## THE PARSONS STEEL LINED GUN.

Mr. Parsons' converted 68-pounder gun has been tested at Woolwich with 30 lb. charges of powder, since its removal from Shoeburyness. After firing many rounds, a crack appeared in the cast iron outer tube, and for the present, experiments with the gun have been suspended. So far, the steel tube is presumably intact, though it is probable that further firing would destroy it; and as it constitutes the most costly part of the weapon, it is proposed that it shall be withdrawn from its present envelope, and inserted in another, and heavier, cast iron tube. The endurance so far displayed by Mr. Parsons' guns—that under consideration is the second that has been made—is undoubtedly remarkable, and, in one sense so opposed to all theories hitherto formed respecting the action of gunpowder that it deserves some attention.

The facts are very simple. We have in the Parsons' gun an inner steel tube, which, it is generally admitted, is quite incapable of withstanding, unsupported, even one charge of 30 lb of powder. We have, in the second place, a cast iron envelope so thin and weak that it is all but certain that a single charge of 10 lb. of powder, fired behind a 150 lb. projectile, would blow it to atoms. Steel and iron put together give us a gun, weak to excess in its parts, yet strong as a whole. In this fact lies, we have no hesitation in saying, one of the most singular problems ever offered for solution to the artillerist, or the engineer. If it could be shown that one of the two elements of the gun could alone withstand half the strain due to a 30 lb. charge, and the other element the other half, we could understand how, when put together, they could withstand the total strain due to the full charge named. But as a matter of fact, neither the steel tube, nor the iron tube alone, could bear the bursting strain of a 15 lb. charge, fired behind a 150 lb. shot. How is it, then, that when combined, they withstood 30 lb. charges so long?

In attempting to solve this question it is quite unnecessary, in our opinion, to consider for a moment the elaborate mathematical investigations which have been carried out by others, in the endeavor to find a reason for the endurance of converted cast iron guns. These, each and all, so far as we are aware, have been conducted with a view to determine how much of the strain due to an exploding charge is resisted by the steel and how much by the iron. Inasmuch, however, as no mathematician has proved that either element of a converted gun, will bear half the strain of the maximum charge which the compound gun will endure, we regard their method of reasoning, and their calculations as, so far, wide of the mark. If we find that no single engine possessed by a railway company, will draw fifty loaded trucks up a given incline at all, while two engines will take one hundred similar trucks up the same gradient at rapid pace, it is a matter of little importance to consider what share of the performance each separately fulfills; and if we further find that the tractive force is actually in excess of that deduced from calculations based on the pressure of steam, and the space passed through by the load and the pistons respectively, then the calculations must be regarded as of little or no value in the face of facts, which disprove their accuracy, or demonstrate that some element has been overlooked by the mathematician; some element, that is to say, which only operates when the locomotives combine their efforts, and which has nothing whatever to do with the isolated exertions of either. That some at present obscure influence of power, operates in the compound gun to resist disruption we have no doubt whatever; but to believe in the existence of phenomena, and to explain their causes are two different matters, and the endurance of the Parsons' gun depends, we think, on causes not yet defined or properly investigated.

Mr. Parsons' gun, weighing but seven tuns, or thereabouts, has withstood a test which has sometimes proved too severe for guns weighing twelve tuns. The steel tube of the Parsons' gun is practically the same as the steel tube of the 12 tun gun. The difference lies in the envelope alone, and this, in the Parsons' gun, consists of cast iron, in some places not more than a couple of inches thick, and in no place nearly so thick as the wrought iron guns with which it compares, in one sense, favorably. Taking the facts as they stand, we are irresistibly driven to the conclusions, either that the tensile strength of wrought iron in guns is not so great as that of cast iron, or that the metal in a gun has duties to perform, to the successful discharge of which, great tensile strength may not be essential. The first hypothesis is disproved by facts; the second we can only examine speculatively, because there are few or no facts on which to base our reasoning, other than the main fact, that a gun which, according to theory, ought to have long since gone to pieces, still remains together, and probably in a condition to fire moderate service charges for some time to come.

