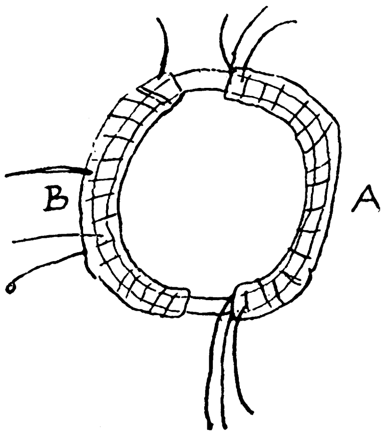
PHYSICS

Classics of Science

Induction of Electric Currents



THE INDUCTION RING used by Faraday in the first experiment reprinted. This is a reproduction of Faraday's own drawing from his laboratory notebook

The experiments quoted below were the successful result of much work on the relation between magnetism and electricity by not only Faraday but most of the physicists of the day. Here Faraday discovered that the peculiar effects accidentally discovered by others were the result of a ***make*** or ***break*** in the current of the primary coil, or the relative motion of magnet and coil of wire.

To repeat these experiments with modern apparatus, substitute dry cells for Faraday's battery of ten pairs of plates, or make your own wet cells like his from pairs of copper and zinc plates in dilute sulphuric acid. The helix cylinder in the third experiment was made by coiling up 220 feet of wire.

EXPERIMENTAL RESEARCHES IN ELECTRICITY, by Michael Faraday, London, 1839.

The First Induction Coil

I have had an iron ring made (soft iron) iron round and 7/8ths of an inch thick, and ring six inches in external diameter. Wound many coils of copper round, one half of the coils being separated by twine and calico; there were three lengths of wire, each about twenty-four feet long, and they could be connected as one length, or used as separate lengths. By trials with a trough each was insulated from the other. Will call this side of the ring A. On the other side, but separated by an interval, was wound wire in two pieces, together amounting to about sixty feet in length, the direction being as with the former coils. This side call B.

Charged a battery of ten pairs of plates four inches square. Made the coil on B side one coil, and connected its extremities by a copper wire passing to a distance, and just over a magnetic needle (three feet from wire ring), then connected the ends of one of the pieces on A side with battery; immediately a sensible effect on needle. It oscillated and settled at last in original position. On breaking connection of A side with battery, again a disturbance of the needle.

Electricity From Magnetism

A cylindrical bar magnet three-quarters of an inch in diameter, and eight inches and a half in length, had one end just inserted into the end of the helix cylinder (220 feet long); then it was quickly thrust in the whole length, and the *galvanometer* needle moved; then pulled out, and again the *needle moved,* but in the opposite direction. This effect was repeated every time the magnet was put in or out, and therefore a wave of electricity was so produced from *mere approximation of a magnet,* and not from its formation *in situ.*

Cutting Earth's Magnetic Lines

The helix had the soft iron cylinder (freed from magnetism by a full red heat and cooling slowly) put into it, and it was then connected with the galvanometer by wires eight feet long; then inverted the bar and helix and immediately the needle moved; inverted it again, the needle moved back; and, by repeating the motion with the oscillations of the needle, made the latter vibrate 180°, or more.

Faraday's Reasoning

Whether Ampere's beautiful theory were adopted, or any other, or whatever reservation were mentally made, still it appeared very extraordinary, that as every electric current was accompanied by a corresponding intensity of magnetic action at right angles to the current, good conductors of electricity, when placed within the sphere of this action, should not have any current induced through them, or some sensible effect produced equivalent in force to such a current.

These considerations, with their consequence, the hope of obtaining electricity from ordinary magnetism, have stimulated me at various times to investigate experimentally the inductive effect of electric currents. I lately arrived at positive results; and not only had my hopes fulfilled, but obtained a key which appeared to me to open out a full explanation of Arago's magnetic phenomena, and also to discover a new state, which may probably have great influence in some of the most important effects of electric currents.

Michael Faraday, born Sept. 22, 1791, died August 25, 1867, had the good fortune to become assistant to Sir Humphrey Davy at the Royal Institution, London, at the age of 22. The experiments reprinted above laid the foundation for the modern application of electricity for every motor or dynamo that turns today is a verification of Faraday's researches of 1831. He stayed at the Royal Institution all his life, extending his researches into electrolysis, the influence of a magnetic field on light, and the magnetic properties of various substances.

Science News-Letter, October 1, 1927

ASTRONOMY

Mercury Has 2112-Hour Day

The planet Mercury, nearest to the sun of all the members of the solar system, turns once on its axis in 88 days, the same time that it takes to travel once in its orbit around the sun. The result is that it always keeps the same face to the sun, just as the moon always keeps the same part of its surface towards the earth. E. M. Antoniadi, famed planetary observer of the Meudon Observatory, at Meudon, France, has just completed a series of observations which indicate these facts, and confirm the views of Schiaparelli, an Italian astronomer. M. Antoniadi has made his planetary observations with the great 33-inch refracting telescope of the Meudon Observatory. This instrument is the world's third largest, and the largest outside the United States.

In a series of observations during the past summer, most of them made in broad daylight, while Mercury was high in the sky, and not down near the horizon, as it is ordinarily seen with the unaided eye, M. Antoniadi has seen markings on the planet which were previously unnoticed. From these he has detected the period of rotation, or the planet's "day", which turns out to be the same as its "year." As a result of another motion which the astronomer calls libration, however, more than half of the planet's surface is exposed to the sun's rays at one time or another. However, despite the libration, there is a little over three-eighths of the surface which is never exposed to the sun's rays, but is perpetually in night. As the sun is on the average only 36 million miles from Mercury, as compared with 93 million miles from the earth, the part of the opposite side where the sun is almost always directly overhead, must be exceedingly hot.

While Mercury is so small that it is generally supposed that it can have no atmosphere, M. Antoniadi thinks it possible that some sort of a veil,

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