Oct. 2, 1934. G. R. GOLDTHWAITE 1,975,267

METHOD AND APPARATUS FOR CONDITIONING AIR

Filed Aug. 25, 1931 2 Sheets-Sheet 1

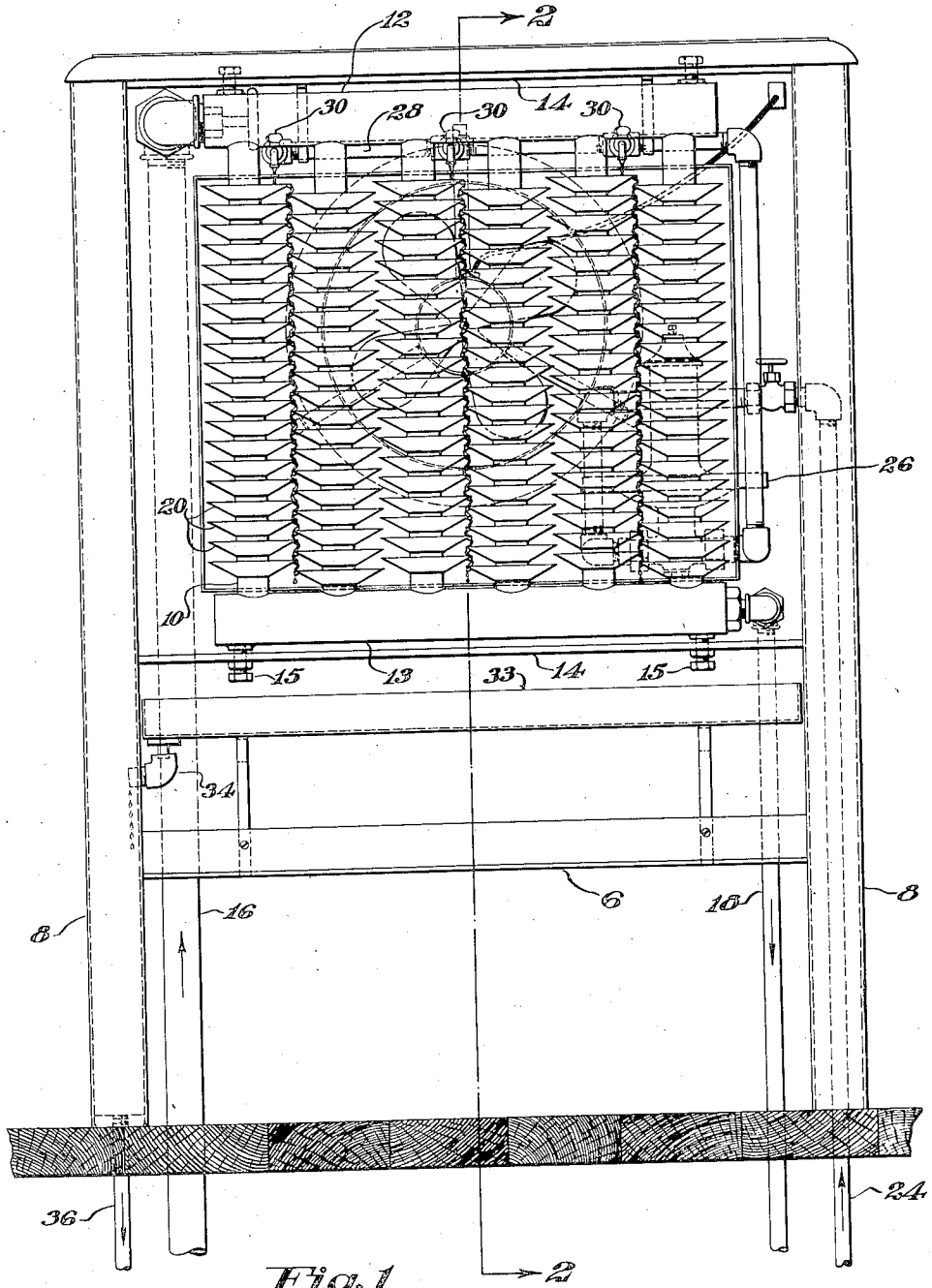


Fig. 1

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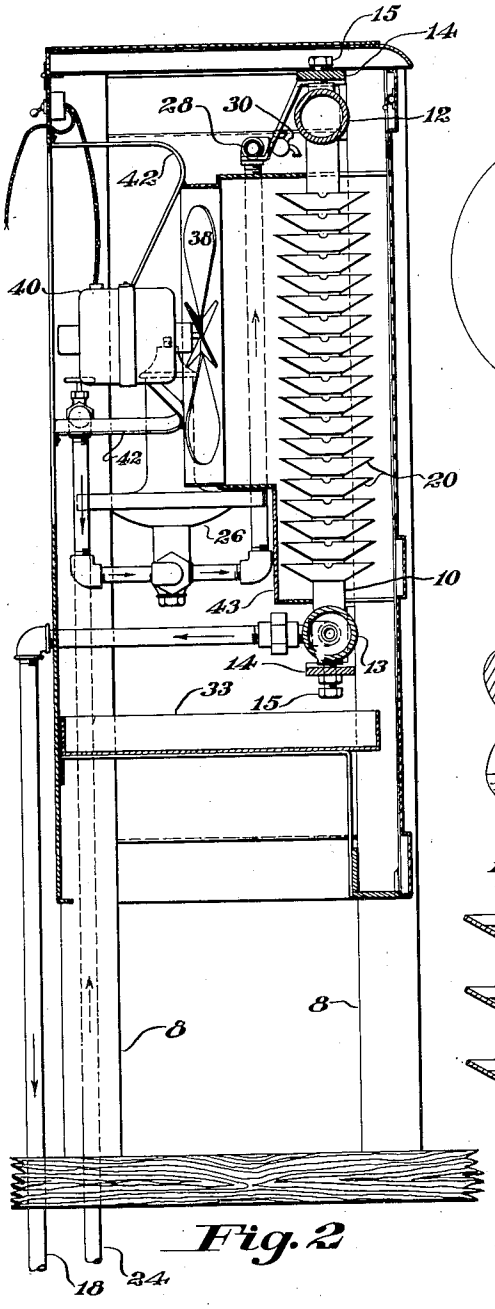


Fig. 2

Fig. 4

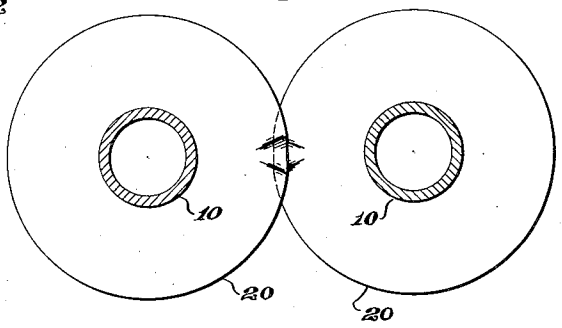
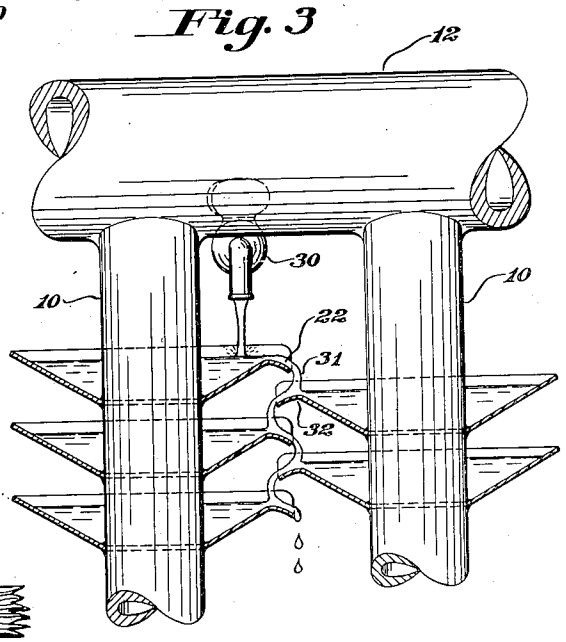


Fig. 3



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Patented Oct. 2, 1934 1,975,267

UNITED STATES PATENT OFFICE

1,975,267

METHOD AND APPARATUS FOR CONDITIONING AIR

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Application August 25, 1931, Serial No. 559,171

12 Claims. (Cl. 257—180)

The present invention relates to methods and apparatus for conditioning air.

The objects of the present invention are to provide an improved method for conditioning air, particularly for heating and humidification thereof, and to provide apparatus operable with little or no attention, of light weight and large surface, and capable of evaporating considerable quantities of water into the air.

