On the Application of Voltaic Ignition to Lighting Mines. By W. R. GROVE, ESQ., *M. A., F. R. S., Professor of Experimental Philosophy in the London Institution.*

In the *Comptes Rendus* of the Paris Academy of Sciences for the 1st and 15th of September last, are communications by M. Boussingault and M. De la Rive, on the employment of the voltaic disruptive discharge for the illumination of mines. M. Boussingault is inclined to believe that some of the accidents in mines have occurred from draughts or currents of inflammable gas, and not from the carelessness of the workmen in the use of the safety-lamp, to which they are generally attributed; he considers that the voltaic arc, being independent of atmospheric air or other supporter of combustion, in the usual sense of the word, might be rendered practically available. M. De la Rive states that he has been occupied with the subject, and proposes a cylinder of close-textured charcoal, similar to that of Bunsen, with a metallic ring or plate above it; the carbon being rendered the positive terminal of a voltaic pile, the particles transferred from it to the disk fall down again by their own gravity, and a tolerably constant light is obtained; the vessel containing the electrodes is hermetically sealed, and the oxygen being soon exhausted by the ignited charcoal, the ignition proceeds in the residual nitrogen. M. De la Rive appears, however, to have met with but partial success, and says there are still many difficulties to contend with.

Four or five years ago, soon after publishing the nitric acid battery, I was naturally struck by the facility and constancy with which the voltaic arc could be obtained by that combination, as compared with any previous one, and made several attempts to reduce it to a practical form for the purposes of illumination, but my success was very limited. By attending to certain precautions, which I will not stop to describe, I could occasionally keep up a steady voltaic light in attenuated nitrogen for four or five hours, but it was never sure; from some unseen imperfection in the charcoal, or other cause, it would become suddenly extinct; the glass also in which it was ignited became gradually dimmed by a deposition of condensed carbon vapor; it was costly, from the number of series, and consequently of equivalents of zinc and acid consumed; too bulky for portable purposes, and from the intensity of the heat, unless the recipient was very large, the collar of leathers and joints, into which the wires were sealed or cemented, were destroyed; and when ground plates were employed, the grease was liquefied. M. de la Rive does not state his method of hermetically sealing the vessel he employs; this I found one of the most difficult parts of the process. Not being able satisfactorily to overcome these difficulties, I abandoned it for the time, and made some experiments on another method of voltaic illumination, which appeared to me more applicable to lighting mines; their publication was postponed, and I had nearly forgotten them, until reminded by the papers above mentioned.

I substituted the voltaic ignition of a platina wire for the disruptive

discharge. Any one who has seen the common lecture-table experiment of igniting a platina wire by the voltaic current nearly to the point of fusion, will have no doubt of the brilliancy of the light emitted; although inferior to that of the voltaic arc, yet it is too intense for the naked eye to support, and amply sufficient for the miner to work by. My plan was then to ignite a coil of platinum wire as near to the point of fusion as was practicable, in a closed vessel of atmospheric air, or other gas, and the following was one of the apparatus which I used for this purpose, and by the light of which I have experimented and read for hours:—A coil of platinum wire is attached to two copper wires, the lower parts of which, or those most distant from the platinum, are well varnished; these are fixed erect in a glass of distilled water, and another cylindrical glass closed at the upper end is inverted over them, so that its open mouth rests on the bottom of the former glass; the projecting ends of the copper wires are connected with a voltaic battery (two or three pairs of the nitric acid combination,) and the ignited wire now gives a steady light, which continues without any alteration or inconvenience as long as the battery continues constant, the length of time being of course dependent upon the quantity of the electrolyte in the battery cells. Instead of making the wires pass through water, they may be fixed to metallic caps well luted to the necks of a glass globe.

The spirals of the helix should be as nearly approximated as possible, as each aids by its heat that of its neighbor, or rather diminishes the cooling effect of the gaseous atmosphere; the wire should not be too fine, as it would not then become fully ignited; nor too large, as it would not offer sufficient resistance, and would consume too rapidly the battery constituents; for the same reason, *i. e.* increased resistance, it should be as long as the battery is capable of igniting to a full incandescence.

The helix form offers the advantages, that the cooling effect being lessened, a much longer wire can be ignited by the same battery; by this increased length of wire, the battery fuel is economised, while a greater light is afforded; by the increased heat, the resistance is still further increased, and the consumption still further diminished, so that, contrary to the usual result, the increment of consumption decreases with the exaltation of effect produced. The very necessity of inclosing the coil in a glass recipient also augments the heat, the light, and the resistance; if I remember rightly, Mr. Faraday first proposed inclosing wire in a tube for the purpose of being able to ignite a longer portion of it. Lastly, only two or three cells are required, (one indeed might be sometimes sufficient,) and the whole apparatus thus becomes portable and economical. The light is perfectly constant, subject to no fluctuation or interruption, and the heat is not so excessive as to destroy the apparatus.

As the effect of different gases on radiant heat is an important element in the practical application of the above, I had commenced some experiments on this subject, and the following I find in my note-book as the effect of four different gases. A voltameter was interposed in the circuit in order to furnish a better test of the amount of ignition

than the eye, as, according to the position of Davy, that a wire becomes a worse conductor in proportion to its increase of temperature, the amount of gas in the voltameter should be, as indeed in these experiments it turned out to be, in inverse proportion to the degree of ignition. As a further test, the increased volume of the gas by expansion was noted, though the apparatus was not constructed for showing this increase with delicate accuracy.

Platina wire ignited by a given constant voltaic battery in	Effects to the eye.	Voltameter gave at the rate of one cub. in. in	Expansion of volume.
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Hydrogen . . .	Not visible even in the dark .	19	35 to 43
Carbonic acid .	Cherry-red by daylight . .	21·5	35 . . . 43
Oxygen	Incandescent by daylight . . .	23·5	35 . . . 45
Nitrogen	Same	24	35 . . . 45
Atmospheric air	Same	24	35 . . . 45

I had intended to have carried these experiments further with other gases,* and also with condensed and rarefied air, but was interrupted; and as it may be some time before I may be able to renew them, I think I cannot do better than submit these experiments, with your permission, to the readers of the Philosophical Magazine, while the attention of scientific men is directed to this subject; actual practice can alone test their efficacy. Lond., Edin. & Dublin Philos. Mag.

Telegraphic Communication between France and England.

Amidst the many wonderful inventions of modern days, wherein the faculties of man have overcome difficulties apparently insurmountable, and made the very elements themselves subservient to his power and use, there are none more wonderful than that now about to be carried out by the establishment of submarine telegraphs, by which an instantaneous communication will be effected between the coasts of England and France. The British Government, by the Lords Commissioners of the Admiralty, and the French Government, by the Minister of the Interior, have granted permission to two gentlemen, the projectors of the submarine telegraph, to lay it down from coast to coast. The site selected is from Cape Grisnez, or from Cape Blancnez,

* I have some doubt whether the different gases do not exercise a specific action on the ignited wire, somewhat in the nature of catalysis; if a wire be brought by the voltaic current to a white heat in atmospheric air, and a vessel of hydrogen inverted over it, the light is as suddenly extinguished as the flame of a candle would be.