tion, produces a much ſpeedier and more efficacious effect than veſicatories. We have reaſon to hope that this matter will be further examined and illuſtrated.

DEATHS.

On the 17th of June, at Berlin, J. Abrahamſon, the celebrated dye-ſinker. He was born in 1722, in the duchy of Mecklenburgh-Strelitz, and learned, from a very indifferent artiſt of Liſſa, the art of engraving coats of arms, and of engraving on gems; but, being poſſeſſed of an excellent genius, he was able, by his own talents, combined with reflection, diligence, and cloſe application, to raiſe himſelf to that degree of celebrity to which he was ſo juſtly entitled. Without being able to draw or to model, he diſplayed in all his works great ability and readineſs. Among his principal productions may be reckoned his medals on the victories of Frederick II. during the ſeven years war, and particularly that on the battle of Torgau, after Ramler's idea and a drawing by Meils. He entered into the ſervice of his Pruſſian majeſty in 1750.

On the 20th of June, at Gottingen, that reſpectable veteran among the German mathematicians, Abraham Gotthelf Käſtner, in the eighty-firſt year of his age. He was a counſellor of ſtate to his Britannic majeſty, profeſſor of mathematics and natural philoſophy in the univerſity of Gottingen, member of the Royal Academy of Sciences of that city, of the Agricultural Society of Brunſwick Lunenburgh, of the Academies of Stockholm and Berlin, of the Electoral Academy of the Uſeful Sciences at Erfurt, of the Academy of Sciences at Bologna, &c. &c. Beſides poſſeſſing great mathematical knowledge, he was well acquainted with literature in general, and had a rich vein of wit, as appears by his proſe writings and his epigrams.

THE

PHILOSOPHICAL MAGAZINE.

SEPTEMBER 1800.

I. *On the Electricity excited by the mere Contact of conducting Subſtances of different Kinds. In a Letter from Mr.* ALEXANDER VOLTA, *F.R.S. Profeſſor of Natural Philoſophy in the Univerſity of Pavia, to the Right Hon. Sir* JOSEPH BANKS, *Bart. K.B. P.R.S.* *

Como in the Milaneſe, March 20, 1800.

AFTER a long ſilence, for which I ſhall offer no apology, I have the pleaſure of communicating to you, and through you to the Royal Society, ſome ſtriking reſults I have obtained in purſuing my experiments on electricity excited by the mere mutual contact of different kinds of metal, and even by that of other conductors, alſo different from each other, either liquid or containing ſome liquid, to which they are properly indebted for their conducting power. The principal of theſe reſults, which comprehends nearly all the reſt, is the conſtruction of an apparatus having a reſemblance in ts effects (that is to ſay, in the ſhock it is capable of making the arms, &c. experience) to the Leyden flaſk, or, rather, to an electric battery weakly charged acting inceſſantly, which ſhould charge itſelf after each exploſion; and, in a word, which ſhould have an inexhauſtible charge, a perpetual action or impulſe on the electric fluid; but which differs from it eſſentially both by this continual action, which is peculiar

* Tranſlated from the author's paper publiſhed in French in the Philoſophical Tranſactions for 1800, part 2.

Yet, led by the analogy of this fact, its diſcoverer found that a ſimilar artifice did not ſucceed in decompoſing the muriatic acid. "As vital air," he obſerves, "is attracted by a compound of phoſphorus and calcareous earth more powerfully than by charcoal, I was deſirous of trying their efficacy upon thoſe acids which may from analogy be ſuppoſed to contain vital air, but which are not affected by the application of charcoal. With this intention, I made phoſphorus paſs through a compound of marine acid and calcareous earth, and alſo of fluor acid and calcareous earth, but without producing in either of them any alteration. Since the ſtrong attraction which theſe acids have for calcareous earth tends to prevent their decompoſition, it might be thought, that in this manner they were not more diſpoſed to part with vital air than by the attraction of charcoal: but this, however, does not appear to be the fact. I have found that phoſphorus cannot be obtained by paſſing marine acid through a compound of bones and charcoal when red-hot. The attraction, therefore, of phoſphorus and lime for vital air exceeds the attraction of charcoal by a greater force than that ariſing from the attraction of marine acid for lime *."

