New Theory of Magnetism

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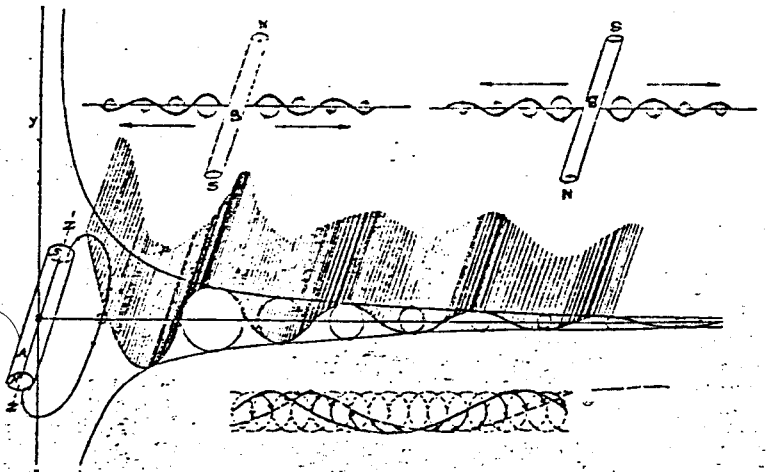
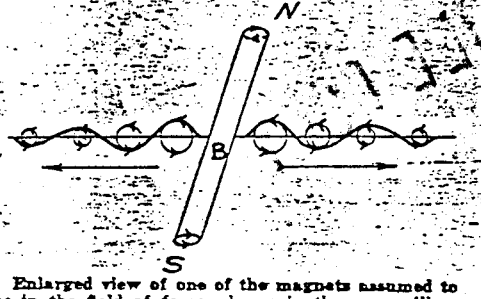
IT is scarcely necessary to point out to the readers of PRACTICAL ELECTRICS that although we have had many notable treatises on magnetism since the first great work published in the year 1600 by Dr. Gilbert, of Colchester, physician to Queen Elizabeth, yet in all these modern treatises not a single explanation worthy of the name has been offered on the *cause* of magnetism! The result is a great need for a working theory of magnetism which will enable us to see what is going on in the field about a magnet.

The theory herein set forth was developed by the writer in 1916, and first published in a work entitled *Electrodynamic Wave-Theory of Physical Forces*, Vol. I, 170 pages, Boston, London and Paris, 1917; but has recently been extended in a series of papers on the *New Theory of Æther* just appearing in the *Astronomische Nachrichten*, the international journal of astronomy at Kiel, which is now in its hundredth year and 212th volume. As the *New Theory of the Æther* is a very extensive work of highly mathematical character, we are obliged to restrict the discussion to very simple outlines which will convey clear ideas to our minds.



1. The magnetic field of force and its effect upon, and the reaction between it and magnets adjacent to it. Decreased attraction in the left hand magnet, and increased attraction in the right hand one.



Enlarged view of one of the magnets assumed to be in the field of force, shown in the upper illustration immediately above the field.

For a long time it has been known that all matter sends out a peculiar influence or *flux of energy*, which acts on other bodies; and ever since the publication of Sir Isaac Newton's *Principia*, 1687, it has been shown that all actions are mutual. Thus any influence exerted by one body on another will be based on the interactions of the two bodies, through the Etherial Medium enveloping both masses.

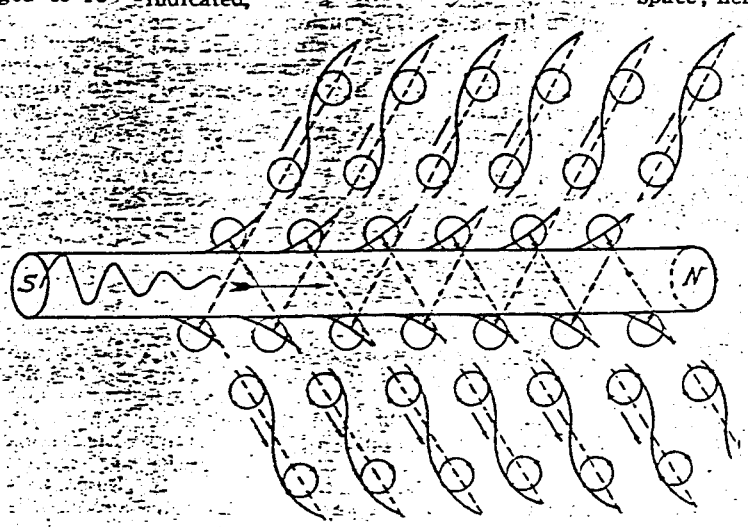
About 1850 it was discovered by the celebrated English electrician, Faraday, that all bodies are magnetic, but in varying degrees. Iron, steel and nickel are typical metals with strongly magnetic properties, and as far back as 1822 the celebrated French physicist, Ampère, explained magnetism by elementary electric currents circulating about the atoms. In the year 1917 the writer was able to show that this Ampère theory is identical with the modern wave-theory, in which the atoms are supposed to be vibrating and incessantly sending out waves through the surrounding aether.

