T-RAIL SHELL-PROOF FRIGATES—LEARNING BY EXPERIENCE.

Nine months ago (on page 345, Vol. IV. (new series) of the SCIENTIFIC AMERICAN) we urged our naval authorities to proceed instantly and plate several powerful steamboats with T-rail, and thus render them shell-proof and adapted to attack forts and other strongholds of the enemy. We advised the employment of such plating, not because we thought it equal to forged, or rolled iron plates for the purpose, but to provide, in the shortest possible period of time, a number of invulnerable vessels for active warfare.

We said, "Let us adapt ourselves to the circumstances of the case and make the best use we can of what we have. Thus we have plenty of T-rail iron, and we think it can be bent and adapted to several powerful steamboats." Had our advice been acted upon, every shore fort, every harbor and vessel in secessiondom would now have been in the possession of the Union forces.

It grieves us to reflect that our navy, for the first time in this conflict, has been humiliated, in a measure, by the secessionists acting upon the very advice which our naval authorities stupidly rejected. Since we penned the article referred to, the sunken frigate *Merrimac* has been raised at Norfolk, plated with rail iron, and on the 8th inst. she steamed out into Hampton Roads, destroyed the frigate *Congress*, of 50 guns; the sloop-of-war *Cumberland*; the gunboat *Oregon*; injured several other vessels, and but for the timely arrival of the *Monitor* at the scene of action, she would have destroyed the *Minnesota*, and perhaps the whole of our shipping at Fortress Monroe.

The days of wooden war vessels are numbered. The *Merrimac* proved far more formidable than we had anticipated, and she has given us a dear-bought lesson. We could have had at least seven iron-clad vessels equal to the *Merrimac* ready for action at the present moment, instead of but one—the *Monitor*—had those in authority appreciated the practical information which has been published in our columns on iron-clad ships of war.

HOW LONG HAS THE SUN SHONE, AND HOW LONG WILL IT CONTINUE TO SHINE?

At the late meeting, at Manchester, of the British Association, Professor W. Thompson read a paper entitled "Physical considerations regarding the possible age of the sun's heat," in which he gave expression to some of those daring and sublime speculations that are constantly being suggested by our rapidly enlarging knowledge of the universe.

The author prefaced his remarks by drawing attention to some principles previously established. It is a principle of irreversible action in nature that, "although mechanical energy is indestructible, there is a universal tendency to its dissipation, which produces gradual augmentation and diffusion of heat, cessation of motion, and exhaustion of potential energy, through the material universe." The result of this would be a state of universal rest and death, if the universe were finite and left to obey existing laws. But as no limit is known to extent of matter, science points rather to an endless progress through an endless space, of action involving the transformation of potential energy through palpable motion into heat, than to a single finite mechanism, running down like a clock and stopping for ever. It is also impossible to conceive either the beginning or the continuance of life without a creating and over-ruling power. The author's object was to lay before the Section an application of these general views to the discovery of probable limits to the periods of time *past* and *future*, during which the sun can be reckoned on as a source of heat and light. The subject was divided under two heads: first, on the secular cooling of the sun; second, on the origin and total amount of the sun's heat.

In the first part it is shown that the sun is probably an incandescent liquid mass radiating away heat without any appreciable compensation by the influx of meteoric matter. The rate at which heat is radiated from the sun has been measured by Herschel and Pouillet independently; and, according to their results, the author estimates that if the mean specific heat of the sun were the same as that of liquid water, his temperature would be lowered 1°. 4 Centigrade annually. In considering what the sun's specific heat may actually be, the author first remarks that there are excellent reasons for believing that his substance is very much like the earth's. For the last eight or nine years, Stoke's principles of solar and stellar chemistry have been taught in the public lectures on natural philosophy in the University of Glasgow; and it has been shown as a first result that there certainly is sodium in the sun's atmosphere. The recent application of these principles in the splendid researches of Bunsen and Kirchhoff (who made an independent discovery of Stokes's theory), has demonstrated with equal certainty that there are iron and manganese, and several of our other known metals in the sun. The specific heat of each of these substances is less than the specific heat of water, which indeed exceeds that of every other known terrestrial solid or liquid. It might therefore at first sight seem probable that the mean specific heat of the sun's whole substance is less, and very certain that it cannot be much greater, than that of water. But thermodynamic reasons, explained in the paper, lead to a very different conclusion, and make it probable that, on account of the enormous pressure which the sun's interior bears, his specifie heat is more than ten times, although not more than 10,000 times, that of liquid water. Hence it is probable that the sun cools as much as 14° C. in some time more than 100 years, but less than 100,000 years.

