FAILURE OF THE ENGLISH IRON-CLADS.

The following article appears as a leader in the London *Mechanics' Magazine*, the best mechanical paper, with the soundest engineering views, published abroad:—

"The event foreshadowed in the *Mechanics' Magazine* more than two years since, is close at hand. The fleet of experimental iron-clads, of which the *Warrior* is the type, must, if they are to be in a condition to cope with the armor-plated ships of foreign powers, be reconstructed. What a bitter sarcasm is this announcement on Admiralty management. The *Warrior* **has been held up to the admiration of the naval world as the most perfect specimen of a screw iron-clad frigate. Quite recently, it was represented on Whitehall authority, that 'her excellent sea-going qualities and rate of** speed under steam were unrivalled,' and she was 'just in such splendid order in all her internal arrangements as can only be attained by unremitting exertions at the close of an ordinary term of commission.' It seems incredible that this magnificent vessel, which, we are told, the Admiralty **officials** 'feel a just pride in calling the finest and **fastest of her Majesty's iron-clad fleet,' is suddenly discovered to be utterly defenseless as a ship of war.**

"We were prepared for this discovery. Whilst she was still under construction we pointed out that the unprotected condition of her bows and stern would be fatal to her in action, as it would enable a completely armored antagonist to make a wreck of her two ends, and in her crippled state leave her no choice but destruction or surrender. Representations to that effect were urged on the notice of the Admiralty but disregarded with sublime indifference by 'my Lords' and their noble secretary. Remonstrance was in vain; the square fighting-box, occupying 200 feet in length of the center of the ship, was a capital invention. The batteries and the gunners were safe **in this iron fortress: the arrangement was perfection, nothing could be better. The Controller and his staff were jubilant; they treated with disdain** the sinister **predictions of** professional and civilian critics, and not content with one experimental iron-clad on the fighting-box system, costing nearly half a million, they induced the Admiralty to order three others on the same **principle. Four ships, at a cost of** nearly a million and a half; were built on an untried plan, and now, after their completion, by a trial, which **might** and ought to have been made long before the **first of the** number was ready for sea, it is discovered **that the objectors, whose opinions were treated with** scorn, are right, and the plan is a failure.

The recent shell practice against the target-ship *Alfred*, at Portsmouth, has suddenly opened the eyes of the 'Lords,' who witnessed it, to the unpleasant fact that a *Warrior* with her bows and stern unprotected by iron armor would be no match for a *Gloire*, much less for a *Couronne* or a *Magenta*.

"A panic has seized the Controller of the Navy and his Chief Constructor, and spread to the Board. The fear of Parliament is before their eyes. Hastily, 'the *Warrior* is to be paid out of commission, and **is ordered to be thoroughly dismantled, everything being returned to store and her machinery taken to pieces.' Three reasons are** spoken of as having in**fluenced the** Admiralty in paying her out of commis**sion**:—'First, want of men for the three-decker *Victoria*; secondly, the defective condition of the ship's boilers; and, thirdly, the *intended alterations and continuation of the armor-plating around the bows and stern*." The first two reasons are mere pretexts —the last is the true one. At length the murder is **out.** The famous *Warrior*, **the splendid iron-clad, cannot meet an enemy without being doomed to destruction and without disgracing England's flag.** The remedy is a bitter pill for the Government to swallow; but there is no avoiding it. *The Warrior must be reconstructed*; and this will commence the reconstruction of our entire iron-clad navy. The *Warrior* or elastic system of armor plating—iron on wood backing—which, with slight modification, is adopted for every plated ship, as we have frequently shown, is defective in principle, and must be replaced by a system of greater rigidity. The expense will be enormous, but it is unavoidable.

"The intended alteration to the *Warrior's* bow and stern will necessitate the opening and lengthening of the ship's frame forward and aft, otherwise she would be unable to carry the additional armor plating, and would be ruined in her present excellent sea-going qualities and speed. In plain words, it is found necessary to cut the *Warrior* into three parts and reunite them by splicing (to use a familiar term) at both ends. This work will necessitate the removal of the armor plates and backing at the two extremities of the ship, the reconstruction and replating of the latter, and probably alterations in the masting and rigging. These changes will involve great expense, and may be seriously prejudicial to the trim of the vessel. Three other iron-clads on the same plan will have to be reconstructed.

"But worse still remains to be told. What is to **be done with Mr. Reed's fleet of wooden bottoms and unprotected ends, carrying square iron fighting boxes on the** *Warrior* **plan, but with such instability of** structure that the iron top sides vibrate alarmingly from the fire of the ship's guns, with armor that will hardly resist 68-pounders at short ranges, and with **the** hamper of movable bulkheads on deck? If the formidable *Warrior* cannot encounter an enemy without being reconstructed, what is to become of the ships of the *Research* and *Enterprise* class, of which eight were built or laid on the stocks before **one was tried? They have** neither strength **nor speed, are neither liners nor cruisers, and cannot by any process of reconstruction be converted into serviceable craft. With these prospects before us, the** condition of the navy is by no means satisfactory."

FURTHER EXTRACTS FROM PROFESSOR TREADWELL ON HOOPED CANNON.

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EFFECT OF LIGHT AND HEAVY SHOT.

