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Contents:

(Illustrated articles are marked with an asterisk.)

EVAPORATIVE POWER OF BOILERS.

Engineers, accustomed to test the evaporative power of boilers, are aware of certain apparent variations, in steam generating capacity, unaccounted for by differences in construction. Two boilers exactly alike, or enough so to be called alike, will, under the same apparent circumstances, perform unequally.

This is not the only instance in mechanics where such unaccountable differences have been observed. Musicians have observed that, of two violins as nearly alike as human skill can make them, one may be a valuable and the other a comparatively worthless instrument. Those who have studied the art of violin making attribute the difference in tone to unexplained peculiarities in the wood from which these instruments are made.

Similarly Messrs. James D. Whelpley and Jacob I. Storer, whose communication upon this subject will be found in another column, attribute marked differences in the action of boilers to differences in the iron of which they are made, and the tabulated results of their experiments certainly seem to justify their opinion.

These gentlemen have long been known to the engineering public through their attempts to bring about more economical combustion of fuel and more efficient application of heat, to the production of steam, the operations of smelting, puddling, etc.; and their experiments will call attention to a point in boiler construction hitherto, in a great degree, overlooked.

But while we are willing to concede that the quality of boiler iron may greatly affect its power to transmit heat, we think the difference in quality which produces such a result will be found to be mechanical rather than chemical, as Messrs. Whelpley and Storer would seem to think in their remark on the effect of alloys and impurities. At least we have no doubt that molecular conditions, not dependent upon chemical affinity, do affect the conducting power of metals both for electricity and heat.

It is certain that in many substances molecular structure has much to do with conducting power. Wood conducts heat with far greater facility in the direction of the grain than across it. Crystals are well known to exhibit similar variations, in conducting power, relative to the direction of their axes. Conduction is also known to be affected by the conditions of homogeneity or non-homogeneity.

Now as iron is more or less crystalline in structure, according to the thoroughness with which it has been worked, and the presence or absence of foreign materials, we are of the opinion that some of the variations observed by Messrs. Whelpley and Storer may be referred to the arrangement of these imperfect crystals or fibers in the plate, and perhaps to certain approaches to lamellated structure, consequent upon defects in manufacture.

Whatever their cause, if the differences be thoroughly established, they are of the utmost practical importance, and we trust the investigation thus begun will lead to such a general examination and discussion as will throw more light upon the important subject of economical steam production.

THE OPEN POLAR SEA.

In our journal of November 4th, we announced the welcome news that a region, free from ice, of comparatively moderate temperature, had been discovered in the centre of the Arctic Circle. This open space, only to be reached by traversing an almost impenetrable barrier of winter bound country, has long been supposed to exist. The flattening of the earth, at the north and south poles, diminishes the radius of our globe, and brings the surface nearer the internal heat of the earth, by thirteen miles; and our readers will understand that the comparative proximity, of the open polar spaces, to the central fire, will make, unless diminished by other causes, an enormous increase in the surface temperature.

Putting the solar and atmospheric influences altogether out of the question, the heat of the earth increases, as we descend, at the considerable rate of about 27° Fahrenheit for every thousand feet; and the theory that the hightened temperature in the centre of the Arctic Circle is more than sufficient to overcome the cold induced by the feebleness and, at the actual poles, the absence, of the sun's direct rays, has always been regarded by physical geographers as eminently reasonable, and is now, by actual experiment, found to be true.

We need hardly recapitulate the various attempts that have been made to penetrate the ice barriers of the Arctic region, and the, in many instances, self sacrificing courage and bravery of the explorers. The names of Buchan, Franklin, Ross, Parry, Kane and others, are known, in connection with this subject, to all our readers; and the difficulties and privations they have endured, the wonderful scenes and countries they have visited, make a history, fuller of strange and romantic incident than the most improbable creations of fiction. Of the hardihood and endurance of the men who have devoted themselves to the investigation of this great subject, many instances might be cited; the following, however, gives a just idea of the nature of their task, and of the men who gave their labors, and in many instances their lives, to its accomplishment:

