Electric Motor – Student Notes

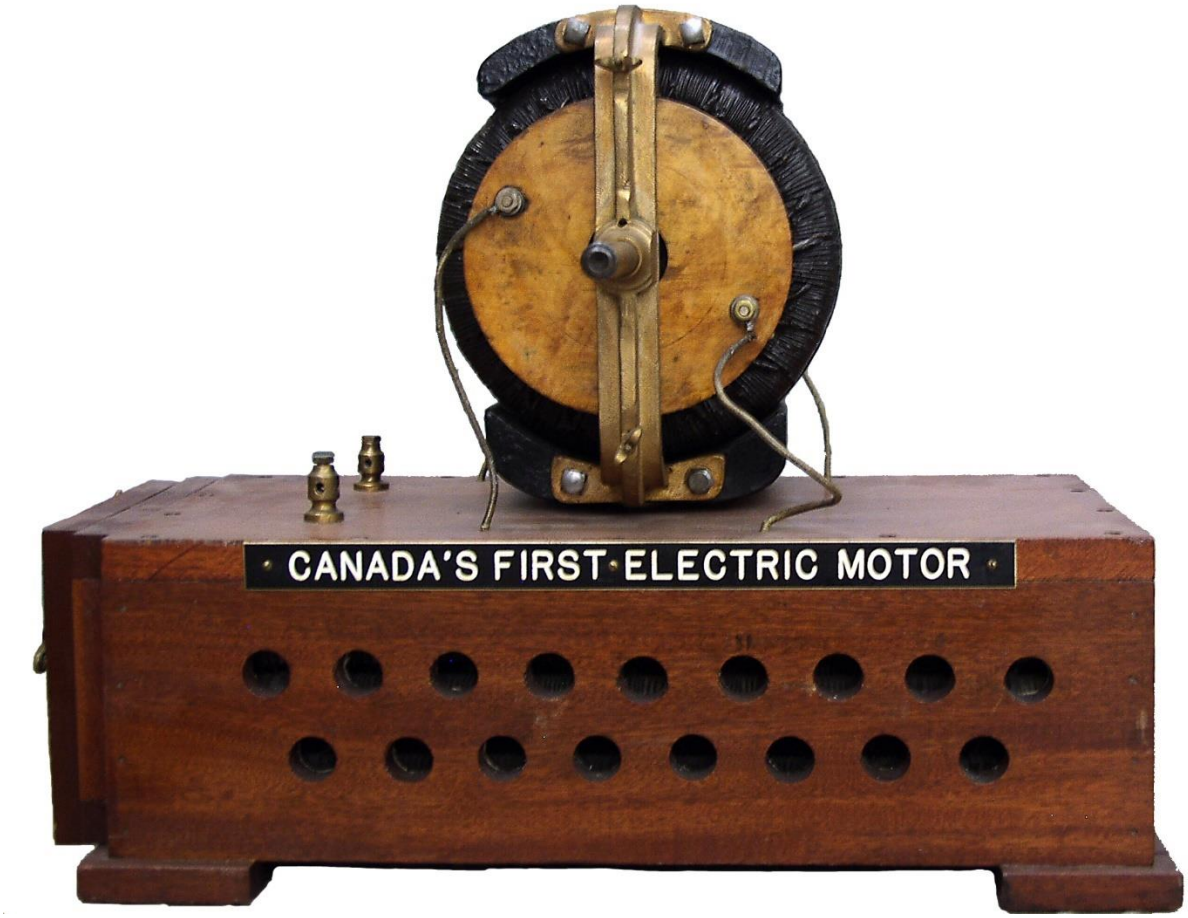

Figure 1 – Canada's first electric motor

Introduction

An electric motor is a device which converts electrical energy into mechanical energy. Mechanical energy is the energy of an object due to its motion and position. In other words it is the sum of the kinetic energy (movement) and potential energy (stored energy). Electric motors can be powered by direct current (DC) sources such as batteries or by alternating current (AC) sources such as from the power grid. They can be small to be used in small equipment like an electric watch or big enough to run an entire factory of industrial machinery. We use electric motors in our daily life when we use a hair dryer, a washing machine, an electric juicer, automotive vehicles and many other electric tools. In today's practical investigation you will be creating your own electric motor.

Risk analysis

There are a number of risks associated with constructing and operating a motor. Write your own list and check it with your teacher and class members.

Questions

What variables can you change?

Does the size of the coils, magnet or battery matter?

How can you increase the speed of the motor?

What other questions could you ask with this investigation?

How can you improve this investigation to get better results?

Aim

To construct an electric motor and investigate variables affecting the performance of the motor.

Plan

In this experiment, you will be constructing an electric motor. It requires a lot of patience to construct a working motor. It is a good idea to prepare yourself by reading about the topic and watching videos that might help you with your mission.

