April 27, 1926.

1,582,550

J. M. SEYMOUR

COOLING TOWER

Filed March 11, 1925 2 Sheets-Sheet 1

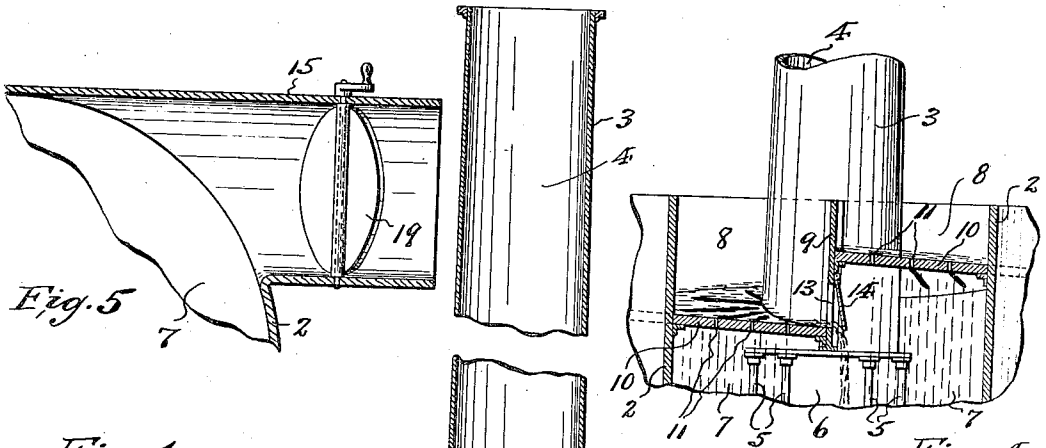
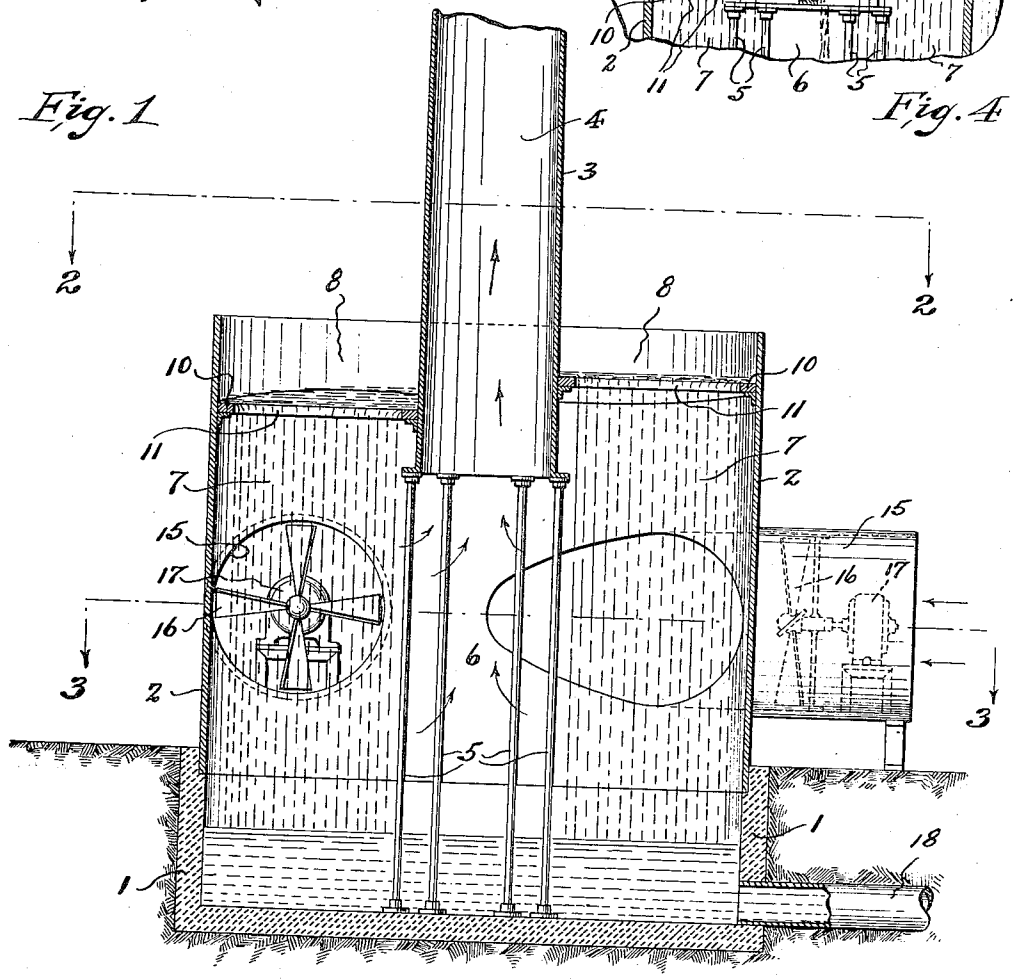