In September, 1819, an overland expedition left the western shore of Hudson's Bay. The party consisted of Lieutenant Sir John Franklin, Doctor Sir John Richardson, Midshipmen Hood and Back, and a seaman named Hepburn. It was calculated that this party would meet Sir John Parry, on his first exploring voyage, at some point on the coast. Sir John and his fellow travellers reached Chipewyan on March 26, 1820, having journeyed on foot nearly nine hundred miles, in a climate which froze the mercury in their thermometers. In July of the same year, they were at Fort Enterprise, five hundred miles further on, and arranged to winter there, dispatching Mr. Back to Fort Chipewyan, to forward supplies. Mr. Back reached Fort Enterprise again on March 17, 1821, having journeyed eleven hundred miles, the thermometer averaging about 50° below the zero of Fahrenheit. He had only a blanket and a deerskin for covering at night, and was frequently two or three days at a time without food. Three months afterwards, the party was at Coppermine, 80 miles further on, having dragged their canoes, supplies of food and material, overland to the stream at that place. After travelling by the shore for five hundred and fifty miles, they found themselves in open sea, and believed that their object was accomplished, but found, to their extreme chagrin, that they had only reached the commencement of a large gulf. Having only three days' provisions remaining, they mournfully decided to retrace their steps, and turned towards Hood river. "Short of food," says the narrator of this memorable voyage, "in a country deserted even by the few animals which supply the scanty larder of the Arctic voyager, ill provided with all that could facilitate their progress, eating the remains of their old shoes and whatever scraps of leather they had, obliged from exhaustion to abandon their canoes when they came to rapids, subsisting, at the last, upon rock tripe and the mosses which they could gather by the way, disappointed in finding assistance at a station where they had expected it, the sufferings of this party were almost unparalleled, and such as but few men could have endured. They lost two of their companions, and reached, in July, 1822, York Factory (their starting point), whence they had started three years before." In this time they had journeyed upwards of 5,500 miles, through obstacles, in weather, and with privations such as have seldom fallen upon men, even among the noble army of martyrs to scientific discovery.

There must be a feeling of gratification all over the world at the solution of this formidable problem. It has interested the civilized nations of the earth for nearly seventy years, expeditions having been fitted out, through all that time, to add to our scanty fund of information on the subject. And none can say that the labor, the money, or even the lives, have been ill bestowed in the cause. The bravery and self-sacrifice of the warrior has always been the favorite theme of the poet, and deeds of courage in the battle field have never lacked praise or pœan; but a more imperishable and enduring glory is due to the peaceful traveller who risks his life in pursuance of the far higher duty of increasing our knowledge, and carrying the never fading banner of Science to the uttermost parts of the earth.

THE SALE OF PATENTED ARTICLES.

As we contemplate the few homely articles which form the outfit of an editor's table, it occurs to us to enumerate how many of these exist in their present convenient form solely on account of the stimulus of a good patent system.

To begin with, there is the inkstand patented. So is the ink it contains. So are the pen rack, the penholders, and pens. So are the ruler, the eraser, the blotter, and the paper fasteners. Yes, and so are the paper files, and the portfolio, and even the gas burner, by the aid of which, these shortening days, we are able to protract our labors somewhat into the dusk of evening.

All these things are good after their kind, and were purchased, as being most likely to be convenient for our use, out of many other patented articles.

If we, in the limited furniture of an editorial *sanctum*, can find ourselves so much indebted for comfort and convenience to patented articles, surely it were not a hard task for the farmer, the artisan, and the housewife to count up a host of things which not only minister to their comfort, but without which they could scarcely now proceed with their business, and all of which have been patented. Very few of these things would have been produced without the hope of gain held out by the patent system.

Those who will take the trouble to see how many patented devices are in constant use by them, will certainly be better prepared to appreciate the value of patents in themselves, and will not be so ready to throw odium upon the system on account of the practices of an occasional fraudulent vender that infests rural districts.

It has been complained that there are many of these who pass through the country, under the pretence of selling rights to use or to make and sell patented articles of various kinds but whose sole object is to defraud the simple, and to make money by dishonest practices.

Thus we have heard of a case where the exclusive right to make and sell a machine for a certain town was sold to three individuals in the same town. We have heard of other cases where parties, in signing a supposed agreement to pay a stipulated price for a machine at the expiration of a given time, under a proviso that certain results should accrue or the article should be returned, have signed negotiable notes which were sold at a discount, and which they were compelled to pay when the scoundrels, who took advantage of their simplicity, were far beyond their reach.

