Dec. 25, 1956 J. F. SHELTON 2,775,310

COOLING TOWER

Filed June 1, 1953. 2 Sheets-Sheet 1

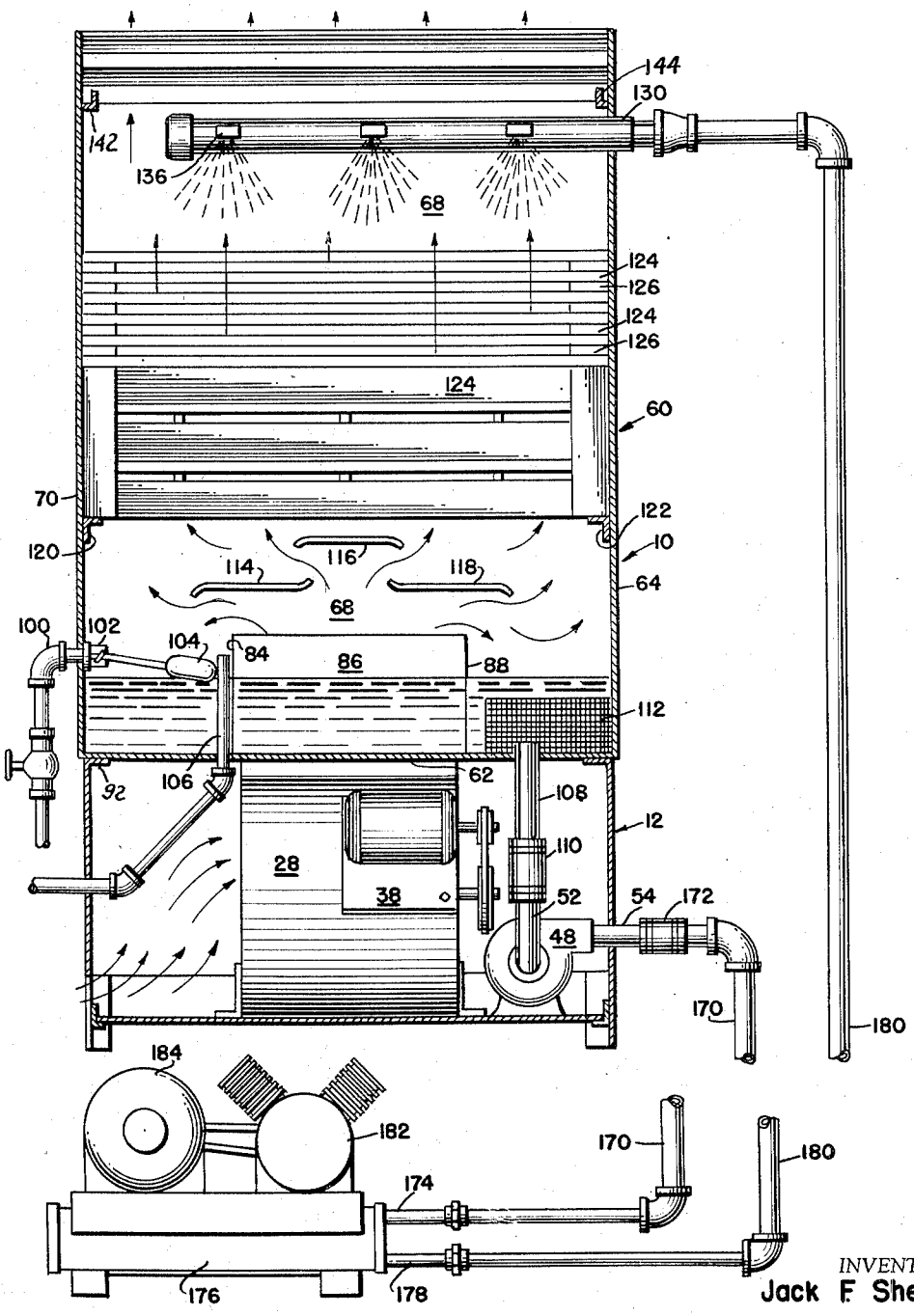


FIG. 1.

