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APPARATUS FOR COOLING AND REFRIGERATION.

APPLICATION FILED OCT. 10, 1906. RENEWED JAN. 15, 1912.

1,036,528. Patented Aug. 20, 1912.

Fig: 1.

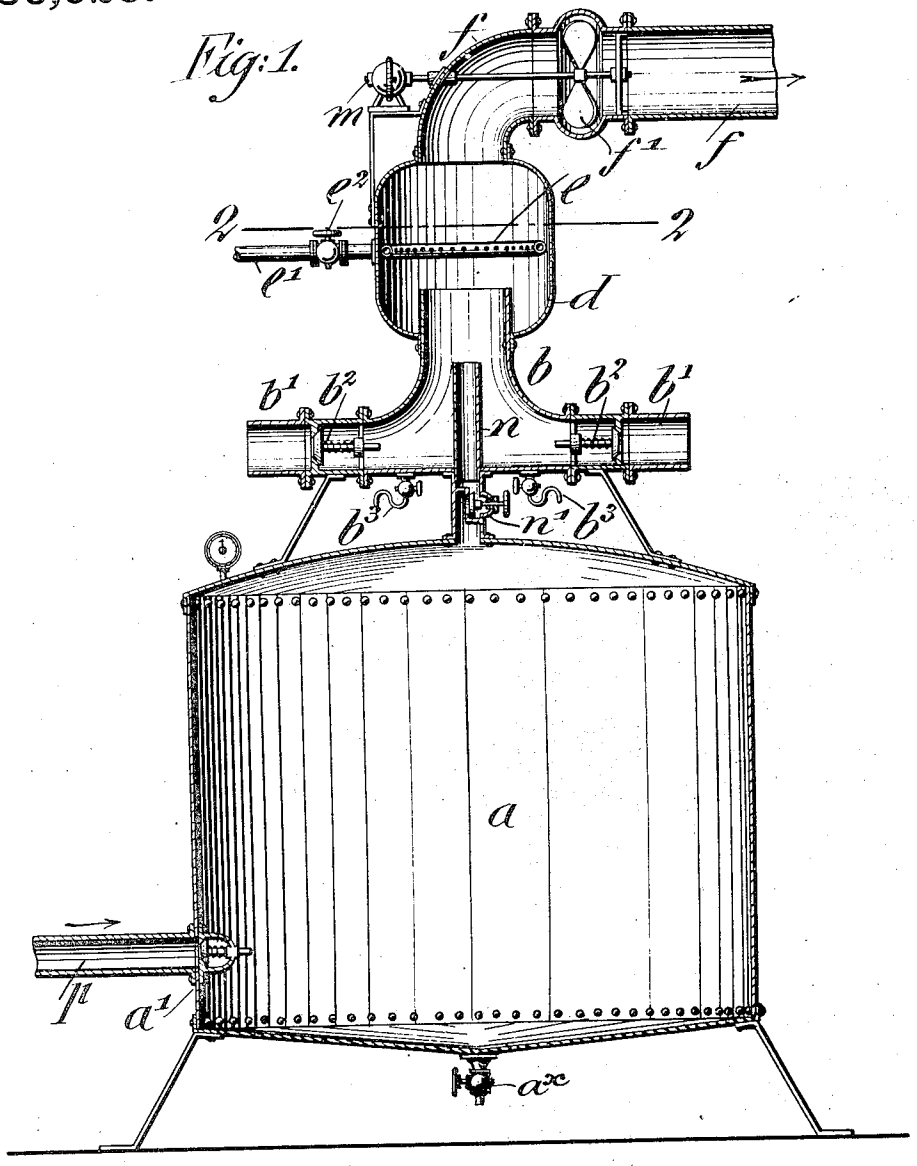
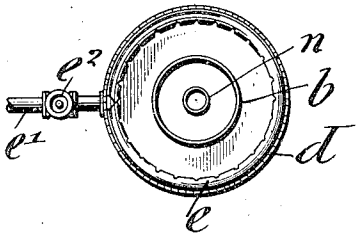


Fig: 2



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OTTO KUPHAL, OF NEW YORK, N. Y.; HELEN KUPHAL, EXECUTRIX OF SAID OTTO KUPHAL, DECEASED, ASSIGNOR OF ONE-HALF TO AUGUST STAMM, OF NEW YORK, N. Y.

APPARATUS FOR COOLING AND REFRIGERATION.

1,036,528. Specification of Letters Patent. Patented Aug. 20, 1912.

