July 1, 1941. L. T. MART 2,247,514

CENTER VENT DOUBLE FLOW COIL TOWER

Filed July 22, 1940 3 Sheets-Sheet 1

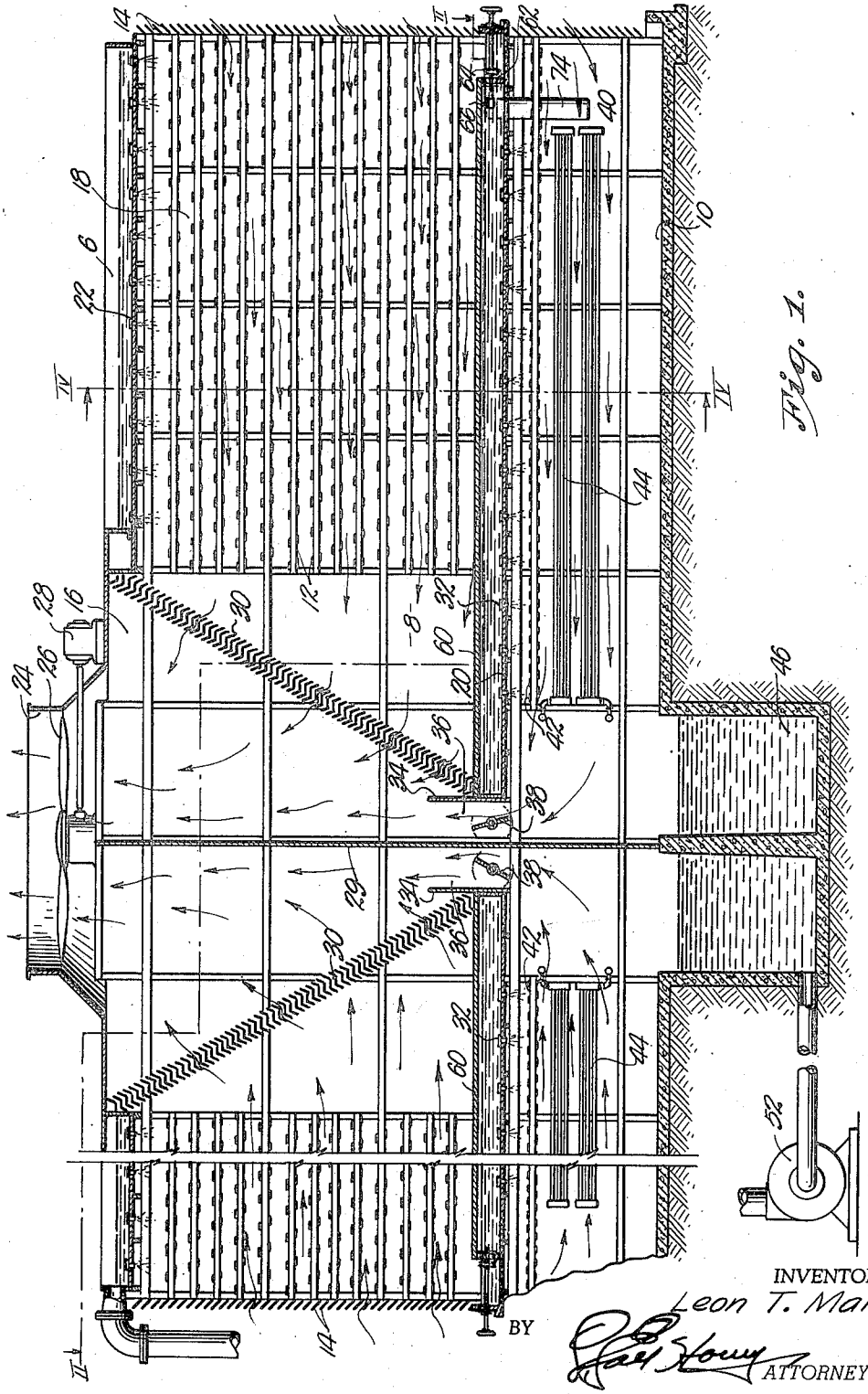

Fig. 1.

