Practical 9 Effect of length and current on the force on a wire in a magnetic field

Purpose

The aim of this experiment is to investigate how the force experienced by a current-carrying wire in a magnetic field depends on the length of the wire and the current passing through it.

You will need:

- Electronic balance
- Length of thin copper rod
- Power supply (0–12 V dc, 0–5 A)
- 4 mm connecting leads
- Strong U-shaped magnet (two magnadur magnets on a yoke can be used if the balance is sufficiently sensitive)
- Two crocodile clips
- Ammeter (0–5 A dc)
- 30 cm ruler
- Two retort stands
- Bosses and clamps

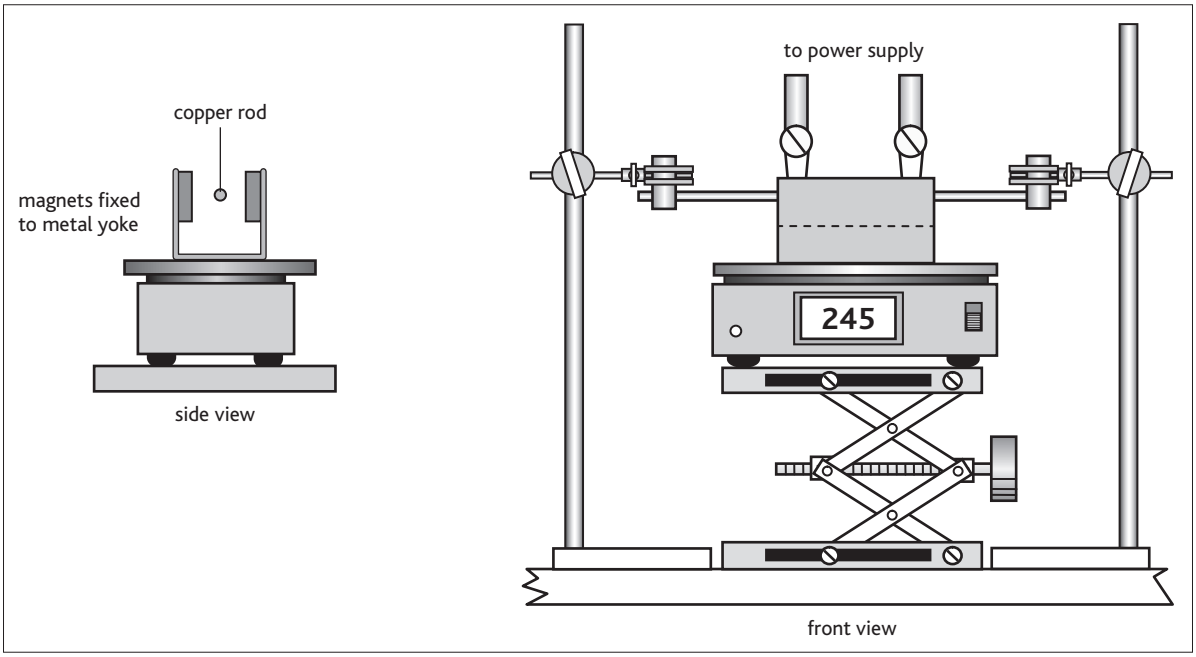

Figure 1: The experimental arrangement

Experimental instructions

Set up the apparatus as shown with the crocodile clips a measured distance apart (say 4 cm). Take the reading on the balance and then switch on the power supply so that a current of 5 A flows through the rod. If necessary, change the direction of the current flow so that it causes an increase in the balance reading. Record the new reading of the balance.

Change the separation of the crocodile clips and repeat the reading, keeping the current constant. Note that the separation of the crocodile clips must not be greater than the length of the magnet poles. Repeat for a number of different crocodile clip separations.

Return the crocodile clips to their original separation and repeat the experiment with a new value of the current. Repeat this for a number of different currents.

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Analysis and conclusions

Calculate the force on the current using the equation $F = BIl$ (if B is known) and compare it with the increase in the balance reading.

If the value of B is not known, use the increase in balance reading ($= mg$) to calculate it.

Plot graphs of force against crocodile clip separation and force against current. Comment on your graphs.