

Design and Development of a Low Cost Air Cooler

Kiran Suryawanshi¹ Aashish Tupe² Prasad Ghode³

¹Professor ^{2,3}Student

^{1,2,3}GGSP, Nashik, India

Abstract— Air Cooler is one of the appliances that keeping the atmosphere cold. The basic concept of water cooling is to find a medium that can handle and transport heat more efficiently than air. Water has a very good ability to retain heat, in the meantime stay in a liquid form. Secondary researches have been carried out to collect data regarding the present design of air cooler. Various types of air cooler available in the market have been identified. Ethnographic study and questionnaire survey has been done for understanding the user product interface. The issues related to current air cooler have been found out.

Keywords: Low Cost, Air Cooler

I. INTRODUCTION

Air Cooler is one of the appliances that keeping the atmosphere cold. The basic idea of water cooling is to find a medium that can handle and transport heat more efficiently than air. Water has a good ability to retain heat, in the meantime stay in a liquid form. As long as can circulate cool water to the hot parts. Water can cool it down more efficiently than air.

Method of Air cooling is a dissipating heat. Which works by making the object to be cooled have a larger surface area or have an increased flow of air. Evaporative cooling is based on a physical phenomenon in which evaporation of a liquid into surrounding air cools an object or a liquid in contact with it. As the liquid turns to a gas, the phase change absorbs heat, Latent heat of evaporation. Water is an excellent coolant because it is plentiful, non-toxic, and evaporates easily in most climates.

The concept, was refined, became the air cooler which will provide a low cost, alternative to typical water air cooler. Cold water is flowed through copper tubes and air passing over copper tubes cooled due condensation on surface of tube

A. History of Air Cooler

Civilizations throughout the ages have found ingenious ways to combat the heat in their region. An earlier form of air cooling, the wind catcher, was invented in Persia (Iran) thousands of years ago in the form of wind shafts on the roof, which caught the wind, passed it over subterranean water in aquanaut and discharged the cooled air into the building. Nowadays Iranians have changed the wind catcher into an evaporative cooler and use it widely. There are 9 million evaporative coolers in central Iran, and in just the first two months of year 1385 in the Persian/Iranian calendar (April–May 2006) 130,000 evaporative coolers were sold in Iran [1].



Fig. 1: Air Cooler

The evaporative cooler was the subject of numerous US patents in the 20th century; many of these, starting in 1906, suggested or assumed the use of excelsior (wood wool) pads as the elements to bring a large volume of water in contact with moving air to allow evaporation to occur. [2]

A typical design, as shown in a 1945 patent, includes a water reservoir (usually with level controlled by a float valve), a pump to circulate water over the excelsior pads and a squirrel-cage fan to draw air through the pads and into the house. This design and this material remain dominant in evaporative coolers in the American Southwest, where they are also used to increase humidity. In the United States, the use of the term swamp cooler may be due to the odour of algae produced by early units. [3]

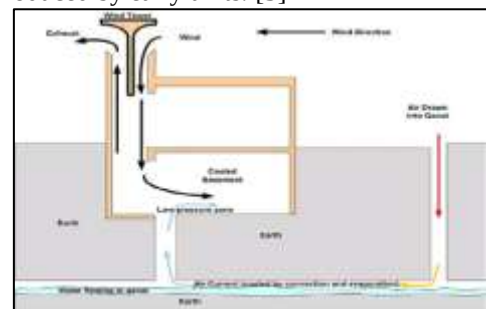


Fig. 2: Schematic diagram of an Iranian wind catcher [2]

II. WORKING PRINCIPLE

A fan draws air through the pads, where evaporation drops the temperature approximately 20 degrees. The fan then blows this cooled air into the house. Small units can be installed in a window, blowing cooled air directly into a room. Larger units can blow air into a central location, or the air can travel through ductwork to individual rooms.

This air cooler works on principle of surface air condensation. Cold water is passed through copper tubes with recirculating water pump. Fan draws air, which comes in contact with copper tubes which contains cold water. Surface condensation takes place on surface of copper tubes (Figure

3). As we are using water as refrigerant, Water absorbs heat from air. Due to this we get cooled air without any complex structure and construction.

