

June 2, 1942.

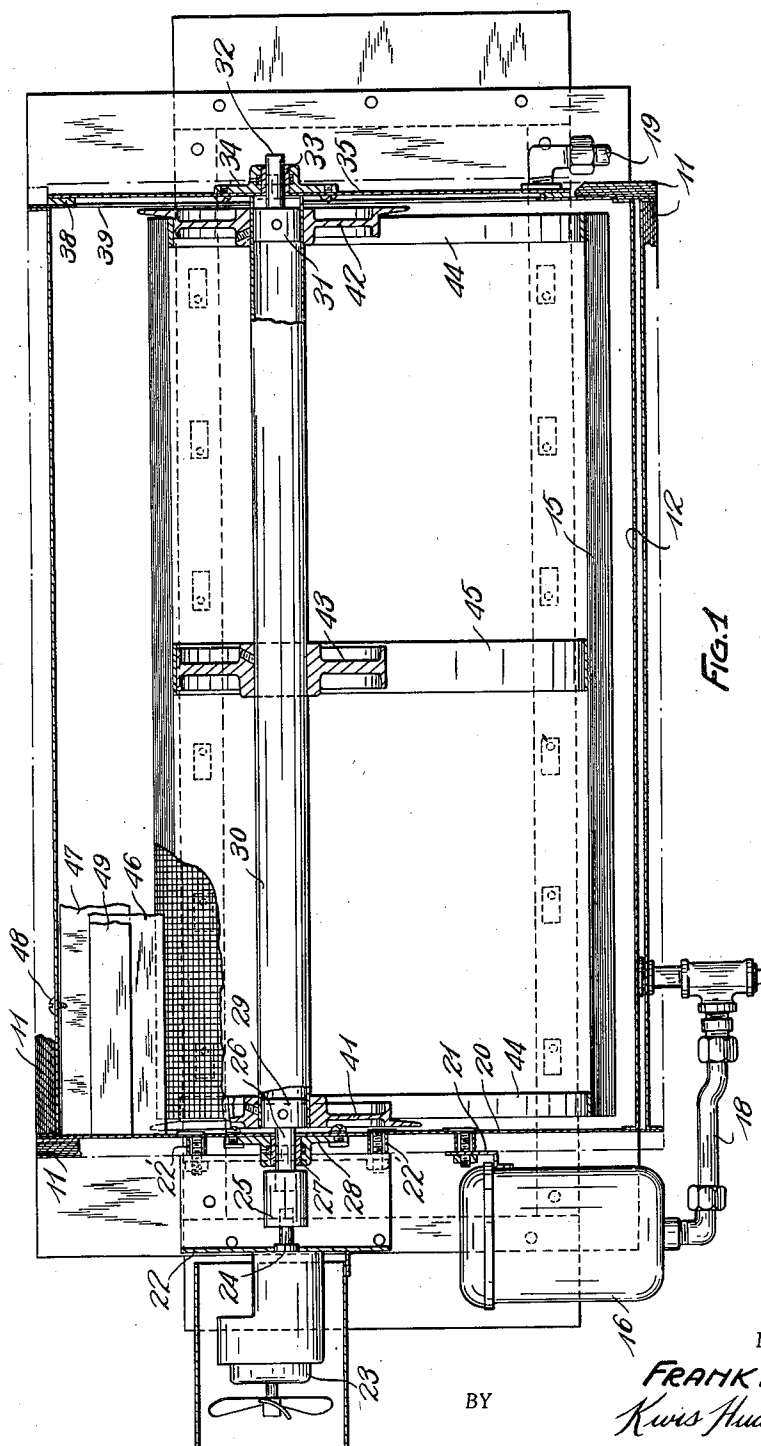
F. R. HIGLEY

2,285,089

RESATURATION COOLER

Filed Jan. 27, 1940

2 Sheets-Sheet 1



June 2, 1942.

