March 4, 1858.

The LORD WROTTESLEY, President, in the Chair.

The President announced that the Chemical Society had met and adjourned, in order to attend the Bakerian Lecture, and would, with permission of the Meeting, be present.

The Lord Talbot de Malahide was admitted into the Society.

In accordance with the Statutes, the Secretary read the following list of Candidates for Election into the Society :—

Thomas Graham Balfour, M.D.
John Bateman, Esq.
Henry Foster Baxter, Esq.
Samuel Husbands Beckles, Esq.
Edward Mounier Boxer, Capt. R.A.
William Brinton, M.D.
Frederick Crace Calvert, Esq.
Thomas Russell Crampton, Esq.
Frederick Currey, Esq., M.A.
Hugh Welch Diamond, M.D.
Thomas Rowe Edmonds, Esq., B.A.
David Forbes, Esq.
S. W. Fullom, Esq.
Francis Galton, Esq.
Alfred Baring Garrod, M.D.
William Henry Harvey, M.D.
Rev. Samuel Haughton.
Henry Hennessy, Esq.
Henry Letheby, M.B.
David Livingstone, LL.D.
Edward Joseph Lowe, Esq.
John Lubbock, Esq.
David Macloughlin, M.D.
Capt. Rochfort Maguire, R.N.
Capt. William Searth Moorsom.
Robert William Mylne, Esq.
William Newmarch, Esq.
William Peters, Esq.
Henry Darwin Rogers, LL.D.
William Scovell Savory, M.B.
Sir Robert Schomburgk.
Edward Smith, M.D.
Warington Wilkinson Smyth, Esq., M.A.
Col. Andrew Scott Waugh, B.E.
Thomas Williams, M.D.
Bennet Woodcroft, Esq.

The Bakerian Lecture was delivered by John P. Gassiot, Esq., V.P.R.S., "On the Stratifications and Dark Bands in Electrical Discharges as observed in Torricellian Vacuums."

The Lecturer gave an exposition of the substance of a Paper, communicated by him under the above title, and illustrated his Lecture by a repetition, before the Society, of the Experiments described. The following is an abstract :—

The author refers to the stratified appearance of the electrical discharge when taken from the terminals of a Ruhmkorff's induction-coil in the vapour of phosphorus, and in highly attenuated gases, first noticed by Mr. Grove (Phil. Trans. Part I. 1852, and Phil. Mag., Dec. 1852). Having witnessed the experiments of Mr. Grove, Mr. Gassiot in the same year examined the discharge in a barometrical vacuum in which the mercury had been carefully boiled, but he could not obtain any signs of stratification. These experiments were subsequently repeated by several continental electricians, whom he names, and who all describe the induction-discharge in a barometrical vacuum as intensely white, and filling the whole tube without stratification.

After alluding to the experiments of the Rev. Dr. Robinson (Proc. R. I. Acad., Dec. 1856), and to some recent improvements in the construction of the induction-coil, the author proceeds to describe apparatus which he had constructed for the more careful examination of the character of the induction-discharge. His first experiments were made on glass tubes about 10 inches long, in which the mercury could be lowered or raised to any required level by means of the air-pump. He also experimented with barometrical vacuums obtained by inverting a tube of about 44 inches in length, filled with boiled mercury, over a vessel containing that metal, and then sealing the tube 2 or 3 inches above the barometrical height.

The results obtained by these methods having been found unsatisfactory, the author had recourse to that first suggested by Mr. Welsh (Phil. Trans. 1856, p. 507), by which that gentleman constructed the large barometer at the Kew Observatory. Following

out the principles indicated by Mr. Welsh, by carefully removing all trace of moisture, and thoroughly cleaning the tubes before introducing the mercury, the author succeeded in obtaining Torricellian vacuums which exhibit the stratifications in a uniform and very marked manner.

The sealed tubes generally used by Mr. Gassiot are then described. They are made of the usual glass tubing, about an inch internal diameter, and of the form fig. 1.

They vary from 10 to 38 inches in length. In the latter case the platinum wires *a b* are about 32 inches apart. One tube is described 5 feet 3 inches in length, with wires 4 feet 9 inches apart.

With a tube prepared on Mr. Welsh's principle, and the usual-sized Ruhmkorff's induction-coil excited by a single cell of Grove's nitric acid battery, with or without a condenser, the phenomena of the stratified discharge can be seen and examined with ease, and without the trouble and uncertain manipulation of an air-pump, or the employment of phosphorous or other vapours.

If the discharges are made in one direction, a black deposit takes place on the sides of the tube nearest the negative terminal. This deposit is platinum in a state of minute division emanating from the wire, which becomes black and rough as if corroded. The minute particles of platinum are deposited in a lateral direction from the negative wire, and consequently in a different manner from what is described as occurring in the voltaic arc (De la Rive's 'Electricity,' vol. ii. p. 288), so that the luminous appearance of discharge from the induction-machine can in no way arise from the emanation of particles of the metal.

