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Contents.

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TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 587

For the Week Ending April 17, 1886.

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THE COAST SURVEY.

Those who are familiar with the character of the work performed by the Coast Survey while it was under the direction of Hassler and Bache and Pierce can scarcely help feeling a regret that it has been suffered to fall into its present deplorable condition.

During the administration of these men, the Coast Survey was looked upon as "out of politics," its work conducted on a strictly business and scientific basis, and no officer, whether from the army, navy, or the civil service, could hope to retain his position once incompetency or a lack of diligence became apparent. As a result, the Coast Survey hydrographic charts came to be known for accuracy among navigators the world over; the stranger or the native skipper found it so easy to approach our coast and enter our harbors by their aid that they complained of the laws of compulsory pilotage; and it was an achievement upon which either was justly entitled to pride himself when he discovered a shoal, a ledge, or even a solitary submerged rock not laid down in the Coast Survey charts, or, if there, inaccurately determined. After the death of that noble old man, Prof. Benjamin Pierce, perhaps the greatest mathematician of his time, there was a short interregnum during which the Coast Survey had practically no head; and then came a period of mismanagement, not to use a harsher term, in which politics, for the first time in the history of the Coast Survey, was suffered to exert its malign influences in every branch of the service, when original investigation got no applause and honest industry no reward. This was happily ended by the recent removal of Superintendent Hilgard under serious and, so far as has yet appeared, unrefuted charges.

Curiously enough, the office of Chief of the Coast Survey having been refused by Prof. Agassiz, of Cambridge, son of the late eminent scientist, it was turned over to a subordinate of the Treasury department, who, however estimable a man he may be, is unknown to the scientific world, and, it seems, possesses neither the experience nor the qualifications which are essential to the control and direction of this important work.

Few persons outside of the Coast Survey are aware of the powerful influence which for many years has been working to turn the service over to the departments of War and the Navy—the geodetic work to the one and the hydrographic to the other.

The Engineer Corps of the army, it was urged, was entirely competent to perform the trigonometrical and topographical work, and the sounding out of bays, rivers, and harbors, the locating of shoals and ledges, the observance of tidal phenomena, and the work upon the high seas was alleged to pertain to the proper and professional duties of the navy.

Professors Hassler, Bache, and Pierce succeeded in making out a strong case in opposition to this. They were able to show, with at least sufficient force to convince those who had the power to make the change asked for, that a special training was required to accurately and intelligently perform the work of the Survey, and that those engaged in its conduct should be at least temporarily removed from the influence of "red tapism" and the "circumlocution office," and freed from the restrictions of military discipline.

They showed, by a comparison of work in the field, the difference between that performed by the army and navy officers while with their commands and by these same and other officers while under the direction of the Coast Survey office, in which the superiority of the latter both in quality and quantity was clearly apparent.

But the standard of excellence established by the three noted men whose names have been mentioned it is not easy to maintain; the influence exerted by them in the service itself, and the confidence that was felt in their skill by those without who were interested in its success, none but a very able and experienced and conscientious man could hope to replace.

Once let the old time reputation of the service lessen—it seems now to be on the wane—and its mergence with departments more or less political may be looked upon as likely, if not certain.

RAILWAYS IN CHINA.

Engineers and capitalists have for some time past regarded the Celestial Empire as offering one of the most promising fields for railway enterprises that still remains unoccupied. They have manifested, consequently, a very strong desire to possess it. A dense population and large natural resources give undoubted assurance of success, could the officials who guard the imperial conservatism once be propitiated. But this is an obstacle which the most importunate diplomacy has not yet succeeded in overcoming. If one glances at the later history of China, however, her unwillingness to entertain any foreign propositions, without very careful consideration indeed, can readily be understood. The assertion is constantly being made that the empire is about to throw off her orientalism, and to become in effect an annex to Europe, as far as the adoption of western civilization and methods can produce such a transformation. But the change has not come, and those familiar with her modes of thought do not regard it as possible until some years have passed. Her contact with western methods has not shown them to be altogether alluring. From experience, the Chinese officials have come to have a positive dread of the "promoters" of foreign enterprises. They have, unfortunately, been taken in so often by irresponsible adventurers that it is quite possible what we have flattered ourselves has been an opening wedge may be in reality another nail in closing the doors against us.

It is hard to predict what their course will be. We have allowed ourselves to regard them as a very slow people; but while their foreign policy has often only negative merits, it shows in many cases a justice and wisdom of which our own country cannot always boast. We are even now in the midst of a dispute with China in regard to the question of indemnity for the deplorable outrages committed against the Chinese laborers in Wyoming and other parts of the West. We cannot blame China, if the settlement of this question determines the treatment of our own countrymen within the borders of her empire. To injustice, or at least retarded justice, we have now added discourtesy. The Chinese minister and his suite on their entrance into our territory are received, not with the courtesy and attention due to their position, and particularly ordered by the State Department, but with unequivocal marks of disrepect and with churlish demands for credentials. These things must all react upon ourselves. We cannot outrage a nation, however conservative, with impunity. China is not vindictive, but she has shown herself to have a good memory.

