sands of that division. To whatever division, however, of the Bagshots these beds may be assigned eventually, the occurrence of fossils in them is, I think, worthy of record.

53 Warwick Square, November 25. R. S. HERRIES.

The Ffynnon Beuno and Cae Gwyn Caves.

SINCE writing my note, as published in NATURE of November 3, p. 7, I have paid another visit to the British Museum, and seen a second implement from the Denbighshire caves, presented by Dr. Hicks and Mr. Luxmore. It is a small and highly-finished scraper, exactly agreeing with the Neolithic scrapers of Icklingham and Mildenhall, and with small scrapers found in caves of confessedly very late date. This scraper is quite sufficient to condemn any pre-Glacial theory, and it enables me to emphasize my former remark that the cave contents, instead of belonging to the earliest Palæolithic class, belong to the *very latest*. I do not believe that a similar scraper has ever been found in any *really old, or even moderately old, Palæolithic river gravel*. Such scrapers were only made in the most recent of Palæolithic times.

Mr. G. H. Morton is not justified in his remark (Nov. 10, p. 32) that my former letter afforded "a remarkable instance of rushing into print and giving an opinion on a subject with which the writer was unacquainted," for I have studied the drifts of Wales for twenty years, and during that time I have never failed to make one or two visits a year to Wales. I have also examined nearly every cave in North and South Wales, and handled the shovel and pickaxe myself. From the experience I have obtained during this time, I say the drift in front of the Denbighshire caves is *not in its original position*, but *distinctly and obviously relaid;* and I even doubt whether before it was relaid it was a true Glacial gravel at all.

I will "read up the literature of the subject" if I get time: in the meantime there is no great harm done in expressing an opinion from a study of some of the real objects, even if that opinion is "not worth anything" and "of no consequence," as Mr. Morton concludes. WORTHINGTON G. SMITH.

Meteor.

ON Tuesday night, November 15, a wonderfully fine meteor was seen at Falmouth, and being out star-gazing at the time, I was fortunate enough to see it. I was looking towards that part of the Milky Way between Auriga, Perseus, and Cassiopeia, when suddenly a curved train of light flashed out; but, instead of just going away, it remained visible for quite eight seconds; meanwhile the lower extremity burst into a brilliant mauve "cone" of light, about a quarter the size of the full moon. So bright was it that it lit up the roadway, quite overpowering the lamps.

It was a grand sight, and I sincerely hope other eyes than mine saw it. B. TRUSCOTT.

4 Alma Crescent, Falmouth.

MODERN VIEWS OF ELECTRICITY.[1]

PART III.—MAGNETISM.

V.

WE next proceed to consider electricity in a state of *rotation*. What happens if we make a whirlpool of electricity? Coil up a wire conveying a current, and try. The result is it behaves like a magnet: compass-needles near it are affected, steel put near it gets magnetized, and iron nails or filings get attracted by it—sucked up into it if the current be strong enough. In short, it *is* a magnet. Not of course a permanent one, but a temporary one, lasting as long as the current flows. It is thus suggested that magnetism may perhaps be simply electricity in rotation. Let us work out this idea more fully.

First of all, one may notice that everything that can be done with a permanent magnet can be imitated by a coiled wire conveying a current. (It would not do altogether to make the converse statement.) Float a coil attached to a battery vertically on water, and you have a compass-needle: it sets itself with its axis north and south. Suspend two coils, and they will attract or repel or turn each other round just like two magnets.

As long as one only considers the action of a coil at some distance from itself, there is no need to trouble about the shape of the particular magnet which it most closely simulates; but as soon as one begins to consider the action of a coil on things close to it, it is necessary to specify the shape of the corresponding magnet.

If the coil be a long cylindrical helix like a close-spired corkscrew, as in Fig. 16, it behaves like a cylindrical magnet filling the same space. But if the coil be a short wide hank, like a curtain-ring, it behaves again like a cylindrical magnet, but one so short that it is more easily thought of as a disk. A disk or plate of steel magnetized with one face all north and the other face all south can be cut to imitate any thin hank of wire conveying a current. It will be round if the coil be round, square if it be square, and irregular in outline if the coil be irregular.

