

June 23, 1942.

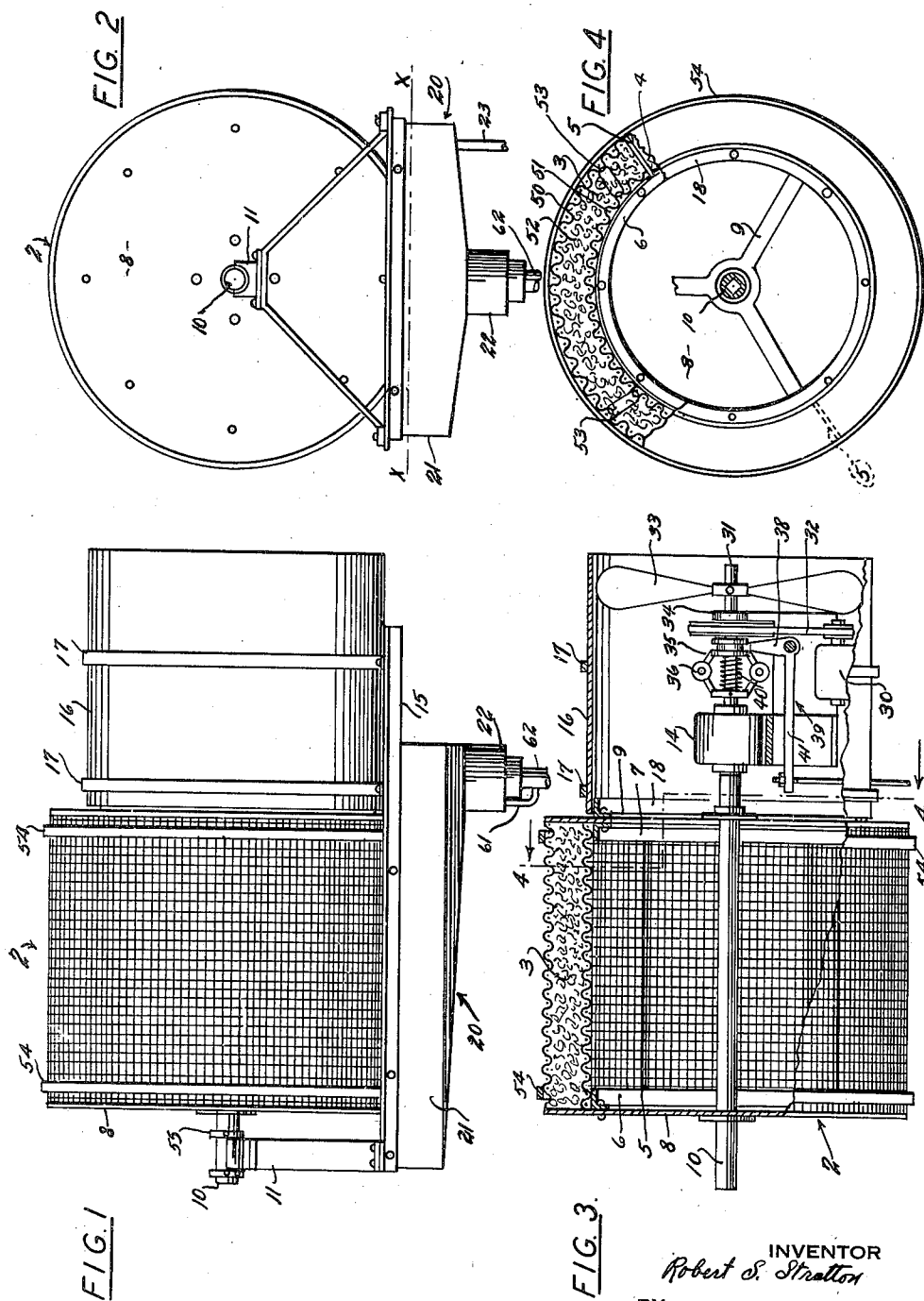
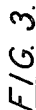
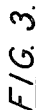
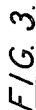
R. S. STRATTON

