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Design and Development of Portable Air Conditioner

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Abstract **Air conditioning is defined as the simultaneous control of temperature, humidity, cleanliness and air motion depending upon the requirement, air conditioning is divided into summer air conditioning and winter air conditioning. Air conditioner conditions the air, transport it, and introduce it to the conditioned space. It provides heating and cooling of air. The portable Air conditioner system should satisfy the need of user at the most economical cost. The selection of system depends upon many factors. It could be only a relief in temperature or complete control of environment. It could be lowest first cost or lowest running cost. Level of cleanliness, acoustics, and concentration of load within the space may affect the selection. The portable air conditioner is based on air water system, in this system the room unit is supplied with both processed air and chilled water. life .Conventional Air conditioners satisfies that need but they are not affordable to everybody. The solution on this problem is portable air conditioner which is having very low manufacturing and maintenance cost. Its cooling power is comparable to wall air conditioner. It provides transportability, can be move anywhere easily. It is small in size; hence it would sit nicely in our bedroom, drawing room and kitchen. It is completely non-polluting.**

Keywords: Human comfort, Refrigerants, Air conditioner.

I. INTRODUCTION

This book is an attempt to show with a concrete example backed by facts and figures how this extra burden on the power starved metropolis could be reduced by half or more by overhauling and simplifying our cooling and heating systems. On a national scale the saving in our peak load capacity may be as high as 25000 MW or even higher.

In Air conditioner the only source of power is a 23-watt fan which needs less energy than the electric bulb in your room and can be run for a virtually unlimited period on an inverter or a car battery to bring down the room temperature by at least seven degrees centigrade.

Apart from being a permanent standby against power breakdowns in the homes of the elite in metropolitan cities, it would be an ideal cooling device for small towns and villages throughout the country that usually have an indifferent supply of electricity. Its movability from room to room makes it most suited to small hotels, guest houses and nursing homes that rarely have wall air conditioners or hundred percent occupancy.

A 1.5-ton room air conditioner consumes 1500 units of power in one hour, which is sufficient to produce 30 kilograms of ice in an ice factory.1 With that much ice Air conditioner can keep a room almost equally cool and dehumidified for eight hours. One might say there are distribution losses in ice deliveries. Under Indian conditions electricity transmission losses are no less, for which there are a variety of reasons including technical deficiencies and massive "thefts", committed in the open, mainly by the richer power guzzling sections of society such as big factories and large bungalows and flats. Add to that the colossal investments in the shape of electrical energy and finance to create the giant-sized infrastructure of power houses and transmission lines for every additional megawatt of power. If you take all this into account you will arrive at the sobering conclusion that a gadget which consumes one unit of energy per hour is in fact using two, the other half being invisible.

II. PREVIOUS TECHNOLOGY

In previous days people use hand fans during summer season, but it gives hot air due to high temperature and also due to this hand get pain. After that table fan is invented, later ceiling fan is invented but as usual it gives hot air.

In villages people mostly use to cover the window with wet cloth so that the air pass through it is get cool and moist due to which person feel relax and comfortable. But it works for half hours or one hour only.

III. LITRATURE SURVEY

Franck Lucasa, Pascal Ortegaa, Mathieu Davidb, Frantz Sinamab, Boris Brangeonb Fabien Picgirardc, ICAE2015[4]:A method to evaluate energy performance of buildings cooled by room air conditioners. Because of their low cost, small air conditioning systems (AC) like split air conditioning systems are often installed without a proper study of building envelope performance. Furthermore, these systems are sometimes installed by tradesmen who neglect to comply with the appropriate rules and regulations. Finally, when routine maintenance is not rigorously carried out, the energetic performance of the system is compromised over time. This article presents a practical, global approach to diagnose the performance of existing small air-conditioning installations in buildings applied in Reunion Island. This tropical Island aspires to become electricity self-sufficient.. This approach relies on a numerical tool and dynamic simulations of buildings equipped with AC. The simulations, which take account of the building envelope, a description of the system as well as the practices of the users, are based on the kernel calculation Energy. They also take into account the climatic conditions and provide an estimate of the annual electricity consumption related to the cooling of the zone. This global analysis helps to qualify the entire system by assigning an energy label.

