thirds. Whereas now, in consequence of the improved lines which are mainly due to the long scientific investigations of Mr. Scott Russell and his coadjutors, the resistance is only one-twelfth of that of the box first mentioned; and this fraction may before long be reduced to one-twentieth or even one-twenty-fourth. The consequence of this is, that twenty years ago engines of 500-horse power barely sufficed to drive a vessel of 1,000 tuns burthen ten knots through the water; the same engines would now propel a vessel of 1,500 tuns at least fourteen knots; and better results than this are being attained. Already twenty miles an hour has been reached, the Holyhead packets working steadily at that rate; and even an armed dispatch vessel has just left this country for China, which, with all her armament on board, can do as much, and that without any extraordinary exertion. Having reached this speed, we cannot long be content with less. Vessels must cross the Atlantic at the rate of 500 miles a day. It would be expensive to build a vessel to do this to-day, and it might beat some waste of power she would accomplish it; but day by day it is becoming less difficult, and before long it will be easy. Had the *Great Eastern* been built for speed alone, she could easily have accomplished this; but carrying power was her great object, and her calculated speed was 15 miles, which she accomplishes with singular evenness in rough weather as well as smooth. She has run 475 miles in twenty-four hours, but her average speed is about 360, or 15 miles per hour, or about the average speed of the best ocean steamers of the present day. This they accomplish easily, without the sacrifice of any of their qualities as sea-going vessels, while retaining the capability of accommodating a large number of passengers, and a considerable amount of cargo for a voyage of 3,000 miles—the distance (speaking in round numbers) of New York from Liverpool.

But it is not only in speed that such progress has been made, as vessels have increased in size in even a greater ratio. Thirty years ago 1,300 tuns was the measurement of our largest indiamen, and 2,000 tuns of a first-class line-of-battle ship. We were all astonished some ten years ago when we heard of the *Duke of Wellington* being launched, of 3,800 tuns; and the *Himalaya*, of 3,600, built since that time, was the largest merchant vessel the world had ever seen. Now our first-class iron-plated frigates measure at least 6,000 tuns. The *Great Eastern* is 691 feet long, 83 feet wide, and registers 18,914 tuns, though her real capacity is nearer 25,000 tuns, and the indicated power of paddle-wheel engines is equal to 3,600 horses, and that of her screw to 4,800, making together 8,400 horse power. If she has not obtained, commercially, the success that was anticipated, it is not that our engineers did not know how to design and build her, or how to furnish her with the requisite power, but simply that she was born before her time. The world is not yet ready for vessels of her size. Without disrespect to any one we may say that until vessels of very large size become more common than they are, and until nautical experience has been enlarged by the use of such ships, there cannot be captains capable, in the highest sense, of commanding, or sailors and engineers sufficiently educated to work so gigantic a machine.

[To be continued.]

Physiology of Swimming.—The medical authorities of the French army especially recommend that men inclined to disease of the chest should be made to swim. The following are the effects (which M. le Docteur Dulon attributes to swimming) on the organs of respiration:—A swimmer wishing to proceed from one place to another, is obliged to deploy his arms and legs to cut through the liquid, and beat the water with them to sustain himself. It is to the chest, as being the central point of sustentation, that every movement of the limbs responds. This irradiation of the movements of the chest, far from being hurtful to it, is beneficial; for, according to a sacred principle of physiology, the more an organ is put into action, the more vigor and aptitude it will gain to perform its functions. Applying this principle to nature, it will easily be perceived how the membranes of the chest of a swimmer acquire development—the pulmonary tissues firmness, tone and energy.

There is an American railway-car line in operation between the Place de la Concorde, Paris, and Sevres.

## Correspondence

### Heaton's System of Defensive Armor.

Messrs. Editors:—In your paper of Jan. 2d, you make some remarks on my system of defensive armor, which is illustrated in that paper; though not in such a way as to convey to a great majority of your readers a correct idea of it. You show a turret, supposed to be plated on two systems, one side on my system, and the other on the present or all iron system. But in my system you show what ought to be a thick iron plate, as wood, which makes the thing contradict itself; for if that was wood no bolts would be broken, and none of the disastrous effects of concussion which you show would be possible.

