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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The Troy meeting commenced on the 17th of August, and closed on the 24th. It was a gratifying success; the proceedings were harmonious, dignified, and vigorous; many of the papers read are valuable.

The attendance was respectable, and all parts of the country were represented. But many familiar faces were not to be seen. Death has made sad havoc among the old men. Henry is in Europe; Agassiz and Peirce were kept away by sickness. There was, however, a crowd of earnest young men, of whom we name as examples the Salem naturalists, and Cope, Pickering, Hitchcock, Young, and Storer, who are ready (and who will, perhaps, some day be able) to take their places. Of course there were clap-trap, private axgrinding, and speeches for Buncombe, and yet probably no more than at former meetings.

The Association is indeed one of the most important of living agencies for the advancement of science in America. Its list of members comprises nearly all the American names which are distinguished in scientific literature. It brings together harmoniously the members of all our other learned bodies, and thus it represents the science of the whole continent. The Association is a national institution, and it asks for the sympathy of all the friends of progress.

It is to us a very gratifying fact that the Association is respected and honored by the people at large. At the present time there is no other annual peripatetic convention which is so much invited, prepared for, talked about, and hospitably entertained; and all this notwithstanding its proceedings are as unintelligible as Greek to most of its kind friends. No one can see this and believe that America is justly reproached with neglect or distaste for scientific pursuits. If America is behind other nations in scientific advancement it cannot be because our scientific laborers need the stimulus of sympathy and appreciation.

As an example of how kindly the Association is treated we may mention some interesting facts about the Troy meeting. The citizens of Troy contributed $10,000 to defray the expenses of the entertainment. Hotels, private houses, and public buildings were freely opened for the use of the Association, and the members were honored as if they were guests of the whole population. Elegant receptions were given at the houses of the Mayor and of other leading citizens. The Association in a body, at the invitation of the Troy local committee, went in a special train to enjoy the elegancies of Saratoga, and, at the invitation of the State Department of Education and in a steamer chartered by citizens of Albany, visited the Capital.

The Association is, then, a very respectable society, and it receives the hearty homage of the people. The people surely contribute fully their part in the cause of science. Should not their liberality and hospitality be a stimulus to still greater exertion on the part of the Association? Does the Association owe a duty to the public, and is that duty well attended to?

Because we respect the Association so highly, we desire to see it improved if possible, and it is for the same reason we see its defects. In some respects it is better than it was before the war; it is more in earnest, and it has more workers; and in other respects it has sadly changed. There are lately more trashy papers, and especially papers which are made big with padding from encyclopedias and old almanacs. Perhaps it is impracticable to prevent such papers being offered, but there surely may be some way of keeping them out of the printed transactions. The printing of some of these papers recently, has made the Association an object of ridicule all over the world. Why not try to prevent such a thing happening again. A little quackery, boring, or axgrinding, which lasts only during a meeting, is perhaps best to be endured, but print it in the transactions and it is a disgrace for all time.

THE ST. LOUIS BRIDGE.

The bridge now in process of erection across the Mississippi at St. Louis, is one of the wonders of the age. It is to be a tubular, cast steel, arch bridge, supported by the abutments and two piers; the latter are 515 feet apart, and 497 feet each from its nearest abutment, making three spans of about 500 feet each. Its greatest span is the same as that of the Kuilenburg bridge over the Leck, an arm of the Rhine, in Holland. Thomas Telford's suspension bridge across the Menai Straits, in the northwestern part of Wales, has a span of 570 feet. The Victoria tubular iron bridge of Montreal, exceeds this greatly in length, being 6,600 feet (1¼ miles), but it rests upon 24 piers, and its spans are only 275 feet. The Suspension Bridge at Niagara spans 821 feet, and is 245 feet above the water. The East River Bridge will span 1,600 feet, at a hight midway of 130 feet.