There is no need for the coil to have a great number of turns of wire except to increase its power: one is sufficient, and it may be of any shape or size. So when we come to remember that every current of electricity must necessarily flow in a closed circuit, one perceives that *every current of electricity is virtually a coil of more or less fantastic shape*, and accordingly imitates some magnet or other which can be specified. Thus we learn that every current of electricity must exhibit magnetic phenomena: the two are inseparable—a very important truth.

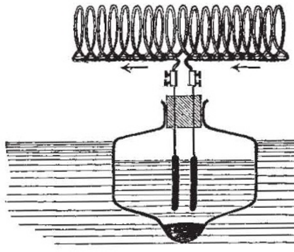

FIG. 16.—Floating battery and helix acting as a compass-needle.

There is one detail in which the magnetized disk and the coil are not equivalent, and the advantage lies on the side of the coil: it has a property beyond that possessed by any ordinary magnet. It has a penetrable interior, which the magnet has not. For space outside both, they simulate each other exactly; for space inside either, they behave differently. The coil can be made to do all that the magnet can do; but the magnet cannot in every respect imitate and replace the coil: else would perpetual motion be an every-day occurrence.

Now I want to illustrate and bring home forcibly the fact that there is something rotatory about magnetism—something in its nature which makes rotation an easy and natural effect to obtain if one goes about it properly. One will not observe this by taking two magnets: one will see it better by taking a current and a magnet, and studying their mutual action.

A magnet involves, as you know, two poles—a north and a south pole—of precisely opposite properties: it may be considered as composed of these two poles for many purposes; and the action of a current on a magnet may be discussed as compounded of its action on each pole separately. Now how does a current act on a magnetic pole? Two currents attract or repel each other; two poles attract or repel each other; but a current and a pole exert a mutual force which is neither attraction nor repulsion: it is a rotatory force. They tend neither to approach nor to recede; they tend to revolve

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[1] This Part is an expansion of a lecture delivered at the London Institution on January 5, 1885. Continued from p. 13.

round each other. A singular action this, and at first sight unique. All ordinary actions and reactions between two bodies take place in the line joining them: the forces acting between a current and a pole act exactly at right angles to the line joining them.

Helmholtz long ago (in 1847) showed that the conservation of energy could only be true if forces between bodies varied in some way with distance and acted in the line joining them. Now here is a case where the forces are not in the line joining the bodies, and accordingly the conservation of energy is defied: the two things will revolve round each other for ever. This affords and has afforded a fine field for the perpetual motionist; and if only the current would maintain itself without sustaining power, a perpetual motion would in fact be attained. But this after all is scarcely remarkable, for the same may be said of a sewing-machine or any other piece of mechanism: if only it would continue to go without sustaining power it would be a perpetual motion. Attend to pole and current only, and the energy is *not* conserved, it is perpetually being wasted; but include the battery as an essential part of the complete system, and the mystery disappears: everything is perfectly regular.

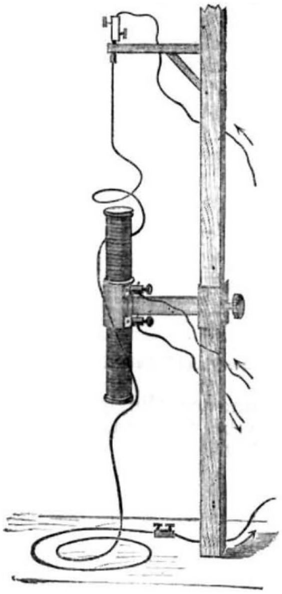

FIG. 17.—A long flexible conductor twisting itself into a spiral round a powerful bar-magnet.

The easiest way perhaps of showing the rotation of a conductor conveying a current round a magnetic pole is to take an 8-feet-long piece of gold thread, such as military officers stitch upon their garments, and hanging it vertically supply it with as strong a current as it will stand. Then bring near it a vertical bar-magnet, and instantly you will see the thread coil itself into a spiral, half of it twisting round the north end of the bar, and half twisting the other way round the south end (Fig. 17).

