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Multi Utility Hybrid Cooler

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***Abstract*— The paper presents the detailed information about 'Multi Utility Hybrid Cooler (MUHC)'. We have designed this cooler by making modifications in the conventional desert coolers used in our country. This is a multipurpose cooler which gives air cooling effect, cooling water for drinking as well as provides cool space for storing perishable products.**

***Keywords*—Radiator, Desert Cooler, Hybrid, refrigeration, evaporative cooling, Multipurpose.**

I. INTRODUCTION

In the North Western part of India, the humidity of air is quite low during summer season whereas the average temperature is 40^0C to 45^0C. It even reaches up to 48^0C to 50^0C in the month of June. To maintain comfortable condition in (i.e. temperature) in the summer season various types of appliances are used such as 'Air Conditioner', 'cooler'. This climate is most suitable for evaporative cooling. Fresh outside air is sucked through moist pads where it is cooled by evaporation of water and this cooled air circulated in a room or building by small fan or blower. Also evaporative cooling is the natural way of keeping water cool in summer season.

We have designed a "MULTI-UTILITY HYBRID COOLER (MUHC)"which is modification of the conventional cooler. It is Air Conditioner cum refrigerator for the people who cannot afford costly equipment's like air conditioner, refrigerator and other such appliances. The modified desert cooler is designed and developed to provide better cooling effect than the conventional. It also provides cold pure water for drinking purpose and storage for perishable items comparatively at low cost than refrigerator. Modification is carried out with the help of accessories such as radiator, copper tubes, water tanks, storage box and PVC pipes.

II. OBJECTIVES

With the modified cooler, the following objectives can be achieved.

1. Air cooling effect
2. Cool water for drinking purpose.
3. Storage space for perishable goods.

III. REVIEW

In the paper published ISSN- 2319-7560 it shows that efforts have been made to improve efficiency of the conventional desert cooler.

To increase the efficiency of the desert cooler it is modified in such a way that it can cool the water too. Different devices are required to cool air, water and store perishable products but by making the modifications in the desert cooler the all the three devices can be combined to make a multi utility hybrid cooler. The hybrid cooler is different as it is more compact and serves all the three purposes very well in less space as well as less cost.

There's a world of difference between old-style swamp coolers and modern evaporative cooling systems. The latter can provide years of trouble-free service and cool, clean, comfortable, fresh air at a lower energy cost than conventional air conditioners—and initial costs are competitive as well. In addition, the latest evaporative cooler designs are a lot easier on the grid than compressor-based cooling systems. Instead of peak demands of three to five kilowatts (kW) or more, typical demands for mid-size evaporative coolers are on the order of one kW. In addition to improved performance, modern evaporative coolers include options for thermostatic control and automated flushing of reservoir water to reduce build-up of impurities. Accordingly, wide-spread use of evaporative coolers can help delay adding expensive new power plants to the electric grid and the controversial transmission lines that often accompany them. That's the reason a number of utility companies in areas with hot, dry summers and substantial population growth have programs to promote efficient evaporative coolers.

Hence the above reviews let us know that conventional cooler only serve the humans by cooling the air by reducing the temperature but our Multi Utility Cooler can be used for three purposes in low cost as well as small space. It cools air which gives comfort as well and serves cooling of water.

Also in the paper which is published in the journal-'Energy and Buildings'-Energy consumption in buildings due to heating, cooling and air conditioning (HVAC) systems has a steadily growing trend as a consequence of enhanced indoor thermal comfort conditions. The role of cooling in HVAC oriented energy consumption is remarkable especially in regions with extreme climatic conditions such as Africa and Middle East. In hot and arid climates, cooling demand is usually met by cost-effective evaporative cooling solutions. However, in hot and humid climates, evaporative cooling systems are not capable of providing cooling as the outdoor air is already almost saturated in most cases.

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Since the main purpose of the system developed is to provide cost-effective thermal comfort conditions. Our 'MUHC' provides a great solution in the desert conditions by combining the three devices which provide cooling of air as well as it also provides cold water in summer and stores food stuff.