INVENTOR
Jack F Shelton

BY Sylvester J. Liddy
Arthur L. Nathanson
ATTORNEY

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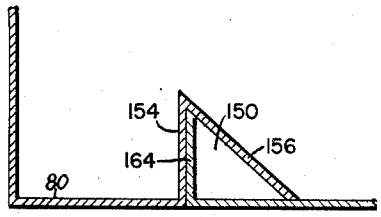


FIG. 4.

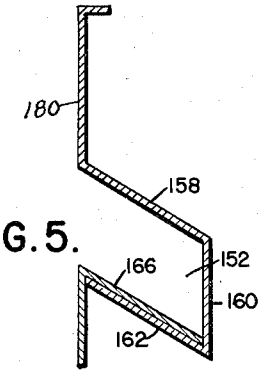


FIG. 5.

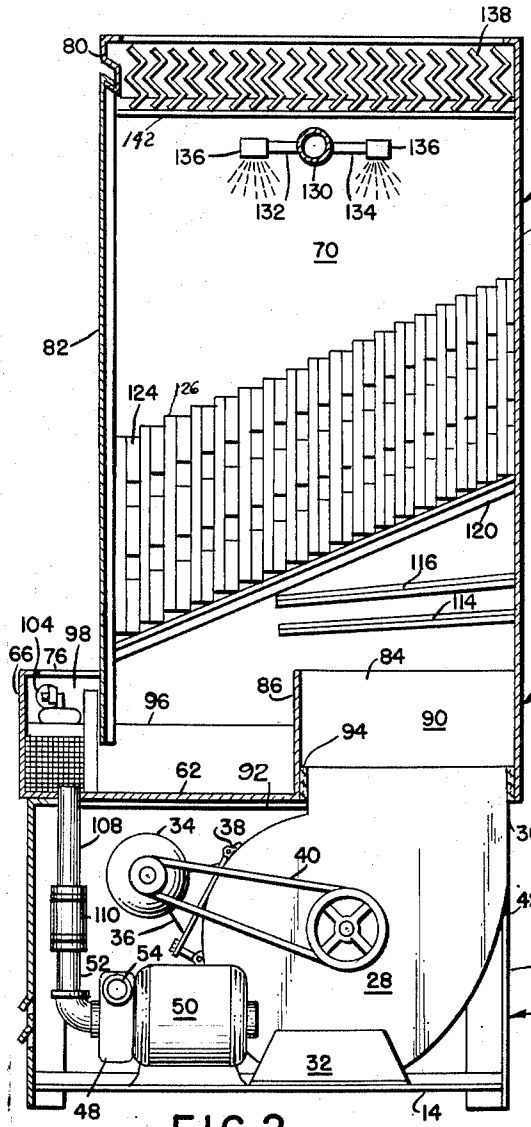


FIG. 2.

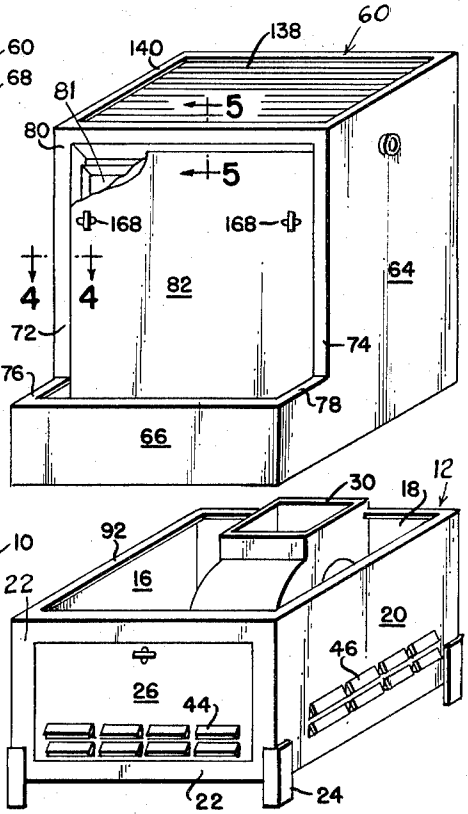


FIG. 3.

