



LXIV. On the external field of helically magnetized rings

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LXIV. *On the External Field of Helically Magnetized Rings.*
By W. M. MORDEY*.

ON the subject of some experiments by the present writer relating to drag on armature conductors, enclosed or nearly enclosed in iron, Prof. H. du Bois contributed an article in the *Elektrotechnische Zeitschrift* of August 19 last (a translation of which appeared in the 'Electrician' of August 27), in the course of which attention was particularly directed to a phenomenon of ring magnets. Prof. du Bois writes:—*A ring-magnet experiences a side thrust when in an external field whose lines of force are in the same plane as the ring; and conversely it exerts a thrust in the opposite direction upon the supporter of the external field.*" "This deduction," he adds, "so astonishing at first sight, I have proved to be verified by experiment." As its author gives the emphasis of italics to this passage, it may be well to submit what appears to be the explanation, as the present writer chanced to come across the effect in question a good many years ago. It is, as Prof. du Bois says, rather astonishing at first sight, but the explanation seems to be quite simple. The external field is caused by the advancing or longitudinal constituent of the helix. Magnetically a helix traversed by current acts as a series of rings, but in addition it has a minor magnetizing effect, at right angles to that of the rings, due to the advance of the conductor from end to end of the helix. Thus, a helix bent into a ring or wound about an annular core, forms an endless or ring-magnet when traversed by current. But in addition to this main effect, the faces of the ring, regarded axially, present N. and S. polarity respectively, the whole closed helix acting externally (so far as this subsidiary effect is concerned), and as regards external fields, as a simple loop or ring of conductor carrying current. This may be illustrated by a lines-of-force figure, taken from a ring helically wound with a single layer of winding. In such a figure the lines of force radiate from the centre or axis of the ring at right angles to the axis of the spiral—they represent portions of closed lines of force which enclose the axis of the spiral. In a helix wound with two layers, one forward, the other back, the external magnetizing effect due to this cause is *nil*. In a single layer (or simple) helix, this external effect may be neutralized by returning the wire along the axis of the helix.

A simple straight helix acts externally as a straight conductor.

A flat spiral acts like a disk or wheel, or as a number of radial conductors in one plane traversed by current passing from or to the centre.

* Communicated by the Author.