But the novel method of the construction of this bridge in some particulars, renders it especially worthy of note. The piers are sunk in the following manner: The masonry is commenced at the surface of the water, upon an inverted elliptical-shaped caisson, 80 feet long by 40 wide—the dimensions of the pier. This is closed at the top and open at the bottom, with its lower part larger than the upper, to facilitate its passage through the sand after it reaches the bed of the river. It would be very much like building the pier upon the bottom of an inverted wash-tub, of the same size and shape as the caisson. The caisson is filled with air, like a diving bell, and the mass of masonry which constantly accumulates upon it is borne up by the confined air, and, as the caisson descends, the pressure of the water condenses the air so that the water rises considerably within it, just as when an inverted tumbler is pressed down into a vessel of water. To prevent this and give greater buoyancy to the mass, air is forced into the caisson through a vertical passage in the masonry by a powerful steam pump. The caisson with its superstructure of masonry must be sunk to the rock bed of the river, because the deposit of sand above it—which at one pier is 79 feet deep—in times of flood and freshet, is scoured away to a great depth, if not to the rock itself. When the caisson reaches the river bed, the sand within it must be removed. This is done by a current of water that is forced down, by a tube, through the masonry, into the caisson and then up again to the surface; and as it takes its upward course the sand is shoveled into it through a contrivance for the purpose, and carried to the surface in the form of muddy water by the ascending current and poured out into the river. Here it causes a bank of sand to accumulate which sometimes rises to the surface of the water.

Workmen are needed in this caisson of condensed air, below the bed of the river, to shovel the sand and do other necessary work. These pass down by means of a circular stairway in another vertical passage—there being five in all—through the center of the pier, and are admitted into the caisson through an air-lock or chamber, with an air-tight door on the upper and lower sides. Into this chamber, after the men have passed the upper door, the condensed air is gradually admitted till it is as dense in the lock as in the caisson below. They experience here very peculiar sensations, among which are, a burdensome pressure upon the whole system and especially upon the drum of the ear, and a great increase of heat in the system, because condensed air has a smaller capacity for heat than in its ordinary state. In passing out, of course, the order of proceeding and of sensation is reversed. The workmen in the caisson are exposed to considerable danger from the unusual atmospheric pressure, which sometimes amounts to two or three atmospheres. Several have died from the injuries here received. When the caisson has reached the bed rock, the rock which "dips" towards the Illinois shore, is leveled off with concrete; then the caisson and the passages in the pier are filled with concrete, and the *solid pier* rests upon a foundation of limestone rock. Two piers have been sunk in this manner and are now above the surface of the water; the last will be similarly sunk this fall.

The manner of testing the steel which will form the arches of the superstructure is also very interesting. This is done by means of a massive machine which acts by hydrostatic power. By its use the power of the steel to resist both compression and tension is accurately determined. It is a well known principle of hydrostatics, that a given pressure upon one square inch of liquid surface causes equal pressure upon *every* inch of that surface. This instrument is so constructed that the surface where the power is exerted is to the surface of the piston where the power is applied as 1 to 100; hence the exertion of one pound of power produces a compressing or tensile force of 100 pounds. Any change in the length of the steel to be tested, even to the 20,000th of an inch, it is said can be detected. This change is indicated by a mirror, which revolves as the piston moves, and which reflects light from a graduated arc, 25 feet distant, to a telescope situated in the arc. Through this the observer looks and records the continued changes of the steel by the varied pressure to which it is subjected. Every piece is tested until its limit of elasticity is reached, that is, until it has become so compressed that it will not spring back when the pressure is removed. It may be subjected to a force of 100 tuns.

A WANT IN LOCOMOTIVE ENGINEERING.

We this week saw in an English paper a controversy in regard to the speed of a train in rounding a curve, it being charged that a "driver," as our British cousins style a man who runs a locomotive, was in the habit of taking a particular train around a curve above the standard speed of forty miles an hour, for which the curves are calculated, thus endangering the safety of passengers.