F. R. HIGLEY
RESATURATION COOLER
Filed Jan. 27, 1940

2,285,089

2 Sheets-Sheet 2

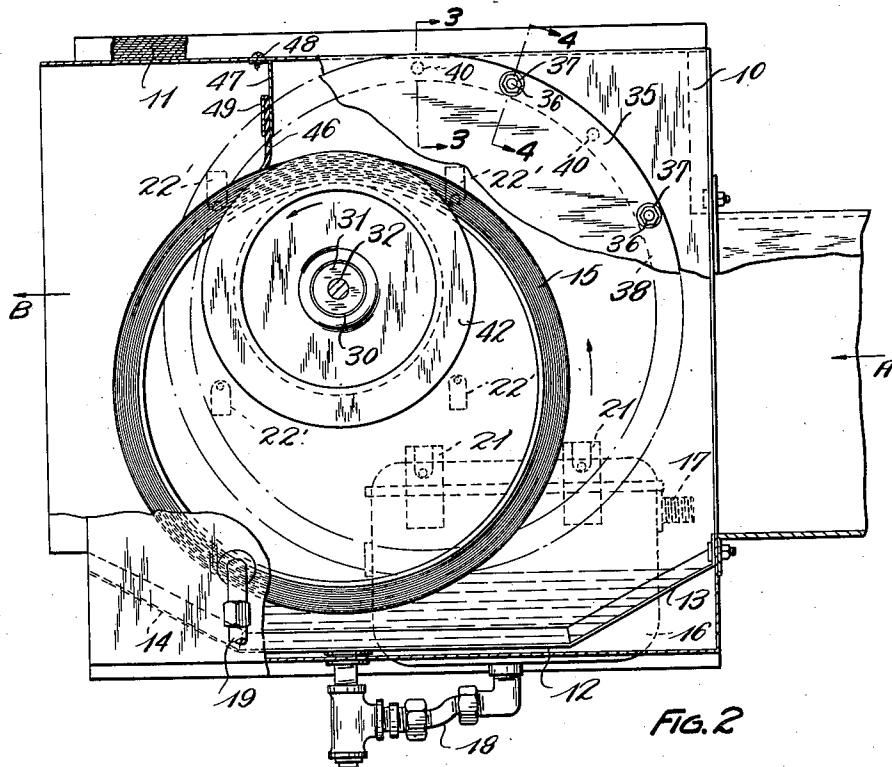


FIG. 2

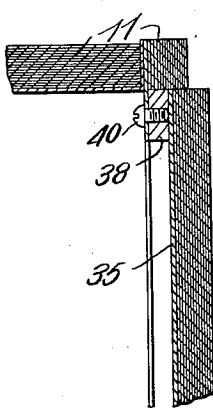


FIG. 3

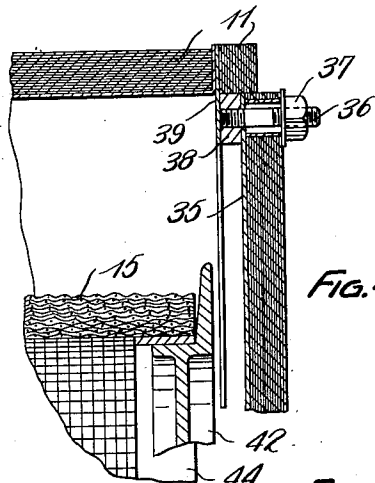


FIG. 4

BY

INVENTOR.
FRANK R. HIGLEY
Kewis Hudson Kent
ATTORNEYS

UNITED STATES PATENT OFFICE

2,285,089

RESATURATION COOLER

Frank R. Higley, Cleveland Heights, Ohio, assignor to The Bryant Heater Company, Cleveland, Ohio, a corporation of Ohio

Application January 27, 1940, Serial No. 315,974

10 Claims. (Cl. 261—92)

This invention relates to improvements in resaturation coolers, that is to say coolers for dehumidified air. The dehumidification of air by treatment with certain chemicals, as for example silica gel, raises the temperatures of the air. Frequently it is important to keep the temperature down, as when the dehumidified air is to be circulated through living quarters. Hence the warm air issuing from a dehumidifier is usually cooled before being circulated. This cooling is accomplished in some cases by causing the heated air to vaporize water, so that the temperature of the air is lowered to the extent of the latent heat of vaporization which is required for carrying out the process. The present invention has to do with the provision of improved apparatus of the rotary drum type for facilitating the evaporation of water by the dehumidified air.

One of the objects of the invention therefore is the provision of a low cost foraminous drum for the purpose specified, which may be removed and cleaned or replaced readily and quickly.

Another object is the provision of novel means for supporting and driving the drum.

Still another object of the invention is the provision of means for facilitating the removal of a drum from its casing through an end wall of the latter.

Other objects and features of novelty will appear as I proceed with the description of that embodiment of the invention which, for the purposes of the present application, I have illustrated in the accompanying drawings, in which

Fig. 1 is an elevational view, partly in section, of a drum apparatus embodying the invention, the drum being placed with its axis transverse to the air path, so that the air must pass through both side walls of the drum.