On account of these and other fraudulent practices, many have been victimized and become disgusted with patented articles; and now refuse to examine useful and important inventions, which it would be for their interest to purchase and use. This is as silly as it would be to denounce watches, because some rascals sell pinchbeck for real gold.

The utter absence of common and necessary precautions, in the transaction of all business, displayed by the dupes of fraudulent vendors, enables pretenders and cheats to bleed their purses. Let our rural friends never sign their names without being sure what they are signing, consult their lawyers as to the validity and intent of the contracts they propose to make, take the affidavit of parties proposing to sell patent rights that they are entitled to sell, and that the territory bargained for has not already been sold, and employ such other precautions as careful business men always use, and they will render the occupation of these land sharks very unwholesome, in a legal point of view.

That the simple and careless shall become the dupes of the shrewd and unscrupulous is in the nature of things. If a man should lie down to sleep in an exposed situation, and wake to find his pocket-book and watch abstracted by some prowling thief, he would scarcely blame anything more than his own folly. So if men attempt to execute contracts, and take upon them obligations of which they know nothing, without trustworthy advice, they must themselves take the burden of blame if they get swindled.

This, however, does not exonerate the swindlers. In many cases they might be brought to justice, were it not for indisposition to pursue and punish them. Such a course, though a duty to the public, protecting both honest sellers and buyers, involves some trouble, and it is much easier to "take it out" in maledictions against patents and all who traffic in them.

HOW TO PREVENT AND HOW TO EXTINGUISH FIRES.

The discussion of the proper building materials to use, and the best means of extinguishing fires, are, of course, the prevailing topics, just now, at Chicago. A correspondent, writing to one of the papers of that city, asks: "Have we any incombustible material that can be safely and economically put in the place of wood for these finishing works? Iron only is at present available, and with the present perfected processes of working, preparing, and finishing iron, we see no reason why it cannot be made equally acceptable in all these uses. If it were employed, the contents of a building, the goods and merchandize stored in it, might burn; but, except in the case of large quantities of highly inflammable material—as oils, spirits, etc.—could scarcely produce sufficient heat to materially damage the structure, and even then there would be no possibility of the fire extending beyond the building in which it originated. I believe that iron may be used, and our buildings be none the less ornate, none the less acceptable, all things considered. The only question to be discussed, then, under this head, is that of economy."

This correspondent's belief about the use of iron is correct, and has, for years, been in practice in most of the prominent cities, Chicago excepted.

The same correspondent says:—"Recent events prove that water, applied with all the skill and power men possess, is utterly useless to arrest the progress of flame under precisely those circumstances which most demand an efficient means of resistance to the fiery element. Certain gases have the effect of at once smothering and subduing the most violent conflagration by withdrawing the supply of oxygen. But here a difficulty presents itself. That which thus smothers a fire suffocates all living beings, and, for the same reason, to apply the gas, without its deadly result, is the problem for solution. This problem we commend, as we have done the first one, to the investigation of all who are interested in humanity, and can do aught to promote its study."

We suspect that the writer is not a reader of the SCIENTIFIC AMERICAN, and therefore perhaps not as well posted, in respect to the nature of the existing appliances for using water in cases of fire, as he might otherwise be. For example, on page 191 of our present volume, he will find illustrations of the Hall method of extinguishing fires by means of water directed through perforated pipes, which, at a small expense, may be extended through any building. This system is extensively used in New England, and so valuable is it considered, that many of the insurance companies in that section will not insure a manufactory unless it is put in.

We know of several instances where large buildings, containing hundreds of thousands of dollars worth of property, have taken fire, but it was instantly extinguished by simply letting on the water. We call to mind no instance where the apparatus has failed. It puts out a fire in as many minutes as are often required in hours by the ordinary fire engines.

In our opinion, the Hall system of perforated piping ought to be placed in all large stores, warehouses, and buildings containing much inflammable material.

Where there is a proper supply of water, the use of this system comes about as near to perfect safety against fire as we can reasonably expect to attain.

THE PROPOSED EXHIBITION OF VIENNA, IN 1873.

