A

JOURNAL

OF

NATURAL PHILOSOPHY,

CHEMISTRY,

AND

THE ARTS.

VOL. IX.

Illustrated with Engravings.

BY WILLIAM NICHOLSON.

LONDON:

PRINTED BY W. STRATFORD, CROWN COURT, TEMPLE BAR; FOR

THE AUTHOR,

AND SOLD BY HIM AT NO. 10, SOHO-SQUARE;

AND BY

J. MURRAY, NO. 32, FLEET-STREET.

1804.

IV.

Deſcription of a compound Electrical Inſtrument for condenſing and doubling: with Experiments. By Mr. WILSON.

London, Auguſt 10, 1804.

To Mr. NICHOLSON,

SIR,

I TAKE the liberty of troubling you with the following account and drawing of a compound condenſer of electricity, which I think is an improvement on Cavallo's multiplier of electricity, deſcribed in his Treatiſe on Electricity in the third volume, of the fourth edition, and if you think it worth a place in your Philoſophical Journal, you will very much oblige me by inſerting it therein. Compound electrical condenſer.

I am your obedient
Humble ſervant,
W. WILSON.

The drawing is an exact repreſentation of the inſtrument, about half its real ſize, *(Plate* 3.*)* The plates A, B, C, D, and E are ſupported by glaſs ſticks, covered with ſealing wax at the upper part; but the plate F is ſupported by a wire, which has a joint at the bottom, by which it may be brought near the plate E, or thrown back away from it. 3 is a ſcrew, which ſtops againſt the glaſs ſupport of E, and regulates the diſtance of the two plates when one is brought near the other. The plates A, C and E are fixed to the bottom board, and B and D to the levers L l, which move round the pins p p, and and are connected by the rod R. It will be ſeen by the drawing, that when the lever L is moved, the plates B and D are moved in contrary directions, that is, they both approach towards or recede from the plate C at the ſame time, but on oppoſite ſides. The faces of the plates are ground flat, and they are ſo adjuſted that if the ſcrews 2 2 did not ſtop the levers when they are moved, the face of B would ſtop flat againſt the face of A, and ſo would the face of D againſt C. The ſcrews 2 2 ſtop them when at a very ſmall diſtance, which may be made more or leſs by turning the ſcrews. Deſcription and drawing of the inſtrument.

Its uſes as a condenſer, a ſingle and double multiplier, and a doubler of electricity.

This inſtrument ſerves the purpoſe of a condenſer, a ſingle and double multiplier, and a doubler of electricity. When it is uſed as a ſingle condenſer, the plate B is brought as near A as the ſcrew 2 will permit, and then the wires *b* and *f* touch one another and uninſulate B, which increaſes the capacity of A. As the capacity of A is increaſed it will receive a greater charge of electricity from any electrified body brought into contact with it. Conſequently, when B is removed, the charge on A will be much more intenſe than it would have been if the plate B had not been oppoſed to it; but this intenſity will not be greater than that of the electrified body, if its ſurface is not greater than the ſurface of the receiving plate A; for a condenſer does not increaſe the quantity of electricity, it only collects it into a ſmaller ſpace than it was before. So that if the electricity of a very ſmall body is required to be aſcertained, the ſimple condenſer will not anſwer the purpoſe. Some other means muſt be uſed when this is the caſe, and Cavallo's multiplier is the leaſt exceptionable of the inſtruments uſed for this purpoſe. The inſtrument repreſented in the drawing forms a multiplier, either ſingle or double, for when B is near A and uninſulated, A will receive a much greater charge that it would if B had not been near. And becauſe B is uninſulated, A will induce a contrary ſtate on B, and of nearly equal intenſity; which ſtate is preſerved: For the inſtant the lever is moved to carry B farther from A; the contact between the wires *b* and *f* is diſcontinued, and B inſulated, and as it removes farther away from A, the intenſity of its charge will increaſe the ſame as that of A will, and be ready to part with nearly the whole to another condenſer.

