

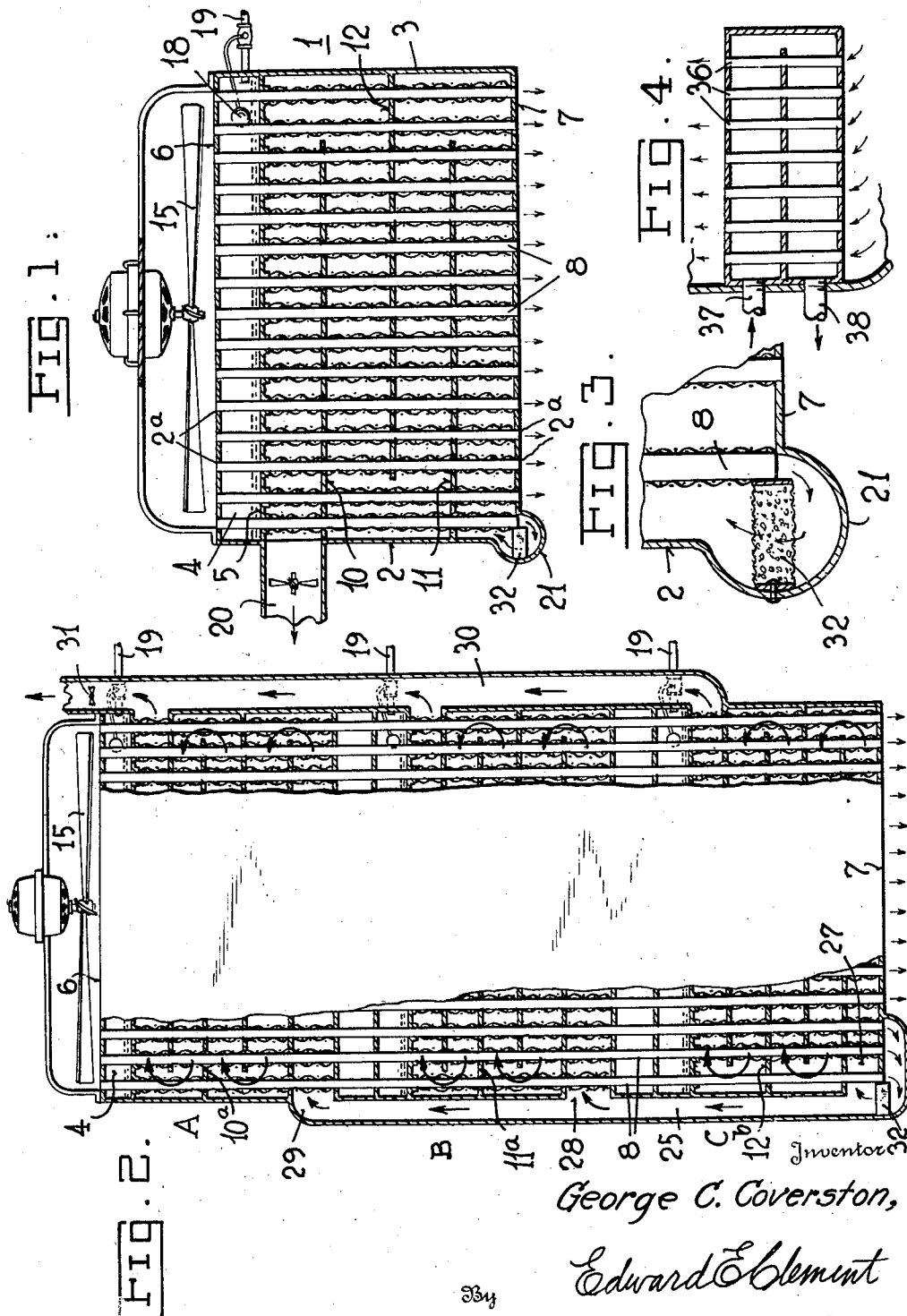
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COOLING APPARATUS

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COOLING APPARATUS

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2 Claims. (Cl. 62-139)

This invention relates to cooling apparatus and methods and especially to such methods as employ water or an equivalent fluid as the cooling medium and is a continuation in part of my co-
 5 pending application, Serial No. 21,652, filed May 15, 1935. It has for its objects to increase the comparative difference between the wet point and the dry point temperatures of the refrigerant as well as to increase the general efficiency of such
 10 a system.

I attain my objects by causing relatively dry air to circulate into and out of thermic relation with the cooling medium, and taking off the dry air from the bottom of the system and carrying
 15 it to the top and causing it to be re-exposed to fractional cooling so as to produce a cumulative or additive effect, which may be repeated as often as desired, also feeding coldest air produced to an evaporating chamber, since cooling is relative,
 20 and lower temperatures are now obtained.