We have been inclined to believe that the Exposition of Paris, 1867, was destined to be the last that the world would ever see of exhibitions, planned and accomplished on so gigantic a scale: but it seems that the Austrian Government is ambitious of trying its hand at the expensive luxury, and, as our readers are aware, has issued its prospectus for a great international exhibition, to be opened on the 1st of May, 1853.

It has been our rare good fortune to visit every one of the World's Fairs, in London, in 1851 and 1862, in Paris, in 1853 and 1867, in New York, in Dublin, and in Munich, and at each we have been astonished at the magnitude of the preparations and the importance of the results.

We observe that the Austrian Government intend to introduce several important new features, and to outstrip all of the preceding efforts of other countries. They propose to bring out, in special magnificence, specimens of the almost inexhaustible resources of the Indian Empire. This will be the strong point of the exhibition, as Eastern nations have never been fully represented, and there is great curiosity to see what they can produce. Another new feature is the intention to present the productions of all countries in groups corresponding with their geographical position. It is also proposed to represent a history of inventions, a history of prices, a history of industry, and a history of natural productions, "so that the world's progress in arts, science, industry, and natural products will thus be brought into contrast." The classification, of the objects to be exhibited, we have given in a former number, to which we must refer to avoid repetition.

Our object now is to call attention to the exhibition, and to impress upon inventors the importance of being well represented on an occasion that bids fair to attract a larger multitude of people than was ever collected together on any similar occasion. At the Paris Exhibition we were very poorly represented in quantity, but admirably in quality. The few articles sent over from this country attracted great attention; nearly every one received a commendatory notice, and it would be interesting to know how much business grew out of this small show. Americans felt that there were many omissions, and, for the credit of this country, as well as for the good of society, they were sorry to observe this want. The mistakes of 1867 ought not to be repeated in 1873. We ought to begin at once in the organization of committees and commissions to take the matter in charge, so that, by circulars and special effort, a majority of our best things may be forwarded to Vienna. We doubt if any good article need be brought back, and it is impossible to predict the extent of trade that is likely to grow out of such an extensive notice as the Fair will give to all exhibitors.

The inhabitants of the populous countries of the East will be present in large numbers. It is notorious that they have great need of many mechanical contrivances; and as, on the seaboard and in large cities, they have already called for a large number of steam engines, they will be apt to order many minor articles for the interior, and offer their own rich wares in return.

We remember what crowds of people gathered around the sewing machines at the Paris Exhibition of 1855. It is almost incredible that the woman to work the machine had to be sent out from America, as there was no one in Paris who understood its management, and yet it is true. The sewing machine was seen by several hundred thousand people, and out of this Exhibition has grown an enormous industry.

American pianos took the prize over all others, in 1867, and the consequence has been heavy orders from Europe. But it is in the thousand and one little inventions adapted to supply the wants of every day life that we excel. Such articles appear to be too insignificant to be sent abroad, and yet they are exactly what they need in Europe. If the preparation of a list of desirable objects to be sent were to be entrusted to a proper committee, some system could be thrown into the selection of objects, and there would be less danger of important omissions. A central advisory board, composed of twenty-six experts, representing the groups into which it is proposed to divide the Exhibition, could be organized in New York, and they could cull out the best articles in each department. The labors of such a commission would be productive of much good, and we dare say that a sufficient number of desirable men could be found willing to work in so good a cause.

At the time of the last Paris Exhibition, an advisory committee was organized in New York, and all of the articles to be forwarded were examined and passed by them; this committee also induced several manufacturers to send forward their inventions for the sake of doing credit to our country.

It may be more difficult to send bulky articles to Vienna than it was to Paris, but we have no doubt that the Austrian Government will seek to obviate this disadvantage by granting peculiar facilities to all persons who send from a great distance.

The experience we acquire in getting ready for the Vienna Exhibition will be of service in preparing for the great centennial celebration, to take place in Philadelphia in 1876.

It is the characteristic of the age that good things are not hidden away, and the chief benefit of international fairs is to make known what one people produces and what another wants. The Vienna Fair will be a grand opportunity for advertising our good things, and it ought not to be neglected.

FIREPROOF BUILDINGS FOR PRESERVING PUBLIC RECORDS.

The insecurity of public documents and records is one of the painful reflections forced upon us by the recent fire in Chicago. Our readers will find in another column an account of the character of the public buildings that were destroyed in that ill fated city.

