vity was formed within it, indicating that the charcoal was volatilised at this side, and transferred to the other, where it was condensed and fused, the piece of charcoal at this pile being elongated considerably. This fused charcoal was four times denser than before fusion.

Owing to its superior conducting power, a continued vol­taic current will maintain, in a state of incandescence, a greater length of silver wire than of platinum or iron ; but if we form a wire of short pieces of silver and platinum wire alternately, the platinum portion will become red-hot, while the silver ones remain cold. In this case, the current which passes readily along the silver wire, encounters the degree of obstruction in the platinum which produces the red heat. This fact is no doubt connected with the very remarkable one observed by M. Peltier, in the passage of weak currents through metallic circuits, where *cold* was produced at the points of junction of certain crystallizable metals.

Sect. IV.—*On the chemical Effects of Voltaic Electricity.*

In a preceding article we have given a full account of the general chemical effects of *ordinary electricity.* We shall therefore confine ourselves at present to the chemical effects of the voltaic pile. No sooner was this apparatus made known in England, than Messrs Nicholson and Car­lisle applied it to chemical inquiries. Although Volta had inferred from the shock, that the action of the pile was elec­trical, yet it was to the above inquirers that we are indebt­ed for determining by means of the revolving doubler, that the *silver* end of the battery was in a *negative,* and the *zinc* end in a positive state of electricity. In the course of their experiments, they observed a disengagement of gas, which smelt of hydrogen, from water which happened to be in the circuit; and on the 2d of May 1800, they discovered that water was decomposed into its elements, viz. oxygen and hydrogen, when the water formed part of the circuit be­tween the positive and negative ends of the pile. Mr Cruickshanks of Woolwich confirmed this result, and found that *hydrogen* was always emitted from the *silver* or *copper* end of the pile, and *oxygen* from the other. He discover­ed also the important fact, that metals could be revived from their solutions, under the same circumstances, the reduced metal being deposited at the end of the wire ; and he suc­ceeded in decomposing some of the neutral salts. Dr Henry decomposed the nitric and sulphuric acids and ammonia ; and he reduced the oxymuriatic to the state of muriatic acid.

The attention of our illustrious countryman, Sir H. Davy, was about this time attracted to the subject. So early as 1802, he had made experiments on the chemical agency of the pile ; but in 1806, in his first Bakerian Lec­ture, he was led to the conclusion, *that chemical attraction and repulsion were produced by the same cause, acting in the one case on particles, in the other on masses, and that the same property, under different circumstances, was the cause of all the phenomena exhibitedby differ entvoltaic com­binations.* In October 1807, he decomposed potash and soda, and proved that they were oxides of two new metals, *potas­sium* and *sodium.* With a voltaic battery of 2000 plates, he decomposed several of the earths, and discovered their metallic bases, *barium, strontium, calcium,* and *magnesium.* In attempting to decompose the proper earths, he was less successful. He succeeded in proving, however, that they consist of bases united to oxygen, but the completion of the inquiry was left to Wohler, Bussy, and Berzelius, who found that all the bases of these earths, except silica, were metallic, and capable of uniting with iron.@@1

Our narrow limits will not permit us to give an account of the successive labours of different philosophers, in ef­fecting decompositions by the voltaic battery. We shall con­tent ourselves with giving a brief account of the researches of our distinguished countryman, Dr Faraday, to whom this branch of science owes its greatest acquisitions.

The phenomena of electro-chemical decomposition have been generally ascribed to two opposite powers residing in the two poles of the voltaic battery. Grotthus2 regards the pile as an electric magnet with *attracting* and *repelling* poles, the one attracting hydrogen and repelling oxygen, and the other attracting oxygen and repelling hydrogen. The force exerted upon each molecule of the body is sup­posed to be inversely as its distance from the poles, and a succession of decompositions and recompositions is sup­posed to exist among the intervening molecules. Sir H. Davy adopts the idea of attractions at the poles, diminish­ing to the middle or neutral points, and he thinks a succes­sion of decompositions and recompositions probable. Messrs Riffault and Champre regard the *negative* current as col­lecting and carrying the acids on to they *positive* pole, and the *positive* current as doing the same, with the bases toward\* the *negative* pole. Μ. Biot attributes the effects to the op­posite electrical states of the decomposing substances in the vicinity of the two poles. M. de la Rive considers the por­tions decomposed to be those contiguous to both poles, the current from the *positive* pole combining with the hydrogen or the bases which are there present, and leaving the oxy­gen or acids at liberty, but carrying the substances in union with it across to the negative pole, where it is separated from them, entering the conducting metal, and leaving on its surface the hydrogen, or its bases. Dr Faraday regards the poles as exercising no specific action, but merely as sur­faces or doors by which the electricity enters into or passes out of the substance undergoing decomposition. He sup­poses that “ the effects are due to a modification of the electric current, and the chemical affinity of the particles through or by which that current is passing, giving them the power of acting more forcibly in one direction than in another, and consequently making them travel by a series of successive decompositions and recompositions in opposite directions, and finally causing their expulsion or exclusion at the boundaries of the body under decomposition in the direction of the current, and that in larger or smaller quan­tities, according as the current is more or less powerful.

In resolving a compound body into its elements, liquidity is an essential condition of the body. A plate of iron, the 16th of an inch thick, placed between the two sides of the pile, will stop completely the most powerful electrical cur­rent.

When the elements of a body are separated by electric action, the current communicates to each a definite direc­tion, the oxygen travelling towards the zinc, and the hy­drogen towards the platina pole.

By an irresistible body of evidence, Dr Faraday has es­tablished the important proposition, “ that the chemical power of a current of electricity is in direct proportion to the absolute quantity which passes and this is true of all bodies capable of electro-chemical decomposition.

The same eminent philosopher has also deduced, from a variety of facts, the following conclusion, “ that the quan­tity of electricity, which, being naturally associated with the particles of matter, gives them their combining power, is able, when thrown into a current, to separate these particles from their state of combination ; or, in other words, that *the electricity which decomposes, and that which is evolved by the decomposition of a certain quantity of matter, are alike.”* According to this theory, “ the equivalent weights of bodies are simply those quantities of them which contain equal quantities of electricity, or have naturally equal elec-

@@@1 See our articles Chemistry and Davy, for a full account of Sir Humphry Davy’s electro-chemical researches. Ann. de Cbim. 1806, tom. lviii. p. 61,