This question of speed always comes up when accidents occur, and as yet no adequate means have been adopted whereby the precise speed of a locomotive engine at any given point of its running can be so recorded as to settle such questions beyond dispute.

Such an instrument would be a boon to engineers who run locomotives, and who are, in our opinion, much more often unjustly than justly blamed for undue and improper speed on the occasion of accidents.

The problem is not a difficult one to solve. We once, as a matter of personal amusement, designed an instrument on the principle of the ball governor which would do it perfectly. The balls, instead of being hung on pivoted arms, slid out on horizontal arms against scale-springs of definite power, as they revolved by motion derived from one of the truck wheels. In doing this they raised a tracing point along the side of a vertical cylinder revolving by clock-work, making a mark of given hight for a given speed, rising with increased speed, and falling as the velocity of the locomotive decreased. Vertical lines on the surface of the cylinder represented hours and five minute divisions, and the position of the pointer between these lines might easily be computed for any less time than five minutes.

The general principle of this device is simply the conversion of rotary motion into pressure, and taking a diagram of the pressure at different points of motion, as is done with the steam indicator.

Doubtless inventors might greatly simplify this device, or it may be, adopting a different principle, succeed in devising something much better.

In these days of accurate measurement in everything pertaining to the use of steam it seems a little singular that a matter of such importance, in a scientific as well as a legal point of view, should have been so long overlooked.

In legal actions arising from accidents on railways the corporations are always placed at a disadvantage before juries, the latter always being inclined to sympathize with individuals rather than with the companies, who, it is thought, can better afford to pay, than the individual can afford to fail to recover the damages he claims.

The witnesses, also, are, many of them, totally incompetent to judge of the question of speed, and are mostly liable to overrate it. The adoption of such an instrument as we have described, or some other calculated to effect the same object, would obviate all disagreements of this character, and thus prove valuable to the corporations, as well as to those who hold the responsible posts of engineers.

THE SOUTHERN DEMAND FOR MACHINERY.

We find in the columns of the Kaufman (Texas) *Star*, an article calling attention to the changed condition of the South, and the pressing need of employing machinery to make up the existing deficiency in labor. That the minds of the most enterprising of the people are fully aroused to this need is evident from the many communications we receive in relation to it, and also from the fact that a very respectable beginning in manufacturing has been already made in some of the States.

The article alluded to gives some facts relative to the section of the State—Kaufman County—in which the journal above named is published.

These facts, as significant of the great want of machinery in various parts of the South, and that immense development which may be expected from its introduction, will be of interest to our mechanical readers, especially those engaged in the manufacture of wood-working machines.

This section is, like many other Southern sections, well stocked with valuable timber. The Bois d'arc fork of the Trinity River passes through the county, and the bottom lands constitute one vast forest of bois d'arc trees, two miles wide, and fifty miles long. These trees here attain to a diameter of from two to three feet.

The journal referred to states that this timber is the most durable in the world. It says: "We will venture the assertion that no living man ever saw the symptom of decay in this remarkable timber. The running gear of a wagon that has been in constant use over twenty years, is before us as we write this article, and yet the wood works are, to all appear ance, as sound as when turned out of the shop. There is an oil in the wood which fills up the pores and prevents either air or water from affecting it. No one can tell how long it will last, even when exposed to the weather. A reward might be offered in vain, for a decayed particle of this timber. It is not affected by the rays of the sun, and hence it never shrinks. A carriage wheel made of bois d'arc will run until the tire is worn out, without having to set it. But the greatest evidence of the superior quality of this wood, for wagons and carriages, may be estimated from the fact that a rough home-made bois d'arc wagon is worth about double the best Northern-made wagon."

To make by hand twenty-four spokes of this timber has been considered a fair day's work. Four wagon hubs were also considered a day's work.