She will hardly permit Americans to take any part in the development of her resources while such serious grivances remain unanswered. A statement has recently gone the rounds of the newspapers to the effect that several lines of railways had been determined upon, and that the contracts for materials had been placed in America. It is impossible to find out whether the statement is correct or not, but if such contracts have been made, the present antagonistic attitude of our country will be apt to defeat their fulfillment. It is difficult to know just what they are doing in that conservative empire, for it was only a short time ago that a prominent English journal stated authoritatively that the Chinese were about to introduce foreign systems for working their coal mines, and had arranged with a Belgian firm for the importation of machinery and skilled miners. The statement brought forth a communication from a Chinese employe at the Kaiping Mines, near Pekin, that such a system had already been in use for three years past, a part of the plant consisting of a tramway from the mine mouth to the nearest canal. There is, consequently, a railway in actual operation at the present time. As the outside world is so unsuccessful in keeping informed about what has already been done, its failure to obtain the secret of what the Government proposes to do in the future is hardly remarkable. It requires, however, more than even the reputed amount of American assurance to believe that China will permit a people who have insulted and assassinated her own citizens to take any part in her contemplated improvements until these wrongs have been redressed.

Economy of Fuel.

There is no question that the application of many mechanical devices to locomotives is calculated to effect a saving in fuel, says the *National Car-Builder*. Steam is not used so economically that less could not be made to do the work now done by a greater quantity, and there might be many improvements introduced that would reduce the temperature of the gases being passed into the atmosphere. Skill, ingenuity, and perseverance are, however, required to apply the forms of improvement indicated, and great difference of opinion may rationally exist among accomplished mechanical engineers as to the probable effect of structural changes proposed with the view of promoting economy of heat. But there ought to be no room for difference of opinion about the desirability of accomplishing saving, when all the changes to be effected are the introduction of the means of keeping an accurate record of fuel consumed. It is merely a slight change of method to keep the record of fuel consumed and work done by *enginemen* instead of *engines*, but the curtailment of waste that results from this change is by no means slight.

There is no line of economy in railway management at the present day that promises results equal to that of stopping the rushing leaks resulting from senseless waste of fuel in locomotive firing. We know of no plan that will stop the leakage so effectually as the introduction of the premium system of coal accounts. Putting on traveling engineers well acquainted with the proper methods of firing and fuel saving might do some good if these engineers would insist on their methods being followed. But it is an excessively difficult matter to get enginemen to change the free and easy style they have been brought up to, and which takes no thought of any higher duty than that of getting over the road comfortably. The proper and only effectual mode of inspiring the enginemen with zeal for fuel saving is to make them pecuniarily interested in its results.

Drum Making.

Of a total of 200,000 drums made in this country last year, it is said that 178,000 were manufactured in Granville, Mass. The old fashioned drum with wooden barrel, which was formerly the only kind in the market, is being rapidly supplanted by the neater and lighter model with a tin barrel. For the manufacture of the latter, tin of various colors is employed, blue and red predominating, though the larger quantity of tin drums are made of a brass imitation. This tin comes in sheets of two sizes, 14 by 20 inches and 20 by 28, the sheets being packed in cases holding 112. The process of manufacture is thus described by the Springfield *Republican:* The sheets are first sent to a knife, which cuts them into various lengths, from which drums of sizes varying from 6½ inches across the head to thirteen inches are made. This done, the strips are each punched with a hole, then secured and tightened together. Hoops are placed on the inside rims, and the barrel is then ready to receive the sounding skin. This is generally a sheepskin, which is stretched tightly across the head above and below, and fastened from the outside by hoops. These skins are all imported from Liverpool, and cost from $1.75 to $2.50 a dozen. Previous to using, they are stretched and dried by steam in the winter and by the sun in summer. Before being stretched over the drum barrels, they are once more moistened, generally in a solution of pure water or slightly ammoniacal. Then remains the tightening of the drum hoops. This is done either by strings or rods. The first are stretched diagonally, leather tighteners being inserted to stiffen the sound skins. The rods are hooked on one end and screwed at the other. Of this latter kind, the consumption is over six times that of the older fashioned.