As to the sun's actual temperature at the present time, it is remarked that at his surface it cannot, as we have many reasons for believing, be incomparably higher than temperatures attainable artificially at the earth's surface. Among other reasons, it may be mentioned that he radiates heat from every square foot of his surface at only about 7,000-horse power. Coal burning at the rate of a little less than a pound per two seconds would generate the same amount; and it is estimated (Rankine, "Prime Movers," p. 285, edit. 1859) that in the furnaces of locomotive engines, coal burns at from 1 lb. in 30 seconds to 1 lb. in 90 seconds per square foot of grate-bars. Hence heat is radiated from the sun at a rate not more than from fifteen to forty-five times as high as that at which heat is generated on the grate bars of a locomotive furnace, per equal areas.

The interior temperature of the sun is probably far higher than that at the surface, because conduction can play no sensible part in the transference of heat between the inner and outer portions of his mass, and there must be an approximate convective equilibrium of heat throughout the whole; that is to say, the temperatures at different distances from the center must be approximately those which any portion of the substance, if carried from the center to the surface, would acquire by expansion without loss or gain of heat.

The sun being, for reasons referred to above, assumed to be an incandescent liquid now losing heat, the question naturally occurs, how did this heat originate? It is certain that it cannot have existed in the sun through an infinity of past time, because as long as it has so existed it must have been suffering dissipation; and the finiteness of the sun precludes the supposition of an infinite primitive store of heat in his body. The sun must therefore either have been created an active source of heat at some time of not immeasurable antiquity by an overruling decree; or the heat which he has already radiated away, and that which he still possesses, must have been acquired by some natural process following permanently established laws. Without pronouncing the former supposition to be essentially incredible, the author assumes that it may be safely said to be in the highest degree improbable, if, as he believes to be the case, we can show the latter to be not contradictory to known physical laws.

The author then reviews the meteoric theory of of solar heat, and shows that in the form in which it was advocated by Helmholz it is adequate, and it is the only theory consistent with natural laws which is adequate to account for the present condition of the sun, and for radiation continued at a very slowly decreasing rate during many millions of years past and future. But neither this nor any other natural theory can account for solar radiation continuing at anything like the present rate for many hundred millions of years. The paper concludes as follows:—"It seems, therefore, on the whole, most probable that the sun has not illuminated the earth for 100,000,000 years, and almost certain that he has not done so for 500,000,000 years. As for the future, we may say with equal certainty that inhabitants of the earth cannot continue to enjoy the light and heat essential to their life for many million years longer, unless new sources, now unknown to us, are prepared in the great storehouse of Creation."

British Patents Issued.