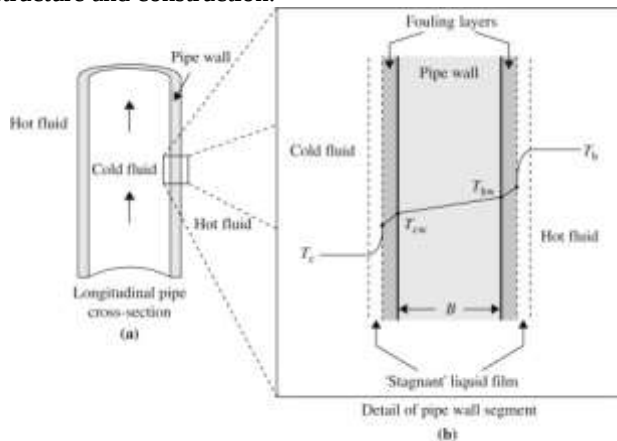


Fig. 3: Surface Condensation

Normal air conditioning is a closed system, taking air from inside a house and recycling it. For air conditioning to function properly, doors and windows should be closed. Evaporative cooling, however, takes air from outside the house. For this air cooler to work properly, the cooled outside air must be allowed to escape. By choosing which doors or windows in your home you leave open, which can to help direct the flow of cooled air to areas where it is needed

A. Table Fan



Fig. 4: Table Fan

A fan draws air through, where evaporation drops the temperature approximately 20 degrees. The fan then blows this cooled air into the house. Small units can be installed in a window, blowing cooled air directly into a room. Larger units can blow air into a central location, or the air can travel through ductwork to individual rooms. Normal air conditioning is a closed system, taking air from inside a house and recycling it. For air conditioning to function properly, doors and windows should be closed. Evaporative cooling, however, takes air from outside the house. For evaporative cooling to work properly, the cooled outside air must be allowed to escape. By choosing which doors or windows in your home you leave open, we can to help direct the flow of cooled air to areas where it is needed

Fan can only control velocity of air flowing not temperature. Fan will blow air on copper tube winding in which cold water is flowing.

B. Re-circulating water pump



Fig. 5: Re-circulating water pump

A re-circulating pump draws water from the basin under the pumps it through a system of sprays (or water distributors) from which the water is directed onto the tube. Air is induced or forced over the wetted tube surfaces and through the rain of water droplets. By intimate contact of the air with the wetted tube surfaces and water droplets evaporation of part of the water occurs thus cooling both the tube surfaces and the water simultaneously. In this manner evaporation is used to increase the rate of heat transfer from the tubes to the air.

C. Copper Tube



Fig. 6: Copper Tube

Copper is ductile material and also good conductor of heat, hence it will provide more heat transfer between both fluids i.e. air and water. This copper tube are mounted on protection gauge of fan and the both end of tube are connected to re-circulating pump. Cold water will passed through this tube.

III. DESIGN CONSIDERATION

- Giving more importance for the working mechanism of cooling
- It should be portable and easy to use.
- It should be easy to maintenance and for assembly also.
- Cost should as less as possible.

IV. ACTUAL WORKING MODEL



Fig. 7: Actual Working Model

In this concept the cooling mechanism is entirely different from the current air coolers. For storing water a water storage area is provided at the bottom of the cooler. Water circulating pump is provided inside the water storage area. One water outlet tube is connected with circulating pump. Blower is shown at the top of the cooler connected with a motor.

The working principle for this concept is once the water circulating pump is started the water begins to flow through the water outlet tube; the end of this tube is fixed behind the fan as a result the water flows at high pressure through the water outlet tube and comes in contact with air. As a result the water absorbs heat from air and air cools. This cooled air will flow out of the air cooler.

The main factor affecting the performance is the temperature of incoming water. Cool water will work, but ice water will result in a cooler room, quicker. We have attached the tubing to the front of the fan as well. This will increase performance.

V. SUMMARY AND CONCLUSION

- Secondary research method like literature review was conducted by referring magazines, journals, manuals, publications, websites etc.
- Data collection was done by product study, user study and market study through ethnography, images, videos etc. at houses and shops.
- Detailed drawing of the concept was prepared.
- Working model of the final concept is made by assembling components.

A low cost air cooler for residential use has been made to meet the requirements of the customers. All the product design specifications arrived after research has been fulfilled at the end of this project. The project gave an excellent opportunity to go through the end to end life cycle of a product.

VI. REFERENCES

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