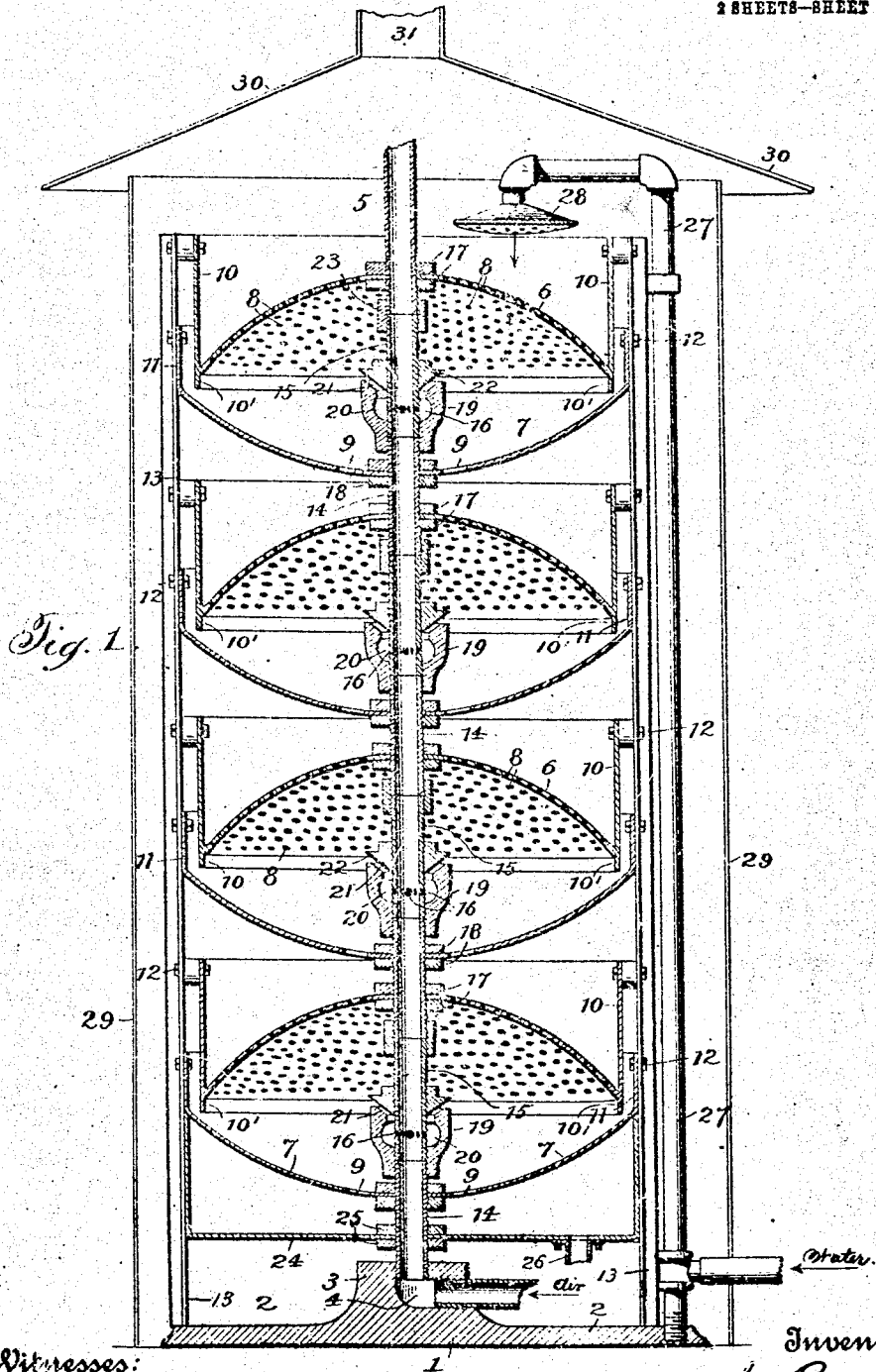


J. W. BECK.
COOLING TOWER.
APPLICATION FILED APR. 18, 1906.

969,743.