By means ſimilar to thoſe employed in attempting the analyſis of the muriatic acid, I tried to effect that of the fluoric acid. When electrified alone, in a glaſs tube coated internally with wax, it ſuſtained a diminution of bulk, and there remained a portion of hydrogenous gas. But neither in this mode, nor by ſubmitting it, mixed with carbonated hydrogenous gas, to the action of electricity, was any progreſs made towards its analyſis. Theſe experiments, however, render it probable, that the fluoric acid, like the muriatic, is ſuſceptible of ſtill further oxygenation, in which ſtate it becomes capable of acting on mercury. The carbonic acid, on the contrary, appears not to admit of two different degrees of oxygenation. When the electric ſhock has been repeatedly paſſed through a portion of this acid gas, its bulk is enlarged, and a permanent gas is produced, which is evidently a mixture of oxygenous and hydrogenous gaſes; for, when an electric ſpark is paſſed through the gas that remains after the abſorption of the carbonic acid by cauſtic alkali, it immediately explodes. Theſe reſults even take place on electrifying carbonic acid from marble, previouſly calcined in a low red heat, to expel its water, and then diſtilled in an earthen retort *.

* Philoſophical Tranſactions, Vol. LXXI. p. 184.

IV. *Experiments in Galvanic Electricity, by Meſſrs.* NICHOLSON, CARLISLE, CRUICKSHANK, &c.

IN the fourth volume of the Philoſophical Magazine, p. 59, 163, and 306, we laid before our readers M. Volta's account of the progreſs he had then made in Galvaniſm; and in our number for May laſt we ſtated that Mr. Carliſle had been making ſome experiments which were likely to lead to ſome important diſcovery in Galvanic electricity. We ſhould have then mentioned, but we knew not the fact, that he made them in conjunction with Mr. Nicholſon, editor of a well conducted and well known philoſophical journal. When we learnt the circumſtance, motives of delicacy, which our readers muſt approve, forbade our attempting to give any further particulars till Mr. Nicholſon himſelf, who had the beſt right, ſhould firſt lay them before the public.

Since that time Mr. Nicholſon has publiſhed ſeveral curious and important papers on this ſubject, from which we ſhall now ſelect a few particulars for the information of our readers; referring thoſe who may wiſh for a fuller account, to Mr. Nicholſon's journal.

The general apparatus we need not particularly to deſcribe, having in the preſent number given a tranſlation of M. Volta's paper which appeared in the ſecond part of the Philoſophical Tranſactions for the preſent year, juſt publiſhed.

* Meſſieurs Landriani and Van Marum (*An. de Chemie*, Tome II. p. 270) obtained only hydrogenous gas by electrifying the carbonic acid gas. But the conductor of their apparatus was an iron one; which metal would combine with the oxygen of the water, and prevent it from appearing in a gaſeous ſtate. In my experiments the conductors were of platina.

Mr. Anthony Carliſle, having been favoured with a peruſal of this paper by the very reſpectable Preſident of the Royal Society, the Right Hon. Sir Joſeph Banks, Bart. ſoon after, in conjunction with Mr. Nicholſon, began to repeat the experiments of M. Volta, and obtained ſimilar reſults. Very early in this courſe, the contacts being made ſure by placing a drop of water upon the upper plate of the pile, Mr. Carliſle obſerved a diſengagement of gas round the conducting wire. This gas, though minute in quantity, ſeemed to Mr. Nicholſon to have the ſmell of hydrogen when the wire of communication was ſteel. This, with ſome other facts, led him to propoſe to break the circuit by the ſubſtitution of a tube of water between two wires. Accordingly, a braſs wire through each of two corks was inſerted at the oppoſite ends of a glaſs tube about half an inch in diameter, filled between the corks with water: the diſtance between the points of the wires in the water, was about an inch and three quarters.

"This compound diſcharger was applied ſo that the external ends of its wire were in contact with the two extreme plates of a pile of thirty-ſix half crowns with the correſpondent pieces of zinc and paſteboard. A fine ſtream of minute bubbles immediately began to flow from the point of the lower wire in the tube, which communicated with the ſilver, and the oppoſite point of the upper wire became tarniſhed, firſt deep orange, and then black. On reverſing the tube, the gas came from the other point, which was now loweſt, while the upper, in its turn, became tarniſhed and black. Reverſing the tube again, the phenomena again changed their order. In this ſtate the whole was left for two hours and a half. The upper wire gradually emitted whitiſh filmy clouds, which, towards the end of the proceſs, became of a pea-green colour, and hung in perpendicular threads from the extreme half inch of the wire, the water being rendered ſemi-opaque by what fell off, and in a great part lay, of a pale green, on the lower ſurface of the tube, which, in this diſpoſition of the apparatus, was inclined about forty degrees to the horizon. The lower wire, three quarters of an inch long, conſtantly emitted gas, except when another circuit, or complete wire, was applied to the apparatus; during which time

time the emiſſion of gas was ſuſpended. When this laſt mentioned wire was removed, the gas reappeared as before, not inſtantly, but after the lapſe of four beats of a half ſecond clock ſtanding in the room. The product of gas, during the whole two hours and a half, was two-thirtieths of a cubic inch. It was then mixed with an equal quantity of common air, and exploded by the application of a lighted waxed thread."