The following is an analytical list of patents granted in England in 1861, as prepared by Mr. G. Shaw of Birmingham and published in the *Ironmonger*:—Working mines and raising mineral, 23; capstands, crabs, and windlasses, 8; raising weights, machinery for, 9; alarums, 4; reducing and smelting ores, &c., furnaces for, 19; iron manufacture, 24; steel manufacture, 23; lead refining, and making litharges, 5; copper and tin, 9; zinc, brass, and other alloys, 7; tinning, coating and plating metals, 17; casting metals and foundry operations and apparatus, 6; rolling metals, 4; drawing pipes and wire working, 6; pinching, die sinking, stamping, carving and ornamenting, 42; sawing, planing, turning and boring metals and wood, 38; metallurgical operations, various, 19; bellows, blowing machines and forges, 6; rolls and cylinders, 4; nails, bolts, screws, nuts and rivets, 24; chain manufacture, 6; files, rasps and cutting of, 1; saws and edge tools, 1; cutlery, 9; fenders and fire-irons, 2; locks, latches and fastenings for doors, 24; hinges and springs for hanging and closing doors, 11; casters for furniture, 6; spoons, forks and corkscrews, 1; tea and coffee apparatus, 4; Japan ware and papier-maché, 1; bell hangings and bells, 4; vices, 3; button manufacture, 11; pins, needles and fish-hooks, 5; firearms, 74; breeching, locks and triggers, 3; gun and pistol barrels, 4; ordnance and gun carriages, 38; shot and projectiles, shot and powder cases and fireworks, 48; gunpowder and detonating powder, 4; packing presses, hydrostatic and other, 13; mangles and calendring machines, 10; steam engines, 75; steam boilers and generators, 96; marine steam engines and propelling machinery, 38; railway and locomotive engines and carriages and railways, 83; sheathing and preserving ships' bottoms, 7; anchors, cables and stoppers, 8; springs for hanging carriages, 9; wheels for railway and other carriages and naves of wheels, 38; axletrees and axleboxes, 15; drags and retarding apparatus, 32; small wares, 2; surgical instruments and operations, 20; fire-proof safes and boxes and rendering articles fire proof, 2; miscellaneous machinery and apparatuses, 60; sewing machinery, 40; plows and plowing, 15; reaping and mowing machines, 35; thrashing, separating, winnowing and dressing grain, 11; hay making machines, 4; cutting chaff, turnips, &c., as food for cattle, 7; churns, churning and treating milk, 13; agricultural and horticultural implements and processes, various, 9; mills for grinding grain, coffee, &c., 14; fire and garden engines and syringes, &c., 10; water closets and urinals, 6; metallic pipes and tubes for water, steam and gas and joints for ditto, 25; cocks, taps and valves, 40; filtration and purification of liquids, 10; freezing and making ice and substitutes for ice, 2; lamps, lanterns, chandelliers and candlesticks, 32; warming and ventilating buildings, ships, carriages, &c., 29; stoves, grates, fire places and kitchen ranges, 24; jacks and roasting apparatuses, 1; culinary apparatus, various; mincing and sausage machines, 9; skates, 2; buckles and substitutes for, 1; stirrups, housings and spurs, ; horseshoes and substitutes, heels and tips for boots, &c., 12; type foundry and stereotype, 10; telescopes and microscopes, 4; miscellaneous optical instruments, cameras, &c., 7; mariners' compasses, 6; barometers, pressure gages, thermometers and hygrometers, 13; philosophical and mathematical instruments, miscellaneous, 5; weighing machines, 11; coffins, hearses and preserving the dead, 2. The following is the number of patents applied for in each of the last four years:—

In 1858	3,007.
In 1859	3,000.
In 1860	3,196.
In 1861	3,276

During the last year 536 patentees paid the stamp duty of £50, due on their patents at the end of the third year from their respective dates; and in the same period 138 patentees paid the stamp duty of £100 due on their patents at the end of the seventh year from their respective dates.

AN exchange recommends carrots in coffee. Dry it, grind and mix with coffee to suit the taste.

Commerce of Egypt---Cotton.

Mr. Thayer, our Consul-General at Alexandria, has addressed a communication to Secretary Seward in relation to the commerce of Egypt. He states that the gross value of the merchandise imported into that country during the year 1861 was $14,206,053, while the exports amounted to $18,192,370. The principal article of export is cotton, of which the shipments last year were as follows :—

	Quantity. Cantars.	*Value.*
To England	494,950	$4,623,828
To France	149,124	1,745,841
To Austria	51,856	667,094
To other countries	268	3,139
Total exports	596,200	$6,979,902

Mr. Thayer adds :—

The average value for the year, per pound, according to the Custom House books, is thus 11 7-10 cents, or about one-half the present quotation. The fluctuations to which the traffic in this staple has been subjected, by reason of political agitations, have been referred to in my despatches, numbers 4, 6, 7, 8, 10, 12 and 13.

Grain stands next in consequence among the exports; the quantity of wheat alone exported during the year having been valued at 317,938 dollars, besides considerable quantities of Indian corn (*blé de Turquie*), beans, barley, &c.

The exports to America from Egypt are chiefly rags and gums. The imports are chiefly machinery, furniture and rice. Nearly all the machines used in the cleaning of cotton have been imported from the United States, as well as a considerable portion of the rolling stock used upon the Viceroy's railway to Suez.

The natural impediment to direct commerce between the United States and Egypt is obviously the identity of the principal exportable productions of the two countries —cotton and grain. Vessels can be freighted in the United States with goods which readily find a sale in Egypt; but, exceping rags and gums, they find here among the usual exports of the country few articles which would advantageously command a market in the United States.

Since, however, American bottoms have a preference in freights hence for Europe, a ship may come hither from the United States loaded with American manufactures, and take hence cotton or grain to Liverpool or Marseilles, where return cargoes to the United States can generally be obtained without difficulty.

The facility with which a profitable commercial intercourse between the two countries may thus be established does not appear to be generally understood by our merchants.

The Effects of Railway Traveling.