INVENTOR.
Leon T. Mart
BY
Paul Young
ATTORNEYS.

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CENTER VENT DOUBLE FLOW COIL TOWER

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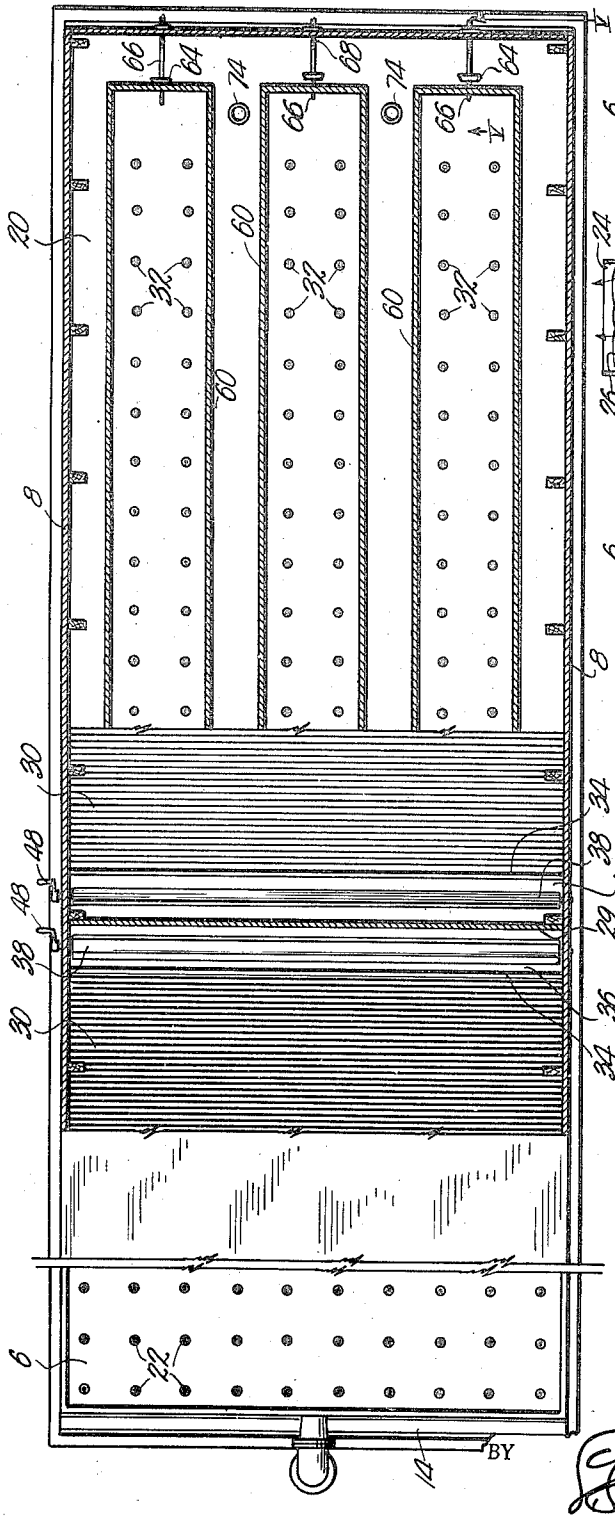

Fig. 2.

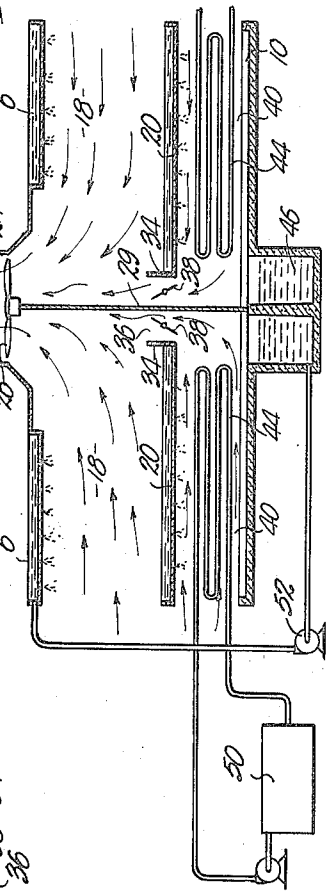

Fig. 3.