Also the in the paper published 2421-2426 in energy Procedia the research shows us that Evaporative cooling is a very interesting high temperature cooling solution that has potential to save energy comparing to refrigerant cooling systems and at the same time provide more cooling reliability than mechanical or natural ventilation system without cooling . Annual analysis is conducted based on hourly weather data for 15 cities located in Denmark and 123 European cities. The European conditions are also different from the desert conditions for which we have worked. Our 'MUHC' is also suited in European conditions and can serve people across the globe with any climatic conditions which makes it flexible as well as serving three purposes at a time.

IV. Human Comfort

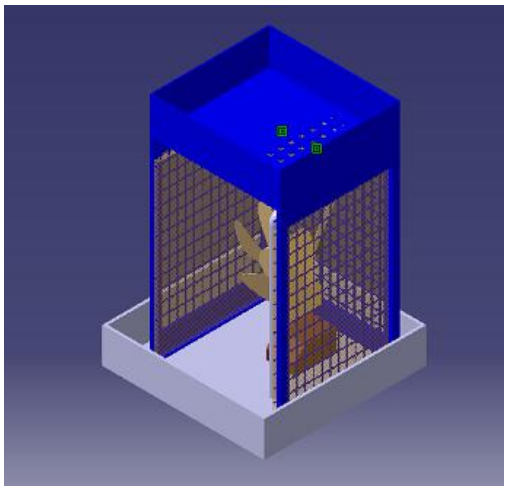
Temperature is the most significant component to the experience of comfort in a space. Our bodies perform within an internal temperature range much narrower than external temperatures. In the process our bodies' metabolism generates heat, which must dissipate into the surrounding air or surfaces. Humans maintain comfort levels in very diverse climates. When external temperatures are high, this process becomes more difficult and we may overheat or feel warm. When external temperatures are low, the rate of heat loss becomes more rapid, and we may feel uncomfortably cold. When assessing thermal comfort in a confined space, we must examine both the general temperature in the room, as well as the uneven distribution of heat in the room. Typically when people refer to temperature, they mean the temperature of the air; however, our experience of thermal comfort depends on more than simply air temperature. The mean radiant temperature entails averaging the temperatures of each surface in the room. Combined with the air temperature this produces an overall measure, the mean operative temperature. However, even this measure has its limitations, as how close a person will be to a particular surface is usually variable, and in these cases different surfaces will dominate at different times. Differences in temperature within a room or across a body can create a sense of discomfort.

When temperatures from different surfaces diverge, we sense a surface as radiating heat or "giving off" cold. When the ceiling is the contrasting surface, we note discomfort when the ceiling is greater than 9˚ F (5˚ C) warmer or 25˚ F (14˚ C) colder than the other surface temperatures in the room.

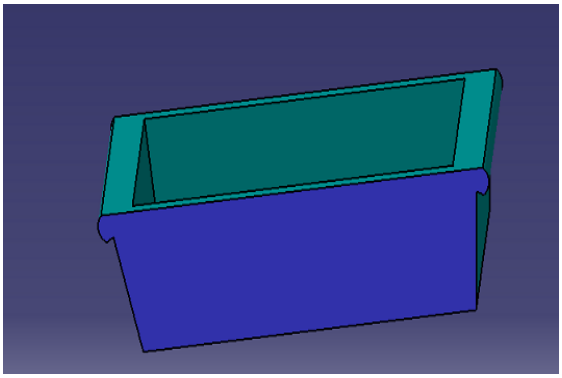
We allow a greater divergence of wall temperature from alternate surfaces temperature before we sense discomfort, 41˚ F (23˚ C) for warmer walls and 18˚ F (10˚ C) for cooler walls.1 As well, a vertical air difference from our feet to our head shouldn't exceed 5.5˚ F (3˚ C),2 otherwise the high temperature gradient highlights one part of the body as feeling notably warmer or colder than the other.

