

Some Observations on Atmospheric Electricity. By JOHN DAVY,
M. D., F. R. S. Communicated by Professor FORBES.

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THE few facts we possess relative to the chemical agency of atmospheric electricity, and a certain degree of obscurity connected with these facts, as pointed out by Mr FARADAY,* in commenting on the late Mr BARRY's results, published in the *Philosophical Transactions* for 1831,† have induced me to institute some experiments on the subject, with the hope of acquiring additional information.

Reflecting on the manner in which, in certain instances, the great experiment of FRANKLIN, in apparent proof of the identity of common and of atmospheric electricity, had been repeated, especially in our own country;‡ reflecting also on the experiments of M. COLLADON on atmospheric electricity,§ made by means of a lightning-conductor,—it appeared to me not improbable that results might be witnessed of some interest by substituting for an electrical kite, the means employed by Mr BARRY, an insulated wire raised a few feet above the summit of any building of moderate height.

As most convenient for the trial, I chose a turret just fifty feet above the street, the highest part of my own house—situated rather high—though not in the loftiest part of Valletta, and overtopped considerably by the summits of several of the public buildings of the city. There I elevated, by means of an iron rod

* *Philosophical Transactions*, 1833, p. 42.

† On the Chemical Action of Atmospheric Electricity, by Alexander Barry, Esq. F. L. S.

‡ *Phil. Trans.* abridged, vol. x. p. 303.

§ *Annales de Chimie et de Physique*, tome xxx. p. 72.

well secured, a glass tube, to which was attached, and by means of which was insulated, a copper wire of moderate thickness, furnished with short projecting lengths of fine wire of pure gold. This upper conductor thus terminating, stood about six feet above the summit of the turret. For communication with the earth, another copper wire was used, the inferior end of which was immersed in water contained in a small cistern, from whence a leaden pipe descended through the building to the ground.

On the 13th of last October I began the experiments, and continued them till the middle of March, when I was obliged to stop, in consequence of having to prepare to leave Malta and return to England.

The first experiment instituted was on the gelatinous transparent compound, formed by mixing together moist starch and a strong solution of the iodide of potassium, which is, I believe, the most delicate of all the tests yet known of electro-chemical action. The two conductors were connected with naked platina wires, which passed through a cork into a glass tube containing the compound in which they were plunged, about a quarter of an inch asunder. The results of this experiment were clear and decisive. I shall limit myself to mentioning them briefly. In fine weather, even when the sky was cloudless, a slight precipitation of iodine was commonly observed, in the course of twenty-four hours, on the platina wire of the inferior conductor. When the wind was strong, the effect was occasionally greater; and it was almost invariably so when clouds were passing, especially low clouds. The direction of the wind did not appear to influence the effect materially; on the whole, *cæteris paribus*, perhaps the effect was more marked when the south-east wind, the damp sirocco, was blowing, than when the cooler and commonly drier north-west wind prevailed. These remarks apply to dry weather, at least to absence of rain. During thunder storms, and during showers of hail even without thunder, and heavy showers of rain, the effect was more strongly marked. In the two first

instances, the precipitation of iodine was always copious and rapid, and almost invariably on both the platina wires—sometimes in greatest abundance on that of the inferior conductor, but occasionally on the superior;—even when the platina wires were placed rather more than half an inch asunder, the results were decisive. In these instances it may be inferred that the precipitation on the two wires was not simultaneous but in succession, in consequence of the passing clouds, or portions of air in motion, being in different electrical states,—and, as might be expected, in accordance with this, at no time when the wires were under observation was there any indication contrary to this inference. It may be right to mention, that in these trials with the solution of iodide of potassium and starch, the platina wires were cleaned as often as was required, on account of iodine precipitated and adhering to them; and that the gelatinous solution itself was often changed, which was necessary both owing to its tendency to spontaneous decomposition, and to the iodine precipitated electro-chemically, in part becoming diffused through it.

Other experiments which I have made on the electro-chemical agency of atmospheric electricity, have been far less satisfactory. Using Volta's eudiometer, filled with a strong solution of common salt, no indications could be obtained of the decomposition of water, although the platina wires of the eudiometer-tube connected with the conductors were within one-tenth of an inch of each other, and though the experiment was more than once made when it was thundering.

The only result obtained clearly shewing the decomposition of water, was in an experiment in which fine sewing needles, coated with sealing-wax, excepting at their points, were substituted for the eudiometer. On one occasion, using this apparatus with a strong solution of salt, the point of the needle communicating with the inferior conductor was oxidated, whilst the other point communicating with the superior remained bright, and round the latter very minute bubbles of gas were collected.

This result was obtained during stormy and showery weather, with a sirocco wind.

