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(54) **FLYWHEEL DOUBLY-FED SYSTEM WITH CAPABILITY TO SUPPLY A DOUBLE INERTIAL CONTRIBUTION, NATURAL AND SYNTHETIC, AND RELATED INNOVATIVE OPERATION LOGIC**

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(57) **ABSTRACT**

The invention relates to a system for supporting the stability of an electrical grid by storing/releasing electrical energy from/to said electrical grid, comprising: an asynchronous electric machine including a rotor provided with an accessible rotor circuit and a stator provided with a stator circuit; a flywheel coupled to the rotor; a static converter, and electronic control means. The stator circuit is connected to the electrical grid to be fed by the latter. The static converter is connected between the electrical grid and the rotor circuit and is controllable to supply said rotor circuit with an electrical power supply with adjustable frequency and voltage. The asynchronous electric machine is configured to: absorb electrical energy from the electrical grid by converting the absorbed electrical energy into kinetic energy and storing said kinetic energy by means of the flywheel; and deliver electrical energy to the electrical grid by converting the stored kinetic energy by means of the flywheel into electrical energy and providing the latter to the electrical grid. The electronic control means are configured to: receive measurement data indicative of a measured electrical grid frequency; determine, based on the received measurement data, ROCOF values indicative of a derivative of the measured frequency of the electrical grid; and control the operation of the static converter based on the determined ROCOF values. Furthermore, in case of a change in the frequency of the electrical grid, the asynchronous electric machine is configured to immediately provide an uncontrolled natural inertial response to said change in frequency by absorbing active power from the electrical grid in case of an increase in frequency or by supplying active power to the electrical grid in case of a reduction in frequency; and the electronic control means are configured to determine a given ROCOF value relative to said change in frequency and, once said given ROCOF value has been determined, begin to control the operation of the static converter such that the asynchronous electric machine begins to supply a controlled synthetic inertial response wherein the active power absorbed/supplied is modulated according to the given ROCOF value determined and the uncontrolled natural inertial response already provided.