V. *Remarks on Dr. GIRTANNER's Memoir respecting the Question, whether Azot be a simple or a compound Body.*
By C. BERTHOLLET*.

DR. PRIESTLEY long ago made experiments which at first induced him to believe, that water distilled from lime, and, above all, from argil, or even without addition in an earthen retort, or one of rough glafs, would be converted into air; but he afterwards proved that this phenomenon was fallacious, and that a transmissiion only of the surrounding air took place on this occasion. Guyton added some further observations to those of Priestley †, and the circumstance seemed to be sufficiently cleared up.

Wiegleb, however, published a memoir in which he pretended to prove, by his own experiments and those of some others, that the gas obtained by making water pass through ignited earthen tubes, ought to be ascribed only to the combination of the aqueous vapour with the matter of heat, and that this combination gave birth to azotic gas.

This memoir gave rise to an answer published by Deiman, Van Troostwyk, and Lauwrenburg. These learned chemists examined, with the greatest care, all the circumstances respecting the pretended production of azotic gas by water; and I should have believed that no further doubt could exist respecting the consequence they deduced from their experiments, *viz.* “that the azotic gas, obtained in some cases by making the steam of water pass through ignited tubes, arose merely from the exterior air deprived of its oxygen gas by the fire in which the tubes are placed, and that thus the pretended conversion of water into azotic gas, by its combination with the matter of heat, vanishes.”

After all these discussions, Girtanner supports the new ideas which he brings forwards in his memoir ‡ on several facts, the greater part of them borrowed, and already discussed with

* From *Annales de Chimie*, No. 103. † *Encyclop.* Vol. I. p. 674.

‡ See this Memoir, p. 335.

care. Among those which he affirms, we ought to consider the following as his fundamental one: "When water is boiled in a retort of glass, or any other material, you obtain azotic gas." The author prescribes these precautions:—"To obtain azotic gas in the greatest quantity, the water must be evaporated only very slowly and by a very gentle heat, which you must take care not to augment too much."

"It may be observed in all these experiments, without exception, that, when the last drop of water is evaporated, the azotic gas ceases to be produced, though the fire be continued."

An assertion so positive induced me to repeat the experiment with the precautions prescribed by Girtanner. It was made with water recently distilled, and the precipitate from sulphat of alum by potash well washed; it was made also with very white argil furnished by Guyton: but though the quantity of water was considerable, and these two experiments lasted, therefore, a long time, no gas was disengaged, and the result was the same as that of the Dutch chemists.

It was on this fact, however, so easy to be ascertained, that Girtanner chiefly established the composition of azot; and hence that of the atmosphere, "which (says he) is not, as hitherto believed, a mixture of oxygen gas and azotic gas, but rather a mixture of oxygen gas and hydrogen; a water in the form of gas, if I may be allowed the expression. When, by chemical experiments called improperly *eudiometric*, the oxygen is separated from the hydrogen, this separation can never be entirely and completely effected; a part of the oxygen remains united to the hydrogen, and forms that chemical combination which we call azot, and which we obtain in these experiments."

Thus, when we make a mixture of oxygen gas and hydrogen gas, we form atmospheric air; and the differences of specific gravity, of properties found by all the tests, of products in combustion, are only trifling circumstances, to which Girtanner pays little attention.

C. Bouillon-Lagrange, in consequence of Girtanner's memoir, has made experiments more numerous than mine, but
which

which conduct to the same results. I shall here give a short view of them, which he was so kind as to communicate to me.

He did not obtain azotic gas by boiling distilled water alone, or with argil or alumine, in a glass retort, having adapted to it a glass or porcelain tube.

He had no disengagement of azotic gas when he made the same experiment with flint obtained from the fluoric acid.

Having placed lime obtained from white marble in a similar tube, he caused the steam of water to pass through the tube, the other end of which was immersed in lime-water. There was still disengaged a little carbonic acid, which formed carbonat of lime, but there was no azotic gas.

If, instead of lime, argil be used with the same apparatus, there is formed a little carbonat of lime, but there is no disengagement of azotic gas.

If water be made to pass through a porcelain tube into which lead has been put, this metal passes partly to the state of a yellow oxyd and becomes vitrified, but no azotic gas is disengaged.

If, instead of lead, you put tin into the tube, that metal becomes oxydated, and you obtain hydrogen gas. Zinc gives the same result.

