

Sunlight Powered Steam Engine

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Abstract

This paper presents an overview of reciprocating engine which is powered by converged sunlight heat source. In this system sunlight is incident on a parabolic trough and focused on metal tube. The parabolic trough has large surface area, more surface area to converge more sunlight and sufficient heat is produced to convert water into steam. In this system, the sunlight energy is converted into mechanical work.

Keywords: Sunlight powered steam engine etc.

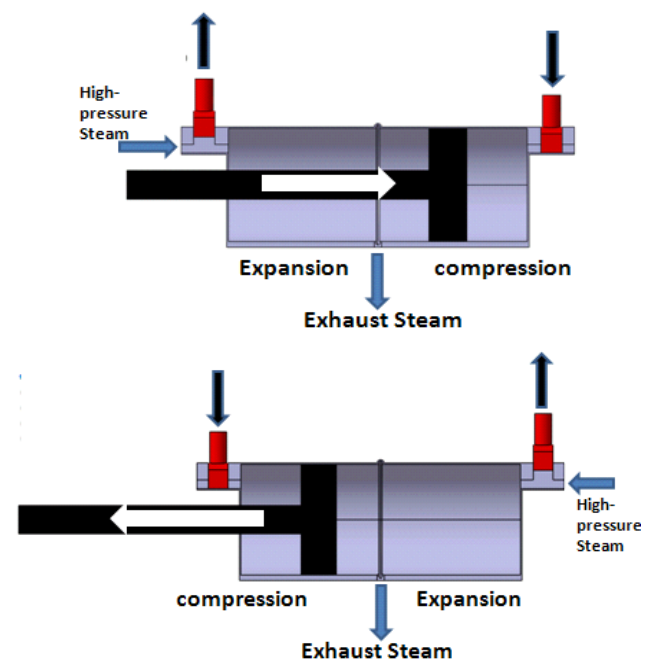
1. Introduction

1.1 Steam Engine: Solar energy is one of the more attractive renewable energy sources that can be used as an input energy source for heat engines. In fact, any heat energy source can be used with the reciprocating engine. The direct conversion of solar power into mechanical power reduces both the cost and complexity of the prime mover. Because of its simple construction, and its manufacture being the same as the reciprocating internal combustion engine, and when produced in a large number of units per year, the steam engine would obtain the economy of scale and could be built as a cheap power source for developing countries. The objective of this article is to provide a basic background and review of existing literature on solar-powered Steam engines.

A Steam engine is a machine for converting the heat energy of pressurized steam into mechanical energy, using steam as a medium, or working fluid. When water is converted into steam it expands, its volume increasing about 1,600 times. The force produced by the conversion is the basis of all steam engines.

Basic principle of steam engine: Like the more familiar car engine, a steam engine has a piston that moves when pressure is applied, and valves to control the intake and exhaust of the contents of the cylinder. On an internal combustion engine, air and fuel are drawn in; they are exploded, and like a big Rhino in the cannon barrel, push on the piston trying to escape. In a steam engine, the inlet valve opens, and steam under pressure pushes on the piston, until you open the exhaust valve to let it out. While they both have a piston moving in a cylinder, valves, and a crankshaft, there are a lot of detail differences. While steam engines can be quite simple,

most have more parts than a comparable internal combustion engine.

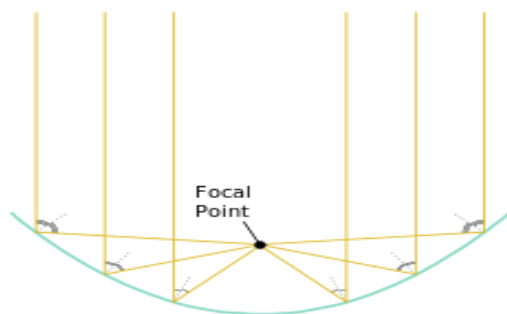
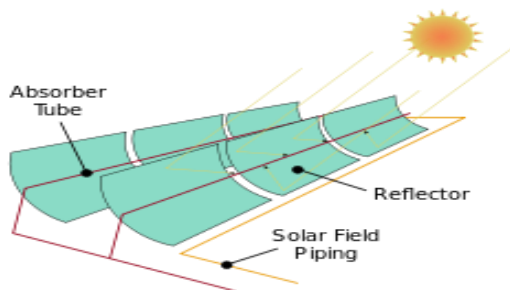


1.2 Parabolic Trough: A parabolic trough is a type of solar thermal collector that is straight in one dimension and curved as a parabola in the other two, lined with a polished metal mirror. The energy of sunlight which enters the mirror parallel to its plane of symmetry is focused along the focal line, where objects are positioned that are intended to be heated. For example, food may be placed at the focal line of a trough, which causes the food to be cooked when the trough is aimed so the Sun is in its plane of symmetry.

