

SPHERICAL STEEL SHOT.

MR. BESSEMER has addressed the following letter to the Editor of the London *Times*:—

"SIR:—Under the head of 'Naval and Military Intelligence,' in your impression of the 14th, you have given a most interesting account of the experiments made with Bessemer steel spherical shots fired from a smooth-bored gun against 5½-inch armor plate; their destructive effects, as compared with projectiles made of cast or wrought iron, entirely confirm the views I so long advocated in vain.

"It is now just three years since I obtained a patent for producing cast-steel spherical shot by a peculiar arrangement of the rolling-mill, by means of which spherical steel shots may be made with rapidity and correctness. I also exhibited a spherical steel cannon ball at the International Exhibition of 1862, for the purpose of giving further publicity to my views on this important question; but it is only after this lapse of time that a trial is made of them in England, although a delay of ten or twelve days, and an expenditure of £50, would have given us as full proof of their efficiency three years ago as we have to-day. Meanwhile, however, many hundred thousand pounds have been expended in building iron-plated ships, which these long neglected steel projectiles will riddle as easily as the cast-iron shot found its way through the wooden walls of our old men-of-war. It is marvellous how the advantages of using such a material for projectiles did not force itself on the attention of every practical artilleryman, irrespective of any efforts on my part, for there is scarce a school-boy to be found who does not know that a snow-ball flung with great force is perfectly harmless, while a stone or other solid substance of equal weight would inflict a severe injury, simply because the snow-ball will fall to pieces on striking the object, while the stone would remain entire, and, consequently, administer the whole force with which it was thrown. Now, the way in which I cast-iron shot is broken and scattered in a shower of small fragments, on striking an armor-plate, bears a very strong analogy to the snow-ball in the case supposed. Indeed, it must be obvious to every mechanical mind that when a cast-iron shot is shivered to atoms against an armor plate, the force expanded in the disintegration of the solid spherical mass must be considerable; and it is equally clear that the force so expanded is not a new force created for a special purpose, but is part of the original force imparted to the shot, and that the amount of force so expanded on the shot must consequently be deducted from the available force to be expended on the armor plate, and hence the great inferiority of cast-iron as compared with steel shots, since the latter are not crushed by the force of the blow.

"It is not less remarkable that while our firm has manufactured at Sheffield some 150 pieces of Bessemer steel ordnance for foreign service, guns made of this material are still untried by our Government, although it is well known that the strength of this metal is double that of ordinary iron, while such is the facility of production that a solid steel gun block of 20 tons in weight can be produced from fluid cast-iron in the short space of twenty minutes, the homogeneous mass being entire and free from weld or joint.

"My object, however, in addressing you, sir, is not so much to point out that which has not been done as to call attention to what I believe to be of vital importance for the future.

"Our armor-plate system has certainly received a severe shock, and it behoves us now to see how far it be possible to increase the resisting power of ships so far as to keep pace with the advances made by steel shot. Not longer ago than the 12th of December the fine ship *Minotaur* was launched from the dock of her builders at Blackwall. She was all that excellent workmanship and the best iron could make her, but still she was only iron.

"It has been stated that the hull of this vessel weighs 6,000 tons, and her 4½-in. armor 1,850 tons, making a gross weight of 7,850 tons. Now, had the hull of this vessel been built of a material possessing double the strength of ordinary iron, her weight might theoretically have been reduced to 3,000 tons, but practically it would be wise to estimate more liberally, so that, while we admit a double strength of material, suppose we only reduce the weight by one-

third, this would give 4,000 tons of steel for the hull. Now, with this reduction in the weight of the hull, we may employ 9-in. armor plates in lieu of the 4½-in. armor plates now employed. This would give 2,700 tons of armor and 4,000 tons of hull, equal to a gross weight of 7,700 tons, or 150 tons less than the weight of the vessel as now constructed; and it must be borne in mind that the resistance offered by the armor plate is equal to the square of its thickness; hence a vessel constructed in the manner proposed would bear a blow of four times the force that the present structure is calculated to withstand.

"These weights given in round numbers are sufficiently accurate to explain the principle of construction which I propose and the important advantages which it holds out.

"It must not be supposed, however, that such a change would entail any of those difficulties which attended the change from wooden ships to iron ones, for what I propose is merely to employ a very strong and tough material in place of a much weaker one, so as to reduce the weight of the ship in nearly the same ratio. Such artisans as are now employed can work this metal with facility; the same machinery will cut and fashion it, and, indeed, all the present appliances of the iron shipbuilder will remain perfectly the same as at present. Already two ships are being built in foreign waters entirely of Bessemer steel, and the plates for a merchant vessel to be built in England have been ordered. It surely, therefore, would not be premature in our Government to investigate this subject most fully, for if a ship can, by the means I have pointed out, be enabled to carry 9-in. armor plates, we may rest assured that other nations will not be long without them.

"Thousands of Bessemer steel projectiles are now being made for Russia, and from undoubted sources I learn that other orders for steel shots have been given to the extent of £120,000 in value. Have we a single ship afloat that can keep out these simple round steel shot fired from a common smooth-bored gun, if ever directed against us? This is a grave question, and demands a speedy answer."