Fig. 5

Fig. 1

Fig. 4



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Fig. 2

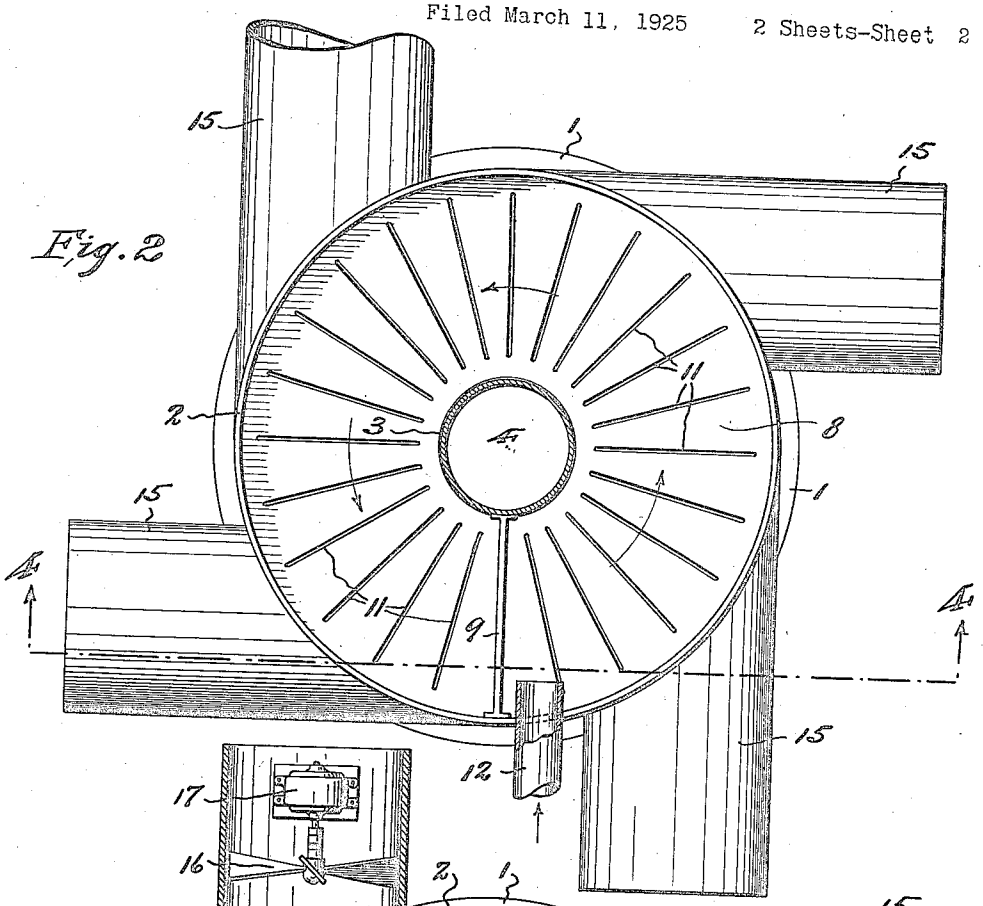
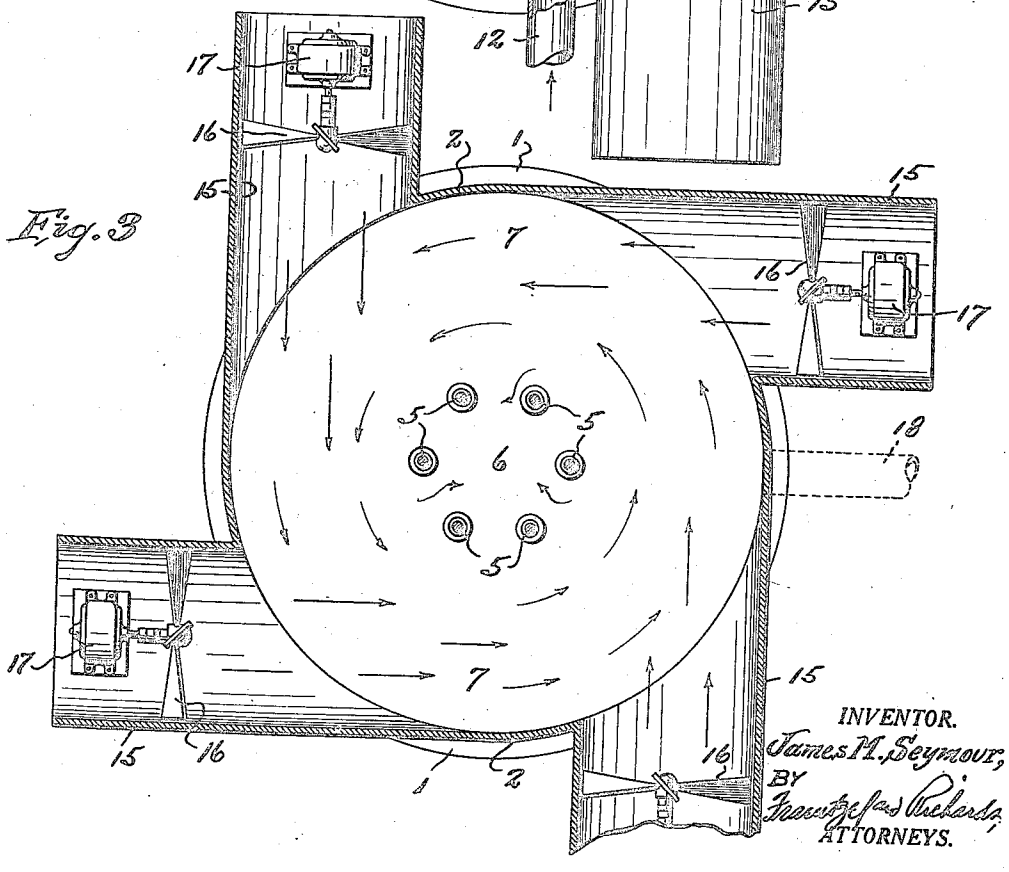


