the immense pains and vast expenditure laid out on the Rhine and Moselle fortresses would be absolute waste if Germany had to fight France single handed. Their real object is to make an inner barrier against French attack, to be held by troops of the second class, whilst Germany may deal with Russia on the open side by the use of a vigorous offensive; and this design can explain the apparent inequality of strength deliberately displayed on her western and eastern frontiers. He declines to prophesy the result of such a combination, but thinks it quite possible that she might come victorious out of the struggle, provided, that is, that Austria, which would hold precisely the same dominating position on the flank of the combatants as she did just before she declared against Napoleon in 1813, does not repeat her conduct of that period, and throw "her slow but heavy sword" into the balance at the first appearance of check to the army to which she owed her humiliation in 1866. The article concludes with a warm appeal to Berlin Councillors, which, coming from a quarter friendly to Germany, should have the more weight to disarm the uneasiness and almost animosity now felt throughout Europe towards their country, and discountenancing such violent and high handed proposals as that contemplated last year, the execution of which would recall the worst deeds of Napoleon against his weaker neighbors.

Chemical Theory of Gunpowder.

Ever since the introduction of gunpowder the exact method of the action of the ingredients upon each other has received considerable attention from chemists. Gay Lussac was the first to make a systematic analysis of the products of combustion, but it was not possible satisfactorily to explain the reactions taking place, by a formula. The recent researches of Professor Abel and Captain Noble have shown that a much larger number of products is formed than was previously supposed, rendering it even more difficult to explain the nature of the changes tacking place by a symbolic formula. Professor Bunsen, of Heidelberg, found by the combustion of a mixture of hydrogen and carbonic oxide with a quantity of oxygen not sufficient to burn the whole of the two gases, that the water and carbonic acid produced stood to each other in proportion of their molecular weights, or their molecular weights multiplied by simple coefficients, and these coefficients may be the same for mixtures of various compositions, but change suddenly when the amount of one or both of the gases is changed beyond certain limits. Dr. Debos has shown that the same law obtains when a mixture of baric and calcic chloride is precipitated by an insufficient amount of sodic carbonate—viz, that the barium carbonate and calcium carbonate percipitated are in proportion of their molecular weights, or their molecular weights multiplied by a simple coefficient. A necessary condition is that the reactions should be simultaneous. In the combustion of powder in an ordinary gun this condition is very nearly satisfied, and accordingly the quantities of some of the products formed obeys the laws enunciated by Bunsen. Dr. Debus deduced from the analytical results published in Messrs. Noble and Abel's most excellent researches on fired gunpowder, as well as from the analyses of the products of the combustion of powder published by Bunsen and Schiskoff, the following general results concerning the products of combustion—(1) the sum of the potassium contained in the potassic hyposulphite, sulphate and sulphide, stands to the potassium in the potassium carbonate approximately in simple proportions; (2) the carbon of the carbonic oxide stands to the carbon of the potassic corbonate also approximately in a simple proportion. From this, as well as from the relation of the sum of the potassium contained in the sulphide and hyposulphite to the potassium in the sulphate, it is possible to form a theory for the combustion of powder. There are several reactions between the constituents of powder when the latter is fired. Two of these are simultaneous; the way in which the others succeed each other cannot be accurately determined, as first, when a portion of the carbon is burned, potassic carbonate, corbonic oxide, nitrogen, and carbonic acid are produced. Simultaneously with this reaction another takes place—a portion of the saltpetre and the whole or a portion of the sulphur from potassic sulphate and carbonic acid. The action of still unburnt carbon and of free sulphur on the potassic sulphate, in a succeeding stage of the combustion, causes the formation of potassic sulphide and hyposulphite. On the ground of such considerations, the processes taking place during the combustion of powder can be represented by equations. Dr. Gladstone said one great value of such a research was that it started other investigators, who, approaching it from different points of view, were able to obtain data not perhaps dreamt of by the orignial investigators. This observation applied to the inquiries of Messrs Abel and Noble on the combustion of gunpowder. Those gentlemen dealt rather with practical results than with the conclusions to be derived from them. Dr. Debus, approaching the same subject from a more theoretical point of view, had been able to draw conclusions confirmatory of results he had obtained from some other reactions, to explain more fully what actually took place in the combustion of gunpowder, and to enter upon the domain of molecular physics. By the conjoint action of the chemist and the physicist, no doubt it would not be long before much more would be learnt about what takes place in chemical reactions.

