No. 786,113. PATENTED MAR. 28, 1905.

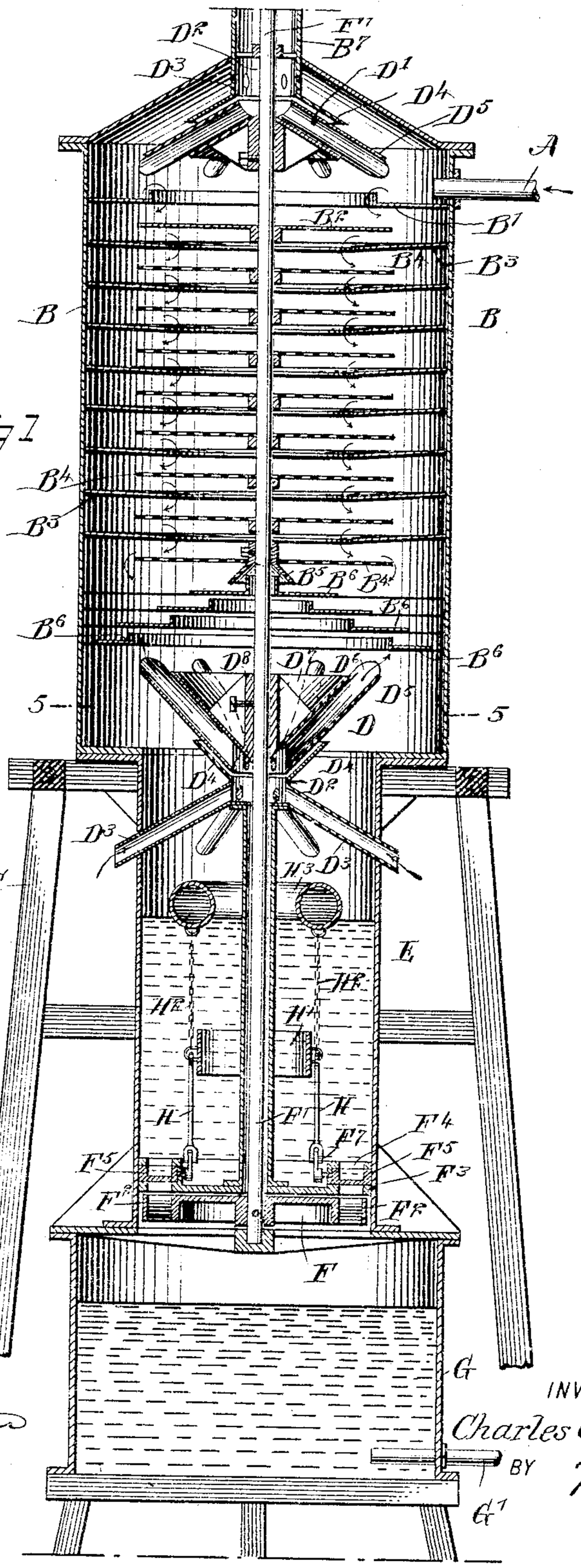
C. GROHMAN.

APPARATUS FOR COOLING LIQUIDS.

APPLICATION FILED JAN. 20, 1904.

3 SHEETS—SHEET 1.

Fig 1.



