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360 Degree Air Cooler and Heater

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Abstract: 360 degree air cooler and heater is a device used to cool or heat the air according to the requirement of the user. As the years are passing by the energy consumption by humans is also increasing as a result there will be no energy or less energy left for the future generations to use. To reduce the consumption of energy a 360 degree air cooler and heater need to be used. Another reason for the use of 360 degree air cooler and heater is reduction in global warming as the conventional air conditioning system gives out Chloro-Flouro carbon resulting in depletion of Ozone layer due to global warming and also affects climate. Conventional air conditioning system uses three to five times electricity as compared to the 360 degree air cooler and heater which results in emission of a considerable amount of heat resulting in global warming.360 degree air cooler and heater is also beneficial as compared to conventional air conditioning system as it cools the air of all the four direction with the help of chilled water. During the time of winters the relative humidity of air is high which also leads to low dry bulb temperature so the cooler is in ideal condition, the efficiency is low as high relative humidity is present. Hence, using a heating coil will make the cooler more efficient even though the relative humidity of air is high and it will provide us with hot air in colder conditions. This paper will review the various findings by different researchers to study and compare various design and results obtained with 360 degree air cooler and heater.

Key Word*: Evaporative cooling, Specific humidity, Chloro-Flouro Carbon, Air cooler, 360 degree*

I. Introduction

The evaporative cooling and forced convection heater is one of the earliest methods employed by men for conditioning their houses. Only now a day, it has been put on sound footing thermodynamically. India is a tropical climate country in which most the cities experience very low temperatures during the winter and very high or humid temperatures during the summer seasons. In which, the temperature range between summer and winter seasons seen is very large. Hence, there is not a very pleasant experience and highly uncomfortable conditions for humans without external devices. There are some cheaper methods of heating are available during the winter season, methods of cooling the hot temperatures during the summer do not have wide variety of options which are affordable. Air conditioners have high initial and running costs; they are expensive which cannot be afforded by all the middle class people in a developing country like India. Desert air coolers are generally cheap, but provide unsatisfactory results; there is a need for developing a cheaper and comfortable room cooling system. Majority of affordable air coolers in market gives air supply in one direction at a time. Conventional air conditioning and refrigeration are one of the major contributors which release CFCs into the atmosphere. An alternative sort of cooling, which does not expel CFCs is highly desirable and recommended as one important step in the correction of

this problem. It is 100% fresh air cooling which even helps to clean the air it cools. A review has been taken here to make a comprehensive study of design and working of a 360 degree air cooler and heater done by various researchers and study different methods used.

1.1 Problem definition:

Now a day's problem of power crisis is much more. So, we should give more importance to power saving and energy conservation. Efforts are being concentrated on finding resources or method of saving energy. In this project 360 degree evaporative cooler will be design, developed and fabricate to low operational and overall cost. It doesn't create any type of pollution so it is environment friendly. This A.C. supplies air without increasing humidity compared with conventional air coolers.360 direction will allow sitting people anywhere.

1.2 Objectives:

1 To develop and design a power saving, energy efficient, environment friendly evaporative air conditioning system having low operating cost and can be used in hot and dry regions.
2 To design a cooler, this allows air to flow in 360 directions.
3 To save the water and electricity by using the same cooler for all rooms of home.
4 Main important of this cooler is this air cooler gives cool air as well hot air so for all season we can use it.
5 Less weight with more benefits and safety for types users like industrial as well home.

1.3 Methodology:

1. Selection of Design Parameters.
2. Compiling the problems, difficulties obtained for air cooling technology, finding best way to cure it.
3. Research on evaporative cooling and comparison with other technologies.
4. Conceptualized Cad Model.
5. Design calculations.
6. Finding out the best way to design 360-degree air cooler and heater and reducing comparing aspects.
7. Testing and results.
8. Conclusion.

