No. 621,718. Patented Mar. 21, 1899.

J. M. SEYMOUR, JR.

WATER COOLING TOWER.

(Application filed Jan. 26, 1899.)

(No Model.)

Fig. 1.

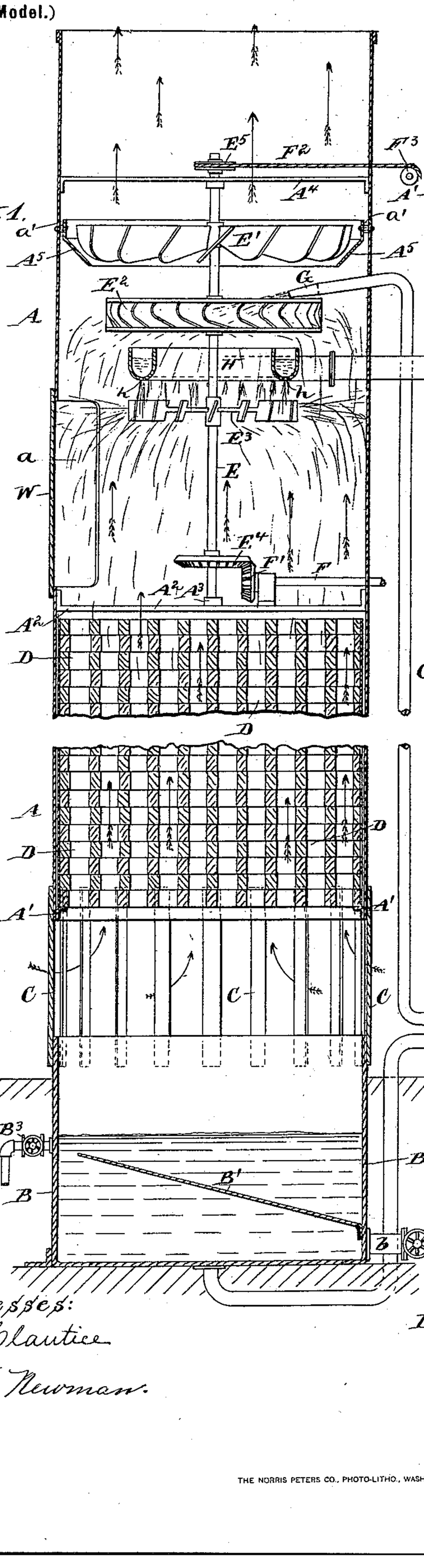
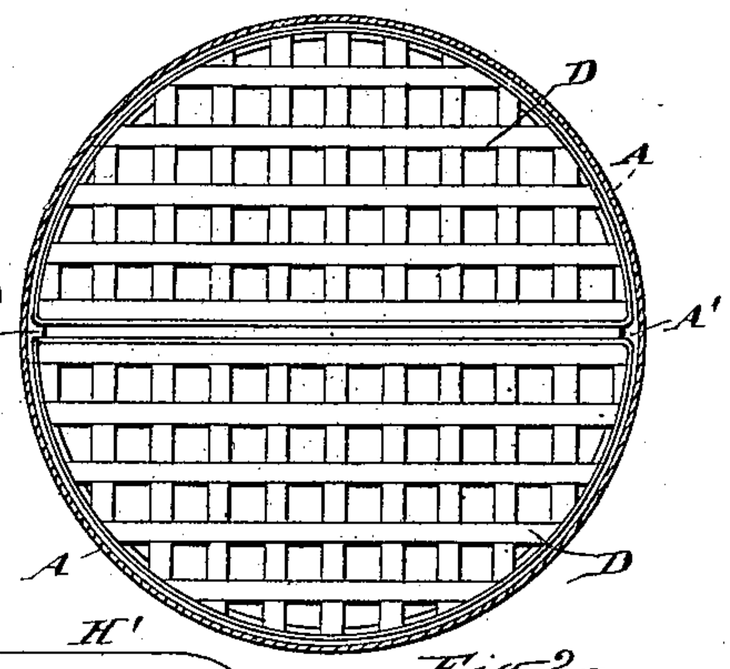


Fig. 2.



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JAMES M. SEYMOUR, JR., OF NEWARK, NEW JERSEY.