INVENTOR
Jack F. Shelton

BY Sylvester J. Liddy
Arthur L. Nathanson
ATTORNEY

United States Patent Office

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COOLING TOWER

Jack F. Shelton, Memphis, Tenn.

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8 Claims. (Cl. 183—26)

This invention relates to heat exchangers and in particular to a forced pressure draft cooling tower.

In refrigeration and air conditioning apparatus it is common to employ a water cooled condensing unit for condensing refrigerant delivered from a compressor. In many instances the water which is circulated through the condenser is itself cooled after it leaves the condenser and re-circulated. Thus the amount of water used is held to a minimum and the cost of operation of the cooling plant is maintained at an economical level. The hereinafter described invention relates to a means for cooling the water (fluid) used in condensing units.

Such water coolers must in turn be compact in size and as a corollary efficient in operation in order to keep their initial cost, installation and operation expense within reason. Furthermore it is necessary that such units be constructed so that they can be easily cleaned and serviced. It is standard practice to clean cooling towers frequently owing to the amount of air that is drawn into the tower, etc. Dust will accumulate and form a muck in the bottom which must be removed from time to time, and the inside of the towers must be painted every two years to prevent rust. Also the spraying heads and other apparatus must be cleaned and serviced.

It is accordingly among the objects of this invention to provide a cooling tower which is compact and efficient in operation, which can be easily installed, which can be easily serviced and conveniently cleaned and inspected.

Another object of this invention is to provide a multiple section cooling tower comprising an upper and lower section with powered apparatus mounted in the lower section and the cooling compartment enclosure provided in the upper section.

Yet another object of this invention is to provide a cooling tower having a blower mounted in a lower section thereof with novel means for transmitting air delivered therefrom into a water reservoir in an upper section thereof.

Still another object of this invention is to provide a sectional cooling tower with means for preventing the transmission of vibration from one section to another.

Also an object of this invention is to provide a cooling tower having a main water reservoir and a fluid level control reservoir in communication therewith, thereby insuring proper fluid (water) control.

Another object of the invention is the provision of a means providing access to the tower proper for maintenance which functions as a divider for dividing the main reservoir from the fluid level control reservoir and being removable to provide easy access to both reservoirs for cleaning and inspection.

In standard cooling towers used today inspection doors are held in position by screws, bolts and gaskets which rust or corrode and which must be cut out from time to time to open the doors and then replaced. Accordingly, the objects of this invention include the provision of an

inspection door which cooperates with the tower proper in a way such as to insure an effective tight sealing fit yet with which bolts, nuts, and gaskets, etc., are not needed. According to the invention disclosed herein, there is provided an inspection door and a reservoir divider which is maintained securely in operating position yet which can be easily removed.

A further object of this invention is to provide a vertically positioned inspection door which can be held in a sealed closing relationship with a cooling tower by gravitational force.

To insure effective cooling action, the objects of this invention also include the provision of novel baffle means for directing the flow of air delivered by a blower so as to agitate the water maintained in the fluid reservoir.

Other objects of the present invention include the provision of a low cost, easily installed, highly efficient, reliably-operating, easy to maintain forced draft cooling tower of a compact size.

These and other objects and advantages will become apparent from the following description and accompanying drawings in which:

Figure 1 is a front elevational view, partly in section showing a cooling tower constructed in accordance with the invention and a condenser and compressor unit used therewith.

Figure 2 is a side elevational view partly in section illustrating the cooling tower shown in Fig. 1.

Figure 3 is an exploded perspective view of the cooling tower of Fig. 1.

Figure 4 is a sectional view taken along line 4—4 of Fig. 3.

Figure 5 is a sectional view taken along line 5—5 of Fig. 3.

Similar reference characters in the several figures represent similar parts.