II. Literature Survey

Sr. no.	Name of author	Year of Publication	Work done
1	Akhilesh Yadav, Rajatkumar Bachchan, Sankesh Toraskar	2018	Manufacturing and results of 360 cooler cum heater.
2	Vijaykumar Kalwa and R Prakash	2014	In this paper modeling and fabrication of solar based air cooler with cooling cabin for household food items is done.
3	J.Sabari priyana, S.Sakthivela, K.Sowndar Rajana, S.Rajavelb	2016	In this modified air cooler is designed which provides both air cooling as well as cooling storage.
4	Prof. Nilesh Ambaji Jadhav	2019	Design and review of 360 air cooler and heater.
5	J.K. Jain, D.A. Hindoliya	2011	Performance analysis of different cooling pad materials and comparison on cooling efficiency.

6	Min-Hwi Kim, An-Seop Choi, Jae-Weon Jeong	2012	This research is done to verify the heating energy reduction capacity of an indirect and direct evaporative cooler assisted outdoor air system via actual winter operation of the pilot unit installed in a campus building and efficiencies are compared.

Table no 1: Summery of literature survey

III. Cad Model and Calculations

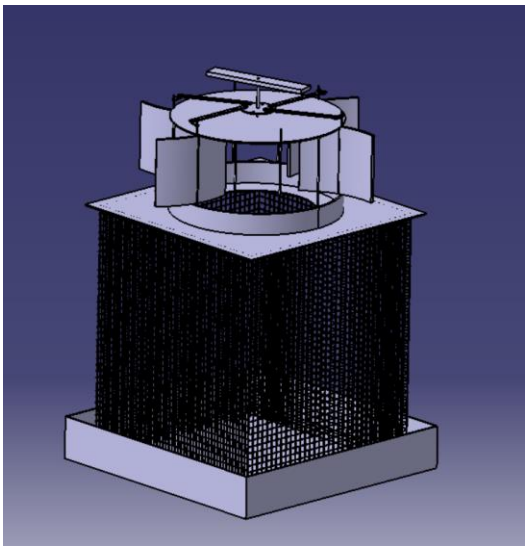


Fig 1: Cad Model

Calculations:

Material = C 30 (mild steel)

Taking fos 2.5

$\sigma_t = \sigma_b =$ 600/fos = 240 N/mm^2

$\sigma_s = 0.5\ \sigma_t$

= 0.5 x 270

= 120 N/mm^2

Designing of shaft

Let force applied by human hand is 10 kg = 100 N

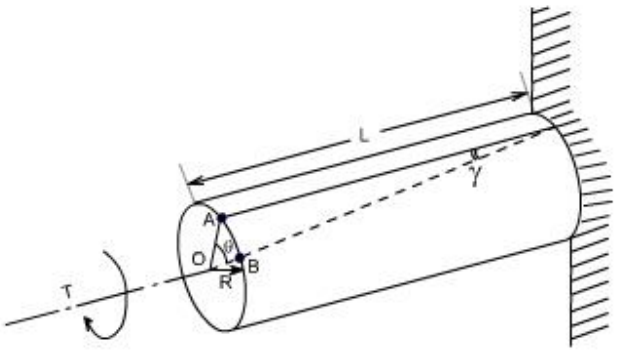


Fig 2: Design of shaft

Torque transmitted by shaft,

T = F x L

= 100 x 70

= 7000 N-mm.

$T = \pi/16 \times \sigma_s \times d^3$

Therefore, $7000 = \pi/16 \times d^3 \times 120$
$d^3 = 7000 \times 16/3.142 \times 120$
$d = 6.67$ mm

But we are using 10 mm shaft for safer design.
This link which we are using for rotating flappers may fail under bending

F = maximum force applied = 100 N
For cantilever, M = F x L

M = 100 x 160 = 117600 N-mm

And section modulus = $Z = 1/6\ bh^2$

$Z = 1/6 \times 5x25^2$

$Z = 1/6 \times 3125$

$Z = 520.8\ mm^3$.

