of the composition of that examined by Sir F. Abel and Captain Noble, in their classical researches on the composition of fired gunpowder, we may deduce from their results the following equation:

$$4\,KNO_3 + 2\,S + 7\,C = K_2S_2 + K_2CO_3 + 3\,CO_2 + 3\,CO + 2\,N_2.$$

From this equation it follows that 552 grammes of gunpowder will yield $8 \times 22{,}327$ cc. = 178,616 cc. of gas, measured at 0°C and 760 mm. bar. Hence 1 gramme will yield 323 cc. But since the heat evolved by the explosion of one gramme of gunpowder is about 500 calories, and since the specific heat of the products of the explosion may be roughly put at about ¼, the calculated temperature of explosion will be 2009° c. and the 323 cc. will expand to 2,689 cc. One gramme of gunpowder occupies about 1 cc. The sulphide and carbonate of potassium are liquid at this temperature and occupy about ½ cc. Hence the pressure will be over 5,000 atmospheres or 40 tons to the square inch. Abel and Noble have found experimentally 42 tons to the square inch.

Saltpetre contains as much oxygen as 3,000 times its bulk of air, and gunpowder is merely a contrivance for burning carbon by means of this enormously compressed oxygen and forming carbon dioxide and carbon monoxide gases, while the nitrogen of the saltpetre is liberated at the same time.

The explosion of nitro-glycerine may be represented by the equation

$$4\,C_3H_5N_3O_9 = 12\,CO_2 + 10\,H_2O + 6\,N_2 + O_2$$

from which it follows that 1 gramme gives 713 cc., and 1 cc. (= 1.6 grammes) gives 1,141 cc., which is expanded by the heat evolved at least eight times, (Berthelot) probably more than this.

But the nature of this reaction is totally different from that which takes place in the explosion of gunpowder. That is a combustion propagated from particle to particle at a comparatively slow rate. The explosion of nitro-glycerine on the other hand is a detonation, a breaking up of the molecules propagated with a velocity comparable to that of sound —exceeding 5,000 feet per second.

Six cubic inches of nitro-glycerine gives about a cubic yard of gas, requiring about $\frac{1}{25000}$ of a second for its formation, (Lewis). A square yard of surface carries an atmospheric pressure of 9 tons, and this has to be lifted in the $\frac{1}{25000}$ of a second—*i.e.*, more than one million foot tons per second. Figures such as these amply account for the well known shattering effect of nitro-glycerine, and for its destructive effects when