Referring now in particular to the drawings, reference character 10 designates a cooling tower constructed in accordance with the invention. The tower comprises a lower or base section 12 having a bottom 14, upstanding sides 16, 18, 20 and 22, legs 24 and a service door 26. Service door 26 is mounted in front side 22 in any convenient manner.

A blower 28 having an upwardly directed discharge outlet 30 is mounted in the lower or base section by means of brackets 32. A motor 34 mounted on the blower housing by flange 36 and mounting means 38, is connected to the blower by belt 40. The rear portion of the blower housing merges with rear side 18 as at 42 to form a portion of the rear side of the lower section. The blower housing and rear side 18 can be fastened to each other by any convenient means such as flanges, gaskets, etc. Grills such as 44 and 46 are provided for the free admission of air to the blower.

Pump 48, motor 50 and conduits 52 and 54 are also supported in the base section and serve to convey water to cooling units and to the upper section of the cooling tower hereinafter described.

Upper section 60 comprises a base 62 and spaced vertically extending sides 64, 66, 68 and 70. Front side 66 extends only a short distance above base 62 and sides 64 and 70 are cut back as shown at 72 and 74 to provide sections 76 and 78 which are vertically coextensive with side 66. An upper bridging panel 80 connects the portions of sides 70 and 64 lying above sections 76 and 78. The bridging panel has an access opening 81 formed therein.

A panel or door 82 cooperates with bridging panel 80 and sides 64, 68 and 70 to form an enclosure or cooling tower proper and normally is positioned to close opening 81. Panel 82 extends downwardly below the

upper edges of side **66** and sections **76** and **78** but lies above base or bottom **62**.

Upstanding sheets **84**, **86** and **88** are affixed to base **62** and rear side panel **68** so as to form a collar **90** with said rear side panel. As shown in Figures 1 and 2, base **62** of upper section **60** rests on and is supported by flange **92** of lower section **12** and collar **90** receives discharge outlet **30** of blower **28**. The collar is spaced from the discharge outlet sufficiently to receive a gasket **94** therebetween. Gasket **94** is made of felt or other vibration dampening material. Gasket **94** is secured to the blower discharge outlet only and closely abuts said outlet and collar **90**. By means of the gasket as well as by use of proper mounting of the blower and motor **50** on bottom **14** the transmission of vibration is eliminated.

Collar **90**, base **62**, and sides **64**, **66**, **68** and **70** form a water reservoir in the bottom of upper section **60**. When the reservoir is filled to the level shown panel **82** divides the reservoir into a main reservoir **96** and a fluid level control reservoir **98**.

Reservoir **98** is, as shown in Fig. 2, outside the enclosure formed by sides **68**, **70** and **64** and panel **82** and is open at the top. Thus, it and any equipment therein can be easily inspected without the removal of any panels or access doors.

Fluid level control reservoir **98** is provided with a water inlet pipe **100** having a cut-off valve **102** actuated by a float **104**. Pipe **100** is connected to the water supply. By proper adjustment of valve **102** and float **104** the admission of water into the system can be controlled by the water level in reservoir **98**. Overflow pipe **106** is also mounted in reservoir **98** to control the maximum water level. Pipe **106** can be connected to the sewer, etc.

Intake conduit **108** extends through base **62** and connects by means of flexible hose connector **110** to conduit **52**. Screen **112** prevents the entrance of foreign matter into the cooling system.

Baffles **114**, **116** and **118** extend outwardly from the rear side **68** and overlie collar **90** and discharge outlet **30** so as to intercept the air delivered by the blower and to prevent water inserted into the upper enclosure from falling into the blower. Baffles **114** and **118**, in particular, direct the flow of air laterally of the collar and toward as well as downwardly into the main reservoir so as to force the water therein upwardly along the sides of the enclosure formed by panel **82** and sides **64**, **68** and **70**, and so as to keep the water therein in a state of agitation which facilitates the cooling thereof.