INVENTOR.
Leon T. Mart
BY
Paul Howey
ATTORNEYS.

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CENTER VENT DOUBLE FLOW COIL TOWER

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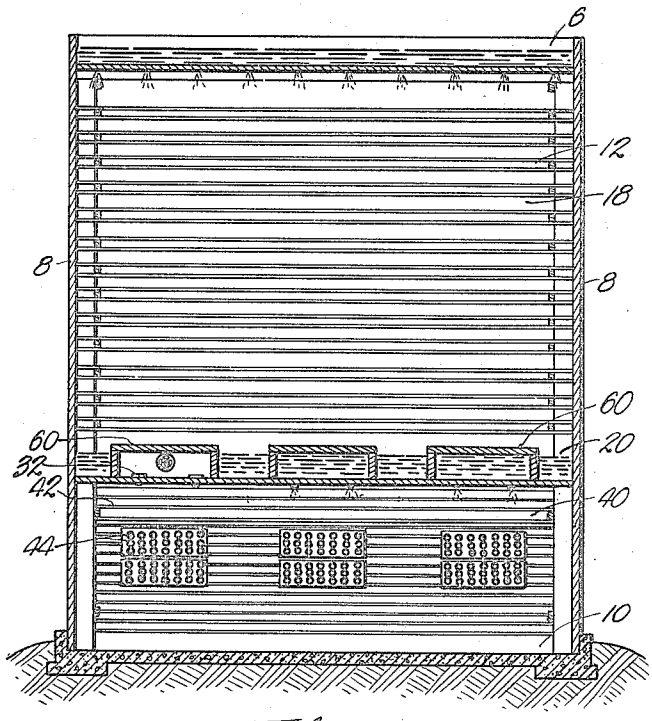

Fig. 4.

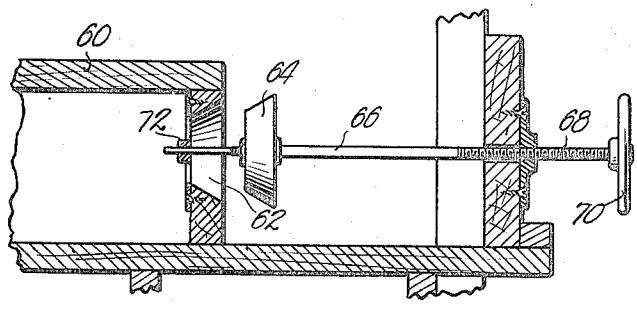

Fig. 5.

INVENTOR.
Leon T. Mart

BY Joel Young

ATTORNEYS.

Patented July 1, 1941

2,247,514

UNITED STATES PATENT OFFICE

2,247,514

CENTER VENT DOUBLE FLOW COIL TOWER

Leon T. Mart, Mission Township, Johnson County, Kans., assignor to The Marley Company, Kansas City, Kans., a corporation of Missouri

Application July 22, 1940, Serial No. 346,765

10 Claims. (Cl. 261—11)

This invention relates to cooling towers and has for a primary object the provision of a tower wherein not only is the temperature of water lowered, but a plurality of coils are cooled by the action of such water after it has been initially acted upon by currents of air having paths of travel greater than the length of the path of travel through which the water has fallen prior to its introduction to said coils.

One of the important aims of the instant invention is the provision of a cooling tower preferably of the induced draft type, wherein the body is relatively long, wide and low to effect economic water distribution, simplicity of operation, high efficiency, and relatively low maintenance and operation cost.

