FILINGS ATTRACTED TO WIRE; MAGNETIZED NEEDLE

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The brilliant discovery which M. OErstcd has just made consists, as we have seen, in the action which the Volcanic current exerts on a previously magnetised steel needle. In repeating the experiments of the Danish physicist, I recognized that this same current strongly develops the magnetic virtue in iron or steel blades which, at first, were totally deprived of it.

I will report the experiments which establish this result, in order, to a great extent, where they were made.

Having adapted a cylindrical wire of copper, rather fine, to one of the poles of the voltaic pile, I noticed that the moment this wire was in communication with the opposite pole, it attracted the filth of soft iron, as a real magnet would have done.

The thread, immersed in the filings, also took care of it all around, and acquired, by this addition, a diameter almost equal to that of an ordinary pen-pipe.

As soon as the connective thread ceased to be in communication with the two poles of the pile at once, the filings were detached from the thread and fell.

These effects did not depend on prior magnetization of the filings, since soft iron or steel wires did not attract any parcel.

They would be explained just as little by attributing them to ordinary electric actions; for, by repeating the experiment with filings of copper and brass, or with sawdust, we find that they do not in any case attach themselves in a sensible manner to the connective thread.

This attraction, which the connective thread exerts on the iron filings, diminishes very rapidly as the action of the battery weakens. Perhaps one will find, one day, in the weight of the quantity of filings raised by a given length of thread, the measure of the energy of this instrument, at different times of the same experiment.

The action of the connective thread on the iron is exerted at a distance: it is easy to see, indeed, that the filings rise well before the thread is in contact with it.

I have spoken so far only of a connective thread of brass; but silver, platinum, and so on. give similar results. It remains to be studied, however, whether, in parity of form, mass or diameter, wires of different metals act exactly with the same intensity.

The connective thread communicates to the soft iron only a momentary magnetization; if small pieces of steel are used, they are sometimes given permanent magnetization. I even managed to completely magnetize a sewing needle

M. Ampere, to whom I showed these experiments, had just made the important discovery that two straight and parallel wires, through which pass two electric currents, attract each other when the currents move in the same direction, and repel each other when they are directed in opposite directions; he had also drawn from this, by analogy, the consequence that the attractive and repulsive properties of the magnets depend on electric currents, which circulate around the molecules of iron and steel, in a direction perpendicular to the line which joins the two poles. . M. Ampere still supposed that on a horizontal needle directed to the north, the current in the upper part was moving from west to east. These theoretical views suggested to him at once the thought that a stronger magnetization would be obtained by substituting for the right connective thread of which I had used, a wire folded in a helix in the center of which the steel needle would be placed; he hoped, moreover, that a constant position would be obtained from the poles, which would not happen in my method. Here is how we have subjected, Mr. Ampère and myself, these conjectures to the test of experience.

A helically rolled copper wire was terminated by two rectilinear portions which could be adapted, at will, to the opposite poles of a strong horizontal voltaic pile; a steel needle wrapped in paper was introduced into the helix, but only after communication between the two poles had been established, so that the effect expected was not attributable to the electric discharge, which manifests itself at the instant when the connective thread ends at the two poles. During the experiment, the portion of this thread in which the steel needle was enclosed, remained constantly perpendicular to the magnetic meridian, so that nothing was to be feared from the action of the terrestrial globe.

Now, after a few minutes' residence in the propeller, the steel needle had received a fairly high dose of magnetism; the position of the north and south poles was, moreover, perfectly in conformity with the result which M. Ampere had deduced, in advance, from the direction of the elements of the propeller, and from the hypothesis that the electric current flows through the wire connective by going from the zinc end of the pile to the copper end.

It seems, therefore, proved from these experiments that if a steel wire is magnetized by a galvanic current which traverses it longitudinally, the position of the poles is not determined solely by the direction of the current; and that slight circumstances almost inappreciable, such, for example, as a feeble beginning of magnetization; a slight irregularity in the shape or texture of the wire can completely change the results; while if the galvanic current circulates around the steel, along the turns of a propeller, we can always foresee, in advance, where will be placed the north and south poles.

Reflecting however on the singular discrepancies that magnetization experiments by electric shocks have presented to physicists who took care of this research, it seemed to me necessary to submit to more decisive tests the phenomena of helical currents. The reader will judge if we have achieved this goal.