Now as the plate B removes away from A, the plate D approaches C, and when at a ſmall diſtance from it, the wires *d* and *g* come into contact, which operation uninſulates D, and therefore cauſes the two plates C and D to form a condenſer; and at the ſame inſtant that *d* touches *g*, the wires *b* and *c* touch one another, ſo that nearly the whole of the charge of B is communicated to C, which induces a contrary ſtate on D, as the charge of A did on B. D will therefore be in the ſame ſtate as A is, which ſtate is preſerved; for the inſtant the plate B removes away from near C, the plate D alſo removes away from it, and the contact between the wires *d* and *g* is diſcontinued, and D inſulated; and by continuing the motion the plate

plate B will come near A, and D will remove away from C till the wires *b* and *f* touch one another, at which inſtant the wire *d* touches the wire *e*. Now if the plate E and F are near one another, they will form a third condenſer, and nearly the whole of the charge of D is communicated to E in the ſame manner the charge of B was communicated to C; at the ſame time B recruits its charge by coming near A, which will be communicated to C, which induces a contrary ſtate on D, and which D communicates to E, and this operation is repeated every time the lever is moved backwards and forwards; ſo that the charge on C is increaſing at every motion of the lever, while the charge on A remains the ſame; and when C becomes ſo much charged as not to be capable of receiving any more from B (which will be the caſe in a certain number of motions) the operation will ſtill go on between D and E, the charge on E increaſing while the charge on C remains the ſame, ſo that E will acquire a charge as much greater than C as the charge on C is greater than the charge on A, which will be manifeſted by removing the plate F away from E. When the wire *a* is ſcrewed into the plate A, and connected with E by means of the wire 4 5; the inſtrument then poſſeſſes all the properties of the double of electricity, for then all the charge communicated to E (which is of the ſame nature as that of A) will be communicated to A, which will continually increaſe the intenſity of its charge, and that will have an increaſed effect on B, &c. at every motion of the lever. There is no limits to this accumulation, but that where the charge is ſo intenſe as to paſs from one plate to the other in the form of a ſpark.

Its uſes as a condenſer, a ſingle and double multiplier, and a doubler of electricity.

I have made many experiments with this inſtrument relative to its ſpontaneous electricity, and I find, as a ſingle multiplier (that is when an electrometer is connected with C) it has no effect on the moſt delicate gold leaf electrometer I could make; but as a double multiplier (that is when an electrometer is connected with E) there is ſome ſmall effect if ſome electricity had been communicated to it within an hour or two, although it may have been diſcharged by touching each of the plates with a metal point (which I find is the moſt effectual way of diſcharging ſmall portions of electricity,) but if it has ſtood three or four hours after being diſcharged, it will not give any ſigns of electricity. When uſed as a doubler it always becomes electrified with between eight and ſixteen motions of the lever,

On the ſpontaneous electricity of this inſtrument.

On the ſpontaneous electricity of this inſtrument.

even though it has not been uſed for two or three months.—But if it has been uſed within two or three hours, the effect will take place with fewer motions of the lever, and if it has been uſed within a few minutes, two or three motions will be more than ſufficient to aſcertain the quality of the electricity. It is to be obſerved that the inſtrument was always diſcharged (by the metal point as before obſerved) between each trial.

In the courſe of making the experiments on the ſpontaneous electricity of this inſtrument I found that it was always poſitive if the inſtrument had not been uſed for two or three days, whatever electricity it was laſt charged with. But the time it muſt ſtand unuſed after it has been diſcharged, to produce this effect, depends a great deal on the weather; if the air is very humid, twenty-four hours is quite ſufficient, but if it is very dry, it will require four or five days.

