

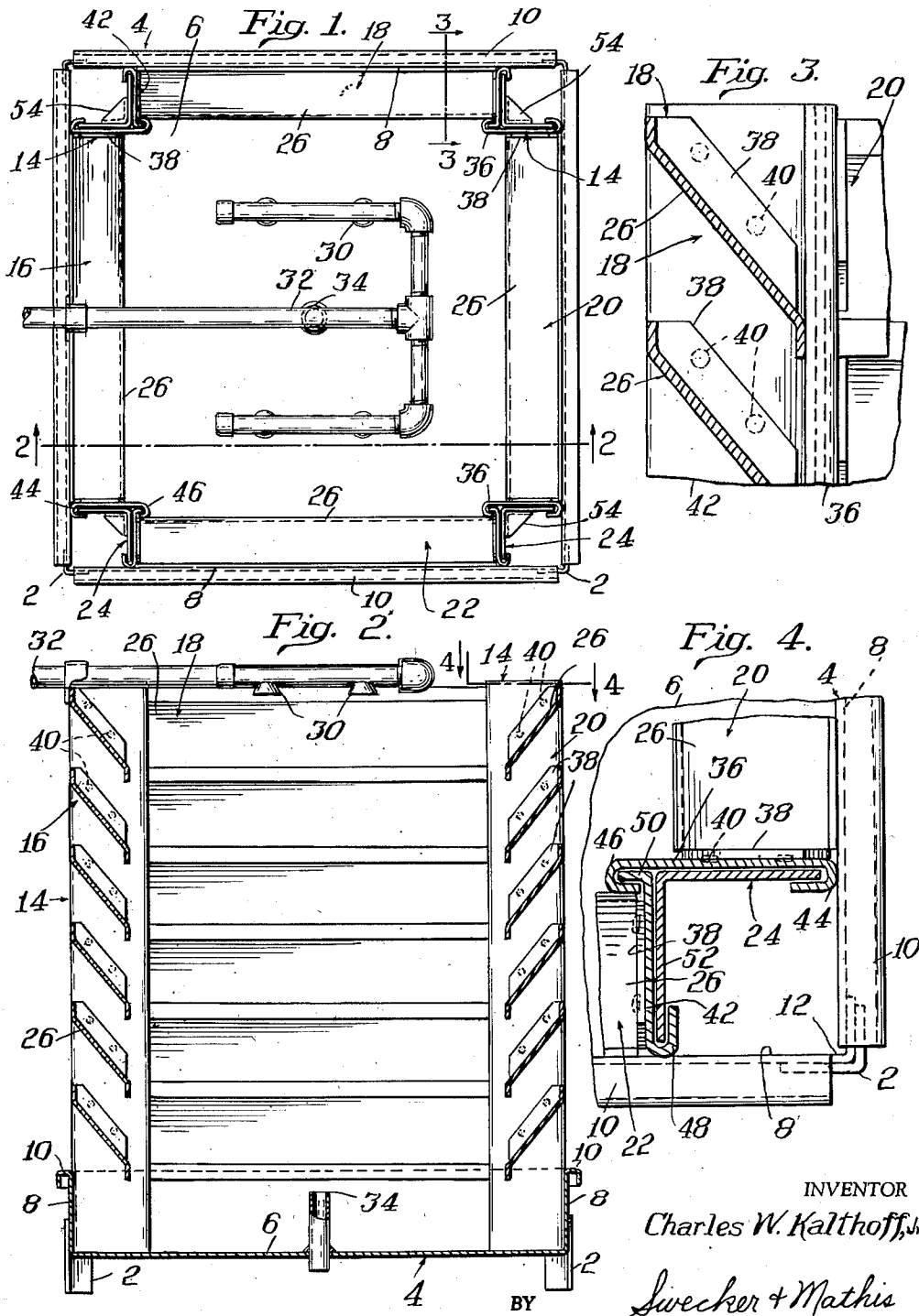
Feb. 5, 1957

C. W. KALTHOFF, JR

2,780,447

COOLING TOWER

Filed March 1, 1955



INVENTOR

Charles W. Kalthoff, Jr.