When emitted violently the atoms [illegible]

and light. Accordingly, why may not these short waves correspond to parts of the longer waves of magnetism and of gravitation? Such was the question which has at length led to the very remarkable new theory of the ether, with simple and direct explanation of magnetism and electrodynamic action.

In the accompanying figure 1 we have outlined the body of a simple bar magnet, and also traced in detail the type of waves supposed to recede away from the magnet in the equatorial plane. It will be remembered that although the great mathematical physicist J. Clerk Maxwell was able to show that certain stresses are at work in the ether about a magnet, by which the lines of force tend to shorten themselves, he was unable to conceive of any physical cause for the action. Maxwell had not thought of waves of the type here imagined.

It is easily shown (cf. *Astron. Nachr.*, No. 5044, p. 54, May, 1920) that the *amplitude* of the waves follows the law here indicated,



2. The field of force surrounding a wire through which a current is passing, giving in diagram the effect upon the ether.

$$A = \frac{k}{r} \qquad (1)$$

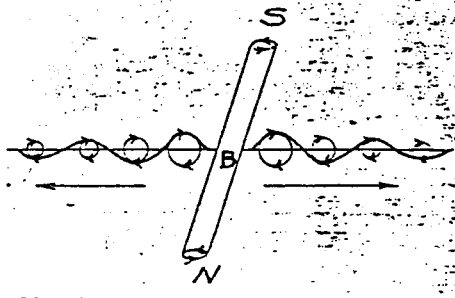
or varies inversely as the distance.

And it is proved in works on physics that the energy of the waves *is proportional to the square of the amplitude*, and thus the force they exert becomes simply:

This is the formula for gravitation, magnetism and similar forces which follow the law of the inverse squares.

Now it is very remarkable that the chief forces in nature vary inversely as the square of the distance. From this fact we know that if waves be the cause of the forces, the waves have to have amplitudes varying inversely as the distance, as shown in equation 1 above.

To deduce the law of the wave amplitude (1) in tridimensional space we proceed as follows: The displacement of any particle of a medium due to wave motion, of a given wave length, is independent of the periodic time; and since the oscillatory orbits of the particles are described in equal times, under continuous flow of the waves, these orbits will be proportional to the displacements or other homologous lines pertaining to the peri-



The other magnet on an enlarged scale, as shown to the right in the upper illustration.

odic paths of the particles. Let the velocities of the moving particles be v, and m their mass; then their kinetic energies will be represented by $1/2\ mv^2$. In the spherical expansion of the ether waves there will be no loss of energy in free space; hence on two successive sphere surfaces of thickness dr, the energies are equal, so that we have:

$$4\pi r^2 \cdot \tfrac{1}{2} m v^2 = 4\pi r'^2 \cdot \tfrac{1}{2} m v'^2 \qquad (3)$$

or

$$v^2 : v'^2 = r'^2 : r^2 \qquad (4)$$

The kinetic energy of the vibrating molecules varies inversely as the square of the distance. But the velocity varies also as the amplitude, in simple harmonic motion; therefore, for the amplitudes A' and A", corresponding to the radii r' and r", we have by taking the square root in equation (4)

$$A' : A'' = r'' : r' \qquad (5)$$

$$A' = \frac{A'r'}{r'} = \frac{k'}{r'} \qquad (6)$$

Accordingly the amplitude or side displacement becomes

$$A = \frac{k}{r} \qquad (7)$$

as shown in the accompanying figure 1.

To understand the mechanism of magnetism, imagine waves receding away from the larger magnet, as shown in the diagram, and let the smaller magnet (B) present opposite poles. This corresponds to the case of attraction. The waves from the small magnet (B) rotate in the oppo-

penetrate, they undo one another as far possible at every point of the wave-

Thus the larger waves tend to collapse when the smaller waves run through them; and this collapse or contraction gives rise to pulling. Such a *contraction* of the ether between the bodies is what we call *attraction*. The action when the ether contracts is like that of a stretched piece of India rubber—it pulls the bodies together, by forces depending on the two magnets, their size and power, or degree of perfection of magnetization.