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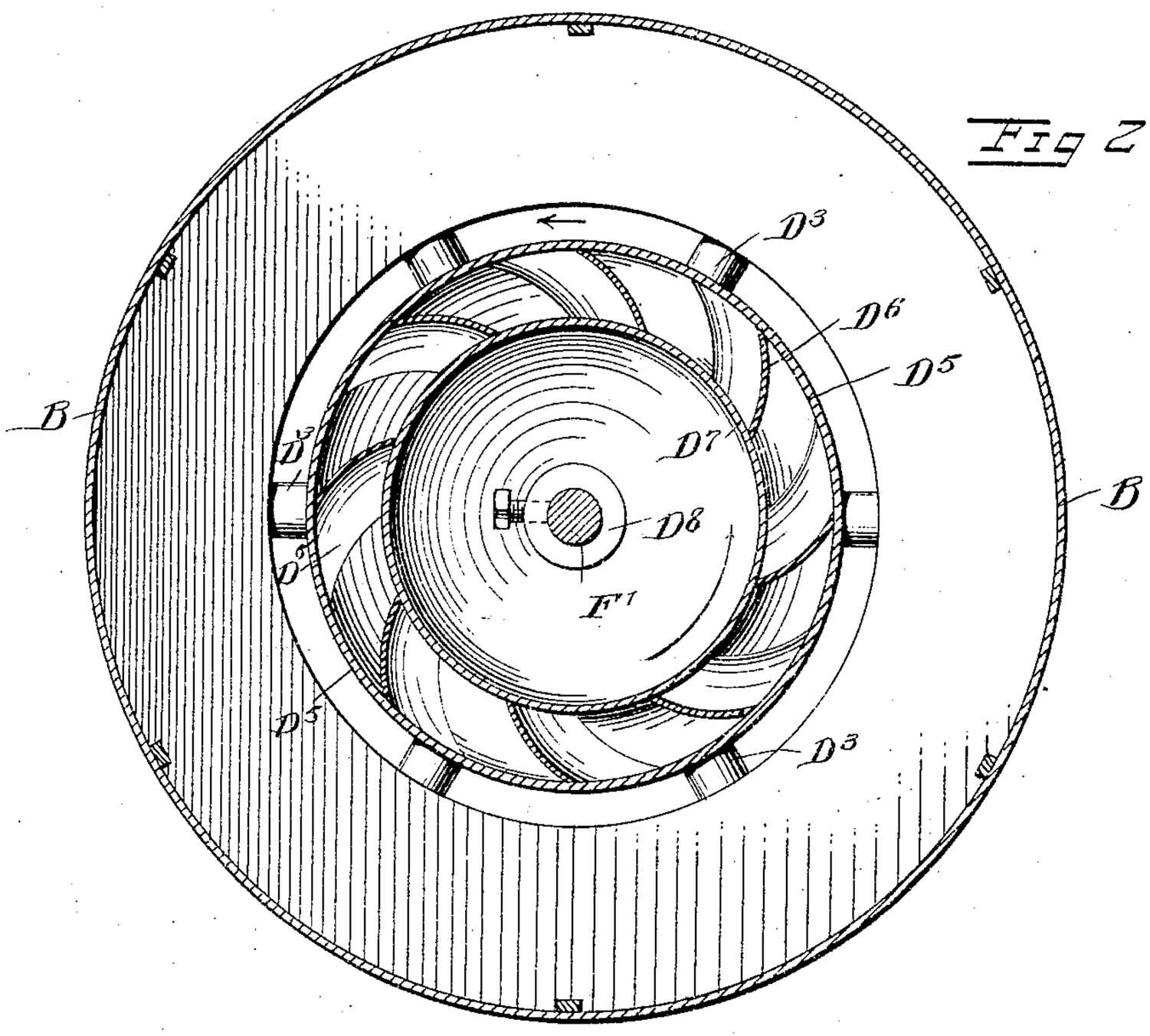
3 SHEETS—SHEET 2.

Fig 2



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3 SHEETS—SHEET 3.