THE PRODUCTION OF CAST STEEL DIRECTLY FROM PIG IRON.

The *Jolliery Guardian* (England) says:—"None of the foreign papers seem to have noticed the attempts of Cazanave to obtain cast steel directly from pig iron. The idea itself appears to be very ingenious, but of course the question is whether it is applicable in practice. The foundation of this new method is the influence of steam on a thin stream of pig iron. If we take an iron tube of a certain diameter with sides of the necessary strength, form a ring out of it, and fix on its circumference, towards the centre, three or more tubes, we have a tube ring with three or more radii. The radius is made fast to the tubular pipe; the ends of these tubes, which are open, do not quite reach to the centre of the ring, and have therefore, between the ends an empty space, in which the pig iron is allowed to flow in a stream of a certain strength. The stream led into the boiler from the tubular pipe flows out of the openings of the three tubes, and operates directly upon the pig iron. It is said that the oxygen of the steam oxidizes the carbon of the pig iron, the silicium, a portion of the sulphur, phosphorus, and other impurities in the pig iron; the hydrogen combines with the carbon, sulphur, phosphorus, arsenic, and other bodies, with which it forms combinations of hydrogen. The carbonized and purified metal falls into a crucible or other vessel placed immediately under the apparatus. The metal obtained contains impurities, and must, therefore, be smelted in crucibles in a blast or reverberatory furnace. This is the essential part of the process; the simplicity of the method and the cheapness of the product are evident.

"Now arises the questions:—Is it possible to obtain steel in large quantities by this method; will it be of the same quality as the small quantity obtained on trial; and, if it is possible, at what price can it be obtained?"

"In answer to these questions, Cazanave asserts that by his method steel can be obtained in great quantities, not inferior to the best steel, and proportionately cheaper; for his best quality steel can be obtained for £18 per ton. This is difficult to believe,

but the inventor affirms that it is so, and at the same time warrants the excellent quality of his steel. In the present method of obtaining steel, good iron must be used, which is cemented, and the cemented iron, that is the steel is smelted in crucibles. By Cazanave's method cementation of the iron is avoided, so that the cast steel may be obtained in unlimited quantities. If this new method turns out practicable, it will be possible to work up the whole daily production of a blast-furnace into steel. For this only the apparatus is required, which is not very costly, and which would be erected near the blast furnace and stream of pig iron. The stream would be divided into rays of the necessary strength, and each one directed into an apparatus. By Bessemer's process about ten tons of steel are obtained per day at Sheffield; while by Cazanave's method sixty and seventy tons per day could be obtained, and a blast-furnace is being erected at Charleroi which will produce about seventy-four tons per day! The samples of steel furnished by this new process are reported to be very good. They were obtained from pig iron smelted with coke, but it is supposed that charcoal pig iron would give better results."

Economy is Wealth.

There is nothing which goes so far towards placing young people beyond the reach of poverty as proper economy in the management of household affairs. It matters not whether a man furnishes little or much for his family, if there is a continued leakage in his kitchen or parlor; it runs away, he knows not how, and that demon Waste cries "More!" like the horse-leech's daughter, until he that provided has no more to give. It is the husband's duty to bring into the house; and it is the duty of the wife to see that none goes wrongfully out of it. A man gets a wife to look after his affairs, and to assist him in his journey through life; to educate and prepare their children for a proper station in life, and not to dissipate his property. The husband's interest should be the wife's care, and her greatest ambition to carry her no further than his welfare or happiness, together with that of her children. This should be her sole aim, and the theater of her exploits in the bosom of her family, where she may do as much toward making a fortune as he can in the counting-room or the workshop. It is not the money earned that makes a man wealthy, it is what he saves from his earnings. Self-gratification in dress, or indulgence in appetite, or more company than his purse can well entertain, are equally pernicious.

BUSINESS RULES.—An Eastern paper gives the following seasonable and excellent rules for young men commencing business:—

The world estimates men by their success in life, and, by general consent, success is evidence of superiority.

Never under any circumstances assume a responsibility you can avoid consistently with your duty to yourself and others.

Base all your actions upon a principle of right; preserve your integrity of character, and in doing this never reckon on the cost.

Remember that self-interest is more likely to warp your judgment than all other circumstances combined; therefore, look well to your duty when your interest is concerned.

Never make money at the expense of your reputation.

Be neither lavish nor niggardly; of the two avoid the latter. A mean man is universally despised, but public favor is a stepping-stone to preferment; therefore, generous feelings should be cultivated.

Say but little—think much and do more.

Let your expenses be such as to leave a balance in your pocket. Ready money is a friend in need.

Keep clear of the law; for, even if you gain your case, you are generally a loser.

Avoid borrowing and lending.

Wine-drinking and smoking cigars are bad habits; they impair the mind and pocket, and lead to a waste of time.

Never relate your misfortune, and never grieve over what you cannot prevent.

SOME hearts, like primroses, open most beautifully in the shadows of life.