There are no doubt plenty of machines that will turn out these spokes at an average rate of one thousand per day, and which can be afforded for less than the cost of one man's labor for a single year. We are certain that machines are made which will turn out also from three to four hundred hubs of this timber per day. Indeed, the Kaufman *Star* informs us that a Northern firm offer to furnish spoke machines capable of making from twelve hundred to fifteen hundred spokes per day, for $250 each, and machines at the same price that shall make from four hundred to four hundred and fifty hubs per day, each requiring only one attendant, and the two doing more work than one hundred men could do without machinery.

It is easy to see how the introduction of such machinery into the region described would enable these hubs and spokes to be made for shipment to all parts of the country at a remunerative price, or even to be exported.

But Texas is not alone in the possession of timber treasures. Virginia, Georgia, North and South Carolina, and many other parts of the Southern States also can boast of very large tracts of valuable timber land, the most of which could be made to yield immense returns by the introduction of such machinery as has been for years employed in the timbered sections of the North. The cost of transportation after the raw material has been made into forms of increased value, is not materially more than for the shipment of the crude lumber, while it pays far better.

The manufacture of tubs, pails, chairs, sashes and blinds, and the great variety of wares which have made New England famous as a wood-working section, might, without doubt, be most advantageously carried on in the South, and our information of some few factories of this kind, which are now running in Southern localities is such as to greatly encourage the establishment of others.

PARAFFINE INDUSTRY.

In the Paris Exhibition of 1855 was shown a block of paraffine, with a few candles. Few visitors understood what it was, and no one could have anticipated the great extent to which the trade in this article would subsequently be pushed. The manufacture of paraffine candles has become an important industry, and there are single establishments in Germany capable of turning out 240,000 candles daily. In England and France the industry has reached vast proportions, and in this country it has no mean significance. Wagner estimates the production of paraffine in Prussia alone for the year 1870 at 11,000,000 pounds. The brown coal of Germany and the bog-head of Scotland and the Rangoon petroleum are particularly well adapted to the production of paraffine, while Bohemian and Austrian and other continental coals yield a very small quantity. The uses of paraffine are many. As its melting point is low it is proposed to employ it for the preservation of meat. Meat several times immersed in a bath of melted paraffine will keep for a long time, and when wanted it is only necessary to melt off the adhering wax-like coating to prepare it for cooking. For stoppers to acid bottles, to coat paper for photographic and other uses, as a lubricator, for candles, as burning oil, to coat pills, in the refinery of alcohol and spirits, paraffine now finds ready use. It has also been employed for the adulteration of chocolate and candies; for the preservation of railroad timber; to saturate filter paper for certain purposes; to coat the sides of vessels in which hydrofluoric acid was to be kept; to preserve fruit from decay; for oil baths of constant temperature; to prevent the oxidation of the protoxides; to render fabrics waterproof; as a substitute for wax in the manufacture of matches; as a disinfecting agent; as a varnish for leather, and for many other useful purposes. There are very few bodies that can attack or in any way decompose paraffine, and hence its great value in many chemical processes. Its use is likely to be further extended the more we become familiar with its properties, and it appears destined to assume an important position among our chemical industries.

CRAIK'S PRACTICAL AMERICAN MILLWRIGHT AND MILLER.