2,287,147

EVAPORATIVE COOLER

Filed Nov. 23, 1940

2 Sheets-Sheet 1



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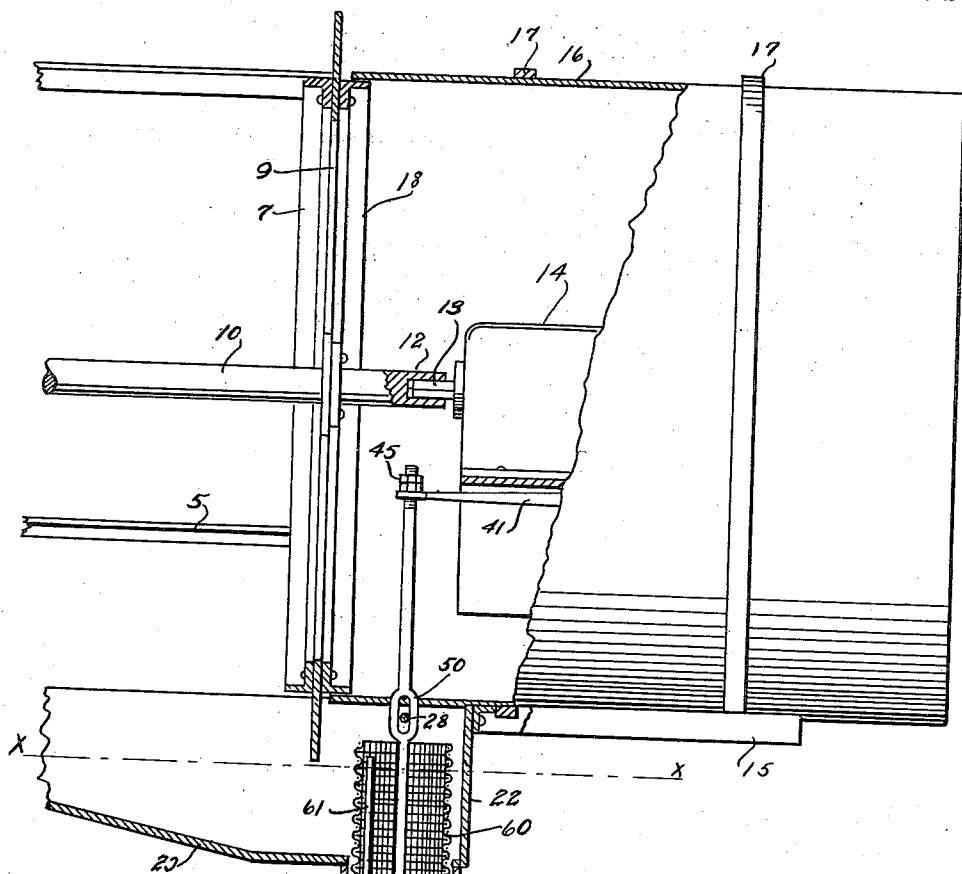
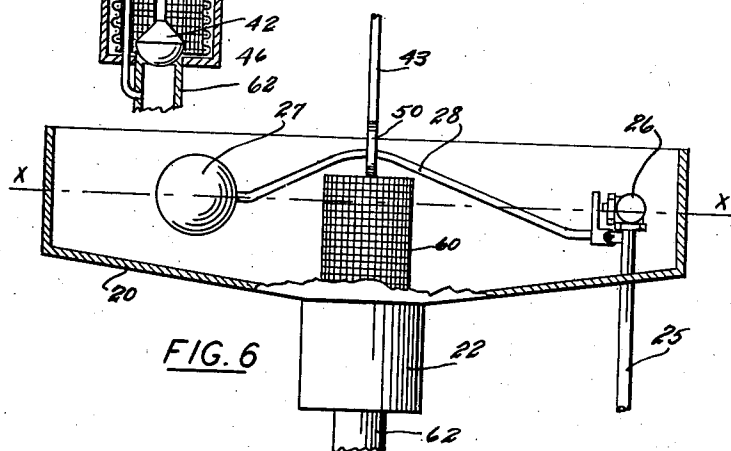
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UNITED STATES PATENT OFFICE

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EVAPORATIVE COOLER

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Application November 23, 1940, Serial No. 366,813

3 Claims. (Cl. 261—92)

This invention relates to coolers of the evaporative type; particularly those used for cooling habitations in semi-arid countries where the lack of humidity makes it possible to cool the outside air by addition to moisture thereto, in order to secure air of a somewhat higher humidity, but of a lower sensible temperature.

Heretofore, the cooling by means of wet air, as above referred to, has progressed rapidly in the semi-arid districts of the United States. Coolers of this type are commonly known as evaporative coolers. In general, the practice has been to provide an enclosure, a portion of the vertical walls of which consist of pads of absorbent material which is kept in a moist condition by a continuous application of water from either a drip at the top or a spray on the outside, combined with a means for drawing air through the pad from the outside and forcing it into the interior of the room or habitation to be cooled. The efficiency of this type of cooler depends, for a great part, upon the uniformity of the thickness of the pad, the absence of "draft holes" and the absence of the "coursing" of the water through the pad without uniformly moistening it.