The first point which presents itself for notice, is that if the thin outer envelope of the Parsons' gun is sufficiently strong, then the jackets ordinarily fitted on the steel tubes of wrought iron guns are immensely too thick. Yet practice tells us, in language which there is no mistaking, that this is not the case. Are we to assume, then, that the Parsons' envelope is too thin? Again practice steps in, and says, "No." How shall we reconcile facts so conflicting? In dealing with the question we must consider the nature of the strains to which a gun is exposed, and the manner in which its various parts resist them. We have already, for the moment, rejected mathematical investigation, and they would be out of place in an article like the present dealing, as it does only with broad facts, and more or less crude speculations. We shall consider the strains to which a gun is exposed as twofold in character. The first is strictly tensile, the second it is not easy to characterise by a single word or phrase. If we term it a jarring strain, we shall, perhaps, not be wide of the mark. If we strike a girder, supported at both ends, about the middle of its length, with a heavy hammer, the tensile strain thrown on the lower web may be very small. Reasoning by analogy, and regarding the action of powder as being conformable with the theory of Lynal Thomas, and the experiments by Piobert, we arrive at the conclusion that—especially when a quick-burning powder is used—no tensile strain what ever is thrown upon the outer rings of a gun, the rending force being concentrated on the inner tube, for the simple reason that the wave of transmission of force is not propagated quickly through the metal. According to this hypothesis, it matters nothing whether the outer envelope of a gun does, or does not possess much tensile strength, so long as the inner tube does. The theory is supported by the results of experiment with the Parsons' gun. If, however, we suppose the inner tube to be so weak that it gives way at once by stretching, then the strain will be transmitted immediately to what we may term the next zone of resistance, and if this lies in the outer envelope, then the outer portion of the gun will be exposed to a tensile strain. Furthermore, the rate with which a wave of force transmission travels through various substances, probably varies very considerably with the nature of the substance. On this latter point, evidence derived from direct experiment is much wanting.

Now, the nearer the zone of maximum resistance can be kept to the central axis of the gun, the better. Guns lined with steel tubes fulfill this condition admirably. Hence their success. When we hoop a case iron gun outside, we transfer the zone of maximum resistance to the furthest point from the center. Hence the failure of the Parrott and Blakely systems. We have reason to believe that the thick inner steel tube of any modern gun, whether wrought or converted, possesses in itself sufficient tensile strength to resist the charges ordinarily used. Mr. Parsons' tube, out of its case, would, were one condition fulfilled, to which we shall come in a moment, have stood the tests to which the gun, as a whole, has been exposed with success. Indeed, the bursting force which the existing envelope can withstand is so small that it did little or nothing to preserve the inner tube.

So far we have dealt with facts, or theories ordinarily and correctly received as demonstrably true. We have now to enter on the regions of mere speculation. We have called the second strain to which a gun is exposed a jarring strain, and the precise effect of jar on metals, and other substances, is not fully understood, simply because it has never been properly investigated. It appears to act on the internal atoms of a metal, not by overcoming the attraction of cohesion, but actually by annihilating that attraction for the moment. We may cite a few instances in point. By suddenly striking a flat vessel containing mercury, the metal may be separated into a multitude of little globules; cast iron and stone may be absolutely ground to powder by the explosion of some fulminates. A very moderate blow properly, and sharply delivered, will sometimes crack a large casting. It is generally assumed of the latter phenomenon, that portions of the metal were previously in a state of high tension, owing to contraction; but there is no reason for assuming that this is always the case. The action of jar on a metal is well illustrated by striking a flask rammed with sand. The particles of the sand separate from each other immediately, and the whole falls out. We have not space to prolong our consideration of the effect and mode of action of jar. Suffice it to say that its tendency is to reduce the metal to its component particles, atoms or crystals.

Let us apply this to a gun. If we fire a heavy charge in a steel tube alone, the tube will be broken—or burst, in common parlance—not by the internal strain overcoming its tensile strength, but by the jar; and this statement has been borne out by observed facts, which we shall not stop to cite. Put the tube into another of any material which will absorb the effects of jar, and the tube will stand. Reasoning on this hypothesis, we may suppose the tube in Mr. Parsons' gun saying to the outer envelope: "A charge has been rammed home within us, and we are going to be exposed to two violent attacks, one a bursting strain, the other a jar. If you will only take care of the latter, I am competent to deal with the former." If the theory embodied in these words be correct, great tensile strength is not required in the outer portions of guns having thick steel inner tubes. With iron inner tubes the case is different, and Major Palliser's failures are, in a great measure, due to the circumstance that he used iron inner tubes—a mistake which Mr. Parsons avoids.

Are we to assume, then, that guns should have cast iron, instead of wrought iron envelopes? Certainly not. In the converted gun there is but one zone of resistance; in the wrought iron gun there may be several. Besides this, cast iron is inferior to wrought iron, because it is less able to withstand external violence, as inflicted, say, by the blow of an enemy's shot. Furthermore, it is not certain, or even probable, that cast iron is the best material that can be used in neutralising the effects of jar; its great advantage lies in its homogeneity. In order to settle the relative value of the two materials—cast and wrought iron—let a steel tube, like that used by Mr. Parsons, be similarly fitted in a wrought iron envelope of the same weight as a re-bored cast iron gun. If the work is done with care, the result will be more satisfactory with wrought, than with cast iron.

In conclusion, we must beg our readers to observe that there is one way of solving the mystery connected with the endurance of the Parsons' gun. This lies in assuming that there is in reality, no mystery at all, and that we are as far as ever from the acquision of a thoroughly trustworthy system of utilising our cast iron guns by conversion. The endurance of the gun has, no doubt, been very great—for a converted gun; but, absolutely, the performance is nothing to boast of. Mr. Parsons has done not a little to show that a good many light trifles may be made from our old 68-pounders; but it remains to be proved that uniform results, such as they are, can always be obtained, and that light rifled guns will be useful to us when we have got them.—*The Engineer,*

[The gun, a 68-pounder, 96 cwt., burst at the 33d round, the charge being 30lbs of large grained pounder with a 150 lbs shot—Eds.

