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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 given developments of the dynamical theory which entitle them to merit, and who bave contributed most essentially in supporting it by new proofs. In 1843, I applied the dynamical theory of heat to vital processes, and in 1847, in a lecture, explained the phenomena of shooting stars, and also stated that the effect of the earth falling into the sun would be to increase the temperature of that luminary. Since that time Thomson by his profound investigations, has made the dynamical theory of heat, as applied to cosmical phenomena, his own."

To Mr. Joule belongs the chief credit of proving by experiment the law which had previously been a subject of speculative theory, that not only heat and motive power but all other kinds of physical energy, such as chemical action, electricity and magnetism, are convertible and equivalent. Any one of those kinds of energy may, by its expenditure, be made the means of developing any other in definite proportions. Thus, the energy of the steam engine in driving a Beardslees' magneto-electric machine, is converted into currents of electricity, the force of which decomposes water and disintegrates metallic plates. M. Joule by experiments on the friction of water, oil, mercury, air and other substances, determined that the mechanical equivalent of a unit of heat is 772 foot-pounds, and it has been called "Joule's equivalent." The law of thermodynamics is that heat and mechanical energy are mutually convertible, and heat requires for its production and produces by its disappearance, mechanical energy in the proportion of 772 foot-pounds for each unit of heat. This unit is the amount of heat required to raise the temperature of one pound of water by one degree of Fahrenheit. In other words, the work or energy of raising 772 pounds one foot, or 1 pound 772 feet, expended in friction upon 1 pound of water will raise its temperature 1° Fah.; this is a unit of heat. The remarks of Mr. Joule accord with the views published on page 37, Vol. XII. (1856) old series SCIENTIFIC AMERICAN, in answer to an article in the London *Engineer* on the dynamical theory of heat.

BALLOON ASCENT FOR SCIENTIFIC PURPOSES.

On the 17th ultimo an ascent was made at Wolverhampton, England, being the second aerial voyage since March last at the same place for scientific purposes. The ascents were made by an appointed Committee of the British Association for the Advancement of Science, for the purpose of making various observations on the humidity of the atmosphere with philosophical instruments. The balloon used was of American oil cloth and contained 90,000 cubic feet of gas, the specific gravity of which was 330 compared with the the air at 1,000. Messrs. Glaisher and Coxwell were the balloonists, and the former has published a record of the ascent which only occupied about three hours.

