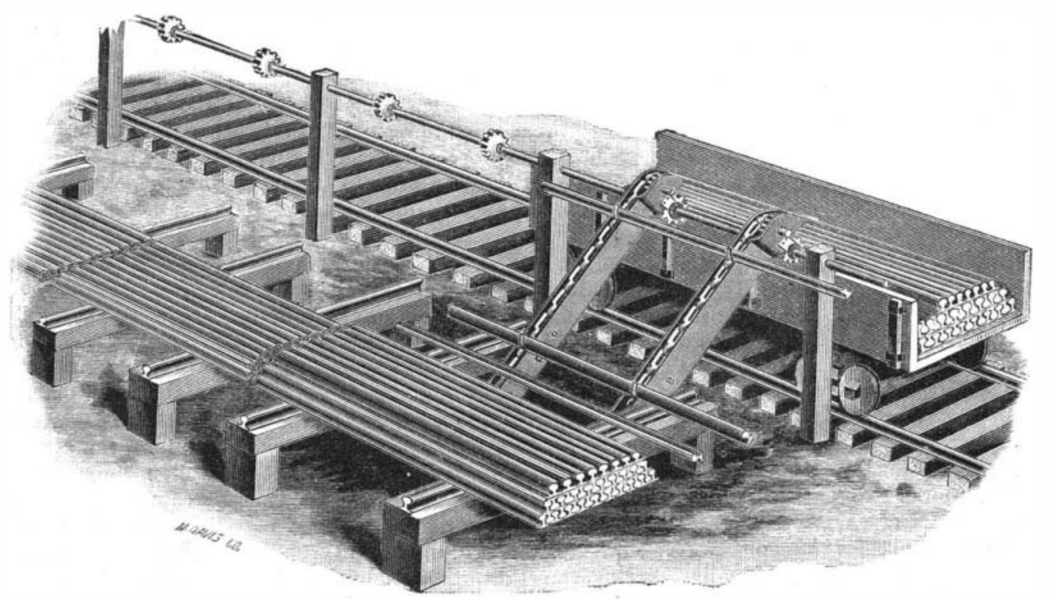
IMPROVED RAIL LOADING MACHINE.

A rail loading machine, by the use of which rails may be loaded into cars cheaply and expeditiously, has been patented by Cyrus P. Tittle, of Johnstown, Pa. A cut and description of it are herewith given. While to a limited extent machinery has been used for loading rails, this machine, being portable, presents a feature not possessed by others, in which there must be duplicate machinery for each bed or pile of rails, or all the rails must be loaded from one pile. This can be moved from one rail pile to another, and when not in use can be taken out of the way.

The machine consists of two plates bolted together, having a short shaft with a cog wheel and sprocket wheel attached running through the upper end, and a similar shaft with sprocket wheel running through the lower end. An endless chain, with hooks at regular intervals, engages with the sprocket wheels. In front of the rails to be loaded, a shaft having fast to it cog wheels in pairs, as many as desired, is supported at a suitable height from the ground. Two of the loaders are used, and are placed with the lugs or supports on the under side of the plates, resting on the shaft in such manner as to have the cog wheel of the machine engage with the cog wheel on the shaft. Power is applied to the shaft and motion consequently imparted to the chain. As the rails are brought to the front of the pile, the hooks elevate them to the top of the machine and tip them into the car. If the car is not of the same height as the machine, suitable sliding bars can be arranged to conduct the rails into the car.

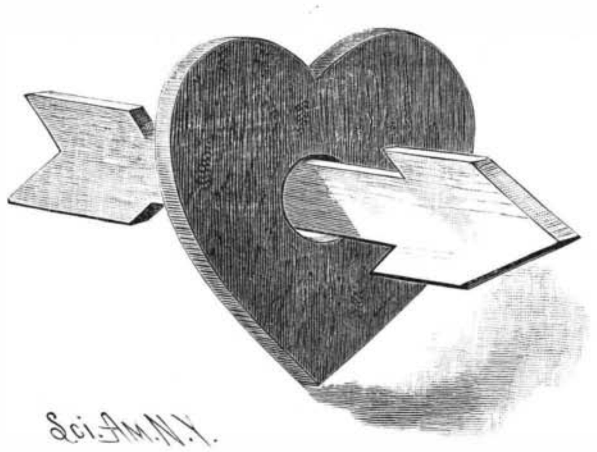


IMPROVED RAIL LOADING MACHINE.

