B. H. COFFEY.

COOLING TOWER.

APPLICATION FILED FEB. 24, 1910.

1,027,184.

Patented May 21, 1912.

3 SHEETS—SHEET 1.

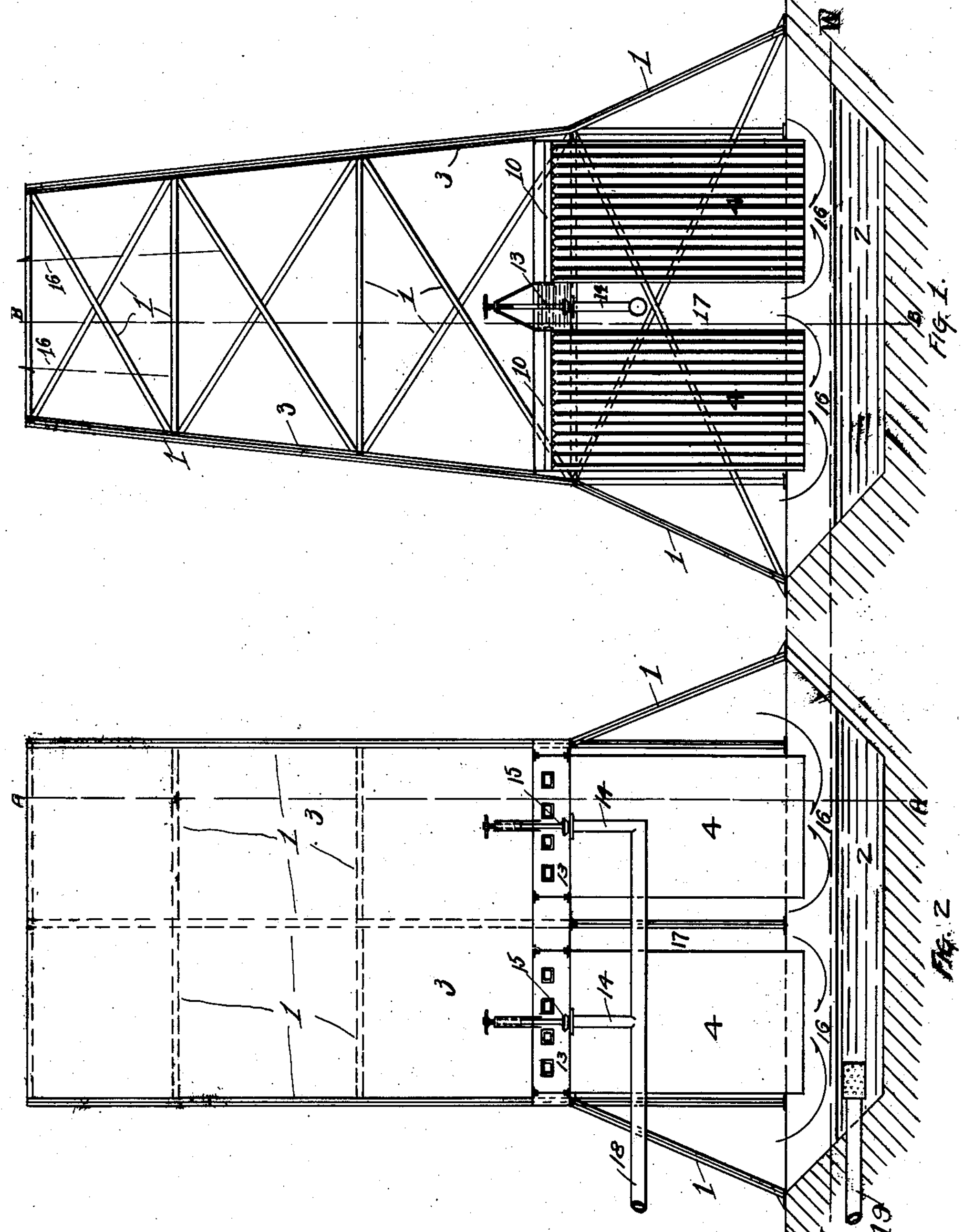

FIG. 1.

FIG. 2.