After I had obſerved that after the inſtrument was charged with poſitive electricity its ſpontaneous electricity was always poſitive; and that after it was charged with negative electricity, its ſpontaneous electricity was negative only within a certain time after it had been diſcharged, and then became poſitive; and alſo that it required a greater number of motions of the lever to produce a certain effect on the electrometer with negative electricity, the longer it ſtood after it had been charged with negative electricity, and that when it became poſitive, the longer it ſtood the leſs number of motions of the lever it required to effect the electrometer with poſitive electricity to a certain degree, and this within ſome certain limits. I was at a loſs how to account for this change. However, after ſome conſideration, I began to ſuſpect that the plates (although all of the ſame metal, copper) had each a property peculiar to itſelf, of acquiring a certain ſmall charge of one kind of electricity in preference to the other; and that if they were left to themſelves they would naturally do ſo. I therefore began a ſet of experiments to aſcertain the probability of this ſuppoſition. Firſt, directly after the inſtrument had been uſed for negative electricity, I diſcharged it by touching each of the plates with a metal point, which I held in contact with each plate for two or three ſeconds. An electrometer was then connected with the plate A, and while it was in this ſituation, it was made to diverge with poſitive electricity;* it was then

* The electrometer was made to diverge by bringing an excited glaſs or ſealing wax near it.

diſ-

diſcharged by a ſlight touch with the finger, the lever was then moved backwards and forwards about fourteen times, and the electrometer diverged with negative electricity. This was repeated ſeveral times with the ſame effect. On the ſpontaneous electricity of this inſtrument.

The lever was then put in ſuch a poſition that the plates could not be ſuppoſed to act as condenſers, one pair more than another, and the whole was left untouched for twenty-four hours. It was then tried, and with twenty motions of the lever the electrometer diverged with poſitive electricity.

It was then left untouched for eighteen hours more, and on trial the electrometer diverged with poſitive electricity. The inſtrument was next diſcharged with the metal point as before, and the electrometer made to diverge with negative electricity, which was diſcharged by a ſlight touch of the finger. The lever was now worked, and with nine motions of the electrometer diverged with poſitive electricity. It was then diſcharged and left untouched for ſixteen hours, after which it diverged with poſitive electricity after a few motions of the lever. It was then left untouched for five days, after that time it gave poſitive electricity when the lever was worked. Theſe experiments I have repeated a great many times with the ſame effect.

As it appeared from the foregoing experiments that the reſiduum on the electrometer was inſufficient to overcome the effect of the reſiduum on the plates, I was induced to charge the whole inſtrument with the effect of the electricity, I would wiſh to communicate to it, and this I did by making the electrometer diverge with the deſired electricity, and while it was divergent I began working the lever, to communicate the effect to all the plates. I charged the inſtrument with negative electricity firſt, and diſcharged it with the metal point. The lever was then worked, and in eight motions the electrometer diverged with negative electricity. It was then left untouched for five days, when eighteen motions of the lever made the electrometer diverge with poſitive electricity. This has been often repeated with the ſame effect.

The inſtrument was next charged with poſitive electricity, and diſcharged as before, after which, ſix motions of the lever made the electrometer diverge with poſitive electricity. It was left untouched for twenty-four hours, when the electrometer

On the ſpontaneous electricity of this inſtrument.

trometer diverged with poſitive electricity with twelve motions of the lever, and ſo it did after it had ſtood untouched for ſix days.

The probability of the foregoing ſuppoſition concerning the property of the plates acquiring a charge of one electricity in preference to the other, was more ſtrengthened by the following experiment, which has been repeated ſeveral times. The inſtrument was charged with negative electricity, and then left without diſcharging for twenty-four hours, when ſixteen motions of the lever made the electrometer diverge with poſitive electricity.

I make no doubt if the plates were of different metals this effect would be more ſtriking, and that in ſome caſes we ſhould have the contrary electricity. I intend to conſtruct one of theſe inſtruments in ſuch a way that plates of any metal may be put on, and their effect tried. I think this a ſubject well worth purſuing as it may throw ſome light on ſome of the phenomena of electricity, which have their cauſes at preſent buried in obſcurity.

V.

Note reſpecting the Suſpenſion of Zinc in Hidrogen, and the conſequent Ignition and Fuſion of Platina Wire. By AMICUS.

To Mr. NICHOLSON.