Fig. 3



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UNITED STATES PATENT OFFICE.

JAMES M. SEYMOUR, OF NEWARK, NEW JERSEY.

COOLING TOWER.

Application filed March 11, 1925. Serial No. 14,654.

To all whom it may concern:

Be it known that I, JAMES M. SEYMOUR, a citizen of the United States, residing at Newark, in the county of Essex and State of New Jersey, 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, reference being had to the accompanying drawings, and to characters of reference marked thereon, which form a part of this specification.

This invention relates, generally, to improvements in cooling towers for cooling condenser water and for similar uses; and the invention has reference, more particularly, to a construction of cooling tower provided with a novel means for bringing together air and water to be cooled while the air is centrifugally gyrated or rotated, whereby the lighter air, which is nearest the saturation point, is first vented or exhausted through the central discharge opening of the tower, while the heavier or drier air is retained in contact with the water to be cooled by centrifugal action, and its escape through the discharge opening of the tower is retarded until it has efficiently exercised its cooling function and has in turn become saturated.

It is well known that, in cooling towers as heretofore constructed, there is a large volume of air passing through the tower without performing all the cooling effect it is possible for it to perform. In other words, a large volume of air passes through every cooling tower and is allowed to escape while only partly saturated. It is also well known that the evaporation taking place within the cooling tower produces the largest part of the cooling effect. In the ordinary construction of cooling tower, the air is delivered into the base of the tower with the air stream directed toward the center line or axis of the discharge opening stack or flue. Deflectors are commonly employed to start the air stream on its upward course through the numerous baffles that are placed within the shell of the tower. These deflectors and baffles interfere with the free flow of the air currents, and produce a back pressure on the air driving fans necessitating an increased expenditure of power to operate the fans.

It is the object of this invention to provide a novel construction of cooling tower, in which the cooling air and water are brought together and retained in operative relation until a maximum of the cooling effect of the air is attained, while at the same time eliminating, as far as possible, all obstruction to free movement, circulation and escape of the air stream, both during the performance of its cooling function and when discharged from the tower upon accomplishment of its cooling function. With this end in view this invention seeks to eliminate waste of air, to reduce the amount of power required to circulate the air, while nevertheless attaining a more rapid and complete cooling effect upon the water or other medium under treatment.

Other objects of this invention, not at this time more particularly enumerated, will be clearly understood from the following detailed description of the same.

