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DESIGN AND MANUFACTURE OF A SOLAR ELECTRIC MOTOR FOR INDUSTRIAL AUTOMATION

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Abstract: The paper proposes to replace the usual electric motors with solar engines. The solar engine (also called Mendocino) is a DC magneto-levitation electric motor. A Mendocino engine can be used as an electric power generator with better performance than solar panels with simple photovoltaic cells and comparable to solar photovoltaic panels with concentrator. Using solar motors instead of classical ones would bring actual economic and technical benefits because of: simple construction, longer work life, easy maintenance and safe operation. But these solar engines also have drawbacks in that they develop a small torque and always require a light source.

Keywords: electric motor, solar electric motor, solar energy, photovoltaic cells, Mendocino motor.

1. GENERLAL CONSIDERATIONS ON ELECTRIC MOTORS

An electric motor is an electromechanical device that converts converts power into motion. Electric motors can be classified according to the type of current: DC motors and AC motors. Alternating current motors can be: single-phase or polyphase [4], [5], [6], [9].

The concept of the solar motor was first introduced in 1959. It allows the conversion of light energy into mechanical one without needing brushes or other power electronics [1], [2].

The solar engine (also called Mendocino) is a DC magneto-levitation electric motor. The principle of a light-switched engine, in which solar energy is stored into a solar battery and supplies the engine's coils separately, has been described for the first time by Daryl Chapin in his solar energy experiment in 1962 [1], [2].

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A solar motor was built by Larry Spring in 1994 (fig. 1).

Fig.1. Solar Motor

This is an electric motor without collector and without brushes, low power with a rotor with magnetic bearings and powered by solar energy.

The motor consists of a four-part rotor mounted on a shaft (fig. 2). The rotor has two sets of windings powered by solar panels. The shaft is horizontal, at each end of which is a permanent annular magnet. The magnets on the shaft provide levitation by being on top of the base magnets which produce the repellent effect. The additional magnet, located under the rotor, creates a magnetic field in the rotor winding [1], [2].

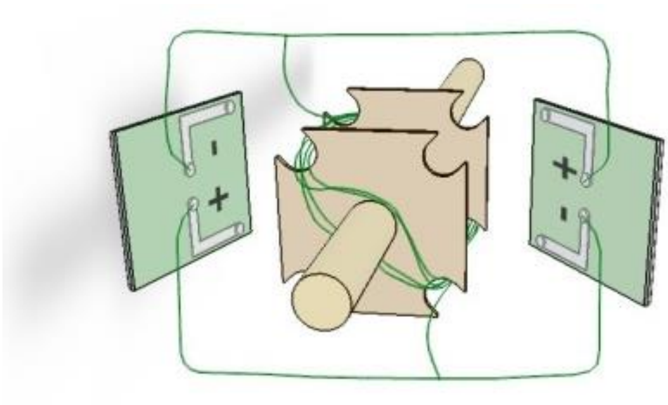

Fig.2. Solar motor parts and work principle

The panels are diametrically opposed and connected in parallel.

When light falls on one of the solar cells, it generates an electric current that flows through the rotor winding [3], [8]. This current produces a magnetic field that interacts with the magnetic field of the rotor. This interaction causes the rotor to rotate. By rotating the rotor, the next solar cell moves towards the light and generates current in the second winding [7]. The process repeats as long as the light falls on the solar cells.

2. MANUFACTURE OF A MENDOCINO SOLAR ELECTRIC MOTOR

The stator we made has a simple construction with supports for magnets and a vertical plate made of organic glass on which rests the rotor. The parts are made in accordance with the execution drawing shown in fig.3.

