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- II. TECHNOLOGY.—Chromo-Photography. A new Albert-type Process that reproduces color in pictures.—Edwards' Enlarging and Copying Camera. 2 figures.—The Colloid-bromide Emulsion Process.—Direct Ink Printing from Glass Negatives. By HANS BRAND. The Use of Chalk in Dyeing Wool.—Manganese and Chrome Blues. Blue Alizarin.—Dyes and Colors. Lakes. Eosin Fixation on Cotton. Rose Bengale. Chrome Residues. Caulin. Soda Silicate.—Portland Cement.—Seal Brown. Fast Black on Wool.—Scarlet on Cotton.—Light Brown-red on clean Wool.—Scarlet on Wool.—Orange on clean Wool. An important Trade-Mark Case.
- III. FRENCH INTERNATIONAL EXPOSITION OF 1878.—Tank Locomotive, Paris and Orleans Railway. Dimensions and 1 illustration. Swiss Tramway Locomotive, engraving, with dimensions and description. New Portable Windmill. Engraving. 1 figure with description. 100 H. P. Horizontal Condensing Engine. 3 figures to scale, with description.
- IV. CHEMISTRY AND METALLURGY.—Contributions to Blowpipe Chemistry. By P. CASAMAJOR. A paper read before the American Chemical Society. No. I. New Blowpipe Bellows. 3 figures. Constant Pressure. Spring Catch. Water Trap.—Absorption of Carbonic Acid.—Determination of Vapor-densities.—Food.—Formic Acid.
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- VI. NATURAL HISTORY, GEOLOGY, ETC.—The Canons of the Colorado. From the Report of J. W. Powell, Geologist in charge of the survey of the Territories. The Grand Canon, the Kaibab Fault, the Unkarret Mountains, and other wonderful formations, and the agencies to which they owe their existence. Surface corrosion in moist and arid climates. Altitude, and how it determines the character of a region. With 8 engravings of remarkable scenery, island monuments, Glen Canon, 4 views of Grand Canon, Whittie's Grotto, Sumner's Amphitheater, etc. American Archaeology. Proposed illustrated work on American Archaeology by the Smithsonian Institution, including ancient mounds and shell heaps, cave and cliff dwellings, masonry, sculptured slabs or carved images, inscriptions and rock paintings, graves and cemeteries, aboriginal quarries and salt works, oches, workshops, etc. Ancient roads or trails, and reservoirs and aqueducts. Information wanted on these subjects, and questions addressed to the inhabitants of America, with special memoranda and instructions to explorers. A call for specimens for the National Museum. Forest Tree Borer. By MARY E. MURTFELDT. The wood-boring beetles. The bark beetle. The wood weevils. The saw-horn. The long horn or Carpinom beetle. Insects destructive to hickory, walnut, oak, elm, beech, prickly ash, pine. The twig-girdler. How Nature checks the ravages of wood-boring insects. Parasitism. Flies, birds, and other exterminators. Protection of trees about dwellings.—The Fire Bush.
- VII. CHESS RECORD.—Biographical Sketch and Portrait, with one Problem, of G. N. Cheney, Syracuse, N. Y.—Rousseau as a Chess Player.—Frank Leslie's Problem Tournament of 1858.—Letter Problem.—Problem by J. H. Morrison.

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THE ELEVATED RAILROAD NUISANCE.

The steam elevated railroads in this city are amply fulfilling the predictions of those who, like ourselves, have maintained that they were not suited to the needs of rapid transit here, and would, in all probability, be found an oppressive nuisance. On both lines accidents have recently occurred with alarming frequency. Two persons have been killed falling from the Metropolitan structure within the last few days. A workman had his head nearly cut off by a locomotive while painting the iron work. Sparks falling from a furnace-have set fire in one case to bales of cotton, and in others to awnings in the street below, and several persons have been struck and injured by objects falling from

merous runaways, and one person was seriously injured while riding on a street car through his leaning out and striking one of the supporting pillars of the road above. On the New York Elevated line a terrible disaster, which would have involved the precipitation of a whole train filled with passengers upon the sidewalk beneath, was so narrowly escaped that the public will feel a natural trepidation in passing over such portions of the aerial lines as are not provided with guard fences. Some mischievous boys, taking advantage of the ladders formed by the lattice-work pillars, climbed up to the track and placed heavy paving stones on the rails. The train was greatly shaken, but fortunately the guard rails kept it on the track and prevented its destruction. This is only the beginning of a probably long chapter of serious disasters, and it is suggestive to remember that the line on which nearly all have occurred is less than five miles long, and has been in operation but three weeks. How many people the elevated railroad companies propose to kill or injure daily after their whole forty miles of road is in operation, the long-suffering citizens of this metropolis will discover in course of time.

