IV. "Luminosity and Photometry." By JOHN BERRY HAYCRAFT, M.D., University College, Cardiff. Communicated by Professor SCHÄFER, F.R.S.

"Experiments on the Absence of Mechanical Connection between Ether and Matter." By OLIVER LODGE, D.Sc., F.R.S., Professor of Physics, University College, Liverpool. Received January 19,—Read March 4, 1897.

(Abstract.)

The author gives an abbreviated account of a long series of experiments conducted by himself and his assistant, Mr. Davies, in continuation of those related in 'Phil. Trans.,' A, 1893 (Aberration Problems, &c.). The method consists in bifurcating a beam of light, and sending each half in opposite directions round a closed periphery very near a rapidly rotating mass of matter, and then observing by means of interference fringes whether the velocity of light is affected in the slightest degree by this neighbourhood of moving matter. The steel disks have been now whirled to higher speeds, chiefly at 3000 revolutions a minute; the steadiness of the machine and the definition of the bands have been improved, other minor improvements have been made, and a long series of micrometric readings have been taken, both at increasing and at decreasing speeds.

Further, the steel disks have been replaced by a much more massive lump of iron, weighing $\frac{3}{4}$ ton, with a narrower channel for the light to travel in; and the bands have been observed close up to the moving surface, and even when reflected in it. The rotation was also continued for some hours to see if by chance *time* had any influence.

Moreover, the iron mass was strongly magnetised by a steady current, so that the light travelled across a moving magnetic field; and lastly the steel disks were replaced, with an insulated third disk between them, and strongly electrified, so that the beam of light travelled across a moving electrostatic field. After a number of spurious disturbances had been gradually eliminated, the author finds that in none of these ways is the velocity of light at all appreciably affected, and accordingly concludes that there is no viscous connexion between the ether and matter of observable magnitude; *i.e.*, that whatever motion moving matter may confer upon the ether must be of an irrotational kind. It was demonstrated theoretically in the previous memoir that no optical experiments could be competent to detect motion of this latter character, and accordingly no attempt has

been made to look for any kind of motion except such as would be caused by something akin to viscosity.

Incidentally the author points out that by rotating the whole optical apparatus and observer, instead of the disks, at a very moderate speed, a shift of the bands should be seen; and even that the earth's rotation would with a large enough frame produce an effect, which latter, however, it appears difficult or impossible to observe, not on account of its smallness, but on account of its constancy.

The effect to be expected on Fresnel-Fizeau principles from whirling *air*, was unfortunately just too small for the author to safely observe. The residual disturbing causes just masked it, but it is probably not beyond the reach of another attempt with a still more thoroughly steady machine, if anyone feels inclined to persevere so far. At the same time if it be supposed that any microscopic trace of true ether effect still possibly exists (which the author wholly disbelieves), and if a further attempt be hereafter made to observe it, a number of slight residual disturbing causes would be got rid of (and probably other difficulties introduced) by rotating the machine in a vacuum.

## "Second Report on a Series of Specimens of the Deposits of the Nile Delta, obtained by Boring Operations undertaken by the Royal Society." By JOHN W. JUDD, C.B., LL.D., F.R.S., Professor of Geology in the Royal College of Science. Communicated by desire of the Delta Committee. Received February 11,—Read March 4, 1897.

The last report on the borings undertaken in the delta of the Nile under the auspices of the Royal Society was communicated to the Society by the direction of the Delta Committee on November 12, 1885, and published in No. 240 of the 'Proceedings.' This report dealt with the materials obtained from the three borings made at Kasr-el-Nil, at Kafr-ez-Zayat, and at Tantah, which reached depths of 45 feet, 84 feet, and 73 feet respectively. Although these borings made known to us the character of the delta deposits at greater depths than the explorations made by Mr. Leonard Horner and M. Linant de Bellefondes, yet none of them succeeded in reaching the solid rock on which these deposits lie, and in which the Nile Valley was originally excavated. It was therefore decided by the Delta Committee to make still more strenuous efforts to attain this result—a result which the sections published by Figari Bey, said to be based on borings made for the purpose, led the Committee to believe might be arrived at with a moderate expenditure.

In their attempts to carry out this important work, the Delta Com-

mittee have received the most valuable aid from the Secretary of State for War, the Inspector-General of Fortifications, and the officers of the detachment of the Royal Engineers attached to the Army of Occupation in Egypt; and their thanks are especially due to Colonel Turner, R.E., Captain Dickenson, R.E., Lieutenant Godly, R.E., and Corporal Bellinger, R.E. To the Egyptian Railway Administration the Committee is indebted for permission to choose a site for boring on their land, and for much assistance given from time to time.

Zagazig having been chosen by the Royal Society Committee as a suitable site for the next attempt to penetrate the delta deposits, a Legrand-and-Sutcliffe boring apparatus, which had already been set up and tested at Kasr-el-Nil, was brought to the selected locality, and arrangements were made for carrying the boring to the depth of 100 feet with a 5-inch lining tube, and to another 100 feet with a 4-inch tube. It was considered certain at that time—and many published statements supported the belief—that the solid rock of the Nile Valley could not fail to be met with at a depth of *less than* 200 feet. The spot where the boring commenced had an elevation of 26 feet 1 inch above the sea-level at Alexandria, as determined by the Egyptian Public Works Department.

A pit having been dug to the depth of 8 feet, and a platform erected over it, the 5-inch pipes were driven in and carried without any great difficulty to a depth of 97 feet from the surface. At this depth a 4-inch pipe was driven within the other, and the boring operations were proceeded with. When, however, a depth of 190 feet 6 inches had been reached, it was found impossible to drive the pipe farther, its bottom being still in a quicksand. Thus the work, which had been commenced on May 7, 1886, had to be discontinued on August 14 of the same year.

On the recommendation of Captain Dickenson, R.E., who had so ably and successfully directed these operations, it was decided by the Delta Committee to resume the work at this borehole in the following year, with a 3-inch pipe. The necessary apparatus having been sent out, the work was resumed on April 21, 1887, and by vigorous and skilful efforts carried to a depth of 339 feet 6 inches.

At that point, however, it was found impossible to drive the 3-inch pipe farther, but a rod was pushed down 5 feet 6 inches without reaching solid rock: the exploration thus attained a total depth from the surface of 345 feet, or 319 feet below the sea-level.

From the surface to a depth of 115 feet the strata passed through in the Zagazig boring closely resembled those already reported upon as occurring in the three earlier borings of Kasr-el-Nil, Kafr-ez-Zayat and Tantah, and consisted of alternations of desert-sand and Nile-mud. All the samples sent home have been carefully