With these objects in view, the principal feature of the invention comprises an element to carry a heating medium such as steam or hot water, or if desired, a cooling medium, together with extended surface therefor, arranged not only to increase the surface of the element, but also to maintain bodies of water which are swept by the air. In the preferred form of the invention, the extended surface is in the form of concave fins, each adapted to hold a quantity of water. The water presents a large surface to the air, thereby not only enhancing the evaporation, but also providing additional surface for conducting heat from the element to the air.

Other features of the present invention comprise a method and apparatus for feeding water automatically to the fins, and certain novel features of construction hereinafter described and particularly defined in the claims.

In the accompanying drawings, Fig. 1 is a front elevation of what is now considered the preferred embodiment of the invention; Fig. 2 is a section on line 2—2 of Fig. 1; Fig. 3 is a detail view showing the manner of supplying water to the apparatus; and Fig. 4 is a detail horizontal sectional view of two adjacent tubes.

The invention is herein illustrated and described as embodied in a unit heater and humidifier.

The illustrated embodiment of the invention comprises a frame 6 having hollow supporting legs 8. The frame may be enclosed within an ornamental cabinet of any desired construction.

The heating elements comprise a row of vertical tubes 10, six of such tubes being shown in Fig. 1. The tubes are connected at their upper ends into an inlet header 12 and at their lower ends into an outlet header 13. The headers are supported between brackets 14 by leveling screws 15. The heating fluid, such as steam, is admitted to the header 12 by the pipe 16 and the return steam pipe 18 is connected with the outlet header 13.

On each tube is secured a plurality of extended surface fins 20, preferably by soldered connections to assure good heat conduction from the tube to the air through the fins. Each fin, as shown in Fig. 3, is concave or cup-shaped to hold a body or pool of water. The fins of adjacent tubes are vertically staggered and as shown in Fig. 4, are arranged to overlap horizontally. In the construction shown, each pair of tubes comprises a unit through which water courses from the top to the bottom, the six tubes of the entire heater comprising three of such units. For each unit or pair of tubes, the fins are provided with opposed downwardly sloping lips 22 arranged to permit the continuous downward flow of a stream of water and thereby to permit accumulation of water in the individual fins.

Water is admitted to the uppermost fin of each pair of tubes from a water supply line 24 passed upwardly through one of the hollow legs of the frame. From the pipe 24, the water passes through an automatic pressure reducing valve 26 to a header 28 from which the water is conducted to the units by three pet cocks 30. The pipe 24 is connected to the domestic water supply. The water is fed slowly through the pet cocks to the several units and courses downwardly in a continuous stream 31, as shown in Fig. 3. It will be noted that the water falls from one lip to the lip next below at the point 32, which is the junction of the lip with the concave surface of the fin. Since the downwardly flowing water stream does not pass at any time across the fins, the flow is not an overflow from fin to fin; on the contrary, a substantially continuous stream is maintained, and each fin draws off from the stream enough water to maintain the proper level therein. As a result of each fin drawing off water from a descending stream, the water is maintained at a substantially uniform temperature in the several fins and substantially uniform conditions of evaporation prevail throughout, as distinguished from an overflow feed in which the water progressively varies in temperature.

The waste water is collected in a drip pan 33 which connects through an elbow 34 with one of the legs 8 of the frame. Water is conducted from the hollow leg 8 to a drain or sewer connection by a pipe 36 passed through the floor and suitably sealed in the bottom of the leg.

Air is blown horizontally through the heating elements and transversely thereof by means of a fan 38 driven by an electric motor 40, the fan and motor being supported on the frame by brackets 42. A shroud 43 is provided to conduct the air from the fan to the heating elements and to prevent undesired recirculation of air around the fan. The frame 6 is arranged to support the

heating elements at some distance above the floor to permit cold air to flow downwardly under the heating units and upwardly into the fan, thence to be directed horizontally through the heating units.

In operation, the heating fluid is supplied to the heater in the same manner as to an ordinary radiator. The air is rapidly and efficiently heated, owing to the large extended surface placed in the path of the air. The air contacts not only with the prime surface of the tubes, but also with the under surfaces of the cup-shaped fins and with the water in the fins. The water in itself provides for heat conduction from the tube to the air. It will be noted that in passing between adjacent fins, the air is deflected downwardly by the sloping surfaces thereof so that it comes into intimate contact with the water, thereby not only enhancing the heat transfer, but also providing the intimate contact necessary for considerable evaporation of water.

