

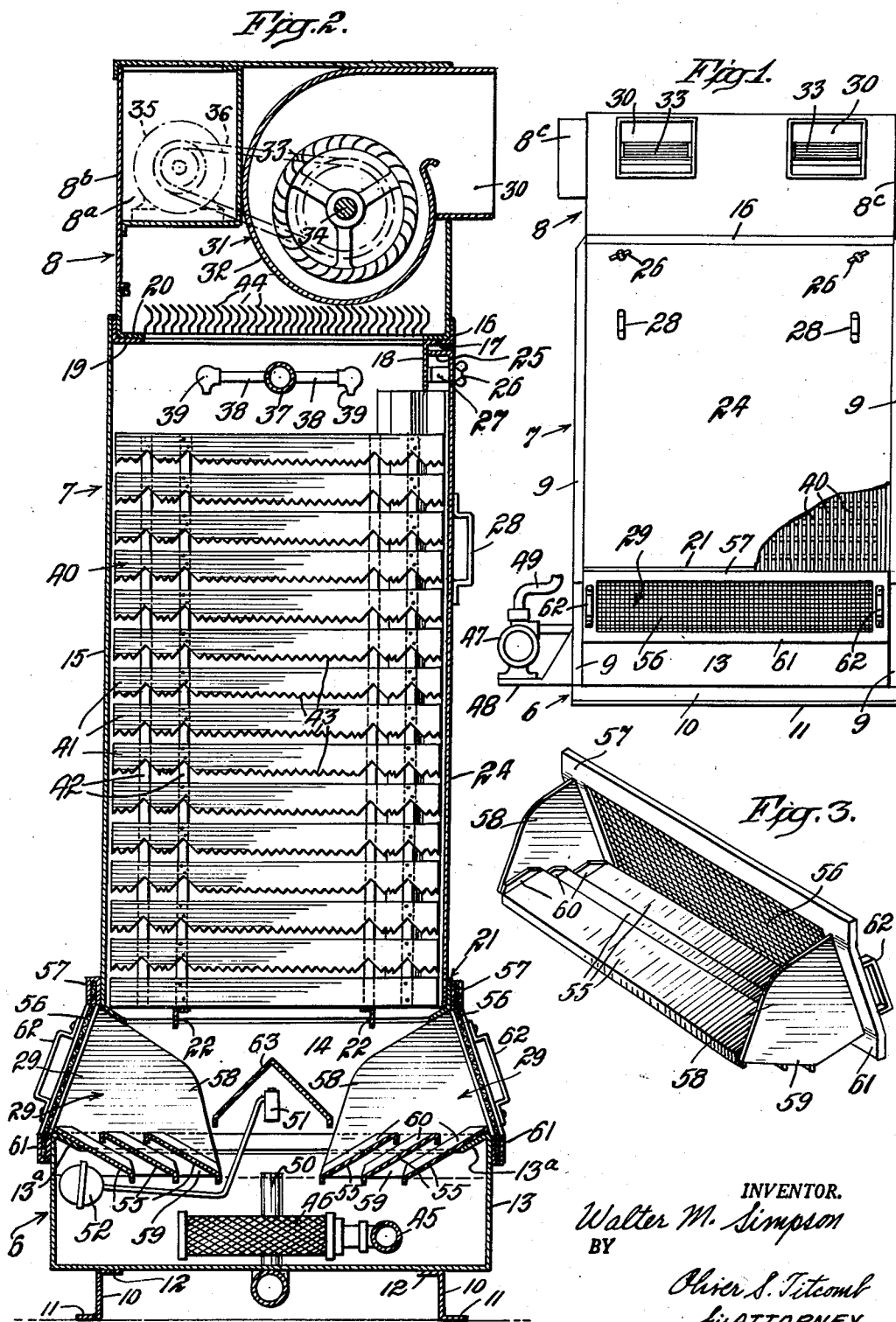
July 31, 1951

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2,562,827

EVAPORATIVE WATER COOLER

Filed March 26, 1947



UNITED STATES PATENT OFFICE

2,562,827

EVAPORATIVE WATER COOLER

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Application March 26, 1947, Serial No. 737,303

8 Claims. (Cl. 261—24)

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The present invention relates to improvements in evaporative water coolers and more particularly to an arrangement of splash baffles in a cooling tower.

