March 7, 1844.

The PRESIDENT in the Chair.

The following were balloted for and elected:—Henry Clutton, Samuel Hocking, Charles Ower, Thomas Brunton, and Captain George Evans, R.N., as Associates.

No. 496. "Remarks on the position of the neutral Axis of Beams." By Dr. Charles Schafhaeuti, Assoc. Inst. C. E.

Neutral
Axis of
Beams.

After the discussion on Mr. Colthurst's paper "On the neutral Axis of Beams," &c.,* it occurred to the author, that a pencil of polarized light was the most delicate test, for ascertaining the position of the neutral axis in a transparent body.

A pencil of polarized light, when analyzed in the common way, after having passed through a transparent body, develops the most vivid colours, whenever the molecular arrangement of the bar, or of the body through which the pencil is passing, is varied even in the smallest degree. If we therefore select a well annealed rectangular bar of glass, and transmit through its broader sides a pencil of polarized light, no colour whatever appears after analyzation. But if we make the smallest attempt to bend the rectangular bar, in a plane perpendicular to the incident pencil, a succession of stripes of vivid colours appears, at the same time, at the upper and the lower edges of the rectangular glass bar, ascending according to Newton's well known scale, towards the central axis of the glass bar, where the colours vanish into a divided black line, which is the neutral axis of the bar, where its molecules are in their unaffected state of perfect equilibrium. It is obvious, that it is only necessary to ascertain the position of this black line, by measurement, (which can be done with the greatest accuracy,) to obtain at the same time, the exact position of the neutral axis of the bar, which is to be found, as Mr. Colthurst has shown, in the centre of the section of the rectangular bar. The coloured stripes on the curved or dilated side of the bar, are found to be positive; the series of stripes, corresponding with the compression of the molecules, at the concave side, are always negative, exactly as theory would have predicted.

These colours, generated in homogeneous bodies, when pressure is applied to them, were discovered by Sir David Brewster as much as

* Vide 'Minutes of Proceedings,' 1841, page 118.

twenty-five years ago, and are minutely described in the 'Philosophical Transactions' for the year 1816 (page 160) and are investigated with the usual ingenuity of their discoverer. The value of these experiments, for the practical purposes of engineering, did not escape the mind of this sagacious observer, and he remarks very justly: "The experiments now described, furnish us with a method of rendering visible, and even of measuring, the mechanical changes which take place during the compression, dilation, or bending of transparent bodies. The tints produced by polarised light, are correct measures of the compressing and dilating forces, and by employing transparent gums of different elasticities, we may ascertain the changes which take place in bodies, before they are either broken or crushed. The subject, therefore, of the strength of materials, and the cohesion of solids, will derive new light from the principles already established."

"There is one practical application of these views which is particularly deserving of notice. In order to observe the manner in which stone arches yield to a superincumbent pressure, Dr. Robison executed several models in chalk, and deduced many general laws, relative to the internal forces by which they were crushed. If the arch stones of models are made of glass, or any other simply refracting substance, such as gum copal, &c., the intensity and direction of all the forces which are excited by a superincumbent load, in different parts of the arch, will be rendered visible, by exposing the model to polarised light. If different degrees of roughness are given to the touching surfaces of the voussoirs, the results may be observed, for any degree of friction at the joints. The intensity and direction of the compressing and dilating forces, which are excited in loading framings of carpentry, may be rendered visible in a similar manner."

Dr. Schafhaeutl wished to direct the attention of the Institution to this, not only because he believed Sir David Brewster's discoveries, and his remarks on them, were very highly interesting, and formed a good comment on Mr. Colthurst's paper, but particularly as the results of these discoveries allowed of a wider application, than that of ascertaining the position of the neutral axis of beams or bars only, and had been published so long ago by an Honorary Member of the Institution, and who was a bright ornament of every scientific body, which had the good fortune to rank him amongst its members.