WATER-COOLING TOWER.

SPECIFICATION forming part of Letters Patent No. 621,718, dated March 21, 1899.

Application filed January 26, 1899. Serial No. 703,432. (No model.)

To all whom it may concern:

Be it known that I, JAMES M. SEYMOUR, Jr., a citizen of the United States, residing at Newark, Essex county, in the State of New Jersey, have invented a certain new and useful Improvement in Water-Cooling Towers, of which the following is a specification.

The invention is intended more particularly for moderately cooling the large quantities of condensing-water required to maintain the vacuum in the use of low-pressure engines where only a limited supply of water is available and will be so described. The same water is used continuously, first being injected or allowed to play in some convenient manner in contact with the exhaust-steam or with the thin metal of the pipes in which the steam is contained and is afterward introduced in the top of my tower and allowed to descend therein, meeting a current of fresh air from the outside, which is caused to move up the tower. A large amount of surface presented by the water allows the air to cool it very effectively. A small quantity of water is evaporated during each treatment and is carried away by the warmed air as it flows out into the atmosphere. This slight source of loss being made up by a supply from a spring or by pumping from a well, the operation can be carried on indefinitely. Many efforts have been made to attain this end. My invention cools the water with peculiar efficiency and economy.

My improvement lies in the details of the construction.

The accompanying drawings form a part of this specification and represent what I consider the best means of carrying out the invention.

Figure 1 is a central vertical section of the upper and lower portions, the middle portion, which is broken out, being like the adjacent portions of the figure. Fig. 2 is a horizontal section near the mid-height of the tower.

Similar letters of reference indicate corresponding parts in both the figures where they appear.

A is the main body of the tower, mainly a cylindrical shell of sheet metal. B is a corresponding reservoir of stouter iron sunk in the earth, and C C are bars of iron or low steel riveted or bolted in place and supporting the shell A upon the reservoir B, with ample space to allow the entrance of air on all sides to flow up through the interior of the tower.

D D are gratings or frames of thin wood matched together, formed each of semicircular outline and of a size to form a half-floor of the tower. These are all superposed one upon another, the lowermost supported by sufficient internal projections or ribs A'. There should be considerable height—say twenty (20) feet or more—of the body of the tower filled with these frames or gratings. They are matched so that the rectangular spaces between their parts coincide and allow the air to rise smoothly with little resistance through the small spaces thus provided in liberal numbers over nearly the whole area of the cross-section of the tower.

A^2 is a narrow girder of iron extending across the interior of the tower just above the series of gratings. This girder may be riveted or otherwise permanently secured in the interior of the tower A and carries a step A^3, which receives the lower end of an upright shaft E, which performs important functions. This step may be equipped with ball-bearings. A corresponding girder A^4 extends across the interior of the tower above and steadies the upper end of the shaft.

E′ is a screw-fan wheel of nearly the full diameter of the interior of the tower. This wheel and also an open-work water-wheel E^2 are each firmly fixed on the shaft E and revolve with it. There is an annular construction A^5, of sheet metal, in the form of a frustum of an inverted cone riveted or otherwise secured in the interior of the tower immediately below this screw-fan and which serves to promote its efficiency in exhausting the air from the tower below. An annular space a' is maintained between this conical casing and the interior of the tower, through which moisture condensed from the damp air above may flow down past the fan E.

The water-wheel receives motion from a small but powerfully-urged jet of water entering through a nearly tangential pipe G, which latter receives the water from a steam-pump or other water-forcing agency G′.

H is a complete or nearly complete annular cup supported by slings or otherwise in the tower and having a series of holes h in its bottom. This communicates through a pipe H′ with the hot-well I of a low-pressure steam-engine, (not fully shown,) the air-pump K of

which maintains the vacuum in the condenser L and impresses on the water in the hot-well the gentle force required to lift it into the annular cup H and allows it to be discharged downward in jets.

E^3 is an open-work distributing-wheel fixed on the same shaft E a little below the ring-cup H and carrying radial arms, with blades adapted to strike and be struck by the several jets descending from the orifices *h*. By placing these radial arms and moderately-inclined blades thereon sufficiently close together nearly all of the water from the jets is intercepted and scattered with practical uniformity over the topmost of the gratings D, from whence it descends, keeping all the gratings or frames wet and presenting the water favorably to the cooling action of the air, which travels upward through the great number of continuous rectangular spaces presented by the series of gratings superposed to reach the screw-fan E′ and be gently driven out thereby.