Cooling towers usually comprise an upright casing enclosing suitable screens or other liquid distributing surfaces for dividing the water to be cooled into thin films over a large area as it flows therethrough by gravity. A portion of the water evaporates into air flowing countercurrent thereto and the abstraction of the heat of vaporization from the remaining water reduces its temperature. The cooled water drips from the liquid distributing surfaces into a sump at the bottom of the casing and an air inlet opening is provided therebetween so that the water falls a substantial distance as it drips into a pool of water in the sump and produces a splashing noise. Such cooling towers are usually large installations for commercial plants and located outside of the building so that the noise of splashing water is not objectionable.

The principal object of the present invention is to provide a small, compact and efficient cooling tower for domestic use to provide cooling water for a household appliance, such as an absorption refrigeration system.

Another object is to provide an arrangement of splash baffles in a cooling tower to eliminate the noise produced by water dripping from the liquid distributing packing into a pool of water in the sump.

Another object is to provide an air screen and splash baffle assembly in the form of a drawer adapted to be readily inserted into and withdrawn from the casing to facilitate cleaning and servicing of the assembly and sump.

Another object is to provide combined air screen and splash baffle assembly units at opposite sides of the casing which cooperate to provide splash baffles over a substantial part of the cross-sectional area of the casing.

Still another object of the invention is to provide an arrangement of splash baffles of the type indicated which will not interfere with or restrict the flow of air through the casing.

These and other objects will become more apparent from the following description and drawing in which like reference characters denote like parts throughout the several views. It is to be expressly understood, however, that the drawing is for the purpose of illustration only and not a definition of the limits of the invention, reference being had for this purpose to the appended claims. In the drawing:

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Fig. 1 is a front elevational view of a cooling tower incorporating the splash baffle arrangement of the present invention;

Fig. 2 is an enlarged sectional view of the cooling tower showing combined air screen and splash baffle units mounted in the air inlet openings at opposite sides of the tower; and

Fig. 3 is a perspective view of one of the combined air screen and splash baffle units.

Referring to the drawing the present invention is shown applied to a cooling tower comprising an upright sheet metal housing or casing having a lower part 6, constituting a sump, an intermediate part 7 for enclosing a liquid distributing packing and an upper part 8 constituting a blower assembly. The sections 6, 7 and 8 are supported by a frame having corner stanchions 9 with plates 10 extending between the lower ends of the stanchions 9 at the front and back of the frame. The plates 10, see Fig. 2, have outwardly projecting flanges 11 at their lower edges to provide feet for supporting the frame and inwardly projecting flanges 12 at their upper edges for supporting a rectangular sump tank 13. Sump tank 13 projects beyond the front and back of the frame and has an inwardly directed marginal flange 13a at its upper edge which form an inverted V-shaped seat at the upper edge of the tank. Overlying the ends of the tank are panels 14 attached to the corner stanchions 9 at the inside of the frame. The tank 13 and panels 14 constitute the lower part 6 of the upright housing or casing.

The intermediate part 7 of the casing comprises a back panel 15 and end panels (not shown) which are mounted on the corner stanchions 9 of the frame to provide an enclosing housing having an open front. An upper cross piece 16 extends between the end panels of the intermediate section 7 of the casing at the top of the open front which is of angle shape in cross section forming a front flange, a cross web constituting a seat 17 and a depending flange 18 offset rearwardly from the front flange, see Fig. 2. Angle flanges 19 are fixedly attached to the inside faces of the rear and end panels to provide a seat 20 on three sides constituting a continuation of the seat 17 of the cross piece 16. A lower cross piece 21 also is provided at the bottom of the open front having a front flange offset forwardly from the plane of the upper cross piece flange 16. The lower edge portions of the back panel 15, the end panels and the lower edge of the cross piece 21 are flanged inwardly to stiffen the structure. Extending between the

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lower ends of the end panels are beams 22 for supporting the liquid distributing packing as later described.