Swecker + Mathis

ATTORNEYS

1

2,780,447

COOLING TOWER

Charles W. Kalthoff, Jr., Knoxville, Tenn.

Application March 1, 1955, Serial No. 491,246

6 Claims. (Cl. 261—111)

This invention relates to a cooling tower, and more particularly, to a cooling tower of the type used to bring about an intimate contact between a liquid and a gas for heat exchange purposes.

Cooling towers of the type with which this invention is concerned are frequently employed in large air conditioning systems. The water employed as the cooling medium in the condenser of such a system must be maintained at a relatively low temperature in order for the system to operate properly. The maintenance of the proper temperature in the cooling water circulating system is the function assigned to the cooling tower.

The heated water from the condenser is usually pumped up to the roof of the building in which the air conditioning system is employed, and there it is sprayed from nozzles onto a plurality of groups of superposed, inclined slats. Air, at atmospheric temperature, a temperature lower than the temperature of the water, passes between the slats of each of the groups. Consequently, as the water trickles down from one slat to another in the several groups, it is brought into intimate contact with the air, and its temperature is lowered. The cooled water is then collected in a container at the base of the cooling tower from which it is returned to the condenser of the air conditioning system.

The cooling towers employed in many systems must be very large in order to handle the substantial quantities of water being used. The size of these large cooling towers has made installation of them a troublesome matter. If the cooling tower is assembled at the factory, difficulty may be encountered in getting it onto the roof of the building where it is to be used, because the various openings normally provided in buildings are not designed to accommodate such a large object. Furthermore, the shipping of a factory assembled cooling tower is unnecessarily expensive.

The alternative to shipping a cooling tower to the point of use in assembled form is, of course, to construct the cooling tower right at the place where it is to be used. With the prior art constructions, however, this method was not an economical one. The advantages of factory production had to be abandoned altogether in many cases, leaving the job one of custom construction. Additionally, the places where the cooling towers were to be located frequently were unsafe places for the builders to work.

This invention overcomes the difficulties noted above by providing a cooling tower which can be shipped from the factory in partly assembled form. Then, at the point of use, the various subassemblies may be connected together to form the completed cooling tower. The construction is such that the erection of the cooling tower at the point of use may be accomplished by one man without the use of screws, nails, or welding apparatus.

The cooling tower of this invention is shipped from the factory as a package or packages of subassemblies. These subassemblies include a base in the form of a container which is ultimately to receive the cooled water after its passage through the cooling zone of the device,

2

four slat panels which are to form the sides of the assembled cooling tower, and four corner elements for connecting together the slat panels.

The corner construction of the cooling tower of this invention is a novel one, and it permits the assembly of the apparatus without the use of conventional fasteners. Each of the slat panels has upright members at its ends, and adjacent ones of the upright members are configured so that they may be interlocked. Each of the corner members is adapted to cooperate with one pair of interlocked upright members to prevent separation thereof. The positioning of the corner members involves nothing more than sliding them into the guideways provided by the configuration of the uprights. With all four of the corner constructions completed, the structure becomes a stable side wall unit. This unit has outside dimensions which correspond to the inside dimensions of the base or container member of the cooling tower so that when the lower end of the side wall unit is disposed within the container, it will be supported by the side walls of the container to prevent tilting. The side wall unit need not be fixed to the base member.

A better understanding of this invention and its advantages will be gained from a consideration of a detailed description of the embodiment illustrated in the accompanying drawings in which:

Fig. 1 is a plan view of a cooling tower according to this invention;

Fig. 2 is a vertical cross-sectional view along the line 2—2 in Fig. 1;

Fig. 3 is an enlarged vertical cross-sectional view along the line 3—3 in Fig. 1; and

Fig. 4 is an enlarged horizontal cross-sectional view along the line 4—4 in Fig. 2.

The cooling tower is supported by suitable legs such as those indicated by the numerals 2 in Fig. 2. These legs are permanently attached to a base or container member 4 by welding or other suitable means. However, in some installations, it is contemplated that the container 4 will rest directly upon the supporting surface and that the legs 2 will be omitted.