V. Components

1) Conventional Cooler



2) Storage Box and Puff



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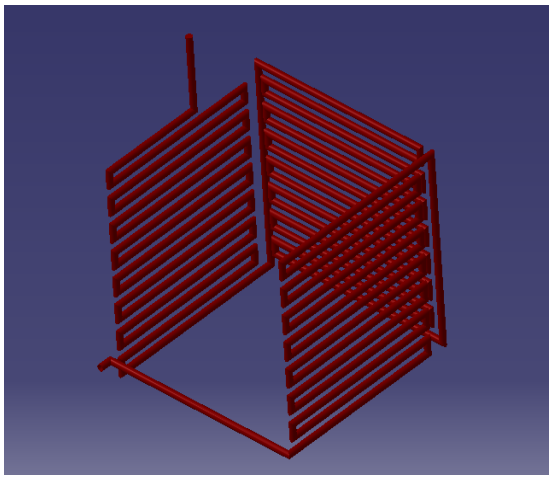
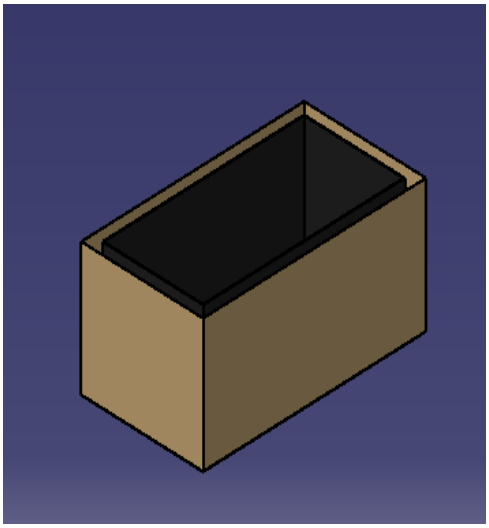
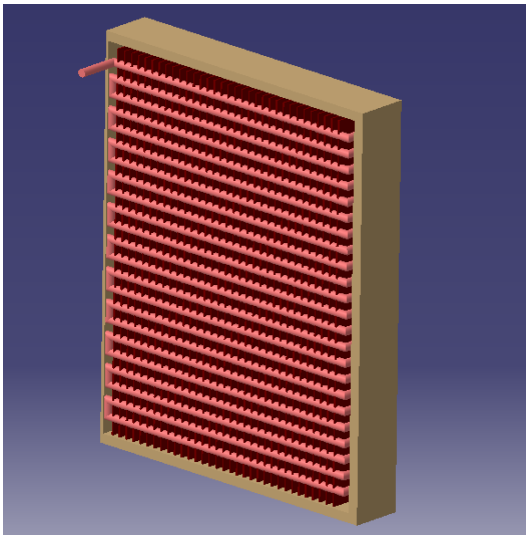
3) Copper Tubes.



4) Water tanks.



5)Radiator.



VI. Description Of Assembly

The assembly consists of following components:

Cooler assembled with storage box.

Simple small size water tanks.

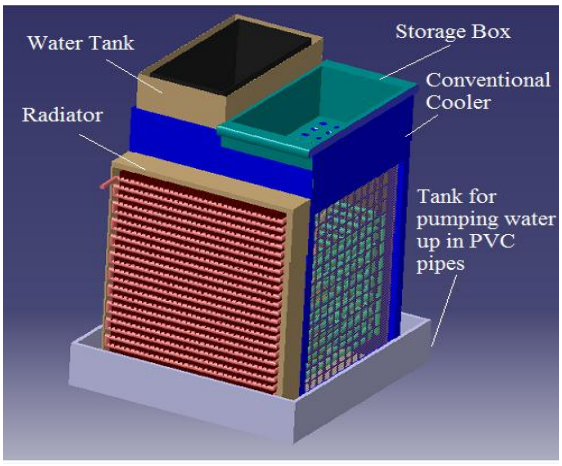
One big size tank.

Connecting tubes of copper.

Perforated PVC pipes for trickling of water on aspen pads.

Radiator in front of fan.