In practice, it has been found that it is almost impossible to find a drip or spray device which will keep all parts of the pad uniformly moist. As a portion of the pad surface of the pad becomes dry then the material, which is almost universally made of wood excelsior or fiber shavings composition, becomes dry and shrinks. This permits more air to enter through this dry portion and consequently, less air through the moist portions of the pad, with the result that air delivered into the room is a mixture of moistened cool air and a draft of hot, uncooled air. The net beneficial results are diminished accordingly.

Another difficulty experienced with this type of cooler is that the pad invariably becomes fouled with a collection of dust and bacteria from the air, together with such substances as bugs, flies and the like, and these substances mixing with water on the outer surface of the pad form a fertile bed for bacterial activity and putrefaction. This action fouls the pad and produces unpleasant and noxious odors, as well as bacterial contaminations, all of which are driven into the room in the air current.

Heretofore, various means have been tried to correct this condition, such as by the treating of the pad with germicidal compounds and by moistening it with germicidal and disinfectant solutions at the termination of each operating period. These remedies, however, have only been par-

tially effective and, furthermore, do not prevent deterioration and rotting of the fibers of the pad.

In view of the foregoing, my invention has for its objects

(1) To provide an evaporative cooler having a pad constructed and combined with a moistening device so that the entire pad is at all times kept in a uniformly moist condition during operation;

(2) To provide an evaporative cooler of the type described wherein the pad, being kept in a uniformly moist condition, is prevented from forming draft holes due to dry spots or coursing of the moistening water;

(3) To provide a device, as above described, wherein the body of the pad is continuously washed during operation to remove and prevent the collection of dust, bacteria, and other contaminating substances from the air on the surface of the pad, and consequently to prevent the fouling of the pad by bacterial action and putrefaction;

(4) A further object is to provide an evaporative cooler wherein the pad is made in a cylindrical shape, the surface of which is uniformly moistened by turning through moistening water contained in a pan positioned to contact the outer periphery of the pad;

(5) A still further object provides for the turning of the cylindrical pad during operation at a uniform rate sufficient to maintain the pad in a uniformly moist condition;

(6) To provide mechanism for automatically filling the moistening pan to a desired level with water when operation of the device is commenced, maintaining the water at this level, and then draining the water from the pan when operation is stopped, so that there is always a fresh supply of water at the commencement of operation, and this water is released at the end of the operating period and not permitted to stand;

(7) A further object is to provide a device, as above described, wherein the body of the pad is composed of a plurality of sections which are easily replaceable in a supporting framework, and

(8) Lastly, an object of the device is to provide a framework for a cylindrical pad which is easily removed from the supporting and operative elements of the device without the use of tools or the like.

Other objects will appear hereinafter.

I attain the foregoing objects by means of the construction and the devices illustrated in the accompanying drawings, in which:

Figure 1 is a side elevation of the assembled cooler;

Figure 2 is an elevation of the rear or outside end thereof;

Figure 3 is a vertical mid-sectional view of the pad and its operating mechanism;

Figure 4 is an end elevational section taken substantially on line 4—4, Figure 3;

Figure 5 is a side elevational view of the mechanism for turning the pad and filling and emptying the moistening pad when the device is operative, drawn on an enlarged scale, and

Figure 6 is a similarly drawn end elevation of the pan.

Similar numerals refer to similar parts in the several views.

The evaporative element indicated generally by numeral 2 is made cylindrical in shape, composed of accurately shaped pad sections, as 3 and 4, supported on a framework consisting of longitudinal plates 5 connecting flanged rings which are attached respectively to a disk 8 at the outer end and forming a closure, and to a spider at the inner end. Both the disk 8 and the spider piece 9 extend annularly outward from rings 6 and 7 to provide flanges, so that the frame constitutes a spool to accommodate the accurately shaped pad portions 4 and 5 which are fitted between them.

A shaft 10 passes axially through the element 2 being supported by the end disk 8 at the outer end, and by the spider 9 at the other. This extends at the outer end to bear on a pillow block or open half bearing 11 at the outer end, and is provided with an axial squared hole 18 at the inner end which fits over the squared shaft 13 extending from the speed reducing gear box 14. The element 2 is thus supported to turn on a horizontal axis.