Fig. 2 is a view, partly in elevation and partly in section, looking toward the left in Fig. 1.

Figs. 3 and 4 are sectional detail views taken substantially on lines 3—3 and 4—4 of Fig. 2, but on a larger scale.

Referring first to Fig. 2 of the drawings, 10 represents a casing which is intended to be introduced into the air conduit leading from a dehumidifier of an air conditioning system to the room or rooms to be air conditioned. The air to be cooled enters the casing on the right, Fig. 2, as indicated by the arrow A, and leaves from the left, as indicated by the arrow B. While that dimension of the casing which is transverse to the path of the air is longer than the longitudinal dimension, considered with respect to air travel, I will nevertheless term the walls parallel to the air path the side walls of the casing, and the walls transverse to the air path the end walls thereof. The casing is suitably covered with insulation material as illustrated at 11. Mounted somewhat above its principal bottom wall, the

casing is provided with a false bottom which constitutes a water pan 12 that extends the full length of the casing between the side walls of the latter. The two ends of this pan are inclined upwardly as shown at 13 and 14, Fig. 2, thereby reducing the volume of water necessary to maintain a given water level and providing air pockets which serve, together with the space beneath the middle flat portion of the pan, as further insulating means. A drum 15 of foraminous material extending through the casing substantially from side wall to side wall dips into the water in the pan 12 and revolves slowly. The end walls of the drum abut the side walls of the casing. As the warm dry air flows through the casing, moisture carried up by the drum is evaporated and carried away, the temperature of the air being lowered accordingly.

In order to maintain a constant water level in the pan 12 I provide a small tank 16 which may be connected at 17 with a water line. In the tank there is a float-controlled valve, not shown, of any standard or desired form, which controls the flow of water into the tank. A pipe connection 18 extends from the bottom of the tank through the bottom of the casing into the pan 12. An overflow connection 19 leading to a drain or sewer is also provided so that if the float control fails to function properly there will nevertheless be no flooding of the apparatus due to an overflowing pan. The tank 16 is preferably supported on an end wall 20 of the casing by means of brackets 21.

Upon this same end wall 20 there is also mounted a channel shaped bracket 22 attached to the wall by means of fasteners 22', upon which bracket is carried a back geared motor 23 with an output shaft 24 which turns quite slowly, but at a rate such that the rotating drum entering the water in the pan will still be moist. Shaft 24 carries a coupling 25 which removably receives a shaft 26. The connection between the coupling and the latter shaft prevents relative rotation but permits relative longitudinal movement. Shaft 26 is slidably as well as rotatably mounted in a bushing 27 that forms part of a bearing 28 which is secured to the end wall 20 of the casing in line with a perforation formed therethrough. The inner end of shaft 26 has a cylindrical head 29 which fits tightly within a tubular shaft 30 that extends through the casing to the opposite end thereof where it receives a cylindrical head 31 attached to a short shaft 32 journaled in a bushing 33 carried by a bearing 34, these parts being identical with the similar parts at the opposite end of the shaft 30. Bearing 34 is fastened to a circular panel 35 which is fastened by studs 36 and nuts 37 to a ring 38 which reinforces a side wall 39 of the casing. Ring 38 forms a rim for a circular opening in

the side wall 39 to which it is attached by means of screws 40 or the like.

At the ends of the shaft 30 I mount flanged wheels 41 and 42 and at the middle of the shaft a further unflanged wheel 43, all of these wheels having outer bearing surfaces of the same diameter. These wheels form the supporting as well as the driving means for drum 15.

While in accordance with the broader aspects of the invention the drum may be made in different ways of various materials, I prefer to form it of wire mesh material of the proper width rolled up into a coil of a number of turns. The ends of the coil are preferably fastened down as by soldering, and brass bands 44 and 45 may be secured to the coil internally thereof as wear treads for engagement with the peripheries of the wheels. One size of drum manufactured in accordance with the invention has a wall thickness of approximately three-quarters of an inch and an outer diameter of twelve inches approximately. The opening in the wall 39 is sufficiently larger than the outside diameter of the drum to permit the latter to be readily withdrawn from the casing through that opening.

In order to form an air baffle above the drum and prevent the by-passing of air around and above the drum I provide a rubber, leather, or other flexible strip 46 having sufficient body to maintain engagement with the periphery of the drum in opposition to the force exerted by the flowing air. This strip extends entirely across the casing. It is suitably supported from the top of the latter, as by means of a mounting strip 47 of sheet metal fastened by screws 48 to the top wall of the casing. A reinforcing strip 49 of metal is preferably employed on the opposite side.

