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PRODUCTION OF ELECTRICITY BY SOLAR STIRLING ENGINE

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ABSTRACT:
The Stirling engine is both practically and theoretically a significant device, its practical virtue is simple, reliable and safe. The engine operates on a closed thermodynamic cycle, which is reversible. Today Stirling cycle-based systems are in commercial use as a heat pump, cryogenic refrigeration and air liquefaction. As a prime mover, Stirling cycles remain the subject of research and development efforts. A number of attempts have been made to build and improve the performance of Stirling engines. For successful operation of engine system with good efficiency, a careful design of heat exchangers, proper selection of drive mechanism and engine configuration is essential. Our Discussion indicates that a Stirling cycle engine working with relatively low temperature with air of helium as working fluid is potentially attractive engines of the future, especially solar-powered low-temperature differential Stirling engines with vertical, double acting, and gamma configuration. It is pollution free engine and use of any type of fuel characteristics and it shows a greater potential over any other type of engine existing today. This paper represents adetailed review of the past efforts taken for the development of the Stirling cycle engine and techniques used for engine analysis.

KEYWORDS: Drive mechanism, Stirling cycle engine, solar-powered, gamma configuration.

MOTIVATION

This type of engine is not known to many as this engine is quite difficult to construct. This engine's efficiency is way too high than a simple photovoltaic cell and using solar power as the source this type of engine will have many more applications and efficiency will increase exponentially.

OBJECTIVES

The objectives of this project are

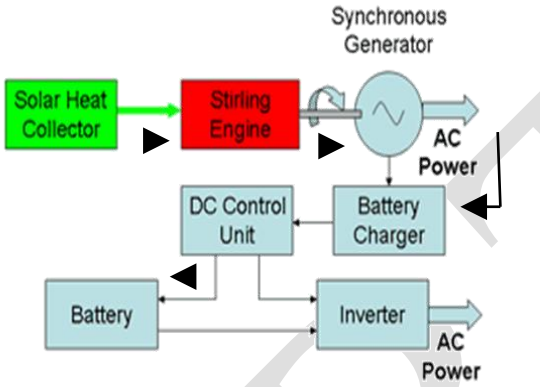
- The main aim of this project is to design, build, and test a Stirling engine capable of generating between 200-500 watts of electricity.
- Concentrated solar energy was considered as a potential heat source.
- The general objective is to minimize waste and to design a useful product which uses renewable source to generate electricity.

- This way of generation ensures to be Eco-friendly too. The convenience of this engine is that it can be operated at any time, day or night.
- This method of power production has no pollution, no noise.

PROJECT GOALS

The goal is to Construction of a solar stirling engine whose efficiency is greater than a photovoltaic cell and production of electricity.

BLOCK DIAGRAM



Small Scale Electric Power from Solar Thermal Energy

BLOCKDIAGRAM DESCRIPTION

The block diagram above shows a broader view of components required in constructing a solar stirling engine. The SOLAR HEAT COLLECTOR used will be a FRESNEL LENS. This lens has a shorter focal length and easy to construct. The lens can be of plastic rather than glass which will reduce the cost with same amount of convergence. This lens will converge the solar rays to a single point and will heat the stirling engine to displace the displacer which intern rotates the shaft. Stirling engine will convert heat energy into mechanical energy. Generator used will convert mechanical energy into electrical energy which will be coupled with shaft. This electricity can be given into load or can be stored in batteries by converting it into DC. A control unit can be used to control the output power and give it to the batteries.

WORKING

The stirling engine has two heat exchangers, hot and cold heat exchangers. Solar sun rays are made to converge at a single point with the help of fresnel lens and the air inside is heated. This hot air will move the shaft partially and it is made to pass through heat sink. The heat sink will absorb heat in the air and is made to pass through cold heat exchanger. The cold air in the cold heat exchanger will complete the shaft rotation. The shaft will be coupled with generator which will rotate simultaneously as the shafts rotates. This will produce electricity using renewable source.

ADVANTAGES

- Stirling engines can run directly on anyavailable heat source, not just one produced by combustion, so they can run on heat from solar, geothermal, biological, nuclear sources or waste heat from industrial processes. If heat comes from a renewable energy source they produce no emissions.
- They start easily and run more efficiently in cold weather, in comparison to the internal combustion which starts quickly in warm weather, but not in cold weather.
- They are extremely flexible. They can be used as CHP (combined heat and power) in the winter and as coolers in summer.
- Waste heat is easily harvested (compared to waste heat from an internal combustion engine) making Stirling engines useful for dual-output heat and power systems.
- They run very silent and they don’t need any air supply. That’s why they are used a lot in submarines.

APPLICATIONS

- In home appliances
- To drive single phase induction motor
- In industries
- It ranges from heating and cooling to underwater power systems
- It can function in reverse as a heat pump for heating or cooling
- It is also used in heat pump, marine engines and low temperature difference engines
- It is also used in DOD,NASA and military applications
- It avoids 5 tons of greenhouse gases per annum

FUTURE ENHANCEMENT

We can increase the efficiency by using some catalyst inside the heat exchanger which will heat the air in quicker rate. This engine has a capability of producing high power, so the basement should be made strong and engine powerful. This can be achieved by building a large stirling engine which produce more power.

CONCLUSION

The Stirling cycle engine has multi-fuel capability to operate with any possible fuel source-liquid, gaseous or solid fuels with wide temperature range. This is an important feature of the engine that it can use abundant heat source from solar radiation, waste heat from industry, heat produced from agricultural waste and so many other low-temperature sources. The study indicates, since from invention of the engine have made a good base line information for designing engine system, but a more insight is essential to design systems together for thermo-fluid-mechanical approach. It is seen that for successful operation of such a system is careful selection of drive mechanism and engine configuration is essential. An additional development is needed to produce a practical engine by selection of suitable configuration; adoption of good working fluid and development of better seal may make Stirling engine a real practical alternative for power generation.

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