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EXPERIENCE WITH STEAM FIRE ENGINES.

It is now generally conceded that steam fire-engines, as compared with hand fire engines, are the most efficient and desirable in two features. One consists in the constant and reliable operation of the steam moter. Its iron sinews never grow weary like those of the human arm which move the hand engine. It also possesses greater power than the hand engine for throwing water to higher elevations, such as the roofs of lofty buildings. These are important advantages; but on the other hand, it has been urged against them that their first cost is greater, and being heavier than the old engines they cannot be drawn so rapidly to fires nor set to work so quickly. And to crown all, it has been asserted that as they have so many movable parts they are very liable to get broken, or become deranged when drawn over rough streets and when working, and thus they are extravagantly expensive to keep in order. We have heard it asserted that these assumed defects of steam fire engines counterbalance all their admitted advantages. It is only by practical experience that reliable information can be obtained respecting the comparative advantages and disadvantages of any two systems, like those of hand and steam engines for extinguishing fires. Heretofore full information on such a subject has been most difficult to obtain, but we have now received it in the annual report of the Board of Fire Commissioners for the City of Troy, N. Y., by Samuel K. Briggs, Esq., President of the Fire Department.

Three steam fire engines have been purchased and used, and have been found more efficient than seven hand engines, and the report says: "There is every reason to believe that when the present department shall have been thoroughly organized its yearly cost will be little, if any, above half of that system which it supersedes." The citizens of Troy feel so much greater security from the steam than the old engines, that the report says: "If the present security from fire was purchased at a larger annual outlay, it is believed the tax-payers would willingly submit to an increased burden in view of the advantages thus secured." Of the three steam fire engines used in Troy one called the "Hugh Rankin," built at the Amoskeag works, Manchester, N. H., has done wonders, and a very full report of its performances is given. Its entire cost with horses and all complete, was $3,562. It had been eighty-five times at work, and from September, 1860, till February, 1862, it had operated one hundred and sixteen hours, thus affording ample opportunities to test its qualities. In one instance, from the time the bell struck the alarm until the "Hugh Rankin" had a stream on the fire through one thousand feet of hose it was only seven minutes. On another occasion, during a conflagration in Schenectady, in answer to a telegraph dispatch for this engine, it was placed upon a platform car, conveyed a distance of twenty-one miles by railroad, dragged by hand over one third of a mile, and had a stream of water on the fire in fifty minutes from the period the message for it was sent. No hand engine could have been more promptly brought into action upon these fires. With respect to durability the report says: "This engine never missed fire by being disabled or compelled to stop and return home when on trial, or doing fire duty by any disability." And during the whole period of its use it has only cost $31.50 for repairs. It has an upright tubular boiler with a fire surface of one hundred and fifty-two square feet. The pump is a double-acting piston cylinder four and three-quarter inches in diameter and twelve inches stroke, placed directly under the steam cylinder which is eight inches in diameter and the same stroke as the pump. Its weight with engineer, driver and fuel on board is 5,600 pounds. Those citizens in Troy most interested in procuring this light engine obtained it to demonstrate to the public that steam fire engines could be put to work as quickly as hand engines, and that they were as efficient at small fires. It was also obtained to show that such an engine was perfectly practical and economical to use in a city where many of the streets are very rough and hilly. It has been completely successful and has cost much less for repairs than a hand engine would have done in performing much less work. The first steam fire engines which were built for our cities were rather large, clumsy and heavy. They are now being superseded by a class of lighter and more compact engines, which have proven themselves to be so efficient that insurance companies may profitably reduce the rates which they formerly charged under the old hand engine system.

OPINIONS ABOUT ARMOR-CLAD WAR SHIPS.

We lately (on pages 134 and 135, present Vol. SCIENTIFIC AMERICAN) published an interesting lecture of J. Scott Russell on iron-clad ships. This distinguished engineer has also published a pamphlet in London on the building of armor ships, which has called out a considerable amount of criticism, and provoked some animated controversy. He has attacked the British Admiralty for incapacity in expending twelve million pounds ($60,000,000), within the past three years in producing only two efficient frigates, the *Warrior* and *Black Prince*, and expending the rest on two armor "tubs," the *Defense* and *Resistance*, and in changing several wooden frigates to armor clads, like the American *Roanoke*. Mr. E. J. Reed, a naval architect employed by the Admiralty to rebuild the combined wood and armor frigates, forming them out of staunch old wooden ships, defends his own system, and attacks that of Scott Russell; the London *Times* being the arena of this wordy conflict.

A large frigate of the *Warrior* type, with a strong iron frame, thick plating, wooden lining, a fine model and powerful engines, seems to realize Mr. Russell's ideas of a perfect armor-clad war vessel, and he consequently condemns all other types. Respecting the *Warrior*, the London *Mechanics' Magazine* says:—"it is unprotected at both ends, and might be disabled by a very few broadsides; she steers and rolls awfully, leaks through the joints of her armor like a sieve, and worst of all, she is armor plated in so defective a manner, that by the admission of the First Lord of the Admiralty, and from the results of experiments at Shoeburyness, the through bolts which form the fastenings are liable to be destroyed by a few discharges of shot, and the plates to fall bodily off the side of the ship." These are serious charges against the construction of this frigate.

