tric powers. It being the *electricity* which determines the equivalent number, because it determines the combining force ; or if we adopt the atomic theory or phraseology, then the atoms of bodies which are equivalents to each other in their ordinary chemical action, have equal quanti­ties of electricity naturally associated with them.”

When exposed to the voltaic current, bodies are decom­posed with different degrees of facility. Dr Faraday found by experiment, that the following bodies were decomposed with currents of different intensities, those at the top of the list being decomposed by currents of lowest intensity.

|  |  |
| --- | --- |
| **Iodide of potassium (solution.)** | **Iodide of lead (fused.)** |
| **Chloride of silver (fused.)** | **Muriatic acid (solution.)** |
| **Proto chloride of tin (fused.)** | **Water acidulated with sulphuric acid.** |
| **Chloride of lead (fused.)** |  |

All compound bodies are not decomposable by electric currents. The following bodies are not decomposed under ordinary circumstances

|  |  |
| --- | --- |
| **Chlorides of sulphur, phosphorus, and carbon.** | **Boracic acid.**  **Iodide of sulphur.** |

The following bodies are not decomposed :—

|  |  |
| --- | --- |
| **Chloride of antimony.** | **Periodide of mercury** |
| **Hydro-carbon.** | **Ammonia.** |
| **Acetic acid.** |  |

All solid non-conductors which become conductors when liquified by heat, with the exception of *periodide of mer­cury,* are decomposed.

Mr Faraday is of opinion that all *binary compounds,* one of whose elements goes to the *negative,* and the other to the *positive* pole, are decomposable, but not ternary com­pounds.

The following bodies, being non-conductors of electricity, are not decomposed by it.

|  |  |
| --- | --- |
| **Sulphuric acid.** | **Nitric acid.** |
| **Phosphoric acid.** | **Chloride of sulphur.** |
| **Arsenic acid.** | **Proto-chloride of phosphorus.** |
| **Hypo-nitrous acid.** | **Proto-chloride of carbon.** |

The perchlorides of mercury and of antimony, being conductors when liquid, are decomposable, but periodide of mercury’, though a conductor when liquid, is not decom­posable.

The following bodies are not decomposable by voltaic electricity:—

|  |  |
| --- | --- |
| **Nitre.** | **Tartaric acid.** |
| **Nitrate of ammonia.** | **Tartrates.** |
| **Sulphurous acid.** | **Benzoides.** |
| **Hydrofluoric acid.** | **Sugar.** |
| **Fluorides.** | **Gum.** |
| **Acetates** |  |

The following table contains a list of the elementary constituents of decomposable bodies, with their electro­chemical equivalents@@1 :—

*Elements which go to the* Positive *Pole.*

|  |  |  |
| --- | --- | --- |
| **Oxygen 8** | **Selenic acid 64** | **Acetic acid 51** |
| **Chlorine 35·5** | **Nitric acid 54** | **Tartaric acid 66** |
| **Iodine 126** | **Chloric arid 75·5** | **Citric acid 58** |
| **Bromine....... 78 ∙3** | **Phosphoric acid.. 35·7** | **Oxalic acid 36** |
| **Fluorine 18·7** | **Carbonic acid....22** | **Sulphur ? 16** |
| **Cyanogen 26** | **Boracic acid 24** | **Selenium ?** |
| **Sulphuric acid.. 40** |  | **Sulpho-cyanogen.** |

