How do you make Electro-Magnets Stronger?

Introduction

When a current passes through a circuit it creates 2 things: Heat and a magnetic field. All things electrical create a magnetic field; this field surrounds all electrical objects in a circle like way. The magnetic field then makes the circuit/object turn into an electromagnet. An Electromagnet is something that acts like a magnet when electricity passes through it. This investigation is trying to find out how to make an electromagnet stronger and more powerful.

Compared to a permanent magnet, an electro-magnet has the advantage that it can be switched on and off. However it has the disadvantage that it requires power. They have many different uses. Some of which are listed below

1. The crane in a scrap yard
2. Hospitals: to remove metal (iron, Cobalt, Nickel or alloys with these metals in) splinters.
3. Electromagnetic relay. A relay is something which changes a current form Big to Small, or Visa Versa
4. Doors in Banks/Jewellers

Variables

The different variables that can affect an Electromagnets field are:

- Is the wire coiled (solenoid)
- Number of coils in a wire
- Different voltages
- Is there an magnetic substance
- Tightness (density) of the coils

I will look at the number of coils and different voltages

Hypotheses

I think that an Electromagnet will be stronger if the wire is coiled round a magnetic substance tightly. I think this because this is because tight coils together will create a bigger current – especially when wrapped around a magnetic substance. Also a higher voltage will create a bigger push (Current) and a bigger magnetic field.

Apparatus

Power box (0V – 12V)
Copper wire
Crocodile clips
Iron nail (4 inches)
Wire cutters
Paper clips (15)

Fair test

To make this a fair test I will keep (for the Voltage tests) the number of coils the same (10 coils). The tightness of the coils. The length of the wire and I will use the same nail. For the number of coils test I will keep: the tightness of the coils the same. The same nail and the same volta ge (6 volts).

Method

1. Collect the equipment and set up as shown in the diagram.
2. Activate you equipment by turning on the power supply.
3. Using Gloves pick up the nail.
4. Try and pick up as many paper clips as possible using the head of the nail.
5. Deactivate the circuit and count the number of paper clips picked up
6. Record your results
7. Repeat each experiment at least 3 times for each different setting within your variable
8. When you've finished repeat steps 1-7 for another variable

Safety

Always wear gloves to pick up the nail as it is part of a live circuit and generates Heat and will give you an electric shock.
Deactivate your circuit when not in use to protect you and ***other*** people.
If there's a problem with your circuit deactivate it immediately.

Results table & Graph

For graph see attached graph paper.

Variables :

Voltage:

	Repeats			Average
Voltage (V)	1	2	3	
2	1	1	1	1
4	3	2	2	2.33
6	2	2	3	2.33
9	3	3	3	3
12	3	4	4	4.66

Number of Coils:

	Repeats			Average
Number of Coils	1	2	3	
5	3	3	3	3
10	5	5	5	5
15	7	7	6	6.66
20	9	9	9	9
25	13	11	12	12
30	14	14	14	14
35	17	18	17	17.33

Conclusion

From the results I can see that the voltage of the current didn't really help the magnetic field or the strength of the Electro magnet. I did see however that the number of coils does affect the power of the Electro magnet. I believe I proved my Hypothesis in saying that the more coils the stronger and more clustered is the magnetic field around 1 point; the Iron nail. I can see from my table and graph that for every 5 coils added another 2 paper clips could be picked up. This concludes that the best way to make an

Electromagnet stronger is by raising the number of coils located around the magnetic object.

Evaluation

I think I preformed the Experiments to the best of my ability. I believe the results correct because there was a definite trend in them, helping me to predict further results. Also I think I preformed it well because there were an anomalous results. I think that the experment would be improved if it was preformed where there was no other electrical Instruments around to interfere with the Electromagnet. Also if the paper clips were all the exact same weight and shape.