Basic principle of parabolic trough: There is a tube, which runs the length of the trough at its focal line. The mirror is oriented so that sunlight which it reflects is

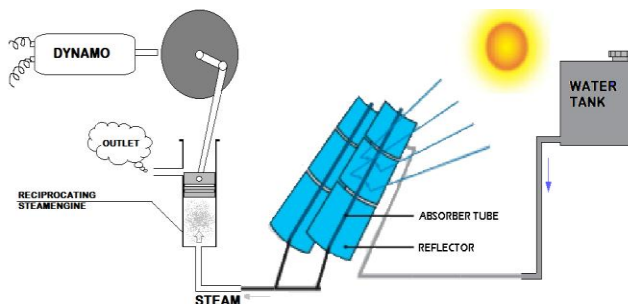
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concentrated on the tube, which contains a fluid which is heated to a high temperature by the energy of the sunlight. The hot fluid can be used for many purposes. Often, it is piped to a heat engine, which uses the heat energy to drive machinery or to generate electricity. This solar energy collector is the most common and best known type of parabolic trough.



2. Engine drive by steam by using parabolic trough

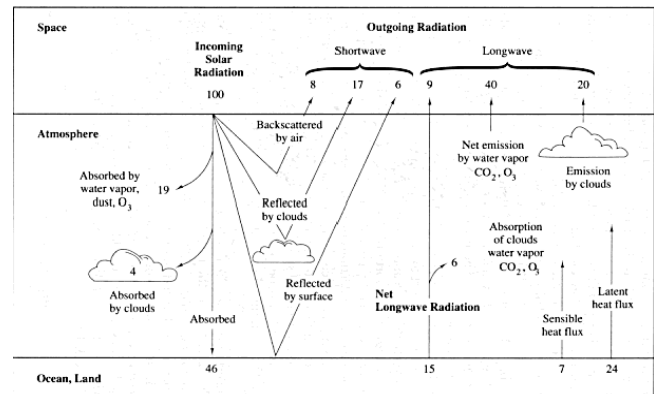
The system consists of water tank, heat absorbing tube, reciprocating steam engine and parabolic trough. The water tank is located over the height of absorbing tube as shown in figure, the parabolic trough is set as the focus of sunlight is concentrated on absorbing tube to produce heat. This heat is utilized to convert water into steam at high temperature and pressure. The pressure is sufficient to run the reciprocating engine. Finally engine gives the mechanical work from the source of sunlight, and it can be utilized into many purposes like to drive wheel, to produce electricity from dynamo or generator, to run the compressor, etc.



Sunlight powered steam engine

Energy balance in the atmosphere

Heat transfer fluid (usually thermal oil) runs through the tube to absorb the concentrated sunlight. This increases the temperature of the fluid to some 400°C. The heat transfer fluid is then used to heat steam in a standard turbine generator. The process is economical and, for heating the pipe, thermal efficiency ranges from 60-80%.



- Cloud reflect 17% back into space.If the earth gets more cloudy.
- 8% scattered backwards by air molecules.
- 19% gets absorbed directly by dust, ozone and water vapour in the upper atmosphere.
- 4% get absorbed by cloud located in the troposphere.
- The remaining 47% of the sunlight that reaches the surface.

Conclusions

The objective of this article is to provide a basic background and review of existing literature on solar-powered Steam engines and low temperature differential Steam engine technology.

The Steam engine could be used in many application such as:

1. a very good cooling source is available;
2. quiet operation is required;
3. relatively low speed operation is permitted;
4. constant power output operation is permitted;
5. slow changing of engine power output is permitted;
6. a long warm-up period is permitted.

In this model there is a best utilization of non-conventional energy resources from Sunlight for producing a mechanical power and it can be utilized into many purpose like to drive wheel, to produce electricity from dynamo or generator, to run the compressor, etc.

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