A still further aim of the present invention is to provide a cooling tower of the induced draft type that has set off in the casing thereof, two distinct compartments arranged one above the other, the upper compartment being bottomed by a water collecting tray beneath which and in the lower compartment, is disposed a plurality of coils arranged in banks to be wetted by water escaping through spray heads in the bottom of the tray.

Another important object of this invention is the provision of a cooling tower of the aforementioned character wherein is provided means for controlling the amount of water passing from the tray to any one of the banks of coils in the lowermost chamber thereof.

This invention has for a yet further aim the provision of a cooling tower having two distinct horizontal compartments, both of which communicate with an air discharge chamber, the air from one of said compartments being controlled by a valved port.

Heretofore, cooling towers have assumed proportions and been constructed so that the travel of a large amount of air through short paths intersecting long paths of travel of water, have necessitated heavy equipment, such as motors and pumps to lift the water to high points of distribution from whence it gravitated through the short horizontal air currents. It has been found by actual experience and commercial tests that less air per given volume of water is needed when the paths of travel of air and water are as hereinafter specified, and therefore, the total amount of power required to drive both the fan and water pumps of the system wherein the cooling tower is located, is appreciably reduced.

In addition to the foregoing extremely advantageous results that are obtained from cooling towers having proportions similar to those shown in the accompanying drawings, further advantages arise from such cooling tower because the same permits more compact arrangement of component parts, simplified framing and bracing to meet design stresses, better proportioning for good appearance, and greater ease and safety in maintenance work.

More specific objects of the invention will appear during the course of the following specification, referring to the accompanying drawings wherein:

Figure 1 is a vertical longitudinal sectional view through a cooling tower made to embody the present invention.

Fig. 2 is an irregular horizontal sectional view through the cooling tower taken on line II—II of Fig. 1.

Fig. 3 is a diagrammatical view of a complete installation embodying the cooling tower and condenser tubes.

Fig. 4 is a vertical cross sectional view through the cooling tower taken on line IV—IV of Fig. 1; and

Fig. 5 is an enlarged detailed sectional view illustrating a means for controlling the entrance of water into one of the covers above a tube bank.

The casing for this center vent double flow coil tower is of conventional nature and has heretofore been employed in a manner illustrated in my United States Letters Patent No. 2,191,938, issued February 27, 1940.

A water distribution basin 6 at the top of the tower cooperates with side walls 8 at each of two opposite sides thereof, and a collecting chamber 10 at the bottom to produce a horizontal air guiding conduit.

Vertically spaced decks 12 below basin 6 extend from louvres 14 at one end of the air guiding conduit to a zone of connection between a discharge chamber 16 and the aforesaid horizontal conduit. This horizontal conduit 18 is relatively long with respect to the distance between collecting tray 20 and basin 6.

Basin 6 has openings formed through the bottom thereof into which are fitted spray heads 22 of conventional type, whereby water is allowed to flow from basin 6 downwardly through horizontal conduit 18, over decks 12 and into collecting tray 20. Air discharge chamber 16 has an upwardly directed mouth 24 wherein is disposed fan 26 driven by motor 28.

The double flow type of tower, illustrated in the accompanying drawings, is desirable so far as fan 26 is concerned because said fan serves to force air through a plurality of horizontal conduits 18.

Partition 29 extends from immediately below fan 26 downwardly to collecting basin 10 to insure that any atmospheric air currents, due to wind conditions, will not pass horizontally through one air guiding conduit 18 into the other. Partition 29 will divert upwardly any air entering discharge chamber 16.

Baffle elements 30 are positioned within discharge chamber 16 to divide the latter into two portions, one of which overlies a part of collecting tray 20, while the other part is beneath fan 26. Elements 30 serve to eliminate water from the air passing therethrough toward fan 26 and also operate to produce a uniform flow of air horizontally through conduit 18 between decks 12. Any water removed from the air currents by baffle elements 30 will gravitate into tray 20. Tray 20 sets off a lower compartment 40 and extends to a point spaced from partition 29.

