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Strains on Material.

There are infinite varieties of strains, but all are reducible to, or compounded of, five classes:—

First, The tensile strain, or fair pull, that to which ropes are commonly exposed. This is that to which most material can oppose the greatest resistance.

Second, The shearing strain, that to which pins in machinery, or constructions of any kind, are generally exposed. Although very much affected by the kind of shearing edge, and the manner in which the object is held, the resistance of most materials at common temperatures is, in round numbers, generally assumed to be equal to the tensile strain.—Thus, for example, if a pin in a joint must be sheared off in three places to allow the joint to separate, we assume the resistance of said pin to be equal to three times that which would rend it asunder, by a fair pull in the direction of its axis.

Third, The crushing strain, or that to which stone or brick are generally subjected in buildings. The same strain, much modified by the length, however, is that which is resisted by piles, pillars, struts, stanchions, and the like. The strength of most materials to resist a crushing strain is greater than its tensile strain when the object is of little length, but far less when it becomes much lengthened, as in the long and slender connecting rods of steam engines.

Fourth, May be ranked the twisting or torsional strain. It is that to which, more than any other, the shafts of mills and geared work are exposed.

The fifth, and last in our series, is the transverse or cross strain—that to which we always subject material when we intend to break it, this fact of itself being sufficiently indicative that the material opposes less resistance thereto. This is the strain on girders generally, on levers of all kinds, on the arms of wheels and pulleys in machinery, on the axles of carriages and cars, on the brest-summers or girders of bridges, and on the rafters and floor timbers of buildings, etc.

The ability to resist the tensile strain depends entirely on the area of the cross-section, whatever may be its form. A square, flat, or round bar of wrought iron one square inch in section, will bear a strain of from 50,000 to 90,000 pounds, and in that proportion for any other size, without regard to form. But it must be remembered that this calculation refers to sound iron alone, and that very large rods are liable—in fact are almost certain, to be imperfectly welded. Cast steel bears more; in some cases as high as 125,000 lbs. per square inch. Cast iron bears less, ranging from 8,000 to 40,000 lbs.

In resisting crushing strains, the form is important. A hollow pipe is far stronger to resist this strain than a solid pillar of the same weight, partly on account of the superior soundness of the metal, but partly also on account of the advantage this distribution of the metal affords in resisting the tendency to bend. Pillars or props of any considerable length almost invariably bend to one side before crushing or splitting; and in such cases the material, in fact, becomes exposed to a transverse strain—the fifth in our series. The torsional strain is best resisted by a tubular form; but, for convenience in manufacturing, shafts of all kinds, except large cast iron ones, are usually made round and solid. Nothing is gained by squaring, or adopting any other form except the hollow.

The transverse strain has been very carefully experimented on by ancient and modern philosophers, both on a small and a large scale. Gallileo first established the grand and fundamental theorem—the only point of importance which can be noticed here—that the strength of a beam, or other mass of material exposed to this strain, is as the square of the depth. A timber, for example, will resist a load in proportion to its width multiplied by the square of its depth, and divided by its length. It is, on this account, advisable to make every part exposed to this strain as deep as possible in the direction of the strain. For this purpose floor timbers, the beams of steam engines, the girders of bridges, and generally all large pieces exposed to this strain alone, are made comparatively narrow and deep. But there is a limit beyond which this form cannot be carried to advantage. Thus, for example, timbers may be made so very deep and thin as to bend to one side, or twist, when exposed to a load; and, in fact, generally large warehouses and the like, are made with the floor timbers somewhat too thin and deep to stand well alone; but by stiffening with light strips extending diagonally across from one to another, they are compelled each to support the other, and thus they resist this tendency very efficiently, and the floor as a whole is an example of the greatest strength practically obtainable with the quantity of material employed.

Strength and Temperature.