NOVEL PUZZLE.

Our engraving shows a single perforated piece of wood having the form of a conventional heart, and in the perforation is inserted an arrow, also formed of a single piece of wood, the barb and head being much larger than the perforation in which the shank of the arrow is received. The heart is made of one kind of wood and the arrow of another. The question is, How did the arrow get into the heart? We have heard of the philosopher who was unable to rightly place a horse collar, and we have seen philosophers who could readily harness a horse, but who could not explain how the arrow got into the heart.

The puzzle illustrated is one of many thousands distributed gratuitously upon the streets of New York as an advertisement. The heart is of black walnut and the arrow is of basswood. Now we fear that the secret is out, for any one familiar with the properties of basswood knows that it may be enormously compressed, after which it may be steamed and expanded to its original volume. One end of the arrow was thus compressed, and in its compressed state was passed through the aperture of the heart, after which it was expanded. Advantage has been taken of this principle in the manufacture of certain kinds of mouldings. The portions of the wood to be left in relief are first compressed or pushed down by suitable dies below the general level of the board, then the board is planed down to a level surface, and afterward steamed. The compressed portions of the board are expanded by the steam, so that they stand out in relief.



A NOVEL PUZZLE.

Charles Loudon Bloxam.

Mr. Charles Loudon Bloxam, who for many years held the professorship of chemistry in King's College, London, and was formerly lecturer at the Royal Military Academy, Woolwich, died on November 28, aged fifty-five years. Mr. Bloxam's original researches, contributed mostly to the Chemical Society, were of a highly technical character. As far back as 1853 he devised methods for the analytical separation of tin, antimony, and arsenic; and he subsequently investigated the action of boracic acid upon the alkaline carbonates and alkaline earths. The poisonous metals claimed a good deal of his attention; he suggested an electrolytic test for the presence of arsenic, made a special study of the compounds of arsenious acid, and investigated the source of the arsenic which occurs in the sulphuric acid of commerce. In conjunction with Sir F. A. Abel, about thirty years ago, he conducted researches on the valuation of niter. Mr. Bloxam was the author of a well known manual of chemistry and of some smaller works on the metals.

APPARATUS FOR THE ELECTROLYSIS OF WATER.

T. O'CONOR SLOANE, PH.D.

The apparatus shown in the cut accompanying this article is intended to demonstrate that water disappears when electrolyzed, and to afford an approximate measurement of the amount decomposed. It forms a very good appendix to the ordinary experiment of decomposing water by the electric current and collecting the evolved gases separately. The amount of water corresponding to a large volume of electrolytic gases is so very small that the most delicate means have to be adopted to render it perceptible, unless a very strong current is used, and a long time occupied in the decomposition.

The apparatus consists essentially of two tubes, one the decomposition tube and the other a funnel tube. Their general shape is apparent from the cut. The decomposition tube is twelve inches high. The large portions are three-quarters of an inch in internal diameter. The connecting portion is made of capillary tubing. This may be from one-sixteenth to one-sixty-fourth inch bore. To this a scale is attached. It may be made of paper or pasteboard and secured by gum tragacanth. The funnel tube is six inches long, and its long stem is made of the same capillary tubing as that used for the other. It communicates by an India rubber tube with a lateral outlet leading from the decomposition tube.

Two plates of platinum are inserted at opposite sides of the lower portion of the decomposition tube, and a good cork is driven in to retain them. A portion of each plate projects downward, lying against the side of the cork outside of the tube. If an ordinary cork is used, it is well to insert with it a lump of sealing wax or paraffine. Then, when the cork is forced in well, the wax or paraffine is melted so as to be completely fluid, and is allowed to solidify while the tube stands vertically. This must be done while the tube is perfectly dry. If a very good and soft India rubber cork is used with thin plates of platinum, the treatment with wax is unnecessary.