In artillery practice, the restraining power which causes the powder to act against the walls of the cannon is derived principally from the inertia of the **shot. This is so much greater than the inertia of the powder itself, that the latter may be neglected in the** considerations that are to follow. Now, bearing in mind what has been already said, let us compare the difference of the force of powder as exerted upon a small and a large gun respectively. It is perfectly well known, that, if we have a pipe or hollow cylin**der of say two inches in diameter with walls an inch** thick, and if this cylinder will bear a pressure from within of 1,000 pounds per inch, another cylinder, of the same material, of ten inches in diameter, will bear the same number of **pounds to the inch** if we increase **the walls in the same proportion, or make** them five inches thick. A cross-section of these cylinders will present an area proportional to the squares of their diameters, and if the pressure be produced by the weight of plungers or pistons, as in the hydrostatic press, the weight required in the pistons will be as the squares of the diameters, or as 4 to 100.

Now carry this to two cannon of different calibers, and take an extreme case. Suppose the caliber of one to be 2 inches in diameter and the other 10 inches, and that the sides of each gun equal, in thickness, the diameter of its caliber. Then to develop the **same force, per inch, from the powder of each gun, the inertia of the balls should be as the squares of** the diameters of the calibers, respectively; **that is,** one should be 25 times as great as the other. But the balls, being one 2 and the other 10 inches in diameter, will weigh 1 pound and 125 pounds respectively—the weights being as the cubes of the calibers. Hence each inch of powder in the large gun will be opposed by five times as much inertia as is **found in** the small gun. This produces **a state of things** precisely **similar to that of loading the small gun with 5 balls instead of 1; and although the strain thrown upon the gun by 5 balls is by no means five times as** great as that by 1 ball, there can be, I think, no doubt that the strain produced by different weights of ball is in a ratio as high as that of the cube roots of the respective weights. This would give, in the example before us, an increase of from 1 to 1·71, or the stress upon the walls of the 10-inch gun would be 71 per cent greater than upon those of the 2-inch gun.

GREATER PRESSURE IN LARGE THAN IN SMALL GUNS.

The foregoing statement and comparison, however, do not present the whole case; for they are made upon the supposition that the charge of powder, in **each** instance, is as the square of the diameter of the shot, or that the cartridges of the 2 and the 10-inch guns are of the same length. This, if we take the charge of the small gun at $\frac{1}{3}$ of a pound, would give but $8\frac{1}{3}$ pounds for the large, or $\frac{1}{15}$ of the weight of the shot. The velocity obtained from this charge would produce neither range nor practical effect, and to obtain these results, that is, 1,600 feet a second, we must either increase the force through the whole length of the gun to 5 times that required for the small gun, or, the force remaining the same, we must provide for its acting through five times the space. Neither of these conditions can be practically accomplished. However, by an increase of both the charge and the length of the bore, the result may, in **the limits under consideration, be attained. Thus, taking the large bore, if we double its length and make the cartridge** five times as long, **increasing the** weight from $8\frac{1}{3}$ to $41\frac{2}{3}$ pounds—or perhaps, **having** an advantage from the comparative diminution **of** windage and the better preservation of the heat, **with** a charge of **from 30 to 35** pounds—we may obtain the full velocity of 1,600 feet a second. But this again increases enormously the strain upon the gun.

It does not appear obvious, at a first **view, how an** increase in the charge **should increase the tension of the fluid produced from it, if the cavity inclosing it be proportionably enlarged. If a steam pipe a foot long will sustain the pressure of a given quantity of steam, of a given temperature, a pipe two feet long,** of the same thickness and diameter, will sustain the pressure produced by a double weight of steam from the same boiler. Why then should the pressure upon a cannon be increased by a double length of cartridge? The difference seems to be this; with the steam, the pressure is as in a closed cavity; with the powder, the tension depends upon the movement of the shot while the fluid is forming. Now, whether the charge be large or small, the motion of the shot commences while the pressure is the same in both **cases, and before the charge is fully burned, and with the same velocity in both cases; but with the large** charge the fluid is formed faster than with the small, while the enlargement of the cavity by the movement of the shot is nearly the same in both cases. This destroys the proportion between the sizes of the two cavities, and the tension must increase faster, **and become greater, from the larger charge.** The law of this increase cannot, from the complicate **na**ture of the problem, be stated **with any reliable ex**actness, but we **may, I think, conclude, from the increased velocity of the shot, and many other effects, that the stress thrown upon the gun by different** charges of powder, within ordinary limits, will not vary essentially from the square roots of those charges If then we increase, in the example under consideration, from a charge of $8\frac{1}{3}$ pounds to one of 32 pounds, the stress upon the gun, being as the square roots of these numbers, is raised from 2·88 to 5·65, or from 1 to 1·96. Having already increased the stress upon the gun, by the shot, from 1 to 1·71, if we multiply these together, we have a total increase of from 1 to 3·35. That is to say, if, under the conditions here stated, we load a gun of 2 inches caliber with 1 shot **and $\frac{1}{3}$ of a pound of powder, and a gun of 10 inches caliber with 1 shot and 32 pounds of powder,** the **stress upon each square inch of the bores will be 3·35** times greater **with the large than with the small gun**; when at the same time, **if the walls of both have** a thickness proportional to the diameters of **the cali**bers in each, the large gun will be incapable of sustaining a greater pressure per inch than the small **one. Even with a charge of** 12 pounds of powder, the stress upon the **large gun must be more than double that upon the small gun when charged** with **one-third the weight of its ball.**

It is calculated that about 8,000 dozen pounds of candles per week are used in the **mines** of Cornwall alone, taking no account whatever of the large consumption in private houses. This would make an annual consumption of about 600,000 lbs. of tallow every year; and the total value of candles used for mining purposes would, at an average of 5s. 3d. per dozen pounds, represent an expenditure of about £13,000 for candles alone.

A Mrs. Egbert, wife of one of the oil-well princes, recently forwarded $5,000 to provide a Christmas dinner for the soldiers in the Philadelphia hospitals.