Now using the relation,

$Fb = M / Z$

$Fb = 117600/ 520.8 = 225.8\ N/mm^2$

Induced stress is less then allowable 240 N/mm^2 so design is safe.

IV. Results

Initial room temperature (DBT) = 34 C, Relative humidity=60, Area of room = 150 sq ft, height = 10 ft.

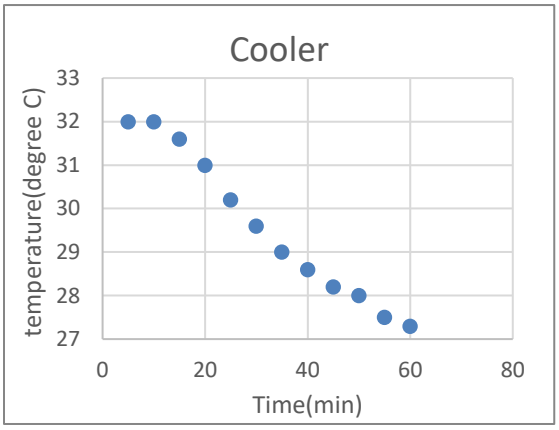
Observation no	Time interval in minutes	Initial Room temperature	Final room temperature
1	5	34	32
2	10	32	32
3	15	32	31.6
4	20	31.6	31
5	25	31	30.2
6	30	30.2	29.6
7	35	39.6	29
8	40	29	28.6
9	45	28.6	28.2
10	50	28.2	28
11	55	28	27.5
12	60	27.5	27.3

Table no 2: Cooling observations

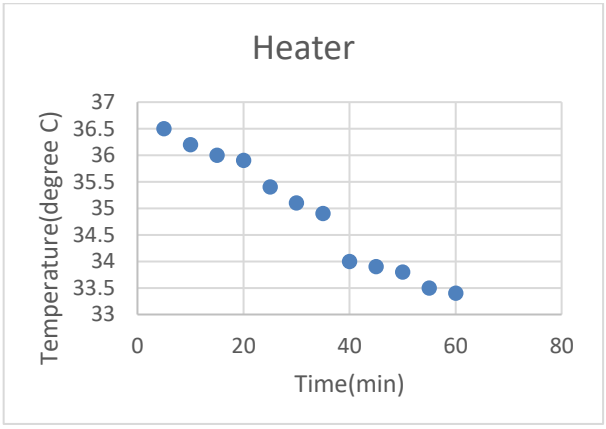
Observation no	Initial room temperature	Temperature of air at exit of heater	Final room temperature

1	32	69.5	36.5
2	32	68.3	36.2
3	32	67.5	36
4	32	67	35.9
5	32	66.2	35.4
6	32	62.4	35.1
7	32	60.5	34.9
8	32	58.4	34
9	32	55.2	33.9
10	32	52.8	33.8
11	32	50.1	33.5
12	32	50	33.4

Table no 3: Heating observations



Graph 1: Temperature change while cooling



Graph 2: Temperature change while heating

V. Conclusion and Future Scope

5.1 Conclusion:

This paper undertook a review based study on 360 degree air cooler and heater. Majority of affordable air coolers in market gives air supply in one direction at a time. This paper is based on innovation and moderation to those typical desert air coolers. This cooler is designed in such a way that it can give cold as well as hot air in all 360 degree directions. Main idea of this project is to make an affordable air cooler as well as heater that can be used in villages or other small regions as well. The recent researches and results have shown that a considerable saving in power consumed and at the same time the cooling and considerable heating effectiveness can be enhanced. 360 degree air cooler and heater also has an advantage of saving the natural resources as it works on natural phenomenon and it is pollution free.

5.2 Future Scope:

- If this cooler is manufactured in mass production, it can be available in much cheaper price and can be used in small villages also.
- Frame can also be made from plastic fiber to reduce weight.
- With the use of dehumidifier added at the inlet of cooler will increase its efficiency. And it will also enable to use this cooler in condition when relative humidity of air is high.

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