RESEARCH ARTICLE OPEN ACCESS

Sol Aura: Solar Air Heater

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ABSTRACT
Energy being a crucial input in the process of social, economical and industrial development, plays a vital role in our daily lives. The present trends show a continuous increase in the energy demands, with a simultaneous reduction in the available conventional energy resources. Hence, there is an urgent need to come up with energy efficient alternatives, such as developing devices that employ renewable energy resources. Sol Aura is one such product that holds the potential to replace conventional heaters that employ electrical energy. Sol Aura utilizes solar energy for the required energy conversion and thus, increase the temperature of indoor areas. The paper presents the product design and the related mathematical computations. Future scope and the advantages have also been covered within the scope of the paper.
Keywords- *Electrical energy, conventional heaters,* renewable *energy resources.*

I. INTRODUCTION

Day by day the energy consumption is increasing quite rapidly. The world's fossil fuel supply(mainly coal, petroleum and natural gas) are expected to get depleted in the next few hundred years. The rate of energy consumption is increasing along with a continuous reduction in the supply of fossil fuels, leading to inflation and energy shortage. Hence, we are slowly progressing towards a stage called energy crisis. To avoid further deterioration, non-conventional or the renewable energy sources need to be developed and utilized in order to meet our future demands. Now-a-days the charge of electricity is very high and consequently the running cost of a conventional solar heater working on electricity is too high.

Sol Aura is designed to replace the conventional heaters that utilise electrical energy to increase the temperature of the room, by solar heaters that use the sunlight to heat the air passing through the heater. Solar energy, one of the major non-conventional energy sources, having a potential of 178 billion MW worldwide and 5,000 trillion KWh/year in India alone, is being employed for the required energy conversion [1]. This type of heater configuration operates by drawing air from the building envelope or from the outdoor environment and then passing it through the collector where the air warms via conduction from the absorber and is then supplied to the living or working space by either passive means or with the assistance of a fan [2]. Specifically, the Sol Aura uses columns of ordinary aluminum soda pop cans arranged in the form of a matrix with the ends cut out by a drilling machine. The sun shines on the black painted pop cans heating them, and air flowing through the inside of the can columns picks up the heat and delivers it to the room. The box as well as the cans is painted black to enable maximum absorption of light and hence, improve the overall heating inside the cans and the wooden box.

Thus, Sol Aura is a kind of space heater that uses solar energy, has low running cost and is environment friendly. These non-conventional heaters can be widely used in industrial as well as residential space heating applications. Not only they are a step ahead in the development of non-conventional resources but also provide a cost effective heating, with safe and quiet operation. Producing such space heaters using only solar energy is important because some serious repercussions the world might face if the renewable sources of energy continue on depleting.

II. PRODUCT DESCRIPTION

Sol Aura is a space heater with the motto of reducing energy costs. It is a kind of a space heater that is made from recycled aluminium cans with a very minimalistic design while ensuring safety and reliability. Sol Aura's collector uses columns of ordinary aluminium soda pop cans with the ends cut out. The sun shines on the black painted pop cans heating them, and air flowing through the inside of the can columns picks up the heat and delivers it to the room. It is engineered to provide maximum efficiency and faster paybacks. The wooden box that contains a matrix of aluminium cans is the heart of Sol Aura. Fan1 being the input fan, sends air inside the body of the box and heated air is thrown out by the output fan, i.e fan2. Two temperature devices have been connected to read the input and output temperature. The switch and battery are connected in series, and this combination has been connected in parallel

with fan1 and fan2. Regulator has been connected to control the speed of the fan.