This method of inserting the plates is given because it is the easiest. It is advisable to bend them a little inward, so that they will not lie against the glass. But it would be still better to secure them to platinum wires, which, by a good glass blower, could be passed through the glass tube above the cork, and there melted in place. Care in either case must be taken to see that they do not touch each other

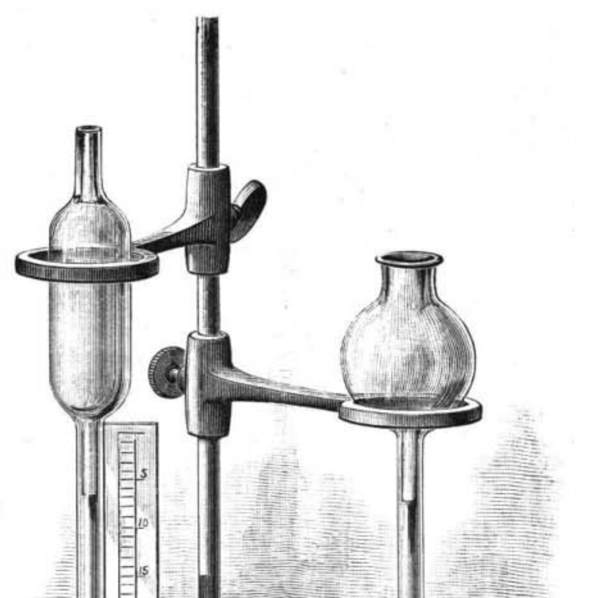
The apparatus may be supported in some kind of an improvised stand. As shown, it is arranged with a ring stand, an extra ring being borrowed to hold the funnel tube.

Some water is mixed with one-twentieth its volume of sulphuric acid and allowed to become perfectly cool. This fluid is poured into the funnel tube. It flows down through this into the decomposition tube. Air bubbles are almost certain to be carried with it. These are disposed of very easily by raising and lowering either tube several times until they all escape. In this way the acidulated water is added until it stands at about the middle of the stem of the funnel, and near the top of the scale attached to the decomposition tube. The ring carrying the funnel may be moved up and down, and water added very slowly until this condition is secured. Upon the stem of the funnel tube near its center a mark should be made. This may be done with a piece of thread tied around it, or with common ink. When filled, the water must stand exactly at the level of such mark.

The apparatus is allowed to stand for a few minutes, the funnel tube is adjusted if necessary, and the reading of the scale is taken and noted. The funnel is lowered until the level of fluid in the decomposition tube sinks just to the shoulder, but is well above the plates. Then a current of electricity is caused to pass through the water. The wires may be connected to the plates, as shown, by a spring clothespin.

At once bubbles rise in clouds from the plates. The gas as evolved may or may not be collected by a tube connected to the upper end of the decomposition tube. After ten or fifteen minutes' working, enough water will have been decomposed for its disappearance to be discernible. The battery is disconnected. The funnel tube is raised and lowered a few times to free the liquid of bubbles. It is brought to such a level that the fluid rises exactly to the mark on its stem, being allowed to stand before final adjustment, and a second reading is taken. This should be lower than the first, and the difference should give the amount of water decomposed. But as the gases are somewhat soluble in water, and as some gas may adhere to the platinum, the first reading will generally be higher, indicating an increase of volume. This reading, then, is taken as the basis. The funnel is again lowered, the current, for ten or fifteen minutes more, is passed through the solution, and the operations already described are repeated. This time the reading will be lower, indicating a disappearance of water.

Some knack is required to manipulate the apparatus. It should always be allowed to stand a few minutes before the final adjustment of the level of the funnel tube,



APPARATUS FOR THE ELECTROLYSIS OF WATER.

to collect any drainage from the funnel. The experimenter must remember that he is making an exceedingly delicate measurement, and must exert patience and care. By raising and lowering either the funnel or the decomposition tube, or both in succession, every bubble can be disposed of without trouble.

