II.—*Demagnetization of Electro-magnets*; by ROBERT W. WILLSON, Junior Class, Harv. Coll.

Wiedemann has shown Pogg. Ann. C. 235, Ann. de Min. (3), 1, 189, that the intensity of the current necessary to demagnetize a steel magnet is much less than that of the current by which the bar was originally magnetized.

It has occurred to me to experiment, with a view to ascertaining how far this principle can be applied to electro-magnets.

The apparatus used consisted of a cylindrical bar of soft iron 8 c.m. in length and 1 c.m. in diameter, slightly rounded at the end. The armature was a piece of soft iron, of the same diameter and 2 c.m. in length.

Around this core were placed two concentric helices, wound in opposite directions, through each of which could be passed the current of a single Grove's cell.

The method of experimenting was as follows. A current was first passed through the inner helix, which, for convenience, I shall call A, and the weight supported by the bar was noted. This current being broken, the outer helix, B, was introduced into the circuit, and the corresponding weight noted. The current through B being then broken, and that through A closed, after a short time, the current was again passed through B and the weight noted. The following table shows the results.

Wt. supported by—

A	B	A diminished by B
490 grms.	250	130
470	240	130
460	230	130
460	220	120
420	220	130
410	200	110
Mean 452	227	125

Taking the mean result, we see that while the helix B can only develop sufficient magnetism in the bar to render it capable of sustaining 227 gr., yet, if it act in opposition to A, it can diminish the weight which the latter supports by 327 grms.; that is, its power to demagnetize is greater than its power to magnetize.

If then we suppose the coercive force of the steel bar used in Wiedemann's experiments to be represented by the helix A, and the demagnetizing current of feeble intensity to be represented by the helix B, of less magnetizing power, we have here an interesting confirmation of Wiedemann's results, while we may also extend the application of the principle to electro-magnets, and may assert, in general, that a current of given intensity, or a helix of given dimensions, traversed by a constant current, has greater power to demagnetize than to magnetize. It is evident that the case of demagnetizing an electro-magnet by a current is more difficult than the process of demagnetizing a steel bar; for whereas in a steel magnet the resistance is simply the coercive force of the steel, so that the bar when partially deprived of its magnetism has no tendency to return to its original state, even if the demagnetizing current be broken, in the case of electro-magnets the helix, by which the bar was originally magnetized, is still acting with its full power when the demagnetizing helix is introduced into the circuit.

A natural inquiry was this: if the bar were magnetized by the weaker helix B, and then demagnetized by the helix A, what additional amount of magnetism could A impart to the bar? It is evident that this case, though somewhat similar to the former, is not identical with it; here the helix B acts as resistance to the magnetization of the bar, while in the former case it acted to deprive the bar of a portion of the magnetism which it already possessed.

Accordingly the bar, being magnetized by B, was submitted to the action of A, and the weight supported being noted, the reverse operation was performed, and the weights supported compared as follows:

A demagnetized by B.	B demagnetized by A.
85	65
70	65
65	60
65	50

It will be noticed that the results in the left hand are larger than those in the right hand column, that is, when A is simply demagnetized by B, it can support a greater weight than when it is employed to magnetize the bar against the resistance of B.

In short, the result of my experiments has been to show that a given helix, traversed by a given current, has more power to demagnetize than to magnetize, while its power to prevent magnetization is greater than either.