The strength of different materials differs very greatly, not only in regard to absolute cohesion, but also in ability to resist different *kinds* of strains. When quite juvenile, we were once thrown upon quite intimate terms with a very distinguished civil engineer, and were much struck with his answer to an inquiry as to what was "the most important point to be attained in preparing for the profession?" The answer was simply "a knowledge of materials." The strength of some materials is affected very greatly by temperature. Copper, for example, grows weaker with every elevation of temperature above the coldest ever yet tried, while iron grows stronger by warming up to a certain point, a change which, by the way, as is much to be regretted, has never been attended to in the long and careful experiments on this material made at the expense of our government a few years since. Common consent, based on imperfect experiments made many years ago, has assumed the maximum strength of most varieties of iron at about 500° Fah. but some recent experiments by Fairbairn—Wm. Fairbairn, Manchester, Eng.,—indicate a point much lower, or somewhere between 200° and 300° Fah. At all events, it is well established that this metal loses much of its strength—probably at least one-third—by intense cold. In almost every material a low temperature adds to its rigidity and liability to break by sudden impact, if it does not detract from its cohesive strength.

Galvanized Iron.

Last week we described Morehead's process of coating iron with zinc, and it is generally allowed to be an excellent method. Iron, however, may also be covered with zinc by other modes of treatment; but it is necessary, in every case, to clean its surface first by acids and scrubbing with sand, to remove all scale and oxyd, or the zinc will not adhere to it. A very common zincing process is to dip the cleaned iron first into a solution of sal-ammoniac, then into the bath of molten zinc, the surface of which is covered with a thin stratum of powdered sal-ammoniac. The plate or sheet of iron may be held by each end with a pair of tongs, dipped vertically and slowly into the molten zinc, held in it for a few moments, and then lifted out. If held in the molten zinc too long, the iron becomes very brittle. This is the method in most common use for zincing iron chains and small articles; these may be kept in the molten zinc bath much longer than thin sheet iron. This process is public property.

The strength of the dilute sulphuric acid for removing the oxyd and scale must be proportioned to the articles to be treated. Sheet iron requires a weak liquor; chains for pumps and other strong iron articles, may be immersed in a strong liquor, made with a gill of the acid added to five gallons of water. The articles when taken out of the acid are always scrubbed in warm water with sand or emery.

In France, a bath of hydrochloride of zinc is frequently employed as a substitute for the sal-ammoniac preparatory pickle. It is made by dissolving zinc in muriatic acid, and is used at a strength of 17°. We do not believe it is superior to sal-ammon ac; one pound of which, dissolved in five gallons of water, makes a good liquor, which must be frequently renewed while being used.

Pure zinc must be used in these operations or the process will prove very troublesome and often fail. The zinc of commerce is often adulterated with arsenic and lead.

It has been frequently proposed to zinc or galvanize iron by the electrotype method in some form; but this—the real galvanizing process—although it is the best for the iron, is too tedious and expensive to be employed for coating common or large articles. It is, therefore, not in use anywhere, so far as we know. The zincing of iron by the two hot processes we have described, is now pretty generally practiced in Europe and in our own country; in fact, it is fast becoming a great business among us. In this city, we have been told, that 2,000 tuns of iron are zinced per annum; in Philadelphia, 800 tuns, and in Boston and some other cities in the same proportions.

We might describe some other methods of galvanizing iron, but we have given those believed to be the best and most simple. The information imparted will enable any person to coat iron articles with zinc, if he has only an iron kettle for melting the metal, and a wooden tub for scouring his articles and containing the preparatory solution.

Artesian Well Water.

We have spent the most of a day among the deep-tubed wells of this city, and now wish to give our readers the benefit of the results for application in other localities. The water is not uniformly good, as we were led to suppose, when after a visit to one alone we wrote the article of March 7.

To aid those of our readers who are not conversant with the position of New York city, we may remark that it stands on an island called Manhattan, a moderately elevated strip of land twelve miles long and two miles wide. It is situated at the mouth of the Hudson, called here the North river, and separated from Long Island by a narrow strait termed the East river. In the channels of both the North and East rivers, the tides rush in and out with considerable force, and the fresh water of the Hudson is so extensively commingled with that from the sea, that except in great freshets, when the torrent from the country temporarily drives out the sea, the water on both sides of the island may be considered ordinary salt water. Wells sunk to a little depth yield plenty of hard, unpalatable water, which is little used since the completion of a magnificent aqueduct forty miles long, which, by a gradual descent, brings in the water of the Croton river, and distributes it to all portions of the city.