A vertical wall projecting upwardly from the inner end of tray 20 assists in creating port 36 through which air passes from lower compartment 40 to discharge chamber 16. Damper 38 is mounted in port 36 so that the operator may control the passage of air from lower compartment 40 into collecting chamber 16. Cranks or other suitable handles 48 are secured to dampers 38 and disposed exteriorly of the tower casing so that the dampers may be set from time-to-time.

Tray 20 is provided with a number of openings therethrough into which are fitted spray heads or the like 32, through which passes the water after it has been collected in tray 20 and after it has been permitted to flow into one of the covers, hereinafter more fully described.

Water from collecting tray 20 drops by gravity onto decks 42 where it is broken up into finely divided form for better heat transfer and to thoroughly cover condenser tubes 44 disposed in lower compartment 40. The falling water enters basin 10 and flows into sump 46 from where it may be pumped directly to a point of re-use or back to water distribution basin 6 at the top of the tower.

The spray heads and openings into which the same are fitted, are divided into groups, as shown in Fig. 2. Each group of spray heads 32 is confined within a cover 60 that cooperates with the bottom of tray 20 in forming box-like receivers for water that is intended to flow downwardly through spray heads 32 and onto condenser tubes 44. Tubes 44 are arranged in banks, as illustrated in Fig. 4, and each bank of tubes is wetted by water falling through spray heads 32 beneath a cover 60.

Water is allowed to enter the covers 60 only through an inlet opening 62, the size of which is controlled by a valve head 64 mounted upon rod 66. This rod 66 is screw-threaded as at 68 and has a handle 70, one end thereof which projects outwardly from one end of the cooling tower. The inner end of rod 66 is slidably mounted in a bearing 72 so that upon rotation of rod 66, valve head 64 will move toward and from a position closing opening 62. Thus, as shown in Fig. 4, one cover 60 may be closed entirely to preclude the flow of water downwardly onto a bank of condenser tubes while the other covers may have a desired amount of water passing therethrough to wet the underlying condenser tubes to the required degree.

The amount of air pulled through lower compartment 40 by fan 26 may be increased when all of the banks of condenser tubes 44 are being cooled. Fan 26 is common to both upper and lower compartments in the cooling tower and the degree at which the water in lower compartment 40 is cooled, is due to the volume of air drawn therethrough by fan 26. After the water has been initially cooled by passing downwardly through decks 12, it may remain at a temperature desirable for commercial use in engines, for example, even after it has functioned to cool condenser tubes 44. The amount of air therefore, which is allowed to pass through port 36, will have to be varied in accordance with the work required of the water as it passes over the several banks of condenser tubes 44.

If all of covers 60 are closed, overflow pipes 74 will carry the water past tubes 44 and into chamber 10.

Fig. 3 illustrates the manner in which the condenser tubes 44 may form a part of commercial equipment 50. The use to which cooling towers are placed is well-known in the art and such commercial equipment 50 may be a boiler or the like. The manner of forcing the water from sump 46 to water distribution basin 6 may be through a pump 52 of known type. Obviously, this water from sump 46 may be passed through commercial equipment prior to its return to basin 6.

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

1. In a cooling tower of the character described, a casing formed with a discharge chamber and having the top, bottom and sides thereof closed to form a horizontal air guiding conduit in communication with the discharge chamber; water distributing means for discharging water at the top of the conduit for gravitating downwardly therethrough; a fan in the discharge chamber for forcibly propelling air through the conduit; a water collecting tray vertically spaced above the bottom of the conduit, provided with downwardly directed openings and setting off an upper and lower compartment in the conduit; a water collecting basin at the bottom of said conduit; condenser tubes arranged in horizontally spaced apart banks in the lower compartment spaced above the water in said collecting basin and below said tray to be wetted by the water falling from the tray to the basin; and a pump for returning water from the basin to the said water distributing means at the top of the conduit said openings in the tray being arranged in groups above each bank of condenser tubes respectively, each of said groups of openings having means for controlling the flow of water through all the openings thereof.

