Scientific Journal of Impact Factor(SJIF): 3.134

e-ISSN(O): 2348-4470
p-ISSN(P): 2348-6406

International Journal of Advance Engineering and Research Development

Volume 2,Issue 1, January -2015

SLEEPER (NINDRA) AIR CONDITIONER, A NOVEL CONCEPT IN COMFORT AIR CONDITIONER INDUSTRIES

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Abstract — *Global warming is the prime concern of human being. There are various types of side effects of global warming. Weather of Globe is changing drastically and in an erratic manner. Countries on equator and on tropics are facing extreme heat condition due to green house effect and industrialization. Average mercury level also shoots up in this area. To develop comfort condition to scour the heat wave, a novel machine is designed which gives the desired comfort level at much lower cost, called "Nindra air conditioner" for middle class and lower middle class people.*

Keywords- *air conditioner, refrigeration, heat, comfort, air, velocity, flow, ton, energy, temperature, tonnage*

I. INTRODUCTION

Effect of Global warming leads to rise in average temperature of earth every year. Advanced and developed countries are jointly working to cope up with global warming. It takes long time to reach the objective of KYOTO protocol. However lot of research work is going on for comfort air conditioner and air cooler. These research works is in the form of up-gradation of existing technology and improve the efficiency. However no one think about the price factor and running cost. People who live on equatorial and tropical regions belong to developing and under developed countries. So their economy standards are different than developed countries. Air conditioner is the luxury in this region. People cannot afford to buy and run this product when mercury shoots up. Ordinary ceiling fan and Air cooler are the only economical option available to the people of this region. Author has studied this issue in detail and conceptualized new alternative design which is called "Sleeper (Nindra) Air conditioner".

II. PRESENT AVAILABLE TECHNOLOGIES

Well known brands producing comfort machineries and equipments globally. Technology is being used now days for Evaporation of refrigerant in the closed tube by creating high pressure and low pressure conditions by compressor and expansion device. This is known as Air conditioner.

Air-conditioner gives the desired comfort condition with control mechanism. However capital investment running cost is very high for Air conditioner.

Authors thought on these issues on high capital investment and running cost and conceptualize a solution which addresses both capital as well as running cost. New conceptualized design called Sleeper Air conditioner will fill the gap of capital and running cost issues.

III. WORKING PRINCIPLE OF AIR CONDITIONER

In the refrigeration cycle, heat is transported from a colder location to a hotter area. As heat would naturally flow in the opposite direction, work is required to achieve this. A refrigerator is an example of such a system, as it transports the heat out of the interior and into its environment (i.e. the room). The refrigerant is used as the medium which absorbs and removes heat from the space to be cooled and subsequently rejects that heat elsewhere.

Circulating refrigerant vapor enters the compressor and is compressed to a higher pressure, resulting in a higher temperature as well. The hot, compressed refrigerant vapor is now at a temperature and pressure at which it can be condensed and is routed through a condenser. Here it is cooled by air flowing across the condenser coils and condensed into a liquid. Thus, the circulating refrigerant rejects heat from the system and the heat is carried away by the air.

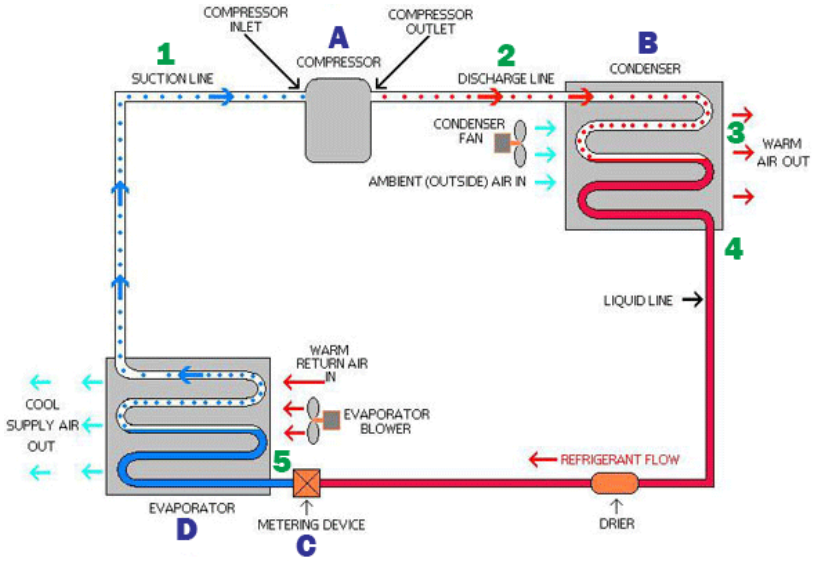

Figure 1

The condensed and pressurized liquid refrigerant is next routed through an expansion valve where it undergoes an abrupt reduction in pressure. That pressure reduction results in flash evaporation of a part of the liquid refrigerant, lowering its temperature. The cold refrigerant is then routed through the evaporator. A fan blows the warm air (which is to be cooled) across the evaporator, causing the liquid part of the cold refrigerant mixture to evaporate as well, further lowering the temperature. The warm air is therefore cooled.

To complete the refrigeration cycle, the refrigerant vapor is routed back into the compressor.

IV. WORKING PRINCIPLE OF SLEEPER AIR CONDITIONER

Sleeper Air conditioner works on Vapour Compression Refrigeration (VCR) system. However it differs in terms of application and room load calculation. This concept can be used only for bedroom Air conditioner that too particularly when a person sleeps. Normally the room load calculation includes the size of the room, wall facing, shading of wall, objects in the room and also electrical load like tube light, night lamp etc. Normal room sizes vary from 10'x10' to 14'X12' and loads lying in the room. This requires higher tonnage size of air conditioner from 1 ton to 2 ton. Sleeper air conditioner design is conceptualized on reducing room load. A novel thought came to the mind of the author to eliminate the room's other load and reduce the space to be conditioned, resulting in to small size of tonnage requirement and less running cost.