What I claim is, that wood cannot be made to communicate fracturing force to iron, indirectly; wood can be shot directly through iron, but not indirectly. For instance: A shot strikes fairly against the side of a turret composed of all iron, the ball does not go through, and, from an outward view no serious damage is inflicted, a dent, perhaps two inches deep, being the only apparent injury. But to see the real extent of the damage you must look inside the turret, when you will find a bulge, which will be in size just in proportion to the size of the shot and the thickness of the turret, every plate from the point of the shots impact communicating the force to the next one to it, until the inside plates which are furthest from the shot and which would be thought by some to be least liable to injury, are injured the most; being strained beyond endurance they crack and burst open, breaking the bolts and communicating the force of the shot to the inmates, often more seriously than if the shot actually entered directly; a bolt-head being just about as likely to "put a man out of the fight," as a ten or fifteen inch shot, if it only hit him right. The object of my system is to "take up" or destroy the first or maximum forceof the shot, with a material of softer nature than iron; which material shall, in so "taking up" or destroying the force of the shot, communicate no fracturing force to the real or "main armor," which is held in reserve and not opposed directly to the action of the shot. Is a ship plated to save the ship or the inmates from injury? Can a shot be thrown against the sides of an iron-clad structure with sufficient force to smash the shot to pieces, without injuring the surface against which it is broken? It cannot, I think, no matter how heavily plated, within reason. If it is injured, in order to keep the ship shot-proof, it must be repaired: which is the most readily and cheaply repaired, iron or wood? I claim that the wood I use, in addition to actually saving the "iron armor" from serious injury, takes the damage which must be received in arresting shot suddenly, and is easily replaced. Wood may be forced through iron, or a soft substance through a harder one, by a sustained power or a continued application of force; but not by a cannon ball, because it is not a "continued application of force." It is simply weight and impetus—the result of force, and the momentary application of it—but not the continued application of it; and by no such means as this can a soft substance be forced through, or made to communicate fracturing force to a harder one; because the soft substance must first be rendered as dense or hard as the harder one before it can either injure it or communicate injury to it. And in this compression or densifying of the soft substance the force of the shot is exhausted or "taken up," or so much so without being communicated to the iron as to allow of its being arrested, without any serious injury to the main armor, and without producing that shock or concussion which is the cause of breaking bolts. Wood may be shot directly through iron, because here you have its weight and velocity to arrest; but it cannot be indirectly forced through a harder substance than itself. Chas. W. S. Heaton.

New York Dec. 29, 1863.

[Since publishing the article referred to by our correspondent, we are in receipt of the official report from the Ordnance Bureau, of some experiments made with Heaton's target, from which it seems that his theory of construction is found wanting in practice. The official report will be published with illustrations, in the next number of the journal.—Eds.

### Further Illustrations of the Electric Wave.

Messrs. Editors:—In my first article on the Electric Wave, there were points not sufficiently elucidated, and one or two mistakes unnoticed were printed. The latter I will now correct, and the former explain more fully.

When I say "The electric current does not run in a line of narrow limits; neither does it run in a straight line," I mean no more than to say that it runs just as a cylinder of two feet diamater runs, when turned by a crank and pushed longitudinally at the same time. We turn from the left to the right. So rotates or turns also the electric current or wave—from the left to the right. This law, as it relates to the electric current, is universal. We see that the cylinder turns at its remote end simultaneously with its turning at the crank end. So, likewise, is the turning or revolving of the electric wave. In regard to the wave, however, if the line of its motion be extended to a great distance, the motion of the wave at its terminus is not *precisely* simultaneous with its motion at the commencement. This is owing to the obstacles it has to overcome in its long passage, owing to the imperfect conducting properties of the intervening media along which it has to pass.

While the electric wave is thus rotating, it generates at its central line of motion a current at a right angle with its motion; and this is magnetism. This magnetic force or current does not rotate, but runs in a direct course from one of its poles to the other, in a line the motion of which commences with that of the electric wave. This magnetic force or current is very strikingly exemplified in the helices of the ordinary electro-magnetic machines, where the iron wire that is introduced into them becomes powerfully magnetic, with its north and south pole.

Besides this rotary motion, the electric wave has also a lineal motion; that is, it moves directly forward simultaneously with its rotation; this constitutes a spiral motion.