The adjustment of the pet cocks is not critical. It will be noted that from the standpoint of humidification, a good control of evaporation is automatically provided. When the outside air is at low temperature and hence of low moisture content, a large quantity of heat is supplied to the heater and therefore a large quantity of water is evaporated. When the outside air is at higher temperature and of higher moisture content, a relatively small amount of heat is necessary to be supplied and consequently, a smaller degree of evaporation takes place. Preferably, the pet cocks 30 are set just to maintain the full level of water in the lowermost fins without waste under the requirements of maximum heating. Under temporarily milder conditions, less water is diverted from the descending stream into the fins, and some water will be wasted in the drip pan, but the waste is practicaly negligible. Under permanently milder conditions, as for example in the spring and fall where considerably less humidification is required, the pet cocks 30 may be adjusted so that the lower fins receive no water, evaporation taking place only from the upper fins, but the lower fins still serving as heat radiating surface.

For cooling air, the apparatus may be employed by circulating a cooling medium through the tubes and supplying cold water to the fins.

The invention may be modified in various respects. For example, if maximum humidification is not desired, the concave fins may be used on only a part of the tubes, the remaining fins being flat, to provide heating surface without holding water. In other respects also, the construction may be modified without departing from the invention, except as limited by the appended claims.

Having thus described the invention, what is claimed is:

1. Air conditioning apparatus comprising a tube, and circumferential inverted cone-shaped fins on the tube constructed and arranged to maintain bodies of water to be transversely swept by the air.

2. Air conditioning apparatus comprising a tube, a plurality of circumferential inverted cone-shaped fins on the tube for maintaining water therein, and means for passing air transversely across the tube and between the fins.

3. Air conditioning apparatus comprising a row of vertical tubes, a plurality of extended surface fins on each tube constructed and arranged to hold water, the fins of adjacent tubes being vertically staggered and horizontally overlapping, and means for feeding water between the rows and downwardly to permit taking up of water by the fins.

4. Air conditioning apparatus comprising a plurality of vertical tubes, a plurality of circumferential extended surface fins on each tube constructed and arranged to hold bodies of water, each fin having a lip, and means for feeding water in a continuous stream downwardly from the lip of a fin on one tube to the lip of a fin on another tube to permit diversion of water from the stream to the fins.

5. A heater and humidifier comprising rows of vertical heating tubes and a plurality of extended surface fins on each tube constructed and arranged to hold water, the fins of adjacent tubes being vertically staggered and horizontally overlapping, the overlapping portions of the fins having lips to conduct water in a stream from row to row and downwardly.

6. A heater and humidifier comprising a pair of vertical heating tubes, a plurality of concave extended surface fins on each tube, vertically staggered and horizontally overlapping opposed lips on fins of the adjacent tubes, and means for introducing water into the uppermost fin of one of said tubes.

7. A heater and humidifier comprising a pair of vertical heating tubes, concave fins on the tubes, the fins of the two tubes being vertically staggered and horizontally overlapping, lips on the overlapping portions of the fins, and means for introducing water to descend in a stream from one lip to another and to permit diversion of water from the stream into the individual fins.

8. The method of humidifying air which consists in forming a plurality of vertically disposed pools of water, heating the pools, passing a continuous stream of water from the edge of one pool to the edge of another and externally thereof, diverting water from the stream to the separate pools, and passing air transversely across the pools.

9. The method of conditioning air which consists in passing fluid through a vertical tube, forming and supporting horizontal pools of water about the tube, passing a continuous stream of water downwardly adjacent the edges of the pools and externally of the pools, collecting water in the pools from the stream, and passing air transversely of the tube.

10. Air conditioning apparatus comprising two vertical heating tubes, a plurality of concave fins on each tube, the fins of the two tubes being staggered vertically and having marginal portions only overlapping, and a single water feed for both sets of fins.

11. Air conditioning apparatus comprising a vertical heating tube, a plurality of concave fins on the tube, and means for directing a continuous stream of water downwardly and externally of the fins and against edge portions only thereof whereby each fin, if not filled, diverts water from the stream.

12. Air conditioning apparatus comprising heating tubes, a plurality of concave water holding fins for the tubes, means for supplying water to the fins, and means for conducting excess water away from each fin to an adjacent fin, said means being immediately adjacent to the point of supply of water to the fin whereby the water in passing from fin to fin is not required to mix with the water present in the fins.

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