sets of forces,

$$p^2 = \frac{n^2-n}{\rho a^3}\left\{(n+1)\,\mathrm{T} - \frac{2\mathrm{Q}^2}{\pi l^2 a}\right\}.$$

The influence of electrical charge in diminishing the stability of a cylinder for transverse disturbances may be readily illustrated by causing a jet of water from an elliptical aperture to pass along the axis of an insulated inductor-tube, which is placed in connexion with an electrical machine. The jet is marked with a recurrent pattern, fixed in space, whose wave-length represents the distance travelled by the water in the time of one vibration of type $n=2$. When the machine is worked, the pattern is thrust outwards along the jet, indicating a prolongation of the time of transverse vibration. The inductor should be placed no further from the nozzle than is necessary to prevent the passage of sparks, and must be short enough to allow the issue of the jet before its resolution into drops.

The value of T being known (81 C.G.S.), we may calculate what electrification is necessary to render a small raindrop of, say, 1 millimetre diameter unstable. The potential, expressed in electrostatic measure, is given by

$$\mathrm{V} = \frac{\mathrm{Q}}{a_0} = \sqrt{(16\pi a_0 \mathrm{T})} = 20.$$

The electromotive force of a Daniell cell is about ·004; so that an electrification of about 5000 cells would cause the division of the drop in question.

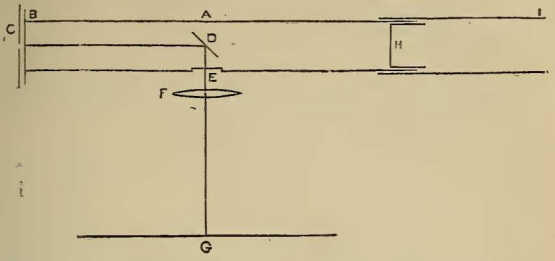
XXI. *On an Instrument capable of Measuring the Intensity of Aerial Vibrations.* *By* Lord Rayleigh, *F.R.S.**

THIS instrument arose out of an experiment described in the 'Proceedings of the Cambridge Philosophical Society'†, Nov. 1880, from which it appeared that a light disk, capable of rotation about a vertical diameter, tends with some decision to set itself at right angles to the direction of alternating aerial currents. In fig. 1, A is a brass tube closed at one end with a glass plate B, behind which is a slit C backed by a lamp. D is a light mirror with attached magnets, such as are used for reflecting-galvanometers, and is suspended by a silk fibre. The light from the slit is incident

* Communicated by the Author.

† See also Proc. Roy. Soc. May 5, 1881, p. 110.

upon the mirror at an angle of 45°, and, after reflection, escapes from the tube through a glass window at E. It then



falls upon a lens F, and throws an image of the slit upon a scale G. At a distance DH, equal to DC, the tube is closed by a diaphragm of tissue paper, beyond which it is acoustically prolonged by a sliding tube I.

When the instrument is exposed to sounds whose half wave-length is equal to C H, H becomes a node of the stationary vibrations, and the paper diaphragm offers but little impediment. Its office is to screen the suspended parts from accidental currents of air. At D there is a loop; and the mirror tends to set itself at right angles to the tube under the influence of the vibratory motion. This tendency is opposed by the magnetic forces; but the image upon the scale shifts its position through a distance proportional to the intensity of the action.

As in galvanometers, increased sensitiveness may be obtained by compensating the earth's magnetic force with an external magnet. Inasmuch, however, as the effect to be measured is not magnetic, it is better to obtain a small force of restitution by diminishing the moment of the suspended magnet, rather than by diminishing the intensity of the field in which it works. In this way the zero will be less liable to be affected by accidental magnetic disturbances.

So far as I have tested it hitherto, the performance of the instrument is satisfactory. What strikes one most in its use is the enormous disproportion that it reveals between sounds which, when heard consecutively, appear to be of the same order of magnitude.

June, 1882.

505
L85
MNT

THE

LONDON, EDINBURGH, AND DUBLIN

PHILOSOPHICAL MAGAZINE

AND

JOURNAL OF SCIENCE.

CONDUCTED BY

SIR ROBERT KANE, LL.D. F.R.S. M.R.I.A. F.C.S.