If the magnet were flexible and the conductor rigid, the magnet would in like manner coil itself in a spiral round the current: the force is strictly mutual. A rigid magnet put near a stiff conductor shows only the last remnants of this action: it sets itself at right angles to the wire, and approaches its middle to touch it, but that is all it can do.

The experiment with the flexible gold thread is simple, satisfactory, and striking, but the rotatory properties connected with a magnet may be illustrated in numbers of other ways. Thus, pivot a disk at its centre, and arrange some light contact to touch its edge, either at one point or all round, it matters not; then supply a current to disk from centre to circumference, and bringing a bar-magnet near it along its axis, or, better, two bar-magnets, with opposite poles one on each side, near the contact place of the rim, the disk at once begins to rotate (Figs. 18 and 19).

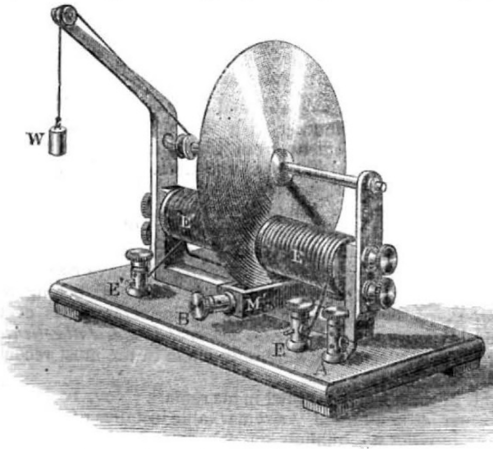

FIG. 18.—Pivoted disk with radial current, revolving in a magnetic field and winding up a weight. The current is supplied to the axle by screw A, and leaves the rim by mercury trough M. The same apparatus obviously serves to demonstrate currents induced by motion; both directly and by the damping effect.

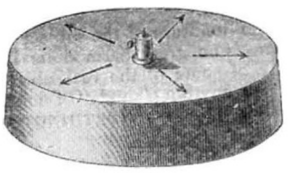

FIG. 19.—Another pivoted disk with flange to dip into liquid so as to make contact all round its rim. It rotates when a magnet is brought above or below; or even in the field of the earth.

Instead of a disk one may use a single radius of it, viz. a pivoted arm (Fig. 20) dipping into a circular trough of mercury; or we may use a light sphere rolling on two concentric circular lines of railway (Gore's arrangement, Fig. 21). In every case rotation begins as soon as a magnet is brought near.

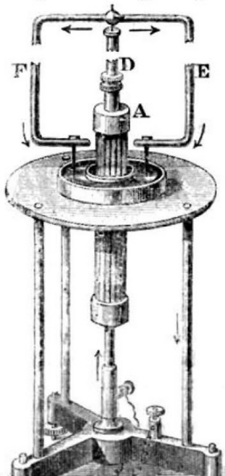

FIG. 20.—A couple of radii of the above disk provided with points to dip into mercury, and rotating constantly under the influence of the steel magnet A.

Nor is the revolving action confined to metallic conductors and to true conduction. Liquids and gases, although they convey electricity by something of the nature of convection, are susceptible to rotation in a precisely similar manner.

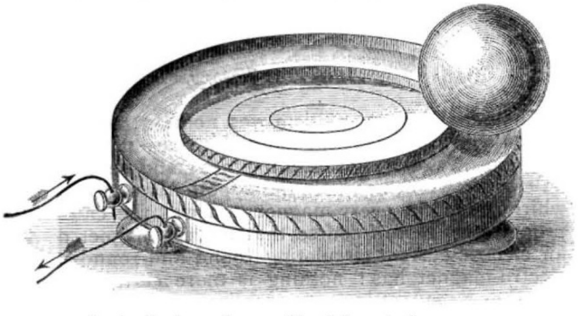

FIG. 21.—Gore's circular railway. The light spherical metal ball revolves round the two concentric metal hoops or rails whenever it is made to convey a current between them in a vertical magnetic field.