WITNESSES

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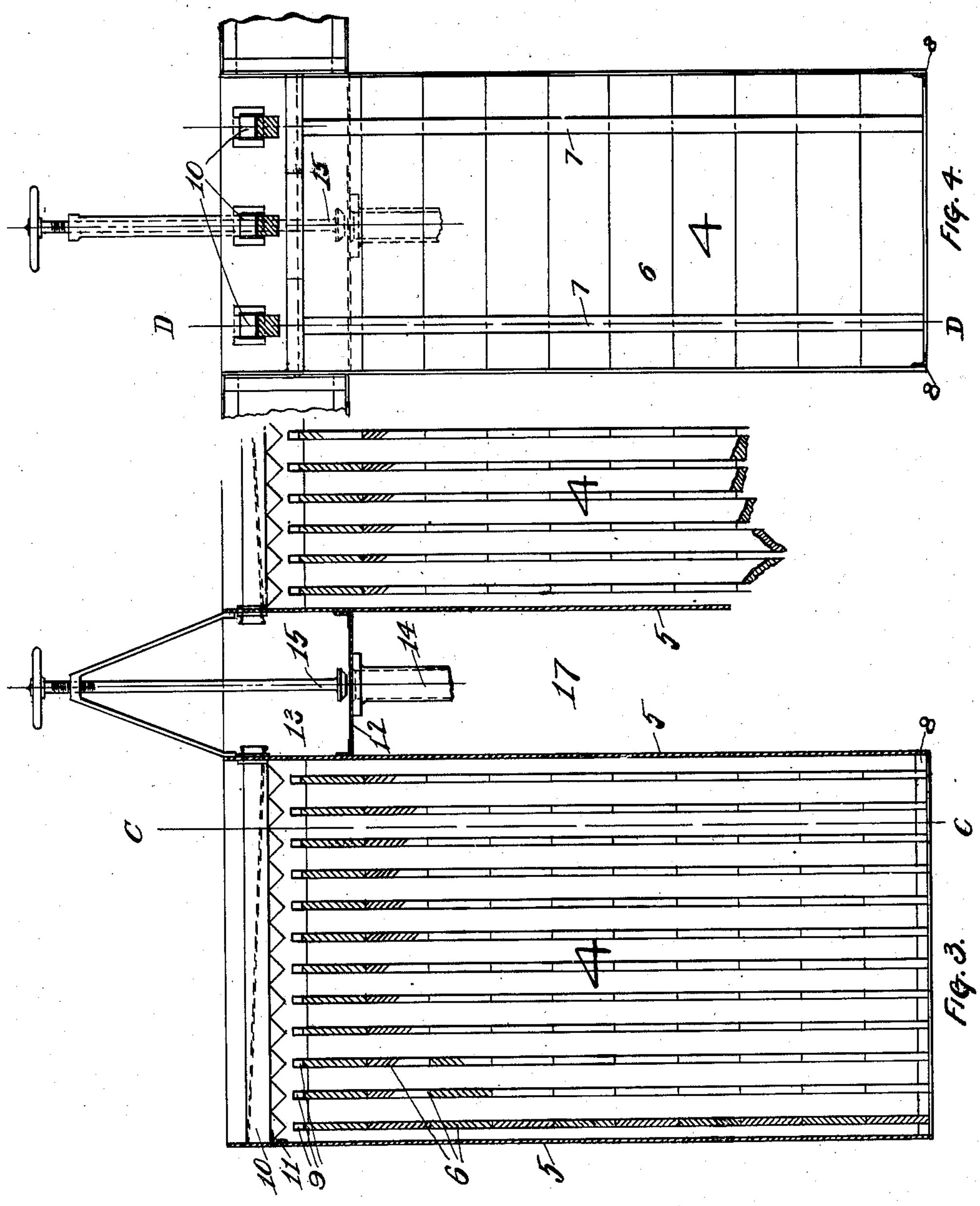

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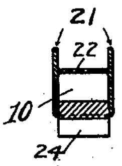

Fig. 7

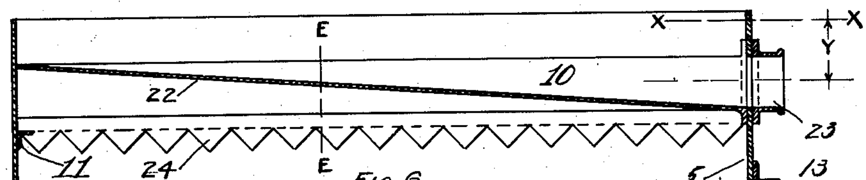

Fig. 6

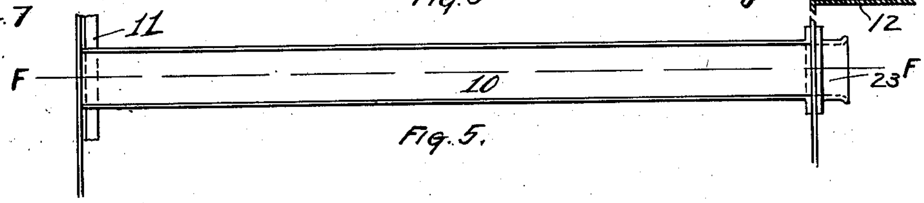

Fig. 5.