A removable service door 24, claimed in my copending application for Letters Patent Serial No. 737,302 filed concurrently herewith, cooperates with the end panels and upper and lower cross pieces 16 and 21 to close the open front of the intermediate casing part 7. The service door 24 has its lower end set into the forwardly offset flange of the lower cross piece 21, a rearwardly projecting flange 25 at its upper edge abutting the depending flange 18 of the cross piece 16 and suitable sealing means at the sides of the door to seal the intermediate casing part 7 to prevent water from leaking out or air from leaking into the casing. Removable wing bolts 26 are screwed into brackets 27 on the cross piece 16 to detachably connect the service door to the casing and handles 28 are provided on the door to facilitate its removal.

Air inlet openings 29 are provided between the lower and intermediate casing parts 6 and 7 at the front and back of the casing and the openings extend throughout the width of the casing. The air inlet opening 29 at the front of the casing extends between the top edge of the sump tank 13 and the cross piece 21 and the air inlet opening at the back of the casing extends between the top edge of the sump tank and the bottom edge of the rear panel 15.

The upper casing part 8 is a hollow box-like sheet metal casing having an open bottom and resting on the seats 17 and 20, the lower edges of its front and rearward walls being shaped to conform to the seats. The casing part 8 is mounted on the intermediate casing part 7 by merely placing it on the seats 17 and 20. On one side of the upper casing part 8 are outlet openings 30 through which air from the casing is discharged. Suitably mounted in the casing part 8 are induction fans 31 for drawing air into the casing through the air inlet openings 29 and discharging it through the air outlet openings 30. Each fan 31 comprises a scroll casing 32 and blade wheel 33 and the wheels of the plurality of fans are mounted on a common shaft 34 driven by a motor 35 and belt 36 positioned forwardly of the line of section of Fig. 2 and indicated by dotted lines. The motor 35 is mounted in a compartment 8a in the casing part 8 and having a small service door 8b to permit access to the motor. Detachable housings 8c at the ends of the casing part 8 enclose the bearings for the wheel shaft 34 and the belt 36.

Water to be cooled is delivered to the top of the intermediate part 7 of the casing by a pipe 37 having branches 38 with spray nozzles 39 at their ends. Underlying the spray nozzles 39 is a packing of the type claimed in my application for Letters Patent Serial No. 737,304 filed concurrently herewith. Suffice it to state herein that the packing comprises a plurality of wooden slat frames 40 arranged in side by side relationship. Each slat frame consists of a plurality of generally horizontal slats 41 attached in spaced relationship to one side of vertical supporting strips 42. Each of the slats 41 has a serrated lower edge to provide a series of drip forming projections 43 for distributing the water uniformly as it flows by gravity to the next adjacent lower slat. The supporting strips 42 hold the slats 41 of adjacent frames in spaced relationship and the strips of adjacent frames are arranged in offset staggered relationship. The slat frames 40 extend

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from a position slightly below the nozzles 39 to the bottom of the intermediate casing part 7 and the frames are supported at their lower ends on the beams 22 extending between the lower ends of the end panels of the casing.

The water delivered from the spray nozzles 39 flows by gravity through the slat frames 40 of the liquid distributing packing in the intermediate part 7 of the casing and into the sump tank 13. Thus, the water flows countercurrent to the direction of flow of air through the casing and a series of water separating baffle plates 44 are provided in the upper casing part 8 between the spray nozzles 39 and fans 31 to reduce the amount of spray discharged with the air.

Mounted in the sump tank 13 and forming an integral part thereof is a suction pipe 45 having an inlet filter screen 46. The suction pipe 45 extends through the end of the sump tank 13 and is connected to a motor driven pump 47 mounted on a platform 48 adapted to be attached to the corner stanchions 9 adjacent the sump tank at either end of the frame. An outlet pipe 49 from the pump delivers cooled water from the sump tank 13 to the place where it is to be used. An overflow pipe 50 is also provided in the sump tank 13 which extends vertically a predetermined distance above its bottom. Make-up water is supplied to the sump tank 13 by a water supply valve 51 suitably supported above the sump tank and controlled by a float 52 in the tank.