When the ascent was made the barometer registered 29·50 and the temperature stood at 55°. In four minutes the voyagers found the temperature to be 45°, the air being dry. The temperature afterward so rapidly decreased that at two minutes after ten, when the sun was shining brilliantly on the balloon, the thermometer stood at 26°. Mr. Glaisher remarks that about this time the balloon being supposed to have attained a hight of about two miles they heard a band of music, and looking downward obtained a picturesque view of the earth. The fields looked like a tesselated pavement, possessing a combination of beautiful colors, and the roads were as clearly defined as though the observers had been but a little hight over them. The next change observed was an increase in the temperature to 31°, and at a quarter past ten the mercury had risen to 37°. On starting Mr. Coxwell's pulse was beating at 75 and Mr. Glaisher's at 76; but at this time Mr. Coxwell's had risen to 86 and Mr. Glaisher's to nearly 100. The gas, too, which had been opaque became perfectly transparent, and the neck being open Mr. Glaisher could see through the gas to the top of the balloon. Its proportions were observed to be accurate, and the netting clung tightly around it. A striking change was observed in the surrounding scenery. The sky, instead of being pale light blue in color was now an intensely deep Prussian blue. The cumuli clouds far below were very rocky in appearance, and the sun was shining upon their surface. The temperature, which had continued slowly to increase, was 38 at 10.30. Now the barometer was reading less than 15 inches, showing that the aëronauts were nearly four miles high. The palpitation of the heart was very perceptible, so much so that each man could hear the beating in the breast of the other. The ticking, too, of Mr. Glaisher's watch was remarkably loud, reverberating like a chronometer beating upon a sounding board, and the rustling caused by turning over the leaves of his note book appeared like the rushing of a high wind. At 10.35 the temperature had increased to 42°, and they had attained a hight of quite four miles. The air was very dry. A peculiar feature was at this time remarked: the hands were dark blue and the lips also blue, but not the face, the circumstance being accounted for by the atmosphere containing but a small amount of oxygen. Now the temperature began to decrease with wonderful rapidity. In four minutes it was reduced to 36°, and by 10.47 it was down to 31°. At 11.1, the highest elevation was reached, the barometer a little above 11 inches, and it was evident that the voyagers had ascended to very nearly five miles. Here the temperature was 16° or just as many degrees below the freezing point, and the breathing, which was observed to be interfered with when heart palpitation commenced, again became affected. Mr. Glaisher had been warned that at this hight blood would issue from the nose, that the eyes would be affected and there would be a tingling in the ears, but neither in the case of Mr. Coxwell nor in his own case were either of these manifestations perceived. Mr. Coxwell only found it necessary to put on one additional coat while they were up, and Mr. Glaisher wrapped a cloak round him but soon threw it off. The fingers were not benumbed, nor were either of the voyagers uncomfortably cold. The air was dry throughout the journey. At the highest elevation it was 18° below the freezing point. No dew was deposited. The dry bulb thermometer read 16° and the wet bulb 9°. Regnault's hygrometer at zero exhibited no dew, nor had Daniel's hygrometer any dew at 8° below zero. No dew could be deposited at this elevation at either of the hygrometers. The descent was made at 11.42. A. M.

VALUABLE RECEIPTS.

TO KEEP SILK.—Silk articles should not be kept folded in white paper, as the chloride of lime used in bleaching the paper will probably impair the color of the silk. Brown or blue paper is better; the yellowish smooth indian paper is best of all. Silk intended for dress should not be kept long in the house before it is made up, as lying in the folds will have a tendency to impair its durability by causing it to cut or split, particularly if the silk has been thickened by gum. Thread lace veils are very easily cut; satin and velvet being soft are not easily cut, but dresses of velvet should not be laid by with any weight above them. If the nap of thin velvet is laid down it is not possible to raise it up again. Hard silk should never be wrinkled, because the thread is easily broken in the crease, and it never can be rectified. The way to take the wrinkles out of silk scarfs or handkerchiefs is to moisten the surface evenly with a sponge and some weak glue, and then pin the silk with toilet pins around the selveges on a mattress or feather bed, taking pains to draw out the silk as tight as possible. When dry the wrinkles will have disappeared. The reason of this is obvious to every person. It is a nice job to dress light colored silk, and few should try it. Some silk articles may be moistened with weak glue or gum water and the wrinkles ironed out on the wrong side by a hot flat-iron.

WATER MELON RIND PRESERVES.—When the rind becomes a little transparent in salt brine, put it into fresh water for a day and night, changing the water several times, then boil it for one hour very fast in fresh water, cover with grape leaves to green them. Take them up and drop in cold water, enough to cool them quickly, then weigh, and to each pound of rind add two pounds of sugar and boil it rapidly with a few pieces of ginger. When done they are very transparent; add, when cold, a few drops of essence of lemon.

TO MAKE CARMINE.—Boil 1 pound 4 ounces of ground cochineal and a very little of the carbonate of soda in 4 gallons of soft water for 20 minutes; then take it from the fire and add 6 drachms of alum, and stir the mixture for a few minutes and let it stand for a quarter of an hour for the dregs to subside, then run off the clear liquor, strain the sediment through a fine sieve or cloth, and then when cold add the white of two eggs with the sediment, fish glue or isinglass will answer as well as the eggs. The muriate of tin may be used instead of alum. The weight of the cochineal may be reduced to any amount to make a small quantity if the proportions are preserved.