2. In a cooling tower of the character described, a casing formed with a discharge chamber and having the top, bottom and sides thereof closed to form a horizontal air guiding conduit in communication with the discharge chamber; water distributing means for discharging water at the top of the conduit for gravitating downwardly therethrough; a fan in the discharge chamber for forcibly propelling air through the conduit; a water collecting tray vertically spaced above the bottom of the conduit, provided with downwardly directed openings and setting off an

upper and lower compartment in the conduit; a water collecting basin at the bottom of said conduit; condenser tubes in the lower compartment spaced above the water in said collecting basin and below said tray to be wetted by the water falling from the tray to the basin; means for controlling the flow of water downwardly through the said tray; and a pump for returning water from the basin to the said water distributing means at the top of the conduit said means for controlling the flow of water downwardly through said tray comprising a number of covers each above a group of openings respectively and each having a valved inlet opening at one side thereof to allow water to flow into the cover and seek its level when the valve is open.

3. In a cooling tower of the character described, a casing formed with a discharge chamber and having the top, bottom and sides thereof closed to form a horizontal air guiding conduit in communication with the discharge chamber; water distributing means for discharging water at the top of the conduit for gravitating downwardly therethrough; a fan in the discharge chamber for forcibly propelling air through the conduit; a water collecting tray vertically spaced above the bottom of the conduit, provided with downwardly directed openings and setting off an upper and lower compartment in the conduit; a water collecting basin at the bottom of said conduit; condenser tubes in the lower compartment spaced above the water in said collecting basin and below said tray to be wetted by the water falling from the tray to the basin; and a pump for returning water from the basin to the said water distributing means at the top of the conduit, said water collecting tray having a plurality of covers overlying certain groups respectively of the openings therein, said covers being provided with means for allowing a predetermined amount of water to pass through the respective underlying openings.

4. In a cooling tower of the character described, a casing formed with a discharge chamber having the top, bottom and sides thereof closed to form a horizontal air guiding conduit in communication with the discharge chamber; water distributing means for discharging water at the top of the conduit for gravitating downwardly therethrough; a fan in the discharge chamber for forcibly propelling air through the conduit; a water collecting tray vertically spaced above the bottom of the conduit, provided with downwardly directed openings and setting off an upper and a lower compartment in the conduit; a water collecting basin at the bottom of said conduit; condenser tubes arranged in segregated banks in the lower compartment spaced above the water in said collecting basin and below said tray to be wetted by the water falling from the tray to the basin; a plurality of vertically spaced splash decks in the air guiding conduit above the collecting tray; a pump for returning water from the basin to the said water distributing means at the top of the conduit; and a closed cover over the openings in the tray above each bank of tubes respectively having a valved inlet opening through one side thereof.

5. In a cooling tower of the character described a casing formed with a discharge chamber and having the top, bottom and sides thereof closed to form a horizontal air guiding conduit in communication with the discharge chamber; water distributing means for discharging water at the top of the conduit for gravitating downwardly therethrough; a fan in the discharge chamber for forcibly propelling air through the conduit; a water collecting tray vertically spaced above the bottom of the conduit, provided with downwardly directed openings and setting off an upper and a lower compartment in the conduit; a water collecting basin at the bottom of said conduit; condenser tubes in the lower compartment spaced above the water in said collecting basin and below said tray to be wetted by the water falling from the tray to the basin; a plurality of vertically spaced splash decks in the air guiding conduit above the collecting tray; a pump for returning water from the basin to the said water distributing means at the top of the conduit; and a valved port establishing the only means of communication between the lower compartment and the discharge chamber.