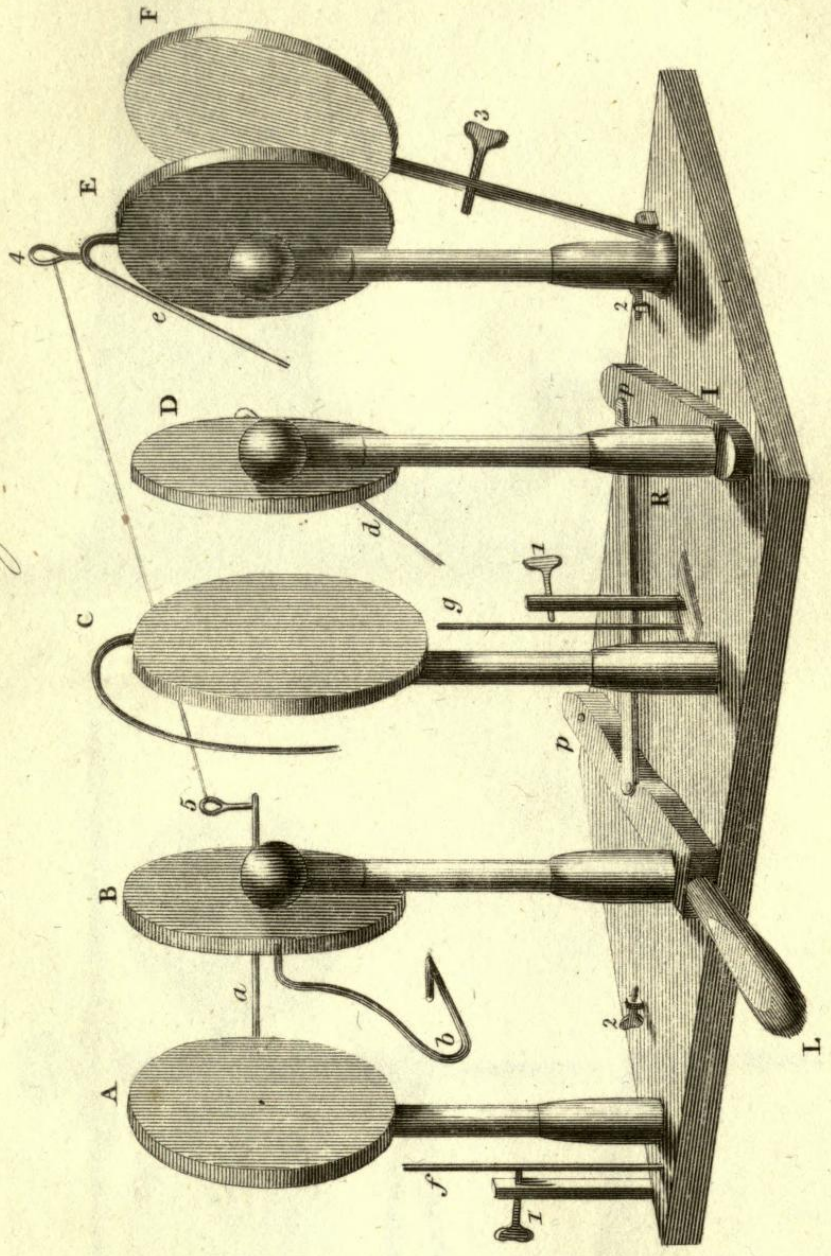
DEAR SIR,

Ignition and fuſion of platina in Cuthbertſon's gazometer,

I EMPLOY a *gaſometer* of a much more ſimple conſtruction and much leſs expence than Lavoiſier's, which that ſkilful and intelligent artiſt, *Cuthbertſon*, invented at my entreaty, about ten years ago. It is deſcribed in your valuable Journal (quarto ſeries, vol. II. p. 235.) The braſs rod or the thick wire, which conveys the electric fire through the upper receiver, has about half an inch of platina wire appended, to hang juſt over the aperture through which the hydrogen gas riſes at the bottom in the braſs work. Zinc of any other ſort of metal would either be melted or readily oxided. But the other day, I was much ſurprized to ſee the platina wire, on becoming as uſual *red hot* from the flame of the hydrogen gas, melt into globules

as

Electrical Instrument by W. & W. Wilson.



Drawn by Blunt.

Engraved by Mutlow.