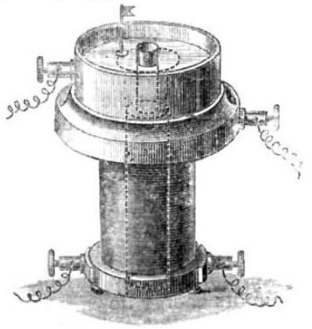

FIG. 22.—Rotation of a liquid disk conveying a radial current in a vertical magnetic field.

To show the rotation of liquid conductors under the influence of a magnet, take a circular shallow trough of liquid, supply it with electrodes at centre and circumference, and put the pole of a magnet below it. The liquid at once begins to rotate, and by using a magnet and current of fair strength can easily be made to whirl so fast as to fly over the edge of the trough (Fig. 22). The experiment is plainly the same as Fig. 19, except that a liquid disk is used in place of a solid one. Or, again, it may be considered the same as Fig. 20. Reverse the magnet, and the rotation is rapidly reversed.

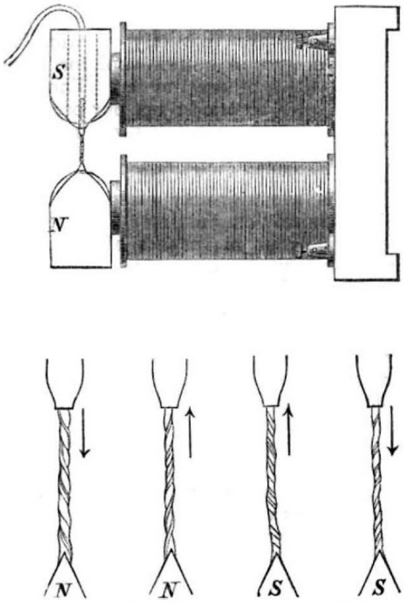

FIG. 23.—A falling stream of liquid conveying a current between two magnetic poles, and being thereby twisted into a spiral. (Copied from a paper in Phil. Mag. by Dr. Silvanus Thompson).

Another method is to send a current along a jet of mercury near a magnet and note the behaviour of the jet. It twists itself into a flat spiral as shown in Fig. 23.

FIG. 24.—Induction coil discharge from *a* to *b* through rarefied gas, rotating round a glass-protected magnetized iron rod.

The rotation of a gas discharge is most commonly illustrated by an arrangement like Fig. 24, where the terminals of the induction coil are connected to the rarefied gas respectively above one pole and round the middle of a magnetized bar. If the discharge can be got to concentrate itself principally down one side, the line of light so formed is seen to revolve.

Action between a Magnet and an Electric Charge in Relative Motion.

From all this it is not to be doubted that a charged pith ball moving in the neighbourhood of a magnet is subject to the same action. There is no known action between a magnet and a *stationary* charged body, but directly either begins to move there is an action between them tending to cause one to rotate round the other. It is true that for ordinary speeds of motion this force is extremely small; but still it is not to be doubted that if a shower of charged pith balls or Lycopodium granules are dropped on to a magnet pole, they will fall, not perfectly straight, but slightly corkscrew fashion. And again, if a set of charged particles were projected horizontally and radially from the top of a magnet, their paths would revolve like the beams of a lighthouse. And if by any means their paths were kept straight, or deflected the other way, they would exert on the magnet an infinitesimal "couple," tending to make it spin on its own axis.

Conversely, if a magnet were spun on its axis rapidly by mechanical means, there is very little doubt but that it would act on charged bodies in its neighbourhood, tending to make them move radially either to or from it. This, however, is an experiment that ought to be tried; and the easiest way of trying it would be to suspend a sort of electrometer needle, electrified positive at one end and negative at the other, near the spinning magnet, and to look for a trace of deflection—to be reversed when the spin is reversed. A magnet of varying strength might be easier to try than a spinning one.

Rotation of a Magnet by a Current.

The easiest way to show the actual rotation of a magnet is to send a current half way along it and back outside. Thus, take a small, round, polished steel bar-magnet with pointed ends, pivot it vertically, and touch it steadily with two flakes or light pads of tin-foil, one near either end and one near the middle; supply a current by these contact pieces, and the magnet spins with great rapidity. Reverse the current, and it rotates the other way. Conversely, by producing the rotation mechanically a current will be excited in a wire joining the two pieces of tin-foil (Figs. 25, 26, and 27).