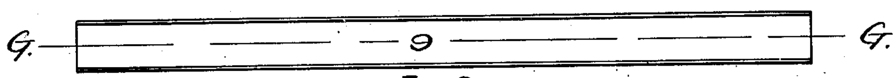

Fig. 8.

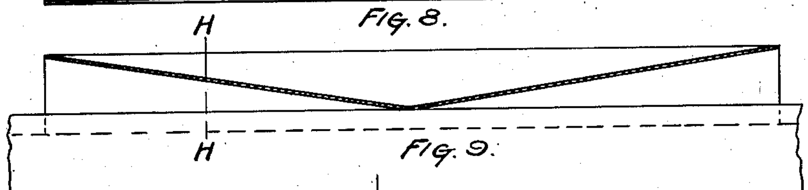

Fig. 9.

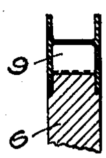

Fig. 10

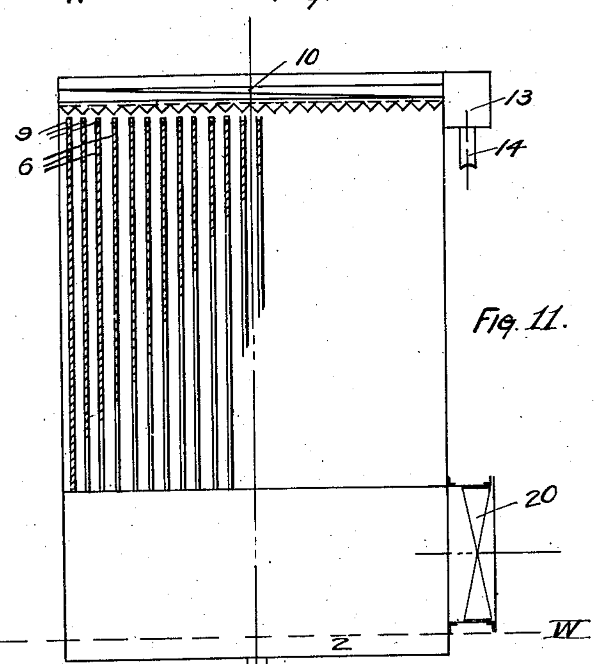

Fig. 11.

WITNESSES

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UNITED STATES PATENT OFFICE.

BARTON H. COFFEY, OF ELIZABETH, NEW JERSEY, ASSIGNOR TO MITCHELL-TAPPEN COMPANY, A CORPORATION OF NEW YORK.

COOLING-TOWER.

1,027,184. Specification of Letters Patent. **Patented May 21, 1912.**

Application filed February 24, 1910. Serial No. 545,762.

To all whom it may concern:

Be it known that I, Barton H. Coffey, a citizen of the United States, residing at Elizabeth, in the county of Union and State of New Jersey, have invented a new and useful Cooling-Tower, of which the following is a specification.

My invention relates to improvements in cooling towers, with special reference to the cooling surfaces and distributers.

Cooling-towers may be divided into three general types; atmospheric, natural draft, and forced draft, to all of which my improvements apply.

As the efficiency of a cooling-tower depends upon bringing a maximum volume of air at maximum practical velocity, in contact with a maximum area of liquid surface, it follows that the mechanical perfection of the devices for producing the above conditions, determine the efficiency of the apparatus.

An ideal cooling surface should be so arranged that while presenting the maximum possible exposure of liquid surface, it should occasion a minimum resistance to the passage of air currents. Tortuous passages and abrupt turns should be avoided, and maximum area of air passage consistent with maximum exposure should be sought. Practical considerations are minimum weight, freedom from corrosion, accessibility for cleaning and repairs, economy in cost, etc. An ideal distributing system should be capable of spreading the liquid evenly over the cooling surfaces, at all rates of flow within the limits of the apparatus. If this is not accomplished there will obviously be a concentration of flow at certain points and a corresponding diminution at others; resulting in a decreased ratio of exposed liquid surface to weight of liquid passing, and a consequent fall in efficiency. If dry spots appear in the cooling surfaces, the entire capacity of the tower is reduced in the proportion these spots bear to the total area of cooling surface. Most systems of distribution are imperfect on general hydraulic principles, and when to this is added clogging from suspended matter, their faults are greatly exaggerated. Small perforations, slots and notches are commonly employed, giving trouble from clogging unless the liquid is very pure.

The object of my invention is to provide more perfect cooling surfaces and distributers on the principles as outlined above.