Commodore Matthew Calbraith Perry, the Inventor of the Ram in Naval Warfare.*

The changes in naval construction required by necessities of war have been many. The history of ship building is literally one of ups and downs. Three great revolutions of the oar, the sail, and the boiler have compelled the changes. The ancient sea boats grew into high decked triremes with many banks of oars, and these again to the low galleys of the Vikings and Berbers. The sides of these, in turn, were elevated until cumbersome vessels with low prow, many-storied and tower-like stern, and enormous top hampers sailed the seas. Again, the ship of the Tudor era was only, by slow processes, cut down to the trim hulls of Nelson's line-of battle ships.

In the clean lines of the American frigate, the naval men of our century saw, as they believed, the acme of perfection. They considered that no revolution in the science of war could seriously affect their shape. Down to 1862, this was the unshakable creed of the average sailor. Naval orthodoxy is as tough in its conservatism as is that of ecclesiastical or legal strain.

Yet both Redfield and Perry, as early as 1835, clearly foresaw that the old models were doomed, the many-banked ships must be razed, and the target surface be reduced. Steam and shells had wrought a revolution that was to bring the upper deck not far from the water, and ultimately rob the war ship of sails and prow. The next problem, between resistance and penetration, was to make the top and bottom of ships much alike, and to put the greater portion of a war vessel under water. It is scarcely probable, however, that either of them believed that the reduction of steam battery should proceed so near the vanishing point, as in the Monitor, to be described as "a cheese box on a raft" or "a tomato can on a shingle."

The first idea concerning "steam batteries," as they were called, was that they were not to have an individuality of their own as battle ships, but were to be subordinate to the stately old sailing frigates. They were expected to be tenders to tow the heavy battering ships into action, or to act as dispatch boats and light cruisers. They were conceived to be the cavalry of the navy—ships mounted, as it were. Redfield and Perry, on the other hand, laid claim for them to the higher characteristics of cavalry and artillery united in a single arm of the service.

The first English steamers were exceedingly cumbrous and unnecessarily heavy. It was with their ships as with their wagons or ax handles—the British, ignorant of the virtues of American hickory, knew not how to combine lightness with strength. Redfield proposed to apply the Yankee jackknife and whittle away all superfluous timber. Denying that the British type was the fastest or the best, he pleaded earnestly that our naval men should discard transatlantic models, and create an American type. Regretting that our government and naval men held aloof from the use of steam as a motor in war, he yet demonstrated that even a clumsy steamer like the Nemesis had proved herself equal to two line-of-battle ships. He prophesied the speedy disappearance from the seas of the old double and treble banked vessels then so proudly floating their pennants. Redfield, writing to Perry as a man of liberal ideas, said: "Opinions will be received with that spirit of candor and kindness which has so uniformly been manifested in your personal intercourse with your fellow-citizens." The confidence of this eminent man of science and practical skill in the naval officer was fully justified.

One thing which occupied Perry's thoughts for a number of years was the question of defending our Atlantic harbors from sudden attacks of a foreign enemy. Steam had altered the old time relations of belligerents. He saw the modern system of carrying on war was to make it sudden, sharp, and decisive, and then compel the beaten party to pay the expenses. A few hostile steamers from England could devastate our ports almost before we knew of a declaration of war. While England was always in readiness to do this, there was not one American sea-going war steamer with heavy ordnance ready to meet her swift and heavily armed cruisers, while river boats would be useless before the heavy shell of the enemy. He did not share the ideas of security possessed by the average fresh water congressman. The spirit of 1812 was not dead in him, but he knew that the brilliant naval duels of Hull and Decatur's time decided rather the spirit of our sailors than the naval ability of the United States.

He proposed a method for extemporizing steam batteries by mounting heavy guns on hulks of dismantled merchant vessels. These were to be moved by a steamer in the center of the gang, holding by chains, and able to make ten knots an hour. If one hulk were disabled, it could be easily separated from the others. Such a battery could be made ready in ten days and fought without sailors. The engines could be covered with bales of cotton or hay made fire proof with soapstone paint.