Patented Sept. 6, 1910.

2 SHEETS—SHEET 1.



Witnesses:

Jas. Hutchinson
F. R. Fitter

Inventor

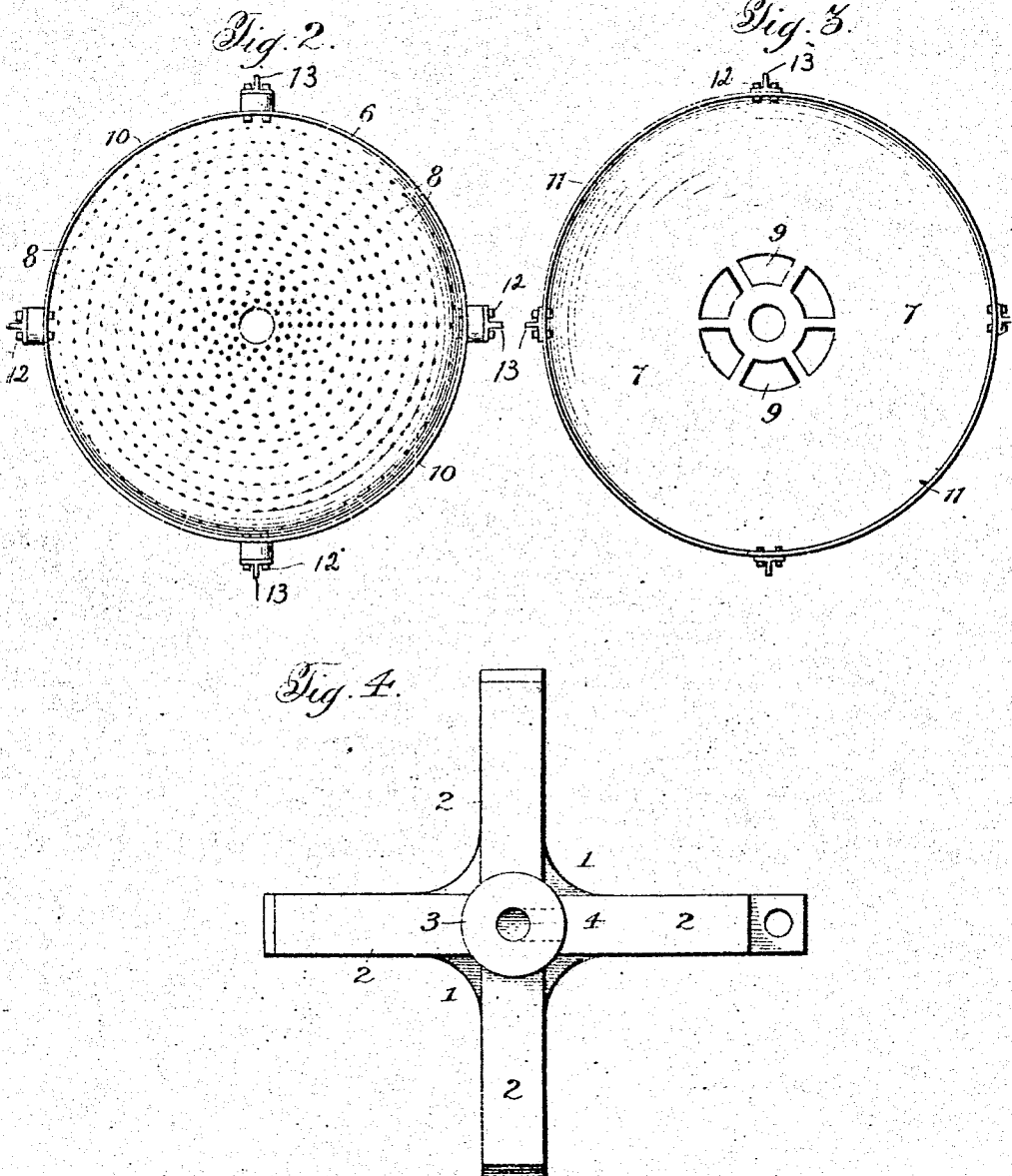
Joseph W. Beck
By *C. C. Conwell* Attorney

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James Hutchinson
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Inventor:
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UNITED STATES PATENT OFFICE.