SIR WILLIAM THOMSON, KNT. LL.D. F.R.S. &c.

AND

WILLIAM FRANCIS, PH.D. F.L.S. F.R.A.S. F.C.S.

"Nec aranearum sane textus ideo melior quia ex se fila gignunt, nec noster vilior quia ex alienis libamus ut apes." JUST. LIPS. *Polit.* lib. i. cap. 1. Not.

VOL. XIV.—FIFTH SERIES.

JULY—DECEMBER 1882.

119983

DEC 16 1882

SMITHSONIAN DEPOSIT.

LONDON:

TAYLOR AND FRANCIS, RED LION COURT, FLEET STREET.

SOLD BY LONGMANS, GREEN, READER, AND DYER; KENT AND CO.; SIMPKIN, MARSHALL, AND CO.; AND WHITTAKER AND CO.;—AND BY ADAM AND CHARLES BLACK, AND THOMAS CLARK, EDINBURGH; SMITH AND SON, GLASGOW;—HODGES, FOSTER, AND CO., DUBLIN;—PUTNAM, NEW YORK;—AND ASHER AND CO., BERLIN.

"Meditationis est perscrutari occulta; contemplationis est admirari perspicua . . . . . Admiratio generat quæstionem, quæstio investigationem, investigatio inventionem."—*Hugo de S. Victore.*

—"Cur spirent venti, cur terra dehiscat,
Cur mare turgescat, pelago cur tantus amaror,
Cur caput obscura Phœbus ferrugine condat,
Quid toties diros cogat flagrare cometas,
Quid pariat nubes, veniant cur fulmina cœlo,
Quo micet igne Iris, superos quis conciat orbes
Tam vario motu."

J. B. Pinelli ad Mazonium.

CONTENTS OF VOL. XIV.

(FIFTH SERIES).

NUMBER LXXXV.—JULY 1882.

Page

Dr. E. J. Mills's Researches on Melting-point 1
Mr. C. V. Boys on Measurement of Curvature and Refractive Index. (Plate I.) 30
Professors Ayrton and Perry's Experiments on the Faure Accumulator 41
Professors Ayrton and Perry on a Simplified Dispersion-Photometer 45
MM. Warburg and v. Babo on the Connexion between Viscosity and Density in Fluids, especially Gaseous Fluids .. 51
Mr. F. D. Brown's Notes on Thermometry. (Plate II.) 57
Notices respecting New Books:—
Geological and Natural-History Survey of Canada, Director's Report for 1879–80 70
Dr. Geikie's Geological Sketches at Home and Abroad.. 71
Proceedings of the Geological Society:—
Prof. J. W. Judd on the Relations of the Eocene and Oligocene Strata in the Hampshire Basin 73
Science and Metaphysic, by Wyndham R. Dunstan, Vice-President of the Aristotelian Society, Demonstrator of Chemistry in the Laboratories of the Pharmaceutical Society .. 75
On the Depression of the Zero-point in Mercurial Thermometers, by J.-M. Crafts 76
On the Oscillations of the Plane of Polarization produced by the Discharge of a Battery: Simultaneity of the Electrical and Optical Phenomena, by D. Bichat and R. Blondlot .. 79

NUMBER LXXXVI.—AUGUST.

M. A. F. Sundell on Absolute Systems of Physical Units.... 81
Major Allan Cunningham on Moseley's Theory of Steady Flow 110
Mr. T. C. Mendenhall on the Influence of Time on the Change in the Resistance of the Carbon Disk of Edison's Tasimeter 115