- *Buildings account* for over 42% of consumption of final energy [1] in France and between 20 and 40% in other developed countries. Perez Lombard [2] reports that the share of HVAC system for heating ventilation and air conditioning has now become the largest energy end use in the residential and non-residential sector. Wong [4] estimates that its represents one third of the total energy consumption for residential housings in Hong Kong.
- *Improving the design of buildings* and of the AC systems in order to reduce cooling loads is the subject of a great deal of research in southern hemisphere tropical climates. A large body of expertise has evolved, especially in respect to French overseas departments, like Reunion Island. As a result of this work, specific recommendations to design buildings adapted to the tropical climate have been established.

Jadhav T. S., Lele M.M., Engineering Science and Technology, an International Journal 18, 2015[5]: Theoretical energy saving analysis of air conditioning system using heat pipe heat exchanger for Indian climatic zones. Heat pipe heat exchanger (HPHX) is an excellent device used for heat recovery in air conditioning systems. The Energy Conservation Building Code (ECBC) e Bureau of Energy Efficiency (BEE) India classifies Indian climatic zones into five categories viz., Hot and Dry , Warm and Humid ,Composite, Cold and Temperate. From the paper we can say that indicated that very limited information is available on annual energy saving analysis of air conditioning system with HPHX for Indian climatic zones. The paper investigates the possible energy savings using HPHX for heat recovery in air conditioning system for Indian climatic zones. This paper discusses the use of HPHX only for the heat recovery application i.e., exchange of sensible heat between fresh outdoor air and conditioned return air. The maximum energy saving potential is revealed for hot and dry, warm and humid and composite Indian climatic zones.

- *In the last six decades*, India's energy use has increased 16 times and the installed electricity capacity by 84 times. In 2008, India's energy use was the fifth highest in the world. The air conditioning contributes towards significant energy usage of a building. The building sector represents about 33% of electricity consumption in India, with commercial sector and residential sector accounting for 8% and 25% respectively.

- *The Energy Conservation* Building Code (ECBC) e Bureau of Energy Efficiency (BEE) India[2] classifies Indian climatic zones into five categories viz., Hot and Dry (e.g. Ahmadabad, Jodhpur etc), Warm and Humid (e.g. Mumbai, Chennai etc), Composite (e.g. Nagpur, Jaipur etc), Cold (e.g. Guwahati etc) and Temperate (e.g. Bangalore etc).

IV. PROJECT WORK

Air conditioning is defined as the simultaneous control of temperature, humidity, cleanliness and air motion depending upon the requirement, air conditioning is divided into summer air conditioning and winter air conditioning. Air conditioner conditions the air, transport it, and introduce it to the conditioned space. It provides heating and cooling of air.

The portable Air conditioner system should satisfy the need of user at the most economical cost. The selection of system depends upon many factors:

a. Customer's objectives: It could be only a relief in temperature or complete control of environment.
b. Economics: It could be lowest first cost or lowest running cost,
c. Occupancy: Single purpose occupancy means all occupants have same purpose in one space or more spaces. Multipurpose occupancy may need complex system.
d. Thermal load: Feasibility of reducing thermal load by choosing construction options or pre-cooling can be introduced in reducing load.
e. Internal Environment: Level of cleanliness, acoustics, and concentration of load within the space may affect the selection.

The portable air conditioner is based on air water system, in this system the room unit is supplied with both processed air and chilled water.

A. Features of Portable Air Conditioner

The main features of portable Air conditioner are as follows

- Flexibility in duration and intensity of cooling capacity. It can be made in order to suit any specific need. The small unit can be cool the room of 120 square feet. It will provide cooling in the room for two to three hours.
- Its cooling power is comparable to wall air conditioner.
- It provides transportability, can be move anywhere easily.
- Manufacturing cost is low. Also maintenance cost is low. Hence total cost of portable air conditioner is comparatively very low and affordable for common people.
- It is small in size; hence it would sit nicely in our bedroom, drawing room and kitchen.