In accordance with the present invention splash baffles 55 are provided to eliminate the noise of water dripping from the bottom of the slat frames 40 of the packing into a pool of water in the sump tank 13. The splash baffles 55 are arranged in separate sets and the baffles of each set are combined with an air screen 56 in a unit assembly mounted in an air inlet opening 29 at the front or back of the cooling tower.

Each combined air screen and splash baffle unit comprises a marginal frame 57 for mounting the screen 56 and wings 58 extending rearwardly from the end members of the marginal frame. The edges of the wings 58 extend downwardly at an angle from the bottom of the screen and then rearwardly to provide a depending portion 59 below the screen. The splash baffles 55 are in the form of plates extending between the depending portions 59 of the wings 58 with flanges 60 at their ends attached to the wings as by welding. The foremost splash baffle plate has its forward edge overlapping the top edge of the bottom member 61 of the marginal frame, see Fig. 3, and extends rearwardly at an angle to the frame. Each of the successive splash baffle plates 55 is mounted in spaced parallel relationship with its upper edge positioned forwardly of the rearward edge of the preceding plate so that the plates of each assembly are arranged angularly in spaced overlapping relationship.

The air screen and splash baffle assembly units are slid into and out of the air inlet openings 29 in the manner of a drawer and the units have handles 62 on the forward faces of the end members of the marginal frame 57 to facilitate their insertion or removal. The lower member 61 of the marginal screen frame 57 and the foremost splash baffle plate 55 provide a notched seat on the unit assembly cooperating with the inverted V-shaped seat formed at the front or back edge of the sump tank 13 by the inwardly directed marginal flange 13a. As illustrated in Fig. 2, the upper and lower members of the marginal screen frame 57 are inclined forwardly and rear-

wardly to adapt them to rest against the lower cross piece 21 and the front of the sump tank 13, respectively, when the notched seat is engaged with the edge of the tank. Thus, an air screen and splash baffle unit may be slid into each of the air inlet openings 29 at which time the overlapping splash baffle plates 55 cover a substantial portion of the cross-sectional area of the cooling tower. To bridge the area between the inner ends of the splash baffle units an inverted V-shaped baffle 63 extends between the end panels 14 above the sump tank 13 and overlies the innermost splash baffle plates 55 of the separate units.

As will be observed by reference to Fig. 2 of the drawing the splash baffle plates 55 are positioned below the air inlet openings 29 so that they do not obstruct or otherwise resist the flow of air into the casing and the baffle 63 acts as a guide for directing the air for vertical flow through the packing. It will also be observed that the lower edges of the plates 55 extend below the liquid level of the pool of water in the sump tank 13 as controlled by the float 52. Thus, water from the packing frames 40 drips onto the angular baffle plates 63 and 55 and runs down the plates into the pool of water without any splashing noise. One form of the invention having now been described in detail, the mode of operation of the cooling tower is explained as follows.

Water to be cooled is delivered to the cooling tower through the pipe 37, branches 38 and nozzles 39 in the form of a spray uniformly distributed over the top of the packing. Simultaneously, air is drawn into the cooling tower by the induction fans 31, the air entering through the screens 56 and air inlet openings 29, flowing upwardly through the slat frames 40 of the packing and water eliminating baffle plates 44 and discharging through the outlet openings 30. The water sprayed from the nozzle 39 descends onto the top slat 41 of each slat frame 40 and flows by gravity down the sides of the slats in a thin film to the drip forming projections 43 at its bottom edge. The water drips from the projections 43 onto the top of the next lowermost slat and continues to flow by gravity over each successive slat of the slot frames 40 from the top to the bottom of the packing. Due to the drop forming projections the water does not run through the packing in localized streams but is uniformly distributed throughout the packing. Water from the lowermost slats 41 of the plurality of frames 40 drips onto the splash baffles 63 and 55 and runs into the pool of water in the sump tank 13 without noise.

As the water flows in thin films over the slats 41 of the slat frames 40, a portion of the water is evaporated into the stream of air flowing through the packing. The heat of vaporization is abstracted from the unevaporated water which reduces its temperature to a value approaching to the wet bulb temperature of the air entering the cooling tower. The cooled water in the sump tank 13 is drawn into the suction pipe 45 by the circulating pump 47 and delivered through the pipe 49 to the appliance to be cooled, such as the condenser and absorber of an absorption refrigeration system, and then back to the distributing pipe 37.