JOSEPH WILLIAM BECK, OF CINCINNATI, OHIO, ASSIGNOR OF ONE-HALF TO JOHN C. METZGER, OF CINCINNATI, OHIO.

COOLING-TOWER.

969,743.

Specification of Letters Patent.

Patented Sept. 6, 1910.

Application filed April 18, 1906. Serial No. 312,472.

To all whom it may concern:

Be it known that I, JOSEPH W. BECK, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Cooling-Towers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in cooling towers, and is more particularly designed for cooling water.

The object of the present invention is the provision of a tower of the character mentioned, whereby water may be speedily cooled and reduced to a low temperature with the highest degree of economy, and which tower will occupy but minimum space.

A further object sought to be accomplished is the provision of a cooling tower designed to be operated absolutely independently of atmospheric conditions, thus enabling the tower to be employed in various localities regardless of the temperature, and providing a tower designed for use as effectually within a building as at the exterior thereof.

The invention also seeks to provide a cooling tower wherein a cooling agent under compression is employed, and in which is embodied efficient means for the most effectual utilization of the cooling agent with a proportionately small expenditure of fuel in handling the water.

The invention further aims to provide a self-contained tower the construction of which is such as to effectually prevent splashing of the water from the tower in its transit therethrough.

With these general objects in view, and others which will appear as the nature of the improvements is better understood, the invention consists substantially in the novel construction, combination and arrangement of parts, as will be hereinafter fully described, illustrated in the accompanying drawings, and pointed out in the appended claims.

While the form of the invention herein shown and described is what is believed to be a preferable embodiment thereof, it is obvious that the same is susceptible of vari-

ous changes in the form, proportion, and minor details of construction, and the right is accordingly reserved to modify or vary the invention as falls within the spirit and scope thereof.

In the drawings—Figure 1 is a vertical transverse sectional view of a cooling tower constructed in accordance with and embodying the herein-described invention. Fig. 2 is a top plan view of one of the distributing pans. Fig. 3 is a similar view of one of the collecting pans. Fig. 4 is also a top plan view of the supporting base.

Referring in detail to the drawings, the numeral 1 designates the supporting base of the herein-described tower, said base being preferably of cast-iron, and including a series of radially-extending supporting feet 2, whereby the base will be firmly held in position. The base 1 is provided at its central portion with a hub 3, provided with an angular passage 4, which latter extends from one side of the hub 3 and terminates at the center of the latter and at the top thereof. Threaded into the upper end of the passage 4 is a vertically-extending pipe 5, which pipe is designed to convey the cooling agent to be hereinafter referred to, and to supply the pipe 5 with said cooling agent a pipe may be connected with the lower end of the passage 4 to convey the cooling agent from a suitable source. Arranged at spaced intervals along the pipe 5 is a plurality of distributing pans 6, and arranged in alternate relation with the distributing pans 6 is a plurality of collecting pans 7. The distributing and collecting pans 6 and 7 may be formed of sheet iron or copper, the distributing pans being of convex shape and having a multiplicity of perforations 8 formed therein so that the water passing from the distributing pans may be broken up into a large number of small jets, and thereby be more susceptible to the action of the cooling agent. The collecting pans are of concave shape, said pans being imperforate, but formed at the central portion thereof is an annular series of openings 9, whereby the water collected by said pans will be concentrated at the central portion thereof and discharged through the openings 9 upon the central portions of the distributing pans below. Each of the distributing pans 6 is provided with a comparatively high peripheral flange 10, the upper edges of said flanges extending fit a