Page
Mr. W. J. Lewis's Crystallographic Notes. (Plate III.) 119
Prof. R. Clausius on the Dimensions of a Unit of Magnetism in the Electrostatic System of Measures 124
M. H. Brongersma on Double Refraction, produced by Electrical Influence, in Glass and Bisulphide of Carbon. (Plate IV. fig. 5 *a–h*.) 127
Notices respecting New Books:—
(i) Mathematical Papers by William Kingdon Clifford; (ii) Mathematical Fragments, being Facsimiles of his unfinished Papers relating to the Theory of Graphs, by the late W. K. Clifford 135
Mr. T. Muir's Treatise on the Theory of Determinants, with graduated sets of Exercises for use in Colleges and Schools 140
Proceedings of the Geological Society:—
Mr. H. J. Johnston-Lavis on the Comparative Specific Gravities of Molten and Solidified Vesuvian Lavas .. 141
Mr. G. Attwood on the Geology of Costa Rica 141
Mr. S. V. Wood on the Newer Pliocene Period in England 142
Don M. F. de Castro on the Discovery of Triassic Fossils in the Sierra de Gador, Province of Almeria, Spain .. 146
Prof. C. Lapworth on the Girvan Succession.—Part I. Stratigraphical 147
Mr. E. Wilson on the Rhætics of Nottinghamshire 149
Dr. F. Schmidt on the Silurian and Cambrian Strata of the Baltic Provinces of Russia 150
Mr. T. F. Jamieson on the Cause of the Depression and Re-elevation of the Land during the Glacial Period .. 151
On some Explosive Alloys of Zinc and the Platinum Metals, by H. Sainte-Claire Deville and H. Debray 152
On the Reaction-current of the Electric Arc, by M. Jamin, with the assistance of M. G. Maneuvrier 154
On the Motion of a Spherical Atom in an Ideal Gas, by G. Lübeck 157

NUMBER LXXXVII.—SEPTEMBER.

MM. Elster and Geitel on the Electricity of Flame. (Plate IV. figs. 1–4) 161
Lord Rayleigh on the Equilibrium of Liquid Conducting Masses charged with Electricity 184
Lord Rayleigh on an Instrument capable of Measuring the Intensity of Aerial Vibrations 186
Dr. C. R. A. Wright on the Determination of Chemical Affinity in terms of Electromotive Force.—Part VI. 188
Mr. W. Baily on an Integrating Anemometer. (Plate V.) .. 212
Rev. O. Fisher on the Effect upon the Ocean-tides of a Liquid Substratum beneath the Earth's Crust 213

Page
Mr. J. J. Thomson on the Dimensions of a Magnetic Pole in the Electrostatic System of Units 225
Mr. F. J. Smith on a new Form of Magnetic Torsion-balance and Magnetometer 227
Notices respecting New Books:—
Dr. G. Lunge's Treatise on the Distillation of Coal-Tar and Ammoniacal Liquor 228
Mr. F. E. Hulme's Worked Examination Questions in Plane Geometrical Drawing 230
On the Duration of the Perception of Light in Direct and Indirect Vision, by Aug. Charpentier 230
On an Air-Thermometer whose Indications are independent of the Barometric Pressure, by Albert A. Michelson 233
On a Property of the Isentropic Curve for a Perfect Gas as drawn upon the Thermodynamic Surface of Pressure, Volume, and Temperature, by Francis E. Nipher 233
On the Influence of the Quantity of Gas dissolved in a Liquid upon its Surface-tension, by S. Wroblewski 236
On the Structure and Movement of Glaciers, by M. F.-A. Forel. 238

NUMBER LXXXVIII.—OCTOBER.

Mr. R. H. M. Bosanquet's Notes on Practical Electricity 241
Prof. G. Wiedemann on the Methods employed for determining the Ohm 258
Mr. L. Fletcher's Crystallographic Notes 276
Mr. E. Vansittart Neale on the Tails of Comets 292
Mr. Silas W. Holman on a Simple Method for Calibrating Thermometers 294
On Boltzmann's Theorem on the average Distribution of Energy in a System of Material Points 299
Mr. W. Le Conte Stevens's Notes on Physiological Optics .. 312
Notices respecting New Books:—
Mr. Latimer Clarke's Treatise on the Transit Instrument as applied to the Determination of Time 319
Geology of Wisconsin. Survey of 1873–79. Vol. III... 319
Dr. J. H. W. Stuckenberg's Life of Immanuel Kant.... 322
On the Conservation of Solar Energy, by Pliny Earle Chase, LL.D. 322
On the Appearances of the Electric Arc in the Vapour of Bisulphide of Carbon, by M. Jamin, with the assistance of M. G. Maneuvrier 324
On the Electric Resistance of Glass at Low Temperatures, by G. Foussereau 325
On the Surface-tension of some Liquids in contact with Carbonic Acid, by S. Wroblewski 327

NUMBER LXXXIX.—NOVEMBER.