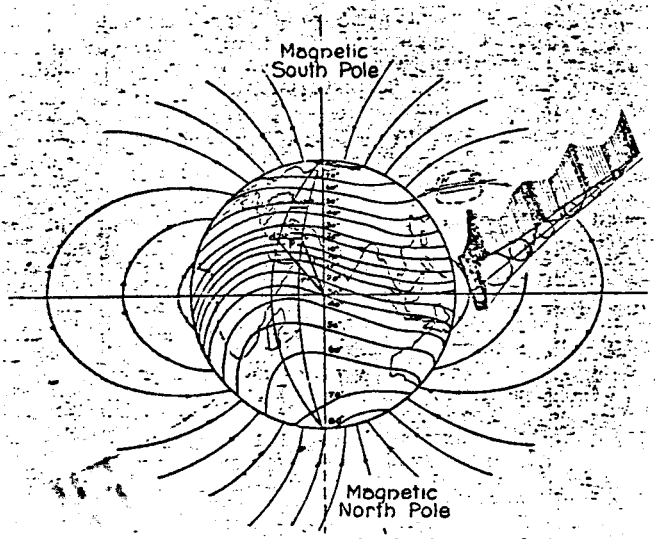
It is shown in the Wave-Theory (A. N. [illegible] p. 55) that the light travels 904,000 times faster than sound, from which it follows that the aether is 689,321,000,000 times more elastic than air in proportion to its density. This number is enormous, and as the waves travel in free space with the velocity of light, and accumulate power by mere superposition, in proportion to the mass, or the number of atoms from which the waves proceed, we perceive that the action will depend directly on the mass, as in Newton's law of gravitation. Moreover, the intensity of the force will vary inversely as the square of the distance. This gives, therefore, a perfect explanation of the attraction of magnets which present opposite poles.

Let us now consider the cause of *repulsion*, when like poles are presented, which is exhibited in the second case on the right, in the same diagram. In this second case the waves from (B) rotate in the same sense as those from the larger magnet (A). When such waves interpenetrate, with the superposed rotations at every point in the same direction, the set of waves adds to the amplitudes of the other set: and the result is increased agitation of the æther, which thus tends to *expand* this medium between the two bodies. This expansive tendency of the æther thus gives rise to *repulsion*, and the magnets tend to push one another away. Thus we have a simple explanation of repulsion when like poles are presented.

Accordingly, we have a simple explanation of both attraction and repulsion, which no one has been able to devise heretofore. An explanation based on waves which is simple and direct has so much to commend it that we may presume it the true cause of the phenomenon. It thus appears as if we have at last discovered the cause of *magnetism*, and finally of electrodynamic action and universal gravitation.

An experiment by Dolbear (*Matter, Ether and Motion*, Boston, 1894, p. 95) throws great light on the tendency of Faraday's lines of force to shorten themselves.

"If a dozen disks five or six inches in diameter are set loosely an inch apart upon a spindle a foot long, so that they may be rotated fast, yet left free to move longitudinally upon the spindle, they will all crowd up close together as the pressure is less between them than outside. If one can imagine the spindle to be flexible and the ends brought opposite each other while rotating, it will be seen that the ends would exhibit an apparent attraction for each other, and, if free to approach, would close up, thus making a vortex ring, with the sections of the disks. If the axis of the disks were shrinkable, the whole thing would contract to a minimum size that would be determined by the rapidity of the rotary movement, in which case not only would it be plain why the ring form was maintained, but why the diameter of the ring as a whole should shrink. So long as it is rotated it would keep up a stress in the air about it. So far as the experimental evidence goes, it appears that a vortex ring in the air exhibits the phenomenon in question."



3. Magnetic field of the earth, showing how exactly it compares with the ether waves already illustrated and described

Now, according to the wave-theory, every line of force about a magnet is an axis of a rotating filament or ether vortex, and thus the lines of force tend to shorten themselves, as in Dolbear's experiment. The lines of force in the form of circles surround a wire bearing a current, which means that the wave rotations are flat in the planes passing through the axis of the wire. This arrangement is shown in figure 2. And as the magnet also sends out waves flat in the equatorial plane, at right angles to the magnetic axis, we see why a magnetic needle sets itself at right angles to the axis of the wire bearing the current, as first noticed by Oersted in 1819.

If we examine figure 2 we notice that the rotations in the waves above are opposite to the ones below. Hence, when two currents flow in the same direction the collapse of the ether waves between the wires causes the wires to attract, which conforms to observation. When the currents flow in opposite direction the rotations of the waves between the wires are in the same direction, and by the increase of amplitude thus arising, the ether expands itself, so that the wires repel, in accordance with observation.

Accordingly, waves are the cause of electrodynamic action. It only remains to add figure 3, to illustrate the wave field of the earth's magnetism. It should be noted, as shown by Gauss, 1838, that the waves receding from the earth depend on 1/1380th part of the atoms of our globe. These atoms are lined up in parallel planes—the other 1379/1380ths being arranged with their planes lying haphazard, and producing the central action of gravitation.

With the rotations of their waves directed so as to harmonize mutually, the compass needle lies in the hollow of the receding earth waves, and thus pointing steadily to the Pole, guides the mariner safely over the trackless sea. This gives a very direct and simple explanation of the earth's magnetic field. The wave field about the globe is so very beautiful to behold that we cannot but regret it was not made known to us long ago. But who will show it to us?