To have reverſed the tube would have anſwered the ſame purpoſe, but they choſe to do this, "and found that, when the zinc was at the bottom, its effects were reverſed; that is to ſay, the gas ſtill came from the wire communicating with the ſilver," &c.

Meſſrs. Carliſle and Nicholſon were "led, by reaſoning on the firſt appearance of hydrogen, to expect a decompoſition of water; but it was with no little ſurpriſe that they found the hydrogen extricated at the contact with one wire, while the oxygen fixed itſelf in combination with the other wire at the diſtance of almoſt two inches. As the diſtance between the wires formed a ſtriking feature in this reſult, it became deſirable to aſcertain whether it would take place to greater diſtances. When a tube three quarters of an inch in diameter, and thirty-ſix inches long, was made uſe of, the effect failed, though the very ſame wires, inſerted into a ſhorter tube, operated very briſkly."

The experiment being tried with tincture of litmus in place of water, and the oxydating wire, namely, from the zinc ſide, being loweſt in the tube, it changed the tincture red in about ten minutes as high as the upper extremity of the wire. The other portion remained blue. Hence it ſeems either an acid was formed, or that a portion of the oxygen combined with the litmus, ſo as to produce the effect of an acid.

"It may be here offered as a general remark, that the electric pile with card, or with woollen cloth, continues in order for about two days, or ſcarcely three; that, from a ſeries of glaſſes ſet up by Mr. Carliſle, as well as from the pile itſelf, it appears that the ſame proceſs of decompoſition of water is carried on between each pair of plates, the zinc being oxyded on the wet face, and hydrogen given out; that

the common ſalt is decompoſed, and exhibits an efflorescence of ſoda round the edges of the pile, extruded, moſt probably, by the hydrogen: and that, on account of the corroſion of the faces of the zinc, it is neceſſary to renew them previouſly to each conſtruction of the pile. This may be done by ſcraping or grinding."

By ſeveral accurate and well conducted experiments, Mr. Nicholſon aſcertained that the electricity of the zinc was plus, and that of the ſilver minus, which ever of them were at the top of the pile. The electric ſpark was even rendered viſible; ſo that there can be no doubt of the identity of the electric and Galvanic fluid.

The decompoſition of water, and oxydation of metallic wire, ſuggeſted other experiments. Two ſmall wires of platina were inſerted, as before, in a ſhort tube. When the connection with the pile was formed, the wire from the ſilver gave a plentiful ſtream of gas, and that from the zinc a ſmaller one. In four hours, neither turbidneſs, oxydation, nor tarniſh appeared. The larger ſtream was naturally ſuppoſed to be hydrogen, the ſmaller oxygen.

With thick gold leaf inſtead of platina, the reſult was the ſame, only the extremity of the ſlip connected with the zinc acquired a coppery or purpliſh tinge.

A braſs wire was ſubſtituted for one of the ſlips of gold. When the former was joined to the ſilver end, the two ſtreams were extricated as before; but when joined to the zinc, it became oxyded, as when both the wires were of braſs.

The ſimple decompoſition of water by platina wires, without oxydation, offered a means of obtaining the gaſes ſeparate from each other. This was tried with a pile of ſixty-eight ſets. A wire from each end of the pile paſſed under ſeparate phials full of water inverted in a faucer of water. "A cloud of gas aroſe from each wire, but moſt from the ſilver or minus ſide. Bubbles were extricated from all parts of the water, and adhered to the whole internal ſurface of the veſſels. The proceſs was continued for thirteen hours, after which the wires were diſengaged, and the gaſes decanted into ſeparate bottles. On meaſuring the quantities, which was

was done by weighing the bottles, it was found that the quantities of water diſplaced by the gaſes were, reſpectively, 72 grains by the gas from the zinc ſide, and 142 grains by the gas from the ſilver ſide; ſo that the whole volume of gas was 1.17 cubic inches, or near an inch and a quarter. Theſe are nearly the proportions in bulk of what are ſtated to be the component parts of water. The gas from the zinc ſide being tried with one meaſure of nitrous gas, contracted to 1.25, and did not contract more by the addition of another meaſure; the gas from the ſilver ſide, by the ſame treatment, contracted to 1.6. The air of the room, on trial, contracted to 1.28. From the ſmallneſs of the quantity, no attempt was made to detonate the air from the zinc ſide; but a portion of that from the ſilver ſide, being mixed with one-third of atmoſpheric air, gave a loud detonation.