Fig. 3

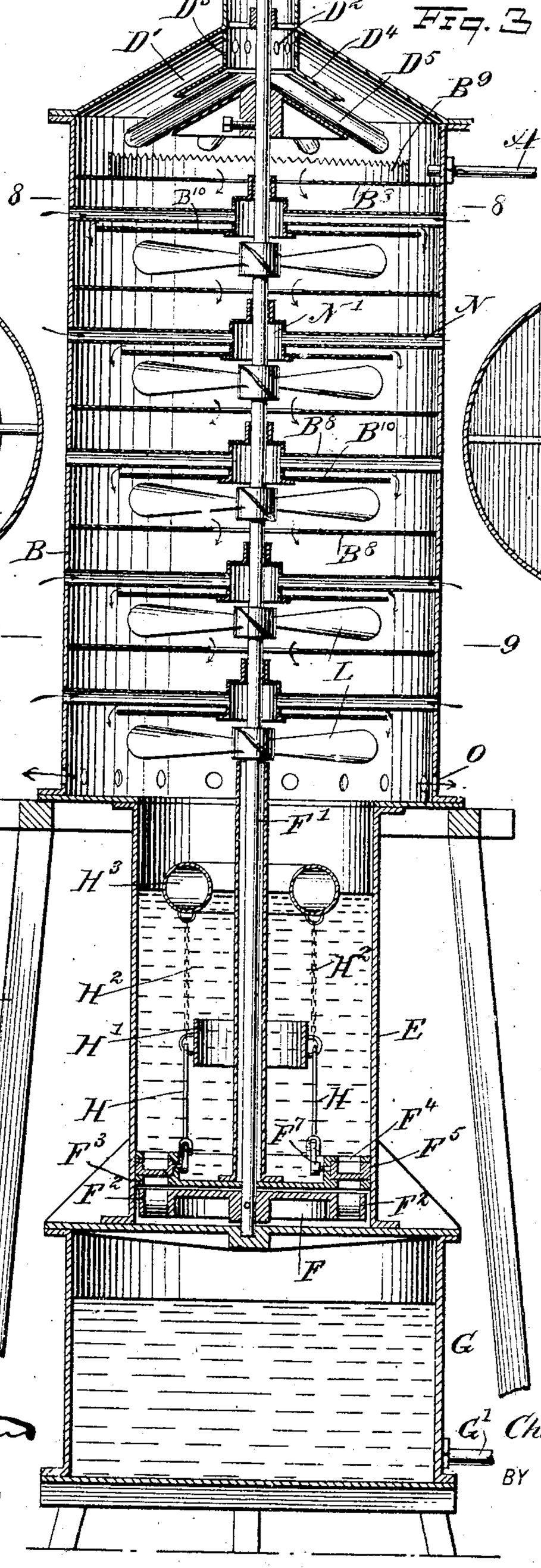

Fig. 4

Fig. 5

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No. 786,113. Patented March 28, 1905.

UNITED STATES PATENT OFFICE.

CHARLES GROHMAN, OF CARTERET, NEW JERSEY.

APPARATUS FOR COOLING LIQUIDS.

SPECIFICATION forming part of Letters Patent No. 786,113, dated March 28, 1905.

Application filed January 20, 1904. Serial No. 189,810.

To all whom it may concern:

Be it known that I, CHARLES GROHMAN, a citizen of the United States, and a resident of Carteret, in the county of Middlesex and State of New Jersey, have invented a new and Improved Apparatus for Cooling Liquids, of which the following is a full, clear, and exact description.

The invention relates to apparatus for cooling water used for cooling purposes in condensers and other machines.

The object of the invention is to provide a new and improved apparatus for cooling a liquid in a very simple and inexpensive manner and mainly by the use of atmospheric air.

The invention consists of novel features and parts and combinations of the same, as will be more fully described hereinafter and then pointed out in the claims.

A practical embodiment of the invention is represented in the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a sectional side elevation of the improvement. Fig. 2 is an enlarged sectional plan view of the blower, the section being on the line 5 5 of Fig. 1. Fig. 3 is a sectional side elevation of a modified form of the improvement. Fig. 4 is a reduced sectional plan view of the same on the line 8 8 of Fig. 3, and Fig. 5 is a like view of the same on the line 9 9 of Fig. 3.