Another object of my invention is to materially reduce the dew point of the air as it is fed upwardly through the cooling apparatus whereby greater cooling of the air is made possible.

While I shall show, describe and claim herein the use of dry air and water as the refrigerant and the cooling medium respectively, I wish it understood that I may substitute other cooling
 25 mediums, other refrigerants and other forms of mechanical devices without departing from the invention. Primarily, however, I employ the elements described.

In the accompanying drawing:

Figure 1 is a cross sectional view of an apparatus such as may be used in my system.

Figure 2 is a part sectional view of another form of apparatus comprising a series of units and the arrangement of a dehydrator in connection there-
 30 with.

Figure 3 is a cross sectional view of a dehydrator such as may be used.

Figure 4 is a cross sectional view of a cooling unit mounted in the system.

Referring more particularly to the drawing, Figure 1 is in the form of a single unit for cooling
 45 and feeding dry air into a space to be cooled and then returning a fraction of the dry air back for recirculation and to further cool the same. It consists of casing 1 with solid side walls 2 and 3 and aligned openings 2a formed in top wall 6
 50 and bottom wall 7. Within the casing 1 is a water chamber 4 formed from a perforated plate 5 and the top wall 6 and uppermost portion of each side wall of casing 1.

Fastened to side wall 2 are baffles 10 and 11

with openings formed therein to permit tubes 8 to extend therethrough. The baffles 10 and 11 extend to a point short of the opposite side wall 3 from which a third baffle plate 12 extends to a point short of wall 2 so as to provide a zig-zag
 5 course, as shown in Figure 1, for the air which is directed upwardly through a dehydrator 32 or suitable cooling unit 34 to stack or flue 20.

In the cup-like member 21 is mounted a dehydrator 32 or a cooling unit 34. The dehydrator 10 comprises a shell or casing having side and end walls of solid material and its top or bottom of wire gauze or perforated metal to permit the upwardly fed air to feed therethrough for dehydra-
 15 tion. This shell is filled with sodium chloride or any dehydrating substance. The dehydrator is mounted by means of rivets 33 driven through the casing unit and dehydrator shell so as to form a tight fit within the upper side portion of the cup-like member 21, as shown in Figure 3 in detail.

The cooling unit 34 may be used in place of the dehydrator 32. The cooling unit 34 is mounted by any suitable means, as solder, and may be constructed as shown in Figure 4. It comprises tubes 25 36 with connections 37 and 38 leading from some refrigerating device, not shown, for the purpose of circulating cooling fluid through the tubes 36. The air is fed through the mechanical cooling unit in the same manner as the dehydrator above described. The dehydrator 32 and the mechanical
 30 cooling unit 34 are described for the purpose of illustration only, as any suitable means to reduce the dew point of the air may be used to accomplish my results.

The dry air initially fed downwardly through 35 the tubes 8 emerges from the tubes below the bottom plate or wall 7 at which point a fraction of the air will go into the space or room to be cooled and another fraction thereof will be turned upwardly by cup-like members 21 formed or attached
 40 to the plate 7, through dehydrator 32 or any suitable cooling unit as 34 and hence around the baffles 10, 11 and 12 and ejected through stack 20.

These cup members are placed just below the lower end of a small number of the tubes 8 so as to supply the evaporating chamber with only a frac-
 45 tion of the downwardly fed dry air.

Extending from opening 2a formed in top plate 6 are tubes or conduits 8. The tubes 8 extend downwardly through the water chamber 4, 50 through openings in plate 5, through baffles 10, 11 and 12 and extend through the bottom wall plate 7. The dry air fed through these tubes is cooled by contact with the inside walls of the tubes 8 and fins 22 and 23 which extend longitudi- 55

nally of each tube so as to divide it into four sections. The tubes 8 which may properly be called air cooling tubes are surrounded by a porous material 9 below the water chamber 4. The air circulating around the porous material 9 causes rapid evaporation of moisture from the material and becomes partially saturated, thereby cooling the tubes 8 by evaporation. For the proper feeding of water from chamber 4, the openings formed in plate 5 are larger in diameter than the tubes 8, but only a small fraction of an inch larger so that the water feed to chamber 4 will only seep through the openings around the tubes 8 sufficiently to merely moisten the porous covering 9 fastened around the tubes. To regulate the water level of tank or chamber 4 a float valve 18 is connected to water pipe 19.