The International Hotel (Taylor's) stands nearly midway between the North and East rivers, and the tight tube (some twenty inches in diameter, driven down some seventy-five feet below the surface springs.) brings up water which, judging from a fairer sample than before, would, in the absence of the Croton, be tolerable water for the table, but it is a little salt and limy, and is consequently not used at all for any purpose. The well is a complete failure for hotel purposes, as it is deemed inexpedient to attempt to lay and keep in order two sets of pipes for conveying water over such a structure. We should have distinctly stated in our former notice that the well water is not used.

Tatham & Brother, in Beekman street, near the East river, sunk a tube 120 feet, found an inadequate supply of brackish water, and abandoned the tube, allowing it to fill up, and dug another well three feet in diameter around the first to a depth of only 45 feet, which gives them plenty of common well water. They use it only for condensing steam.

Ockerhausen & Co., sugar refiners, sunk a tube 100 feet, with a large well around it 45 feet deep, and draw the water from both mixed together. This mixture is no criterion, of course, but we may remark that it is decidedly bad.

Kattenhorn, Brunjes & Co., sugar refiners, near North river, sunk a twenty inch tube 99 feet, and obtained fresh muddy water first day, but did not taste it very carefully, and could get nothing but almost pure salt water from it since. Have filled it up, and dug a large well around it 25 feet deep, which yields ordinary well water in liberal quantities.

Havemeyer & Moller, sugar refiners in Vandam street, who have been announced as pumping 350 gallons per minute from an artesian well, never had such, but pump all their water for condensing from a large surface well.

John Harrison, brewer, Sullivan street, has a very successful example, about 120 feet deep. Yields from 75 to 150 gallons per minute of good water, which is used for beer and for all purposes. Used in the boilers, it produces no sensible incrustation, and deposits less mud than even the pure Croton.

Whether, as we have heretofore supposed, the surface water becomes in this case greatly purified by filtering down through an increased depth of earth, or whether this tube chances to penetrate a channel connecting with a distant and superior spring we are unwilling to decide; but the fact that the sugar refinery of R. L. & A. Stuart, (another place we visited,) is supplied with an extremely liberal quantity of equally good water from two large surface wells, argues in favor of the latter supposition. Mr. A. Stuart, who very courteously showed us about the premises, feels assured that the good water of both is due to a chance communication with springs in the upper portion of the island.

The well on Duane street, (late Howell & Co.'s sugar refinery,) has exemplified two evils which it may be important to avoid in other localities. The well was successful until by pumping too fast—before the water had washed out suitable minute channels for its conduction—the influx started up the earth and excavated a cavity. On driving the tube down farther to avoid this, it is supposed to have been planted so tightly on the ledge of rock which underlies the whole city, and which chanced to be flat and dense at that point, that the supply has since been too feeble to be of importance.

In nearly all the cases referred to, the wells are dug in the cellar of the building, and the surface of the water when at rest rises nearly to the level of the cellar floor—in one case within about fifteen inches. In another instance, where the engineer, backed up by a plumber of experience, insisted that the water surface was forty feet below the pump, and that in opposition to all theory the water was successfully raised that hight by the vacuum; we sounded with a tape, and found the actual depth of the surface to be nine feet.

It appears from all these examples that the chances of obtaining good water from such wells in quicksands below the level of neighboring salt water, although sufficient to induce the attempt in cases where success would be a very great desideratum, are not by any means as certain as we had before intimated. We give these facts as they stand. This is the best answer we can make to numerous inquiries and suggestions in relation to the subject. We have neither the data nor the leisure to make up an elaborate article on the subject. We believe that *generally* the earth, however near the sea, may be assumed to be saturated with fresh water to an indefinite depth, and that the accessions of rain on the surface, by filtering down and displacing it, creates a slight current, flowing through the interstices from the land into the sea. When a deep well penetrates below the sea level, it attracts to itself this insterticial current, and if the sand is tolerably uniform, like that of a great part of Long Island, the drainage thus effected may be estimated with some certainty as extending to a certain measurable distance, and with given effect in all directions. But, on the contrary, if the earth is partially composed of firm layers, which can retain and guide the water, it may be conducted from an immense distance entirely independent of any filtration from the surface. This is the case at Grenelle, near Paris, where the water spontaneously rising through a tube sunk to a depth of eighteen hundred feet below the surface, is by every indication identical with that of lakes situated two hundred miles distant. On this island the source of the water obtainable from wells sunk in the loose earth is, as shown by the above, somewhat uncertain. It may be observed that most or all of the tube wells examined yield water of a quality between that of pure, soft water, like Croton, and that of the hard nauseous fluid from the surface wells.

