smaller, and the assigned distance proportionally greater, than the truth; and this error increases as the object is nearer to the horizon. Hence the propriety of great caution in using this mode of obtaining distances; and the preferable method of a base found by two objects, especially in establishing the several positions of the stationary vessel.

At present, I despair of seeing these fluctuating causes and effects brought under the subjection of any law that could enable us to assign its true amount, and to correct those observations which come under their influence.

G. A. BEDFORD, *Commander, R. A.*

Lond. Naut. Mag.

On Gun Cotton. By PROFESSOR BRANDE.

This communication related: 1st. The history of compounds produced by nitric acid with certain organic substances. 2nd. The preparation and properties of Schönbein's gun-cotton. 3rd. The practical uses of the invention.—1st. With respect to the philosophical history of the discovery. Between fifteen and sixteen years ago, Braconnot ascertained that starch, wood-shavings, saw-dust, linen and cotton fabrics, when treated with concentrated nitric acid, produced a sort of gelatinous substance, which coagulated into a white mass on the addition of water. Braconnot called this substance *xyloidine*, from its resemblance, in some respects, to ligneous matter. Xyloidine is, as Professor Brande demonstrated by experiment, highly inflammable. Two years after Braconnot's investigations, Pelouze published some inquiries into the nature and properties of xyloidine. He ascertained that starch, when converted into this substance, exchanged an atom of its constituent water for an atom of nitric acid. He also observed that it took fire at a temperature of about 360°. This facility of combustion, and the fact of its burning without leaving residue, induced Pelouze to cover paper and other textures with a film of xyloidine by plunging these substances into dilute nitric acid. When thus prepared, they resemble parchment in appearance, are very inflammable, and impervious to moisture. Pelouze suggested the use of paper treated in this manner for the purpose of artillery. Such was the state of science on this subject when, in the course of last year, Professor Schönbein examined the effect produced by a mixture of sulphuric and nitric acids on organic bodies. One purpose of his research was to ascertain the qualities of a form of matter which he calls *ozone*. On this subject we cannot digress further than by presenting the following equation, which will convey Schönbein's views to our chemical readers:—

$\text{NO}^5 \text{HO} + \text{SO}^3 \text{HO} = \text{NO}^4 \text{SO}^2 + 2\text{HO}^2$. (HO^2 , the symbol of the oxy-water of Thenard, being also that of Schönbein's ozone). It was in the course of these researches that Schönbein found that each of those singularly allied bodies, sugar, starch, gum, and woody fibre, assumed its own peculiar state when brought under the influence of

the mixed acids; and that woody fibre in the form of tow, cotton-wool, &c., when plunged into a mixture of these acids, becomes a highly explosive compound. The substance thus prepared was exhibited, on Professor Schönbein's behalf, by Mr. Grove, on the 15th of September last, to the British Association, and (as Professor Brande pointedly observed) it was not till that time that the supposed claims of others to any share in this discovery were advanced.—Professor Brande proceeded, 2ndly, to describe the preparation and properties of the gun-cotton. Having been first cleansed and carded, cotton, according to Schönbein's process, is immersed for a short time in a mixture of two parts (by measure) of sulphuric with one of nitric acid. It is then taken out, well washed with water, and carefully dried. The cotton is then found to have acquired the following properties:—Though identical with common cotton (even under the microscope) in ordinary light, it appears dark when viewed through a magnifier in polarized light. It may be repeatedly moistened with water and dried without losing its acquired properties. It is an insulator of electricity, being powerfully *negatively electric*. It is singularly hygrometric. It catches fire at a temperature of about 360° , and burns with far greater rapidity than gunpowder; and yet the combustion of a train of this cotton can be stopped in its course by strong pressure—an important circumstance as bearing on its application. The products of its combustion are carbonic and nitric oxides, carbonic and oxalic acids, cyanogen, nitrogen, and steam.—3rdly, In respect to the uses of gun-cotton, Professor Brande remarked that it was more energetic than gunpowder. From experiments made at the mills of Messrs Hall & Co., the patentees, it would appear that about one half ounce of gun-cotton carried a 68 lb. shot 255 feet from an 8-inch mortar; while 2 ounces of gunpowder carried a shot of the same weight, from the same gun, only 152 feet. The average of four fires from a tiger-rifle, No. 14 gauge, charged with from 60 to 80 grains of gunpowder, carried a ball through three *inch elm boards* packed closely together; while 30 grains of gun-cotton carried a ball, under the same circumstances, through *six such boards*. Adverting, in conclusion, to the alleged disadvantages and advantages of Schönbein's invention, Professor Brande remarked of the former that it was hardly just to ascribe them to what was so recently known, and, therefore, so imperfectly examined, as an article of commerce. The use of gun-cotton in fire-arms has been said to be attended with the following disadvantages:—That the effects are less regular than those of gunpowder.—That it is more dangerous, because inflaming at a lower temperature.—That it does not take fire when compressed in tubes.—That it burns slowly in all kinds of cartridges.—That guns and pistols must be altered to admit of its use.—That it is not adapted for the use of the army.—That the barrel of the gun is moistened by the water produced during combustion. The advantages, on the other hand, may be stated as follows:—Its extreme cleanliness, leaving no residue after combustion.—Its freedom from all bad smell.—The facility and safety of its preparation.—The possessing treble the force of gunpowder.—Its explosion producing no smoke and less noise than

