame, and to the novel cooling decks in coöperation therewith.

This is a division of my prior Patent No. 1,171,412, dated February 15th, 1916.

I will first describe one embodiment of my invention and will thereafter point out the novel features in the claims.

In the accompanying drawings forming a part hereof, Figure 1 is an elevation of one form of apparatus embodying my improvements, in which the frame-work has been broken away horizontally at different points, for the purpose of vertically condensing the drawing.

Fig. 2 is an elevation view taken at right angles to that of Fig. 1 and showing certain parts in cross-section upon the plane 2—2 of Fig. 1.

Fig. 3 is a section of part of the distributing devices shown in enlarged scale.

Fig. 4 is an elevation of a modification.

Similar letters of reference designate the corresponding parts in the several figures of the drawings.

The frame-work *per se* forms no part of this invention and it may take any desired form, such, for example, as that shown, comprising vertical members A, A and horizontal members B. The frame-work supports the other parts to be referred to, and it may be of different sizes, varying, for example, from a tower four feet square, eighteen feet high, to a tower sixteen feet by sixty feet, with a height of thirty-five feet. It will be understood that the frame-work may be covered with netting, or by a series of louvers (as in my Patent No. 973,163 of October 18, 1910) or other means for preventing a loss of water by the same blowing out of the tower.

The warm water to be cooled may be assumed to be fed through a pipe C which passes to the top of the tower and thence to the distributing means, to be hereinafter described more in full.

Besides the frame-work, generally speaking the present cooling tower comprises a distributing means at the top of the tower, one or more cooling decks at desired elevations below the distributing means and a collecting tank D at the bottom, into which all of the cooled water is gathered, and from which it is led by a pipe d for such use as may be desired.

Referring first to the distributing means hereof, it is shown to comprise two coöperating elements, the first being what may be termed a distributing tank, of a peculiar construction, and the second being a deck composed of a series of channel pieces beneath the distributing tank.

The distributing tank E is in the most elevated position of the cooling tower. Its interior portion e is completely boxed in by a bottom, four side walls, and a top plate, so as to constitute substantially a box. The four vertical, or side walls, however, are extended at e' above the top plate e^2, so as to form an open top trough e^3. The distributing tank, therefore, can be described as comprising the united box e and trough e^3. The water inlet from the pipe C may be located at c at one end of the box e, as seen in Figs. 1 and 2, and the other end of the box may be provided with an opening closed by a plug e^6, whereby the same may be opened for the purpose of cleaning the interior of the box.

Preferably, the distributing tank E is comparatively narrow, its length being the full length of the tower, as shown. The lengthwise direction of the tank may be designated as longitudinal for convenient purposes of description.

Direct communication is provided be-

tween the box e and the trough e^3 of the distributing tank, and this connection will preferably consist of a plurality or series of openings, formed at e^4 in the top plate e^2. It is intended that the water in the box e is to pass upwardly through the openings e^4 into the trough through the uniform pressure created by the pump, or other means of forcing the water through pipe C. In this way, the distributing trough is maintained full of water of equal depth at all parts of its length, thus avoiding accumulation at one side or at one end which might otherwise occur.

I prefer to adjust the height of the openings between the box and the trough, and this may be conveniently accomplished by means of short pieces of threaded pipe e^5 engaged in the openings, which may be turned to regulate their height. The pipes e^5 are shown extending downwardly toward the bottom of the distributing box e with the result that an air space can be maintained within the box above the water level. The maintenance of this air space will be understood by considering a case with the pipe e^5 removed. Then the water would flow directly up into the upper chamber. The pipe serves to trap air in the space e, which air is susceptible to elastic compression, so that it serves as a cushion. This air space is of advantage as equalizing variations in water flow by compression of air, for which purpose the construction described effectively serves.

