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Design and Fabrication of Compressed Solar Air Conditioner

Akeel Ahmad[1], Ahsan Kamal Ansari[2], Pravesh Chandra[3]

[12]UG Student, Department of Mechanical Engineering, MIT Moradabad, Uttar Pradesh, India
[3]Assistant Professor, Department of Mechanical Engineering, MIT Moradabad, Uttar Pradesh, India

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Abstract - *Now a days the main problem we are facing are global warming and energy crisis. But to usage of conventional Air-Conditioner the both problems are increasing. So in the order to that we have Peltier based systems. But they have low COP, In our project we are trying to modify the design so that we can get maximum COP as conventional air-conditioner. The purpose of this project has been to investigate the possibility of heating and cooling air by connecting Peltier Elements to PV panel. The "climate panel" developed is to be used as a compliment to an existing heating system in order to pre-heat and pre-cool the air coming into the house. By decreasing the heating demand in winter and cooling demand in summer the panel could contribute to lowering the annual energy need and thereby save money. The aim of this project has been to investigate the potential for such a panel, and to perform an economic evaluation in comparison to common Swedish heating systems.*

Key Words: crisis, Peltier, PV panel, climate panel, Compliment, potential.

1. INTRODUCTION

Power era is the main source of modern air contamination in the nation. A large portion of our power originates from coal, atomic, and other non-inexhaustible power plants. Creating vitality from these assets takes a serious toll on our condition, dirtying our air, arrive. Sustainable power sources can be utilized to create power with less natural effects. It is conceivable to make power from sustainable power sources without delivering CO2. Sustainable power source is vitality gotten from normal assets that renew themselves over a timeframe without exhausting the Earth's assets. These assets likewise have the advantage of being bounteous, accessible in some limit almost all over the place, and they cause close to nothing, assuming any, natural harm. Vitality from the sun, wind, and warm vitality put away in the Earth's outside layer are cases. For examination, petroleum derivatives, for example, oil, coal, and gaseous petrol are not sustainable, since their amount is limited once we have removed them they will stop to be accessible for use as a financially practical vitality source. While they are delivered through characteristic procedures, these procedures are too ease back to renew these fills as fast as people utilize them, so these sources will run out at some point or another. Another reason, ordinary aerating and cooling framework utilizes refrigerants which discharges CFC's (chlorofluorocarbon) to condition and is exhausting ozone layer. Ozone layer assumes vital part in engrossing the Ultraviolet beams coming towards earth's surface and shield humankind from numerous unsafe maladies, for example, skin disease and so forth. So this venture is planned at the improvement of a sun oriented based compressor free compacted sun based aeration and cooling system. This aeration and cooling system will be appropriate for cooling purposes implied for little questions and will have a moderately little chilling time when contrasted with the ordinary ventilating frameworks. Additionally for the reinforcement, this aeration and cooling system accompanies inbuilt full wave rectifier to work ventilation system with substituting current if there should arise an occurrence of non-accessibility of sun oriented power. In the majority of the rustic regions of our nation, the electric supply is either sporadically accessible or not accessible by any stretch of the imagination. The most extreme impact of this issue is on the Primary Health Care Centers. Because of no power, the vast majority of the PHC's can't be kept up as sterile and patient amicable rooms (as a few patients can be required chilly condition). So in the event of any crisis, the patient is to be alluded either to the town or city healing facility which brings about loss of valuable time and may demonstrate deadly for the patient

2. SOLAR CELLS

When we bring p-sort and n-sort material together, dispersion happens at first glance between them. Electrons begin to diffuse from n-sort to p-sort. So also, openings diffuse from p-sort area to n-sort locale. This dissemination makes an electron-opening free area in a short separation at the interface region. This thin layer is called exhaustion locale. There is an electric field from the n-side to the p-side of the exhaustion district. Since the electrons are negative charges this electric field applies a constrain to an electron entering the consumption area. Any electron produced by daylight in the region of the consumption district may go to the n-side of the intersection effectively. On the off chance that we associate a wire or any heap between the closures of n-sort and p-sort locale with metal contacts, this electron will stream to the p-sort through this outer load.