E^4 is a bevel gear-wheel keyed on the shaft E, and F′ is a bevel gear-wheel engaged therewith carried on the shaft F, extending out through the side of the tower. E^5 E^5 is a grooved pulley keyed on the same upright shaft E at a convenient point above the upper girder A^4 and receiving an endless wire cord F^2, running through holes in the tower over guide-pulleys F^3 and thence around a grooved pulley outside. (Not shown.) Such pulley and the shaft F are revolved by suitable ordinary connections from the main engine or by other convenient means, and the devices contribute to insure the efficient rotation of the screw-fan E′ to draw up the cold air and of the devices E^2 E^3 for distributing the hot water over the extended surfaces D exposed to its influence.

W is a door arranged to close the aperture *a*, provided in the side of the tower A, opening into the liberal space between the distributing-wheel E^3 and the girder A^2. At long intervals this door should be opened and the semicircular gratings or frames D taken out and cleaned, repaired, or exchanged.

I attach importance to the arrangement of the parts so that there is a clear space adjacent to the door and on each side of the shaft E and supporting-girder A^2 through which the gratings D can by properly operating be introduced and removed when required.

B′ is a plate held in the reservoir B in the inclined position represented, with the pipe which conveys the cool water away communicating with the space under the lowest point in this plate. It tends to promote the separation of the oil and emulsion which may be in the water. The oily portions tend to rise by their levity. This plate insures that the water for a considerable distance from the discharge-orifice is quiescent and entirely protected from the disturbance due to the dripping and splashing of water at the surface. Any oily particles rising in the lower portion of the reservoir may be gathered together and allowed to creep up the slightly-inclined under surface of this plate, finally rising therefrom to the surface of the water.

B^2 is a pipe controlled by a cock B^3, arranged for drawing off the oily material at intervals.

The arrangement of the passage *b*, which takes away the cooled water, insures that the water is in the condition of greatest purity least likely to be accompanied by oily particles.

I attach importance to the arrangement of the screw-fan E′ in the top of the tower, for the reason that the air is caused to move upward undisturbed and therefore with less resistance from the several frames than if it is driven by a fan below and is therefore thrown into a great number of actively-whirling streams and also because it makes a partial vacuum in the body of the tower, and thereby promotes the evaporation of the water.

Modifications may be made without departing from the principle or sacrificing the advantages of the invention. It will be understood that the water strongly forced by the pump G′ to act on the water-wheel E^2 is a portion of the hot water which requires to be cooled. The proportion between this and the quantity which is discharged gently through the ring H and orifice *h* may be varied within wide limits. I propose under ordinary circumstances to deliver, say, one-fifth of the water thus strongly pumped and serving as a motive force to rotate the shaft E. A less quantity may serve if vigorously driven, and a much larger quantity may be thus used. In the latter case it may be at less pressure, and consequently with the expenditure of less force in pumping it. The tower A may be continued higher, if necessary, as when the delivery is between high buildings. The upper portion may in such case be made of lighter metal. Instead of the open cup H the upper side of this portion, whether it is a complete ring or of a horseshoe form, may be tightly closed. I prefer the open top because it allows more liberally for relieving the engine in case there should be for short periods more water than usual delivered from the hot-well. The water in excess of that required for the streams descending from the orifices *h* may spill freely over the sides of the annular cup.

Parts of the invention can be used without the whole. I can substitute various other forms of open-work or various forms of tiles for the semicircular gratings or frames D. The condenser and air-pump may be placed lower relatively to the cool-water tank B, or the latter may be mounted higher, so that the gravity of the water shall aid to move it into the condenser when there shall be a period at the commencement or at any other time when there is not sufficient vacuum in the latter to draw it, or the condenser and air-pump may be higher, thus raising the water

a considerable portion of the total lift by means of the vacuum in the condenser. Instead of the standard old-fashioned condenser and scatter-plate and the air-pump with valved bucket other forms of these parts of a condensing steam-engine, including many or all varieties of tubular condensers and double-action air-pumps, may be used. Instead of the three means of driving the shaft E any two of them or one alone may serve.