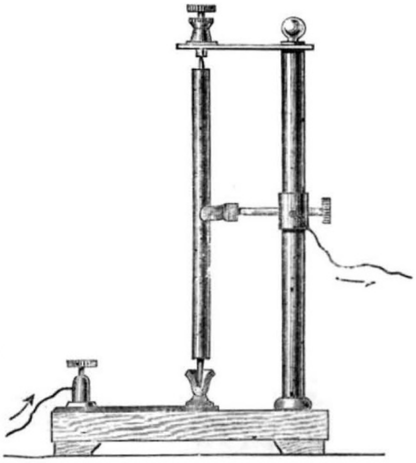

FIG. 25.—Round bright steel bar-magnet pivoted at its ends, spinning rapidly on its axis under the influence of a current supplied to either the bottom or top pivot, or both, and removed near the middle by a scrap of tinfoil lightly touching it.

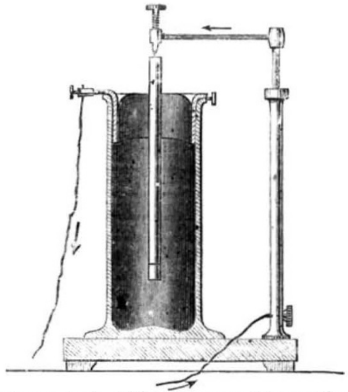

FIG. 26.—Another mode of exhibiting the same thing as Fig. 25. The magnet is loaded so as to float upright in mercury.

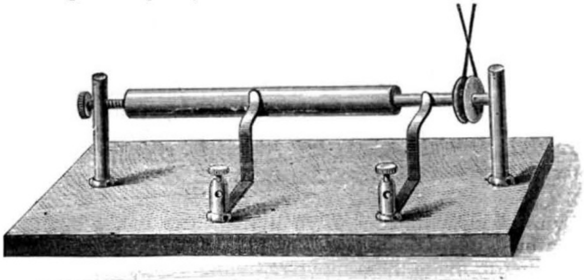

FIG. 27.—The converse of Fig. 25. Spinning the magnet mechanically give a current between two springs, one touching it near or beyond eithe end, the other touching it near middle.

Many more variations of the experiment could be shown, but these are typical ones, and will suffice. They all call attention to the fact that a magnet, considered electrically, is a rotatory phenomenon.

Ampère's Theory.

The idea that magnetism was nothing more nor less than a whirl of electricity is no new one—it is as old as Ampère. Perceiving that a magnet could be imitated by an electric whirl, he made the hypothesis that an electric whirl existed in every magnet and was the cause of its properties. Not of course that a steel magnet contains an electric current circulating round and round it, as an electro-magnet has: nothing is more certain than the fact that a magnet is not magnetized as a whole, but that each particle of it is magnetized, and that the actual magnet is merely an assemblage of polarized particles. The old and familiar experiment of breaking a magnet into pieces proves this. Each particle or molecule of the bar must have its circulating electric current, and then the properties of the whole are explained.

There is only one little difficulty which suggests itself in Ampère's theory—How are these molecular currents maintained? Long ago a similar difficulty was felt in astronomy—What maintains the motions of the planets? Spirits, vortices, and other contrivances were invented to keep them going.

But in the light of Galileo's mechanics the difficulty vanishes. Things continue in motion of themselves until they are stopped. Postulate no resistance, and motion is essentially perpetual.

What stops an ordinary current? Resistance. Start a current in a curtain ring, by any means, and leave it alone. It will run its energy down into heat in the space of half a second or so. But if the metal conducted infinitely well there would be no such dissipation of energy, and the current would be permanent.

In a metal rod, electricity has to pass from atom to atom, and it meets with resistance in so doing; but who is to say that the atoms themselves do not conduct perfectly? They are known to have various infinite properties already: they are infinitely elastic, for instance. Pack up a box of gas in cotton-wool for a century, and see whether it has got any cooler. The experiment, if practicable, should be tried; but our present experience warrants us in assuming no loss of motion among the colliding atoms until the contrary has been definitely proved by experiment. To all intents and purposes *certainly* atoms are infinitely elastic: why should they not also be infinitely conducting? Why should dissipation of energy occur in respect of an electric current circulating wholly inside an atom? There is no known reason why it should. There are many analogies against it.