point considerably above the crest of the pans, and it will thus be seen that each of the collecting pans has a considerable capacity for containing the water discharged therein. The collecting pans 7 are likewise provided with peripheral flanges 11, which flanges extend upwardly to a point beyond the adjacent lower edge or periphery of the distributing pans 6. It will also thus be seen that the flanges of the collecting pans overlap and project beyond the distributing pans, whereby a confined space is provided between each of the collecting pans and the distributing pan immediately thereabove. By reason of this construction the water in its transit through the tower, and from one distributing pan to the collecting pan immediately beneath, will be confined within the limits of the tower and splashing of the water from the pans will be effectually prevented. The distributing pans 6 are also provided with downwardly-extending guard flanges 10, and these flanges will prevent the water, as it discharges from said pans, flowing over the edges thereof and splashing. The flanges 10 and 11 of the distributing and collecting pans are also suitably connected, as by bolts 12, or their equivalent, to vertical standards 13, which standards may be formed of angle or T-iron, and thus the edges of the respective pans are firmly supported, as well as providing a self-contained structure.

The pipe 5, which conveys the cooling agent, in the present instance air under compression, passes upwardly through the centers of the distributing and collecting pans, and it will be noted that said pipe is formed of a series of sections. Of the latter a portion 14 supports the distributing and collecting pans, while the alternate sections 15 are perforated, as at 16, for discharging the cooling agent into the spaces between each of the collecting pans 7 and the distributing pans 6. The exterior of each of the supporting sections 14 is screw threaded, and mounted thereon are two sets of lock nuts 17 and 18, the lock nuts 17 embracing the upper and lower sides of the distributing pans 6, while the nuts 18 embrace the upper and lower sides of the collecting pans 7, thus firmly connecting said pans to the pipe 5. Each of the discharge sections 15 is also exteriorly screw-threaded for a portion of its length, the lower ends of said sections being threaded into a valve chamber 19, which latter in turn is threaded upon the upper end of the supporting sections 14, and each of said valve chambers thereby forms a coupling for connecting the discharge sections 15 with the supporting sections 14. Each of the valve chambers 19 is provided with an internal cavity 20 for the reception of the air discharged from the perforations 16, and the upper end of each of said cham-

bers is also provided with a flared mouth 21 with which cooperates a conical valve 22 threaded upon the immediately contiguous discharge section 15. By reason of the threaded connection of the valves 22 with the sections 15 it is obvious that adjustment of said valves upon said sections toward and away from the valve chambers may be readily effected, whereby the mouth 21 through which the cooling agent discharges may be varied in size in accordance with the volume of air which is required for cooling the water.

The valve chambers 19 and their respective valves 22 constitute a series of nozzles, one of which is placed between each of the collecting pans and the distributing pan immediately thereabove, and by reason of the formation of the valves 22 and the valve chambers 19 it will be seen that the air discharging from these nozzles will be in a sheet or film of inverted conical shape. By reason of this the air will be projected across the path of the water as the latter drops from the distributing pan 6, and consequently, the water being divided into a series of fine jets or streams, the water will be effectually cooled, the minute streams being more susceptible to the cooling effect of the air, and thus effectually being freed of the heat units therein. The upper ends of the discharge sections 15 and the lower ends of the supporting sections 14 are connected by coupling sleeves 23.

At the lower end of the tower is arranged a reservoir 24, which latter is supported upon the pipe 5 by means of lock nuts 25, and said reservoir is also connected to the standards 13. The water, therefore, after being cooled in its transit through the tower will be collected in the reservoir 24 from which it may pass by a discharge pipe 26 to the point of use. If the tower be elevated to a sufficient height the water will readily discharge through the pipe 26 by gravity, but if in a plane below the point of use a pump may be connected to the reservoir for drawing the cooled water therefrom.