The front of the intermediate casing section 7 may be opened by removing the service door 24 to permit removal and replacement of slat frames 40, cleaning or painting the interior of

the tower or servicing of defective parts. Furthermore, the service door 24 may be removed to permit observation of the tower while in operation.

When it is desired to clean or paint the combined air screen and splash baffle assembly units or permit access to the sump tank 13, the units are removed by merely withdrawing them from the air inlet openings 29 by means of the handles 62. When a splash baffle unit is being withdrawn from the air inlet openings 29 the foremost splash baffle plate 55 slides outwardly on the inwardly directed flange 13a of the tank 13 in the manner of a drawer after which the unit is lifted free from the tower. A splash baffle unit may be inserted into an air inlet opening 29 by merely aligning it with the opening and then sliding it into the tower until its notched seat engages the edge of the sump tank 13. Each splash baffle unit is supported in its proper position in an air inlet opening 29 by the engagement of its notched seat with the edge of the sump tank 13 and the engagement of the upper member of the marginal screen frame 57 with the cross piece 21. Due to the angular relationship of the top and bottom members of the screen frame, the latter closely fit the front of the cross member 21 and sump tank 13. The splash baffle units in the air inlet openings 29 at the front and rear of the cooling tower extend inwardly toward each other and the baffle plates 55 of each unit together with the baffle 63 cover the entire cross sectional area of the tower. The baffles 55, however, are positioned below the air inlet openings 29 so as not to interfere with the flow of air into the tower and the lower edges of the baffle plates extend below the level of the pool of liquid in the sump tank 13.

It will now be observed that the present invention provides a small compact and efficient cooling tower adapted for domestic use to provide cooling water for a household appliance such as an absorption refrigeration system. It will also be observed that the present invention provides an arrangement of splash baffles in a cooling tower to eliminate the noise produced by water dripping from the packing into a pool of water in the sump. It will still further be observed that the present invention provides a readily removable air screen and splash baffle unit assembly adapted to be inserted into and withdrawn from an air inlet opening in the manner of a drawer; and in which a pair of such units cooperate to provide splash baffle plates over a substantial part of the cross-sectional area of the casing without restricting or otherwise interfering with the flow of air through the casing.

While a single embodiment of the present invention is illustrated and described, it will be understood that modifications may be made in the construction and arrangement of elements without departing from the spirit or scope of the invention. Therefore, without limiting myself in this respect, the invention is defined by the following claims.

I claim:

1. In a cooling tower, an upright casing, liquid distributing packing in the casing, liquid supplying means for delivering liquid for gravity flow through the packing, a sump below the packing for receiving liquid from the packing, an opening in one side of the casing between the packing and sump, a self-contained baffle assembly unit movable into and removable from the casing through the opening therein, said baffle assembly until

comprising baffle elements for intercepting liquid dripping from the packing to prevent it from splashing into a pool of liquid in the sump, and means on said baffle assembly unit cooperating with the casing at the sides of the opening for mounting the unit in the casing to locate the splash baffle elements in their proper position with respect to the packing and sump to intercept liquid dripping from the packing.

2. In a cooling tower, an upright casing, liquid distributing packing in the casing, liquid supplying means for delivering liquid for gravity flow through the packing, a sump below the packing for receiving liquid from the packing, an opening in one side of the casing between the packing and sump, a self-contained baffle assembly unit movable into and removable from the casing through the opening therein, said baffle assembly unit comprising side members with a plurality of splash baffle plates mounted on and extending between said side members, and means on said baffle assembly unit cooperating with the casing adjacent the opening for mounting the unit in the casing to locate the splash baffle plates at an acute angle to the surface of the liquid in spaced overlapping relationship.