"Upon the above it may be remarked, that it does not ſeem probable that oxygen was afforded by both wires, but that they were mixed by the circumſtances of the experiment."

Mr. Cruickſhank, of Woolwich, alſo made ſome intereſting experiments on this ſubject. He employed plates of zinc and ſilver about 1.6 inches ſquare; and the number of each varied from 40 to 100, according to the power required. He uſed ſilver wire both from the zinc and ſilver plate in his firſt experiments; but to diſtinguiſh the ends of the pile, that wire only is called the ſilver wire, which was connected with the ſilver plate; the other wire he calls (to ſave circumlocution) the zinc wire. Theſe wires were paſſed through corks fitted into a glaſs tube filled with water, and one of the corks made perfectly tight by means of cement. "The tube was then placed upright in a cup containing water, with the uncemented end downwards. As ſoon as the communication was made between the extremities of the pile by the wires, a quantity of ſmall air bubbles began to aſcend from the end of the wire connected with the ſilver, as obſerved by Meſſrs. Nicholſon and Carliſle; but a white cloud at the ſame time made its appearance at the one proceeding from the zinc, or the zinc wire. This cloud gradually increaſed, and aſſumed a darker colour, and at laſt it became purple, or even black. A very few air bubbles were likewiſe collected upon and aſcended

aſcended from this wire; but when the machine was in full force, a conſiderable ſtream could be obſerved.

"The gas was collected, and found to be a mixture of hydrogen and oxygen, in the proportion of three parts of the former to one of the latter. No great dependence, however, was placed upon this in point of accuracy. The zinc wire was found to be much corroded, and looked as if a conſiderable portion of it had been diſſolved. As the cloud which was formed around this wire became purple on expoſure to the light, Mr. Cruickſhank ſuſpected it might be luna cornea, or muriat of ſilver proceeding from the ſilver, which had been ſomehow diſſolved, and afterwards precipitated in this ſtate, by the muriatic ſalts in the common water."

Diſtilled water, to which a little tincture of litmus was added, was next employed in the tube. Gas aroſe from both wires, but in greateſt quantity from the ſilver wire. In a ſhort time, the whole fluid below the point of the zinc wire became red, and the fluid above the ſilver wire looked of a deeper blue than before, the ſlight tinge of purple being deſtroyed.

Diſtilled water, tinged with Brazil wood, ſoon became of as deep a purple as could be produced by ammonia, while the portion of the fluid round the zinc wire became very pale. From theſe experiments it appears to Mr. Cruickſhank, that an acid, probably the nitrous, is produced at the wire connected with the zinc, and an alkali, probably ammonia, at that connected with the ſilver, end of the pile.

When lime-water was employed, the wire was likewiſe acted upon, but in a leſs degree. The cloud at firſt had an olive colour, exactly reſembling the precipitate of ſilver by lime water.

In theſe experiments the quantity of ſilver diſſolved was conſiderable, and, where water was employed, a portion of it remained in ſolution, which was proved by adding muriatic acid. More would probably have been ſuſpended, but that an evident precipitation near the upper extremity of the zinc wire, was occaſioned by the alkali generated by the proceſs.

As hydrogen gas, when heated, or in its naſcent ſtate, reduces

reduces metallic oxyds, Mr. Cruickſhank filled the glaſs tube with a ſolution of acetite of lead to ſeparate the hydrogen from the oxygen, and thus obtain the latter pure. An exceſs of acid was added to the acetite to take up the alkali: in a minute or two after the communication was made, ſome fine metallic needles, which afterwards aſſumed the form of a feather, or rather that of the cryſtals of ammonia, were perceivable at the end of the ſilver wire. The lead was in its metallic ſtate.

Solutions of ſulphat of copper and nitrat of ſilver, were tried in the ſame way, and with ſimilar reſults. The metals were revived.

When pure water, mixed with diſtilled vinegar or with a very little ſulphuric acid, were employed in the tube, metallic ſilver was precipitated by the ſilver wire, the acid employed preventing the alkali from precipitating the ſilver diſſolved by the generated acid; in conſequence of which, when a ſufficient quantity of the metal was taken up, it was again thrown down by the ſilver wire in its metallic form.