There is something sublime in contemplating this wonderful force. In it there is found the epitome of the universe. Its rotary and lineal motions represent the motions of the heavenly bodies on their own axis, as well as their orbitual motions; the one confined to its own center, and the other rushing from it.

Electricity in motion begets magnetism; and magnetism in motion begets electricity. The two elements, although so intimately related to each other, are, nevertheless, totally distinct in their powers. Glass offers an insurmountable obstacle to the transmission through it of electricity; while magnetism passes through without the least resistance. The passage of electricity is instantaneous, leaving no traces behind of its presence. Magnetism, on the contrary, on certain metals, such as steel, remains in full force. Electricity gives, but loses while it gives; but, wonderful as it may seem, magnetism gives and loses nothing. With one magnet we may make a thousand, without its losing the least of its magnetic power. It seems to be a God-like power. "God," as we read, "created man in his own image." Gen. i. 27. Yet God is the same he was before man was created, so the magnet remains the same after making other magnets. It is, doubtlessly, these two great principles that sustain the universe, and impart and regulate all its motions.

Samuel B. Smith.

Errata.—In my communication on the Electric Wave, which appeared in the Scientific American, Dec. 19th, 1863, the types make me say, "The electric wave extends twelve miles from its line of motion;" for *miles* read *inches*,—which is quite a difference.

### A Bald Head.

Messrs. Editors:—I am only 23 years of age, and during the past twelve months the hair on the top of my head has become very thin and continues to get thinner; so much so that I fear ere long I shall, like Cesar, wear my wreath of laurels (a wig, I mean,) to conceal my baldness. Please be so kind as to inform me, through the columns of your much-esteemed journal, of the best remedy to make my hair grow again. J. M. J.

[We really sympathize with our correspondent in his affliction, but we fear that there is no help for his case. One of us has a head as bare as a pumpkin, we mean on the outside, and when we first discovered its approach we made a rush for hair restoratives, poultices, flying sinapisms—indeed anything to save us from a bald head—but in vain; we could neither coerce nor coax a spear of wool to grow where it ought to grow, and we have at last yielded to our bare-headed fate. Seriously, we do not think the thing can be done, and the advertised hair restoratives are usually money-traps, to gull the public; all certificates to the contrary, notwithstanding. A gentleman of our acquaintance has informed us that he has improved his hair crop by the free use of Castile soap and water with a generous rubbing—a simple remedy which it will do no harm to try.—Eds.

### ANNUAL PETROLEUM PRODUCT.

A very full and interesting annual review of the petroleum trade is given in the *Shipping and Commercial List and New York Price Current.* From it we learn that no less than 28,000,000 gallons were exported during the year 1863. This export was as follows:—From New York, 19,547,604 gallons; Boston, 2,049,431; Philadelphia, 5,395,738; Baltimore, 915,866; Portland, 342,082. In 1861, the total export was only 1,112,476 gallons; in 1862, 10,857,701 gallons. This trade has sprung into existence with such rapidity and attained to such dimensions, that it appears almost like the work of some great wizard. A few years since, some persons, while boring for water in an obscure Pennsylvanian valley, were surprised to find their labors culminating in an oil instead of a water-spout. The event caused great excitement; other wells were soon sunk, with like results, until finally the rocky chambers of that valley have become the natural laboratory which supplies all the rural mansions and cottages in America and Europe with beautiful artificial light to cheer the long winter evening hours. Next to gas, refined petroleum gives the most clear light, while it is also the cheapest ever used by man; we therefore hope, for the good of our fellowmen, that the supply of it will long continue to be copious.

Since petroleum was first introduced, great improvements have been made in refining it. Formerly it produced an offensive odor while being burned, and it was usually of a dark color. That which is now generally used is freed from disagreeable smell, and is as clear and colorless as water. The present price of the crude is 31 cents per gallon; refined, 53 cents. The quantity exported in 1863 amounted to 252,000 tuns weight, and engaged no less than 252 ships of 1,000 tuns burden each, to carry it. It has become one of the most important of our national products. The value of 28,000,000 gallons of the refined article is no less than $14,840,000, but not over one-half of the quantity forwarded was refined; still, with this allowance, our petroleum has brought the country $11,900,000 during the past year—a snug little sum for such a young trade. While in conversation, a few days since, with a gentleman engaged in this business, he stated that the export for the next year would, in all likelihood, greatly exceed that of the past twelve months, and would probably reach forty millions of gallons.