With the various objects of this invention in view, the same consists, primarily, in the novel construction and arrangement of cooling tower hereinafter set forth; and, the invention consists, furthermore, in the novel arrangements and combinations of the various devices and parts, as well as in the details of the construction of the same, all of which will be hereinafter more fully described, and then finally embodied in the claims appended hereto.

The invention is clearly illustrated in the accompanying drawings, in which:—

Figure 1 is a central vertical section of a cooling tower made according to and embodying the principles of this invention; Figure 2 is a horizontal section, taken on line 2—2 in Figure 1; Figure 3 is another horizontal section, taken on line 3—3 in Figure 1; Figure 4 is a fragmentary vertical section, taken on line 4—4 in Figure 2; and Figure 5 shows a fragmentary section of an air intake pipe equipped with a control damper,

Similar characters of reference are employed in all of the hereinabove described views, to indicate corresponding parts.

Referring now to said drawings, the reference character 1 indicates a catch-basin which is provided in connection with the bottom of the cooling tower. The said catch-basin 1 may be constructed from any suitable material, but is preferably made of concrete, and countersunk below ground level, as shown. Supported above said catch-basin 1 is a substantially cylindrical tower housing 2, the lower end of which is open and in communication with the interior of said catch-basin 1. The tower housing 2 may be built of wood, sheet metal, masonry or any other material found convenient or desirable.

Axially alined with and communicating with the upper end portion of the interior of said tower housing 2 is a vertically and upwardly extending chimney or stack 3 which provides a discharge opening 4. Preferably said chimney or stack 3 is of considerably reduced diameter relative to the diameter of the tower housing 2. Said chimney or stack 3 may also be made of sheet metal, wood, masonry, or of any other desired material. Said chimney or stack 3 is supported from the bottom of said catch-basin 1 by a plurality of perpendicular columns 5, thus leaving a central open space 6 which is alined with and which communicates with the lower receiving end of the discharge opening 4. The interior of the tower housing 1, intermediate its outer walls and said central open space 6, provides an annular chamber 7 opening into said central space 6.

Suitably arranged at the upper end of the tower housing 2 and above said annular chamber 7 is a water receiving and distributing trough 8. This trough 8 surrounds the upwardly projecting chimney or stack 3, and is preferably open to the atmosphere. The ends of the trough 8 are determined by a partition member 9. Beginning at one side of said partition member 9, the floor or bottom portion 10 of the trough inclines or slopes downwardly, as it winds about the chimney or stack 3, to the opposite side of the partition 9, thereby establishing a descending grade from one end of the trough to the other, whereby water delivered thereinto will flow by gravity around the entire length of the same. The bottom portion 10 of the trough is provided throughout its extent with a plurality of discharge openings or perforations, through which the water delivered thereinto may escape in thin streams, so as to descend through the annular chamber 7 of the tower housing 2, to be there subject as it gravitates to the catch basin 1, to the cooling effects of air circulated within said chamber 7. The said discharge openings may be in the form of a series of radially disposed narrow slots 11, as shown, or they may be of any other conformation found to be convenient. The hot water or other medium to be cooled is delivered from a condenser or other source through a delivery pipe 12, which discharges the same into the high level end of the trough 8, so that the same flows downwardly around the same, and is thence discharged through the bottom openings 11 to rain downwardly through the annular chamber 7 in the interior of the tower housing 2. That portion of the partition 9 which is adjacent to the low level end of the trough 8 is provided with discharge port 13 leading into the interior of the tower housing 2, so that any water in the trough 8, in excess of that discharged through the bottom openings 11, is caused to empty into and fall downwardly through the interior of the tower housing 2, and thence into the catch basin 1. Said port 13 is closed by an inwardly swinging gate 14, which opens inwardly to the pressure of the water, which reaches the low level of the trough 8, so that the water is thus admitted into the interior of the tower housing 2, while the air circulated therein is not discharged outwardly through said port 13. The above described construction of excess water discharge means for the trough 8 is clearly illustrated in Figure 4 of the accompanying drawings.

Said tower housing 2 is provided with one or more air delivery devices adapted to deliver air tangentially into the interior of the annular chamber 7 within said tower housing. Each air delivery device comprises a tubular intake arm or pipe 15 tangentially projecting from the outer circumference of said tower housing 2. The outer end of said intake arm or pipe 15 is open to the atmosphere, while the inner end thereof communicates with the interior of said annular chamber 7 within the tower housing 2. Mounted within each tangential intake arm or pipe 15 is a transversely disposed air propulsion fan 16. The fan 16 may be suitably driven from any source of power, but it is probably most convenient to drive the same by means of a direct connected electric-motor 17 as shown in the drawings.