Muriat of ammonia in ſolution being tried, a little gas was diſengaged from the ſilver wire: an incruſtation of luna cornea was formed round the zinc wire. The liquor remaining after the experiment, ſmelled ſtrongly of ammonia. Common ſalt was decompoſed alſo. Indeed, when a ſolution of muriat of ſoda or of ammonia is employed to moiſten the papers in the pile, the ſalt is always decompoſed.

Nitrat of magneſia was decompoſed by the ſame means.

In ſome after experiments gold wires were tried, and the quantity of oxygen gas obtained was much greater than when ſilver wires were employed.

Two gold wires were paſſed through a cork looſely introduced into the mouth of a three-ounce phial filled with lime water: the phial being inverted over pure water, the exterior ends of the wires were connected with the pile in the uſual way. In four hours the phial was filled with gas extricated from the wires, eſpecially the one connected with the ſilver. One meaſure of the gas mixed with two of nitrous gas, a diminution of one meaſure took place: the reſiduum contained nitrous gas mixed with hydrogen. Four meaſures exploded

exploded by the electric ſpark over mercury, diſappeared, except about $\frac{1}{15}$ of a meaſure, which appeared to be azot.

Two gold wires were paſſed through corks, ſecured by cement in the ends of a glaſs tube, about 10 inches long, bent into the form of the letter V; they reached to within an inch of each other, at the angle, in which there was a hole about one-tenth of an inch in diameter. The tube was then filled with diſtilled water, and the opening at the angle being ſhut with the finger to keep in the water, it was thus placed in a cup of water with the angle downwards. The extremities of the wires being then joined to thoſe of the pile, gas was diſengaged from both, but moſt from that connected with the ſilver; the gaſes were thus kept diſtinct. One meaſure of the gas from the ſilver end, mixed with one of nitrous gas, gave red fumes, a diminution of one-third of a meaſure, and a reſiduum conſiſting of nitrous and hydrogen gas. Two meaſures with one of oxygen being exploded over mercury diſappeared, except about one-fifth of a meaſure, which by the nitrous teſt appeared to be chiefly oxygen. A denſe white vapour was perceived over the mercury for ſome time after the exploſion. One meaſure of the gas from the zinc end, being mixed with two of nitrous gas, the whole nearly diſappeared: another meaſure of the latter being added, the total diminution was nearly three meaſures.

With platina wires Mr. Cruickſhank obtained almoſt ſimilar reſults. The one connected with the zinc end became tarniſhed; the ſame thing happened when gold wires were uſed.

A ſolution of cryſtallized muriat of lime, incloſed in a tube in the common manner, and gold wires being employed, the one from the ſilver gave little gas, but that from the zinc a conſiderable quantity, and the fluid ſurrounding it aſſumed a fine yellow colour, a ſolution of the gold having been effected. After a time ſome gas came from the firſt wire, but there was no precipitation of lime. When the tube was opened, the fluid ſmelled of aqua regia, or the oxy-muriatic acid. When platina wires were employed in place of gold, the ſmell of nitro-muriatic acid was ſoon obſervable

ſervable, but no ſolution of the platina. When the tube was filled with a ſolution of muriat of ſoda, a nitro-muriatic acid was likewiſe produced.

Mr. Cruickſhank from theſe experiments draws the following concluſions:

"1. That hydrogen gas, mixed with a very ſmall proportion of oxygen and ammonia, is ſomehow diſengaged at the wire connected with the ſilver extremity of the machine; and that this effect is equally produced, whatever the nature of the metallic wire may be, provided the fluid operated upon be pure water.

"2. That where metallic ſolutions are employed inſtead of water, the ſame wire which ſeparates the hydrogen revives the metallic calx, and depoſits it at the extremity of the wire in its pure metallic ſtate; in this caſe no hydrogen gas is diſengaged. The wire employed for this purpoſe may be of any metal.

"3. That of the earthy ſolutions, thoſe of magneſia and argill only are decompoſed by the ſilver wire; a circumſtance which ſtrongly favours the production of ammonia.

"4. That when the wire connected with the zinc extremity of the pile conſiſts either of gold or platina, a quantity of oxygen gas, mixed with a little azot and nitrous acid, is diſengaged; and the quantity of gas thus obtained is a little better than one-third of the hydrogen gas ſeparated by the ſilver wire at the ſame time.

