Assuming Archdeacon Pratt's area 397.7 miles (which, however, is irreconcilable with his centre of gravity, deduced without either rectangle or parabola), I find the pressure on the crown of the arch to be 6213 miles of rock.

This cannot crush an igneous rock, which will bear 115,755 miles of its own material, as may be inferred from the following experiment of Tredgold:

"It required a weight of 24,556 lbs. avoirdupois to crush a cube of Aberdeen granite 1½ inch side, and spec. grav. 2.625."

In the equation (Phil. Mag. p. 347, foot of page) the coefficient 2 is left out before \((h + a \text{ versin } \theta)\), an error which affects nearly all the figures of page 348; but as this numerical inaccuracy does not seriously affect the result obtained by Archdeacon Pratt, I lay no stress upon it.

Trinity College, Dublin,
November 10, 1859.

Samuel Haughton.

LXIV. On the bearing of the Phenomena of Diffraction on the Direction of the Vibrations of Polarized Light, with Remarks on the Paper of Professor F. Eisenlohr. By Professor G. G. Stokes*.

The appearance in the Philosophical Magazine for September of a translation of Professor F. Eisenlohr's paper in the 104th volume of Poggendorff's Annalen, induces me to offer some remarks on the subject there treated of.

Had my paper "On the Dynamical Theory of Diffraction†" been accessible to M. Eisenlohr at the time when he wrote, he would have seen that I did not content myself with merely resolving the vibrations of the incident light in directions parallel and perpendicular to the diffracted ray, and neglecting the former component, as competent to produce only normal vibrations, but that I gave a rigorous dynamical solution of the problem, in which the normal vibrations, or their imaginary representatives, as well as the transversal vibrations, were fully taken into account, though the result of the investigation showed that, in case of diffraction in one and the same medium (the only case investigated), the state of polarization of the diffracted ray was independent of the normal vibrations. M. Eisenlohr's result, on the other hand, confessedly rests on the assumption that the diffracted ray may be regarded as produced by an incident ray agreeing in direction of propagation with an incident ray which would produce the diffracted ray by regular refraction, but in direction of vibration (in the immediate neighbourhood of the

* Communicated by the Author.
On the Angle of Dock Gates and the Bee's Cell.  427

surface at which the diffraction takes place) with the actual incident ray. This assumption, though plausible at first sight, is altogether precarious; and since in the particular case of diffraction in one and the same medium it leads to a result at variance with that of a rigorous investigation, it cannot be admitted.

M. Eisenlohr's formula agrees no doubt very well with M. Holtzmann's experiments; but then it must be recollected that the formula contains a disposable constant, whereby such an agreement can in good measure be brought about. But in agreeing with these experiments, it is necessarily at variance with mine, in passing to which it is not allowable to change the value of the disposable constant. I can no more ignore the uniform result of my own experiments, than I am disposed to dispute the accuracy of M. Holtzmann's, made under different experimental circumstances. Whether the circumstances of his experiments or of mine made the nearer approach to the simplicity assumed in theory, or whether in both there did not exist experimental conditions sensibly influencing the result, but of such a nature that it would be impracticable to take account of them in theory, is a question which at present I think it would be premature to discuss. I still adhere to the opinion I formerly expressed*, that the whole question must be subjected to a thoroughly searching experimental investigation before physical conclusions can safely be drawn from the phenomena.


To the Editors of the Philosophical Magazine and Journal.

Gentlemen,

The question as to the proper angle at which dock gates should be placed so that the timber employed should yield the most favourable result, has often been discussed by mathematicians, and determined as a problem of maxima and minima. The angle has been found to be 109° 28' 16''.

A patient consideration of the properties of the cube and its partition, has led me to the fact that the geometrical solid formed by the union of two cubes, being a dodecahedron with twelve rhomboidal faces, produces angles affording the greatest amount of resistance.

The obtuse angle on the face of this dodecahedron produced by the union of two cubes as above mentioned, is the precise angle which affords the greatest resistance to water pressure in a dock gate.

* Phil. Mag. Ser. 4. vol. xiii. p. 159.