California Wants and our Manufactures.

We have received quite an interesting letter from one of our correspondents—Mr. A. Doolittle, of Alpha, Cal.—in which he complains of the depreciation in the character of many of our manufactures recently sent to the Golden State. We will specify some of these:

India Rubber Goods.—The india rubber boots recently exported to California are much inferior to those formerly sent there. As the consumption of these have increased, inferior kinds have been manufactured and sent out to meet the demand for them. The retail price for one pair is from $7 to $9, and the same sum for an india rubber coat. After a few days' wear by the miner, the boots come apart in the seams, and the coat leaks somewhere, and thus they are rendered totally useless. India rubber clothing is indispensible to miners, and they are willing to pay a good price for them, but they must be impervious to water. When a miner gets himself wet (and he is constantly exposed to water) by the leakage of his coat or boots, he is liable to become sick. Some good qualities of india rubber miners' clothing are still to be found, but the complaint is, that a great quantity—indeed, the mass—has become bad; and this we desire to tell the manufacturers of such goods, whoever they may be, is a gross imposition, and the wrong will recoil upon their own interests if they do not reform their conduct.

Miners' Picks.—The "Collins" picks have depreciated in character. They are too small in the upper side of the eye, and are liable to become loose. Their stock is good, but they contain too little steel; their axe ends are rather wide and light, and their pointed ends too short and light. The axe end generally bends down; the pointed end wears up with a very few days working. As formerly made, the picks could be repaired by a blacksmith, but now they are so small they cannot be worked over. The sledge hammers sent to California have too little steel on their ends, and soon wear out. As great quantities of picks and other miners' tools are required in California, and vast sums of money are paid for them, the manufacturers of such implements in the East stand a very fair chance of losing this trade altogether. Our correspondent says, he will not buy another box of the kind of picks referred to. Such articles will be manufactured hereafter in California unless better goods are sent there.

Quartz Mining Machinery.—The machinery that had been exported for this kind of mining was ill adapted for the purpose, and all such machinery is now manufactured at great expense in California. The old stamping mill maintains its ground against all other grinding mills. Quartz rock mining is generally looked upon with suspicion as a losing business, as quite number of companies have failed in consequence of such operations. Last year, however, was a more favorable one for quartz mining, and the prospect is still growing brighter. No doubt much money has been lost for the want of proper knowledge on the part of those engaged in quartz mills, but experience will teach them, and success, we believe, will yet crown their efforts. If the California quartz is as rich in gold as is asserted, surely quartz mining will ultimately pay well, if properly managed. It does so in other parts of the world. Why not in California?

Our correspondent has given us information respecting the late depreciation in the character of certain articles sent to California, and those which are much required in that State. We have directed the attention of the manufacturers of such goods or wares to the subject, with the express object in view of giving them correct information, in order that they may hereafter—for their own benefit, as well as that of the people of California—change their miserable policy, and make and send better goods to their Californian customers.

Americans Raising Sunken Vessels.

Our countrymen have long been distinguished for raising sunken vessels, and for submarine feats in general. A Boston carpenter, prior to the Revolution, made an independent fortune, and at last received the order of knighthood in England, for raising great treasures from some sunken Spanish galleons. A few years since, American submarine divers, after repeated failures by Englishmen, removed the hull of the steam frigate *Missouri*, which was sunk at the mouth of the harbor of Gibraltar. Their character stands very high for marine engineering, and an evidence of this fact is found in their employment by the Russian government, to raise the ships which were sunk at Sevastopol during the famous siege of that city. We understand that the contract was made with Col. J. E. Gowan, of Boston, who achieved so much distinction at Gibraltar, and he has departed with a large corps of Americans to carry out his engagements with Russia. Apparatus has been sent from Philadelphia and Boston to Sevastopol to conduct the operations, and our countrymen are confident that they will succeed in raising the sunken fleet, which amounts to one hundred vessels—large and small—some of these being 84 gun ships. The undertaking is one of great magnitude—the greatest of the kind ever attempted—and will be the means, it is believed, of making the fortunes of the principal persons engaged in the enterprise—Col. Gowan, and those whom he has associated with him.