With the aid of his friend W. C. Redfield, he collected statistics of all the privately owned steamers in the United States, with their cost, dimensions and consumption of fuel, showing their possible power of conversion for war purposes. Encouraged by Perry, Mr. Redfield treated the whole question of naval offense and defense in a series of letters on "The Means of National Defense." These were printed in the New York *Journal of Commerce* during the summer of 1841, and afterward reprinted in the *Journal of the Franklin Institute*, in Philadelphia. His note books, with illustrations, diagrams, and pen sketches, show that his coming ideal war ships were like the Lackawanna of our civil war days, which, while but five feet narrower, is sixty-two feet longer than Old Ironsides, the Constitution of 1812. His favorite type was a long, narrow, and comparatively low vessel like the Kearsarge, which is twenty-two feet less in breadth than an old "seventy-four." Like Perry, he looked forward to the day when one eleven-inch shell gun would be able to discharge the metal once hurled by a twenty-gun broadside of the old President.

An accident which happened to the Fulton, one of the early war steamers of the U. S. Navy, revealed to Commodore Perry's alert mind a valuable principle, destined to work a revolution in the tactics of naval battles. Like the mountaineer of Potosi, who, when his bush failed as a support, found something better in the silver beneath, so Perry discovered at the roots of a chance accident a new element of power in war.

The Fulton was rather a massive floating battery than a sea steamer. Once started, her speed for those days was respectable, but to turn her was no easy matter. To stop her quickly was an impossibility.

On August 28, 1838, the Fulton, while making her way to Sandy Hook amid the dense crowd of sloops, schooners, ships, and ferry boats of the East River, came into partial collision with the Montevideo. The brig lay at anchor, and Lieutenant Lynch, in charge of the Fulton, wished to pass her stern, and ahead of her starboard quarter. When nearly up with the brig, the flood tide running strongly caused her to sheer suddenly to the full length of her cable, and thus brought her directly in line of the contemplated route. Lynch, to save life, was obliged to destroy property.

The steamer's cutter and gig were stove in and her bulwarks, in paint and nails, somewhat injured. With the brig, the case was different. Though only a glancing stroke, the smitten vessel was all but sunk.

Captain Perry was not on board the Fulton, having remained on shore, owing to indisposition. On hearing the story of Lieutenant Lynch, there was at once revealed to him the addition that steam had made to the number and variety of implements of destruction. The old trireme's beak was to reappear on the modern steam war vessel and create a double revolution in naval warfare. The boiler, paddle, and screw had more than replaced the war galley's banks of oars, by furnishing a motive power that thereafter should not only sink the enemy by ramming, but should change the naval order of battle. The broadside to broadside lines of evolution must give way to fighting "prow on." In a word, he saw the ram.

Perry required written reports of the affair from his lieutenants, and wrote a letter to the Secretary of the Navy suggesting the possibilities of the rostral prow.

To think of the new weapon was to wish to demonstrate its power. He proposed to try the Fulton again purposely, upon a hulk, to satisfy himself as to the sinking power of the steamer. He arranged to do this by special staying of the boiler pipes and chimneys, so that no damage from the shock would result. He was also prepared, by exact mathematical computation of mass, velocity, and friction, with careful observations of wind and tide, to express the results with scientific accuracy.

The report was duly received at Washington, and, instead of being acted upon, was pigeonholed. Perry was unable, at private expense, to follow up the idea, but thought much of it at the time, and the subject, though not officially noticed, remained in his mind.

After the Mexican war, having leisure, he wrote the following letter:

Washington, D. C., November 11, 1850.

Sir: Since the introduction of steamers of war into the navies of the world, I have frequently thought that a most effectual mode of attack might be brought into operation by using a steamer as a striking body, and precipitating her with all her power of motion and weight upon some weak point of a vessel of the enemy moved only by sails, and seizing upon a moment of calm, or when the sail vessel is motionless or moving slowly through the water.

I had always determined to try this experiment, should opportunity afford, and actually made preparations for securing the boilers and steam pipes of the Fulton at New York, when I thought it probable I might be sent in her to our eastern border ports at the time of the expected rupture with Great Britain upon the northeastern boundary question.

Experience has shown that a vessel moving rapidly through the water, and striking with her stem another motionless, or passing in a transverse direction, invariably destroys or seriously injures the vessel stricken, without material damage to the assailant. Imagine, for example, the steamer Mississippi under full steam and moving at the moderate rate of 12 statute miles per hour, her weight considered as a projectile being estimated at 2,500 tons, the minimum calculation, and multiplying this weight by her velocity, say 17½ feet per second, the power and weight of momentum would be a little short of 44,000 tons, and the effect of collision upon the vessel attacked, whatever may be her size, inevitably overwhelming.

