

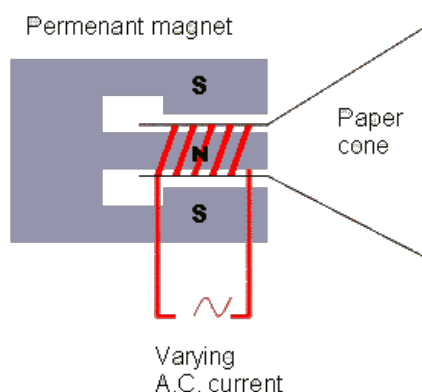
7.2.2 Uses of electromagnets

Electromagnets are used widely in various devices. We will consider three.



The loudspeaker

A loudspeaker consists of a permanent magnet and a solenoid (coil of wire). When a current passes through the solenoid it produces a magnetic field. This interacts with the magnetic field of the permanent magnet causing the coil to move in or out, depending on the direction of the current. If an alternating current (e.g. one which repeatedly changes direction) is passed through the solenoid, it will oscillate backwards and forwards. The solenoid is attached to a paper cone. The oscillations of the paper cone squeeze and stretch the air producing sound waves.



(1) *What 3 things could be changed to produce a louder sound?*

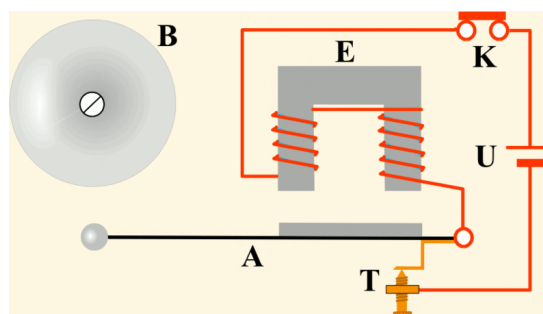
(2) *How could a sound with a higher pitch be produced?*

The electric doorbell

Note: you can find an animated version of the diagram here:

https://commons.wikimedia.org/wiki/File:Electric_Bell_animation.gif

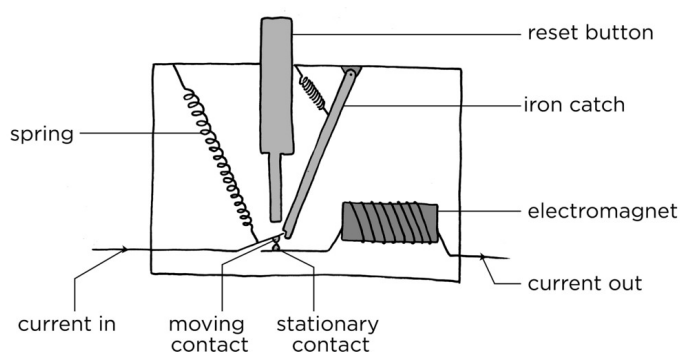
When the switch K is pressed closed, a current can flow around the circuit (shown in red). The electromagnet E becomes magnetised. This attracts a piece of iron attached to the armature A, causing it to pivot. The striker hits the bell B. In the process, a gap in the circuit is produced at the contact switch T. The current stops flowing, the electromagnet demagnetises, and the piece of iron is no longer attracted. The armature springs back, and the contact switch closes again. Again, a current flows and the process repeats itself. As a result, the striker repeatedly strikes the bell while switch K is pressed.



(3) *Why does the core of the electromagnet E need to be made of 'magnetically soft' iron?*

The circuit breaker

A circuit breaker is designed to limit the flow of current flowing in a circuit. The act is in a similar way to a fuse. For example, a circuit breaker with a rating of 30A will stop a current of more than 30A flowing. The advantage of a circuit breaker over a fuse is that a fuse needs to be replaced once it has blown, whereas a circuit breaker can be reset using the reset button.



(4) *Study the diagram of the circuit breaker and explain how it works. (Hint: the larger the current, the stronger the electromagnet becomes. The electromagnet will attract things made of iron.)*