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DESIGN AND FABRICATION OF HUMIDITY CONTROLLED AIR COOLER

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Abstract - This paper is based on innovation to conventional coolers. In conventional or normal cooler, we get Direct Evaporative Cooling. This cooler is designed in such a way that the people sitting in any area in the room will get humidity-controlled cooled air. The humidity-controlled air cooler consists of basic things like aluminium tubes, pumps, motor fans, pipes, and various sensors. The air cooler can consume less water than conventional coolers due to indirect evaporative cooling. Thus, this cooler can be used where the temperature is high and as well as in the rainy season.

Key Words: Chamber, fan, aluminium tubes, Sensors, Pump

1. INTRODUCTION

The EVAPORATIVE cooling is one of the earliest methods employed by men for conditioning their houses. Only in recent years, it has been put on sound footing thermodynamically. It is a process of adiabatic saturation of air when a spray of water is made to aluminum tubes. The initial investment cost of such a system is low & the operation is simple & cheap.

Simple Humidity controlled air cooling is achieved by indirect contact of water and air and contact of water-tubes-air. If the water is circulated without a source of heat & cooling, dry air will become more humid & will drop in temperature. In a complete contact process, the air would become saturated at the WBT of the entering air.

The minimum outdoor temperature required for successful humidity-controlled air cooling is above 350 c & another requirement is relatively low. Wet-bulb temperature. The comfort is given by the humidity less air cooling always depends upon the outdoor temperature & R.H. High D.B.T & low W.B.T. always gives more comfort with less stick and less humidity. Although the humidity-controlled air cooling does not perform all the functions of true air- conditioning it provides comfort by filtering & circulating the cooled air. This system does dehumidify the air. We have used the two concepts in one heat exchanger with indirect evaporative cooling and cooling tower. In this system, cooling pads are not used so water vapor is not mixed in the environment air which is sucked by the fan.

These cooling systems are economical in terms of energy usage. During the energy crisis, it can be promoted as to control household utility bills and can be affordable to most of the peoples.

2. LITERATURE REVIEW

The history was categorized as primitive, modern, Eastern, and Western judging from the Egyptian water jars of 2500 BC manually fanned by slaves to cool water up to the development of homemade drip coolers of 1935 when they became more popular (Watt et al, 1997).

Historically also the ancient Egyptians hung wet mats in their doors and windows while wind blowing through the mats cooled the air making this to be the first attempt at air conditioning. The idea was refined through the centuries. Chronologically; mechanical fans to provide air movement came in the 16th century, cooling towers with fans that blew Water-cooled air inside factories in the early 19th Century and swamp coolers in the 20th Century

Evaporative cooling has existed in different forms and using different materials for centuries ago. Examples include the fired clay porous ceramic jars “Botijos” of Spain and Southern Italy used to provide water for agricultural workers in the fields (Brian and Rosa, 2003). Other areas are Egypt and Sudan, (Ibrahim et al, 2003)

Similarly in Nigeria from centuries to the present day locally fired porous clay pots are very popular for cooling water in homes and farms. The most popular shapes are spherical differing in the openings at the top. The size of the opening depends on the nature and shapes of the item to be cooled or stored and the size of the ceramic pot as well. As warm dry air flows over the wet body of the water-filled porous clay pot evaporation takes place on the surface. The air downstream becomes coo1.and humidified while the water in the pot becomes cool. The same materials are used for the preservation of some agricultural products such as kola nuts and vegetables (Elkahoji, 2004).

3. PROBLEM STATEMENT

Presently a day's force emergency is significantly more. So, significance ought to be given to control saving and energy preservation. Endeavors being focused on discovering assets or strategies for saving energy. In this task Moistness controlled Air Cooler will be configured, created, and manufactured to low operational and general expense.

Fig-1: Prototype of Humidity controlled air cooler

It doesn't make any kind of contamination so it is eco-accommodating. This A.C. supplies air without expanding dampness contrasted and regular air cooler one can feel solace and feel non-tacky.

4. OBJECTIVE

To foster the Energy effective, climate cordial backhanded evaporative cooling framework having low working expense reasonable for blistering and dry districts.
This project can be used in the room as well as in open areas such as dhobis, hotels, restaurants, etc.

4. WORKING PRINCIPLE

First, start the pump which sucks water from the bottom tank which was already filled with water. Water goes on stationery to up to sprayer and then split to tubes where heat exchanges and the air is cooled. After that, the exhaust fan starts & sucks the atmospheric air, which is passed through aluminum tubes. In this process, cooling is achieved by indirect contact of water particles & moving air stream. In the complete contact process, the air would become saturated at WBT of entering the air. In other words, the sensible heat of air is carried by water in the form of latent heat.

After some time, air may be sufficiently cooled by an indirect process, which results in considerable control of humidity. For better effect add an ice cube or chilled water to the bottom tank.