This baffle is offset from the vertical plane through the hollow shaft 30 when the latter is in its normal operative position as shown in Fig. 2. It will be observed that the axis of the drum when in this position is offset to the left of the central vertical plane of the panel 35. Now, when it is desired to remove the drum for cleaning or for replacement, which becomes necessary at intervals because of the deposit of scum and the incrustation of salts from the water, the panel 35 is removed from the side wall 39, thereby sliding the bearing 34 off the shaft 32. That end of the drum is then lifted diagonally upward toward the right, as viewed in Fig. 2, thus clearing the baffle strip 46. When it is brought opposite the opening in the end wall it is withdrawn. The shaft 30 with the wheels 41, 42, 43 is preferably withdrawn at the same time, although these parts may be left in place if some temporary means of support for the outer end of the shaft 30 is provided.

It will be observed that the water level in pan 12 is below the bottom of the opening in the end wall 39, as indicated in Fig. 2, so that the removal of the drum does not necessitate draining the pan or disturbing the water connections. The drum turns slowly in the anti-clockwise direction, as viewed in Fig. 2, thereby presenting the wetter part of the drum to the air entering the casing, that is before any cooling of the air has taken place. A further evaporation takes place however as the air passes through the opposite side wall of the drum. The drive imparted to the drum from the wheels 41, 42, 43 is purely frictional, and no mounting of the drum otherwise is provided, so that more or less swinging of the drum upon its support would ensue

were it not for the fact that the contact of the drum with the water in pan 12 is directly opposite the line of support and acts through a favorable leverage as a damper, preventing swinging motion.

It is within the scope of the present invention to support and drive the drum directly from a shaft, like the hollow shaft 30 herein illustrated for example, which form of support and driving means has the advantage of requiring less speed reduction in the back gearing of the motor. I prefer however to utilize a plurality of narrow wheels for several reasons. In the first place the contacting surfaces of shaft and drum or wheels and drum tend to squeeze some water from the drum which should be available for evaporation on the descending side of the drum. Narrow contacting surfaces provided they are wide enough to afford sufficient traction are therefore preferable from this standpoint. Also, with wheels of fairly large diameter the actual contact extends through a small arc of the drum since the weight of the latter distorts it slightly. The smaller the wheel diameter the smaller will be the arc of contact. Larger supporting and driving elements therefore give better tractive effort. Furthermore the tendency of the drum to swing, as previously mentioned, is reduced as the size of the supporting wheels is increased.

The present invention has an important advantage when employed in a system wherein the operation of the cooler is controlled by a thermostat in the premises being air conditioned and where the motor 23 is turned on and off periodically by the control, in that when the thermostat calls for operation of the cooler an appreciable amount of time is required to raise moisture into the path of the air, and occupants of the premises are not suddenly subjected to a materially reduced temperature. Similarly, when the motor is turned off an appreciable amount of time is required to dry out the drum, so that the rise in temperature of the premises is gradual.

While in the foregoing description and in the accompanying drawings I have disclosed with considerable particularity one specific embodiment of the invention in order to comply with the requirements of the statute, it is to be understood that such disclosures are not to be construed as amounting to limitations except as they may be defined in the accompanying claims.

Having thus described my invention, I claim:

1. In an air conditioning system, apparatus for cooling dehumidified air comprising a water pan, a drum mounted to turn upon a horizontal axis, said drum being positioned above and depending into said water pan, the cylindrical portion of said drum being foraminous and adapted to carry moisture upward out of said water pan, means circular in cross section and of smaller diameter than the drum arranged interiorly thereof upon which the ends of the drum hang and by means of which it is driven, and means for directing the air to be cooled through the side walls of said drum, whereby the air is caused to give up heat for the evaporation of moisture on the drum.

2. In an air conditioning system, apparatus for cooling dehumidified air comprising a water pan, a drum mounted to turn upon a horizontal axis, said drum being positioned above and depending into said water pan, the cylindrical portion of said drum being made of wire mesh material, means circular in cross section and of

smaller diameter than the drum arranged in-

teriorly thereof upon which the ends of the drum hang and by means of which it is driven, means for turning said circular means, and means for directing the air to be cooled through the side walls of said drum, whereby the air is caused to give up heat for the evaporation of moisture on the drum.