*Elements which go to the* Negative *Pole.*

|  |  |  |
| --- | --- | --- |
| **Hydrogen 1** | **Copper 31∙6** | **Soda 31·3** |
| **Potassium 39·2** | **Cadmium 55·8** | **Lithia 18** |
| **Sudium 23·3** | **Cerium 46** | **Baryta 76 ∙7**  **Strontia 51·8** |
| **Lithium 10** | **Cobalt 29·5** |
| **Barium 68·7** | **Nickel 29·5** | **Lime 28·5** |
| **Strontium 43·8** | **Antimony 64∙6** | **Magnesia 20·7** |

|  |  |  |
| --- | --- | --- |
| **Calcium 20·5** | **Bismuth 71** | **Alumina ?** |
| **Magnesium 12·7** | **Mercury 200** | **Protoxides generally.** |
| **Manganese 27·7** | **Silver 108** | **Quinia 171·6** |
| **Zinc 32·5** | **Platina 98·6?** | **Cinchona 160** |
| **Tin 57 ∙7** | **Gold ?** | **Morphia 290** |
| **Lead 103·5** | **Vegeto alkalies generally.** |
| **Iron 28** | **Ammonia 17** |
|  | **Potassa 47·2** |

In the course of his electrical researches, Dr Faraday@@\* discovered the very remarkable fact, that metals and other bodies had the power of promoting the combination of gaseous bodies. When a plate of clean platinum was put into a mixture of oxygen and hydrogen gas, the two gases gradually disappeared, in consequence of having united and formed water. When the platinum plate was made very clean, by placing it in sulphuric acid. It acted with such energy on the gases, that the tube became warm, the pla­tina became red-hot, and the residue of the gases was in­flamed. A solution of tartaric or acetic acids gave the pla­tinum plate the power of producing explosion in the mixed gases, but strong sulphuric acid was most certain and power­ful. *Gold* and *palladium,* when acted on by hot oil of vitriol, possess also the power of combining oxygen and hydrogen.

Dobereiner had previously discovered the remarkable pro­perty possessed by platinum, which, in the state of a fine black powder, or spongy, became hot, and ignited a jet of hydro­gen. This is the well known instantaneous light apparatus. The following is the theory of these remarkable facts. The particles of hydrogen repel each other, so do those of oxygen ; but the strong adhesion of the gaseous particles to the pla­tina suspends, as it were, upon its surface, the above repul­sive forces, and brings the particles of oxygen and hydro­gen within the influence of their mutual affinity.

Spongy platinum also decomposes ammonia, and its salts when mixed with atmospheric air, and passed over the me­tal at 572° of Fahr. Non-metallic bodies, such as pounded glass and charcoal, have, at 600° Fahr., the same property as platinum.

Sect. V.—*On Electro-chemical Decompositions by weak Electric currents.*

The precipitation of metals from their solutions, by the presence of other metals, has been long known. A plate of copper, for example, will throw down metallic silver from a solution of the nitrate. Ritter, Sylvester, and Bucholz found that these precipitations were owing to electric cur­rents, and obtained some interesting results. It is to Μ. Becquerel, however, a distinguished member of the lnsti- tute of France, that we owe the successful investigation of this curious subject. In 1826, he found that, by very feeble electric forces, metals easily reducible were precipitatcd from their solutions, by plates of the same metal as that held ln solution. In 1627, he formed chlorides and iodides in the same way, and also double chlorides and double io­dides. In 1829, he succeeded in forming sulphureis, io­dides, and bromides by similar methods; and when the elec­tric energy of the apparatus was exceedingly feeble, and the decomposition slow, the sulphurets had time to assume a regular crystalline form, and he thus obtained crystals of almost all the metals. In a similar manner, he obtained distinct crystals of the metallic iodides.

In 1830, M. Becquerel found that new compounds were formed during these processes, by the reaction of the oxide of the metal at the positive pole of a solution. By the re­action of two solutions, one of which was the sulpho-carbo­nate of potash, and the other the sulphate of copper, and by employing an arc of copper and lead, the copper plung­ing into the sulphate, and the lead into the sulpho-carbo­nate, he succeeded in depositing on the lead small octahe­dral crystals of sulphur, with rhomboidal faces, exactly si.

@@@1 Faraday’s Experimental Researches, p. 247, § 846.

@@@’ Id. Id. p. 195, § 564, &c.