STARTER GENERATOR SYSTEM FOR CARS

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Introduction. Increasingly stringent economic and environmental requirements, as well as safety and comfort requirements, are leading major car companies to choose new directions in the development of electromechanical devices for the systems of starting and generating electricity for cars. One way to solve these problems is to use a starter generator.

The starter-generator system is an electric machine mounted between the internal combustion engine and the gearbox in the car [1]. The stator of the electric machine is fixed on the cylinder block and the rotor on the crankshaft instead of the standard flywheel (Figure 1).

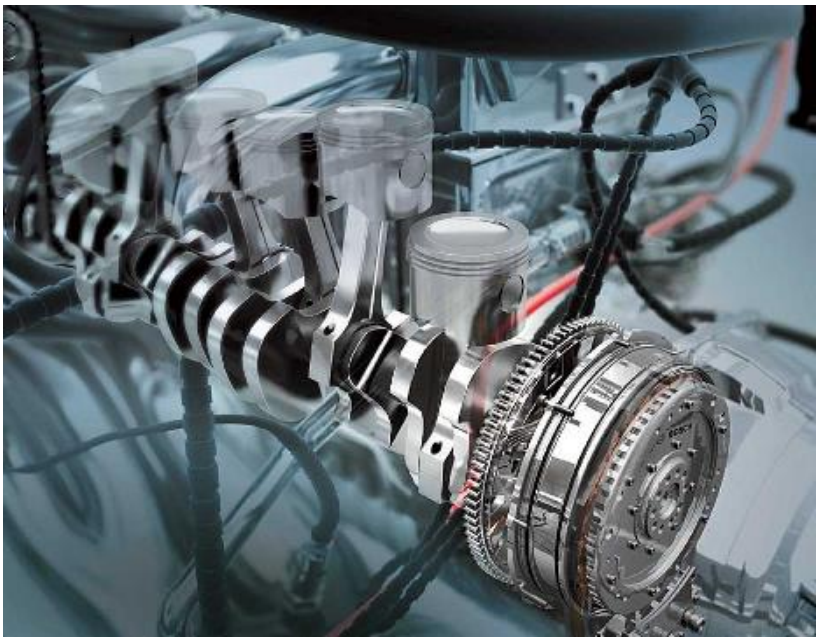

Figure 1 – Starter generator system

The starter-generator system is designed in order to secure the necessary needs, as well as the ability to integrate the functions of the starter and generator when the generation and start-up systems are simplified. Improving the reliability and safety of cars is achieved by reducing the number of components and by maintaining efficiency in case of the internal combustion engine failure. What's more there is a possibility of continuation of the ride from electrical drive and energy recuperation system during braking of the car.

The purpose of the work. The purpose of the study is to study automotive electromechanical systems with starter generators based on contactless electric machines with improved energy, operational and mass indexes.

Materials and results of the work. To date, combined systems with the starter generator are mostly using asynchronous machines with short-circuited rotor and synchronous machines with permanent magnets (Figure 2, Figure 3) [2, 3].

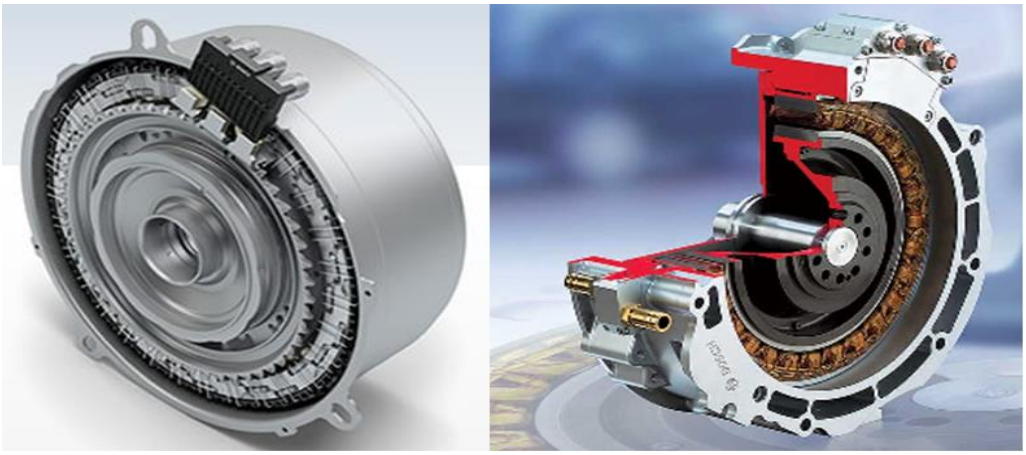

Figure 2 – Bosch starter generator

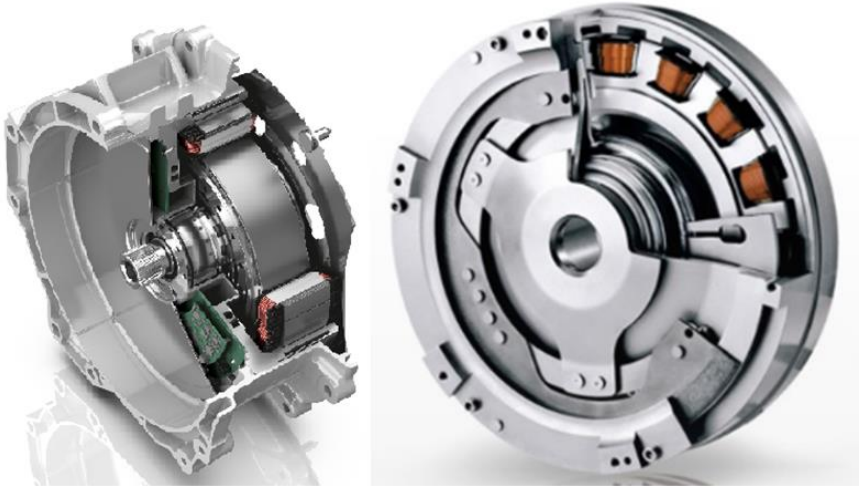

Figure 3 – ZF Starter Generator

Electric machines for starter-generator systems are compared by basic parameters such as mass, geometric dimensions, starting and rated torques, power consumption and usefulness, its cost. If we set the same torque values for all types of machines and compare, it turns out that the asynchronous machine has at least twice the size and weight. The permanent magnet synchronous machine is much more expensive because of the use of expensive magnets, although it has better energy performance.

Starter generator systems have the following advantages:

- integration of starter and generator functions;
- noise reduction during the car start-up;
- Increasing the power of the starter generator allows to reduce toxic emissions due to the displacement of the car on electric traction and ensuring the optimum mode of operation of the internal combustion engine;
- fuel savings of 10-20%;
- the possibility in the generator mode to increase the voltage on board from 14V (12V), for the future planned electrical system of the car 42V (36V);
- possibility of using the system as an integrated damping starter;
- the ability to provide the vehicle with an effective start-stop system;
- the possibility of reducing the mass of the internal combustion engine;

To date, virtually all global automakers are using these systems to varying degrees [4], so Figure 4 shows an engine equipped with an integrated Ford starter motor and Figure 5 shows a car with a Continental car starter motor. General Motors [5].

Figure 4 – Ford starter generator

Figure 5 – Continental Company's starter

Conclusions. The study of automotive electromechanical systems with starter generators based on contactless electric machines with improved energy, operational and mass indexes. The prospects of such systems for the automotive industry are clearly laid out.

References

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