This, moreover, is but one class of the nuisances chargeable to the elevated system. Many of the most determined adherents of the Metropolitan road, while it was still in embryo, now are loud in their denunciations of the annoyances to which it subjects them. Nothing whatever has been done to reduce the deafening racket of the trains as they thunder over the resounding iron bridge, every sound-vibration of which is intensified and reflected downward by the huge sounding boards afforded by the car bottoms. Not content with throwing sparks, carbonic acid gas, and smoke into windows, necessarily kept open during the hot weather, the companies supply a detestable grade of coal especially rich in sulphur, and the result is that the unfortunate dwellers along the route, as well as the passengers, are nauseated by the stenches of sulphureted hydrogen. It is like putting a foul chimney in front of every one's bedroom window.

The management of the new line are profuse in promises of what is going to be done, and the urgent necessity for improvement begets the strong hope that their efforts will amount to something more than empty words. At the present time cars are run not nearly approaching sufficiency in numbers to accommodate the travel. And they are packed so full that the trip from terminus to terminus, about four and a half miles, frequently occupies, including stops, forty minutes. This is practically no improvement on the horse cars.

The only remedy for all these dangers and nuisances is to sink the tracks. This had to be done, and public opinion compelled it, on the Fourth avenue surface road, and the present underground line is a grand success. The Metropolitan road can put its iron tunnel under ground as well as above it. The present girders which support the rails can serve as the roof, and the track can be laid on the bottom of the cut. As matters stand now, the citizens of New York are receiving sparks, dirt, stenches, a deafening racket, dark, damp and obstructed streets, depreciated property, danger of trains leaving the track, and danger from runaway below, in return for valuable franchises for which not a cent is paid, too high rates of fare, and for the privilege of being packed in cars like cattle and slowly transported over a limited portion of the city.

STEAM BOILERS.

The relative advantages of steel and iron for boilers have been the subject of much discussion and experiment, by which the superiority of the former, in respect to strength and durability and the advantage in weight, has been clearly established; but its claims to superior economy do not seem to have been so convincingly advocated as to induce its substitution, in any considerable degree, for iron.

Most of the users of boilers are ready to admit that the steel boiler is more durable and less liable to fracture and explosion because of the homogeneity of the metal, but they are not sufficiently assured that these advantages offset its higher cost.

The hard times, too, intensify their disinclination to any change, and especially to the spending of time and money on experiments. Consequently iron boilers, notwithstanding their defects, still hold their prominent position as steam generators.

Knowing that suggestions which may result in greater safety to life and property, or to economy of manufacture, are of especial value now, and therefore pretty sure to be well received, we call attention to certain experiments that were made not long since, to determine the heat-transmitting powers of iron and steel boiler plates, feeling certain that our doing so will induce thorough investigation into the matter on the part of the manufacturers of each kind of plate.

Studying carefully the reports of boiler tests, and with some experience in such matters themselves, Messrs. Whelpley & Storer formed a theory respecting the causes of many of the discrepancies which were found in the services of boilers, and instituted a series of experiments to demonstrate its correctness.

Though conducted on a small scale the experiments were made with great care, and were repeated and continued through several weeks.

Thirteen pieces of boiler plate, of uniform thickness and a foot square, were obtained from manufacturers and boiler makers. Three of these were of Siemens-Martin steel and the others of iron.

to one face of each plate, forming a receptacle for a measured quantity of water.

Each plate, holding water of ascertained quantity and temperature, was then, in turn, placed over the carefully adjusted flame of an oil stove, and the time of evaporation noted.

As constant a temperature as possible was maintained throughout the experiment, and registered by a high grade thermometer, with bulb secured just under the lower surface of the plate.