that of gunpowder.—Its filamentary nature admitting of its being used overhead in mining operations.—Its not being liable (as a granulated substance is) to the accidents of leakage.—Its occasioning very little recoil.—*Trans. Royal Inst.* Athenæum.

On Gunpowder. By PROF. FARADAY.

Prof. Faraday briefly noticed the known composition of gunpowder as consisting of—75 parts of nitre, 15 parts of charcoal, 10 parts of sulphur; which, converted into equivalents, give—1 of potassium, 1 of nitrogen, 6 of oxygen, 3·4 of carbon, 0·85 of sulphur, in a state of mechanical mixture. He then proceeded to advert, 1stly, to the *manner of the action of gunpowder*. Gunpowder was described as a solid body, in which a source of enormous power was locked up, capable of being brought into immediate operation whenever wanted: the action thus elicited being itself regulated by human skill with wonderful precision. The respective functions of the sulphur, nitre, and charcoal, in producing the effects of gunpowder, were experimentally shown. The enormous quantity of gas generated by the combustion of gunpowder, irrespective of heat, was exhibited. It was remarked that, on the ignition of gunpowder, though the sulphur begins the combustion, it is not itself burned by the oxygen of the nitre, but unites chiefly with the potassium of that salt to form sulphuret of potassium,—a substance which assists in giving to the flame of gunpowder an intense heat. 2ndly. The *amount of heat required for the inflammation of gunpowder* was next adverted to. If gunpowder and steel filings be dropped together through four or five inches of flame, the latter will burn, though the former will not. A flame from gas was made to play for several seconds on a heap of gunpowder, without lighting it; but, 3rdly, *when actually lighted, gunpowder evolves very great heat*. It is to the immense heat produced on the solid products of the combustion of gunpowder, that the certainty of its complete combustion is greatly owing. In this respect gunpowder differs characteristically from gun-cotton. The latter fires at a heat which would not affect the former; but produces, by its combustion, a degree and condition of heat much less communicable to other bodies. 4thly. The *effect of the heat generated, independent of the chemical change from the solid to the gaseous or vaporous state*, namely, that due to mere expansion or increased elasticity producing the effects of gunpowder, was adverted to. This was illustrated by the violence with which a mixture of one volume of oxygen with two of hydrogen gas bursts the vessel which contains it, solely in consequence of the heat elicited during their combination. This is manifest from the fact that the space occupied by the uncombined gases, is greater by one-half than that taken by the resulting steam. 5thly. Prof. Faraday laid great stress on the *effect of the granulation of gunpowder*. To this condition of gunpowder, presenting, as it does, a number of separated surfaces of size just sufficient to become surrounded with flame at the same instant of ignition, much of the disruptive or projectile effect of gunpowder was ascribed. It was shown