ed together, the terminal plates of the adjacent troughs are joined by slips of copper, which unite the zinc end of one trough with the copper end of the other.

The *galvanic trough,* as it is called, is shewn in fig. 7, as constructed by Mr Cruikshanks of Wool­wich. Plates of zinc and copper C Z, C Z, &c., fig­fl, soldered together, are made to constitute the partitions of a trough, T T, of baked wood, by fixing them into grooves formed in its side, all the zinc surfaces being on one side and all the copper ones on the other. The spaces or cells between them are then filled with a solution of salt and water, or with diluted muriatic or sulphuric acid. Troughs of this description are very apt to get out of order from the warping of the wood by the action of the acid solution, from the cracking of the cement, and other causes which affect the condition of the cells. This trough was still farther improved by keeping the plates of zinc and copper separate as at Z, C, but united at their summits S, with a small ribbon of copper. Each of these double plates was then placed upon the earthenware or glass partitions of a trough like that in fig. 6.

Dr Wollaston found that the power of a gal­vanic battery was greatly increased, when each surface of the zinc plate was opposed to a sur­face of copper, and in 1815 he constructed on this principle what be calls an *elementary galvanic bat­tery.* From a series of experiments, made for the purpose of ascertaining the most compendious form of apparatus, by which visible ignition might be shewn, he found that a single plate of zinc, *one inch* square, when rightly mounted, was more than sufficient to ignite a wire of platina 1/3000dth of an inch in diameter, even when the acid is very diluted (fifty parts of water to one of sulphuric acid). “ But for this purpose,” he adds, “ each surface of the zinc must have its counterpart of copper, or other meta), opposed to it ; for when copper is opposed only to one face, the action on the posterior surface of the zinc is wasted to little or no purpose. The smallest battery that I formed of this construction consisted of a thimble without its top, flattened till its opposite sides were about 2/10ths of an inch asunder. The bottom part was then nearly one inch wide, and the top about 8/10ths, and as its length did not exceed 9/10ths of an inch, the plate of zinc to be inserted was less than ¾ths of an inch square.”@@1

The plan thus suggested by Dr Wollaston was employed by Mr Children in the construction of a magnificent bat­tery, in which each plate presented a surface of thirty-two

square feet ; the plates being six feet long, and two feet eight inches broad. The plates are attached to a strong wooden frame, suspended by ropes and pullies, which, being counterpoised, is easily lowered and elevated, so as to im­merse the plates in, or raise them out, of the acid. The cells of the battery were twenty-one in number and their united capacities 945 gallons.@@3

Having seen a new battery of Dr Wollaston’s, constructed on a large scale by Newman, Mr Hart@@’ of Glasgow con­ceived the idea of adding sides and bottoms to the double copper plates, so as to make them form cells of themselves, for holding the acidulous liquid. In this way, each galva­nic pair became a *triad,* consisting of *two* plates of copper inclosing one of zinc. The following is the method of con­structing such a battery as given by Mr Hart :—

“ The cells are formed by cutting the copper in the form represented by fig. 9, they are then folded up as seen in fig. 10, and the seams grooved. A drop of tin is run into each lower corner, to render the cells perfectly tight, and at the same time to increase the positive state of the cop­per. Fig. 11. represents the zinc plate cast in the usual manner, and having a piece of screwed brass wire cast into the top of it, in order to suspend it by.

“Fig. 12. is a section of the battery, showing how the copper tail of the first cell is connected with the zinc plate of the second, and so on. This connection is rendered perfect, by joining them with a drop of solder. The zinc plates are kept firm in their place in the cells by three small pieces of wood, in the same manner as in Dr Wollaston’s battery ; the whole are then fixed (by means of screw nuts fitted on the brass wires) to a bar of baked wood, previously well varnished. Fig. 13 represents the battery in its complete state.

"When the battery is small, two may be suspended on one frame. When used for shocks, they may be arranged with the positive or negative poles together, and joined with wire to complete the circuit ; but when employed for de­flagration, the batteries ought to be placed alongside of

@@@1 Annals of Philosophy, vol. vi. p. 210.

@@@, Phil. Trans. 1815, p. 363.

@@@» Edin. Journal of Science, No. vii. p. 19, Jan. 1826.