A water supply pipe 27 may be supported on one of the feet 2 of the base 1, the upper end of said pipe overhanging the upper distributing pan 6 and having a discharge nozzle 28, whereby the water may be fed into said pan from said pipe. By so positioning the supply pipe 27 the tower is complete, and when set up for use it is only necessary to connect the passage 4 with the source of the cooling agent, and the pipe 27 with the source from which the heated water is taken to be led to the tower.

Under some conditions it is necessary to incase the herein-described cooler so that the evaporated moisture will be carried off, and not permitted to become deposited upon

machinery. This is especially true when the cooler is used in a room with machinery, and to the accomplishment of this end a jacket 29 is employed. This jacket is preferably made in sections and extends as high as the top distributing pan 6, and it will thus be seen that the moisture passing between the distributing and collecting pans will be held within the confines of the jacket. The latter may be made of any desired material, and its sectional construction will render the same to be readily removed should occasion require. In conjunction with the jacket 29 a hood 30 is arranged above the same to inclose the top of the cooler, said hood overlapping the upper end of the jacket and being provided with an uptake 31 whereby the moisture may be conveyed from the jacket. This uptake may be connected with the atmosphere, or discharged to some other suitable point.

In the operation of the herein-described tower the heated water will discharge from the nozzle 28 upon the upper distributing pan 6. By reason of the convexity of this pan the water will readily flow over the surface thereof, and accumulate within said pan, whence it discharges through the perforations 8 upon the collecting pan 7 immediately below. In passing from the distributing pan 6 to the collecting pan 7 the minute streams of water encounter the film or sheet of the compressed air, as the latter discharges from the air nozzle immediately above the collecting pan, and consequently the initial cooling under the influence of the air is effected. The air being under pressure is projected to the periphery of the tower structure, and thus effectually acts upon all of the water, but the latter is prevented splashing from the pans by reason of the upwardly-extending flanges thereon. As the water falls upon the collecting pan 7 the concave shape of the latter causes the water to flow down to the central portion of the pan, and at this point the water passes through the openings 9 to the central portion of the distributing pan 6 beneath said collecting pan. Here the water is again broken up into a multiplicity of small streams, dropping from the distributing pan which it has encountered, and falling to the collecting pan below. The water is a second time acted upon by the compressed air in its transit from the second distributing pan to the second collecting pan, and this operation continues through the entire height of the structure from the top to the bottom, the number of the distributing and collecting pans being determined in accordance with the volume of water which it is desired to cool, and the temperature to which it is desired to reduce the water. Furthermore, the pressure of the air is likewise gaged, as well as the volume issuing from the respective

nozzles, by the conditions just referred to, and by simply adjusting the valves 22 in relation to the chambers 19, the volume of the discharge may be readily changed to suit the conditions.

While the tower has been described for use in cooling water, it is perfectly obvious that the same may be employed for cooling other liquids, and the invention is therefore not restricted to employment with water alone.

Having thus described the invention, what is claimed as new, and desired to be secured by Letters Patent, is—

1. A cooling tower of the class described, comprising a plurality of distributing pans, a plurality of collecting pans associated therewith and alternately arranged with respect to the distributing pans, whereby each of the collecting pans is adapted to receive the drip from the distributing pan immediately above, and means arranged intermediate the edges of the distributing and collecting pans for subjecting the drip in the transit of the liquid through the tower to the action of a cooling agent projected under pressure in an inverted conical sheet across the path of the drip.

2. A cooling tower of the class described, comprising a plurality of distributing pans, a plurality of collecting pans associated therewith and alternately arranged with respect to the distributing pans, whereby each of the collecting pans is adapted to receive the drip from the distributing pan immediately above, each of the distributing and collecting pans having peripheral flanges, the flanges of the collecting pans overlapping the distributing pans to prevent splashing of the water therefrom, and means for subjecting the drip in the transit of the liquid through the tower to the action of a cooling agent.