3. In air conditioning apparatus for cooling dehumidified air, a casing, an open ended drum within said casing with its ends contiguous to opposite walls of the casing, a water pan at the bottom of the casing into which the drum extends, an elongated element extending through said drum and journaled in said walls, means for rotating said elongated element, said element having a supporting and driving surface of circular cross section upon which said drum hangs at a plurality of longitudinally spaced points, an air baffle between the drum and the top of the casing, and means for directing the air to be cooled through the casing and through the side walls of said drum.

4. In air conditioning apparatus for cooling dehumidified air, a water pan, a drum mounted to turn upon a horizontal axis, said drum being positioned above and depending into said water pan, the cylindrical portion of said drum being made of a coil of wire mesh material, means circular in cross section and of smaller diameter than the drum extending through the drum supporting and driving the same by engagement with its interior upper surface, means for turning said circular means, and means for directing air to be cooled through the sides of the drum, whereby the air is caused to give up heat for the evaporation of moisture on the drum.

5. In air conditioning apparatus for cooling dehumidified air, a casing, an open ended drum within said casing with its ends contiguous to opposite side walls of the casing, a water pan at the bottom of the casing into which the drum extends, an elongated element extending through said drum and journaled in said walls, means for rotating said elongated element, said element having a supporting and driving surface of circular cross section upon which said drum hangs, an air baffle between the drum and the top of the casing, one of said casing walls having a removable panel in order to permit the withdrawal of said drum, and means for directing the air to be cooled through the casing and through said drum.

6. In air conditioning apparatus for cooling dehumidified air, a casing, a water pan at the bottom thereof, an open ended foraminous drum extending into said pan, the open ends of said drum being arranged contiguous to opposite side walls of the casing, a shaft extending through the drum from which the cylindrical wall of the drum is supported exclusively and by which it is driven, said shaft being journaled in said opposite casing walls, and a separable coupling for the shaft outside one of said casing walls through which said shaft is driven, the opposite wall having a removable panel, whereby said shaft may be uncoupled and withdrawn from the casing through the opening left by the removed panel.

7. In air conditioning apparatus for cooling dehumidified air, a casing, a water pan at the bottom thereof, a foraminous drum within said casing supported from opposite walls thereof

and depending into said water pan below the normal water level therein, one of said walls having a removable panel the center of which is offset diagonally upward from the normal axis of the drum, and an air baffle in the upper part of the casing normally engaging the upper part of the drum along a line offset from the axis thereof in a direction opposite to that of the first named offset, whereby upon the removal of said panel said drum may be lifted diagonally upward and withdrawn through the opening left by said panel.

8. In air conditioning apparatus for cooling dehumidified air, a casing, an open ended drum within said casing with its ends contiguous to opposite side walls of the case, a water pan at the bottom of the casing into which the drum extends, an elongated element extending through said drum and journaled in said walls, means for rotating said elongated element, said element having a supporting and driving surface of circular cross section upon which said drum hangs, one of said casing walls having a removable panel in order to permit the withdrawal of said drum, and means for directing the air to be cooled through the casing and through said drum.

9. In air conditioning apparatus for cooling dehumidified air, a casing extending across the path of flow of the air to be treated having inlet and outlet openings in said path and having end walls extending parallel to said path, said casing having a water container at the bottom thereof, a rotatable foraminous drum mounted in the casing to extend below the water level with its axis transverse to said path of flow, supporting and driving means for said drum, whereby the air to be treated flows through the casing and through the foraminous drum above the water level, one of the end walls of the casing having an opening therethrough located entirely above the water level, and a removable panel for normally closing said opening, whereby upon the removal of said panel said drum may be lifted to a position above the water level and withdrawn endwise from the casing.

10. In air conditioning apparatus for cooling dehumidified air, a casing extending across the path of flow of the air to be treated having inlet and outlet openings in said path and having end walls extending parallel to said path, said casing having a water container at the bottom thereof, a rotatable foraminous drum mounted in the casing to extend below the water level with its axis transverse to said path of flow, supporting and driving means for said drum, whereby the air to be treated flows through the casing and through the foraminous drum above the water level, an air baffle depending from the top of the casing extending parallel to the axis of the drum and normally engaging the upper part of the drum along a line offset from the vertical plane through the axis of the drum, one of said end walls having an opening therethrough, a removable panel for closing said opening, said opening being arranged entirely above the water level and extending laterally away from said baffle sufficiently to permit the drum to be raised diagonally upward away from the water level and away from said baffle and be withdrawn through the opening in said end wall.

FRANK R. HIGLEY.