6. In a cooling tower of the character described a casing formed with a discharge chamber and having the top, bottom and sides thereof closed to form a horizontal air guiding conduit in communication with the discharge chamber; water distributing means for discharging water at the top of the conduit for gravitating downwardly therethrough; a fan in the discharge chamber for forcibly propelling air through the conduit; a water collecting tray vertically spaced above the bottom of the conduit, provided with downwardly directed openings and setting off an upper and a lower compartment in the conduit; a water collecting basin at the bottom of said conduit; condenser tubes in the lower compartment spaced above the water in said collecting basin and below said tray to be wetted by the water falling from the tray to the basin; a plurality of vertically spaced splash decks in the air guiding conduit above the collecting tray; a pump for returning water from the basin to the said water distributing means at the top of the conduit; a port establishing the only means of communication between the lower compartment and the discharge chamber; a valve in said port; and means for setting the valve to cause a predetermined amount of air to pass to the discharge chamber from the lower compartment.

7. In a cooling tower of the character described a casing formed with a discharge chamber and having the top, bottom and sides thereof closed to form a horizontal air guiding conduit in communication with the discharge chamber; water distributing means for discharging water at the top of the conduit for gravitating downwardly therethrough; a fan in the discharge chamber for forcibly propelling air through the conduit; a water collecting tray vertically spaced above the bottom of the conduit, provided with downwardly directed openings and setting off an upper and a lower compartment in the conduit; a water collecting basin at the bottom of said conduit; condenser tubes in the lower compartment spaced above the water in said collecting basin and below said tray to be wetted by the water falling from the tray to the basin; a plurality of vertically spaced splash decks in the air guiding conduit above the collecting tray; a pump for returning water from the basin to the said water distributing means at the top of the conduit; and a valved port establishing the only means of communication between the lower compartment and the discharge chamber, said discharge chamber having baffle means therein be-

tween the said decks and said fan to equalize the flow of air horizontally and in substantially uniform volume in parallel streams across the entire deck areas.

8. In a cooling tower of the character described, a casing formed with a discharge chamber and having the top, bottom and sides thereof closed to form a horizontal air guiding conduit in communication with the discharge chamber; water distributing means for discharging water at the top of the conduit for gravitating downwardly therethrough; a water collecting tray vertically spaced above the bottom of the conduit, provided with downwardly directed openings and setting off an upper and lower compartment in the conduit; a water collecting basin at the bottom of said conduit; condenser tubes arranged in horizontally spaced apart banks in the lower compartment spaced above the water in said collecting basin and below said tray to be wetted by the water falling from the tray to the basin; and a pump for returning water from the basin to the said water distributing means at the top of the conduit, said openings in the tray being arranged in groups above each bank of condenser tubes respectively, each of said groups of openings having means for controlling the flow of water through all the openings thereof.

9. In a cooling tower of the character described, a casing formed with a discharge chamber and having the top, bottom and sides thereof closed to form a horizontal air guiding conduit in communication with the discharge chamber; water distributing means for discharging water at the top of the conduit for gravitating downwardly therethrough; a fan in the discharge chamber for forcibly propelling air through the conduit; a water collecting tray vertically spaced above the bottom of the conduit; provided with downwardly directed openings and setting off an upper and lower compartment in the conduit; a water collecting basin at the bottom of said conduit; and condenser tubes arranged in horizontally spaced apart banks in the lower compartment spaced above the water in said collecting basin and below said tray to be wetted by the water falling from the tray to the basin, said openings in the tray being arranged in groups above each bank of condenser tubes respectively, each of said groups of openings having means for controlling the flow of water through all the openings thereof.

10. In a cooling tower of the character described, a casing formed with a discharge chamber and having the top, bottom and sides thereof closed to form a horizontal air guiding conduit in communication with the discharge chamber; water distributing means for discharging water at the top of the conduit for gravitating downwardly therethrough; a water collecting tray vertically spaced above the bottom of the conduit, provided with downwardly directed openings and setting off an upper and lower compartment in the conduit; a water collecting basin at the bottom of said conduit; and condenser tubes arranged in horizontally spaced apart banks in the lower compartment spaced above the water in said collecting basin and below said tray to be wetted by the water falling from the tray to the basin, said openings in the tray being arranged in groups above each bank of condenser tubes respectively, each of said groups of openings having means for controlling the flow of water through all the openings thereof.

LEON T. MART.