V. DESIGN CONCEPTULIZATION

Air conditioner dealers generally follow the thumb rule for selection of air conditioner according to the room sizes. They are not much conversant with detailed calculation of room load for conditioned purpose. Dealers always suggest higher tonnage then requirement so that later on complains on less cooling do not arise. But a customer has to pay more for it.

The author thought in different way, two novel ideas incorporated in conceptualization of Sleeper Air conditioner.

i. Selected boundary condition based on actual need during sleep.
ii. Considering this idea i.e. the size of Sleeper Air conditioner can be reduced in terms of physical size and tonnage capacity.

By considering this idea i.e. the actual space to be cooled ($25.48m^3$ to $42.81m^3$) can reduce to $3.74m^3$. Almost reduced 6.81 to 11.44 times lower than room size. The author thought to cool 6'x5.5'x4' size than the room size. Here size consideration is the length of the double bed size (6 feet) x width of double bed size (5.5 feet) x height above mattresses of double bed(4feet).This is the system boundary and the volume of this system boundary ($3.74m^3$) needs to be conditioned during sleep. Normally air conditioner condition the entire room's volume where as actual requirement is much lesser than the room size. This required system boundary can be created with transparent polycarbonate sheet or FRP plastic sheet. This is the additional requirement of Sleeper Air conditioner. This way conditioned space volume can be reduced and also the required tonnage to cool this place can be reduced. This will reduce the capital cost and the running cost of the Slipper Air conditioner. Tonnage can be reduced from minimum 1 ton to 0.2 ton.

Air Conditioner (AC) Unit Tonnage Calculation

Room Length:	6	(Ft)
Room Width:	5.5	(Ft)
No. of persons:	2	
Equipments watts:	0	(W)
No. of Lightings:	0	
North window:	○ Yes ◉ No	
Shading:	○ Yes ○ No	
Length:	(m) Width:	(m)
south window:	○ Yes ◉ No	
Shading:	○ Yes ○ No	
Length:	(m) Width:	(m)

Submit Reset

Ac Unit Tonnage: 0.0859375

Above calculator is just for sample calculation of tonnage requirement.

VI. SCHEMATIC LAYOUT OF SLEEPER AIR CONDITIONER

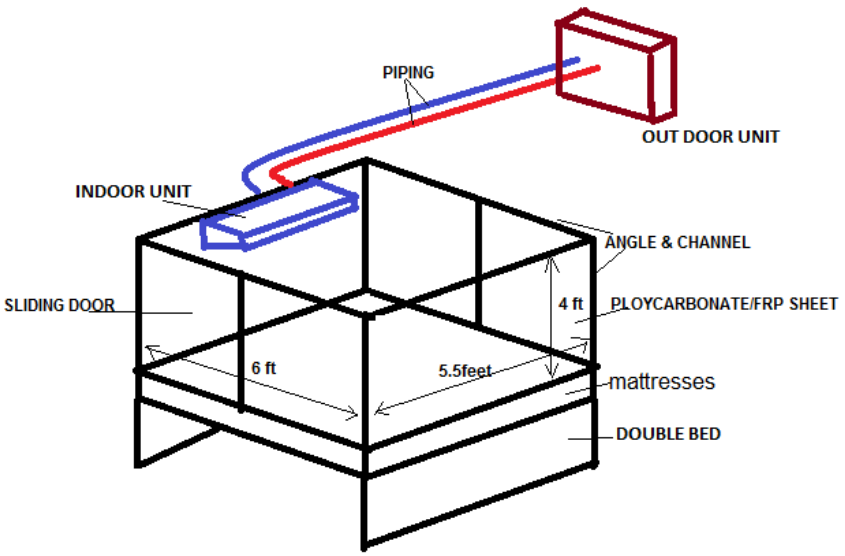

Figure 2

VII. MATERIAL REQUIREMENT

1. Polycarbonate sheet/ Fibre Reinforced plastics (FRP) sheet of size 2- 6'x4', 2-5.5'x4', 1-6'x5.5' of thickness 5mm
2. Metallic/plastic Angles to support polycarbonate sheet/FRP sheet
3. Aluminium/plastic channels to make the sliding doors on either side to enter on the bed.
4. Mounting fixture hanger for indoor unit.
5. Copper tubes with insulation to connect indoor and outdoor unit.

VIII. CONSIDERATIONS OF SLEEPER AIR CONDITIONER FOR COOLING LOAD

i. All walls are shaded hence heat gained through this structure is neglected.
ii. There is no window on proposed design hence the heat gained through the window is also neglected.
iii. Cooling load from appliance is also neglected as all the appliances are outside the boundary of the proposed design.
iv. Here, the number of occupants will be maximum 2 and minimum 1 hence occupant's load is considered.
v. Cooling load from Infiltration and ventilation air considered. It is considered that the air changes per hour.
vi. Latent heat of confined space is considered as 20% -30% Room Sensible Heat gain.

IX. CONCLUSION

Sleeper Air conditioner is the novel conceptualization in the current dearness situation. It will save energy and also help in the carbon credit of nation and globe as a whole with same comfort level as room air conditioner. This air conditioner can be used only for sleeping purpose. This purpose cannot be used in living room, dining room and office air conditioner. Hence it is named as "*Nindra (Sleeper) Air conditioner"*

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