The container 4 is of sheet metal construction. It includes a bottom wall 6 and four side walls 8. Each of the side walls is rolled over at its upper edge as indicated by the numeral 10 in the drawings, to provide a stiffening flange, and the side walls are connected to each other by means of corner flaps 12, which also serve to make the corners watertight.

Positioned within and extending upwardly from the container 4 is a side wall unit 14. This unit is composed of four slat panels 16, 18, 20 and 22, arranged in a rectangle and connected together by corner members 24. Each of the slat panels includes a group of superposed slats 26. Each of the slats 26 slopes downwardly toward the inside of the cooling tower, and the slats of each group overlap vertically to some extent as shown in Fig. 2.

Positioned above the side wall unit 14 in any suitable manner is a group of spray nozzles 30 for directing the water to be cooled onto the inclined slats of the side wall unit. A suitable conduit 32 supplies the water to the spray nozzles 30.

In operation, the water to be cooled is introduced into the cooling tower by means of the spray nozzles 30 in such a way that it moves downwardly over the slats of the side wall unit. Drops of water roll down the surface of a slat, and at the lower end of that slat, surface tension imparts a force to the drops directing them outwardly as they fall onto the slat immediately below. In this manner, the water is brought into intimate contact with the air and is cooled thereby.

The cooled water collects in the container 4. It is

3

withdrawn from the container 4 through suitable outlet openings, to be returned to the condenser of the air conditioning system. In the drawings, the outlet opening for the container 4 is in the form of an overflow pipe 34, welded to the bottom 6 of the container. The arrangement is such that there can be no leakage at the joint between the bottom of the container and the pipe 34. It will be understood that the overflow pipe type of outlet is illustrated merely as an example and that other types may be used, either in place of, or in combination with that shown. These are conventional in the art, and need not be described in detail.

The construction of the several slat panels is similar, and a description of panel 20 will make the construction of all of them apparent. The panel 20 is composed of two spaced apart, vertical uprights 36 extending from its top to its bottom. The slats 26 include vertical end flanges 38, the outer faces of which bear against the inner faces of the two uprights 36. The flanges 38 are secured to the uprights 36 by spot welding, as indicated by the dotted lines to which the numeral 40 is applied in the drawings.

The slat panel 16 is exactly the same as the slat panel 20 just described. The slat panels 18 and 22 differ from panel 20 only in the configuration of the uprights to which the slats are secured. The uprights for the panels 18 and 22 are designated by the numeral 42 in the drawings. The difference will become clear from a description of the novel corner construction of the cooling tower of this invention.

As best shown in Fig. 4, the upright 36 has turned-over outer and inner edge portions 44 and 46, respectively. The configuration is such as to provide guideways along the edge portions of the upright on the side thereof opposite that to which the slats 26 are secured.

Each of the uprights 42 has a turned-over outer edge portion 48 and a laterally extending flange portion 50 at its inner edge. The turned-over edge 48 is similar in all respects to the turned-over outer edge 44 of the upright 36. The lateral flange portion 50, however, is adapted to interlock with the turned-over inner edge portion 46 of the upright 36, as shown in Fig. 4.

The interlocked uprights 36 and 42 are held in the position shown in Fig. 4 by means of a corner member 24, composed of a piece of sheet metal 52 of angular configuration, and of at least one triangular bracing piece 54 welded to the two sides of the piece of angular configuration to fix the angle between its two sides as a right angle. The ends of the piece 52 fit within the guideways formed by the turned-over outer edge portions 44 and 48 of the two cooperating uprights 36 and 42.

With the corner member in place, the adjacent slat panels are rigidly connected together. Referring to Fig. 4, it will be seen that the interlock between the flange 50 and the turned-over inner edge portion 46 is such as to prevent either inward or outward movement of the upright 42 relative to the upright 36. It will also be seen that endwise movement in one direction of the panel 22, that is the panel of which the upright 42 is a part, is prevented by the presence of the corner member 24. Endwise movement of this panel in the opposite direction is prevented by the relationship existing between the inner edge portions of the two uprights 36 and 42. Upon consideration, it will be apparent that the panel 20 is also firmly locked in position against movement in any direction.