The foregoing form as described involves the same principle of operation as the form shown and described in Figure 1. The latter differs only in that the tubes 8 are elongated so as to project through 3 sections or units A, B and C instead of one unit as shown in Figure 1. The object being to dehydrate and reduce the temperature of the dry air with each section, thereby making the air of the second section colder than the first section and so on. The colder dry air having a greater density than the warmer air as first introduced into the tubes of section A will feed downward until it reaches the third and last section C. At this point the air will naturally be coldest and a fraction of dry air is then turned and fed upwardly into air duct 25 through a dehydrator 32 or a cooling unit 34 mounted before the inlet of the first evaporating chamber into sections A, B, and C, and around the baffles 10a, 11a, and 12b. If desired, a dehydrator may be placed before the inlet of each section. A form of dehydrator which may be used is shown in Figure 3 as previously described. The dehydrator when used in connection with Figure 5 is mounted by any suitable means such as by rivets driven through the wall of duct 25 and into the shell of the dehydrator before the inlet of the evaporator section so as to form a tight fit within the duct. Or if the cooling unit 34 is used it may be soldered tightly within the duct. The dry air fed upwardly through duct 25 will fraction off into approximately three parts. One third entering section B at port 27 as indicated by the arrows and around the baffles to vent duct 30. Another one-third enters a port 28 and through section C to the vent duct 30 and the final fraction enters at port 29 and is fed through the section A to vent duct 30. The duct 30 serves as a common exit for the air from all three sections and may be provided with a suction fan 31 to speed the flow of air through the evaporation chambers A, B and C to increase evaporation and is vented outside of the space to be cooled. The air as it is fed and drawn upwardly through each of the three sections will cause very rapid evaporation of the moisture in the porous material 9 around the tubes 8, especially rapid because it is dry or dehydrated air. The temperature of the air fed through my apparatus is reduced at each recirculation and hence I am enabled to produce air of a colder temperature at the end of each circulation. Inasmuch as the difference between a wet and a dry bulb is relative, the lower the temperature of the dry air used in the evaporating process, the lower will be the final temperature. Furthermore, the dew point of the air fed through my apparatus is reduced. It is well es-

tablished in a law of physics that, for example, if the dew point is 40° F. the temperature will not fall much below the dew point. Therefore the efficiency is increased by reducing the dew point, enabling a colder temperature to be obtained.

To summarize the operation of the unit shown in Figure 1, dry air is fed by fan 15 through tubes 8. The dry air so fed now emerges from the tubes below the plate 7 of casing 1 and a fraction of the said air is turned by cup member or members 21 and fed upwardly through the dehydrator 32 or cooling unit 34 to the evaporation chamber 1 around tubes 8 and their moist coverings 9 and around the baffles 10, 11 and 12 in a zig-zag course. The air thus fed causes evaporation of the moisture in material 9 and becomes saturated to a degree, thereby cooling the dry air feeding through the tubes indirectly. The evaporation cools the tube walls and fins 22 and 23 inside the tubes, with which the dry air contacts. The major portion of the dry air discharges into the lower part of the space to be cooled and by gravity or the aid of fan 15 is returned for recirculation. The minor portion of the dry air enters the evaporating chambers and is ejected from the space to be cooled, being replaced by air seeping into or being admitted by a duct for that purpose.

The modified form of Figure 1 operates in the same way and only differs in that it has an additional air duct 25 mounted on the opposite side from the vent duct or stack 30. This is done to provide for dividing the air into thirds to equal the number of sections used and to limit the proportional amount of air fed to each evaporating section. If five sections were used instead of three as shown in the drawing, the vent 25 would have five ports opening therefrom, one into each section. The air from each section is then fed into the duct 30 for exhaust.

While I have shown and described two particular forms of apparatus for carrying out my method, it is apparent that many changes may be made without departing from the spirit of the invention.

What I claim is:

1. A cooling apparatus comprising an evaporating chamber, air conduits partly covered with porous material extending through the evaporation chamber, a liquid containing compartment within the evaporating chamber adapted to feed liquid to the covered portion of said conduits, a cup member formed around the ends of a portion of said air conduits to turn the down flowing air upwardly through the evaporating chamber, and a dehydrator mounted in the cup member to reduce the dew point of the upwardly flowing air.

2. A cooling device comprising a series of evaporation chambers, air passages extending through the evaporation chambers covered with moisture laden material, an air vent duct over the ends of a portion of the air passages and extending to one side of the evaporation chambers from the bottom of the last evaporation chamber to the bottom of the top evaporation chamber, ports formed in the air vent duct near the lowermost portion of each evaporation chamber to direct the air through each evaporation chamber, and a dehydrator mounted in the air vent duct before the lower port formed in said air duct.

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