Flanges **120** and **122** are fastened on sides **70** and **64**, respectively, and extend downwardly toward panel **82** in parallel spaced relationship. Wooden fillers **124** are mounted in vertically spaced relationship on flanges **120** and **122**. Spacers **126** maintain the fillers in spaced relationship and bridging panel **80** maintains the group of fillers and spacers in vertical position.

By slanting flanges **120** and **122** downwardly toward inspection panel or door **82**, inspection and removal of the individual fillers is facilitated.

Inlet pipe **130** is supported above the fillers and has laterally extending branch conduits **132**, **134** provided with spray nozzles **136**. The spray nozzles introduce the cooling fluid (water) into the cooling tower enclosure above the fillers.

The wooden fillers check the flow of water from the spray heads. The water spreads over the surface of the fillers which are equally spaced. The water passes down between the fillers and the air passes upwardly between them. The pressure of the air, which is delivered in quantities of approximately 1600 cubic feet per minute in the tower shown, flattens the water into a thin layer over the entire surface of the fillers. No part of the water delivered by the spray heads can fall to the bottom of the tower without undergoing a constant scrubbing action in the fillers. After the air passes through the fillers it comes in direct contact with the water at the spray heads, and breaks the water up into a heavy mist which settles on the fillers.

Water eliminators **138** which may be formed of thin sheet material shaped as shown extend across the upper end of the tower enclosure below the upper edge **140**. Spaced parallel supporting flanges **142** and **144** mounted on sides **70** and **64** provide vertical support for the eliminators. The eliminators can be fastened to side elements **70** and **64** by any convenient means. They are designed to separate the water from the air. A tortuous path in which the direction of movement of the air is reversed is provided by the eliminators.

The door or panel **82** of the tower enclosure or compartment cooperates or is hung in a unique manner. As shown in Figs. 3, 4 and 5, bridging panel **80** is provided with vertically extending recesses **150** opening outwardly along each inner side thereof and a horizontal recess **152** opening outwardly thereof along its upper inner side and communicating with the two vertical recesses **150**.

Recesses **150** are formed by inwardly extending leg **154** and outwardly extending leg **156** of panel **80**. The latter leg extends angularly outwardly of leg **154** to a position approximately flush with the inner surface of panel **80** proper.

Recess **152** is formed by downwardly and inwardly projecting leg **158**, vertical inner leg **160** and outwardly and upwardly extending leg **162**. Leg **162** extends parallel to leg **158** and leg **160** extends parallel to panel **80**. Recesses **150** and **152** are connected at their adjacent ends to form a continuous outwardly opening recess extending around the perimeter of opening **81**. Any water in the recesses will drain into the reservoir. Leg **162** angles downwardly.

Removable panel **82** has an inwardly extending flange **164** along its vertical sides and a similar flange **166** along its upper sides. Flange **164** extends parallel to and in abutting relationship with leg **154**. Flange **166** angles downwardly and extends parallel to and in abutting relationship with leg **162**. Flanges **164** and **166** are connected at their adjacent edges to form a continuous flange adapted to be seated, as shown, in recess **150—152**. As clearly indicated in the drawings, panel or door **82** will remain in its normally closed position (illustrated) without the need of any fastening devices, since gravitational force alone will maintain the panel in normal position with the panel supported by leg **162**. Also it is apparent that no gaskets or similar sealing means are needed to provide a tight fit between panel **80** and door **82** because of the construction of the cooperating recesses and flanges. Lifting handles **168** are provided for lifting and removing panel **82** which lifting and removal can be easily accomplished. It is pointed out that a cover can be provided for the fluid level control reservoir **98** if desired. Such a cover could be hingedly or otherwise attached to panel **80**, **82** or side **66**.

Figure 1 further illustrates a conduit **170** connected by flexible hose **172** to pump outlet conduit **54** and which leads to inlet **174** of water cooled condenser **176**. The outlet **178** of condenser **176** is connected by conduit **180** to spray inlet **130**. The condenser is shown to be associated with a compressor **182** and motor **184** forming part of a cooling system.

