duced by the disengagement of heat during the mixture, which was about 110°. The battery afforded at first twenty-two inches of the mixed gases in five minutes.

Wishing now to try the effect of higher temperatures, he replaced the membranous tubes with cylinders of porous earthenware. These cylinders, closed at the lower ends, had their diameter one and a half inches, and the same height as the copper cells. The bottoms of the latter are fitted with sockets in which the tubes are placed, and which confine them in their proper position, the perfo­rated colanders, which hold the sulphate of copper, pass­ing over their upper ends. These porous tubes require to be thoroughly soaked in dilute acid. The increase of temperature was obtained from steam, and the general re­sult of many experiments was, *that the working rate of this battery was nearly doubled at a temperature of* 212°, provided no secondary action interfered with it.@@1

In the interesting paper which contains these observa­tions, Professor Daniell has described an improved *constant* battery of large dimensions, the effects of which exceeded his most sanguine expectation, and which he thinks cannot be farther improved in point of simplicity and cheapness. This battery consists of *tcn* copper cells, twenty inches high, and three and a half inches diameter. The interior partitions are formed by merely tying the open ends of the oxen’s gullets to the rings of the colanders which hold the blue vitriol, and which are made deeper than before, and suspending them in the cells, to the bottoms of which they reach. Each bag contains rather more than a quart of the dilute acid. The zinc rods are five-8ths of an inch in dia­meter, and well amalgamated, and their connexions the same as formerly. At the temperature of 67° this battery produces, in the voltameter, twelve cubic inches of the mixed gases per minute, or 720 in the hour. It has great power of ignition, and while it will maintain six inches of platinum wire, 1/100of an inch in diameter, red hot. It will still decompose water at the rate of fourteen cubic inches in *jive* minutes. When the battery is not in use, the zinc rods are taken out and wiped, and the membranous bags carefully lifted out of their cells, emptied of their acid, fill­ed with water, and suspended from a frame placed for their reception. Professor Daniell adds, that there is no reason to think that the limits of efficiency have yet been nearly attained, and the gullets could easily be connected together so as to obtain bags of any required length. Professor Daniell has more recently put in action seventy series of his large constant battery, which, on the l6th February 1839, fused titanium, and heated sixteen feet four inches of No. 20 platinum wire.

Another form of the constant battery we owe to J. W. Mullins, Esq., M.P., who calls it the *quantity battery.* It consists of an earthenware pot six inches deep and four wide, which is shewn in action in fig. 35, and in perspective in fig. 36, a cylinder of amalgamated zinc, Z, Z, standing on legs half an inch long, and cut out of the cylinder, is placed in the pot ; the height of the cylinder, including the legs, is only two inches. Within this cylinder, and at the distance of three-8ths of an inch from it, is placed a copper vessel *c c*, having round its outer edge a rim a quarter of an inch wide, round which a thin bladder, well cleaned and moistened, is tied. The bottom of the pot rests on a circular piece of baked wood projecting a quarter of an

inch beyond the cylinder. The bladder is then drawn all over and fastened round the upper rim by a cord, and it is kept clear of the copper by the circular piece of wood. The copper cylinder c c, which is as deep as the pot, is perforated with six holes equidistant from the top and bottom. These holes form communications with an inner cylinder of copper C, C, three quarters of an inch dis­tant from the outer one. The shelf bottom of the space between the two cylinders, is on a level with the lower edge of the holes, and soldered to the large cylinder. The ob­ject of this cylindrical chamber is to hold crystals of sul­phate of copper when required, and to contain the solution, which should not rise higher than the upper edge of the holes. A small quantity of sal-ammoniac, (muriate of am­monia,) in the proportion of five parts of the saturated so­lution to 100 of water, is then poured outside the bladder till it reaches the upper edge of the zinc cylinder Z Z. The solution of sulphate of copper will require a few crystals of the sulphate to be added every four hours, but the am­moniacal solution needs no renewal. The connexions are formed, as in fig. 36, by strips of copper soldered to the zinc cylin­der Z Z, and to the inner copper cylinder C C. The wires bend over the edge of the pot and enter two cups holding mercury, from which the wires that transmit the electrical current through any ap­paratus, may proceed. The ac­tion of this battery will continue as long as a particle of metallic salt remains in solution. If *six* drops of a saturated solution of the sulphate of copper are added to the exhausted and colourless solution, the battery instantly resumes its original power. A constant current, therefore, may be kept up by having a few crystals of the blue vitriol on the shelf, which, by being gradually dissolved, will pass to the external surface of the copper.

Mr Mullins has constructed also a battery for intensity, of the effects of which he has given the following description:@@2 —“ I have put,” he says, “ as in the quantity battery, a shallow cylinder of zinc within, and close to the internal surface of the earthenware pot, next the copper cylinder, as before ; but, instead of letting the inside of this cylinder go for nothing, the internal surface of the copper is lined with very thin caoutchouc for insulation ; then comes an­other small cylinder of zinc, then a copper one lined as the last, then a zinc, and lastly, a copper cock, copper, of course, enveloped in membrane. In this battery the power is immense in proportion to the quantity of the metals used, which, in my opinion, depends upon a new principle, which is developed in this mode of construction and ar­rangement, that is, *restricting* the electric current to gradu­ally *diminishing metallic surfaces* as it advances, so that, as the quantity accumulates, the conducting surfaces are *reduced,* and of course a much higher degree of intensity is a necessary consequence. By merely altering the con­nexions of the plates, which, by the mode I have adopted, can be done with the utmost facility, this battery can be turned into a powerful quantity one, and probably a wine glass full of the solution is amply sufficient.”

Having found that a single piece of zinc, of three square inches, surrounded by a membrane, could be easily fitted up, Mr Shillibear constructed the galvanic apparatus shown

@@@1 The experiments of Marianini and Rogers on the influence of heat upon single voltaic circuits will be found in the *Annales de Chimie,* tom. miii. p. 182, and Sillimans' *Journal,* vol. xxvii. p. 67, January 1835. In Roger's experiments the deflection of the galvanometer, rose from 70° to 147° while the temperature rose from 75“ to 210“.

@@@\* Lend, and Edin. Phil. Mag. 1836, vol. ix. p. 283.