The author describes a series of experiments made in the apparatus first prepared, by which the mercury is lowered or raised in the vacuum tube; he describes the peculiar appearance when the mercury is made either positive or negative. In some instances, and particularly when, instead of wires, platinum balls $\frac{1}{8}$th of an inch in diameter were used for terminals, the stratifications instantly ceased when the mercury rose above the negative ball; but when the pole

of a magnet was presented to the positive ball, the stratifications were drawn to the length of two or three inches down the tube.

In the sealed tubes the stratified discharge was obtained by frictional electricity; and if a charged Leyden jar is discharged through the vacuum by a wet string, the stratifications are as distinct as from the induction-coil.

The author next proceeds to show, that by a single disruptive discharge of the primary current excited by a single cell, the entire tube, whatever may be its length, is filled with stratifications as far as the dark band near the negative wire; and from this experiment he is of opinion that the phenomenon cannot be in any way due to the vibrations of the contact-breaker. With one, two or three cells no appearance of a luminous discharge could be perceived on making contact, it only appeared on breaking. If, however, the intensity of the primary current is increased by using ten or more cells, stratifications appear on making as well as on breaking the contact of the primary circuit. These stratifications are always concave towards the positive terminal, and as the discharges, on making and on breaking, emanate from different terminals, their concavities are in opposite directions,—a fact which explains the different ways in which several electricians have described and figured the form of the discharge with the coil. These stratifications appear in quick succession, but they can always be separated in any part of the tube by a magnet.

Under certain conditions the positive discharge assumes a peculiar form, of which the author gives a drawing. He considers that this exhibits a direction of a force from the positive to the negative, centering to the axis of stratification, which cannot be connected with the passage of particles, and that the latter phenomenon, as it occurs in the voltaic arc, may be but the result of a secondary action.

The author notices the peculiar difference between the positive and negative discharge; he describes an apparatus by which both terminals could be made of surfaces of mercury, or the positive of a surface of mercury, and the negative of a wire, or the reverse. In this apparatus, moreover, the mercury at one end could be elongated 8 or 10 inches. When the mercury was negative, its entire surface was covered with a brilliant glow; when positive, the extreme point

of the mercury exhibited intense light, but the remainder of the surface appeared unaffected by the discharge. In order to test whether any signs of interference could be detected, he had a tube prepared with four wires, by which discharges could be observed when taken from separate coils, as shown in fig. 2, where $a\ b$ and $a'\ b'$ are

platinum wires hermetically sealed, as in the previously described apparatus. Care was taken to manipulate with induction-coils giving discharges of equal intensity; but in no case did any sign of interference appear. The discharges, whether in the same or in opposite directions, mingled; the stratifications, having a tendency to rotate round the poles of a magnet and obeying the well-known law of magnetic rotations, could be separated by either pole.

If, instead of sealed wires, tin-foil coatings, $a\ b$ (fig. 3), are placed

on the vacuum tube, and the coatings are attached to the terminals of the induction-apparatus, brilliant stratifications immediately appear in the portion of the vacuum between the coatings, but without any dark discharge. On approaching a powerful magnet, the stratifications divide into two equal series, in which the bands or strata are concave in opposite directions.

If a vacuum tube, with or without wires or coatings, is placed on the induction-coil, or on the prime conductor of an electrical machine, stratifications appear which are divided by the magnet. Having thus ascertained that there are two distinct forms of the stratified electrical discharge, the author, for the sake of clearness of expression, terms them the direct and the induced discharge. The direct discharge is that which is visible in a vacuum when taken from two wires hermetically sealed therein; this discharge has a tendency to rotate, as a whole, round the poles of a magnet. The induced discharge is that which is visible in the same vacuum when taken from two metallic coatings attached to the outside of the tube, or from one coating and one wire; this discharge is divided by the magnet,

and the two divisions have a tendency to rotate in opposite directions. The character of these two forms of electrical discharge can always be determined by the magnet.

The author concludes his paper in the following words :—"I refrain for the present from any observations as to the action of the magnet on the discharge. The intimate relation of magnetic and electric action has long since been shown; but the curious effect of the power of a magnet to draw out the stratifications from the positive terminal, and in some instances its powerful action on that portion of the discharge which exhibits the phosphorescent light in its greatest intensity, are worthy of further examination. In the preceding experiments my object was directed to the examination of the stratified and of the dark band discharge; at present I am inclined to the opinion that the stratifications in the positive, and the dark band between it and the negative glow, although apparently similar, are effects arising from distinct causes—the former from pulsations or impulses of a force acting in a highly attenuated but resisting medium, the latter from interference. I am at this time engaged in making further experiments for the elucidation of this novel and remarkable phenomenon."

March 11, 1858.

Dr. HOOKER, Vice-President, in the Chair.

The following communications were read :—

I. Notes of Researches on the Poly-Ammonias. By AUG. W. HOFMANN, Ph.D., F.R.S. &c. Received February 4, 1858.

Former investigations had led me to some general conclusions regarding the molecular constitution of the organic bases, which I have communicated to the Royal Society, and which have been published in the 'Philosophical Transactions' (1850, p. 93; 1851, p. 357). My experiments had proved that each equivalent of hydrogen in