Fig 1: Portable Air Conditioner

B. Human Comfort

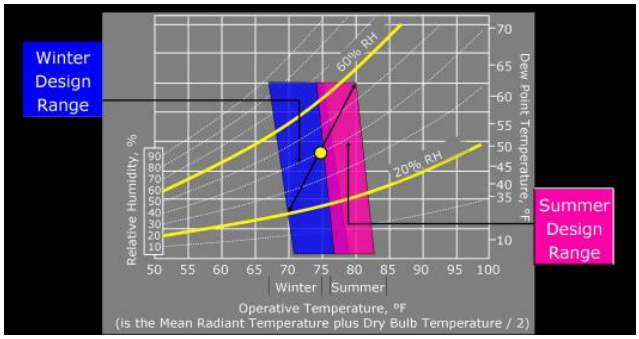

Fig. 2: Human Comfort Chart.

This class of air conditioning is meant to ensure human comfort in the space. As we all are aware of human body is a slow combustion engine. It burns fuel that is food to produce energy for all the activities of human being This energy as it happen in all machineries, degenerate into heat and needs to be dissipated to maintain body temperature. Though nature has provided means of dissipation the human being would be comfortable of heat is transmitted out without physical discomfort like wetting of cloth or cracking of skin etc.

So the factors that affect human comfort are as follows:

- Temperature: A large difference in body temperature and ambient temperature would cause chilling effect in winter. In such case insulation in the form of pullover would avoid chill. So the preferred temperature is in the range of 20 to 25^0C.
- Humidity: Humidity is the amount of moisture content in air. Even at lower temperatures water vapours given out through body pores due to vapour pressure differences. So in dry climate excessive loss of moisture leads to drying of skin and blisters on skin. So the humidity is maintained between 30 to 70%.
- Air Movement: In still air human do not feel comfortable so certain amount of air movement is essential. The air movement in an air conditioned space is limited to air velocity of 8 to 15m/min.
- Air Purity: As atmospheric air have many impurities in it like dust, pollen, lint, carbon particles to microorganism like bacteria and virus. For controlling above factors of ambient air, air conditioner ensures human comfort. However it must also be ensure that while giving thermodynamic comfort the system should not increase noise level in the space.

V. RESULT ANALYSIS

1. First of all take aluminium rods, and then a hole is bored through a middle of each open ended aluminium rod to tie them all together with a steel wire before tying them around the drum.

Fig. 3 Assembly of Metal Rods

2.Three layers of 15 open ended aluminium pipes are placed at the bottom of the bucket.

Fig. 4 Metal Rods Wounded Around the Drum

3. An aluminium sheet being wrapped round the drum.An aluminium sheet is wrapped around the drum and the pipes tied to it.A strip of the aluminium sheet is cut in the space where the air enters the bucket.

Fig. 5 Drum cover with aluminium sheet.

4.The bucket is finally sealed with its lid as shown in fig 8. Due to which it reduce somewhat amount of amount of heat exchanger.

Fig.6 Drum cover with lid.

5. The drum is placed in the bucket and filled with ice. The drum is sealed .

Fig.7 Bottom view of packed drum

Thermal insulation is the resistance to heat transfer (the transfer of thermal energy between objects of different temperature) between objects in thermal contact or in range of radiation influence. Thermal insulation can be achieved with specially engineered method for processes as well as with suitable objects, shapes and material.

7. Final Construction Puffing is the process used for isolating the system. Two chemicals has been used having black and white color. The white color chemical is “polyols” and the black color chemical is “Methylene diphenyl diisocyanate”.

They are used in specific proportion and mixed together in a system to fix or isolate the component. To fix the Aluminum box we have done puffing in portable Air conditioner. It’s main purpose is to avoid leakage, gaps in corners.

Fig. 8 Final setup of portable air conditioner

VI. CONCLUSION

The portable Air conditioner system satisfies the need of user at the most economical cost. The portable air conditioner is having very low manufacturing and maintenance cost. Its cooling power is comparable to wall air conditioner. It provides transportability, can be move anywhere easily. It is small in size; hence it would sit nicely in our bedroom, drawing room and kitchen. It is completely non-polluting.

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