Experiments were tried with a view to the decomposition of some metallic solutions, such as the nitrate of silver, muriate of platinum, and sulphate of copper, using wires of different metals not capable of acting on them chemically, but no satisfactory result was witnessed, excepting once with a solution of sulphate of copper and platina wires, and during a thunder storm, when a slight, just perceptible, precipitate of copper took place on each of the wires immersed.

Occasionally, for comparison, the electro-chemical experiments were interrupted, and the conductors were connected with a galvanometer, and also with a spiral wire, containing a sewing needle, placed at about right angles to the magnetic meridian. The magnetic effects witnessed were very inconsiderable. On one occasion only, when the atmosphere was in a highly electrical state—lightning frequent, near and vivid—was the galvanometer very distinctly affected. The deviation of the needle was from 8° to 10° . I may mention a particular instance, in which the absence of magnetic effect to me appeared remarkable. It was on the 20th December, when I happened to be present during a shower of hail without thunder. For two minutes that I attentively watched the galvanometer, I could not observe the slightest movement of the needle. I then rapidly connected the conductors with the platina wires immersed in the compound of the iodide of potassium and starch,—now, in less than half a minute, there was a considerable precipitation of iodine on the wire communicating with the inferior conductor.

On the needle in the spiral the effect was even less than on the galvanometer. Sometimes it appeared on trial to have acquired a very feeble magnetic power, but which it soon lost on continuing the experiment. It may be worthy of mention, that in the instance in which the galvanometer was affected, as be-

fore described, the needle, in a spiral which was then included in the circle, was not sensibly magnetized.

As the copper-conducting wires, during the period of experimenting, were undergoing oxidation, it was not impossible that the feeble effects which occurred in fine weather, indicated by a very slight precipitation of iodine, might be connected with the chemical change the wires were experiencing. To put this to the proof, gold wires were substituted for the copper throughout. The results were still similar. Whence it may be inferred that the results in question were not connected with the oxidation of the copper wires, and that they depended solely on the foreign influence they were the means of communicating.

It was my wish to have instituted other experiments, in more favourable situations, for witnessing the effects of atmospheric electricity acting with greater energy,—but hitherto I have been prevented. Other inquirers who have the means and leisure, I trust will enter upon the subject and investigate it farther. In the mean time, it may be asked, how do the results of electrochemical action described above, accord with those referred to obtained by Mr BARRY? Making allowance for difference of intensity, they appear sufficiently well to harmonize. Whilst water was rapidly undergoing decomposition in his experiment, he experienced shocks on touching the conducting thread connected with the electrical kite. In none of my experiments did I ever obtain any shock or spark from the insulated conductor, therefore it is not surprising that the chemical effects I witnessed were so much feebler, and that only slight indications were afforded of the decomposition of water.

Mr FARADAY, comparing Mr BARRY's results with the effects of common electricity and of voltaic electricity, justly points out that they are not identical with either. The same remark will apply not less forcibly to the results of the foregoing experiments.*

* In the abstract of Mr BRANDE's Bakerian Lecture for 1819, though, not that can find in the lecture itself, it is stated, that "the brilliant light occasioned by

He is of opinion that, if confirmed, they will prove the existence of “ a form of electrical current, which, both in quantity and intensity, is exactly intermediate between those of the common electrical machine and the voltaic pile.”* Another view may be taken. It may be said, that they seem to be in favour of atmospheric electricity not being a simple and single power, but compounded somewhat after the analogy of the solar ray, and of its possessing even a principle peculiar to itself.

This notion I throw out merely conjecturally at present : it might be equally difficult to prove it correct or to refute it. At present it seems most desirable to accumulate facts, waiting for the time when, by means of extensive induction, we may hope to be enabled to arrive at a satisfactory conclusion. But whatever that conclusion ultimately may be, in the mean time it hardly admits of a doubt, that what is called atmospheric electricity exercises a powerful influence both in the aerial regions and on the surface of the earth ; and on the latter, perhaps, greater and more constantly than has hitherto been supposed. The results of the experiments I have described may warrant this inference in regard to constancy of feeble effect ; and very many facts, well established and universally known, especially the changes not unfrequently witnessed in the cellar and the dairy during thunderstorms, may be adduced in proof of its more energetic action, in accordance with Mr BARRY’S results, as an agent of chemical change.

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the discharge of the voltaic apparatus presently blackens the chloride of silver.”— (*Abstracts of the Philosophical Transactions*, vol. ii. p. 121.) I have exposed this compound moist, just made, to the intensely bright light of a succession of flashes of very vivid lightning, during a thunder-storm by night of unusual violence, even in Malta, and which lasted several hours, without the least change of its colour. If the above statement be correct (and it probably is, as Mr BRANDE, in 1819, was senior Secretary of the Royal Society, by whom the abstracts of papers are I understand generally made), we have here *apparently* another point of difference between voltaic and atmospheric electricity.

* Phil. Trans. 1833, p. 43.