A03-421E-Y21

Determination of Current Magnetic

I. Experiment purpose：

We observe force of between two parallel **current carrying wires** to prove the effect of **magnetic field** to current carrying wire and calculate **electric current**.

II. Experiment theory：

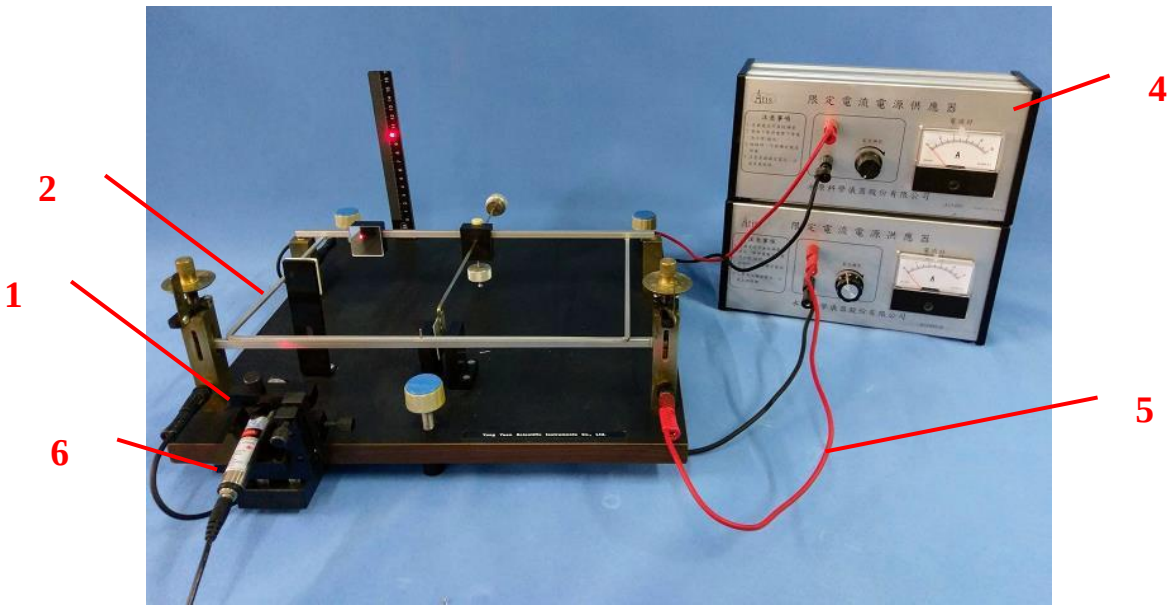
The force of between the two unlimited parallel wires can write:

$$F = k (L / d) I_1 I_2 \qquad (1)$$

$I_1 I_2$ from (1) are two electric currents in the wires, d is the vertical distance of the two wires, L is the length that we consider, F is the force that effects on the line segment, k is a ratio constant which is $\mathbf{2\times10^{-7}\ N/A^2}$. The constant is related to System of Units. We can only measure f in the experiment and then we can know ampere from formula (1). Surely we know the relative value of I_1、I_2 in advance that we usually set $I_1 = I_2$ as the two wires in series. We can use this theory to measure electric current by the force of between two wires that we call **Current Balance** to this device. National Standards of the Republic of China uses this device to make an electric current standard.

III. Experiment device：

1. Current magnetic force meter (included adjustable laser holder × 1 set, straight current rod × 1 piece, spiral adjustable copper pillar × 2 piece, optical measurement × 1 set) × 1 set.
2. Square Current Balance × 1 set.
3. Weight × 1 set.
4. 5A limited electric current power supply (included power cable × 1, banana plug wire × 2) × 2 set.
5. Banana plug wire × 4
6. Red laser (included DC3V power supply × 1) × 1 set.



Device image (For reference only, subject to the actual sample.)

IV. Experiment method and process：

1. We connect power supply and electric current meter with wire as image 1. We use two parallel wires with going through the opposite electric current to create mutual repulsion, so we must note the negative and positive electric current direction when wiring.