Means of controlling the places of overflow of water from the trough e^3 are provided, and while the same might take various forms, I prefer the contrivances or capillary members F indicated. As shown, there may be a series of these overflow controllers on each side of the distributing tank arranged to coöperate with the series of channel pieces in the deck beneath. These capillaries may take various forms such as rods, tubes, pieces of rope or woven fabric or strips of lead or other metal, but I prefer rods.

In these capillary members or rods, F, I take advantage of the principles of capillary attraction, which I find may be usefully employed for the purpose stated. Each of the members F is shown as constituted of a rod bent around upon itself at the upper end and driven snugly onto the top edge of the tank, so as to hug the same and to substantially contact the exterior of the tank throughout its height. In the drawings Fig. 3, there is a slight exaggeration of the space between tank E and rod F.

The action of these overflow controlling devices is merely that when the trough is filled to overflowing, the rods through their capillary attraction determine the points at which the water passes over the vertical walls, and thereby insures that the water being distributed shall pass properly into the channel pieces beneath.

Coming now to the series of channel pieces G G, etc., it will be observed that generally speaking they are arranged transversely of the longitudinal direction of the distributing tank E. Each of the channel pieces constitutes a transverse channel extending from side to side of the tower, although I preferably divide each channel into two pieces, one on each side of the center, as indicated in Figs. 1 and 3.

Above each of the channel pieces G, is one or more of the capillary rods F, so that the channel is supplied by means of the rod with a proportionate share of the overflow water from the distributing tank.

In this way, since the supply of water is continuous, each of the channel pieces is maintained full, and, in fact, overflowing with water throughout the operation of the apparatus.

In order to control and secure even distribution of the water overflowing from the channel pieces G, each of the channel pieces will be seen on both sides to be provided with notches g, preferably equally disposed along the length of the channel pieces. In each channel piece all of the notches g will be of equal depth, so that the water will overflow simultaneously in all of them.

Since an over rapid supply of water might cause a flooding of the trough to an extent beyond the control of the capillary devices, some means is desirable for controlling the amount of the flow of water from the tank. This control is shown as effected herein by means of an ordinary valve c' provided in the supply pipe C. This valve will be opened or closed to the point where the over-flow of water from the trough can be taken care of by the capillary devices to secure the described operation.

By the distributing means thus described, it will be seen that throughout the entire area of the tower, an even, fine, and uniform distribution of falling water is secured, approaching, indeed, the uniformity of a rainfall; and by carrying the sub-division or distribution further in the manner above described the division into small drops or streams can be made as minute as desirable.

From the distributing means the water could be allowed to fall directly to the collecting tank throughout the entire height of the tower without interruption, but since the fall would through acceleration be quite rapid, the efficiency of the apparatus would be impaired, and I, therefore, prefer at one or more points to interpose decks or cooling devices serving to interrupt and delay the downfall of the water, and I have shown a cooling deck composed of a particular form

of cooling members which efficiently cooperates with the distributing means hereinabove described.

Each of the cooling members H, is of the construction to be below described and all of such members may be arranged in a series parallel with the distributing channels G, as shown. Each member H, may be simply a transverse strip located to receive streams of water falling from the channel pieces, but I prefer that the cross section of the member H, shall be substantially as shown in Fig. 2. This cross section may be described as of a form having a flat upper surface h, and a recessed or concaved bottom, as indicated at h', this bottom being formed substantially by the provision of a pair of opposed ribs or flanges, h^2 h^2, along the two sides of the strip.

By this design of cooling member, the water received upon its upper surface is afforded an extensive surface exposure, thereby enhancing the cooling effect and at the same time the stream of water received upon each member H, is in its further passage downward sub-divided into two streams, one falling or dripping from each of the two sides of the member.

This arrangement and the passage of the water are well illustrated in Fig. 2 in which the constant subdivision will be perceived. It will be understood that, as above stated, further series or decks of cooling members might be located below the one illustrated, they to be either of smaller size for further sub-division of the streams, or to be of the same size, as shown, but in staggered relation, so that each member in a lower deck will receive part of the water dripping from two members in the deck above.