All possible precautions were taken to secure like conditions in each case and to eliminate all causes of error.

In the first instance, each plate was tested in the condition in which it was received, then with the under surface brightened, and then blackened with lamp-black.

The mean of the results established that the Siemens-Martin steel possessed a heat-transmitting power—determined by evaporation of water at the pressure of the atmosphere—about 25 per cent higher than the mean of the iron plates; that the evaporation of the poorest steel plate was about 15 per cent higher than that of the best iron, and that the best plate of steel evaporated 40 per cent more water in a given time and under like conditions than the poorest of the iron.

The qualities of the steel plates were very nearly alike, while in the iron plates there were great variations in quality.

The cause of these differences was now sought by analyses of the plates, and Messrs. Whelpley & Storer held that absolute proof of the correctness of their theory was thereby established, to wit: that the presence or absence of non-conducting substances—cinder, oxides of iron, and other impurities—determines the heat-transmitting power, and consequently, in a great measure, the relative values of iron and steel for boilers.

The steels, owing to their mode of manufacture—the cinder separating from the molten metal—were practically free from non-conducting substances, while the irons, from which all such impurities cannot be eliminated in the process of manufacture, varied in their values according to the percentage of cinder and other foreign matters remaining in them. Of the irons the charcoal iron stood highest.

These novel experiments appear to demonstrate that, in conjunction with superior safety, great saving in fuel may also be assured by the use of steel for steam generators—a saving so considerable that it would soon offset the difference of cost between steel and iron.

PROGRESS OF OUR WESTERN INDUSTRIES.

The manufacturing interests of the West are remarkable in many respects, not the least remarkable being their rapid development and their dependence on patented inventions. A few years ago it was thought that the fertile States north of the Ohio and the Missouri were a paradise for farmers, but never could be other than agricultural in character. Even yet there are few persons who do not receive with surprise and incredulity any reference to that region as one pre-eminent for its manufacturing industries, notwithstanding the fact discovered by the census of 1870, that at that time the manufactured products of Ohio, Indiana, Illinois, Missouri, Iowa, Minnesota, and Wisconsin exceeded the agricultural products of those States by \$76,000,000 a year. Since then the manufacturing interests of the West have increased with a rapidity positively amazing; and unlike the great factories of the East, very few Western establishments are engaged on standard products made by time worn processes. In almost every case they are based on recent patents.

As an illustration of Western growth, take the city of Springfield, Ohio, to which the *Graphic* of June 10 gives a double page of illustrations. Fifteen years ago it was simply a pleasant inland town without any specially promising aspect. To-day it is one of the handsomest cities in the State, with a multitude of manufacturing establishments, turning out products to the amount of \$10,000,000 a year. These varied interests the *Graphic* reporter finds in a highly prosperous condition. "Neither the business men nor the manufacturers wear long faces. Their wares find sale in every part of the United States, and the 'Champion City' is well known as one of the leading manufacturing points in the West, and as having played an important part in securing for Ohio her enviable reputation throughout the world as the home of inventive genius and skilled mechanical labor."

The leading industry of Springfield is grouped around the champion reaper and mower, to the production of which a capital of \$7,000,000 is devoted, giving employment to thousands of men, requiring five mammoth manufactories to do the work, and all taxed to the utmost to meet the demands of their customers. In addition the *Graphic* enumerates nearly a hundred manufacturing establishments, some

twenty or more of which employ capitals ranging from \$100,000 to \$1,200,000. A wide range of products are turned out, including agricultural machinery and implements, steam boilers and engines, turbine wheels, burial cases, household and other furniture, carriages, malt liquors, iron railings, bread stuffs, cut stone, oils, soap, brick, sewing machines, gray iron castings, wind engines, tin, copper, and sheet iron ware, galvanized iron, pumps, wringers, churns, etc.

THE DECLINE OF THE WHALING INDUSTRY.

It has been often said that if whaling could profitably be followed in the highest Arctic regions, the attainment of the Pole would be an almost immediate consequence. Both North and South, whale fishermen have been the pioneers, and exploring expeditions have followed them, and it is not one of the least sources of regret, now that the whaling industry of this country has declined to meager dimensions, that these bravest of seamen will no longer open the way through uncharted seas, or make known to civilization the remotest quarters of the globe.