The liquid—such as the condensing-water for a condenser, for instance—is forced by a pump or otherwise through a pipe A into the upper end of a cooling-chamber B, resting on a suitable tower or other support C, and in the said cooling-chamber B is formed a circuitous passage and means for dividing the liquid, so that the liquid in the divided state flows down the said passage in the cooling-chamber and comes during its passage in contact with a current of air forced upward through the chamber by a blower D, arranged partly in the lower portion of the said chamber B and partly in the upper portion of a reservoir E, in which the cooled water accumulates from the cooling-chamber B. The air instead of being forced upward may be forced downward by a blower D′, situated in the upper end of the cooling-chamber B. Either of the blowers D or D′ may be employed, as desired—that is, when the blower D is used the blower D′ is not used, or vice versa.

The cooled water in the reservoir E forms a head and is utilized for driving a turbine F, which discharges into a tank G, from which the water is drawn by a pipe G′ to the condenser or other machine in which it is used.

The turbine F above mentioned is utilized for driving the blower D and also for driving the blower D′, the latter blower serving to force the vapors rising during the cooling process in a downward direction through the circuitous passage to cause a condensation of the said vapors.

The circuitous passage mentioned and arranged in the cooling-chamber B is produced as follows: In the chamber B, directly below the inlet-pipe A, is secured an annular overflow-plate B′, discharging at its inner raised overflow edge onto a plate B^2, having its ends extending a distance from the wall of the chamber B, so that the water flows over the edge of the plate B^2 onto an annular plate B^3, extending a distance from the wall of the chamber inward and somewhat in a downward direction to discharge the water at its inner end onto a central plate B^4, preferably perforated and arranged similar to the plate B^2—that is, terminating a distance from the wall of the chamber B to discharge onto the next following plate B^3, and this construction is repeated a number of times, so that the water is caused to flow in a downward direction from one plate to the other and is minutely divided by flowing through the perforations in the central plates B^4. Below the lowermost perforated central plate B^4 is arranged a conical deflector B^5, discharging onto the uppermost plate of a series of plates B^6 and located one above the other and spaced apart and arranged in step form, so that one plate discharges the water onto the next following plate until the last one discharges into the lower end of the chamber B, from which the cooled water flows into and accumulates in the reservoir E.

The central plates B^2 and B^4 and the deflecting-cone B^5 are secured on the shaft F′ of the

turbine F, and on the said shaft are also secured the movable members of the blowers D and D′. The plates B′, B³, and B⁶ are fixed in the cooling-chamber B and supported in a suitable manner from the side wall thereof. Now the water in flowing down in the chamber B is subjected to a centrifugal action by the revolving plates to divide the water, and the upward-flowing air from the blower D acts on the divided water to rapidly cool the same. From the top of the chamber B leads a flue B⁷ for carrying off the air.

The blowers D and D′ are substantially alike in construction, and each has a shell D², which in the case of the blower D′ is the lower end of the flue B⁷. The shell D² is provided with air-inlets D³, which for the lower blower D are in the form of pipes extending through the wall of the reservoir E to the outside thereof for atmospheric air to pass into the shell, and the inlets for the blower D′ are in the shape of openings connecting the interior of the upper end of the chamber B with the shell for the vapors to pass into the shell.

From the open end of the shell extends a conical flange D⁴, onto the inside of which fits the frustum of a cone D⁵, forming part of the movable member or piston of the blower, which member is secured to the shaft F′ of the turbine F. The frustum of the cone D⁵ is connected by curved wings D⁶ with an inner frustum of a cone D⁷, having a hub D⁸, secured to the shaft F′. When the turbine is in motion, the piston of the blower rotates with it and by the action of the wings D⁶ causes a suction in the shell D², so that air or vapor is drawn into the shell through the air-inlets D³ and the drawn-in air is forced out by the wings D⁶, and in the case of the lower blower this air is blown upward and through the spaces between the plates B⁶ to come in contact with the water dripping off the edges of the plates. The air finally rises in the chamber B through the circuitous passage therein to cool the descending water. In case the upper blower D′ is used the vapors drawn into the shell by the action of the rotating piston and mixing with the air drawn in from the top are partially condensed and forced out of the shell in a downward direction, mixing with the liquid from pipe A, and are condensed and cooled off in their downward passage. In case the lower blower D is used these vapors are forced out of the top of the apparatus into the atmosphere.