"5. That when the wire connected with the zinc is ſilver, or any of the imperfect metals, a ſmall portion of the oxygenous gas is likewiſe given out, but the wire itſelf is either oxydated or diſſolved, or partly oxydated and partly diſſolved: indeed, the effect in this caſe, produced upon the metal, is very ſimilar to that of the concentrated nitrous acid, where a great deal of the metal is oxydated, and but a ſmall quantity held in ſolution*.

* The great difference in the effect produced by this influence on gold and ſilver, which have always been conſidered as equally difficult to oxydate, can only be explained on the ſuppoſition, that nitrous acid is generated; for this acid, it is well known, acts powerfully on ſilver, but has no action whatever on gold. The ſame obſervation applies to platina.

" 6. That when the gafes, obtained by gold or platina wires, are collected together and exploded over mercury, the whole nearly difappears and forms water, with probably a little nitrous acid, for there was always a thick white vapour perceived for fome time after the explofion. The refiduary gas in this cafe appeared to be azot."

Acid folutions of metals having been decompofed, Mr. Cruickfhank tried their folution in alkalies. Pure ammonia was added to a dilute folution of nitrat of filver, till the mixture fmelled ftrongly of the former. Being put into a tube in the ufual way, with filver wires, and the communication made, a rapid production of gas took place from the filver end, but hardly any from the zinc. Grayifh flafhes of metallic filver were feparated from the filver wire, and on the zinc wire a dark gray fubftance was depofited, which, on afterwards endeavouring to fcrape it off with the finger, exploded, though ftill moift. The wire was corroded and full of holes. The fulminating filver of Berthollet had in fact been produced in this experiment.

When pure ammonia was introduced into the tube in place of the folution of the nitrat of filver, the refult was the fame—the filver wire from the zinc being corroded, &c. was taken up by the alkali, and afterwards depofited in its metallic form by the other wire. To the firft adhered fome of the fulminating filver, and a portion was alfo depofited from the fluid, after ftanding fome time.

From pure ammonia, with copper wires, a quantity of very pure metal was precipitated—from an ammoniacal folution of copper the fame pure metallic precipitate. From thefe experiments Mr. Cruickfhank remarks, that it appears that the Galvanic influence might be employed with fuccefs in the analyfis of minerals.

Pure ammonia being introduced into a bottle, and inverted over the fame fluid, with a cork and two wires, as before defcribed, (the wire connected with the zinc being platina and the other filver), a rapid decompofition of the alkali was effected. Two ounce meafures of gas being collected and examined, was found to confift of 15 parts of hydrogen gas, 13 of azotic, and two nearly of oxygen gas.

The

The nitrous acid feemed to be little or not at all acted upon by the Galvanic influence, from which Mr. Cruickfhank infers that it is fo perfect a conductor of the fluid as to tranfmit it like metals, without experiencing any change; and this he thinks may poffibly be owing to the great proportion of oxygen, which enters into its compofition, having before remarked that all fluids, containing little or no oxygen, are non-conductors, or nearly fo.

The corroded matter generated at the wire connected with the zinc are not, Mr. Cruickfhank obferves, pure oxydes; and it follows that an acid, as before mentioned, and probably the nitrous, is produced; for all the green oxyds of copper contain an acid of fome kind or other, the pure oxyds of that metal being either dark red or deep brown.

Mr. Nicholfon's Journal alfo contains fome intereffing experiments on this fubject made by Mr. Davy, of Briftol, which gave refults that almoft all admit of the fame inferences that have been made by Meffrs. Nicholfon, Carlifle, and Cruickfhank. He made an ingenious diverfity in the circuit. Tubes filled with diftilled water, and furnifhed with gold wires connected with the pile, were inverted in different glaffes, and the communication between them formed by mufcular fibre; the gafes were given off in great quantity, and from feveral experiments pure oxygen and pure hydrogen were feparately obtained, nearly in the proportions required to form water.

Some ingenious experiments have alfo been made by Mr. Henry, of Manchefter, and by Lieut. Col. Henry Haldane; for an account of which we muft refer our readers to the Philofophical Journal.

V. *Letter from* HENRY MOYES, *M. D. to* MAXWELL GARTHSHORE, *M. D. containing an Account of fome intereffing Experiments in Galvanic Electricity. Communicated by Dr.* GARTHSHORE.

DEAR SIR, Pittenweem, Fifefhire, Aug. 15, 1800.

HAVING once more returned to my fummer refidence, where folitude increafes the attractions of fcience, I fhall