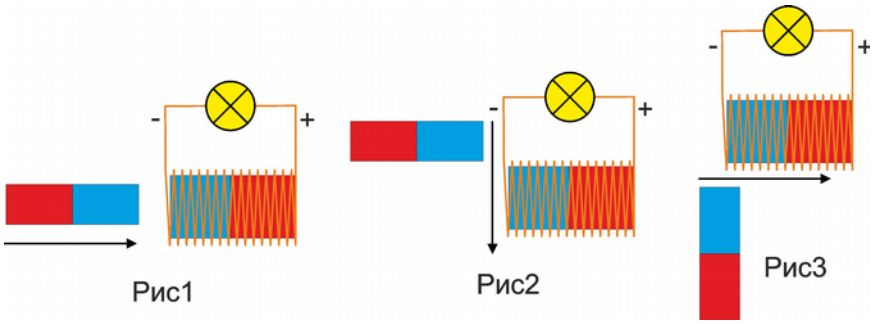
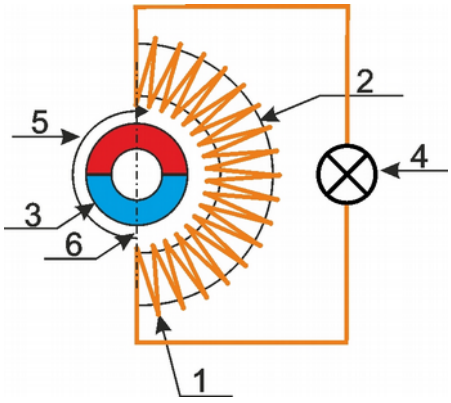
The operating principle of motor-generator.

According to the phenomenon of electromagnetic induction, EMF appears in a *closed loop* when the *magnetic flux* passing through the loop is being changed.
According to the Lenz's law, the *induced current* generated in a closed conducting loop has such a direction that the magnetic field created by it counteracts to the change in the magnetic flux that generated this current. And it doesn't matter how exactly the magnetic flux is moving in relation to the loop (images 1-3).

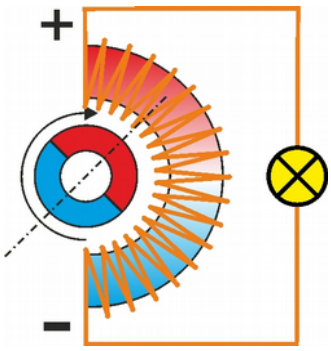


The method of EMF activation in our motor-generator is similar to image 3. It allows us to use the Lenz's law in order to increase a torque on the rotor (inductor).



1) Stator winding
2) Stator magnetic core
3) Inductor (rotor)
4) Load
5) Rotor rotation direction
6) The center line of the inductor poles' magnetic field.

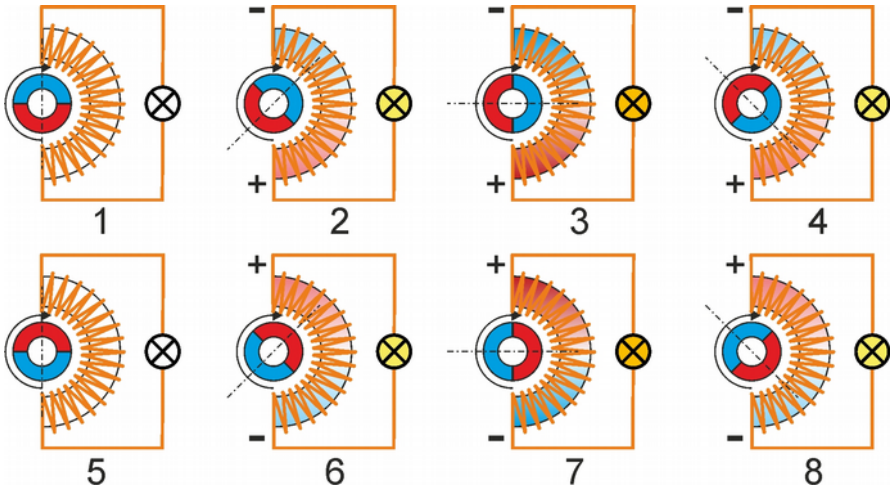
When the external drive is switched on, the rotor (inductor) starts to rotate.
When the magnetic flux of one of the inductor's poles crossing the start of the winding, the EMF is being induced in the winding.
When the load is applied, the current begins to flow in the winding and the poles of the magnetic field that appeared in the windings according to the Lenz's law are directed towards the magnetic flux that activated them.



Since the winding and its core are located on a circular arc, the magnetic field of the rotor moves along the turns (circular arcs) of the winding.

That said, in the start of winding according to the Lenz's law there appears a pole that is identical to the inductor pole. And the opposite pole appears on the other end. Since the like poles repel and the unlike poles attract, the inductor tends to take the position that corresponds with the action of these forces. That creates an additional moment directed along the rotation of the rotor.

Maximum magnetic induction in the winding is achieved when the center line of the inductor poles is located across the middle part of the winding.
Upon further movement of the inductor, the magnetic induction of the winding is reduced, and at the moment when the center line of the inductor pole goes beyond the winding it's equal to nothing.
At the same moment, the start of the winding begins to cross the magnetic field of the second pole of the inductor and according to the rules described above, the edge of the winding, from which the first pole starts to move away, starts to repel it with increasing force.



Images:
1) Zero point, inductor (rotor) poles symmetrically directed at different edges of the winding, EMF = 0.
2) North pole of the magnet (rotor) crossed the start of the winding, EMF appeared in the winding, and a magnetic pole identical to the pole of the exciter (rotor) appeared respectively.
3) Pole of the rotor is in the center of the winding and the maximum value of the EMF is present in the winding.
4) Pole is approaching the end of the winding and EMF is being reduced to the minimum.
5) Next zero point.
6) The south pole enters the winding and the cycle repeats (7;8;1).