### RECENT AMERICAN PATENTS.

The following are some of the most important improvements for which Letters Patent were issued from the United States Patent Office last week: the claims may be found in the official list:—

*Deflecting Window for Railroad Cars.*—This invention consists in having the frame of the car window hung on central pivots, and arranged in such a manner that it may be adjusted in an oblique position relatively with the car body, so as to deflect dust, cinders, &c., from the car while it is in motion and at the same time admit of a passage of air out from the car, and also admit of being so adjusted as to cause air to enter the car through the window when there is no dust to contend with. George Mann, Jr.; of Ottawa, Illinois, is the inventor of this improvement.

*Horse Hay-fork.*—This invention relates to a new and improved horse hay-fork, such as is used for elevating hay in barns. The invention consists in the employment of one or more spiral or screw tines attached to an arbor which is fitted in a suitable head having steady tines or ends attached to it, these parts being used in connection with a pawl and ratchet or other device to serve as a fastening for the above, all being so arranged that large loads may be elevated by the fork. T. H. James and H. James, of Stockport, N, Y., are the inventors of this improvement.

*Nail Machine.*—This invention relates to machinery for the manufacture of forged nails, more especially horse-shoe nails. In the manufacture of such nails by machinery it is difficult to produce as thin or fine a point as is desirable by a hammering or drawing operation. The plan adopted in this invention is to cut the points, after having reduced the nail as much as desirable by hammering or drawing. The improvement consists in the employment, in a machine for making forged nails, of cutters so constructed and applied that they will serve the purpose of cutting the metal from the side of the nail to reduce the thickness and produce the desired form of the point. It also consists in the employment, in combination with such cutters, of a moving finger or presser, so arranged in combination with a fixed guide as to press the nail against such guide and hold it in contact therewith, and in proper position during the operation of cutting the point, and so to act upon the point before or during the cutting operation as to bring it into line with the center of the nail when the cutting is completed. Daniel Dodge, of Keeseville, N. Y., is the inventor of this improvement.

*Horse Hay-fork.*—This invention relates to an improvement in horse hay-forks which are provided with a bail or sustaining bar, and a brace or toggle-joint bar, the latter serving to hold the fork in proper position while being elevated with its load, and admitting, when its joint is shoved out of line with the two parts or bars which it connects, of the load being discharged from the fork. These forks have been much used since being introduced to the public, and have given general satisfaction, the only material objection urged against them being the effort required to actuate the toggle-joint bar in order that the fork may discharge its load. The object of the invention is to obviate this difficulty, and to that end it consists in applying a lever to the fork in such a manner as to act against the toggle-joint bar, and cause the latter, with a quite inconsiderable effort on the part of the attendant, to be so used or adjusted as to admit of the load being discharged. J. D. Halsted, of Rye, N. Y., is the inventor of this hay fork.

*Improvement for Removing Obstructions from Harbors and Rivers.*—This invention consists in providing, in the interior of a vessel propelled by steam, sails or other means, a fixed working chamber with an open bottom and into which air is compressed as in a divingbell, to permit persons to operate within it below the surface of the water so as be protected from an enemy's projectiles by the water. It also consists in the combination with such chamber of an air-lock, so arranged below the surface of the water as to permit persons to pass through it on their way to and from the working chamber. Benjamin Maillefert and Levi Hayden, of No. 108 Wall street, New York city, are the inventors of this improvement.

*Eccentric Valve for Steam Engines.*—This invention consists in a certain novel construction of an eccentric and its encircling strap, whereby it is made so to operate the valve as to give a full opening to the ports, both for induction and eduction, during the first quarter of the stroke of the piston, and to close the ports during the last quarter of the stroke, leaving the valve stationary and the ports full open during the second and third quarters of the stroke, by which is maintained not only the full pressure of steam on the piston more nearly to the termination of its stroke, but to provide for a freer exhaust than is possible when the valve is connected with a common eccentric, thereby obtaining the full power of the engine and enabling it to work at a higher speed and keep up a more steady motion. Wm. G. Snook, of Corning, N. Y,, is the inventor of this improvement.