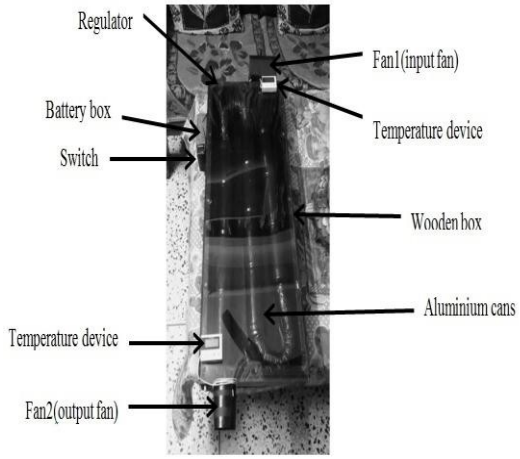

Fig.1. Sol Aura

A. Components Used

The Sol Aura is a solar air heater made from recycled aluminium cans that installs with little changes to the existing home or building. Following are the components used in Sol Aura:

- Small Fan (x2)
- Wood
- Soda Can (x12)
- Glass
- Wires
- Aluminium Foil
- Plastic Pipes
- Black Paint
- Switch
- 9V Battery
- Fan regulator
- Temperature reader (x2)

B. Block Diagram

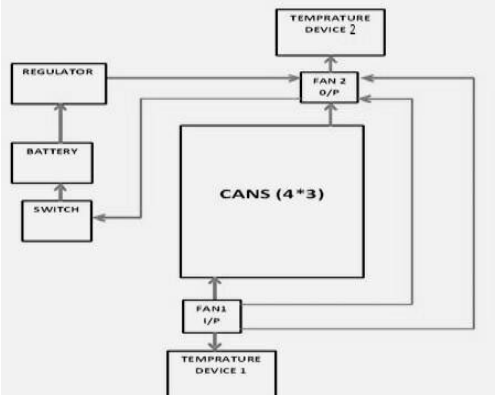

Fig2. Block diagram of Sol Aura

C. Advantages of Sol Aura

1. The first one is wind tolerance. When the wind starts howling, most other solar panels drop down flat to avoid damage. This does not seem to be an issue for Sol aura, for the unit is bolted onto the building; it's not meant to move around. An exception would be if we're talking tornado-level winds.
2. Your energy usage (for the blower) is efficient, only using 31 watts. The whole unit crated is still light in weight. And It is easy to install and use.
3. Another advantage, there is virtually no maintenance required. Rain or snow washes off the dirt; another perk from Mother Nature. So, don't rub the UV-treated coating with paper towels or use any abrasives that will damage it.
4. Environment – saving natural resources, eliminating pollution, lessening the need for infrastructure investment and the resultant impact of infrastructure on the environment etc.
5. Safety and Security – reduction in the need for deliveries and storage of potentially harmful materials, i.e., fuel oil, propane etc., and reduction of the requirement for foreign sources of energy.
6. Health – reduction in the release of emission of pollutants including noxious gasses, greenhouse gases, particulate emanating from the combustion of home heating oil and other "coarse" fuels, i.e., wood, coal.

D. Applications

1. Space heating applications - Space heating for residential and commercial applications can be done through the employment of solar air heating panels. This configuration functions by extracting air from the building envelope or from the outdoor environment and providing it a path through the collector where the air gets heated via conduction from the absorber and is then outfitted to the living or working space by either passive means or with the facilitation of a fan.
2. Dampness removal applications- The problem of dampness in walls of rooms in houses can be eliminated with the help of Sol Aura. The output of this product can be directly linked to the damp wall with help of connecting pipes.
3. Process heat applications –Drying laundry and other drying applications are the process heat applications of the solar air heater. The moisture content of a material can be diminished efficiently with help of the heated air passed over the medium needed to be dried.

III. TESTING & CALCULATIONS

According to the readings recorded at different positions, the maximum temperature

difference of 16.7°C is obtained at the horizontal position and also, the average temperature difference is maximum in case of horizontal position followed by the position of product at an angle of 45°C and the minimum temperature difference is achieved at the vertical position.

Table1. Performance variation in accordance with the position.

Position of product	Average temperature difference
Horizontal	9.29°C
Vertical	5.37°C
45° angle	7.72°C

The comparison between the temperature difference obtained at different positions is depicted by a graph shown below.