Mr. S. Solly, F. R. S., writes to the London *Lancet*:—My personal experience with regard to the effects of railway traveling may be given briefly. When perfectly well, I find no inconvenience from it; but if I am below par, suffering from any congestion of the brain, the result of over work or dyspepsia, and then take a long railway journey, it is certain to give me a headache, which I do not get rid of for a day or two. I always sit with my face to the engine, next to the window, which, as a rule, I prefer open, unless the weather is excessively cold. I do not think I ever got either catarrh or rheumatism from this exposure, as some would call it. I always read if the distance to be traveled is short, but I am sure that it is hurtful to read for any length of time on the rail. I know a public character who used to read incessantly, even if his journey extended from Liverpool to London; but the result was that he was obliged to give up all brain work and amuse himself (to use his own words), with the saw and the billhook. I do not mean to say the brain rest was required solely for the injury done on the rail, for he worked rather too hard at all times; but I am sure that it increased the mischief tenfold. For nearly a twelvemonth he could not read without immediately bringing on pain in his head. By rest, change, and very little medicine, he has now nearly recovered and will, I have every reason to believe be again able to serve his country in the senate, if not in the cabinet. If I am quite well, I can sleep the whole night through almost as well on a railway carriage as in my bed. All these observations apply to first-class carriages. I soon found, even in early life, that I could not endure the rattle and vibration of a second-class carriage. In all cases of congestion of the brain, or a tendency to it, railway travel is injurious. Recently I was visited by a patient, aged 62, who had been suffering from congestion of the brain, which had been completely relieved by medicine and twenty-four leeches to the temples. I had permitted him to go down to Reigate to see about a house previous to his residing there permanently to lead a very quiet life in that beautiful locality. He told me that he had felt perfectly well since his last visit to me, until he traveled up this morning by rail. The motion had reproduced the giddiness from which he had been free for more than a week. This case, perfect in itself, is only one among many that I could adduce in proof of my assertion that a brain disturbed by congestion is injuriously affected by motion on the rail.

Distilled Water for Soldiers on Coast Islands.

In a late lecture delivered on the application of science to military purposes, by F. A. Abel, director of the chemical establishment of the British war department, he gave the following instructions respecting a supply of drinking water on coast stations, such as those on which some of our troops are now encamped on the Southern coast. He said :—The regular supply of drinkable and wholesome water to troops at many coast stations, and in positions temporarily occupied in time of war, has, on many occasions, been attended with formidable difficulties, which, in some cases, have been met by the employment, in such localities, of an apparatus consisting of an efficient condenser, whereby distilled water is produced from the steam generated in the ship's or other boilers. The product, which exactly resembles ordinarily-distilled water, though drinkable, is by no means pleasant when first obtained; it is entirely wanting in the briskness more or less common to all fresh water, and which is due to the gaseous matter contained in solution. If this water be, however, kept in partially-filled tanks for some time, and, particularly if, by the motion of a vessel, for example, it be maintained in continual or frequent agitation, it becomes partially aërated, and is thus rendered somewhat more palatable. It always possesses, however, the peculiar unpleasant flavor of distilled water, which has been produced from steam generated in metal vessels, and which is due to the presence, in solution, of minute quantities of empyreumatic matter, resulting from the decomposition of organic substances contained in the water. This flavor may be at once removed by passing the aërated water through a vessel containing charcoal, which absorbs the minute quantities of organic matter, and promotes their rapid oxidation by the oxygen dissolved in the water.

By combining the application of this fact with a simple ingenious and very efficient method of aërating the distilled water, Dr. Normandy, whose apparatus was illustrated on page 257, Vol. II. (new series) Scientific American, has succeeded in effecting one of the most important and recent improvements in the purification of water, and one which has already received several applications in connection with the military service, though its benefits will unquestionably be far more extensively experienced by all branches of the marine service.

Extensive Rubber Works Burned.

The Beverly (Mass.) Rubber Works were destroyed by fire, on the night of the 5th inst. It originated in the heating room and the goods in the heater, a large quantity of old rubbers to be "restored," and other highly inflammable materials in the immediate vicinity were soon enveloped in flames, causing the work of destruction to extend with fearful rapidity. Some of the machinery was new and very valuable. The loss, though not accurately ascertained, cannot fall short of $100,000. There is an insurance of $70,000 effected, consisting of $5,000 each in fourteen companies. Mr. Green, the business agent, had returned on the same evening from Washington, with a contract for 70,000 blankets. By this sad disaster, the government may be at least discommoded, and 400 or 500 operatives will be thrown out of employmen. This will be severely felt, since this was the most prosperous business of the place, affording employment to many not immediately connected.