For the year 1876 the total value of the importation of oil and bone amounted to but \$2,639,463. This is the lowest recorded total since 1829, and it is about one fourth of that for the year 1854. In 1845, 731 vessels, aggregating 233,149 tons, were employed in the trade. In 1876 there were but 172 vessels, and the total tonnage was 37,828 tons.

It will at first sight be considered remarkable that so profitable an industry should have met with a decline which is amounting to a virtual abandonment. The "History of the Whale Fishery," by Mr. Alexander Starbuck, which we find embodied in the recent report of the United States Commissioner of Fish and Fisheries, gives a large number of instances where the voyages of whaling vessels have been attended with colossal profits. The most extraordinary voyage ever made is stated to be that of the *Envoy of New Bedford*, which sailed in 1848. This vessel returned from a cruise and was condemned as worthless, but her owner decided to fit her up for another trip at a cost of \$8,000. The result of the voyage was a profit of \$133,450. The *Pioneer of New London*, worth with her outfit \$35,800, sailed in June, 1864, and returned in September, 1865, with oil and bone worth \$150,000. On the other hand, there have been many enormously heavy losses, such as those accruing from the beleaguering of whole fleets in the ice of the Arctic regions in 1871 and 1876.

Yet when all the advantages of the whale fishery are summed up, the exploration of unknown regions, the education of a skilled and hardy race of seamen, the support of the sperm candle industry, besides the profits we have indicated, it will appear that the benefits gained were large, and that the decline of the trade may be viewed as a loss in more ways than one. Still, when the causes which have led to this result are considered, it will be seen to have been inevitable. The development of the Pennsylvania coal oil resources, occurring at a time when the expense of procuring whale oil was yearly increasing, proved the most powerful of the antagonistic causes. As the supply of whale oil became scarcer, and it is said shyer and more difficult to capture, so that the length of the voyage has become entirely disproportioned to the quantity of oil returned. The Government, by the abandonment of sperm oil in favor of coal oil for light houses, is aiding in hastening the abandonment of the pursuit; and in addition to all these reasons are those of the increased cost of fitting out and refitting vessels and the difficulty in procuring good crews.

TRANSMITTING POWER BY ELECTRICITY.

The Société du Val d'Osne has an electro-plating establishment in Paris, where a process of coppering cast iron is carried on. The source of electricity is a Gramme machine, ordinarily run by a special engine at considerable expense and trouble, as it was situated at considerable distance from the main motor. M. Cadiat suggested the use of two Gramme machines, one to be connected to the driving shaft of the works, and to produce a current which should set machine No. 2 in motion, and this in turn might drive the machine which supplied current for the baths. Motive power was thus transmitted over a distance about 400 feet by means of a single copper wire. The system, says M. Cadiat, in *La Nature*, has worked perfectly and uniformly for two months. The velocity can be easily regulated by interposing resistance in the circuit. If, in the circuit from machine No. 2 to the electro-plating machine, a copper wire 6.4 feet long and 0.06 inch in diameter be inserted, the velocity falls from 750 to 40 turns per minute; with an iron wire 4.8 feet long and 0.32 inch in diameter, the velocity is reduced to 100 turns. As for the power required, the author states that the starting or stoppage of the system is not recognizable by the engineer who controls the driving engine of about 10 horse power, from which power is also taken for a variety of tools.

Native Magnesium Salts.

We have lately received a small specimen of nearly pure magnesium sulphate—epsomite. It is stated that a deposit of this salt has lately been brought to light on the Tennessee river near Shell Mound, about twelve miles from Chattanooga. The deposit is 31 inches thick, but not entirely clear. Small masses of this substance have heretofore been found in both Sevier and Morgan counties (Safford's Rep., 113). A deposit of magnesium sulphate mixed with chloride has also lately been discovered, according to Dr. Pontz, on the line of the Union Pacific Railroad, near Omaha.

SCIENTIFIC AMERICAN EXPORT EDITION FOR JUNE.