*Method of Removing Torpedoes and Obstructions from Harbors and Rivers.*—This invention consists in the removal or destruction of torpedoes or other submerged or partly submerged obstacles, or obstructions from harbors, rivers and other waters, by throwing over them from a mortar or mortars on board of a vessel placed at a suitable distance, projectiles which are furnished or have attached to them, hooks or other grappling devices, and connected with the vessel by ropes or chains of suitable length and then propelling the vessel in a direction to produce a draft on the said ropes or chains and drag away or destroy the said obstructions or obstacles. By this means the vessel employed in removing the obstructions is not liable to be damaged by the explosion of torpedoes. Charles Shoil, of Brooklyn, N. Y.; is the inventor of this improvement, and it has been assigned to F. A. de Mey, of No. 49 Broad street, New York.

*Manufacture of Glass.*—This invention consists in the employment for what is termed the finishing of glassware, of a furnace and pots of the same kind as are used in the melting process, whereby goods are produced having a brighter and cleaner surface than goods finished by the use of any other kind of furnace, as the glass while being finished is not exposed to the fumes of sulphur or to smoke, dust or any other deleterious agency. It also consists in providing in the outer shell of a glass furnace a system of air flues which are open at the top and the bottom on the exterior of the shell or cone, the lower opening being arranged at a suitable distance from the floor of the glass-house for the reception of the heated and impure air, and the upper ones for the discharge of such air above the roof of the house, and the said flues serving both for the ventilation and cooling of the house and for the reduction of the excessive heat of the shell of the furnace. John L. Gilliland, of Brooklyn, N. Y., is the inventor of this improvement.

*Revolving Fire-arm.*—In revolving cylinder firearms which load at the rear of the cylinder there have been many different constructions of the frame and modes of applying the cylinder to provide for loading. One mode of applying the cylinder, which admits of a very simple construction of the arm, is to attach its axis pin to a swinging support, which permits the cylinder to swing outward from the other parts of the arm in a lateral direction; but as the said pin has only been attached at one end to such support, the attachment has not been sufficiently firm and durable. The object of the first part of this invention is to afford a better support for a so-applied cylinder and its more durable attachment; and to this end it consists in the employment, within the main frame of the arm, of a laterally-swinging frame, constructed to support both ends of the axis pin and to fit within recesses in the main frame. The second part of the invention consists in a novel mode of applying a plunger in combination with a cylinder having such a swinging movement for the purpose of expelling the discharged cartridge shells from the chambers and cleaning them, whereby, while remaining attached to the arm, the said plunger is permitted to have the necessary movements for the purpose, and when not in use is permitted to lie close under the stationary barrel, out of the way. H. A. Briggs and S. S. Hopkins, of Norwich, Conn., are the inventors of these improvements, and C. A. Converse, of Norwich, Conn., may be addressed in relation thereto.

*Postage Revenue Stamps.*—The stamps at present in use for postage and inland revenue can, after being canceled, be easily restored beyond detection except by the most careful examination, owing to their being printed solely with indelible ink, and to the inks commonly used for their cancelation, viz., printer's ink for postage stamps, and writing ink for revenue stamps, being of a fugitive character. The object of this invention is to prevent the restoration of such stamps and thereby to protect the government against loss by their fraudulent second use, and to this end it consists in printing such stamps partly or wholly with fugitive ink, the impression of which will be destroyed or removed by the means that would be likely to be employed for the removal of the fugitive ink employed in their cancelation. Abraham J. Gibson, of Worcester, Mass., is the inventor of this improvement.

*Dyeing and Printing Textile Materials.*—This invention relates to a mode of applying that class of colors derived from aniline, naphthaline, nitro-benzine, cinchonine and analogous substances to the obtaining of patterns or designs upon textile materials and fabrics, and it consists in the employment of tannin, either alone or in combination, for the purpose of fixing colors derived from aniline or analogous substances on to textile materials and fabrics, in such a manner that cheap and fast goods can be produced. Robert H. Gratrix, of No. 69 East Twenty-seventh st, New York, is the inventor of this improvement.

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It is stated that forty thousand dollars worth of Massachusetts marble has been used in the capitol at Washington.