Application filed October 10, 1906, Serial No. 338,221. Renewed January 15, 1912. Serial No. 671,324.

To all whom it may concern:

Be it known that I, OTTO KUPHAL, a citizen of the United States, residing in New York, in the borough of Manhattan, county and State of New York, have invented certain new and useful Improvements in Apparatus for Cooling and Refrigeration, of which the following is a specification.

This invention relates to an improved apparatus for cooling and ventilating buildings of various kinds, and for various refrigerating purposes.

The invention is based upon the expansion of air under pressure in conjunction with the expansion of water to water-vapor, and the primary object of the invention is to overcome the objections to which refrigeration on this principle has heretofore been open, these objections being that the water-vapor was not formed in such a way as to obtain the best results and could not be carried away rapidly enough from the point of its formation, owing to the enormous expansion of the water due to evaporation.

By the present invention improved means are provided for expanding air under pressure and expanding water into water-vapor and for removing it instantly from the point of its formation so as to maintain a continuous evaporation and a steady low temperature.

The invention consists in the novel features of construction and combinations of parts to be hereinafter described and finally pointed out in the claims.

In the accompanying drawings, in which the same parts are denoted by the same reference characters in the two figures, Figure 1 is a vertical central section of a cooling and refrigerating apparatus constructed in accordance with the invention, and Fig. 2 is a horizontal section on line 2, 2, Fig. 1.

In the drawings a denotes a receiver for compressed air which is forced into said receiver through a pipe p having therein a check-valve a^1. At the upper portion of the receiver a there is formed an upwardly-extending discharge-pipe or nozzle n through which compressed air may be discharged from the receiver after properly manipulating a valve n^1 located in the nozzle n. Any water which collects within the receiver a is removed therefrom by means of a self-acting valve a^x arranged in the bottom of said receiver.

The discharge-pipe or nozzle n of the air-receiver extends upwardly into a tube b, which is of inverted T-shape, the nozzle n extending into said tube at the center of the same so that the laterally-extending part of the tube forms two laterally-extending portions b^1 which extend from the nozzle n at either side of the same. The tube b is supported above the receiver a by any suitable means, such as shown. Said nozzle extends well up into the upright portion of the T-shaped tube b, as shown. In each of the laterally-extending tubes b^1 there is located a spring-actuated valve b^2 which may be pushed inwardly by atmospheric pressure when the pressure in the tube b is reduced below that of the atmosphere sufficiently to counteract the outward thrust of its spring, so that atmospheric air is thereby sucked into the tube b, said valves b^2 serving to prevent the out-flow of air from the tubes b^1 before the partial vacuum is properly formed in the tube b when the apparatus is starting. Valves b^3 are arranged in the lower portions of the air-tubes b^1 adjacent the nozzle n.

The upwardly-extending portion of the air-tube b is connected with an evaporator-casing d elliptical in vertical section and of substantially greater diameter than the upright portion of the tube b. The lower and upper ends of the evaporator-casing d are reduced, as shown, and are connected by means of rivets or in any other suitable manner with the upright portion of the tube b and an outlet-pipe f. Within the evaporator-casing d is arranged a ring-shaped spray-pipe e which is formed by an annular pipe supported horizontally on the inner periphery of the casing d about midway of the height of the latter. The spray-pipe e is provided upon its inner surface with a number of minute perforations, as shown. The diameter of the ring formed by the spray-pipe is substantially greater than that of the upwardly-disposed portion of the tube b inasmuch as said pipe is directly connected and supported on the upright wall of the evaporator-casing d. The spray-pipe e is supplied with water by means of a pipe e^1 passing outwardly through the wall of

the evaporator-casing. A valve e^2 in the pipe e^1 controls the admission of water to the spray-pipe.

The outlet-tube f has arranged therein a suction-fan f^1 by which the cooled air is drawn out of the evaporator-casing and forced upwardly through the outlet-tube, as indicated by the arrow, and thence to the place of use. Said fan is rotated by any suitable means, such as a motor m, arranged exteriorly of the outlet-tube and supported in the manner indicated.