How did these currents originate? We may as well ask, How did any of their properties originate? How did their motion originate? These questions are unanswerable. Suffice it for us, there they are. The atoms of a particular substance—iron for instance, or zinc—have an electric whirl of certain strength circulating in them as one of their specific physical properties.

This much is certain, that the Ampèrian currents are not producible by magnetic experiments. When a piece of steel or iron is magnetized, the act of magnetization is not an excitation of Ampèrian current in each molecule—is not in any sense a magnetization of each molecule. The molecules were all fully magnetized to begin with: the act of magnetization consists merely in facing them round so as to look mainly one way—in polarizing them, in fact. This was proved by Beetz long ago; I will not stop to explain it further, but will refer students to Maxwell.

Ampère's Theory extended by Weber to explain Diamagnetism also.

Let us see how far we have got. We have made the following assertions:—

(1) That a magnet consists of an assemblage of polarized molecules.

(2) That these molecules are each of them permanent magnets, whether the substance be in its ordinary or in its magnetized condition, and that the act of magnetization consists in turning them round so as to face more or less one way.

(3) That when all the molecules are faced in the same direction the substance is magnetically completely saturated.

(4) That if each molecule of a definite substance contains an electric current of definite strength circulating in a channel of infinite conductivity the magnetic behaviour of the substance is completely explained.

But now, supposing all this granted, how comes it that the molecular currents are not capable of being generated by magnetic induction? And if we cannot excite them, are we able to vary their strength?

The answer to these questions is included in the following propositions, which I will now for convenience state, and then proceed to explain and justify.

(5) If a substance possessing these molecular currents be immersed in a magnetic field, all those molecules which are able to turn and look along the lines of force in the right direction will have their currents weakened; but on withdrawal from the field they will regain their normal strength.

(6) If the currents flowing in the conducting channels be feeble or *nil*, the act of immersion of the substance in a magnetic field will reverse them or excite *opposite* currents, which will last so long as the body remains in the field, but will be destroyed by its removal.

(7) The molecular currents so magnetically induced are sufficient to explain the phenomena of *diamagnetism*.

Let us first just recall to mind the well-known elementary facts of current induction. A conducting circuit, such as a ring or a coil of wire, suddenly brought near a current-conveying coil or a magnet, has a momentary current induced in it in the opposite direction to the inducing current—in other words, such as to cause momentary repulsion between the two. So long as it remains steady, nothing further happens; but on withdrawing it another momentary current is induced in it in the contrary direction to that first excited. The shortest way of expressing the facts quite generally is to say that while from any cause the magnetic field through a conductor is increasing in strength a current is excited in it tending to drive it out of the field: the disturbance is only temporary, but whenever the magnetic field decreases again to its old value a reverse flow of precisely the same quantity of electricity occurs. Fig. 28 shows a mode of illustrating the facts. A copper disk is supported at the end of a torsion arm and brought close to the face of an unexcited bar electro-magnet. On exciting the magnet the disk is driven violently away: to be sucked back again, however, whenever the magnetism ceases.

Now, why are all these effects so momentary? What makes the induced current cease so soon after excitation? Nothing but dissipation of energy: only the friction of imperfect conductivity. There is nothing to maintain the current: it meets with resistance in its flow through the metal, and so it soon stops.

But in a perfect conductor like a molecule no such dissipation would occur. Electricity in such a body will obey the first law of motion, and continue to flow till stopped. Destroying the magnetic field will stop an induced molecular current, but nothing else will stop it. Hence it follows that the repulsion experienced is no transitory effect like that in Fig. 28, but is as permanent as the magnetic field which excites and exhibits it.

Thus, then, a body whose molecules are perfectly conducting, but without specific current circulating in them, will behave diamagnetically, *i.e.* will move away from strong parts of the field towards weak ones, and thereby set its length equatorially, just as bismuth is known to do.