In our advertising columns of this issue will be found a full description of the contents of the June number of the *SCIENTIFIC AMERICAN Export Edition*. It constitutes a splendidly illustrated history of the progress of the world in science, invention, and the useful arts for one month. Among the prominent subjects discussed which will excite special interest are the elevated railways in New York, the new industry of brush making by machinery, Mr. Edison's wonderful carbon telegraph and heat measurer, the novelties of the Paris Exhibition, and the new electrical gyroscope. In addition to these are embodied descriptions and engravings of a large number of original and useful inventions, processes, etc., together with tables of current prices in New York and other valuable information. The advertising pages, of which there are many, contain scores of large and elegant engravings of the best American machinery, the low price at which space can be obtained enabling manufacturers to make lavish displays of their products for the benefit of purchasers abroad. The number contains ninety-three pages of the full size of the *SCIENTIFIC AMERICAN*, handsomely bound in covers, and constituting the most attractive and fine looking scientific and industrial publication ever issued. This splendid periodical reaches every commercial center of importance throughout the world.

THE EÖTHEN ARCTIC EXPEDITION.

The schooner *Eöthen* sailed from New York on June 19 with an exploring party on board, which proposes to make a protracted search in the Arctic regions for the relics of Sir John Franklin and his expedition. The party is under command of Lieutenant Schwalka, U. S. A., and numbers in all seven persons, including the guide, Esquimaux Joe. Interest in Sir John Franklin's fate has been revived of late by reports that an unvisited tribe of Esquimaux has relics of those of his crew who were the last to perish. The present expedition, which has been fitted out by voluntary contributions, is intended to reach that tribe. The *Eöthen* is to proceed as rapidly as possible to Whale Point, Hudson's Bay, where a number of Esquimaux will be engaged. It is expected that the vessel will winter in Repulse Bay, and after the expeditionary party starts in the spring she will be used as a whaler until the party returns.

PATENT MATTERS IN CONGRESS.

The printing of the patent specifications by the Patent Office, which for some time past has been suspended owing to lack of funds, has now been resumed, Congress prior to adjourning having made the requisite appropriation.

Further consideration of the amendments to the patent laws proposed in the Wadleigh bill has been postponed until next season. Indeed, all the projects for the amendment of the law were suspended, and no changes have been made.

The Turkish Bath.

Dr. Fleming, of Glasgow, has presented to the British Medical Association an account of some experiments by the author upon himself, with a view to ascertain the effect of the Turkish bath, at the temperatures of from 130° to 170° Fah., upon the weight, temperature, pulse, respiration and secretions. The results showed that the immersion of the body in hot, dry air produced loss of weight to an extent considerably greater than normal, amounting, on the average, to the rate of about forty ounces an hour. This was accompanied by an increase in the temperature of the body and a rise in the pulse rate, with at first a fall and then a rise in the rapidity of respiration. The amount of solids secreted by the kidneys was increased, and, coincidentally, the amount of urea. The sweat contained a quantity of solid matter in solution, and, among other things, a considerable amount of urea. The most important effect of the bath, however, was the stimulation of the emunctory action of the skin. By this means, the tissues could, as it were, be washed by passing water through them from within out. The increased temperature and pulse rate pointed to the necessity of caution in the use of the bath when the circulatory system was diseased.

Remarkable Locomotive Performances.

Mr. W. F. Buchanan, Superintendent of Motive Power of the N. Y. Central and Hudson River Railroad, has recently made a report on the performances of the locomotives thereon, from which it appears that the total mileage for the year 1877 on the Hudson River division was 3,726,919. The whole number of engines in service was 97, showing an average mileage for each engine for the year of 38,422 miles. The highest average for any one engine is that of No. 33, from January 1, 1877, to April 1, 1878, a period of fifteen months, when the mileage was 117,872 miles, or 7,858 miles average per month.

The United States Building at the Paris Exposition.

The London *Building News* says: The American facade is a plain wooden building of two stories, surmounted by an open belvedere in the center. The effect has been mainly obtained by paint. The style is a species of Italian, and though not particularly accurate in its details represents fairly, we believe, the sort of villa or country house to be found by thousands in the outskirts of all the principal towns in the States. Some boldly designed shields in the centers of the chief panels contain the arms of the "Keystone" State, and on a series of shields in the frieze are to be found the names of all the great manufacturing cities.