While I have shown and described a preferred form of my invention, it will be understood that variations in details of form may be made without departure from the invention as defined in the appended claims.

I claim:

1. A cooling tower comprising a lower section, a blower including means forming a discharge outlet therefor, an upper section supported on said lower section, means forming a collar in said upper section, said collar surrounding said discharge outlet, a vibration dampening gasket interposed and supported between said collar and

said discharge outlet, said collar being open at its upper end, said upper section having a bottom and sides upstanding therefrom forming together with said collar a water reservoir, a removable panel extending substantially vertically across said upper section inwardly of at least one of said sides and cooperating with the other of said sides to form an enclosure for baffles and fluid spray nozzles and dividing said reservoir, when said reservoir is filled with fluid to a normal level, into a main reservoir, and a fluid level control reservoir in communication therewith, fluid level control means mounted in the last named reservoir, said panel having portions projecting outwardly at an angle thereto adjacent the perimeter thereof received within means forming a recess connected with the other of said sides and opening outwardly of said enclosure, baffles mounted in said enclosure above said collar for directing the flow of air delivered by said blower downwardly into said reservoir, spaced filler elements extending across said enclosure above said baffles and providing passageways for air delivered by said blower, fluid spray nozzles mounted above said filler elements, fluid eliminators mounted above said spray nozzles and providing passageways for the exit of air from said enclosure, and a pump for supplying liquid from at least one of said reservoirs to said spray nozzles.

2. A cooling tower comprising a base section having a blower mounted therein with an upwardly directed discharge outlet, an upper section supported on said base section and having a collar surrounding said discharge outlet, a reservoir in said upper section formed in part by said collar, a baffle mounted in said upper section positioned and formed to direct the flow of air received from said discharge outlet downwardly into said reservoir, a panel normally positioned in said upper section to shield a portion of said reservoir from said flow of air when said reservoir is filled with liquid to a normal level, said upper section having an access opening normally closed by said panel, means forming a recess extending around the perimeter of said access opening, said panel having a flange received in said recess, said flange resting on at least a portion of said means forming said recess and supporting said panel in the normal position, said panel being removable for access to all of said reservoir, said panel being maintained in normal position by gravitational forces only.

3. A cooling tower comprising a substantially vertically extending enclosure having a base and upwardly extending sides, means forming an opening for directing air through said enclosure comprising additional upstanding elements, said elements and said sides forming a fluid reservoir with said base, a baffle extending inwardly of said enclosure into the normal path of movement of said air from said opening and formed to direct said air into said fluid reservoir, and a panel forming a part of said enclosure and shielding a portion of said reservoir from movement of said air as normally directed by said baffle when said reservoir is filled to a normal level with a fluid, said enclosure having an access opening normally closed by said panel, means forming a recess extending around the perimeter of said access opening, said panel having a flange received on said recess, said flange resting on at least a portion of said means forming said recess and supporting said panel in normal position.

4. A cooling tower comprising a substantially vertically extending enclosure having a base and upwardly extending sides, means forming an opening for directing air through said enclosure comprising additional upstanding elements, said elements and said sides forming a fluid reservoir with said base, a baffle extending inwardly of said enclosure into the normal path of movement of said air from said opening and formed to direct said air into said fluid reservoir, a panel forming a part of said enclosure and shielding a portion of said reservoir from movement of said air as normally directed by said baffle when said reservoir is filled to a normal level with a fluid, and means mounted in the shielded portion of said reservoir for maintaining the fluid level in said reservoir at a normal level including a supply pipe having a fluid level operated shut off valve, and an overflow pipe and a spray nozzle mounted adjacent the top of said tower, means for moving water from said reservoir to said spray nozzle, said baffle being positioned below said spray nozzle and being adapted to receive water therefrom, said baffle being formed to direct said water into said reservoir laterally of the flow of air out of said opening and along said baffle.