In raising a sunken vessel, submarine armor and the diving bell are employed to make explorations under water, in order to enclose the vessel so as to shut out the surrounding water. The water is then pumped out of the sunken vessel, and *camels* are afterwards employed to raise it up—float it. Compact steam engines and centrifugal hydraulic pumps have been sent to Sevastopol, and also some india rubber camels. Marine *camels* were first employed by the Dutch in Holland about 1690. They consist of two similar hollow water-tight wooden vessels, so constructed that they can be applied on each side of the hull of a ship. On the deck of each, windlasses are attached which work the chains passed under the keel of the vessel to be raised. When the camel is employed, the water is allowed to fill each half of it; and when the ship is firmly attached to it, the water is pumped out, and the buoyancy of the hollow vessels raises it up. A ship drawing fifteen feet water could by this means be made to draw only eleven feet, and the largest man-of-war then in the Dutch service made to pass the sand-banks of the Zuyder Zee.

It has been related that during the war in 1812, some vessels were built in Buffalo harbor for action on the upper lakes, and being of too great draft to cross the bar, they were actually lifted over it with camels, and did good service afterwards under Commodore Perry.

Telegraph to the Pacific.

In the number of the Scientific American for June 14th, 1856, (page 317), we directed attention to the necessity of having our telegraph lines better constructed and more perfectly insulated than they now are. The article arrested the attention of S. P. Gilbert, of Horicon, Wis., who has, through the *Argus* of that place, referred to it, and has suggested the following method of constructing a telegraph line, which has been proposed to be run between this city and San Francisco. He says:—

"The difficulty of keeping a Pacific telegraph line of several thousand miles in length across the western prairies, the uninhabited regions of New Mexico and the Rocky Mountains to California, in working order, suggested to my mind the following plan. The principal points are these:

First—The telegraph cable to be laid in Kyanized wood tubing, at a depth of say two feet under ground.

Second—The cable to be coated with gutta percha the entire length, like the Atlantic line.

Third—The channel of the cable to be dug by a locomotive steam ditcher (of some sort) two feet deep, and four or five inches wide.

By this plan the line will be perfectly *insulated* the entire length, and *free from atmospheric electricity*, from falling trees, from Indian depredations, from prairie fires, and heavy gales. Instead of being strung up, Haman like, fifty cubits high, it will be below the reach of accidents, and at rest in the tube; not subject to tension by its own specific gravity, or the pressure of winds."

This plan of a Pacific Telegraph is worthy of consideration. The kyanized wooden tubes may also be saturated with wax varnish, and thus rendered fully as good non-conductors as the gutta percha coating of the wires. The great objection to this method of constructing a new telegraph line, is its vast expense, in comparison with elevated wires; but when constructed, the cost for keeping it in repair would be much less.

Caribbean and Peruvian Guano.

In the Chemical Department of Brown University, Providence, R. I., some Caribbean Sea guano has been analyzed by Professor A. P. Hill, and found to contain the following ingredients:—Phosphoric acid, 13·50 per cent.; organic substances, ·21; lime, 19·10; alkalies, 2; water, ·40. Only 2 per cent. of ammonia producing matter was present. Some carbonic and nitric acid, with a little aluminum, were present. The phosphoric acid was in the form of insoluble phosphate of lime. This is a very inferior guano, and our farmers shouldbe made aware of it. The two most valuable constituents of guano are ammonia and phosphoric acid. The genuine Peruvian contains 17 per cent. of ammonia, and 15 per cent. of phosphoric acid, but the former is seven times dearer than the latter. The "Caribbean Sea guano," at twelve dollars per tun, is dearer than Peruvian guano at sixty dollars per tun. This information we have found in the transactions of the Rhode Island Society for the Encouragement of Domestic Industry.

How to Launch the Great Eastern.

The preparations for launching this monster ship are rapidly progressing, and it is expected that she will be ready for launching early in July. The plan intended to be adopted is thus described by Mr. Brunel. In constructing the foundation of the floor on which the ship is being built, provision is made at two points, to insure sufficient strength to bear the whole weight of the ship when completed. At those two points, when the launching has to be effected, two cradles will be introduced, and the entire fabric will be lowered down gradually to low water mark, whence on the ensuing tide, the vessel will be floated off.