Recent Ship Designs.

Sir Edmund Thompson has recently brought out some new designs for the hulls of vessels, which deserve our attention. His first idea is that every vessel ought to be absolutely unsinkable. This it is intended to accomplish by means of air tubes and cells, a principle already employed in various degrees from bulkheading into compartments up to building double skins with dividing partitions at frequent intervals. Mr. Thompson desires to carry the principle to its utmost limit, so that, however much damage may occur to a ship, those parts not absolutely destroyed ought to float and sustain the crew. He also considers the present position of the propeller undesirable as causing the evils of vibration, racing, slip, and injury from missiles or collisions.

Further, in the case of armor plated vessels, he advocates placing the armor plating inside the air tubes or cells, so as to lessen the amount of rolling and the liability to capsize. He proposes the use of steel throughout. His plans embrace numerous collision bulkheads forward, and the construction of a propeller tunnel in the stern, bringing the screw well within the shelter of the hull. It is proposed to guard against torpedoes by a metallic chain slung from falling davits by means of chains passing over suitable pulleys, and raised or lowered by steam hauling engines. The same plan of davits is also proposed for raising and lowering the ship's boats. The armor plating rests on a box girder shelving carried up inside from the floor of the ship, but attached to the frame.

Figures which Seem Untruthful.

Elaborate tables of the commerce of the world recently published put down the annual imports into all ports by all nations at \$7,251,000,000. At the same time the exports from all ports of all nations are stated at \$6,448,000,000, or a deficit of \$803,000,000 less going out of all ports than is coming in at all ports.

In these tables England and Germany are put down as importing nearly \$1,000,000,000 annually more than they export. Asia exports \$100,000,000 more than she imports, and the United States export \$200,000,000 annually more than they import.

Now the question is, Where is this deficit? Is it to be accounted for in the bills of exchange sent out to pay for imports? In this way England would needs send out bills of exchange of nearly \$1,000,000,000 more than her exports each year to meet her imports, but really the balance is the other way, England receiving still more than her difference of imports and exports in interest on money than other nations.

But if so much is shown by customs records to come into port, why not show where it comes from? If America sends England a certain amount of goods, should not our record of exports to England and England's record of imports from America tally? If there is a less exact record kept of exports because they pay no duty than of imports paying duty, then what is the value of statistics? Is America exporting two hundred million more than she has credit for? Is some other nation doing the same? Will Mr. Young please overhaul these statistical facts and tell us how it is?

The Hotchkiss Ship's Log.

Lieutenant D. G. McRitchie, commanding the United States steamer Tallapoosa, has recently made a report to the Navy Department relative to two taffrail logs, respectively of English and American invention. He says, after a thorough test of the American log, invented by Captain Truman Hotchkiss, of Stratford, Conn., he finds that it cannot be fouled with gulf weed or sedge, and that the dial hands cannot be tampered with. He regards it as accurate in registering distances. Its peculiarity is that the register is secured on board, while the rotator is alone towed in the water. This permits a smaller line to be used than ordinarily, and avoids the frequent breakage of the line and the loss of the log. The dial can be easily inspected at all times, even when changing the course of the vessel, without hauling in; there is consequently little danger of overrunning. The rotator is the only part of the log in danger of loss, and that can be replaced at trifling cost. There is no liability to having the log disabled or ruined, when crossing shoals, by striking the bottom, or being filled with sand.

Starting New Industries.

Illustrating the working of a tariff in a new country like the United States, we see that the manufacturers of spool cotton in Scotland have moved machinery and hands over here to Long Island and New Jersey and established the manufacture on American soil, preferring to pay taxes rather than duties. The same is true of one of the largest flax thread manufacturers in the world; they have a branch manufactory in New Jersey, employing 500 hands, but compelled to use mostly Canadian, Russian, Irish, and Belgium flax, because American flax growers are too careless of the product. In this connection we might also mention a great number of tool, machinery, and cutlery manufacturers who have established a prosperous business here.

The Telephone at Sea.

The telephone has lately been successfully used in France to communicate between a vessel being towed and one towing. The wire was carried along one of the hawsers, and circuit was completed through the copper on the bottoms of the ships and the water. Conversation was carried on very distinctly.