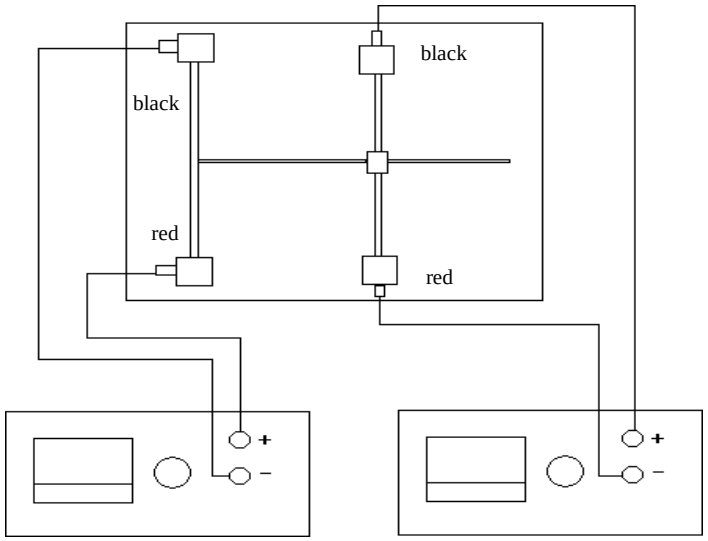
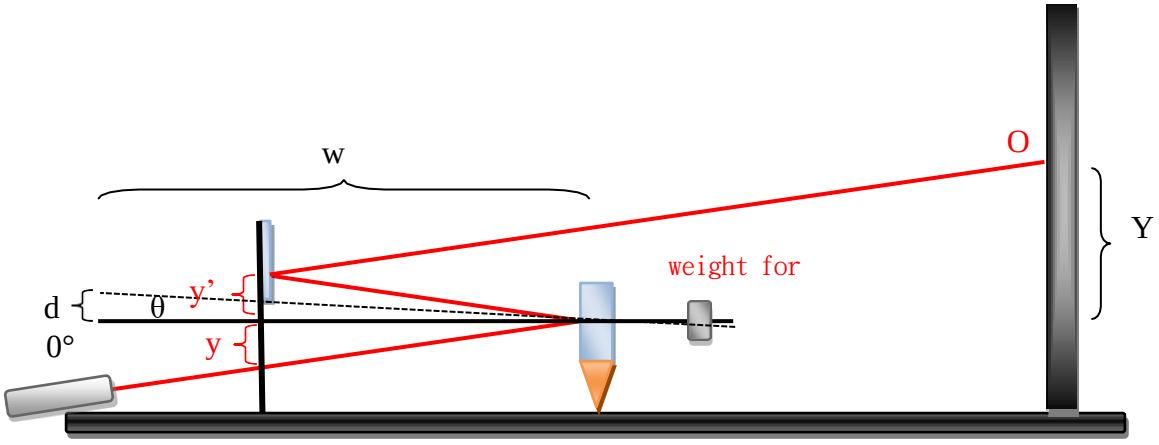


Image 1.

2. We return to zero by using laser and make the rod horizontally. We adjust the weight for a balance to make y = y', and record the return-to-zero point on scale of O. We use the spiral adjustable copper pillar to raise the straight current rod and align to the bottom of Square Current Balance. We keep the laser point in the return-to-zero point O.



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3. We turn on the power supply and test two power supply after increasing electric current. Then, if the two parallel wires are mutual repulsion based on the theory. The Square Current Balance will move up slightly. It means that the electric current direction is correct.

4. We hang lighter weight on the cross bar hook in front of Square Current Balance so the balance wire will be pressed down. The laser indicator will leave away from return-to-zero O. We measure the value of the shift ΔY from O point and get angle of deviation $\Delta\theta$ with trigonometric functions. We measure the width w of the Square current balance and get the vertical distance d of the two wires with trigonometric functions.
5. We increase the electric current on two parallel metals gradually and make the laser indicator close to return-to-zero point. When we increase electric current until the cross bar returns to horizontal level, the value of electric current on the two metals are I_1 and I_2 .
6. We measure the length L of repulsion force that created from two parallel metals and input all the value into (1) formula to get the value of the weight on the object that is attached on the device.

V. Experiment result and data：

	weight	**L**	**d**	I_1	I_2	**F**	**tolerance (%)**
unit							
1							
2							
3							
4							
5							

VI. Experiment discuss：

1. If it corresponds, when we calculate the value and actual weight of object.
2. Why is there tolerance in this experiment?

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