You will also be shown how to make the motor. Things to look out for are the following:

1. The wire is wound into a coil (around a marker pen or something similar) and tied off with the 2 ends of the wire like the axle of a wheel so the coil can spin.
2. The insulation covering the arms of the coil are removed (it is very important to get this bit right).
3. The paperclips are bent and taped to the dry cell.
4. The button magnet is placed onto the side of the cell and the 'motor' is stuck to the bench with a lump of plasticine.
5. The coil is suspended in the bent paperclips.

Form groups of three and assign a role for each member in your group.

Materials

- 1m insulated (enamelled) copper wire of fine gauge.
- 2 paper clips (preferably large ones).
- 1 button magnet (careful – strong and brittle).
- 1 1.5 battery (the correct term is a dry cell – AA in this case).
- 15cm insulation tape (colour optional – sticky tape will do).
- 1 lump of plasticine (colour optional – blu tack will do too).
- Large quantity of patience and perseverance.

Conduct

Follow the procedure below

Procedure

1. Wind the copper wire around a pen as a coil, slip the pen through and tie the ends of the wire by threading each end through the loop twice.
2. Using sand paper, clean the exposed ends of the wire until you completely get rid of the insulation.
3. Straighten the paperclips and bend one end to act as a holder for the coil.
4. Tape the other straight ends of the paperclips to the dry cell.
5. Stick the button magnet using a lump of plasticine on the dry cell as shown in figure 2.
6. Suspend the coil in the bent paperclips and watch.

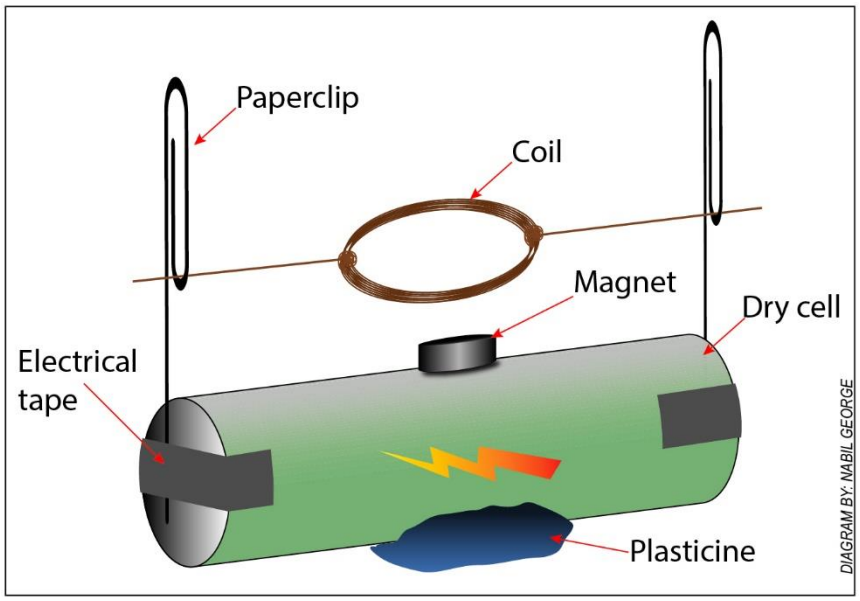

Figure 2 – the setup of the motor

Analysis

Observe what happened when the coil was suspended over the magnet and describe your findings.

Flip the magnet to the other side and observe what happens. Describe your findings.

Problem Solves

Discussion

- Do your results agree with your hypothesis? If not, explain.

- How can you explain your observations?

- What sources of error might have interfered with your results?

- What other variables can you change if you are going to repeat the experiment to study the effect of different variables on the performance of the motor?

Conclusion

Summarise your results and suggest any future work that you would like to do with electric motors.

References

- Link to figure 1 https://www.flickr.com/photos/cstmweb/3323803394/in/photolist-64HmX5-gTr4Rq-2ZU3mW-6BxAua-aJwr5T-cn1pyG-ekRA7p-839vki-bCmzFz-Yp6Xks-iVkLg8-nvgfCC-boiid3-b2sn1c-qn3Zwh-ytLaZ-9o1zQd-4Chd11-6FFK3W-7RWaZ3-dihjJn-8HY6tJ-VWBbDw-bq33VR-TtVY28-nCz3B9-81twGp-8mPGU-Sf5Lct-b9SXMk-9wJXN6-rbQdWr-dxFD4e-q7R13G-awteKs-rbsLHu-cjycRm-ThtVAv-4smovg-q3eDBf-abD6zs-juAGDb-pUx8Pi-aLTqkX-aoUsid-WXAxoJ-Y4LLYM-8Xm8Gc-aMVJia-feUegk Author Canada Science and Technology Museum's photostream Licence https://creativecommons.org/licenses/by-nc-nd/2.0/
- Figure 2 Author Nabil George for ASELL