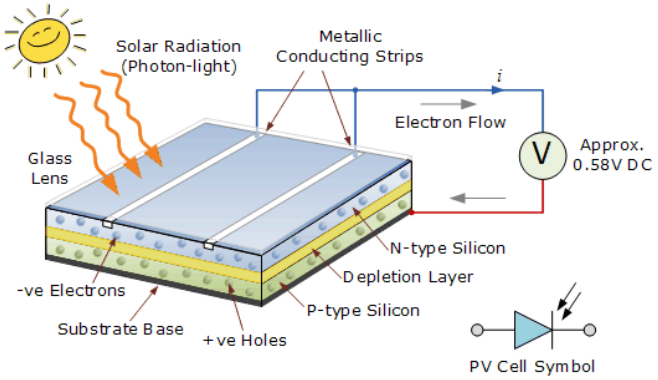

Fig 1 Solar PVCell

So we require an outside vitality to make this present: something ought to stimulate the electrons in the p-sort area to enter consumption district. Sun oriented radiation is an amazing vitality source to carry out this occupation.

3. SOLAR PANELS

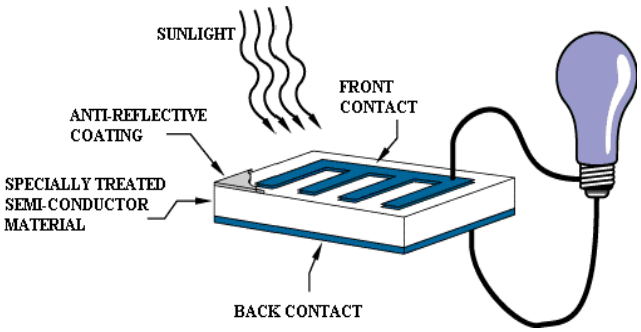

Fig.2 Working of Solar Panel

The graph above delineates the operation of a fundamental photovoltaic cell, likewise called a sun oriented cell. Sunlight based cells are made of similar sorts of semiconductor materials, for example, silicon, utilized as a part of the microelectronics business. For sun based cells, a thin semiconductor wafer is extraordinarily treated to frame an electric field, positive on one side and negative on the other. At the point when light vitality strikes the sun powered cell, electrons are thumped free from the iotas in the semiconductor material. On the off chance that electrical conduits are connected to the positive and negative sides, framing an electrical circuit, the electrons can be caught as an electric current that is, power. This power can then be utilized to control a heap, for example, a light or an instrument. Various sunlight based cells electrically associated with each other and mounted in a bolster structure or casing is known as a photovoltaic module. Modules are intended to supply power at a specific voltage, for example, a typical 12 volts framework. The current created is specifically subject to how much light strikes the module.

4. PELTIER STRUCTURE

A typical thermoelectric module consists of an array of Bismuth Telluride semiconductor pellets that have been -doped|| so that one type of charge carrier– either positive or negative– carries the majority of current. The pairs of P/N pellets are configured so that they are connected electrically in series, but thermally in parallel. Metalized ceramic substrates provide the platform for the pellets and the small conductive tabs that connect them.

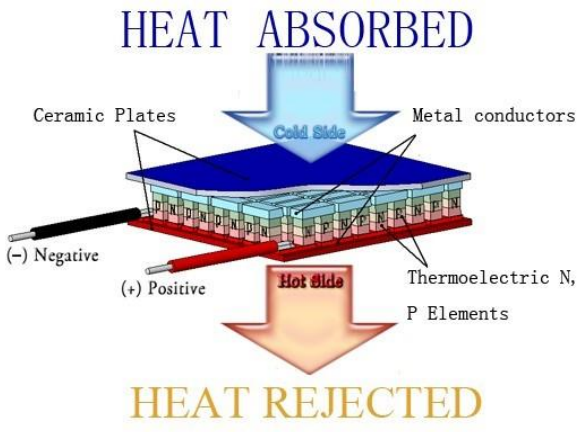

Fig.3 Structure of a Peltier Unit

At the point when DC voltage is connected to the module, the positive and negative charge bearers in the pellet exhibit retain warm vitality from one substrate surface and discharge it to the substrate at the inverse side. The surface where warm vitality is ingested ends up plainly cool; the inverse surface where warm vitality is discharged, winds up noticeably hot. Turning around the extremity will come about inreversed hot and frosty sides

5. PELTIER UNIT

Fig.4 Peltier Units

The peltier unit utilized as a part of this aeration and cooling system is TEC1-12706. This unit takes a shot at 5 volts DC and takes most extreme current of 4 amps at full load. The power rating of this unit is 20 watts.