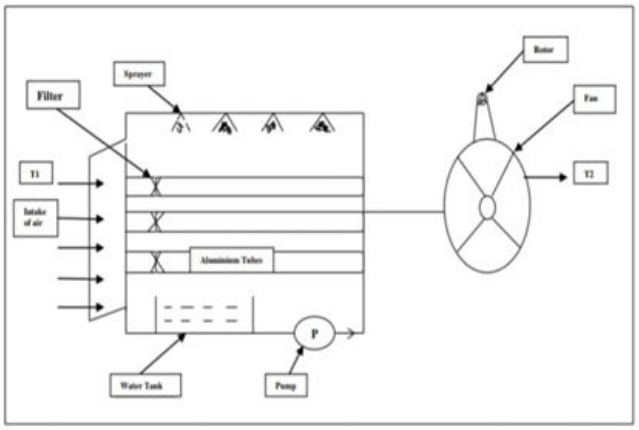


Fig -2: Layout of model

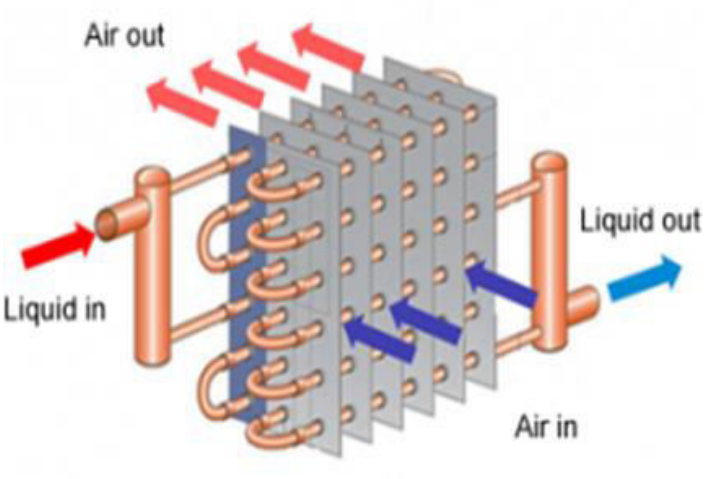
4. PRACTICE, THEORY, AND METHODOLOGY

COLLECTING DATA –

A Humidity controlled air cooler is a device in which air and water are contracted in an adiabatic manner. The surface area for contracting may be supplied by water droplets as in the spray type or by a water film spread over a wetted tube, in either case, the surface area can be maintained by a single pass or multiple passes of feed water and these are referred to as once through, and recirculation system respectively. The overall fed water rate must be more than the evaporation rate to prevent the buildup of salts and solids in the water or near the tubes.

There is a separate motor for the pump and the fan, so they can use independently. The pump pumps the water from the bottom tank to the top and the water twinkles through the holes provided on the top tank and falls passing through the Al tubes then to the bottom tank.

The air is sucked by the fans from all tubes and gets cooled passing through the tubes. The fan in the horizontal plane discharges the cool air.



5. DESIGN AND PARTS

a) FAN

Specification of Fan:
Exhaust Fan: -152.4 mm
1500 rpm, 1 phase, 4 poles
Electric-type fan: - 220/240V, 50Hz, AC
Power- 18W

b) PUMP

Specification of Pump: -
Power Consumption: -18W
Voltage: -AC 220V
Outlet Nozzle Size: -½”
Maximum Head: -1.5m (5 Ft.)
Maximum Flow: -750 L/H

c) TANK

Specification of Tank
Size: 68x60x18 cm3
Capacity: 80-120 liters

d) BODY

Dimensions – 65 x 55 x 120 cm^3

e) ALUMINUM TUBE

Dimensions - 6.3 cm diameter

6. EXPERIMENTAL SETUP INSTRUMENTS:

a) Thermometer

b) Anemometer

c) Psychrometer

d) Energy Meter

7. OBSERVATIONS AND RSESULTS

TRIAL ON AIR COOLER:

Initial room temperature (DBT) = 32 C. Relative Humidity=60
Area of room = 200 ft, height = 10 ft.

Observation number	Temperature in degree centigrade	Time interval in minutes
1	32.0	0
2	32.0	15
3	31.6	30
4	31.0	45
5	30.2	60
6	29.6	75
7	29.0	90
8	28.6	105
9	28.2	120

The net drop in temperature is 3.5 C as the trial is taken in Rajasthan Summer and Rainy Season in an open atmosphere. So, the water-containing capacity of air is less. Cooler works on the principle of evaporation. So, its performance is Moderate and can be work where humidity is more or in the rainy season where more water vapor present in the environmental air.

8. ADVANTAGES, DISADVANTAGES, AND APPLICATIONS

A) ADVANTAGES

1. Ease of maintenance (including checking and cleaning).
2. Easy for repairing.
3. Ease of lifting the loaded light vehicles.
4. Ease of handling.
5. Ease of replacement of any parts.
6. A clean, green, eco-friendly machine

B. DISADVANTAGES

1. Water leakage problem.
2. Water falling Sound.
3. Cleaning is not easy.
4. Corrosion Problem

9. CONCLUSIONS

This project is cheap compared to coolers available in the market. If little advancement is done in such a cooler, then it can be operated on solar energy. Hence the problem of electricity crisis can be reduced more.

From the current examination, it is apparent that for "Humidity Controlled Air Cooler" cooling the presentation qualities cooling the exhibition attributes can be identified with the factors like and thickness and the barometrical conditions, for example, mugginess control and solace. It is additionally conceivable to decide the ideal worth of these plan boundaries however area and one need to upgrade the plan boundaries for relating outside conditions.

The outcome additionally shows that a significant saving in power devoured is conceivable and simultaneously the cooling adequacy can be upgraded. The methodology can be utilized to break down any piece of hardware and work on its exhibition.

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