3. In a cooling tower, an upright casing, liquid distributing packing in the casing, liquid supplying means for delivering liquid for gravity flow through the packing, a sump below the packing for receiving liquid flowing from the packing, means for circulating air through the packing countercurrent to the flow of liquid including air inlet openings at opposite sides of the casing between the packing and sump, and self-contained splash baffle assembly units movable into and removable from the casing through the respective air inlet openings, each of said splash baffle assembly units comprising a plurality of splash baffle plates mounted in spaced parallel relationship, and means on the splash baffle assembly units cooperating with the casing adjacent their respective air inlet openings for mounting the units in the casing to locate the individual splash baffle plates at an acute angle to the surface of the liquid in the sump in spaced overlapping relationship over substantially the entire cross-sectional area of the tower.

4. In a cooling tower, an upright casing, liquid distributing packing in the casing, liquid supplying means in the casing for delivering liquid for gravity flow through the packing, a sump below the packing for receiving liquid flowing from the packing, means for circulating air through the packing countercurrent to the flow of liquid including an air inlet opening in the casing between the packing and sump, and a combined air screen and splash baffle unit in the form of a drawer freely movable into and removable from the air inlet opening in the casing.

5. In a cooling tower, an upright casing, liquid distributing packing in the casing, liquid supplying means in the casing for delivering liquid for gravity flow through the packing, a sump below the packing for receiving liquid flowing from the packing, means for circulating air through the packing countercurrent to the flow of liquid including air inlet openings on opposite sides of the casing, and a combined air screen and splash baffle unit mounted in each air inlet opening, each unit having a screen overlying the air inlet opening and a plurality of splash baffle plates below the air inlet and arranged in spaced overlapping relationship to receive liquid dripping from the packing, and the units at opposite sides

cooperating to provide overlapping baffle plates over a substantial part of the cross sectional area of the casing.

6. In a cooling tower, an upright casing, liquid distributing packing in the casing, liquid supplying means in the casing above the packing for delivering liquid for gravity flow through the packing, a sump below the packing for receiving liquid flowing from the packing, means for circulating air through the packing counter-current to the flow of liquid including an air inlet opening in the casing between the packing and sump, and a combined air screen and splash baffle unit having a marginal frame overlying the casing at the sides of the air inlet opening, an air screen mounted in the marginal frame, supports projecting from the sides of the marginal frame into the casing adjacent the sides of the latter, and splash baffles extending between and mounted on the supports in spaced overlapping relationship.

7. In a cooling tower, an upright casing, liquid distributing packing in the casing, a liquid supplying means in the casing above the packing for delivering liquid for gravity flow through the packing, a sump below the packing for receiving liquid flowing from the packing, means for circulating air through the packing countercurrent to the flow of liquid including an air inlet opening in the casing between the packing and sump, and a combined air screen and splash baffle unit having a marginal frame overlying the casing at the sides of the air inlet opening, an air screen mounted in the marginal frame, wings projecting rearwardly and downwardly from opposite sides of the marginal frame, and a plurality of splash baffles extending between the wings in spaced overlapping relationship below the air inlet opening with their ends attached to the wings.

8. In a cooling tower, an upright casing comprising an upper blower housing, an intermediate packing housing and a lower sump tank, said sump tank extending beyond the front and rear of the packing housing, spray nozzles in the casing for delivering liquid for gravity flow through the packing, air inlet openings at opposite sides of the casing between the packing housing and sump tank extending throughout the width of the housing, and combined air screen and splash baffle units in the air inlet openings, each unit having a marginal screen frame, supports projecting from the sides of the marginal frame, and splash baffles extending between and connected at their ends on the supports in spaced, overlapping relationship below the air inlet openings, the forward edge of the first baffle overlapping the marginal frame to provide a notched seat, and said units being mounted on the casing by the engagement of their notched seats with the edges of the sump tank at the bottom of the air inlet openings and the engagement of their marginal frames with the casing at the sides of the air inlet openings.

WALTER M. SIMPSON.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
648,319	Weightman	Apr. 24, 1900
1,287,402	Mordberg	Dec. 10, 1918
1,997,274	Betz	Apr. 9, 1935
2,347,757	Thomas	May 2, 1944

Certificate of Correction

Patent No. 2,562,827

July 31, 1951

WALTER M. SIMPSON

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 6, line 75, for "until" read *unit*;

and that the said Letters Patent should be read as corrected above, so that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 16th day of October, A. D. 1951.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.