PREVENTING THE FRACTURE OF GLASS CHIMNEYS.—The glass chimneys which are now in such extensive use, not only for oil lamps, but also for the burners of oil and coal gas, very frequently break, and not only expose to danger those who are near them, but occasion very great expense and inconvenience, particularly to those who are resident in the country. The breaking of these glasses very often arises from knots in the glass where it is less perfectly annealed, and also from an inequality of thickness at their lower end, which prevents them from expanding uniformly by heat. The evil arising from inequality of thickness may be cured by making a cut with a diamond in the bottom of the tube

MARINE GLUE.—Dissolve 4 parts of india rubber in 34 parts of coal tar naphtha—aiding the solution with heat and agitation. The solution is then thick as cream, and it should be added to 64 parts of powdered shell-lac, which must be heated in the mixture till all is dissolved. While the mixture is hot it is poured on plates of metal in sheets like leather. It can be kept in that state, and when it is required to be used it is put into a pot and heated till it is soft and then applied with a brush to the surfaces to be joined. Two pieces of wood joined with this cement can scarcely be sundered—it is about as easy to break the wood as the joint.

CEMENT FOR MENDING STEAM BOILERS.—Mix two parts of finely powdered litharge with one part of very fine sand, and one part of quicklime which has been allowed to slack spontaneously by exposure to the air. This mixture may be kept for any length of time without injury. In using it a portion is mixed into paste with linseed oil, or still better, boiled linseed oil. In this state it must be quickly applied as it soon becomes hard.

Steamer Adriatic.

The *Adriatic* (the hull of which was built by the late George Steers, and the engines at the Novelty Works,) lately made a trial trip at Southampton, England, in presence of the Government authorities. She now belongs to the Atlantic Royal Mail Company, and was lately repaired and altered. She attained a speed of 16 statute miles per hour, with steam pressure of 24 lbs. on the inch. Her draft of water was 13¼ feet forward, and 20 feet aft. She had 850 tuns of coal, and 55 tuns of water on board. Her engines made 15 tuns per minute, and the vacuum in the condenser was 29 inches. The *Adriatic* is 354 feet in length; 50 feet in breadth; tunnage 3,700 tuns; nominal horse power of engines 1,300; cylinder 100½ in diameter; stroke of piston 12 feet; diameter of paddle wheel 41 feet.

American Exports.

The following is a table of the value of American exports for the three years ending June 30, 1862. It is made up from returns of the Treasury Department:—

	1859.	1860.	1861.
Products of the Sea	$4,432,974	$4,156,480	$4,451,519
Products of the Forest	14,489.406	1,783,559	10,260,805
Of Animals	15,549,817	20,215,226	24,035,100
Vegetable Food	24,046,752	27,590,298	74,191,993
Cotton	161,434,923	191,806,555	34,051,583
Tobacco	21,074,038	15,906,547	13.784,700
Flaxseed	8,177	3,810	49,609
Cloverseed	536,781	596,919	1,063,141
Hemp	9,279	9,531	8.608
Brown Sugar	196,985	103,244	301,329
Hops	57,016	32,866	2,006,053
Manufactures	33,853,660	39,544,398	35,786,804
Coal	653,536	740,783	577.336
Ice	164,581	183,134	172,263
Quicksilver	—	258,682	631,455
Gold and Silver bullion	33,329,863	30,913,173	10,488,590
Raw Produce not specified	1,858,205	1,355,391	2,794,046

THE FLAXSEED CROP.—In reference to the new crop of flaxseed the Cincinnati *Price Current* says: A good deal of inquiry has been made of us regarding flaxseed. The crop is a large one and has been saved in good order. The yield is fully twenty per cent greater than that of last year. The contract system controls the great bulk of the crop, however, so that the price is an arbitrary one and indicates nothing. The crushers furnish the seed to the farmers on condition that they sell them the crop at one dollar per bushel, and hence this is the price the farmer now gets.