The air delivery arms or pipes 15 direct streams of air by means of the fans 16 tangentially into the annular chamber 7 of the tower housing 2, so that the air within the latter is caused to whirl or gyrate around said annular chamber. The hot water or other medium rains downwardly into the rotating body of air, and in this manner the cooling effect of the air upon the water is produced both by direct transfer of heat from the water to the air and by evaporation of a percentage of the water and its absorption by the moving body of air. The

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whirling or gyrating movement of the air in contact with the water produces a centrifugal action which will cause the heavier and drier air to be thrown outwardly toward the walls of the tower housing 2, and thus retained in contact with the descending streams of water, while the lighter air which is nearest the saturation point will be displaced by the heavier and drier air, and thus forced inwardly to the central space 6 subject to free escape through the discharge opening 4 provided by the chimney or stack, so that the air which has most completely exercised its cooling effect upon the water descending through the interior of the tower-housing, will be first discharged through the chimney or stack 3, while the air, which is still capable of cooling effect, is retained in contact with the water until it too has substantially completed its cooling effect, and is displaced by the relatively dry incoming air so as to be in turn discharged through said discharge opening 4.

By the time the water, descending through the tower housing 2 in contact with the rotating cooling air, comes to rest within the catch-basin 1 the same has been substantially relieved of its heat, and is sufficiently cool to be withdrawn from said catch-basin 1 through a water discharge pipe 18 and delivered to the place of use again.

It may be pointed out that since the novel construction of water distributing trough 8, with which the cooling tower is provided, is open to the atmosphere, there is a perceptible preliminary cooling effect exercised upon the water by reason of its exposure to the atmosphere as it flows around the open trough, so that the open trough possesses additional advantage contributing directly to the cooling functions of the tower.

I desire also to call attention to the fact that the basic principles involved in the construction and operation of my novel cooling tower relate to the delivery of air tangentially into the annular cooling chamber 7 to produce a rotative or gyrating movement of the air in contact with the water to be cooled and then a final discharge of the air upwardly through the discharge opening 4. Such movement of the air body is greatly aided by the air delivery fans 16, but it must be understood that in a simplified form of my invention the fans may be omitted from the tangential air intake pipes 15, so that the natural draft of the stack or chimney 3 will cause the induction of air through the intake pipes 15 and tangentially into the annular chamber 7 to produce more or less gyration or rotative movement of the air with the effects already above described. In such construction, the intake pipes 15 may be provided, if desired, with dampers 19, as shown in Figure 5, to control the volume of admitted air. It therefore follows that the chimney or stack could be relatively short or even omitted and a simple discharge opening alone employed where the power driven fans 16 are used to move the air, or a relatively high chimney or stack could be employed without fans to move the air by natural draft.

Other advantages due to the novel construction of my water tower, and which contribute to the rapid cooling of water or other medium to be treated are as follows:—

The rotation of the air in the annular chamber 7 produces a centrifugal action which constantly throws a certain amount of water against the outer walls of the chamber 7, thereby producing a film of water on said walls against which the moving body of air constantly impinges in frictional contact therewith, so that evaporation is accelerated and a consequent increase of cooling effect is attained by reason of such evaporation.

Additional cooling effect is obtained by the impingement of the moving body of air upon the surface of the water deposited in the catch basin.

Finally it may be pointed out that my invention contemplates broadly, as equivalent to the tangential air delivery pipes 15, either with or without fans 16, any means whereby the air in the base of the tower beneath the chimney or stack 3 may be caused to whirl or gyrate to produce a centrifugal action so that dry air is separated from saturated air, and the latter first displaced toward the discharge flue or vent provided by the chimney or stack 3, while the dry or partially saturated air which is still capable of exercising considerable cooling effect is retained in contact with the water or other medium under treatment until it too becomes saturated and ready for discharge and replacement by dry incoming air.

I am aware that some changes, other than those already pointed out, may be made in the general arrangements and combinations of the various devices and parts comprising this invention, as well as in the details of the construction of the same, without departing from the scope thereof as described in the foregoing specification, and as defined in the appended claims. Hence, I do not limit this invention to the exact arrangements and combinations of the devices and parts as set forth in the foregoing specification, nor do I confine myself to the exact details of the construction of said parts as illustrated in the accompanying drawings.