➢ **Advantages of Peltier Unit**

- No moving parts and environment friendly
- Small and lightweight
- Without maintenance
- Acoustically quiet and electrically -quiet||
- Heating and cooling with a same module (counting temperature cycling)
- Wide working temperature go
- Highly exact temperature control (to inside 0.1 °C)

6. COOLING FAN

Fig.5 Cooling Fan

We are utilizing two Cooling fans in our ventilation system which are separately mounted on one warmth sink each. The fundamental reason for a cooling fan is to scatter warm from the warmth sink by taking in outside air. The fans utilized as a part of this ventilation system deal with 12 volts DC and draws 0.18 amps. The power utilization of each fan is 2.16 watts.

7. HEAT SINK

Fig.6 Heat Sink

A warmth sink is a latent warmth exchanger that cools a gadget by disseminating heat into the encompassing medium. The warmth sink is for the most part comprised of aluminum. The mix of warmth sink and fan (HSF) is alluded to as a dynamic warmth sink, while a warmth sink without a fan is detached warmth sink. Notwithstanding the HSF, a warmth sink compound is a few times utilized. This is a covering between the gadget and the warmth sink to enhance warm conduction.

8. THERMOCOL

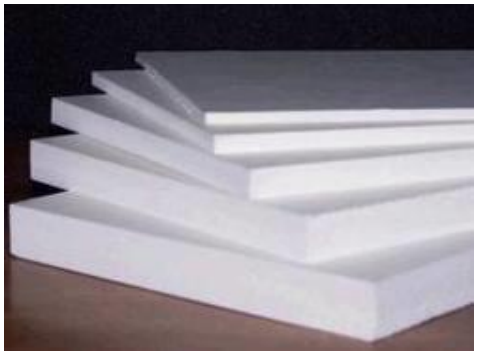

Fig.7 Thermocol

As we probably am aware the ice sellers exploit thermocol for its financial esteem and great protection property as it doesn't permit the inward temperature of chilling medium to go off. Henceforth it is likewise a financial wellspring of protection**.**

9. BATTERY

In this aeration and cooling system one battery is utilized as a period for the working of the ventilation system. Additionally the additional associations for the second battery noticeable all around conditioner are likewise given if all the more cooling is required.

Fig.8 Battery

The battery used in this air-conditioner has following specifications:

- 12 volt DC
- 7.5 ampere hour

10. ON/OFF SWITCH

An on/off Dual Pole Dual Throw (DPDT) has been utilized as a part of the ventilation system for having the control over the power supply being given to the aeration and cooling system. This switch is evaluated at 6 amps.

Fig.9 On/Off switch

11. OBSERVATIONS

For assessing the execution of our compacted sun based aeration and cooling system we tried it utilizing a Fluke multimeter - 287 and information is recorded. A short time later chart was set up for the same by taking the information from the multimeter. The accompanying perceptions were recorded utilizing the Multimeter

Table 1 Readings Table

Serial No.	Start Time	Initial Temp	End Time	Final Temp	Time taken
1	0:00	32.7 °C	7:36	32.2 °C	7:36
2	7:36	32.2 °C	19:41	31.4°C	12:05
3	19:41	31.3 °C	0:26:01	30.8°C	6:22
4	0:26:01	30.7 °C	0:33:11	30.1°C	7:10
5	0:33:11	30 °C	0:41:06	29.3°C	7:55
5	0:41:06	29.3 °C	0:46:50	28.7°C	5:44
6	0:46:50	28.6 °C	0:52:47	28.1°C	5:57
7	0:52:47	28 °C	0:59:33	27.3°C	7:06
8	0:59:33	27.2 °C	1:11:38	26°C	10:45
9	1:11:38	25.9 °C	1:14:43	25.5°C	3:05
10	1:14:43	25.4 °C	1:17:38	25.1°C	2:55
11	1:17:38	25 °C	1:21:23	24.4°C	3:45
12	1:21:23	24.4 °C	1:22:45	24.1°C	1:22
13	1:22:45	24 °C	1:26:21	23.5°C	3:36
14	1:26:21	23.4 °C	1:29:47	23.1°C	3:26
15	1:29:47	23 °C	1:38:42	22.5°C	8:55

