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ALTERNATING CURRENT GENERATOR

Electric current is generated in generators – devices that convert energy of one kind or another into electrical energy. Generators include galvanic cells, electrostatic machines, thermopiles, solar panels, etc. The scope of each of the listed types of electricity generators is determined by their characteristics. So, electrostatic machines create a high potential difference, but are unable to create any significant current in the circuit. Galvanic cells can provide a high current, but their duration is short. Electromechanical induction generators of alternating current play a predominant role in our time. In these generators, mechanical energy is converted into electrical energy. Their action is based on the phenomenon of electromagnetic induction. Such generators have a relatively simple design and allow high currents to be obtained at a sufficiently high voltage.

There are many types of induction generators currently available. But they all consist of the same basic parts. This is, firstly, an electromagnet or permanent magnet that creates a magnetic field, and, secondly, a winding in which an alternating EMF is induced. Since the EMF induced in series-connected turns is added, the amplitude of the induction EMF in the frame is proportional to the number of turns in it. It is also proportional to the amplitude of the alternating magnetic flux through each turn. To obtain a large magnetic flux, a special magnetic system is used in the generators, consisting of two cores made of electrical steel. The windings that create a magnetic field are placed in the slots of one of the cores, and the windings in which the EMF is induced are placed in the slots of the other. One of the cores (usually inner), together with its winding, rotates around a horizontal or vertical axis. Therefore, it is called a rotor. The fixed core with its winding is called a stator. The gap between the stator and rotor cores is kept as small as possible. This ensures the highest value of the flux of magnetic induction. In large industrial generators, an electromagnet rotates, which is a rotor, while the windings, in which the EMF is induced, are laid in the stator slots and remain stationary. The fact is that it is necessary to supply current to the rotor or remove it from the rotor winding into the external circuit using sliding contacts. For this, the rotor is equipped with slip rings attached to the ends of its winding. Fixed plates – brushes – are pressed against the rings and connect the rotor winding with the external circuit. The strength of the current in the windings of the electromagnet, which creates a magnetic field, is much less than the strength of the current given by the generator to the external circuit. Therefore, it is more convenient to remove the generated current from the stationary windings, and to supply a relatively weak current to the rotating electromagnet through sliding contacts. This current is generated by a separate DC generator (exciter) located on the same shaft. In low-power generators, the magnetic field is created by a rotating permanent magnet. In this case, rings and brushes are not needed at all. The appearance of an EMF in the stationary stator windings is explained by the appearance of a vortex electric field in them, generated by a change in the magnetic flux during the rotation of the rotor.

The modern electric generator is an imposing structure made of copper wires, insulating materials and steel structures. With dimensions of several meters, the most important parts of the generators are manufactured with millimeter precision. Nowhere in nature is there such a combination of moving parts that could generate electrical energy just as continuously and economically.