## EXHIBITION EXCHANGE FOR PATENTEES.

There has been felt for a long time among inventors and patentees a necessity for some headquarters in this city where they could exhibit their inventions and negotiate sales of their patents and patented wares. Heretofore the offices and barrooms of some of our hotels have been the resort of this class of persons, and many have realized handsome sums from sales in these saloons; but they are not desirable places for such traffic.

We hail with pleasure the inauguration of a new incorporated company who propose to fill a long desired want in this city, by establishing an exchange in a building on Broadway for exhibiting new inventions, and where patentees can have facilities for consummating sales.

## Modern Improvements in the Preparation of Fat for the Manufacture of Soap and Candles.

For the Scientific American.

### CHEMICAL COMPOSITION OF FAT.

The manufacture of soap and candles is a very ancient branch of industrial art; notwithstanding this, very few improvements were made in it before the chemical nature of fats and fatty oils was discovered by Chevreul in the beginning of this century. He discovered that these substances have a chemical composition similar to many minerals and chemical compounds; namely, that they consist of acids combined with a base. In the same manner that, for instance, gysum consists of the base, lime, combined with the acid, sulphuric acid; or saltpeter consists of the base, potash, combined with the acid, nitric acid. So all fats and fatty acids consist of a base, glycerin, combined with one or more acids, called stearic, margaric, and oleic acids.

### THE MAKING OF SOAP.

In the manufacture of soap we simply combine these fatty acids contained in the fat, with a stronger base, usually potash or soda. This is best done by boiling the fat first with a weak solution of the alkali, and afterward adding a stronger solution; the glycerin being the weaker base is driven out; in soft soaps, it remains in the moisture; in the hard, soaps it is more or less perfectly removed.

Of the acids named the stearic is the hardest; it melts at 157 deg. Fah., and gives the hardest soap. The margaric is less hard, melts at 144 deg. Fah., and gives softer soap. The oleic is fluid at the common temperature and produces an inferior very soft soap. In regard to the base, the potassa produces much softer soap than the soda, and is required in larger quantity than the soda, in order to accomplish the saponification of the same amount of fat, in the proportion of 47 to 31, which are the respective atomic weights of those two bases, representing the quantities required to saturate acids.

The chemical name of fat would thus be stearate, margarate, or oleate of glycerin. All fats contain the three acids, but in different proportions; hard tallow and lard, contain the most stearic acid; human fat contains much margaric acid; and fatty oils contain an abundance of oleic acid. When boiling these fats with a strong solution of potash or soda, we form soap, of which the chemical name, therefore, would be stearate, margarate, and oleate of potassa or soda, all with more or less glycerin; and according to what has been remarked above, the hardest of all soaps is the pure stearate of soda, the softest is the oleate of potassa.

There is a great advantage in using these fatty acids in making soap, over the undecomposed fats themselves, as they require not so strong solutions of the alkalies, they unite much more readily in shorter time and at lower temperatures; even boiling may be dispensed with, and besides they produce harder and more valuable soaps by the absence of glycerin.

### OLD PROCESS OF MANUFACTURING OF GLYCERIN.

We may separate the glycerin from the fats by combining the fatty acids with a base, which makes an insoluble soap; for instance, lime, or better oxide of lead. In the last case the soap is stearate, margarate, and oleate of lead, and is precipitated in the liquid which holds the glycerin in solution, which liquid is separated, and by evaporation of the water is concentrated. This is the old way of making glycerin, and such glycerin is usually contaminated with lead, and unfit for many purposes for which pure glycerin is required.

### OLD PROCESS OF MANUFACTURING FATTY ACIDS.

We may separate the fatty acids from common soap, by adding a stronger acid, diluted sulphuric, acetic, etc. This acid will combine with the base potash or soda, forming a soluble salt, the stearic, margaric and oleic acids are set free, and being insoluble and lighter than water will float on the liquid. Also this is one of the old ways of preparing these acids, but now gone out of use by later inventions.

### DISCOVERY OF THE PRINCIPLE THAT WATER, HEAT, AND PRESSURE WILL DECOMPOSE FATS.

In 1822, it was found in England that in a steam engine of Perkins, which worked under very great heat and pressure, and in which the steam condensed in cylinder and air pumps was continually returned to the boiler, the fats and oils abundantly used for lubricating the piston and cylinder became, by the action of the hot water and steam, decomposed into other substances, which were analyzed by Faraday, who pronounced them to be identical with the glycerin and fatty acids of Chevreul, and the result of this investigation was published in the London Philosophical Magazine and Journal in 1823, under the title: "*change of fat by water, heat, and pressure in Perkins' steam engine.*

About thirty years elapsed before any one took advantage of this discovery, till about 1850 the use of superheated steam

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