Whether this be the true explanation of diamagnetism or not, it is at least a possible one. It is known as Weber's theory.

It does not necessarily follow that the specific molecular currents of a diamagnetic substance are really *nil;* all that is needful is that they shall be weaker than those induced by an ordinary magnetic field. By using an extremely weak field, however, the specific currents need not be quite neutralized, and in such a field the body ought to behave as a very feebly magnetic substance. Such an effect has been looked for (see NATURE, vol. xxxv. p. 484).

One loop-hole there is, however, viz. that every molecule may be so jammed as to be unable to turn round, and such a substance could hardly exhibit any noticeable magnetic properties. The molecules would have got themselves into a state of minimum potential energy, and if jammed therein nothing could be got out of them. The induced currents of diamagnetism would be superposed upon them just as if no initial molecular currents existed. By varying the temperature of such a substance, however, one might expect to alter their arrangement, and so develop magnetic properties in it, just as electrical properties are developed in crystals like tourmaline by heat or by cold.

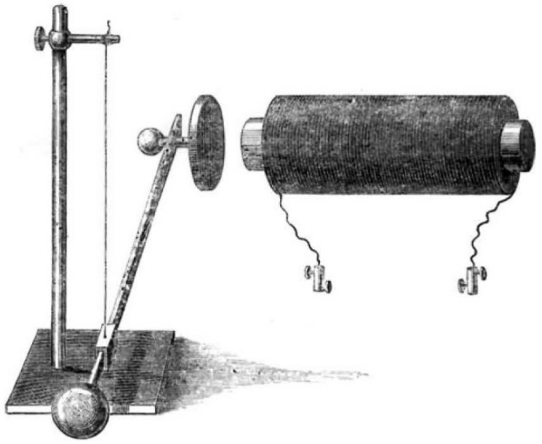

FIG. 28.—Stout disk of copper supported on a horizontal arm near one pole of a bar electro-magnet. The disk is repelled every time the magnet is excited, and is attracted while the magnetism is destroyed.

We are now able clearly to appreciate this much—that the molecular currents needful to explain magnetism are not conceivably excited by the act of magnetization, for they are in the wrong direction. *Induced* molecular currents will be such as to cause repulsion: those which cause attraction must have existed there before, and be merely rotated into fresh positions by the magnetizing force.

Function of the Iron in a Magnet. Two Modes of expressing it.

We can now explain the function of iron, or other magnetic substance, in strengthening a magnetic field. Take a circular coil of wire, Fig. 29, and send a current round it: there is a certain field—a certain number of lines of force—between its faces. Fill the coil with iron, so as to make it a common electro-magnet, and the strength of the field is greatly increased. Why? The common mode of statement likens the magnetic circuit to a voltaic circuit; there is a certain magneto-motive force, and a certain resistance: the quotient gives the resulting magnetic induction, or total number of lines of force. Iron is more permeable than air—say, 300 times more permeable—and accordingly the resistance of the iron part of the circuit is almost negligible in comparison with that of the air-gap between the poles. Thus a good approximation to the total intensity of field is obtained by dividing the magneto-motive force by the width of the air-gap; or more completely and generally by treating the varying material and section of a magnetic circuit just as the varying material and section of a voltaic circuit is treated, and so obtaining its total resistance. Iron is thus to be regarded as a magnetic conductor some 300 times better than air.

This mode of regarding the case is undoubtedly simple and convenient, but it is not the fundamental mode. If we look at it less with a view to practical simplicity than with the aim of seeing what is really going on, we shall express it thus:—

Before the iron was inserted in the coil there were a certain number of circular lines of force inside it due to the current alone. A piece of common iron, although full of polarized molecules, has no external or serviceable lines of force: they are all shut up, as it were, into little closed circuits inside the iron. But directly the iron finds itself in a magnetic field some of these open out, a chain of polarized molecules is formed, and the lines due to its molecular currents add themselves to those belonging to the current of the magnetizing helix.

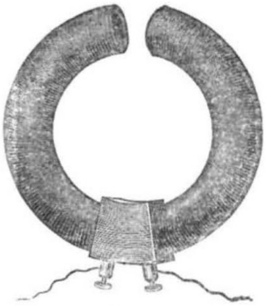

FIG. 29.