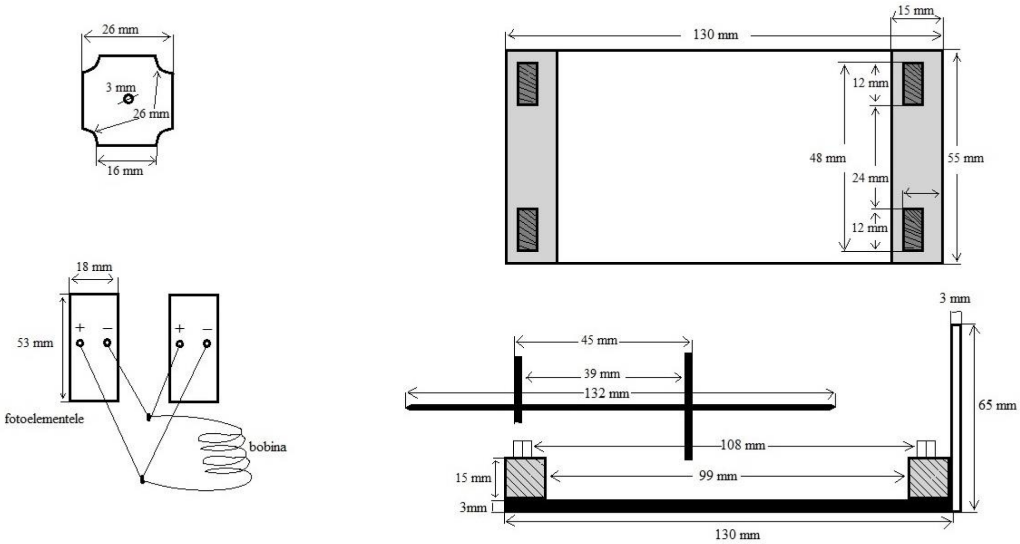

Fig. 3. Execution drawing of the stator

On the sides of the stator base there is a wooden support with two holes having magnets in each.

The magnets are mounted so that each magnet on one side of the base has the same pole as the magnet on the opposite side. Right in the middle of the base are mounted three other magnets (one on top of the other), which have the role to create a magnetic field together with the field created by the rotor. At one of the edges of the base we mounted vertically a trapezoidal organic glass support. The support bears the rotor so to not go out of balance. The stator is presented in fig.4.

Fig. 4. Mendocino solar electric motor stator

The rotor is made of a brass wire for the shaft, a non-magnetic material, on which two square shaped, with inside rounded corners, wooden elements were mounted (fig. 5).

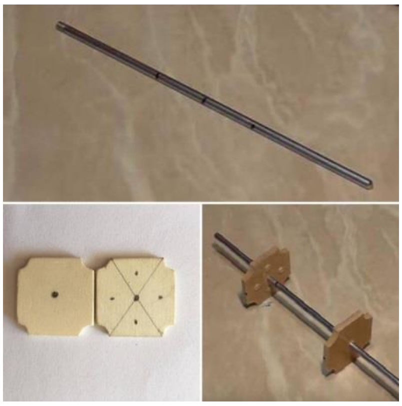

Fig. 5 Rotor shaft

Afterwards, we added the photovoltaic cells of 53x18 mm, 0.5V and 100 mA. On each side of the square part we positioned photovoltaic cells [3], [8] and connected opposite cells to each other, two by two, (fig. 6).

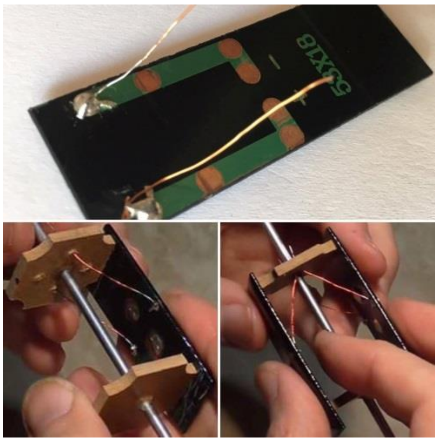

Fig. 6. Photovoltaic cells connection

For each pair of photovoltaic cells, we made a coil of copper enameled wire with 75 turns on one side of the shaft and 75 turns on the other side of the shaft. So, we got a coil of 300 turns (fig.7).

At the ends of the rotor shaft, we mounted two permanent ring magnets with as seen in fig.8.

Fig. 7. Rotor winding

Fig. 8 The rotor

We mounted the magnets on the rotor so that each pair repel with the magnets on that side on the stator, so that the rotor levitated.

Figure 9 shows the final achievement of the motor.

Fig. 9 The solar motor

4. CONCLUSIONS

We made this solar engine prototype in the laboratory so that we could further study it and find ways to improve its operation.

The solar Mendocino electric motor is a continuous electric motor. As long as a light source is present, which falls on the solar panels mounted on the motor rotor, it will be in continuous operation, without the need for a power supply. Because it uses an inexhaustible power supply, namely solar light, it could replace electric motors in industrial automation.

Replacing electric motors with solar ones would bring a profit in several ways, because:

- solar motors have a simpler construction;
- solar motors have a longer working period;
- solar motors require easy maintenance;
- solar motors provide safe operation;
- using solar motors does not consume electricity.

But these solar motors also have disadvantages:

- develops a small couple;
- permanent need for light source.

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