It may be urged that the momentum estimated by the above figures may not be as effective as the rule indicates, yet it cannot be maintained that there would not be sufficient force for all the purposes desired.

I have looked well into the practicability of this mode of attack, and am fully satisfied that if managed with decision and coolness, it will unquestionably succeed, and without immediate injury to the attacking vessel. Much would of course depend on the determination and skill of the commander, and the self-possession of the engineers at the starting bars, in reversing the motion of the engines at the moment of collision; but coolness under dangers of accident from the engines or boilers is considered, by well trained engineers, a point of honor, and I feel well assured there would be no want of conduct or bearing in either those or the other officers of the ship.

The preparations for guarding the attacking steamer against material damage would be to secure the boilers more firmly in their beds, to prepare the steam pipes and connections so as to prevent the separation of their joints, to render firm the smokestack by additional guys and braces, to strip off the lower masts and to remove the bowsprit. All these arrangements could be made in little time and without much inconvenience.

It would be desirable that the bowsprit should be so fitted as to be easily reefed or removed, but in times of emergency this spar should not for a moment be considered as interposing an obstacle to the contemplated collision.

It will be said, and I am free to admit, that much risk would be encountered by the steamer from the guns of the vessel assailed, say of a line-of-battle ship or frigate; but considering the short time she would be under fire, her facilities for advance and retreat, of choice of position, and of the effect of her own heavy guns upon the least defensible point of the enemy's ship, on which she would of course advance, the disparity of armaments should not be taken into view.

I claim no credit for the originality of this suggestion, well knowing that the ancients in their sea fights dashed their sea galleys with great force one upon the other, nor am I ignorant of the plan of a steam prow suggested some years ago by Commodore Barron.* My proposition is simply the renewal of an ancient practice by the application of the power unknown in early times, and, as many believe, in the beginning of its usefulness. With great respect, I have the honor to be, Your most obedient servant,

M. C. PERRY.

The HON. WM. A. GRAHAM,
Secretary of the Navy, Washington, D. C.

Twenty years later, in the river of her own name, the war steamer Mississippi became a formidable ram, though before this time, in 1859, the French ironclad La Gloire had been launched. It had been said of the British Admiral Sir George Sartorius that "he was one of the first to form, in 1855, the revolution in naval warfare, by the renewal of the ancient mode of striking an adversary with the prow." It will be seen that Perry anticipated the Europeans and taught the Americans.

Other points in this letter of Perry's are of interest at this time. First, last, and always, Perry honored the engineer and believed in his equal possession, with the line officers, of all the soldierly virtues, notwithstanding that the man at the lever, out of sight of the enemy, must needs lack the thrilling excitement of the officers on deck. He felt that courage in the engine room had even a finer moral strain than the more physically exciting passions of the deck.

A New Lake Steamship.

The new steel steamship Owego, of the Union Line, made a successful trip from Buffalo, December 7. Her length is 352 feet, beam 41 feet, hold 25½ feet. She has triple expansion engines, 28 × 48½ and 72 × 48 inches. Her wheel is 15 feet in diameter, with pitch of 22 feet. She has six steel boilers placed athwartship in the lower hold, three on either side, each 11½ × 11 feet. She was let out for a short time, and made 76 turns on 158 pounds pressure, or about 14 miles per hour. When in good trim and working order, she is to make 16 miles. Her carrying capacity is about 2,800 tons of freight, besides fuel, on 15½ feet. Her total cost was nearly $300,000. She is the largest craft in dimensions afloat on the lakes.

* Extract from "Matthew Calbraith Perry, a Typical American Officer," by William Elliot Griffis.

* Commodore James Barron's model of his "prow ship" was exhibited in the rotunda of the capitol in Washington in 1836. As described by him in the Patent Office reports, it was a mere mass of logs, white pine, poplar, or gum tree wood. Perry meant to use a real ship, always available for ramming.