Thus our ring electro-magnet has now not only its own old lines of force, but a great many of those belonging to the iron which have sympathetically laid themselves alongside the first.

The end result of either mode of regarding the matter is of course the same—the lines of force between the poles are increased in number by the presence of iron; but whereas, in the first-mentioned mode of treatment, the fact of permeability had to be accepted unexplained, in the second nothing is unexplained except the fundamental facts of the subject, such as the reason why currents tend to set themselves with their axes parallel, and other matters of that sort.

Electrical Momentum once more.

There is just one point which I must stop here to call attention to. The theories of magnetism and diamagnetism, which I have given according to Ampère, Weber, and Maxwell, require as their foundation that in a perfect conductor electricity shall obey the first law of motion—shall continue to flow until stopped by force. But the property of matter which enables it to do this is called *inertia;* the law is called the law of inertia; and anything which behaves in this way must be granted to possess inertia.

It would not do to deduce so important a fact from a yet unverified theory; but at least one must notice that it is essentially involved in Ampère's theory of magnetism. It is the only theory of magnetism yet formulated, and it breaks down unless electricity possesses inertia.

Nevertheless it is a fact that an electro-magnet does not behave in the least like a fly-wheel or spinning-top: there is no momentum mechanically discoverable. Supposing this should turn out to be strictly and finally true, we must admit that a molecular electric current consists of two equal opposite streams of the two kinds of electricity: one must begin to regard negative electricity not as merely the negation or defect of positive, but as a separate entity. Its relation to positive may turn out to be something more like that of sodium to chlorine than that of cold to heat.

I said that no effect due to electric inertia was *mechanically* discoverable, but that is perhaps too sweeping a statement. Think of a couple of india-rubber pipes tied together so as to form a double tube, and through each propel a current of water, one in an opposite direction to the other. Although the double current has no gyrostatic properties, yet the water exhibits momentum, even when the current is quite steady, by its effect on kinks and bends and curves in the tube: these all tend to straighten or smooth themselves out, and the tube if quite free would become a perfect circle.

Precisely the same effect can be observed with a flexible conducting wire or gold thread. Throw a loop of very light flexible thinly-covered stranded wire at random on a glass slab, and pass a strong current through it: it will tend to round off its sharp corners, open out its tangled loops, and do its best to become a perfect circle; and this quite independently of the earth's field, in accordance with the principle numbered 3 on page 8. It will be at once objected that this effect, in the case of the wire, is due to something going on in the medium surrounded by it, and not simply to the inertia of anything in the conducting channel itself, as in the water case. The objection is, of course, perfectly valid, but nevertheless the effect is one worth bearing in mind; and its ultimate explanation may lead us to postulate inertia quite as essentially though not so superficially as the crude hydraulic analogy suggests.

So long as one considered the flow of electricity in ordinary conductors, we could partially avoid the question of inertia by considering it urged forward at every point with a force sufficient to overcome the resistance there and no more; but though this explained the shape of the stream-lines (Fig. 15) yet it did not suffice to render clear the phenomena of self-induction—the lag of the interior electricity in a wire behind the outside until definitely pushed; and still more its temporary persistence in motion after the pushing force has ceased.

But, now that we are dealing with perfect conductors with no pushing force at all, the persistence of molecular currents without inertia, or an equivalent property so like it as to be rightly called by the same name at present, becomes inexplicable. True, the molecular currents are as yet an hypothesis; and that is the only loop-hole out of a definite conclusion.

OLIVER J. LODGE.

(*To be continued.*)

DISCOVERY OF DIAMONDS IN A METEORIC STONE.

IN a Russian paper of October 22 last appears a preliminary report of the examination by Latschinof and Jerofeief, Professors of Mineralogy and Chemistry respectively, of a meteoric stone weighing 4 lbs., which fell in the district of Krasnoslobodsk, Government of Pensa, Russia, on September 4, 1886.

In the insoluble residue small corpuscles showing traces of polarization were observed; they are harder than corundum, and have the density and other characters