mass of brickwork to the other after the explosion than to any want of force in the agent employed. The experimenting committee appear to have arrived at the exact quantum of explosive matter required for the demolition of this class of building, and that their theory should be thus far borne out by actual result is a matter of congratulation both to them and the country.—*Broad Arrow.*

A NEW EXPLOSIVE.

We are indebted for the following to the *Times*.—

"Shortly after the discovery of gun cotton in 1846, attempts were made to increase the explosive force of that substance by impregnating it with a solid oxidising agent such as saltpetre. The preparations of gun cotton were saturated in a solution of the salt, and the water was subsequently evaporated, but the quantity of the 'nitrate' or 'chlorate' which could be introduced by this, the only practical mode of treatment, was so small as to be of little value. The system of reducing gun cotton to a fine state of division by the pulping process has, however, afforded the means of readily incorporating the substance with an agent sufficiently rich in oxygen to oxidise the whole of the carbon in the gun cotton preparation. This requires a comparatively large proportion of saltpetre, or other analogous salt, and Mr. Abel succeeded three or four years ago in obtaining some very promising results in this direction.

"The general mode of producing 'nitrate' or 'chlorate' preparations of gun cotton may be briefly described as follows:—

"The requisite proportion of the oxidising agent, such as saltpetre, is reduced to a very fine powder, and is then intimately mixed with the finely divided or pulped gun-cotton, by steeping the latter in a saturated solution of the salt. The mixture is then granulated or compressed into any desired form by the usual method now followed at Waltham Abbey in the preparation of Abel's compressed gun cotton.

"The products obtained in this way, especially in the disc or compressed state, possess several important advantages over ordinary compressed gun-cotton. The nitrated material forms very hard masses, which are much less liable to break up or give off dust when roughly handled than the ordinary substance. This comparative hardness is probably due to the particles of the mass becoming firmly cemented together by the crystallisation of the salt on the evaporation of the water during the process of drying. Indeed, it has been found that the application of considerably less pressure than is required to produce very compact cakes of ordinary gun-cotton suffices to furnish masses decidedly superior both in hardness and compactness. Moreover, the cakes, or discs, of the nitrated preparation, when dry, are found to have become coated with a hard film of the salt, which acts as an additional protective against mechanical injury, renders the surface less dusty, and thus less readily inflammable, than the ordinary kind.

"Again, it has been conclusively demonstrated by several experiments, continued for considerable periods, that the nitrated preparation is more stable when exposed to the action of high temperature than the unimpregnated gun-cotton.

"So far, therefore, as concerns the question of storage and transport, the nitrated material possesses several important advantages over ordinary compressed gun cotton, but on the other hand, it has two drawbacks.

"It has now being decided —wisley, we think—to store all large suplies of gun cotton in the wet state, in which condition the the material is perfectly uninflamable by ordinary heat. For this purpose the discs of gun cotton are packed in large wooden waterproof tanks, fitted with means of drainage. A tank holds a ton of gun-cotton discs, each disc being three inches in diameter by about two inches in depth, and the ordinary material is wetted by simply filling the tank with water, and allowing the latter to drain off.

"With the nitrated preparation, however, it is desirable that a weak solution of saltpetre instead of pure water should be used it wetting the gun-cotton.

"We do not urge this as a serious drawback, but it is evident that the process of wetting, and re-wetting when necessary, a store of ordinary gun cotton is a comparatively simple process, whereas the same operation might, in the case of nitrated gun cotton, be attended with more or less difficulty under certain circumstances of storage.

"Again, the wet nitrated preparation does not dry so readily as the ordinary material; but, on the other hand, this objection is almost negatived by the fact that wet gun cotton, whether nitrated or not, can be detonated, and made to produce equal, if not superior, effects to the substance in the dry state. Gun-cotton has been detonated with most destructive effect under water, by simply filling a bag net with discs and exploding them by means of one dry disc enclosed in waterproof envelope. The detonating fuse is inserted in in the dry disc and its detonation determines that of all the remaining discs, although the latter are absolutely immersed in, and in contact with, the water.