5. A cooling tower comprising an enclosure including a base, upwardly extending sides, and having a reservoir formed in the bottom thereof, means for directing air upwardly into said enclosure and downwardly into said reservoir, means forming part of said enclosure and extending partially into said reservoir to prevent the passage of said air into a portion thereof when said reservoir has a normal amount of liquid therein, said last named means being removable to provide access to said enclosure and comprising a panel, means forming a recess in said enclosure, said panel having a flange received in said recess, said flange resting on at least a portion of said means forming said recess and supporting said panel in position to form a part of said enclosure and in a position in which said panel extends partially into said reservoir.

6. A cooling tower comprising a lower section, a blower including means forming a discharge outlet therefor, an upper section supported on said lower section, means forming a collar in said upper section, said collar surrounding said discharge outlet and being open at its upper end, said upper section having a base and side members, upstanding therefrom forming a reservoir with said collar, a removable panel extending across said upper section and cooperating with said side members to form an enclosure for a baffle and a fluid spray nozzle, said panel dividing said reservoir, when said reservoir is filled with liquid to a normal level, into a main reservoir and a fluid level control reservoir in communication therewith, fluid level control means mounted in the last named reservoir, said panel having portions projecting outwardly at an angle thereto received within means forming a recess connected with said side members and said recess opening outwardly of said enclosure, a baffle mounted in said enclosure above said collar for directing the flow of air delivered by said blower over the water in said reservoir, filler elements extending across said enclosure above said baffle, a spray nozzle mounted above said filler elements, said filler elements forming passageways for air delivered by said blower and water delivered from said nozzles, fluid eliminators mounted above said nozzle providing passageways for the exit of air, and a pump for supplying liquid from at least one of said reservoirs to said spray nozzle.

7. A cooling tower comprising a lower section having a blower mounted therein, an upper section resting on said lower section, means for directing the discharge of air from said blower into said upper section including a discharge outlet, said upper section being formed by a base member and side members, spaced upstanding members connected to said base member and cooperating with one of said side members to form a collar, said collar receiving said discharge outlet for receiving air from said blower, said upstanding members, said base member and said side members forming a water reservoir, baffle means connected to said upper section and extending horizontally therein over said collar and above said outlet, said baffle means extending completely across said collar and outwardly of the sides of said collar, said baffle means serving to intercept the air delivered through said outlet immediately above said collar and to confine and direct said air horizontally into said upper section and downwardly into said reservoir, spray nozzles mounted above said baffle for spraying water into said upper section above said baffle means,

said baffle means normally receiving said water upon the top thereof and directing said water longitudinally in said upper section and then downwardly across the air directed into said upper section by said baffle means as the air leaves the confinement of the said baffle means.

8. A cooling tower comprising a substantially vertically extending enclosure having a base and upwardly extending sides, spaced upstanding elements connected to said base and forming a collar for receiving air with one of said sides, a blower mounted in said tower for forcing air through said collar, said spaced upstanding members, said sides and said base forming a fluid reservoir, a baffle means connected to said enclosure and extending laterally over said upstanding elements, said baffle means having edges spaced from the others of said sides, said baffle means extending beyond the sides of said collar, said baffle means serving to intercept the air delivered through said collar immediately above said collar and to confine and direct said air horizontally into said enclosure and downwardly into said reservoir, spray nozzles

mounted above said baffle means for spraying water into said enclosure above said baffle means, said baffle means normally receiving said water upon its top and directing said water horizontally in said enclosure and then downwardly across the air directed into said enclosure by said baffle means as the air leaves the confinement of the said baffle means.

References Cited in the file of this patent

UNITED STATES PATENTS

2,192,862	Eagley	Mar. 5, 1940
2,311,155	Carr	Feb. 16, 1943
2,325,692	Maddox	Aug. 3, 1943
2,360,981	Rupp	Oct. 24, 1944
2,384,016	Dishner	Sept. 4, 1945
2,514,631	Elvers	July 11, 1950
2,620,722	Owens	Dec. 9, 1952
2,656,780	Spieth	Oct. 27, 1953
2,661,936	De Vilbiss	Dec. 8, 1953