

connexion with the common galvanic battery, depends upon the relation of the fluid and metal, and not upon that of the metals merely. These experiments should be repeated, with the aid of the insulating glasses, placed so as to receive the coils of your machine. I should be very curious to know whether the effects would be the same; and as I now have the glasses, I shall, as soon as possible, try this experiment. We must look to you, sir, for the explanation of this singular incompatibility between the two instruments. At present, I confess myself unable to explain it. It may, very possibly, lead to important results, and may have a bearing, such as I have not now time to discuss, on your own peculiar theory.

I would state that the mode of connecting the two batteries was varied in every form which occurred, not only to myself, but to several able scientific gentlemen who were present at these experiments, and who were equally with myself surprised and confounded by their results.

I congratulate you upon the brilliant additions which you have made to our experimental means, in this department of knowledge. Along with your invention of the compound Blowpipe, they fairly entitle you to the gratitude of the scientific world, notwithstanding the uncandid attempts which, in relation to the Blowpipe, I am sorry to see, are still persevered in, to deprive you of the credit which you so richly deserve.

I remain, as ever, your friend and servant,
Prof. Robert Hare, M.D. B. SILLIMAN.

XXVIII. *On Addition and Subtraction of Algebra.* By Mr. PAUL NEWTON.

To Dr. Tilloch.

Old Assembly House, Newaick, Feb. 11, 1822.

SIR, — THE confused notions which have hitherto prevailed concerning Addition and Subtraction of Algebra, and the consequent inconsistency with which our best authors have treated these rules, incline me to indulge the hope that you will admit, on this subject, a few observations as a supplement to what you kindly inserted in No. 285 of your distinguished and invaluable Magazine.

“*Time*, which overthrows the illusions of opinion,” must establish, in its progress, just regulations of *quantity*. I shall again refer to Mr. Bonnycastle’s treatise, for instances of injudicious arrangement, not from any invidious motive of detracting from his merit, but because his treatise is, I believe, the last great work on the subject, and because his errors are calculated to mislead,

lead, precisely in proportion to that high degree of estimation in which his writings are held. All Mr. Bonnycastle's three cases, in Addition, exhibit a mixture of positive with negative quantities. Now, this mixture is contrary to the nature of Addition, for its operations should be limited to quantities (whether like or unlike) which are either all positive, or all negative. By avoiding this mixture, Addition will be greatly simplified, and rendered consistent. When positive and negative quantities are opposed to each other, Subtraction must inevitably constitute a part of the operation. Nothing can be more certain than that the "incongruous mixture," in question, should be transferred to the rule for subtracting *simple quantities*, in which the operations will require no change of signs, because only those quantities require to be subtracted, to which the negative sign is prefixed.

A change of signs is applicable to the Subtraction of *compound quantities* only, and to *such only* as contain a mixture of positive with negative terms in the subtrahend; for, when the subtrahend consists entirely of negative terms, Subtraction may then be performed by the rule for *simple quantities*, since the negative terms in the minuend (if any there are) will continue to be negative terms, when transferred to the subtrahend.

To conform to the old rules, out of mere politeness, is to violate reason, in an instance, in which, to exercise reason is our professed purpose. By absurdly admitting a part of Subtraction in Addition, and by confining the nominal rule of Subtraction to a mere change of signs in the subtrahend, our indulgent authors apparently justified each other in the impropriety of prefixing the affirmative sign (+) to a compound quantity, as $13 - \sqrt{b} + (5 - 4 - \sqrt[3]{x})$.

But, should future authors perceive the propriety of making those now arrangements which I have suggested; then, either some new sign must be substituted for (+), when it is used as a prefix to certain compound quantities; or, a more extensive definition must be given to this affirmative sign, than that which is appropriated to it when applied to simple quantities.

It is often fruitless to search for the origin of vulgar errors; but we may with probability suppose that our authors derived their erroneous ideas of Addition, from the operations necessary to be performed in finding the final product of some factors in Multiplication. Thus, suppose it were required to multiply $x^2 + xy - y^2$, by $x - y$.

$$\text{Here } (x^2 + xy - y^2) \times (x - y) =$$

$$(x^2 + xy)x - (x^2 + xy)y - (x - y)y^2 =$$

$$(x^3 + x^2y) - (x^2y + xy^2) - (xy^2 - y^3) = x^3 - 2xy^2 + y^3,$$

which.

which final product, instead of being the result of Multiplication and *Addition*, I entertain no doubt, sir, that all your readers will perceive, is obtained by Multiplication and *Subtraction*.

I have the honour to be, sir,

Your most obedient humble servant,

PAUL NEWTON.

XXIX. On Flame, &c. By JOHN MURRAY, F.L.S. M.W.S.
&c. &c.

To Dr. Tilloch.

London, Feb. 7, 1822.

SIR, — I HAVE elsewhere combated the opinion of Sir H. Davy, touching the structure of flame. In my chemical Prælections I was under the necessity of examining the very ingenious and novel views promulgated by this justly celebrated chemist, and of recording my dissent from some of these inferences. *Inter alia*, I contended that flame in common circumstances was to be considered a *superficial film*, and in this position my numerous experiments are quite conclusive and bear me out. I take leave to quote a passage from Lord Bacon's *Sylva sylvarum*, interesting, as it shows that the opinion of Sir H. Davy was entertained even by that great master of the Philosophy of Induction:

"Sume ceream et statue in tubulo ferreo aut aëreo,—postea impone illum erectum scutellæ, spiritu vini plenæ et calefactæ, deinde cerea et spiritu vini simul igni impositis, flammam ceræ dilatari videbis et quadruplo quintuploque intermiscere, quam ante soleret; apparetque in rotunda non pyramidalis figura. *Insuper internam cereæ flammam conspicias* servato colore, neque quicquam cærulei contrahere versus colorem externæ flammæ in spiritu vini, &c."

This experiment Lord Bacon calls "*egregia instantia*." Now, it is, on the other hand, a *noble example* of what leads to a conclusion the very reverse of that inferred. If the flame of the alcohol envelops that of the taper, the latter is *invariably extinguished*. This fact is best exemplified by using only a limited surface of alcohol, for when a larger quantity is employed the apex of the flame is ragged and uneven, and does not unite in a conical form from the resisting and undulating atmosphere which, therefore, fills up the chasms. The wax of the taper melts down, and affords an additional proportional of carbon to the vapour of the alcohol, thus imparting to the summit of the flame in its transit an increased illuminating power.

It is singular that in a subsequent page, our author under "*Experimentum solitarium spectans flammam*," &c. describes a phenomenon