The building that contains the records in the city of New York is, though nominally fireproof, only so by virtue of its isolation from other structures, and no doubt the majority of such buildings throughout the country are equally insecure.

In connection with the statements of the Chicago *Tribune*, relating to the shabby character of the Post Office, Custom House, and Sub-Treasury buildings that burned, we may profitably consider some statements in regard to the New Record Office, in London, and to methods of fireproofing buildings employed in Europe.

The Record Office, in London, is built wholly of iron and stone. It has no room larger than seventeen feet by twenty-five feet, and seventeen feet high. None of these rooms communicate with any other in the building. Each opens into a vaulted hallway. The doors are iron. The contents of any one room might burn without endangering those of any other in the building.

The use of wood in building for such a purpose ought to be strictly prohibited; then, if partitions were made sufficiently thick, and they were generally constructed on the plan of the London Office, the public records would be probably as nearly safe from fire as it is possible to make them.

How many more severe lessons are necessary to teach us wisdom? There are ways and means, cheap and available, for making buildings that will resist the progress of a fire, even if they will not withstand such heat as was generated by the united burning of the wooden buildings of Chicago. The French have a way of filling in the spaces between timbers, in partitions, with rubble and plastering. There are, in this way of building, no passages for flames through walls. In a very common way of constructing partition walls in this country, with lath and plaster upon studs, the whole building is a series of flues through which flame will rush the moment the plaster wall is crumbled by the heat.

The French method of filling partitions is employed in other parts of Europe. Houses thus constructed are almost as fireproof as if built of brick throughout.

We need not allude here to the many patented devices, calculated to increase security against fire, which have been described in our columns, since they have thus been rendered familiar to our readers. The plain truth is that, with plenty of resources, we have been building throughout the country in a manner disgraceful to a nation whose progress has been so rapid in other respects. Let the lessons we have received teach reform in this matter, and the pecuniary damage sustained will be in great measure compensated for.

SCIENTIFIC INTELLIGENCE.

CONTRIBUTIONS TO OUR KNOWLEDGE OF CARBON.

Berthelot states that the specimen of meteoric iron from Cranbourne, near Melbourne, Australia, contains, among other foreign constituents, fragments of pyrites and amorphous carbon, which latter is generally called graphite. The author concludes, from the behavior of this carbon to nitric acid, or to a mixture of this acid and chlorate of potash, that it is identical with the so called graphite contained in cast iron, but not with native graphite. All of the oxidation products of the meteoric carbon exhibit the same properties as the products of the oxidation of cast iron carbon, differing, however, from what can be obtained from graphite. He infers that the carbon of the Cranbourne meteorite was dissolved in the fused mass of iron, and separated on rapid cooling. From the coincident occurrence of pyrites, he concludes that the carbon comes from the decomposition of bisulphide of carbon by the glowing iron, and not from carbonic oxide. And he sustains this conclusion by acting, upon carbon thus prepared, with nitric acid and chlorate of potash, and finding that it is almost entirely dissolved, the same as the carbon from cast iron. From these experiments, it appears to follow that the native graphite cannot have been originally separated from iron, because it differs entirely from the carbon thus prepared. It is equally improbable that the natural graphite originated from anthracite or from the decomposition of organic substances, as the carbon thus produced does not yield graphitic acid. The author states that true graphite can be obtained by acting upon bisulphide of carbon at a high heat. If his conclusions are correct, the carbon from cast iron is not the same thing as graphite, and we must look to the decomposition of some such compounds as the bisulphide of carbon, or possibly of cyanogen, if we wish to discover the probable origin of graphite. Berthelot some time since prepared the compound of carbon with hydrogen, known as Marsh gas, by passing a mixture of bisulphide of carbon and sulphuretted hydrogen over metallic copper contained in a porcelain tube heated to redness. It would be well for future investigators to employ the method for the determination of carbon, described in the October number of the *American Chemist* by Mr. Cairns, of the Columbia College School of Mines, namely, by oxidizing directly with chromic and sulphuric acids.

A NEW CONSTANT BATTERY.

