LEONARDO

PATENT BROCHURE

THERMOELECTRIC RECOVERY SYSTEM

Main Technological Area ⟶ Energy

Keyword ⟶ TEG | Energy Harvesting| Graphene | DC-DC | Maximum Power Point Tracking (MPPT)

The technical field of the invention concerns the thermo-electric architectures for the recovery of the energy released (otherwise dispersed) from thermal sources. The use of these architectures on board an aircraft, vehicle or vessel can improve its efficiency and reliability, due to the lower fuel consumption required to drag the alternators and the increased redundancy at the level of electricity generation. The solution can be used in a wide range of civil applications.

TECHNICAL FEATURES

The key concept is to integrate thermoelectric technology into the "hot" parts of a means of transport. Available as planar modules, thermoelectric technology is able to develop a voltage proportional to the thermal gradient. The maintenance of the gradient is a necessary condition, obtainable by acting on the heating and / or cooling of the opposite faces of the aforesaid modules. By connecting a suitable number of modules (serial/parallel) it is possible to obtain an output voltage and current suitable for supplying the on-board loads.

With regard to the flue gas ducts, e.g. in a vehicle, the high flat surface area available for the installation of the modules and a high temperature difference between inside and outside can be observed. The modules are held in place by a suitable frame (e.g. a composite "jacket" for high temperatures) and connected to heat sinks for heat extraction (e.g. graphene or other material with high thermal conductivity).

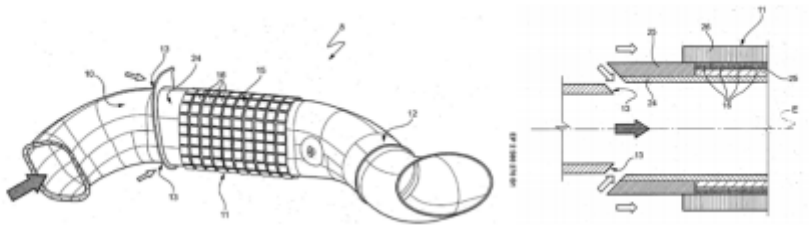

Figure 1 - Installation of the modules on the exhausts (left) and preservation of the gradient using flows / heat sinks

It is possible that the variability of the operating conditions of the heat source (e.g. a jet engine) causes a variation of the thermal conditions and therefore the electrical output characteristics of the system. To overcome this problem, a programmable DC/DC converter (Fig. 3) is used, placed in front of the supply bar and capable of stabilizing the output voltage (in addition to "tracking" the best operating point of the modules, according to "maximum" type algorithms of efficiency power point tracking" - MPPT).

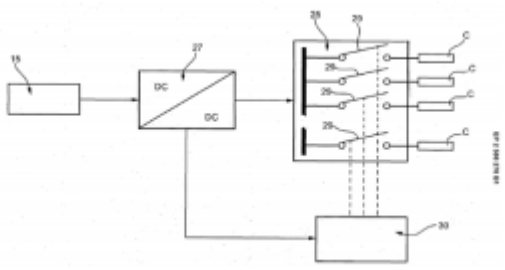

Figure 2 Implementation via DC/DC converter, dedicated power bar and disconnectors

The system is able to recover energy and generate electrical power without the use of moving parts as long as at least one of the heat sources is in operation. This power makes it possible to: reduce the energy absorption of the alternators; take the cessation of operation of an alternator in the event of failure; exceed the limits (duration) of the accumulators; increase the total electricity generation capacity; feed a greater number of users.
Such a solution could therefore usefully be used in long-range flight missions (eg search and rescue at sea, for which the installation of an additional generator is normally required) or at high altitudes (eg mountain rescue during the which the alternators tend to "overload" the source of motion from which they are dragged).
A similar use of this solution is desirable on any land or marine vehicle that presents the described conditions.
In particular, the integration of the conditioning electronics in the thermoelectric modules could optimize the operation of the system adapting in real time the working point of each according to the local temperature gradient.

INNOVATION/BENEFITS

1) Robust design with low maintenance costs due to no moving parts
2) Increased availability of electrical power
3) Increased safety, thanks to the possibility of sharing electrical loads in the event of alternator failure
4) Lower energy consumption.

AREAS OF USE

1) Any vehicles, aircraft, vessels having an heat source
2) Any other system where you have a thermal gradient suitable for the exploitation of a temperature gradient and the installation of an electric power generation device.

PATENT INFORMATION

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