The operation of the improved apparatus is as follows: The receiver a is filled with compressed air arriving from any suitable source through the supply-pipe p. This air is by preference compressed to a pressure of about four atmospheres. When cooled air is to be supplied for ventilating or refrigerating purposes, the water-inlet valve e^2 is opened in order to admit water of usual temperature to the spray-pipe e, and the valve n^1 in the discharge-nozzle of the receiver is opened. The production of an air-blast in the upwardly-directed portion of the T-shaped air-tube b tends to cause a partial vacuum to be formed in the lower portions of such tube and as a consequence the valves b^2 are automatically opened and permit the inrushing of atmospheric air. This air in striking against the cooled discharge-nozzle n has the moisture removed therefrom by condensation, the moisture collecting upon said discharge-nozzle and trickling down to the outlet-valves b^3 at either side of the same, by which it is removed. The atmospheric air after passing through the laterally-extending portions b^1 of the air-tube b and having the moisture removed therefrom, is sucked upwardly into the upper portion of said air-tube and there mixed thoroughly with the compressed air which is being discharged from the discharge-nozzle. Thus there is created at the upper portion of the air-tube b an upward blast of compressed air and of atmospheric air. The tube b, by reason of the fact that it permits the mixing of atmospheric air with the compressed air which is being discharged, may be properly referred to as a mixing-tube. The upward blast of the mixture of atmospheric air and compressed air passes at a great speed in upward direction through the evaporator-casing d.

As has been pointed out, the casing d is substantially larger in horizontal section than the mixing-tube and accordingly the upwardly directed blast of air will pass through the center of said casing without being diffused into its outer part. Moreover, as said blast is created by high pressure and moves upwardly through the evaporator-casing at great speed, the air which has collected in the outer portion of said casing is sucked upwardly by the air-blast so that a partial vacuum will be formed in the outer portion of the casing. The fan f^1 in the outlet-tube also assists in creating a blast moving at such speed that a vacuum will be formed in the outer portion of the casing, the latter being entirely closed to the entrance of air except at the points where the mixing-tube and the outlet-tube communicate therewith. As the mixing-tube only directs the air through the central part of the casing, as before stated, and as the outlet-tube serves only to remove the air, it can be seen how this vacuum is created. It is within this vacuum that the spray-pipe e is located, and consequently the water which is supplied to said pipe after being discharged therefrom in the form of a fine spray, directed toward the incoming air-blast from all sides of the same, is immediately and thoroughly evaporated by means of the vacuum created at that portion of the evaporator-casing. Conforming with the well-known physical law, this evaporation of the water to water-vapor is accompanied by a very great fall of temperature, the ratio of expansion of the water being enormous. As a consequence the air, after passing through the evaporator-casing, reaches the outlet-tube f in a highly cooled state and can then be supplied to the place of use. The carrying away of the water-vapor from the point of its formation with sufficient rapidity has heretofore been an unsolved problem, but by the present apparatus, in which such removal of the water-vapor is aided by the discharge of compressed air into the evaporator-casing at one point by a discharge-nozzle or injector, and an opposite point by a suction-fan arranged in the outlet-pipe, the rapid and efficient removal of the water-vapor from the point of its formation is effected. Accordingly a maximum amount of air, cooled to a maximum degree, can be supplied.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. The combination, with means to direct a blast of expanding compressed air, of a mixing-tube into which said blast is discharged, an evaporator-casing into which said mixing-tube debouches, a spraying device so located with respect to the evaporator-casing and the incoming air-blast as to be in the vacuum produced by such blast, and means for sucking the resulting cooled air from the evaporator-casing.

2. The combination, with a compressed-air receiver, of a discharge-nozzle therefor, a mixing-tube inclosing said discharge-nozzle and provided with suction-operated valves, an evaporator-casing into which said mixing-tube debouches, a spray-pipe in said casing, and means for sucking the air from said evaporator-casing.

3. The combination, with a compressed-air receiver, of an upwardly-extending discharge-nozzle therefor, a mixing-tube inclosing said nozzle and having laterally-extending inlet-portions located at either side of the latter, an evaporator-casing into which said mixing-tube discharges and which is of greater diameter than said tube, a water-supply ring arranged in said evaporator-casing at the peripheral portion thereof, and means for discharging the air from said evaporator-casing.

4. An apparatus for cooling and refrigerating, including in its construction a receiver for compressed air, a discharge-nozzle for said receiver, a T-shaped mixing-tube inclosing said nozzle, suction-operated valves in the laterally-extending portions of said mixing-tube, an evaporator-casing with which said mixing-tube communicates, and a spray-pipe mounted in said casing.

5. In cooling and refrigerating apparatus, the combination of an evaporator casing closed except at the central part of its bottom and top portions, means to direct a blast of compressed air upwardly through the central part only of said casing, and means to spray water into the part of the casing where a partial vacuum is produced by the air-blast.

In testimony, that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

OTTO KUPHAL.

Witnesses:
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