Figuier recommends, for the construction of a constant battery, a special preparation of the carbon which will work with one liquid, namely, dilute sulphuric acid. The carbon pole is coated with a thin layer of porous platinum or of silver. To accomplish the first operation, the carbon is brushed over with a solution of chloride of platinum, dried and exposed to red heat. To coat with silver, the carbon is soaked in a solution of nitrate, then suspended in an atmosphere of hydrochloric acid gas, and heated to free the chloride of silver thus produced. This chloride is subsequently reduced by the hydrogen gas that is evolved. Carbon thus prepared is said to give a constant current in dilute aulphuric acid.

CHEMICAL ACTION OF LIGHT.

M. Morren advances, as the result of numerous experiments, the following hypothesis: All chemical reactions occasioned by sunlight can be divided into two classes; the first class, characteristically represented by sulphuric acid, includes those bodies which are chiefly formed by the heat rays; the second class, represented by hydrochloric acid, includes such compounds as are produced by the action of chemical rays. The research is an important one, as the action of heat in determining chemical reactions is not sufficiently understood. The practical application of our knowledge of chemical rays to photography has led to a closer study of this branch of the subject; by the same industry, applied to heat rays, we may arrive at heat pictures and other interesting applications of this department of physics. A good many hidden changes in chemical compounds may possibly be traced to the action of the thermal rays of light.

VEGETABLE CEMENT.

A good vegetable cement may be prepared by mixing gum arabic with nitrate of lime. The latter is prepared by dissolving an excess of marble in nitric acid, and filtering. The filtered solution will contain 33·3 per cent nitrate of lime, which may be dried by evaporation. For the cement, take two parts by weight of the nitrate of lime, twenty parts of pulverized gum arabic, and twenty-five parts of water. The mixture can be further diluted to adapt it to the uses to which it is to be applied. In the manufacture of artificial stone, a cement of a similar character has been found to serve a good purpose. Something of the kind is used in the Frear stone, but in the *Béton-Coignet* no additional binding material is found necessary.

PRESERVATION OF MEAT.

By repeatedly immersing the meat in hydrochloric acid, subsequently drying, it is sufficiently cured to keep for a considerable time. When required for use, the acid must be neutralized by a little carbonate of soda, by which it will be salted. The strength of the hydrochloric acid must be determined by experiment.

PRESERVATION OF WOOD.

Armand Muller has instituted some interesting experiments upon this interesting subject, and arrives at the conclusion that the phosphate of baryta, formed by the mutual decomposition of phosphate of soda and chloride of barium in the pores of the wood, is one of the best preservative agents available to chemists. For the purposes of the experiment, Muller took twelve pieces of green oak wood, four inches long and one and a half inches in diameter, which he buried for twelve months, after suitable impregnation, in constantly moist earth, near a manure pit. One piece was left without any protection, for purposes of comparison.

No. 1, coated with tar, showed signs of mold and decay.

No. 2, impregnated with a mixture of light and heavy tar oils, containing three to four per cent of creosote, was only tolerably protected.

No. 3, with chloride of calcium, worthless.

No. 4, with chloride of barium, badly decayed,

No. 5, in a solution of borax, and afterwards in a solution of chloride of barium, was covered with mold and decaying.

No. 6. Soak the wood five days in a seven per cent solution of phosphate of soda, and after drying, suspend in a thirteen per cent solution of chloride of barium for seven days. The author thinks that wood thus prepared will withstand the action of moisture better than with any other preparation. The chief obstacle to the use of such chemicals is in their cost. He found the test piece of wood nearly as hard and unchanged as if it had not been buried at all.

No. 7 was separately soaked in solutions of sulphate of iron and soluble glass; result, tolerable.

No. 8. Soda, soap, and sulphate of copper. The wood was perfectly well preserved. This result suggests experiments upon ships' bottoms with such a mixture, as the poisonous effects of the copper would kill the boring worm, while it preserved the wood from decay.

No. 9. Soda, soap, and hydrated chloride of aluminum (chloralum); wood tolerably preserved.

No. 10. Chloride of zinc; this is well known to be one of the best wood preservers.

No. 11. Sulphate of copper, also well known.

No. 12. Corrosive sublimate; same as the last. Mercury salts have long been used as antiseptics.

No. 13, without any preparation, was entirely rotted and useless.

The best results appear to be attained whenever two antiseptic mineral salts mutually decompose each other in the pores of the wood, coagulate the albumen and exclude the water; and in searching for good wood-preserving material,