requires it, from three to five field batteries can be turned out daily. The batteries consist each of eight small pieces and one piece of large calibre; the whole in perfect condition and ready for immediate service. The single piece of large calibre attached to each battery carries a shot weighing close upon 2 ewt. when solid, and about 14 cwt. when hollow. It is rifled and a breech-loader; its price is a little over £2,000. The field-pieces cost about £100 each.

At the works at Essen are manufactured a large number of hollow cast-steel shot, for the express purpose of perforiting the armour plates of menof-war. They are of a conicle cylindrical shape, rounded off at one extremity, and turned externally with deep grooves cut on the surface. They are cast from the best and most expensive description of steel, and afterwards turned, bored, filled, and finished in a superior manner. The interior cavity being filled with gunpowder, the elevation of temperature caused by the passage of the shot through the armour-plating is so great that it suffices to ignite the powder and cause the projectile The proto explode in the interior of the vessel. bable explanation of the ignition of the contents of the shot is that the sudden elevation of temperature is due to the resistance experienced by the shot on traversing the plating, Every one is well aware that if one of the small discs of metal punched out of an iron plate be taken up immediately it leaves the punch, it will be found quite warm, and it is clear that the action of the shot in perforating an armour-plate is perfectly analogous. A fair idea of the enormous expense attending experiments of a similar nature may be gained from the following facts :- A hollow cast-steel shot, weighing 2 ewt., costs for itself alone about  $\pounds 17$ ; its charge is from 271b. to 301b. of powder, and the cost of each separate firing, including interest on the capital, and the proportion represented by the cannon, amounts to £30. In addition to these pieces of ordnance carrying a 2 cwt. ball, which are continually in progress of construction at Essen, others have been and are manufacturod capable of throwing a shot weighing when solid 3 cwt., and 24 cwt. when hollow. The total weight of one of these monsters is nearly 13 tons; there are 32 rifling grooves in it, the charge is 30lb. of powder, and the cost price nearly £3,500. In order to prove that he is able to far surpass these huge specimens of what his establishment can furnish towards improving the national artillery, M. Krupp has in hand at present a cannon destined to attract some notice in the French Exhibition of next year. The process of forging the steel ingot from which the cannon will be formed is now in progress. It will throw a solid shot weighing 10 cwt. The trunnions, however, will not be attached directly to the body of the eannon, but to a strong ring encircling it. This is the usual course whenever the cannon are intended to throw a ball whose weight is more than 2 cwt. It will also be further strengthened by the addition of several hoops or rings fastened on in the ordinary manner. It is calculated that every shot fired in war-time by a piece of ordnance of the above description will cost nearly £200.

The premises of M. Krupp may be regarded in the light of a neutral ground, as a kind of interna-

tional establishment where different nations resort to test the merits of their war-like weapons in general. It is certainly somewhat strange that in a country like Prussia, which is frequently represented as intolerant and prejudiced to a degree, a private individual should be permitted to retain the management and control of an establishment so vast, in mere point of area, so aspiring in its character, and so indispensable to the state. One would have fully expected it to be under the sole surveillance and authority of the Government. As it is, since every nation fancies its own system the best, M. Krupp manufactures impartially for the whole world, whether his orders refer to breechloaders or muzzle-loaders, smooth-bores or riflebores, heavy cylindrical cannon like the English or gracefully tapering ones like the Japanese. Having completed the order, the next step is the testing of the pieces, during which process the cannon is manœuvred by a crane, and enclosed in a protective cover of wood and earth to avoid the chance of injury to the workmen or lookers-on. For these experiments alone the quantity of powder consumed in a month amounts to nearly two tone weight. It was not until a large number of these experiments, as well as numerous others of a different nature, had been undertaken, and a considerable outlay of time and money expended, that M. Krupp was induced to adopt a form of cannon that he believed to best answer the various conditions required of such a weapon. His peculiar invention has been for some time before the public, and its capabilities fully discussed, so that we shall not do more than give a brief description of it. It is a breech loading cannon, the breech being opened and closed by the simple drawing out and in of a bolt. The charge is introduced at the back of the breech, and by means of a screw the cavity behind the cartridge is filled up and solidly closed by a steel pin. A copper ring, which is driven by the explosion against the groove of the closed part, totally prevents all escape of the gas and makes the joint virtually bermetical.

[We omit the results of experiments by commission appointed by the Russian Government, on the different kinds of cannon.—Ep. J.]

One of the chief differences between a wise man and a fool is that the former benefits by his own errors and mistakes whether arising from inexperience or ignorance, while the latter either cannot or will not perceive that he has fallen into error, and remains a fool to the end of the chapter. That the proprietor of Essen belongs to the first-named is amply evidenced by the use he makes of the fractured remnants of his numerous experiments. Instend of redespatching to the melting pot indiscriminately the broken fragments of the specimens of ordnance or other castings operated upon, he has set apart a small portion of his premises as a receptacle for them. In this mechanical hospital he can examine the dam iged pieces at his leisure, can take accurate photographs and impressions of the appearance they present, and make calculations and investigations respecting the proportious and dimensions to be adopted in designing a future example of a similar nature. One of the principal problems to be solved respecting the theoretical