Wooden drums differ but slightly from the above. The barrels are generally bass or white wood, occasionally oak. The stay hoops are of oak or beech. Before the strip of wood can be used, it needs to undergo many processes, among others being bending, planing, and sweating. The first drums made used to be boiled in open tanks, and the limit that could thus be prepared daily was less than fifty. The introduction of machinery and more perfect methods has increased the daily production, so that 2,000 drum pieces is considered nothing more than one man's fair day's work. The log, usually cut to three feet in length, is placed between the teeth of a huge machine, and the slicing begins. The knife receives it, and, as the log revolves, the piece sliced is received on a wooden cylinder and then rolled up. Seventy-five thicknesses make one inch of the log. If then the log is three feet through, one revolution will yield a piece nine feet long, and the total length sliced from the log would extend over a mile. Cutting machines further reduce this huge sheet to the desired lengths. A core of six inches thickness is left, which is taken out of the jaws and split into drumsticks or tenpins. The veneers are heated, then bent, and are soon ready to be shaped as a drum. There are also planing and sandpapering machines, all run by water power. The strips are put through the bender, from three to six at a time. The sticks are smoothed by rolling in revolving barrels, the process being continued for three or four hours.

Experimental Yellow Fever.

Dr. Carlos Finlay, of Havana, has published the results of several experiments he has made on the inoculability of yellow fever. He performed the operation, or rather got it performed for him by mosquitoes, which he caused first to sting a patient suffering from yellow fever and shortly afterward a healthy person who was to be (with his own consent of course) the subject of the experiment. He found that the disease was only inoculable from the third to the sixth day. When two mosquitoes were employed, so that a double dose was given, the symptoms of the experimental disease were somewhat more severe than when only a single mosquito was used. Of eleven cases of inoculation, six were efficacious, one doubtful, and four negative. The period of incubation varied from five to fourteen days; the symptoms consisted of headache, pyrexia, injection, with sometimes an icteric tint of the conjunctiva, and in some cases albuminuria. The fever lasted, as in the ordinary form, from five to twenty-one days. The author believes that this method of producing artificial yellow fever will ultimately be found very valuable as a prophylactic against the natural and dangerous form of the disease.—*Lancet.*

ACCORDING to the *American Railroader*, it costs a little more than 20 cents a mile to run a locomotive, on the average. Nearly 8 cents of this is for fuel, 7¼ for pay of engineer and fireman, ½ cent for oil and waste, and more than 4½ cents for repairs. A ton of coal will run a locomotive twenty-four miles, a pint of oil will run eleven miles, and a pound of waste one hundred and twenty-three miles. The locomotives of a railway like the Northwestern run a half million of miles a month.

The National Defense.

The Select Commission on Ordnance and Gunnery, appointed by Congress July 6, 1884, has been taking testimony at different manufacturing points in the United States, and has now presented its final report to the House. The testimony thus gathered shows that there cannot to-day be made in the United States a steel gun above eight inch caliber, but that various companies are willing to undertake the operations of casting, forging, rough boring, rough turning, and tempering the parts necessary to make guns of the largest caliber, provided sufficient remuneration be offered.

The principal iron companies which appeared before the commission differed widely in their opinion of what the proper remuneration should be. While some of them required contracts for a long term of years, others were content with five. The required output varied from one to two thousand tons annually to five, six, and even ten thousand tons, according to the caliber, as the risks of manufacture increase directly with the bore. The figures furnished by the Cambria and Midvale companies were about $800 per ton. At this rate, the annual amount of the contracts would reach as much as eight millions. With their previous experience in this direction, the Midvale Company refused absolutely to furnish even an estimate of what they would require to be guaranteed to make them undertake the manufacture of guns exceeding twelve inch caliber. In the case of 16 inch guns, the risks at first would be enormous. It is the general opinion of both the commission and private concerns that works which would undertake the smaller sizes would in time be able to produce the largest required, but experience and education will be necessary before the work can be done at anything like a reasonable price. The commission, however, is unanimous in recommending that all guns for use by the army and navy, including those for fortifications, shall be constructed in the United States.

The question then arises as to where, and by whom, the guns shall be made. The report of the Gun Foundry Board shows that the cost of a complete plant for casting, forging, rough boring, rough turning, and tempering parts of guns up to 100 tons would be about $560,000, exclusive of buildings. It would seem, therefore, in view of the immense contracts wanted by private firms, that there must be a wide margin of profit to cover the risks, and that it would be advisable for the Government to establish a national establishment. If, however, the manufacture of the rough material for steel guns be given over to private enterprise, the commission favors the appointment of two firms, in order to guard against the inconvenience which might arise from the reverses to which any business undertaking is liable, and to profit by the closer attention to the details of manufacture, and the consequent greater perfection in the product, which would result from such a competition. In case the building up and furnishing of these guns is done by the Government in its own factory, the selection of the site for such a factory would have to be made with extreme care. It would have to be free from any danger of capture by hostile forces. It would have to be near the establishment furnishing the rough parts of the gun, and so located as to enjoy good transportation facilities both by rail and water, especially the latter, since the guns must be delivered at the proving ground, at Sandy Hook or Annapolis, before distribution to the fortifications. The commission does not seem to favor an interior location, on account of the difficulties of transportation. Where this is accomplished by railroad, due regard must be had to the strength of bridges, as such heavy freight is not common. Proximity to the centers of skilled labor and supplies, as well as the utilization of existing resources of the Government, must also be considered. The question still remains open as to whether the work shall be done wholly or in part by the Government. The commission appears to favor the partnership or combination system, by which privateconcerns act in conjunction with the Government.