To assist in giving support to the cooling members H, properly spaced from each other a series of spacers, or separators, I, may be employed. The separators I, serve not only to space apart the cooling members H, but may be employed also to overcome any tendency toward warping, and when placed at the end, as shown, they close up the opening between the strips, to minimize the loss of water by blowing out of the tower.

If desired, the spacer could be combined with an angle iron, as indicated at I', Fig. 1, thereby enabling the same to be bolted in place.

For giving support to the ends of the members H, might be employed simply supporting angle irons J.

In apparatus of this class, there is sometimes a tendency for the water to be blown endwise along the strips and forced outside of the tower, with a corresponding loss. To avoid this, I have provided horizontal gutters K, located as shown across the ends of the members H, and bolted for convenience to the angle irons J. The water that would otherwise be lost and blown away enters the gutter K, and is therefrom returned to the interior of the tower, by means, for example, of pipe k, leading from the gutters K, as clearly indicated.

In operation, the water pressure in the box e causes an up-flow of water through the pipes e^5 into the trough e^3, which is thereby kept at a uniform fullness or depth. The trough in overflowing is controlled to discharge water at definite points by the capillary rods F, thus sending downwardly a number of streams of water, one or more of which pass to each of the vessels or channel pieces G. These vessels having overflow notches, divide the water into a plurality of further downwardly flowing streams which are seen to strike substantially centrally upon the respective cooling members H, where the water is not only superficially exposed, but is further subdivided into two separate streams. These continue their descent and are further similarly treated, in subsequent cooling decks.

Since the novel trough arrangement may be employed with or without the capillary overflow devices F, I have shown in Fig. 4 a modification in which the capillary rods are replaced by overflow notches F'. Each of these notches is shown as directly above one of the distributing channels G, and as of narrow width. The water flows through the notch as over a weir and thus supplies the channel beneath it. This arrangement is capable of distributing larger quantities of water than a capillary rod arrangement.

By the above described apparatus, the objects heretofore set forth are attained, and other objects as well, which will be obvious to those skilled in the art. It is manifest that many of the details referred to may be indefinitely varied, and some features of invention may be employed without others; wherefore, I do not desire to be restricted to features or details, excepting as set forth in the appended claims:

1. In a cooling tower, means for distributing over the area of the tower the downfall of water to be cooled, the same comprising an elevated water box combined with an open top, longitudinal, overflow trough adjacent said box, the water box having an inlet for a forced flow of water, and a plurality of short passages leading to said trough at spaced points along its length, means to control the overflow from said trough, and transversely arranged members below said trough for completing the water distribution.

2. In a cooling tower, means for distributing over the area of the tower the downfall of water to be cooled, the same comprising an elevated water box combined with an open top, longitudinal, overflow trough adja-

cent said box, the water box having an inlet for a forced flow of water, and a plurality of short passages leading to said trough at spaced points along its length, said passages provided with a downward extension into the box to afford a substantial air trap therein, means to control the overflow from said trough, and transversely arranged members below said trough for completing the water distribution.

3. In a cooling tower, means for distributing over the area of the tower the downfall of water to be cooled, the same comprising an elevated water box combined with an open top, longitudinal, overflow trough adjacent said box, the water box having an inlet for a forced flow of water, and a plurality of short passages leading to said trough at spaced points along its length, said passages provided with upward extensions into the trough to nearly the overflow level, means to control the overflow from said trough, and transversely arranged members below said trough for completing the water distribution.

4. In a cooling tower, means for distributing over the area of the tower the downfall of water to be cooled, the same comprising an elevated water box combined with an open top, longitudinal, overflow trough adjacent said box, the water box having an inlet for a forced flow of water, and a plurality of short passages leading to said trough at spaced points along its length, capillary devices to control the overflow from said trough, and transversely arranged members below said capillary devices for completing the water distribution.

In testimony whereof, I have affixed my signature in presence of two witnesses.

EDWIN BURHORN.

Witnesses:

LOUISE E. BRODE,

ETTA BURHORN.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."