A base 15 made of angle bars forms a support for the bearing 11 at the outer end and for a cylindrical housing 16 at the inner end, which is held in place by bands 17. An annular ring of angle bar 18, having an extending ring, is fitted on the inner face of the spider end piece 9. This ring fits within the outer end of housing 16, and is sized to fit closely enough to minimize air leakage at this joint but not so tight as to prevent its free turning within the cylinder.

Frame 15 supports a pan 20 having vertical side 21 and a bottom sloping toward the rear to provide drainage into a sump 22. The sides are made of a depth, and the pan is otherwise dimensioned, so that the periphery of element 2, when supported on its axle shaft 10, will dip substantially below the edges of the pan. The pan is supplied with water through a supply pipe 25 controlled and maintained at a level $x-x$ by a constant level float valve 26. This may be of the ball float type with the ball 27 supported on the operated rod 28. The level $x-x$ is predetermined and regulated by the float 28 so that as the element 2 turns the pads on its surface dip below the surface so that approximately one-half their thickness is immersed.

Within the cylindrical housing 16 I provide mechanism for turning the evaporative element at a definite speed, for automatically filling and emptying the pan 20, and for drawing a current of air through the evaporative pads into the body of the evaporative element, through this housing and forcing it into the space or habitation to be cooled.

This mechanism includes the motor 30 positioned in the lower part of the housing and belt-

ed to the fan shaft 31 by belt 32 over pulleys so that the fan shaft turns at a speed slower than the motor. This permits the use of a low speed high pitch fan 33 which operates with a minimum of noise.

The inner end of this fan shaft is journaled in gear box 14, the outer end in a bearing 34. A centrifugal governor is positioned on this shaft between these two supports and is provided with a ring 35 movable axially on the shaft under the influence of the governor weights 36. Ring 35 is provided with an annular groove 37 in which a finger on the tip of the upwardly extending arm 38 of the angular lever 39 engages. A spring 40 normally holds ring 35 in an extended position. When in this position the horizontal arm 41 of lever 39 is in its uppermost position and holds drain valve 42 open. This drain valve seats in the bottom of sump 22, consists of a rubber ball of the flush valve type, and is supported on a stem 43.

Approximately in its middle stem 43 is provided with a loop, or slot 50 through which the float valve operative rod 28 extends. The upper end of stem 43 extends through a vertical hole in the outer end of lever arm 41 and is provided with adjusting nuts 45. The length of the stem, the length of the arms of lever 39, and the position of the ball valve 42 relative to its seat 46 is all proportioned so that when the fan shaft attains full speed the governor ring 35 is moved to the left (as viewed in Figures 3 and 5) sufficiently to fully seat valve 42. Preferably the arm 41 moves a little beyond the required distance so that the valve rests freely in closed position. In this position and while the device is operating there is little wear on the finger on arm 38.

The loop 50 is positioned and adjusted relative to rod 28 so that when the lever 39 is in operative position, with the shaft 31 not in motion, and the valve 42 is in raised position, the rod 28 is caught by the loop and raised to a point sufficient to close float valve 26. Thus, these parts work together, controlled by the speed of shaft 31 so that when the device is in operation valve 42 is seated and valve 26 is opened. Conversely, when the shaft 31 is not operating, valve 42 is raised and valve 26 shut off. This mechanism provides an automatic means for filling the pan 20 when operation of the device is commenced, maintaining the level of the water during operation, and for emptying the water at the termination of the operation.

The gear box 14 is provided to afford a bearing support for the inner end of shaft 10, by means of the squared shaft 13, and, a bearing for shaft 31, and a speed reduction means between these two shafts. Gears or other means within the box are ordinarily proportioned to provide a speed reduction ratio of 1200 to 1. For example, in case of a cooler element having a diameter of approximately 24 inches, shaft 31 may be driven with a disk fan, as shown in Figure 3 at a speed of about 600 R. P. M. and shaft 10 should be driven at about one-half a revolution per minute. Obviously the speed at which shaft 10 turns will vary according to its size and diameter. Where the diameter is greater, the speed of turning may be slower. In all cases, however, the speed is fast enough so that the evaporative pads are maintained in a moist or wetted condition throughout a complete revolution, but slow enough so that free water is permitted to drain back into the pan as the pad turns through it. The pads must be maintained in a moist but not a sopping wet

condition, and the peripheral speed is governed accordingly. Gears in the box may consist of a system of both worm and sector, and spur types, sized and proportioned to attain the necessary speed reduction. This gives a positive drive not depending on air currents or other fluctuating media.