The present capacity of the United States to produce armor is lower than its ability to furnish the requisite guns, since less attention has been given to the subject. The maximum thickness which could be produced to-day is twelve inches. No definite information could be obtained in regard to the cost of armor, though a number of firms expressed their willingness to undertake its manufacture, if the compensation were made sufficient.

The question of marine engines was more readily disposed of, for the present equipment of the navy yards at Boston, New York, Washington, and Norfolk would enable them, with slight addition of more modern tools, to produce all that is required. The testimony taken demonstrated the ability of American workshops to build engines equal in every respect to those made in foreign establishments.

The commission also reports favorably on our advance in naval architecture. Iron and steel war vessels can now be built at several of the navy yards in this country and in private establishments already in operation. If any great number were required at short notice, it would be necessary to resort to both the national and private ship yards. It was decided that the most favorable site for the construction of these vessels is on the Delaware River. No difficulty would be experienced in increasing the navy at once, for the necessary plant is already in existence, our iron masters possess the requisite knowledge and their workmen the needed skill.

Power Loom Silk Weaving.

Le Moniteur du Tissage Mecanique des Soieries gives the items of expense for power loom weaving, so that any intending manufacturer may be able to know at once what these are, and by comparing the probable expense for weaving, according to the goods produced, and adding thereto the permanent expenses and the wages to be paid for drawing in and warping and the discount to be allowed to customers, he is able to find exactly what the goods would cost him. The following is the calculation:

	Francs.
Net price of a mill, driven by a turbine, of 200 power looms, at 2,000 francs per loom	400,000
Interest and depreciation of this capital at 12 per cent	48,000
4 tacklers	6,000
2 warehousemen	4,000
2 boys	2,000
1 carpenter and 1 smith	3,000
1 lodgekeeper	1,000
Expenses and dues of water	5,000
Horse and cart	1,500
Cartage	4,000
Insurance	1,000
Taxes	2,500
Lighting	3,000
Heating	2,000
Repairs of looms, healds, reeds, strapping, shuttles, cards, etc., at 100 francs per loom	20,000
Repairs of the building	5,000
Oil, dusters, etc	1,000
4 overlookers	4,000
Traveling expenses	1,000
Dining room and wash house for the workpeople (heating, etc.)	3,000
	517,000

This sum divided between the 200 looms, working 250 days per year, gives us a result of 2·34 frs. per loom per day for a mill driven by water power. For a mill working by steam power, we must add 0·15 fr. per loom per day, making the total into 2·49 frs. A manufacturer starting a mill of 200 looms driven by water power must therefore be prepared to meet expenses amounting to 2·34 frs. per loom per day before calculating any profit on his production.

Introduction of Railways.

The following are the dates of the introduction of railways in the various countries from 1825 to 1860:

England	September 27, 1825
Austria	September 30, 1828
France	October 1, 1828
United States	December 28, 1829
Belgium	May 3, 1835
Germany	December 7, 1835
Island of Cuba	In the year 1837
Russia	April 4, 1838
Italy	September, 1839
Switzerland	July 15, 1844
Jamaica	November 21, 1845
Spain	October 24, 1848
Canada	May, 1850
Mexico	In the year 1850
Peru	In the year 1850
Sweden	In the year 1851
Chili	January, 1852
East Indies	April 18, 1853
Norway	July, 1853
Portugal	In the year 1854
Brazil	April 30, 1854
Victoria	September 14, 1854
Colombia	January 28, 1855
New South Wales	September 25, 1855
Egypt	January, 1856
Middle Australia	April 21, 1856
Natal	June 26, 1860
Turkey	October 4, 1860

Lighthouse Illumination.

At the Society of Arts, on March 10, a lecture was delivered by Mr. E. Price Edwards "On the Lighthouse Illumination Experiments at South Foreland." The general results of these experiments were that while electric arc light was more absorbed in proportion than gas or oil light as it passed through fog, still its greater intensity enabled it to penetrate much further than these. The Berlin core carbons of Messrs. Siemens were found to operate best, the core being of graphite. The conclusion derived from the experiments was that for ordinary purposes of lighthouse illumination mineral oil is best, and that for salient headlands, and very powerful lights, electricity is best. A six-wick mineral oil lamp burning six hours consumes four gallons of oil at 6d., that is to say, 3s., including cylinders, etc., whereas a 108 jet gas burner for the same period of lighting would cost 10s. for coal alone, since it would consume 1,800 cubic feet of gas.