In our column of "New Books and Publications" will be found the notice of a book under the above title which deserves more than the ordinary notice; not that it has no deficiencies, or that it is characterized by scientific style and method, but that it embodies the results of a long and varied experience in the construction of various kinds of mills, an experience all the more valuable, as the author gives evidence in his pages that he is one of the comparatively rare individuals who can observe with discrimination, and draw accurate inferences. Perhaps no department of engineering demands greater fertility of resources than mill construction. Hardly any two mills are alike in circumstances of position, available power, and character of soil, upon which their foundations must be placed. Dams, also, require endless variety of detail according to the peculiarities of the beds of streams upon which they are erected. Varying heads of water, also, introduce further complications. In all of these particulars, and in many others, not specified, no amount of theoretical information can supply the lack of experimental knowledge; and next to such knowledge, personally acquired in practice, ranks that tersely and plainly communicated by such a man as the author of this work. The aim has not been to produce a scientific treatise. The work is rather an embodiment of practical results and tests of the various kinds of mill machinery under a wide range of circumstances, some of them "offering considerable difficulties and calling for great diversity of practice." The six chapters on water wheels are alone worth the price of the book. They however comprise only a comparatively small portion of the work, which is a large octavo, filled with practical information upon nearly every topic connected with the subject of mill building and running. The subjects of wind mills, their construction and adaptation to our Western prairie country, is of great interest, and is treated at length. The style of the work is such as any mechanic may understand, all algebraic formula being avoided, and the rules being simplified to the utmost.

Mr. Craik makes a statement in his discussion of the transmission of motive power, which is not correct. He says, "probably the greatest distance power was ever carried was by a combination of jointed rods used to connect a series of pumps with the water wheels which drove them, at the celebrated waterworks of Marli, near Paris, in France. Eighty-two of these pumps were placed more than three hundred feet above the power which drove them, and *half a mile away*." In Prof. Barnard's report upon the Paris Universal Exposition, on page 132, is an account of the successful transmission of power by Hirn's telodynamic cable, to a distance of nearly three and one eighth miles, at the mines of Falun, in Sweden. A short extract upon this subject, from the report alluded to, was published in our last issue.

But such an error as this is of little importance when compared to the great practical value of the work. In another part of the paper will be found an extract which is a fair sample of the plain, comprehensive character of the book, which we can confidently recommend to all who are interested in mill building and milling.

THE MILLENNIUM, OR SOMETHING LIKE IT.

We have, in another column, noticed the fact that the American Association for the Advancement of Science is forced occasionally to listen to papers containing nothing but twaddle, and that this twaddle, printed, redounds not to the honor of the Association at home or abroad.

Such, however, was not the character of the paper read by the well known scientist, thinker, and inventor of the "panatechner," Clinton Roosevelt, of this city. His paper discussed the question, "Ought a true science of national wealth to be excluded from the curriculum of the American Association for the Advancement of Science?"

If we may judge from the character of many of the papers read, the question as to whether anything should be excluded seems superfluous. But a superfluous question is often a splendid thing to string words upon, especially if in the stringing, the elegancies and accuracies of congruity, pertinence, terseness, perspicuity, and logic, are not considered essential.

To discuss the momentous question propounded by Mr. Roosevelt, was by no means a difficult task to one so rich in ideas, and so fertile and felicitous in diction. We were not present at the reading of his paper, but the report of it, published in the *Times*, gives evidence of its brilliant and exhaustive character. The assembled *savans* no doubt gave full expression to their delight when Mr. Roosevelt finished his paper. Being a polite set of men, they would not be likely to interrupt him by applause during the reading, however much the fullness of emotion might struggle for utterance.

Mr. Roosevelt was willing to allow, according to the motion of Professor Agassiz, made at the last annual meeting of the Association, at Salem., Mass., that the system of political economy, as taught in our colleges and universities, embracing only production, distribution, exchange, and consumption of articles having exchangeable values, is insufficient to embrace a true science of national wealth. In his view the science of national wealth consists of three orders and nine genera, without counting the species, varieties, etc.