As shown in the table, from the readings given following observations can be made:

- Starting temp: 32.7 °C
- Starting time: 0 mint 00 sec
- Final stable temp: 22.5 °C
- Final time: 1 hour 38 mints 42 sec

In the above, the temperature corresponds to the value taken by the air-conditioner using the temperature sensor of the Multimeter. Also from the table it is clear about the start logging instance and stop logging instance of the Multimeter.

12. COST ANALYSIS

The cost analysis for this project is done as follows. All the components along with the miscellaneous cost are included in the total cost of this air-conditioner.

Table 2 Cost Table

S.N.	Name of the Material / Equipment	Cost
1	Peltier Units (x2)	Rs. 600
2	Battery	Rs. 1500
3	Solar Panel (100 watts)	Rs. 1200
4	Cooling fans (x2)	Rs. 300
5	Heat sink (x2)	Rs. 400
6	Insulation material	Rs. 450
7	Box building material	Rs. 700
8	Wiring material	Rs. 200
9	Digital thermometer	Rs. 200
	Total	Rs. 5550

As appeared in the above table, the aggregate cost of the venture is Rs. 5550. In this aggregate cost, sun powered boards represents the significant segments while the general individual cost of the ventilation system is Rs. 3500. In the large scale manufacturing of the ventilation system, the general cost of the aeration and cooling system will be decreased significantly making it shoddy and temperate for the client. Additionally with the same sun oriented boards, various units of the aeration and cooling

system can be connected making it more financially savvy in nature.

13. RESULTS

The point of the advancement of the aeration and cooling system is to give proficient and successful cooling in the assigned areas and spots. As seen from the information over, this aeration and cooling system is fit for keeping up an inward temperature of 16.5°C following 20 minutes of persistent power supply and is keeping up it at a consistent rate. Likewise when the battery will be completely charged, ventilation system will stay operational for the day and age of 3.2 hours after which the battery will be released and the temperature inside the aeration and cooling system will increment at an ease back rate because of the protection gave. On the premise of the above information one might say that the above aeration and cooling system can be effectively utilized for the little chilling operations where cooling is required in a little time. This framework is furnished with a sun oriented board charge controller which can be effortlessly used to charge the battery from the sun based boards.

14. CONCLUSION AND FUTURE SCOPE

Sun oriented power these days is assuming a noteworthy part in meeting the vitality prerequisites of our nation. It is being created at a quick rate and its applications in numerous regions are being investigated. The aeration and cooling system is proposed at investigating the same and gives a productive and conservative answer for the zones where there is no power and cooling is required.

This venture fundamental target was to build up a packed sun oriented aeration and cooling system and this has been effectively done. The utilizations of this ventilation system are wide and it can be utilized as a part of different spots for assortment of operations. Additionally the principle reason for which this ventilation system is to kill utilization of regular aerating and cooling framework in light of refrigerants utilized are draining ozone layer, satisfying the cooling request at monetary rate and where the power is the major issue(where there is no power, for example, towns).

In spite of the fact that this aeration and cooling system is working agreeably to its full limit, still many changes and upgrades should be possible in this ventilation system to make it more clients amicable and advanced in nature. This measures and changes, if actualized can assume an essential part later on models to be created. Some of these measures and changes are:

Number of peltier units can be expanded to further lessening the temperature inside the aeration and cooling system. Same aeration and cooling system can be utilized for warming reason on the off chance that we likewise protect the opposite side i.e. warming side of the ventilation system inside the case.

To build the volume of the ventilation system keeping up a similar temperature inside the aeration and cooling system, number of peltier units and warmth sink must be expanded. PID controllers can be utilized for making it a temperature controlled ventilation system.

This ventilation system can likewise be outfitted with a LCD show and advanced temperature sensor so that the temperature of aeration and cooling system can be observed.

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