Page
Lord Rayleigh's Comparison of Methods for the Determination of Resistances in Absolute Measure 329
Messrs. C. F. Cross and E. J. Bevan on the Correlation of the Chemistry of the Carbon Compounds with the Phenomena of Life 346
Dr. O. J. Lodge on the Dimensions of a Magnetic Pole in the Electrostatic System of Units 357
Dr. Eugen Goldstein on the Electric Discharge in Rarefied Gases 366
Mr. Ernest H. Cook on Carbon Dioxide as a Constituent of the Atmosphere 387
Mr. E. B. Sargant on the Dimensions of the Magnetic Pole in Electrostatic Measure 395
Notices respecting New Books :—
Mr. J. B. Stallo's Concepts and Theories of Modern Physics 396
On Dr. C. W. Siemens's new Theory of the Sun, by M. Faye .. 400
On the Connexion between the Gas-density and Stratum-interval in Geissler Tubes, by Dr. E. Goldstein 402
On the Elasticity of Rarefied Gases, by E. H. Amagat 403
On the Influence of Temperature upon the Spectra of Metalloids, by M. D. van Monckhoven 406
On a Thermoscopic Method for the Determination of the Ohm, by G. Lippmann 407

NUMBER XC.—DECEMBER.

Mr. G. H. Darwin on Variations in the Vertical due to Elasticity of the Earth's Surface 409
Rev. S. Haughton's New Views of Mr. George H. Darwin's Theory of the Evolution of the Earth-Moon System, considered as to its bearing on the question of the Duration of Geological Time 427
Prof. H. Helmholtz on Systems of Absolute Measures for Electric and Magnetic Quantities 430
Messrs. J. Trowbridge and C. B. Penrose on the Thomson Effect 440
Dr. E. Goldstein on the Reflection of Electrical Rays 449
Dr. E. Goldstein on the Influence of the Shape of the Kathode on the Distribution of the Phosphorescent Light in Geissler's Tubes 455
Notices respecting New Books :—
J. B. Chalmers's Graphical Determination of Forces in Engineering Structures 472

Page

J. E. Steggall's Questions in Pure Mathematics proposed at the B.A. and B.Sc. Pass and Honours Examinations of the University of London, with complete Solutions. 476

Prof. J. Morris's Geological Chart 476

Proceedings of the Geological Society:—

Prof. T. G. Bonney on the Hornblendic and other Schists of the Lizard District, with some Additional Notes on the Serpentine 477

On Mr. C. W. Siemens's New Theory of the Sun, by M. G. A. Hirn 478

Reply to M. Faye's Objections to Mr. Siemens's Theory of the Sun, by C. W. Siemens 480

On a Property of the Coefficient of Absorption, by Eilhard Wiedemann 483

ERRATA.

Page 217, line 10, for $\frac{dy^2}{dx^2}$ put $\frac{d^2y}{dx^2}$.

— 221, line 4, *for* $\cos(2\omega+2\delta)$ *put* $\sin(2\omega+2\delta)$.

— 222, line 4, *for* $\cos^2\delta$ *put* $\cos^2 2\delta$.

— 223, line 30, for η read $\frac{g}{a\mu}\eta$ bis.

PLATES.

I. Illustrative of Mr. C. Vernon Boys's Paper on Measurement of Curvature and Refractive Index.

II. Illustrative of Mr. F. D. Brown's Notes on Thermometry.

III. Illustrative of Mr. W. J. Lewis's Crystallographic Notes.

IV. Illustrative of MM. Elster and Geitel's Paper on the Electricity of Flame, and M. H. Brongersma's on Double Refraction, produced by Electrical Influence, in Glass and Bisulphide of Carbon.

V. Illustrative of Mr. W. Baily's Paper on an Integrating Anemometer.

VI. Illustrative of Mr. L. Fletcher's Crystallographic Notes.

VII. Illustrative of Dr. E. Goldstein's Papers on the Reflection of Electrical Rays, and on the Influence of the Shape of the Kathode on the Distribution of the Phosphorescent Light in Geissler's Tubes.