I claim as my invention—

1. The combination with a water-cooling tower, of an exhaust-fan and motor-wheel therefor both located in the upper part of the tower, and a hot-water pipe connecting with the tower and arranged to discharge against and impel the wheel, said motor-wheel being arranged to subdivide and distribute the hot water which drives the same so as to expose the said water through the tower to the upward current of air induced by the said fan, substantially as herein specified.

2. The combination with a water-cooling tower, of an exhaust-fan and hot-water supply in the upper portion a series of removable open-work flat frames or gratings one of whose horizontal dimensions is equal to or exceeds the radius of the said tower arranged below said fan and water-supply, and provisions for removing and exchanging such frames, all arranged for joint operation substantially as herein specified.

3. In combination with a water-cooling tower A and air-exhausting fan E′ and operating means therefor, the removable open-work flat frames D, made each circular in two separate parts adapted to match together and extend over the whole interior of the tower when in use, and to allow each half to be easily turned into an inclined or upright position for insertion and removal, all substantially as herein specified.

4. In combination with a tower, an exhaust-fan near the top of said tower, and a hot-water discharge below the said fan, a cone-frustum A^5 arranged annularly within the tower and around the fan so as to facilitate the action of the fan in lifting the air and leaving a narrow annular space *a′* to allow the water condensed above to flow unobstructedly down past the fan in such annular space, all substantially as herein specified.

5. The combination with a water-cooling tower having an upper hot-water communication and a base tank or reservoir provided with a cool-water discharge, of an inclined plate in said tank extending upwardly from above said discharge to conduct lighter particles as of oil away from the same, substantially as herein specified.

6. The combination with a water-cooling tower, of inclosed open-work frames or gratings having registering apertures forming continuous passages through which the air may move without resistance, said frames being removable, substantially as herein specified.

7. The combination with a water-cooling tower having an exhaust-fan and driving-motor therefor located in the upper part thereof, of a water-pipe and connections arranged to discharge water forcibly to impel the motor, and a larger pipe also delivering hot water but with less force to the upper part of the tower, substantially as herein specified.

8. The combination with a water-cooling tower having an exhaust-fan and driving-motor therefor located in the upper part thereof, of a water-pipe arranged to discharge against the motor, and a second but larger pipe delivering hot water to the upper part of the tower, and a spraying device located in such upper part arranged to diffuse such water, substantially as herein specified.

9. In a water-cooling tower having an exhaust-fan E′ and rotary spraying device E^3 and motor-wheel E^2 for driving both, all located in the upper part, the combination therewith of two pipes G and H′ communicating with said tower and respectively discharging hot water to operate the motor-wheel and to be comminuted by the rotary spraying device, substantially as herein specified.

10. The water-cooling tower A, provided with the inverted-cone frustum A^5 near the top, over the reservoir B, and connected thereto by a series of bars C extending vertically across a space formed between, such bars overlapping upon and firmly secured to the reservoir and tower to support the weight of the latter directly and to allow a liberal opening for the access of air in any direction, in combination with the upright shaft E carrying a screw-fan and with the open-work water-wheel E^2, jet-pipe G and forcing-pump G′, all arranged for joint service as herein specified, said fan and water-wheel being both located in the upper part of said tower and the water-wheel arranged to subdivide and distribute the hot water which drives the same so as to expose the said water through the tower to the upward current of air induced by the said fan.

11. The water-cooling tower A over the reservoir B and connected by a series of bars C extending vertically across the space thus formed, overlapping upon each part and firmly secured to each, the bars arranged to support the weight directly and to allow a liberal opening for the access of air in any direction, provided with the inverted-cone frustum A^5 near the top and with the upright shaft E jet-pipe G and forcing-pump G′, and the distributing-wheel E^3 and the hollow ring H with its perforations *h*, all arranged for joint operation as herein specified.

In testimony that I claim the invention above set forth I affix my signature in presence of two witnesses.

J. M. SEYMOUR, JR.

Witnesses:

MICHAEL P. ROCHE,

PHILIP E. F. DUNN.