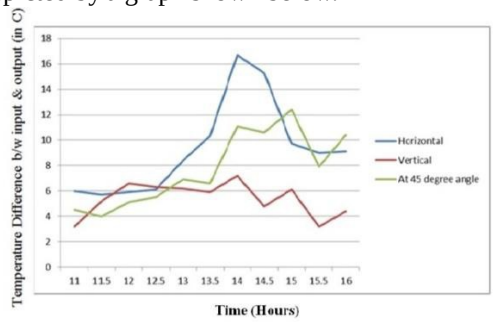

Fig3. Performance variation at different product position

Reflection factor =0.039

Absorption factor =(depends upon the atmospheric conditions, normally lies between 0.58 to 0.95)

Size of flat plate collector is given by:-
Size of flat plate collector = (length×width) of collector
So, Size of the flat plate collector (Acrylic glass) = 69.5 cms × 25.5 cms = 1772.25 sqcms
.
Effective can area is given by:-
Effective can area= pi×(radius×length) of can
So, Effective can area = pi ×2.9 cms ×13.5 cms = 123.04 sqcms.

Therefore, Effective cans area = 12 × 123.04 = 1476.51 sqcmsi.e 83% (1476.51/1772.25) of the collectors illumination directly heat up the cans and remaining 17% accounts for warming up the inner surroundings of the heater and the heat sustaining capability of the device.

Heat Output of the device is computed as given below:

Heat output = Temperature Rise× Air Flow × Air Density × Specific Heat of air
Temperature rise = 9.29°C= 48.722 F
Air flow = 3cfm/sqft of collector = 13.2747 cfm
Air density = 0.075 lbs/cubicfoot
Specific heat = 0.24 BTU/lb/°F
Thus, the heat output =
48.722×13.27×0.061×0.24 = 9.46 BTU/Hr
= 166 joules/min

IV. COMPARISON WITH CONVENTIONAL HEATERS

If one employs a conventional 2KW heater and uses it 120 days per year for 10 hours a day , at a utility rate of Rs.4.2 per unit, you will have to pay a hefty amount of Rs.10,080 , whereas, the operating cost for a non-conventional is Rs.100 only. Thus, we can say that they are not only a step ahead in the development of non-conventional energy resources but also, they hold the potential to become commercially viable.

Table2.Comparison of Sol Aura with conventional heater

	Sol Aura	Usha 3213H
Type	Non-conventional	Conventional
Price	Rs.1500	Rs.9500
Operating Cost	Rs.100	Rs.10,080

V. FUTURE SCOPE

The product has the flexibility to be further developed to serve the purpose of a space cooler, also acknowledging the applications of silica gel by taking into account the humidity and moisture content in air during the rainy season. Its working can be further enhanced by installing either a PV panel.

VI. CONCLUSION

Sol Aura provides an efficient alternative to the conventional heaters that have been employed at residential and industrial places for the longest time, now. There is an urgent need for the development of devices that utilise more and more non-conventional energy resources, in view of the present circumstances and this product solves the purpose very well. Being a low maintenance device, Sol Aura is also insured from ignition hazards. Not only is the product eco-friendly, quiet in operation but also holds the capability to tolerate the damage that canbecaused due to wind storms. In addition to a number of advantages that the device offers, one of the most important points to be considered is that Sol Aura has been able to increase the temperature of input air by approximately 17°C. Moreover, the investment and the operating cost of the device is quite thrift and economical in comparison to the capital requirements of a conventional heater. Hence, it

would not be out of place to assert that, the product proves to be revolutionary in its own aspect. Thus, we can say that the objective behind the project has been accomplished, successfully. Apart from some minor and corrigible disadvantages, that the device poses, the product works fine. The disadvantages can be eliminated if the device is further developed. As Sol Aura is a space heater, hence, the major usage of this product is in space heating applications. But it would be unfair to take away from the fact, that the its applications are not only limited to space heating but also they can be used for various other applications, such as process heating and ventilation inside indoor areas.

REFERENCES

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