Storage box sealed by insulating material. All this is as shown in fig



After assembly

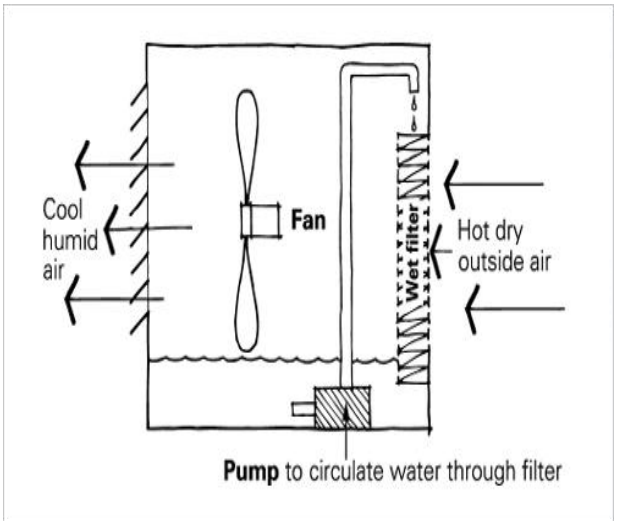
VII. Working

Based on the working principle of evaporative cooling.

Cooling of water through radiator.

Cooling of perishable goods.

1) Cooler works on principle of evaporative cooling as shown in fig.



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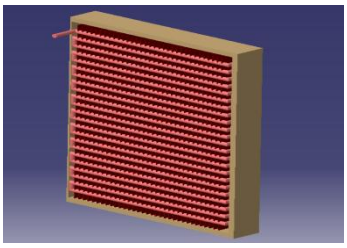
2) Working Of Radiator For Water Cooling:

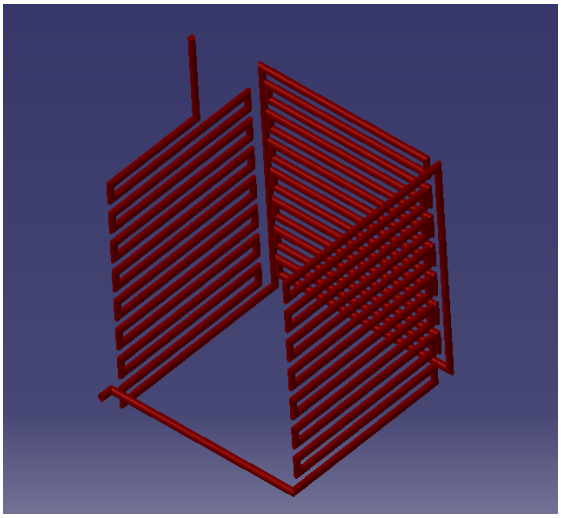


From upper tank water enters copper tubes and by gravity, it flows through those tubes.

Water inside cu-tubes loses temperature as water is trickled through PVC pipes as it is connected near to the aspen pads.

From there, it is taken inside the radiator where further more heat is lost and we get cold water.

Through the fins of radiator, air from cooler also cools down water more.



3) Cooling of perishable goods.

Here we are going to make small holes at the bottom of the storage box and walls of the box are sealed with insulating material.

Through that holes air is going to come inside the storage box and thereby it cools the perishable goods kept inside it.

The insulation helps to prevent the loss of heat i.e. maintains the low temperature inside the box.

VIII. CONCLUSION

So here we conclude that the "MUHC" is a multi functional device serving three functions at time which makes it economical to use and can be afforded by poor people in our country. As it serves the three functions at a time its power consumption is less as compared to three different devices. Also its running cost is low. Our "MUHC" is Eco-friendly and has no green house gas production in its working.

REFERENCES

[1] A review on "Development and testing of Natural Draught Desert Cooler" Ashok Kumar Sharma and Pawan Bishnoi in International Journal of Science and Engineering Applications. Year (2013)

[2] A review on "Experimental Analysis On Cross Flow Indirect Evaporative Cooling" Stefano De Antonellis, Cesare Maria Joppolo, Paolo Liberati, Samanta Milani, Luca Molinaroli. Year (2016)

[3] A textbook of Refrigeration and Air conditioning By R.S. Kurmi and J.K.Gupta.

[4] A textbook of Refrigeration and Air conditioning By P. N. Ananthanarayanan.

[5] Principles of Refrigeration by Roy Dossat.