In practice, it is intended that the cooling tower of this invention be shipped from the factory in kit form. The base or container member 4, with the legs 2 attached where legs are to be used, is made up in finished form and constitutes one element of the kit. Each of the side wall panels is constructed at the factory, and each of them forms an element of the kit. The corner

4

members for connecting adjacent slat panels together complete the kit.

The kit is shipped to the point of use, and there, the elements are assembled to form the complete cooling tower. The assembling operation is very simple. All that need be done is to position a pair of slat panels, such as the panels 20 and 22, along adjacent sides of the container 4, with the flange 50 on the upright 42 of the panel 22 interlocked with the turned-over inner edge portion 46 of the upright 36 of the panel 20 in the manner shown in Fig. 4. In nearly all cases, the parts can be moved to this position by one man and held there with one hand. This leaves the other hand of the worker free to manipulate the corner member 24 comprising the angular piece of sheet metal 52. The corner member is lifted into a position in which its lower edges may be inserted into the passageways formed by the turned-over outer edge portions 44 and 48 of the cooperating uprights. Then, it is allowed to move downwardly in these passageways by gravity as far as it will go. This completes the connection between panels 20 and 22.

The worker then moves the panel 16 into the position shown in Fig. 1, with the turned-over end portion 46 of one of its uprights 36 cooperating with the flange 50 on the opposite one of the uprights 42 of the panel 22. A careful study of Fig. 1 will show that bringing the panel 16 into the desired position presents no problem when no corner members 24 have been associated with it and when its edge opposite the one being interlocked with the panel 22 is free. With the panel 16 in its proper position with respect to the panel 22, the workman locks these two panels together by inserting another one of the corner members 24.

At this moment, the structure is a fairly stable one, and the workman may use both hands in positioning the last one 18 of the slot panels. In many cases the positioning of this panel will present no problem. However, in some situations, it is desirable that the fit between the various parts be very close. With the illustrated construction, the assembly of close fitting parts may be completed by merely lifting the panel 18 so that the bottom ends of the flanges 50 on its uprights 42 may be lowered by gravity into the passageways formed by the turned-over inner edge portions 46 of the uprights of the panels 16 and 20. With the panel 18 in position, the assembling operation is completed by inserting the remaining ones of the corner members 24.

The bearing areas between the side walls 8 of the container 4 and the outer edges of the uprights 36 and 42 of the several slat panels, and the bearing areas between the bottom 6 of the container and the bottoms of the uprights are substantial, and, since the side wall unit is fixed in its rectangular shape, there need be no structural connection between the side wall unit and the container member 4. A force sufficient to cause relative movement between these parts would be sufficient to ruin the apparatus anyway.

While a single embodiment of the invention has been described in considerable detail, various modifications and alterations will be apparent to persons skilled in the art. It is intended, therefore, that the foregoing description should be considered as exemplary only and that the scope of the invention should be determined from the following claims.

I claim:

1. A cooling tower comprising a container having side walls and a bottom wall, a plurality of slat panels each of which includes a pair of spaced uprights and a vertical series of inclined slats secured at their ends to said uprights, said slat panels being supported by said container and arranged end-to-end in a closed outline with adjacent ones of said uprights being interlocked, each pair of interlocked uprights including a first upright having outer and inner vertical guideways and a second upright having

5

an outer vertical guideway and an inner flange disposed within the inner vertical guideway of said first upright, and a plurality of corner members each of which includes side portions disposed within the outer guideways of a pair of interlocked uprights to hold said uprights in interlocked relation.

2. A collapsible side wall unit comprising a plurality of vertical panels arranged end-to-end in a closed outline with adjacent ends of said panels in interlocked relation; each pair of interlocked panel-ends including a first panel-end having outer and inner vertical guideways open at their adjacent edges and closed at their remote edges, and a second panel-end having a flange extending laterally from its inner edge into the inner guideway of said first panel-end, and an outer vertical guideway open at its inner edge and closed at its outer edge; and a plurality of corner members each of which includes side portions disposed at a fixed angle with respect to each other and extending into the outer guideways of a pair of interlocked panel-ends to hold them in interlocked relation.

