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Design of Combat Dress Based on Peltier Effect

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ABSTRACT: To make clothes that take advantage of the Peltier effect to refrigerate the person wearing jacket. Soldiers in extreme heat conditions get dehydrated soon. Using combat dress made of peltier coil will refrigerate them. In the same way in extreme cold conditions this peltier coil in jacket will keep them warm. Using solar cells fixed to dress we can recharge 12v battery for power supply. So it uses a hybrid power system as a power source. A jerkin is a man's short close-fitting jacket, made usually of light-coloured leather, and often without sleeves, worn over the doublet in the sixteenth and seventeenth centuries. The stock phrase buff jerkin refers to an oiled oxhide jerkin, as worn by soldiers.

I.INTRODUCTION

Conventional cooling systems cannot be used in combat dress utilize a heatsink and a cooling fan to transfer heat. Semiconductor thermoelectric coolers (also known as Peltier coolers) offer Several advantages over conventional systems.

They are entirely solid-state devices, with no moving parts; this makes them rugged reliable, and quiet. They use no ozone-depleting chlorofluorocarbons, potentially offering a more environmentally responsible alternative to conventional cooling. They can be extremely compact, much more so than compressor-based systems. Precise temperature control ($< \pm 0.1$ °C) can be achieved with Peltier coolers.

However, their efficiency is low compared to conventional refrigerators. Thus, they are used in niche applications where their unique advantages outweigh their low efficiency. Although some large-scale applications have been considered Peltier coolers are generally used in applications where small size is needed and the cooling demands are not too great, such as for cooling electronic components.

II. LITERATURE REVIEW

The present invention is primarily directed to that class of military who are subjected to a great deal of heat and fatiguing activity, but it will be readily apparent from the following description that the present invention is readily adaptable for all types of weather, and for those engaged in other pursuits as well.

This invention, as adapted for example for use on a cooling dress, minimizes the amount of apparatus that is carried on the user's person, while ensuring a large, positive flow of cooling air to the soldier.

Thermoelectric heat pumping, the principal phenomenon of interest in this Review, utilizes a reverse scheme known as the Peltier effect. In 1834, Jean C. A. Peltier discovered that the passage of an electrical current through the junction of two dissimilar conductors could either cool or heat a junction depending on the direction of the current. The heat generation or absorption rates were proportional to the magnitude of the current and dependent on the temperature of the junction. An electrical current (I) passes from the n-type semiconductor to the p-type semiconductor. The temperature of the cold junction (T_c) decreases, and heat is absorbed from the ambient.

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III. METHODOLOGY

Peltier coil works on the principle heat sink a 12v battery is given as a supply for the peltier coil. The cooler side of peltier coil is faced towards a small fan which circulates cool air through narrow tube .

In the same way the hotter side of peltier coil is faced towards the small fan which circulates hot air through the same narrow tube. The solar cells fixed to jacket will recharge the 12v battery by a charging module. The temperature sensor display will help us to monitor the temperature level inside the combat dress.

- The suite is provided power supply form a 12 volt DC 5 amps battery.
- To start the cooling or heating system, the switch on the box is turned on. When the switch is turned on the Peltier devices and Pump start functioning.
- The air is pumped to the upper smaller rectangle and directs to the hotter side of the Peltier (P1).
- Cold sides of the Peltier transfer the chilling effect to the tube.
- Hot side of the Peltier transfers the hot air to the tube.
- The Peltier thermoelectric Device will be so arranged in a box with proper insulation system and heat sink so that efficient cooling and heating takes place at all the time.
- To turn off the fried, switch can be turned off

During construction of the device several minor changes were made to the design. Each of these changes we feel was justified as they made for easier construction while maintaining the performance of the device with respect to the project goals. The device passed its final inspection and was deemed to have a professional appearance by the design project coordinator. The device was discovered to have ample precision and total heat transfer capabilities while meeting its accuracy requirement.

- Firstly a box of Thermocol is made of given dimensions and then the aluminum box is made and fixed into it. The aluminum box is mounted with a Peltier device at the top and bottom with the help of thermal paste.
- At the top of the aluminum box a small rectangular box is made in which hot side of the Peltier is faced.
- Base of the evaporator is attached with cold side of the Peltier and hot side is attached to a heat sink which is submerged in cooler fan.
- The peltier is placed and heat sink submerged in it.
- One end of the tube is connected to the Water Pump and another end is connected to the small rectangular box mounted on the top side of the evaporator.
- A small rectangular has a channel to the blower in which the air flows to the suit.
- A battery is placed beside the evaporator with proper insulation.
- The terminals of the Peltier devices, and Pump should be connected properly.

The construction setup and the model suite is shown

All these are shown in Figure 3.1 in the form of block diagram

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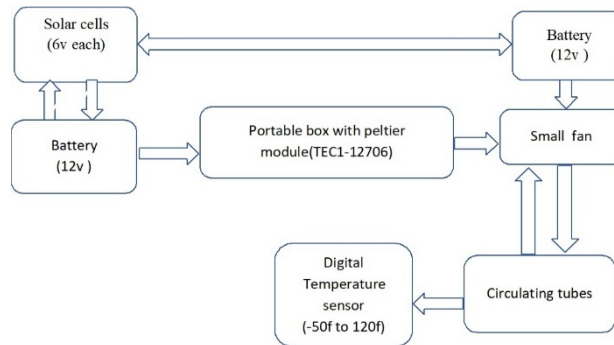


Fig: 3.1 Block Diagram of suite setup

IV.FUTURE SCOPE

A. System Outcomes

- Accurate measurements of inside suite temperature
- User friendly interface for efficient cooling and heating
- Efficient use of energy from the solar panels for battery charging
- The battery should be able to operate for long periods without maintenance.
- Inside system can be well developed for efficient use.
- Resources are effectively allocated to devices with these allocations being dynamic based on output received.
- Able to correctly predict correct temperature based on sensor.
- System is able to learn from feedback received from usage and able to adjust its analysis of data.
- New automatic temperature detection and turning on and off using a microcontroller

V. CONCLUSION

Since Peltier cooling is not efficient comparatively and due to its small size applications, it is not widely used. It found its application only in electronics cooling etc. But, we have seen that there is a huge scope of research in this field about thermoelectric materials, its fabrication, heat sink design etc. Researcher are working on reducing irreversibilities in the systems, because Peltier cooler has more potential which we can see from the vast difference between value of first law efficiency and second law efficiency.

The suite setup is working with satisfactory conditions. We are able to understand the difficulties in maintaining the tolerances and also the quality. We have done to our ability and skill making maximum use of available facilities. In conclusion remarks of our project work, let us add a few more lines about our impressive project work. The cooling suite has no moving parts, fluid, or refrigerants. In particular, its size is very small. This system achieves 40% to 60% of cooling effect compare to conventional refrigerator. For the above reasons this is most effective for poor people (by the cost) and travelling people (because of size)

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