The turbine F is provided with a series of buckets F², arranged in a circle and extending angularly from the top to the bottom, and the upper ends of the buckets are normally closed by a valve-casing F³, forming the bottom for the reservoir E to retain the water therein. In the valve-casing F³ are arranged ports F⁴, located in a circle in register with the buckets F², and the said ports F⁴ are normally closed by rock-valves F⁵, mounted in the valve-casing. The valves are radially disposed, and the inner ends of their valve-stems are provided with arms F⁷, connected by links H with a ring H′, suspended by chains H² from a float H³, preferably in the form of a hollow ring rising and falling with the water in the reservoir E. When the accumulating water in the reservoir E rises, the float H³ moves with it and in doing so imparts a turning motion to the rock-valves F⁵ by the connection described, so that the valves are opened and the water in the reservoir E now flows through the ports F⁴ into the buckets F² to act against the inclined walls thereof to turn the turbine F, and thereby actuate the blowers D D′ and rotate the water-dividing plates in the chamber B for the purpose above described. The water in falling in the reservoir E causes a descent of the float H³ and the ring H′, which by its weight and that of the links H causes a gradual closing of the valves F⁵ to shut off the water from the turbine for the time being to allow the water to again accumulate in the reservoir E to form a working head for driving the turbine.

In the modified form shown in Figs. 3, 4, and 5 the blower D is omitted, and in this case a series of fans L are employed and secured to the turbine-shaft F′, the wings of the fans L being arranged to produce a current of air in a downward direction. Air from the outside is passed to each fan by way of pipes N, extending from the outside of the cooling-chamber to a central chamber N′, open at the bottom for the air to pass downward toward the hub of the fan, to be spread by the latter through the divided water directly below the plates B¹⁰, secured to the chamber and extending to within a short distance from the inner face of the cooling-chamber B. Plates B⁸ extend from the wall of the chamber B and are provided with central openings for the water to flow down onto the next plate B¹⁰ below, from which the water flows down onto the next plate B⁸ below and near the inner surface of the cooling-chamber B, as indicated by the arrows in Fig. 3. Air passes out of the chamber B by openings O in the lower end of the chamber B. The overflow edge B⁹ of the uppermost plate B⁸ is preferably serrated to insure a division of the water in fine streams, and the plates B¹⁰ and B⁸ are preferably provided with radial ribs B¹¹ to insure a proper uniform flow of the water in the cooling-chamber. Now by the arrangement described fresh air is moved against the down-flowing water throughout the length of the cooling-chamber, and consequently a very rapid cooling of the water takes place.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. An apparatus for cooling liquids, comprising a turbine, a reservoir above the turbine for the accumulation of the cooled water, and for forming a head for the turbine, a cool-

ing-chamber above the reservoir for the downflow of the water to be cooled, and means driven by the turbine and located in the upper part of the cooling-chamber for forcing air and the vapors rising during the cooling process in a downward direction in the cooling-chamber.

2. An apparatus for cooling liquids comprising a turbine, a reservoir above the turbine for the accumulation of the cooled water, and for forming a head for the turbine, a cooling-chamber above the reservoir and having means for a zigzag downflow of the water, fans in the said cooling-chamber and secured to the extended shaft of the turbine to be driven by the latter, and air-supply devices for the said fans, as set forth.

3. An apparatus for cooling liquids comprising a turbine, a reservoir above the turbine for the accumulation of the cooled water, and for forming a head for the turbine, a cooling-chamber above the reservoir and having means for a zigzag downflow of the water, fans in the said cooling-chamber and secured to the extended shaft of the turbine to be driven by the latter, and air-supply devices for the said fans, and consisting of sets of pipes each set leading from the outside of the cooling-chamber to an air-chamber opening at its open lower end onto a corresponding fan, as set forth.