The pads 3 and 4 of the evaporative element are composed of accurate pieces 50 and 51 of hardware cloth or heavy screen between which a pad 52 of wood fiber, excelsior, or the like is compressed. The screen pieces may be temporarily held together with wire loops 53, but the whole is finally held in place by bands 54 slipped over outer screen 50.

The entire evaporative element 2 is easily removable since the outer end of shaft 10 is supported only in the half bearing 11, while the inner end fits comparatively loosely on shaft 13. To remove it the outer end of shaft 10 is lifted until collar 55 clears bearing 11; it is then slid outward until annular ring 18 clears the outer edge of housing 16 and shaft 10 disengages from shaft 13, thereupon it may be lifted upward for cleaning or for replacement of the pads.

In operation, the device is installed so that the inner or right hand end of housing projects into a habitation to be cooled, supply pipe 23 is connected to a source of water under pressure, and motor 30 to a source of electricity. Upon starting the motor air is drawn through the pad, into the interior of the evaporative element and through the housing 16 as indicated by the arrows. Water is let into the pan 20 and wets the pads as above explained. The air is cooled by passing through the pads by evaporation of water from the fibers of the wood shavings, this also cools the water in the tank due to dripping back of excess water and the immersion of the cooled metal of the screens and adjacent metal parts. The pad is kept uniformly moist by uniform immersion and this also washes dust and other contaminating substances from its surface. The washed pad does not foster bacterial action. Air passing through the pads is cooled to the maximum by contact with the uniformly moist pad. When the operation is stopped by stopping motor 30, water is drained by the automatic drain above described. The ball flush valve 42 is surrounded by a cylindrical strainer 60 which extends into sump 22 to prevent clogging. In order to prevent overflow, in case of a leaking or sticking water valve 26 an overflow pipe 61 extends from the water level $x-x$ down through the sump bottom and into drain pipe 62.

I realize that the device here shown is subject to many variations, changes and modifications, all of which, however, would remain within the spirit and intendments of the invention, therefore I wish to be limited only by the following claims.

I claim:

1. An evaporative cooler comprising, in combination, a cylindrical evaporative element having a cylindrical pad of fibrous, porous material, bearing supports therefor so that said element will turn axially in a horizontal plane, a pan positioned beneath said element adapted to maintain water at a level sufficient to immerse a peripheral portion of said evaporative pad throughout its

rotary movement, said pan having a drain valve provided with a stem and a water supply pipe with a constant level feed valve thereon, mechanism including a motor for turning said element at a speed sufficient to maintain said pad in moistened but not wetted condition, mechanism in connection with said motor for drawing air through said element and automatic means for filling said pan with water to said predetermined level upon the commencement of the operation of said device, maintaining this level during operation, and discharging water from said pan when operation is stopped, including governor mechanism operative in conjunction with said turning mechanism adopted to communicate its motion relative to the speed of rotation to said drain valve stem and said water feed valve so that when operation is commenced said drain valve closes and said constant level feed valve opens and when operation is stopped said drain valve opens and said feed valve closes.

2. An evaporative cooler comprising in combination a cylindrical evaporative element having an axial shaft support and a peripheral pad of fibrous, porous material, one end of said element being closed, bearing supports therefor adapted to support said element to turn axially in a horizontal plane, means for turning said pad at a predetermined speed including a motor, a fan shaft and speed reducing gearing between said fan shaft and said supporting shaft, a fan on said fan shaft operative in the open end of said evaporative element and adapted to draw air through said evaporative pad, a pan positioned beneath said evaporative element adapted to contain water to a predetermined level sufficient to immerse a peripheral portion of said evaporative pad and provided with a water supply pipe having a constant level feed valve and a drain valve, together with mechanism for providing said pan with water to a predetermined level during the operation of said evaporative element and for discharging said water when said operation is stopped, including a spring normally holding said feed valve closed and said drain valve open, a governor on said fan shaft, mechanism communicating motion therefrom to said feed valve and drain valve so that operation of said governor closes said drain valve and opens said feed valve.

3. In an evaporative cooler, as herein disclosed, having a cylindrical evaporative pad, an axial supporting means and driving means therefor, mechanism for moistening said evaporative pad during operation thereof, including a pan adapted to be positioned beneath said evaporative element and to contain water to a predetermined level sufficient to immerse a peripheral portion of said evaporative pad and being provided with a water supply pipe having a constant level feed valve thereon, a drain and a drain valve operative therein, governor mechanism on said driving means and mechanism operative in conjunction with said governor mechanism adapted to close said feed valve and open said drain valve when the device is inoperative and to close said drain valve and open said feed valves to the limits of its constant level action when the device is in operation.

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