УДК 621.313.13

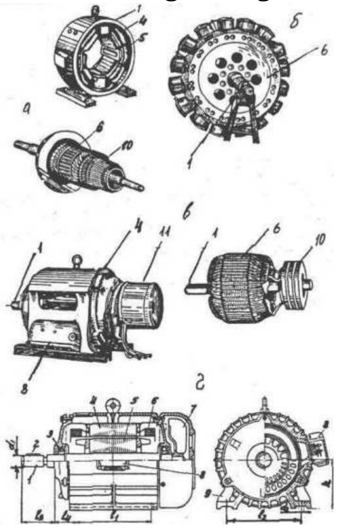
ELECTRIC MOTORS

Kolganov V.V.
Scientific supervisor – Associate professor Yurdanova V.N.

Siberian Federal University

About two centuries ago, electric motors were only theoretical developments. At that time only manual work was used in factories, manufactories, and plants. In the modern world electric motors are used almost in every production, without them can work no one plant. Various models of electric motors are used in everyday life; there are many devices which are driven by motor. In many areas people have found good application for the motor.

The main part of a motor is a coil or armature. The armature is placed between the poles of a powerful magnet. When a motor is put into operation current starts flowing through the coil and the armature starts rotating.



The physical principle of production of mechanical force by the interactions of an electric current and a magnetic field was known as early as 1821. Electric motors of increasing efficiency were constructed throughout the 19th century, but commercial exploitation of electric motors on a large scale required efficient electrical generators and electrical distribution networks.

The conversion of electrical energy into mechanical energy by an electromagnetic means was demonstrated by the British scientist Michael Faraday in 1821. A free-hanging wire was dipped into a pool of mercury, in which a permanent magnet was placed. When a current passed through the wire, the wire rotated around the magnet, showing that the current gave rise to a close circular magnetic field around the wire. This motor is often demonstrated in school physics classes.

In 1827, Hungarian physicist Ányos Jedlik started experimenting with devices which he called "electromagnetic self-rotors". In 1828 Jedlik demonstrated the first device containing three main components of practical direct current motors: stator, rotor and commutator.

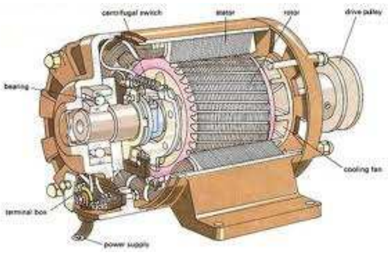
The first commutator-type direct current electric motor capable of turning machinery was invented by the British scientist William Sturgeon in 1832. Following Sturgeon's work, a commutator-type direct-current electric motor made with the intention of commercial use was built by the Americans Emily and Thomas Davenport and patented in 1837. Their motors ran at up to 600 revolutions per minute, and powered machine tools and a printing press.

The modern DC motor was invented by an accident in 1873, when Zénobe Gramme connected the dynamo he had invented to a second similar unit, driving it as a motor. The Gramme machine was the first electric motor that was successful in the industry.

Application of electric motors revolutionized industry. Industrial processes were no longer limited by power transmission using shaft, belts, compressed air or hydraulic pressure. Instead every machine could be equipped with its own electric motor, providing easy control at the point of use, and improving power transmission efficiency. Electric motors applied in agriculture eliminated human and animal muscle power from such tasks as handling grain or pumping water. Household application of electric motors reduced heavy labor at home and made higher standards of convenience, comfort and safety possible. Today, electric motors consume more than half of all electric energy produced.

The classic division of electric motors has been that of Alternating Current (AC) types vs Direct Current (DC) types. This is more a de facto convention, rather than a rigid distinction. For example, many classic DC motors run on AC power, these motors being referred to as universal motors.

The ongoing trend toward electronic control further muddles the distinction, as modern drivers have moved the commutator out of the motor shell. For this new breed of motor, driver circuits are relied upon to generate sinusoidal AC drive currents, or some approximation thereof. The two best examples are: the brushless DC motor and the stepping motor, both being poly-phase AC motors requiring external electronic control, although historically, stepping motors were driven from DC switched by contacts.



Considering all rotating electric motors require synchronism between a moving magnetic field and a moving current sheet for average torque production, there is a clearer distinction between an asynchronous motor and synchronous types. An asynchronous motor requires slip between the moving magnetic field and a winding set to induce current in the winding set by mutual inductance; the most ubiquitous example being the common AC induction motor which must slip to generate torque. In the synchronous types, induction is not a requisite for magnetic field or current production (e.g. permanent magnet motors, synchronous brushless wound-rotor doubly-fed electric machine).

Range of power and size of motors is extremely large. Back in the 20's American watchmaker Gomez built a miniature motor (the size is a little more than a thimble) to drive a toy elevator. M. Maslyuk produced electric motor the size of a match head and a mass of 0.06 g. But this is not the limit. The smallest electric motor in the world was produced by N. Syadristy. The engine has 15 parts; however, the size of it was 4 times less than a poppy seed!

Some of these motors have practical value. Subminiature motors can be used, for example, in medicine. Engine size pill easily swallowed along with a miniature medical probe for analysis of gastric juice. The drive provides promotion of the probe in the stomach. The engine can move the camera to look over the walls of the stomach through the television setup.

The biggest electrical motors are used to drive the propellers of the Soviet nuclear-powered icebreakers ”Sibir” and “Artik”. Reliability high speed operation, frequent reversion and high congestion are ensured by the magnetic sheet which is made of electrical steel. Engine output is 176 kW, efficiency - 0,95.

In conclusion, we can summarize that without electric motors cannot function most modern household devices, modern industrial production in any field, so frequently it depends very much on the quality and reliability of the electric motor. It’s failure could lead not only to stop all production process, but also to concomitant financial losses in profits.