Reference being now had to the drawings, Figures 1 and 2 are respectively transverse and longitudinal sectional elevations of a natural draft tower embodying my improvements, Fig. 1 being taken on line A—A of Fig. 2, and Fig. 2 on line B—B of Fig. 1. Fig. 3 is a detail vertical sectional view of my cooler, embodying my improved distributers and cooling surfaces, taken on line D—D of Fig. 4. Fig. 4 is a sectional elevation of Fig. 3 on line C—C. Fig. 5 is a plan of my primary distributer, showing it attached to the launder. Fig. 6 is a longitudinal section of Fig. 5 on line F—F. Fig. 7 is a cross section on line E—E Fig. 6. Fig. 8 is a plan of my secondary distributer. Fig. 9 a longitudinal section of Fig. 8 on line G—G, and Fig. 10 a cross-section of Fig. 9 on line H—H. Fig. 11 is an elevation partly in section showing my devices applied to a forced draft tower.

In all views similar figures refer to the same part.

Considering Figs. 1 and 2—1 is the framing supporting the entire structure, properly braced for wind pressure and dead load, it can be either of structural steel or timber, and is footed on the ground outside the receiving basin 2, as shown. 3 is a sheathing inside the framework, of boards or corrugated steel, extending from the top of the tower to the coolers 4. The plans show the tower made up of four coolers, though it is obvious the number may be increased or diminished as occasion requires.

The coolers 4 are shown in greater detail in Figs. 3 and 4. They consist of a rectangular shell 5, preferably of metal, open at both bottom and top. The shell is filled with vertical parallel partitions 6 preferably of wood, spaced uniformly by the separators 7, and supported by the angles 8. The top of each partition supports a series of secondary distributers 9, which will be described in greater detail later on. Crossing the top of the partition at right angles, are a series of primary distributers 10, supported at one end by the angle 11 and at the other end by a flange bolted to the shell 5, which has an opening, of section similar to the distributer at this point. The adjacent sides of the shells 5 of a pair of coolers together with the plate 12 form a gutter or launder 13, which is made water-tight. Liquid is supplied through the pipe 14 and the flow controlled by the valve 15.

Returning to Figs. 1 and 2, it will be obvious that the separation of the four coolers by the spaces 17, gives the air currents 16 unimpeded entry at their lower ends from the four sides of each cooler. The air passes up between the partitions 6, becomes heated, enters the upper portion of the tower which forms a chimney and so a draft is produced to maintain the current. The liquid to be cooled enters at the pipe 18, is distributed to the launders 13 by the branch pipes 14, from thence it flows into the primary distributers 10, from thence to the secondary distributers 9, thence down the cooling surfaces or partitions 6, from which it falls in the basin 2, which is maintained at the level W—W and finally escapes from the system by the pipe 19. The application of these devices to a forced draft tower is shown at Fig. 11 in which the draft is mechanically produced by the fan 20 and the chimney eliminated. The functions of all other parts are substantially as above described. Referring particularly to Figs. 5, 6, and 7, the distributer is essentially a rectangular gutter composed of two parallel sides 21 joined by an inclined bottom 22. Bolted on the side of the launder 13 is the nozzle 23 registering with the opening in the plate 5 which corresponds with the open end of the distributer 10. The theory is as follows. If the water level in the launder is X—X, then the entry head into the nozzle will be Y, and water will enter with a velocity due that head. If the gutter was of uniform section and frictionless, the flow would continue indefinitely at this velocity without pressure head and without any rise or fall of level in the gutter, and there would be consequently no flow over the edges. The gradual contraction of area however, due to the inclined bottom, produces a pressure head in the stream and a consequent rise in level which is uniform along the entire length of the gutter, thus producing an even overflow along the edges, and this overflow will be uniform with variable velocities of entry. The water flowing down the sides 21, comes in contact with the serrated piece 24 and drops off the points into the secondary distributers 9 (see Fig. 3).

The principle of action in the secondary distributers Figs. 8, 9 and 10 is similar to that described above. The bottom is inclined in both directions as the water enters at the center (see Fig. 4) in other respects the construction is identical with the primary distributers, and will be clearly understood from the drawings without further description. It will be obvious that these distributers are applicable to the top or distributing deck of atmospheric towers, in which the water showers down from deck to deck, and is cooled by horizontal air currents.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is,

1. In a natural draft cooling-tower, open ended shells containing the cooling surfaces, arranged in pairs, whereby the shells form two walls of the distributing launder, substantially as described.

2. In a cooling device, a distributer having an open top gutter section of gradually decreasing depth and unbroken side walls.

3. In a cooling device, a distributer having an open top gutter section of gradually decreasing depth in combination with an inlet nozzle, registering with an opening at the end of the distributer, substantially as shown and described.

4. In a cooling-tower, a distributer having an open top gutter section of gradually decreasing area, in combination with a serrated drip-bar, substantially as described.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses, on the 21st day of February, 1910.

BARTON H. COFFEY.

Witnesses:

A. BOULOGNE,

LOUIS A. PHILLIPS.