English vs. German Guns.

In an article on guns and ships, the *Pall Mall Gazette* says: Referring to the trials which have taken place this summer on Herr Krupp's shooting ground at Visbeck, near Dulmen, the military contributor of the Cologne *Gazette* observes that it has now been proved that even ironclads of the class of the *Devastation* would be powerless to force an entrance into a harbor guarded with the new heavy guns worked by the German navy. "The condition," he proceeds, "in which the target, an iron plate sixteen inches thick, was left after eleven shots from the 26 centimetre coil gun and ten from the new 30½ centimetre gun, shows that any further strengthening of the iron plates of armored ships would be fruitless. It appears from the photographs taken of the target after each shot that even when the firing was only half over the target was a mere wreck, so that a plate of eighteen or twenty inches would be equally incapable of resisting the new guns as the one on which the experiment was made. These trials have also proved that there is no necessity for increasing the size of our guns, as, if the system of simultaneous discharges by means of electricity were applied to the guns on our ironclads, twenty four and twenty six centimetre guns would be sufficient to penetrate the strongest plates known. How far the results of the trials will have an influence on naval construction remains to be seen. That in fighting at close quarters a broadside frigate firing its guns simultaneously at one point must produce a much more powerful effect than a turret ship, which can only fire two guns at a time, is beyond doubt. The latter, however, ensures a more accurate aim at distant objects, and it is therefore probable that a certain number of turret ships will continue to be used in our ironclad fleet. The *Borsenzeitung* says that the 26 centimetre Krupp, with a charge of 35 kilogrammes and a projectile of 175 kilogrammes, is now regarded by the German Admiralty as the best ship gun, and that the larger calibres of 28 and 30½ centimetres will only be used for coast defences. As to the ships with 24 inch plates, such as the new English turret ship *Inflexible*, Herr Krupp has already laid before the German Admiralty plans for the construction of guns with calibres of 35.5 centimetres, 40 centimetres, and 46 centimetres, the latter, at a distance of 2,000 paces, shooting through a 24 inch plate and its teak backing. Another powerful gun which is to be used both on board ship and for coast defences is the 28 centimetre howitzer. This gun is charged with 20 kilogrammes of prismatic powder, and its projectile weighs 192 kilogrammes. Its range at an elevation of 22 degrees is 5800 metres, and at 60 degrees, 6300 metres: and if it be raised to an angle of 70 degrees, a projectile fired from it will penetrate to the depth of three metres, when falling on a ship's deck. The *Borsenzeitung* adds that the competition which has existed between the England and the German guns since 1868 may now be regarded as definitely closed in favor of the latter. "The English guns have been driven step by step from the continental markets, and there is now not a single State which will use English guns for its navy or the defence of its coasts. Only the other day a trial took place in Japan of the English heavy Woolwich guns and the German breech-loaders, in which the former proved decidedly inferior, and the English gunmakers have thus lost their last customer except Brazil."

The Siege of Paris.

Some American gentlemen visiting Paris last year became much interested in a Dioramic Picture on exhibition there, representing the "Siege of Paris" in the late war, and determined, if possible, to secure it for the American Centennial. This, the great popularity of the picture at home, rendered impracticable—but, after much negotiation, they bargained for a similar and better one, to be executed by French artists. The painting—which is now completed and *en route* to America—has cost, we are informed, exclusive of transportation, duties, and mounting, nearly 500,000f. Colonel Lineard, of Paris, the originator of the picture, accompanies it to America.

A correspondent of "Appleton's Journal" thus describes the picture: I recently inspect the "Siege of Paris," now painting in the vast building originally occupied by *Les Pompes Funebras*, and destined for exhibition, at the American Centennial. The great canvas is stretched flat upon the floor of the great building. As soon as a portion of the painting—which is worked up from miniature sketches in sections—of sufficient dimensions is finished, the surface is covered with paper and the completed part is rolled up, thus bringing a new and unfinished sec-