The dock is to be excavated, and the leviathan ship is to be dropped gently down into the water. How this monster vessel was to be launched in such a narrow river as the Thames, has been the frequent theme of conversation among nautical architects and engineers. Brunel himself has solved the problem satisfactorily.

Photographic Improvement.

Wm. Mayall, of London, some time since obtained a patent for a composition of barytes and albumen, which the English photographic journals speak of in glowing terms. By the substitution of paper forthe metallic plate the advantage that was gained in perspicuity was lost in delicacy. Paper, from its fibrous nature, absorbs the middle tints; and hence in the case of colored works, the artist was forced, by stippling, to supply the defects of the photographer. The chemical properties of ivory render that substance inapplicable to the purposes of the art. But Mayall's compound has the appearance and close texture of ivory, without any of the resisting qualities. The artist executes a work equal in finish to the old ivory miniature, endowed with all the truthfulness proper to photography.

The last number of *Harper's Weekly* illustrates the laying down of the Atlantic Telegraph cable. This is taking time by the forelock, like the account given of an execution before the victim is thrown off the scaffold.

Headache Snuff.

The London *Medical Circular* gives the following formula for a cephalic snuff, which is perhaps equal, if not superior, to any of the snuffs sold for catarrh, sick headache, &c.:—Take Lundyfoot and blackrappee, of each half an ounce; powdered asarabacca, one to two drachms; water, ten or twelve drops; mix well, press the mixture tightly into a small bottle or tin canister, and allow it to repose for a few days. For use, throw a spoonful or two on a piece of writing paper, crush the lumps with the tip of the finger or a knife, and then place it in the snuffbox. A Tonquin bean kept in the box with it is a great improvement. One to three pinches to be taken daily in headache, &c. It is also excellent as an "eye snuff." Asarabacca is a plant found native from Canada to the extremeties of North Carolina, yet it is difficult to obtain from druggists. Its leaves dried and reduced to powder have long been used for cephalic snuff. A few grains taken at night produce a watery discharge, which, in many cases, remove headache, opthalmia, and some paralytic complaints.

Fine Cotton.

A bale of Sea Island, from Charleston S. C., recently sold in this city for $1·25 per pound. It was purchased to go to Brussels, for the manufacture of lace. It is stated to be the finest cotton ever raised, and capable of making yarn as fine as No. 900. An idea of the quality of this cotton may be obtained from examining common cotton cloth at about twelve cents per yard, which is generally made from No. 36 yarn.

Sugar.

This sweet necessary of life still keeps up in price, but some are of opinion it must come down, because it is asserted that there is a large supply in the market.

The maple sugar product this spring has been large, the season was propitious and it is calculated by statistics received from various districts that the amount will not fall much short of seventy million pounds.

The Comet.

Von Littnow, the great German astronomer, writes to the Vienna *Gazette* that there is still a faint possibility that the great comet of 1556, referred to on our last page, may return, but that its "orbit is so situated that it cannot approach the earth within some five millions of miles." He rates M. Babbinet severely for exciting an alarm of the subject.

New Atlantic Telegraph Company.

It is proposed in England to form a new company for a telegraph across the Atlantic, with one relay station at the Azores. The cable is to be laid from the Land's End to Flores in the Azores, where there is to be a station with the relay batteries. From thence another cable is to be laid, either to Halifax or this city.

Screw versus Paddle.

The Peninsular and Oriental Company's paddle-wheel steamer Ripon is to be turned into a full powered screw steamer. She has been many years employed in the Alexandrian mail service, and was employed in the transport service during the Russian war.

The Rise in the Price of Diamonds.

This prince of gems, though merely a condensed form of carbon, is everywhere the accompaniment and the representative of wealth Of late there has been an immensely increased demand for them, and an extraordinary rise in value, amounting within the past year, it is stated, to twenty-five per cent.

Detection of Cotton in Woolen Fabrics.

Dr. Overbeck states that when the fabric is three times immersed in a solution of alloxantin in ten parts water, pressed and dried, then exposed to dry ammonia and washed with water, the wool fibres are dyed carmine color, while the cotton fibres remain colorless.

In the city of Philadelphia paper hangings are manufactured annually to the extent of 1,500 tuns in weight, which amount to 3,240,000 rolls of 30,000,000 yards.