4. An apparatus for cooling liquids comprising a turbine, a reservoir above the turbine, for the accumulation of the cooled water and for forming a head for the turbine, means for controlling the admission of the water to the turbine, a cooling-chamber above the reservoir, means driven from the turbine for forcing air in the cooling-chamber to cool the liquid flowing down the cooling-chamber, and means located in the upper part of the cooling-chamber and driven from the turbine, for forcing the vapors, rising during the cooling process, in a downward direction in the cooling-chamber, as set forth.

5. An apparatus for cooling liquids, comprising a turbine, a reservoir above the turbine, for the accumulation of the cooled water and for forming a head for the turbine, a cooling-chamber through which flows the liquid to be cooled, means driven from the turbine for forcing outside air through the cooling-chamber, and a blower at the top of the cooling-chamber for forcing the vapors rising during the cooling process in a downward direction in the chamber, the said blower having its movable member secured to the shaft of the turbine, as set forth.

6. An apparatus for cooling liquids, comprising a turbine, a reservoir above the turbine, for the accumulation of the cooled water and for forming a head for the turbine, means for controlling the admission of the accumulated water to the turbine, a cooling-chamber above the reservoir through which flows the water to be cooled, means driven by the turbine for forcing a current of air in the cooling-chamber, to cool the liquid flowing down the cooling-chamber, a receiving-chamber into which discharges the turbine, and means located in the upper part of the cooling-chamber for forcing the vapors rising during the cooling process in a downward direction in the cooling-chamber, as set forth.

7. An apparatus for cooling liquids comprising a cooling-chamber having a circuitous passage for the downflow of the liquid, a blower connected with said chamber, and comprising a shell having air-inlets and a conical flange, and a revolving member in the shell having spaced cones and curved wings between the cones, and means for driving the blower, as set forth.

8. An apparatus for cooling liquids, comprising a cooling-chamber having a circuitous passage for the downflow of the liquid, means for forcing outside air through the chamber, and a blower in the upper end of the chamber, having its inlet and outlet in the chamber, for forcing vapors in a downward direction in the chamber, as set forth.

9. An apparatus for cooling liquids provided with a cooling-chamber having a water-inlet at its upper end, sets of plates in the chamber for causing the water to flow from one plate onto the other in a zigzag direction, fans under alternate plates, and air-supply pipes for delivering fresh air from the outside to the fans, as set forth.

10. An apparatus for cooling liquids provided with a cooling-chamber having a water-inlet at its upper end, sets of plates in the chamber for causing the water to flow from one plate onto the other in a zigzag direction, fans under alternate plates, and air-supply pipes for delivering fresh air from the outside to the fans by way of air-chambers open at the bottom and leading to the top of the fans at the hubs thereof, as set forth.

11. An apparatus for cooling liquids comprising a cooling-chamber having a circuitous passage for the downflow of the liquid, means for forcing air through the chamber, and a blower at the top of the chamber comprising a shell having air-inlets and a conical flange, and a revolving member in the shell having spaced cones, and curved wings between the spaced cones, as set forth.

12. An apparatus for cooling liquids comprising a turbine, a reservoir above the turbine for the accumulation of the cooled water and for forming a head for the turbine, a cooling-chamber above the reservoir, fans in the said cooling-chamber and secured to the extended shaft of the turbine to be driven by the latter, air-supply pipes for delivering air from the outside of the apparatus to the fans, and a blower in the upper part of the cooling-chamber and having its movable member secured to the shaft of the turbine, as set forth.

13. An apparatus for cooling liquids provided with a cooling-chamber having an outlet in its bottom for the cooled liquid and provided with a circuitous passage for the downflow of the liquid, an overflow-plate at the upper part of said chamber having a central discharge-opening and a raised overflow edge on said plate surrounding the opening, an inlet-pipe for the liquid extending into the side of the chamber directly above the overflow-plate, means for forcing outside air through the cooling-chamber, and a flue at the top of the cooling-chamber for the passage of air, as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES GROHMAN.

Witnesses:
EDW. J. HEIL,
FRANK G. LASHER.