3. A cooling tower of the class described, comprising a plurality of distributing pans, a plurality of collecting pans associated therewith and alternately arranged with respect to the distributing pans, whereby each of the collecting pans is adapted to receive the drip from the distributing pan immediately above, a pipe passing through the distributing and collecting pans for conveying a cooling agent, and nozzles carried by said pipe and arranged in the spaces between each of the collecting pans and the distributing pan thereabove for directing the cooling agent across the path of the drip in the transit of the liquid through the tower, each of said nozzles comprising a valve chamber, and a valve adjustable relatively thereto.

4. A cooling tower of the class described, comprising a plurality of convex distributing pans, a plurality of concave collecting pans associated therewith and alternately arranged with respect to the distributing

5 pans, whereby each of the collecting pans is adapted to receive the drip from the distributing pan immediately above, each of the distributing and collecting pans being 5 provided with flanges, the flanges of the collecting pans overlapping the distributing pans to prevent splashing of the liquid from the pans, a pipe passing through the distributing and collecting pans for conveying 10 a cooling agent, and nozzles carried by said pipe and arranged in the spaces between each of the collecting pans and the distributing pan thereabove for directing the cooling agent across the path of the drip in the 15 transit of the liquid through the tower.

5. A cooling tower of the class described, comprising a plurality of convex distributing pans, a plurality of concave collecting pans associated therewith and alternately 20 arranged with respect to the distributing pans, whereby each of the collecting pans is adapted to receive the drip from the distributing pan immediately above, each of the distributing and collecting pans being 25 provided with flanges, the flanges of the collecting pans overlapping the distributing pans to prevent splashing of the liquid from the pans, a pipe passing through the distributing and collecting pans for conveying 30 a cooling agent, and nozzles carried by said pipe and arranged in the spaces between each of the collecting pans and the distributing pan thereabove for directing the cooling agent across the path of the drip in the 35 transit of the liquid through the tower, each of said nozzles comprising a valve chamber, and a valve adjustable relatively thereto.

6. A cooling tower of the class described, comprising a supporting base, a pipe connected thereto and projecting upwardly 40 therefrom for conveying a cooling agent, said pipe being formed of a plurality of supporting and discharging sections, a plurality of collecting and distributing pans 45 carried by the supporting sections of said pipe and alternately arranged relatively to each other, whereby the collecting pans are adapted to receive the drip from the dis-

tributing pans, and means associated with the discharging sections of said pipe to 50 direct the cooling agent therefrom across the drip in the transit of the liquid through the tower.

7. A cooling tower of the class described, comprising a supporting base, a pipe connected thereto and projecting upwardly 55 therefrom for conveying a cooling agent, said pipe being formed of a plurality of supporting and discharging sections, a plurality of collecting and distributing pans 60 carried by the supporting sections of said pipe and alternately arranged relatively to each other, whereby the collecting pans are adapted to receive the drip from the distributing pans, means associated with the 65 discharging sections of said pipe to direct the cooling agent therefrom across the drip in the transit of the liquid through the tower, and a reservoir arranged at the bottom of the tower for receiving the cooled 70 liquid from the bottom collecting pan.

8. A cooling tower of the class described, comprising a supporting base, a pipe connected thereto and projecting upwardly 75 therefrom for conveying a cooling agent, said pipe being formed of a plurality of supporting and discharging sections, a plurality of collecting and distributing pans carried by the supporting sections of said 80 pipe and alternately arranged relatively to each other, whereby the collecting pans are adapted to receive the drip from the distributing pans, means associated with the discharging sections of said pipe to direct the 85 cooling agent therefrom across the drip in the transit of the liquid through the tower, and a pipe carried by said base and extending over the top of the tower for discharging the liquid to be cooled into the tower.

In testimony whereof I affix my signature, 90 in the presence of two witnesses.

JOSEPH WILLIAM BECK.

Witnesses:

CHARLES NUHRING,
WILLIAM NUHRING.