3. A cooling tower comprising a container closed at its sides and bottom; a plurality of slat panels each of which includes a pair of spaced uprights resting upon the bottom of said container and contacting the inner surfaces of the sides of said container, and a vertical series of slats secured at their ends to said uprights; said slat panels being arranged end-to-end in a closed outline with adjacent ones of said uprights being interlocked; each pair of interlocked uprights including a first upright having inner and outer vertical guideways open at their proximate edges and closed at their remote edges, and a second upright having a flange extending into the inner guideway of said first upright and an outer vertical guideway open at its inner edge and closed at its outer edge; and a plurality of corner members each of which includes an angular element and a brace secured to said element to hold the sides thereof at a fixed angle, the sides of each of said elements being disposed so as to extend into the outer guideways of a pair of interlocked uprights to hold them together.

4. A cooling tower comprising a rectangular container closed at its sides and its bottom but being open at its top, four panels of slats resting freely upon the bottom of said container and extending upwardly from said container, each of said panels including a pair of spaced uprights contacting at their lower end portions one of the sides of said container and a series of superposed inclined slats secured at their ends to said uprights, the uprights of opposite ones of said panels being similar and adjacent ones of said uprights being interlocked, one upright in each pair of interlocked uprights having turned-over inner and outer edge portions defining vertical guideways open at their proximate edges, the other upright in each pair of interlocked uprights having a turned-over outer edge portion defining a vertical guideway open at its inner edge and a lateral flange extending into the guideway defined by the turned-over inner edge portion of said one upright, and four corner members each of which includes side portions disposed at right angles with respect to each other

6

and extending into the guideways defined by the turned-over outer edge portions of a pair of interlocked uprights to detachably secure said panels together in the form of a rectangular side wall unit.

5. A cooling tower comprising a rectangular container closed at its sides and its bottom but being open at its top, four panels of slats resting freely upon the bottom of said container and extending upwardly from said container, each of said panels including a pair of spaced uprights contacting at their lower end portions one of the sides of said container and a series of superposed inclined slats secured at their ends to said uprights, the uprights of opposite ones of said panels being similar and adjacent ones of said uprights being interlocked, one upright in each pair of interlocked uprights having turned-over inner and outer edge portions defining vertical guideways open at their proximate edges, the other upright in each pair of interlocked uprights having a turned-over outer edge portion defining a vertical guideway open at its inner edge and a lateral flange extending into the guideway defined by the turned-over inner edge portion of said one upright, four corner members each of which includes side portions disposed at right angles with respect to each other and extending into the guideways defined by the turned-over outer edge portions of a pair of interlocked uprights to detachably secure said panels together in the form of a rectangular side wall unit, means for spraying liquid onto the slats of said side wall unit, and means for removing liquid from said rectangular container.

6. A cooling tower kit adapted to be assembled at the point of use comprising a rectangular container open at its top and closed at its sides and bottom, four slat panels each of which includes a pair of spaced uprights and a series of superposed inclined slats secured at their ends to said uprights, said uprights including a first group of four identical uprights each of which has turned-over inner and outer edge portions defining, respectively, inner and outer vertical guideways open at their proximate edges, said uprights also including a second group of four vertical uprights each of which has a lateral flange at its inner edge and a turned-over outer edge portion defining a vertical guideway open at its inner edge, said uprights being arranged so that one from said first group may be disposed adjacent one from said second group in assembling said tower and so that each of said flanges may be inserted into one of said inner vertical guideways to interlock adjacent ones of said uprights, and four corner members each of which includes side portions disposed at right angles with respect to each other and adapted to be inserted into the guideways defined by the turned-over outer edge portions of adjacent uprights.

References Cited in the file of this patent

UNITED STATES PATENTS

1,757,664	Gohmann	May 6, 1930
1,846,485	Hart	Feb. 23, 1932
2,534,161	Collins	Dec. 12, 1950
2,540,091	Brackney	Feb. 9, 1951