I claim:—

1. A substantially cylindrical cooling tower, the top of said tower having a central discharge opening to the atmosphere, an annular water trough at the upper end of

said tower having a perforated bottom to deliver divided streams of water for descent through said tower, means for forcing a plurality of streams of atmospheric air tangentially into said tower for unimpeded rotative movement through the descending water streams, said tangential air streams being projected along the side walls of said tower until each stream reaches the stream in advance thereof which will crowd the former toward the center of the tower where it may pass out freely to the atmosphere through said discharge opening, and a catch basin at the bottom of said tower.

2. A cooling tower, comprising a vertical substantially cylindrical tower housing, a discharge stack axially alined with and communicating with the upper end portion of said tower housing, means for rotating a body of air delivered within said tower housing about the vertical axis of the latter, a catch-basin at the lower end of said tower housing, and means for discharging the medium to be cooled into the upper end of said tower housing for descent through said rotating body of air into said catch-basin, said latter means comprising an annular distributing trough at the upper end of said tower housing having discharge openings in its bottom communicating with the interior of said tower housing.

3. A cooling tower, comprising a vertical substantially cylindrical tower housing, an upwardly extending discharge stack axially alined with and communicating with the upper end portion of said tower housing, air intake means in laterally tangential communication with the interior of said tower housing whereby air is delivered into the latter for rotation about the vertical axis thereof, a catch-basin at the lower end of said tower housing, and means for discharging the medium to be cooled into the upper end of said tower housing for descent through said rotating body of air into said catch-basin, said latter means comprising an annular distributing trough at the upper end of said tower housing having discharge openings in its bottom communicating with the interior of said tower housing.

4. A cooling tower, comprising a vertical substantially cylindrical tower housing, a catch-basin at the lower end of said tower housing, an upwardly extending discharge stack axially alined with and communicating with the upper end portion of said tower housing, air intake means in laterally tangential communication with the interior of said tower housing whereby air is delivered into the latter for rotation about the vertical axis thereof, air propulsion means within said air intake means to propel the air into said tower housing, and means for discharging the medium to be cooled into the upper end of said tower housing for descent through said rotating body of air into said catch-basin, said latter means comprising an annular distributing trough at the upper end of said tower housing extending around said stack intermediate the same and the outer circumference of said tower housing, a transverse partition means to determine the ends of said trough, said trough having a bottom portion inclining downwardly from a high level point at one side of said partition means to a low level point at the opposite side of said partition means, said trough being open to the atmosphere, and said bottom partition having a plurality of discharge openings therein communicating with the interior of said tower housing.

5. A cooling tower, comprising a vertical substantially cylindrical tower housing, a catch-basin at the lower end of said tower housing, an upwardly extending discharge stack axially alined with and communicating with the upper end portion of said tower housing, air intake means in laterally tangential communication with the interior of said tower housing whereby air is delivered into the latter for rotation about the vertical axis thereof, air propulsion means within said air intake means to propel the air into said tower housing, and means for discharging the medium to be cooled into the upper end of said tower housing for descent through said rotating body of air into said catch-basin, said latter means comprising an annular distributing trough at the upper end of said tower housing extending around said stack intermediate the same and the outer circumference of said tower housing, a transverse partition means to determine the ends of said trough, said trough having a bottom portion inclining downwardly from a high level point at one side of said partition means to a low level point at the opposite side of said partition means, said trough being open to the atmosphere, said bottom portion having a plurality of discharge openings therein communicating with the interior of said tower housing, and said partition means having adjacent the low level of said trough a discharge opening provided with an inwardly opening closing means, said discharge opening also communicating with the interior of said tower housing.

6. A cooling tower, comprising a vertical substantially cylindrical tower housing, a catch-basin at the lower end of said tower housing, an upwardly extending discharge stack axially alined with and communicating with the upper end portion of said tower housing, air intake means in laterally tangential communication with the interior of said tower housing whereby air is delivered into the latter for rotation about the vertical axis thereof, air propulsion means

within said air intake means to propel the air into said tower housing, and means for discharging the medium to be cooled into the upper end of said tower housing for descent through said rotating body of air into said catch-basin, said latter means comprising an annular distributing trough at the upper end of said tower housing having discharge openings in its bottom communicating with the interior of said tower housing.

In testimony, that I claim the invention set forth above I have hereunto set my hand this 10th day of March, 1925.

JAMES M. SEYMOUR.