The London *Engineer* describes its favorite iron frigate as follows:—"She wants a long sharp iron hull, alike at each end, and capable of turning upon her center, with two heavy guns at each end, pointing fore and aft, with an accurate range of ten miles. The vessel should in truth, be as stock to the guns to enable them to move at a speed of twenty miles per hour. The vessel should be all steam and gun, and throw a shot of from three to five hundred weight without any recoil whatever. She should choose her own distance, and present no mark save a sharp point to the enemy, and she could meanwhile strike his broadside." This is entirely an ideal vessel. The best known cannon are very unreliable at ranges exceeding twelve hundred yards. It is futile therefore to speak of guns at present having an accurate range of ten miles—seventeen thousand five hundred yards. The American Naval Department wisely resolved, we think, on the building of several classes of armor vessels, and several sizes of some of these vessels. The *Ironsides* is of the *Warrior* type, the *Roanoke* of a different class, and the turret class is entirely different from either of these. In the present state of iron-clad shipbuilding, it is very indiscreet for any scientific or practical man to be dogmatic in his opinions in favor of any one, and against all other classes of armor vessels. This is almost a new art; and knowledge on the subject is so limited, that it becomes all men to be very modest in expressing opinions respecting such vessels. One conclusion, however, appears to be inevitable, if reliance is to be placed in the statements respecting the thick plates of the *Warrior* falling off by the through bolts being broken; namely, that several layers of thin plates with intermediate fastenings, as well as through bolting must be superior to the use of single thick plates. This will permit such vessels to be armor-clad at much less expense; and at the same time it substantiates the superiority of forming the turrets and sides of Ericsson's *Monitors*, with layers of one-inch plates. The commission appointed by the British Government, however, to test plates of various thicknesses, have condemned the use of these plates, and the *Naval Gazette* says on this head: "The American plan of bolting thin plates together, adopted in ignorance of statical laws, is altogether condemned." No accounts of experiments are given to support this scientific dictum. An efficient iron-clad fleet, must comprise vessels of different classes and sizes for different services as has always been the case with wooden fleets, but much experience is yet wanted in determining the best forms, materials and modes of constructing armor-clad vessels.

DYNAMICAL THEORY OF HEAT.

We lately published the interesting lecture of Professor Tyndall, F. R. S., on "Force and the Laws of Motion," in which he described the dynamical theory of heat, which consists in considering heat an action or motion in bodies in contradistinction to considering it a subtle fluid; the latter notion being once entertained by many physicists. In the concluding part of that lecture—page 132, current volume SCIENTIFIC AMERICAN—the honor is awarded to Dr. Mayer for having first propounded and demonstrated the dynamic theory. To these statements Mr. Joule, F. R. S., has replied in a letter published in the *Philosophical Magazine and Journal*, taking some exceptions to Professor's Tyndall's remarks. He says: "Mr. Mayer's merit consists in having announced, apparently without knowledge of what had been done before, the true theory of heat. This is no small merit, and I am the last person who would wish to detract from it. But to give to Mayer, or indeed to any single individual, the undivided praise of propounding the dynamical theory of heat is manifestly unjust to the numerous contributors to that great step in physical science. Two centuries ago Locke said that 'heat is a very brisk agitation of the insensible parts of the object, which produces in us that sensation from whence we denominate the object hot; so that what in our sensation is heat, in the object is nothing but motion.' In 1798, Count Rumford, inquiring into the source of heat developed in the boring of cannon, said, 'it was very difficult, if not quite impossible, to form any distinct idea of anything being excited and communicated in the manner the heat was excited and communicated in these experiments, except it be motion.' In 1812, Davy said: 'The immediate cause of the phenomena of heat then, is motion, and the laws of its communication are precisely the same as the laws of the communication of motion,' and he confirmed his views by that original and interesting experiment, the melting of ice by friction. 'In 1839, Seguin published a work wherein he shows that the natural theory of heat generally adopted would lead to the absurd conclusion that a finite quantity of heat can produce an indefinite quantity of mechanical action.' From the above extracts it will be seen that a great advance had been made before Mayer wrote his paper in 1842. . . . . . . The dynamical theory of heat was certainly not established by Seguin and Mayer. To do this required experiment, and I therefore assert my right to the position which has generally been accredited to me by my fellow physicists, as having been the first to give decisive proof of the correctness of this theory. In saying this I do not wish to claim any monopoly of merit. Even if Rumford, Mayer and Seguin had never produced their works, justice would still compel me to share with Thomson, Rankine, Helmholtz, Holtzman, Clausius and others whose labors have