"In comparing the explosive action of equal weights of compressed gun cotton and of the 'nitrate' mixture, it must be borne in mind that a considerable percentage of the total mass of the latter is formed of a material of about one sixth the cost of pure gun-cotton. Thus a 'nitrate' mixture, prepared with the full theoretical proportion (about 38 per cent. by weight) of the oxidising agent, will not quite equal the effects obtained from the same total weight of ordinary compressed gun-cotton. In other words, the force of the explosion of, say, 100lb. of a material which consists of 38lb. of nitre and 62lb. of gun-cotton will not equal that of 100lb. of pure gun-cotton. Here the loss of force due to the replacement of about one-third of the gun cotton by the salt used is not fully compensated for by the extra work obtained from the complete oxidation of the remaining two-thirds of gun cotton. If, however, about three fourths of the theoretical amount of the salt be employed, the mixture will, weight for weight, equal ordinary compressed gun cotton in explosive effect, although, as we have said, a considerable proportion of the gun-cotton has, in the nitrated preparation, being replaced by a comparatively inexpensive substance. Thus the use of nitrated gun cotton will be attended by material advantage in point of economy.

"But if equal *volumes* of highly compressed gun cotton, and of the 'nitrate' or 'chlorate' mixture, similarly compressed, are compared, the explosive force of the latter will be found to be much greater. Chlorated gun-cotton is decidedly more violent in its action than the nitrated mixture, but it is more costly to manufacture, and more dangerous to store and use. The 'chlorate' salt is comparatively high in price, and more of it is required to furnish the requisite amount of oxygen; it is, moreover, very susceptible of ignition by friction or percussion, and is, therefore, comparatively dangerous. For these reasons, it does not compare favourably with the 'nitrated' preparations. Of the latter the best is that in which saltpetre is used. It is the most readily prepared, and its tendency to absorb moisture is not appreciably greater than that of ordinary compressed gun cotton.

"We understand that important experiments have been, and are being, instituted jointly by the Special Committee on Gun-Cotton, the Torpedo Committee, and the Royal Engineer Committee, on the comparative explosive properties of ordinary gun cotton, both in dry and wet state, and of nitrated gun cotton under similiar conditions.

"Some of these experiments are made by exploding under water equal weights of the several substances under identical circumstances, and registering the resulting pressure or blow by a 'crusher' gauge somewhat similiar to the pressure gauge used by the Committee on Explosives in determining the explosive force of gunpowder in the chamber of a gun.

"Experiments have also been made to ascertain the rapidity of detonation; in other words, the rate at which a string or row of gun cotton discs placed close to one another, will successfully explode if detoned at one extremity. For this purpose the beautiful chronoscope invented by Captain Andrew Noble F. R. S., has been successfully employed. This instrument is designed to measure very minute portions of time, and by arranging the primary conducting wires at equal intervals along a long row of gun-cotton discs a register is obtained of the time occupied in successively breaking the wires at the explosive wave flashes along the row. It has thus been ascertained that the rapididy of the detonation of gun cotton is about 20,000 feet per second.

"The expansive velocity of the gases generated by the explosion of gunpowder has been reckoned at about 7000 feet per second, so that, according to this estimate, gun cotton has about three times the explosive rapidity of gun powder. It is probable that the destructive force of an explosive substance bears a close analogy to the rapidity with which the explosion is transmitted, and the experiments we allude to may possibly furnish most interesting and valuable results. But, whatever may be the method followed in experiments, the considerable advantage which nitrated gun cotton possesses, both in point of cost and power, added to the fact that it is so rapidly susceptible of ignition by detonation, renders it highly probable that this preparation of gun cotton will be largely substituted for the ordinary compressed material in many of its applications.

"Moreover, the circumstance that carbonic oxide, a poisonous gas which is produced in considerable amount upon the explosion of ordinary gun cotton, is present in the products of explosion of nitrated gun cotton is scarcely higher proportion than in those of gunpowder, appears likely to remove that objection to the employment of gun cotton in military mines which arose from the large quantity of carbonic oxide developed when heavy charges of gun cotton were exploded.