Development of power unit with Sterling engine for hybrid transport facilities

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A Sterling Engine operating model for automobile transport facilities was designed and manufactured by the Department of Renewable Power Resources of St.Petersburg State Technical University, featuring low noise levels, low exhaust gas toxicity and capability to use a wide range of fuels and/or heat sources. Compared to other similar machines, the new engine is characterized by a much higher efficiency and a faster response.

Development of self-contained engines is necessitated by the need to convert accumulated heat energy to electric power to be used by various propulsive devices as well as to fulfil some other specific tasks, such as to boost-charge electromobile batteries. The Sterling Engine specifications allow a wide range of capacities, ample choice of fuels and various rinsing times. Our Sterling Generator of 1.0 kW el. capacity, designed for boost-charging electromobile batteries, consists of the following major parts:

1. High-temperature heat-exchange unit complete with a heat tube. The heat-tube evaporator is made in the form of a spherical surface dimensioned to transfer not less than 4 to 5 kW of heat energy to the heater walls.
2. The Sterling Generator working circuit, compriging expansion/compression chambers, a heater and a cooler.
3. Mechanical assembly, compriging a crank-and-rod mechanism, a piston-and-cylinder group and a manual /automatic starting device.
4. Electrical circuit, compriging an electric machine housed in a specially designed pressure-tight casing with its terminals coupled to external electric devices (battery busses) with special sealed outlets.

The Major problem in designing a Sterling Generator for hybrid transport facilities is to ensure pressure-tightness of its working of its working circuit.

It seems feasible that small capacity Sterling Generators shall be made completely pressure-tight, maintaining constant amount of the working medium in operation, which was provided by our model.

This requirement, however, can only be fulfilled if the electric machine is very compact, enabling it to be housed within a close pressure-tight space of the

Sterling Engine crankcase. This helps to maintain a high level of base pressure (twelve bars) of the working medium (helium) inside the crankcase.

Presently no industrial electric machines of suitable dimensions are available in Russia. Therefore, the Department of Renewable Power Resources of St. Petersburg State Technical University developed a light-weight, compact, collector-less reversible electric machine, equipped with permanent magnets which showed electric efficiency as high as 0.97during its test runs.

In order to reduce the weight of the Sterling Generator, high-strength aluminium alloys and alloyed steels were used as well as thin walled engine elements, designed with a high degree of accuracy. Also, a special boltless fixing of the electring machine's hood to the Sterling crankcase was developed, as well as some other design features.

Heat losses are minimized via heat barriers introduced into the Sterling Generator design on the hot side of the engine.

The described design of the Sterling Generator for hybrid-type automobiles is a FIRST both in Russia and globally.

The invention is NOT protected by patents Demand for the product in foreign countries.