The Water Commissioners of Detroit have contracted with Messrs. Jackson & Wiley, of that city, to build them an horizontal condensing engine of eight feet stroke, and having a cylinder of forty-two inches bore. It is intended to run at about eighteen revolutions per minute, and will therefore be nominally a 300-horse-power engine. Its capacity for pumping is expected to exceed 7,000,000 gallons of water per twenty-four hours.

Orders have been received to start up, as soon as possible, all the machinery for fine work of the Boott Corporation Mills, in Lowell. The Company has been running, recently, about half its machinery for this kind of goods—sheetings, shirtings and print cloths, No. 30. They have about two thousand bales of cotton now on hand—enough to last about six months.

Scientific Ants.

A correspondent of the New York *Times*, writing from the island-rock of St. Helena, says that the people there are in great trouble. "About fourteen years ago a ship from Fernando Po, bringing a cargo of lumber, brought also a lot of white ants, which have multiplied and spread to such an extent that the whole town is being gradually destroyed by their ravages. They infest a house, and in an incredibly short space of time the frames, posts, in short all the woodwork of the house, is reduced to a mere shell. The ants are indefatigable workers; night and day a low monotonous clicking sound can be constantly heard, testifying to their sleepless industry. They do not attack the outside of a timber, nor do they ever expose themselves to daylight for a moment. Between one of their haunts and another, should the route cross an open space, they build a perfectly-arched covering, and under it constantly pass and repass. They eat out the inside of a timber, and perhaps the first intimation that one obtains of any defect in an apparently sound beam is its crushing and coming down. Among other buildings that have suffered, that of our Consul, Mr. Carroll, I particularly noticed. Nearly one-half of the building lay on the ground, having fallen in. He showed me a piece of timber which had all the appearance of being perfectly sound. Upon pressing it with my hand, it crushed like an egg shell. Not only wood, but books, paper, clothes, leather, in short any thing softer than iron, furnishes the ants with food. The people are becoming very much alarmed, and the town has offered a reward of $5,000 to any one who can find an exterminator. Wood has been smeared with various substances, but it made no difference, it is the inside, not the out, that they are after. The black ant seems to do more toward suppressing them than any thing else, as the latter eats the white ants, but unfortunately the white outnumber the blacks on the island, thousands to one. Teak and yellow pine are the only woods that resist them at all; the former is too hard, and the latter is too sticky for them. Their implement is augur-shaped, and the resin chokes it up. The people had begun to use iron houses. An iron church, done up in boxes, had arrived from England."

Curious Collection of Arms.

The Chicago *Tibune* gives an account of the curious collection of arms taken from the Fort Donelson prisoners. Any curiosity hunter, or dealer in second-hand relics of almost antediluvian days, might there find matter of profit and interest. Sword canes dating their manufacture from the year one—pistols of curious and unique workmanship, dangerous only to the reckless hand that dare discharge them— revolvers of later origin, but equally effective in warfare, sans barrels, sans stocks, locks, hammers, &c.—dirks of fabulous dimensions, hammered out of files and rasps, with sheaths of untanned horse hide—dirks with handles and without, and all the smaller arms, from a butcher knife to a saber. The accouterments were of the same novel charater. Some 200 small powder horns, such as the aborigines used for powder, were taken, intended, perhaps, to carry the ammunition for the aforesaid pistols. There were a few, and only a few, revolvers and pistols of modern date, showing that, however well the rebels may have been supplied with powder and ball at Donelson, their stock of small shooting irons was decidedly low. Their muskets and swords were equally diversified in age and make.—*Chicago Tibune*

Gas Burning Poisons.

Illuminated gas is never pure. It always contains bisulphide of carbon, and occasionally sulphureted hydrogen. Both these agents are combustible, and when burned yield fearful contaminations. The first result is a gas called sulphurous acid: the very same that is evolved from burning sulphur, and it speedily changes into oil of vitriol. The results of gas combustion are not harmless, because invisible; rather the reverse. Were they like smoke, visible, then the most incautious would guard against them. The products of gas combustion should always be conveyed away by a chimney terminating in an inverted funnel.

We learn from the Boston *Commercial Bulletin* that the Humane Society of Massachusetts has 66 lifeboats, 8 mortar stations and 17 huts of refuge on the coast of Massachusetts.