To ascertain whether this hydrogen gas contained azotic gas, C. Bouillon-Lagrange made it pass over sulphur in a state of fusion, and obtained sulphurated hydrogen gas, but no azot. He still subjected it to another trial.

He mixed the hydrogen gas he had obtained by the means of zinc with oxygen gas; and, having inflamed the mixture by an electric spark, water was formed, but there was no azotic gas.

Girtanner's opinion is connected with that of Humboldt on the absorption of oxygen by the simple earths, and particularly by alumin. There is this difference, however: Humboldt considers the supposed phenomenon as a simple separation of the oxygen, which becomes fixed, from the azot which remains in a gaseous state: but, according to Girtanner, "the azot obtained by the experiments being

always a product of the operation, and not having existed before the experiment under the form of azot in the air examined; Humboldt, who is fond of drawing general conclusions from single facts, seems to have been deceived when he advances that earths might be employed to determine the quantity of azot contained in atmospheric air: earths do not indicate the azot contained in the atmospheric air, they change that air into azot."

Young Sauffure * has formally contradicted the result announced by Humboldt. He agrees that the *humus*, which is the result of a mixture of decomposed vegetables with others not yet decomposed, absorbs oxygen gas, and is a fact well known; but he attests that "this effect does not take place when the earths are pure, and deprived of all vegetable substance." He describes several experiments which he made with alumin, calcareous earth, and flex.

In the *Journal de Physique* for Pluviose the same year, there is an answer of Humboldt, written in a magisterial tone, which contains nearly the assertions contained in the first memoir, with a kind of attestation, because he made his observations in the laboratories of Vauquelin and Fourcroy. This authority would be imposing, if these two learned chemists had co-operated in the observations; but so far from this, we see by the statement that the only experiments tried in their presence would not succeed.

I have been assured that the celebrated Fabbioni, of Florence, repeated the experiments of Humboldt at the same period without success.

Champy the son, a very correct observèr, repeated them at Cairo on alumin, on lime, and on the mud of the Nile, at a temperature which varied from nearly 30 to 36 degrees of the centigrade thermometer, but he obtained no absorption: it is to be remarked that the mud of the Nile contains some remains of vegetable substances, so that when distilled there is extracted from it a certain quantity of carbonic acid and carbonated hydrogen gas.

Chaptal repeated them at Montpellier without obtaining an absorption.

* *Journal de Physique*, Frimaire, an. 7.

I kept moistened alumine a long time in contact with atmospheric air and with oxygen gas, without observing the least absorption. A chemist having related that the absorption took place by the means of agitation, agitation was employed with much patience, but the result was the same. The operation was repeated with white clay which had been sent to me by Guyton, but still without absorption. This argil, however, exposed to a strong heat, gave a little carbonic acid and a small quantity of carbonated hydrogen gas.

VI. *Description of an improved Apparatus for Distilling, by which a considerable Saving may be made in the Article of Fuel; and of an Apparatus for the Rectification of Spirit of Wine.* By J. W. C. FISCHER*.

THE following apparatus, if not entirely new, is attended with such considerable advantage in regard to the saving of fuel, as must be acknowledged by every impartial and competent judge. The principal improvements may be found in Götting's Pocket-book† for Chemists and Apothecaries, 1798; but, as far as I know, little or no use has hitherto been made of them. The reason of this may be, that the above work comes very seldom into the hands of those who have most occasion to make use of it. Distillers by profession continue, for the most part, those modes of operation which they have been taught in learning their business, partly because they have no real opportunity of intro-

* From *Journal für Fabrik, Manufaktur, &c.* December. 1799.

† According to the above pocket-book, this distilling apparatus was first made in Denmark, where it has been used above fifty times on a large scale in one of the distilleries. The person who employed it got the first idea of it from a Danish journal, the author of which had copied it from a German work entitled *Auserlesene Sammlung Oekonomischer Schriften*, Dresden 1790. The whole apparatus, the cooler excepted, cost in Denmark, where every thing is dearer than in Germany, no more than 17 or 18 rix-dollars; whereas a large still would cost from four to five hundred rix-dollars. An apparatus which can be purchased at so cheap a rate, and by which one-half is saved in the article of fuel, must no doubt be of importance to those who may have occasion to employ it.