Surely the *savans* cannot refuse to seize upon a subject involving three orders, nine genera, and an indefinite number of species. Such a field as this to enter in upon and take possession of! A veritable scientific Caanan, flowing with philosophic milk and speculative honey, 'and bearing choice fruits of endless discussion and debate! Surely, they each and all exclaimed in their hearts (being too polite to speak in meeting), "*Here's* richness! Here's *Richness!*"

According to Mr. Roosevelt, "the reason why all systems of government by reason alone, have failed hitherto to make peace on earth and good will to all, is that the will of man is not governed or to be governed by the greatest motives, but by the same general law that governs in physics; thus accepting the science of government as the science of motive powers. Motive powers are of two kinds, metaphysical and physical. And whereas, in physics motive powers operate directly as the substance, and inversely as the squares of the distances in space, in metaphysics motives govern the will of man in times. Thus men who verily believe in eternal rewards and punishments still give way to the present temptations, and fear little practically, until death or the instrument of punishment comes near. Thus, as in the State of Wisconsin, the La Crosse and Milwaukee Railroad Company bribed all at once the Legislature, the Judiciary, and the Executive, and left the people as so many sheep without a shepherd; so has it always been."

As a specimen of much in little, we commend this passage as a model for very young students of English composition. Much words and little sense is a style that pays well in modern literature, as most contributors to our magazine literature are now paid by the column.

"The same things, which, if left alone, are destructive to life and happiness, if removed, become beneficial in their proper places; as the offal of cities left to find its own level in the lowest places, sends forth malaria, disease, and death, if transported to the surrounding country and covered in the soil produces flowers, fruits, and cereals for the support of life and happiness; that there is a law of Providence under the higher law of absolute necessity in the nature of things; that what a man or nation will not labor or fight to gain and guard when gained, shal' not be enjoyed."

This passage is copied verbatim from the *Times'* report. It doubtless means something, and if it were not too late, we would suggest that the Association should appoint a committee to ascertain the meaning, correct the grammar, and report at their next meeting whether it should be admitted into the curriculum of the Association, or not.

At the same time, Mr. Roosevelt's orders, genera, and species might also be distributed among the members—a priceless boon, since, according to that gifted thinker, they comprise "all that man can reasonably desire on earth, as useful or delightful to him"—a millennium, or something like it.

Mr. Roosevelt is especially hard on the free-traders, putting them into the same category with "free-lovers" and "free-booters." We don't see how they are going to stand this violent attack, which, following Mr. Greeley's *Tribune* essays on political economy, is, like charging, after a battle, upon the dead and wounded—to say the least—ungallant of Mr. R. He might, indeed he might, have let the free-traders alone, and confined his remarks to the physical and metaphysical motors which run railways and legislatures. How easy it would have been to have pilloried Prince Erie on his metaphysical motors, Fisk's Opera House, Camp Jay Gould, and an unlimited grab from the pockets of the Erie stockholders, not to mention Fisk himself, the most metaphysical motor on this continent.

But we reluctlantly leave Mr. Roosevelt's paper, from the reading of which we have become better, wiser, and more able to grapple with the hard problems of social science. When in due time the transactions of the American Association for the Advancement of Science shall appear, it will be demonstrated to the world that he who advanced it most, during the year 1870, was Clinton Roosevelt, Scientist, Thinker, and Inventor of the Panatechner.

THE ANALYSIS OF MILK.

Dr. Chandler, of Columbia College, has recently been paying attention to the analysis of milk in connection with an examination of the milk vended in this city. The results of his examination having been published, the method adopted for the analysis of milk in so far as its adulteration by water is concerned, has met with criticism from the pen of Dr. A. E. Davies, in the *Chemical News*. As the short article of Dr. Davies not only gives the method employed by Dr. Chandler to ascertain the amount of adulteration by water, and the reasons why it is considered defective, but adds a method considered much more exact, we copy the whole of it. The method is one that can be easily and generally applied, and will be found of use in the numerous cheese factories established during the past few years in this country.

Dr. Davies says:

"As to water being the only substance which is employed for adulterating milk, I perfectly agree with Dr. Chandler. Carbonate of soda and nitrate of potash are occasionally added, but only rarely, and in very small quantity. I have never met with chalk, sheep's brains, mucilage, sugar, etc., in any sample which I have analyzed.

"Since water, then, appears to be practically the only substance fraudulently added to milk, it is a matter of the greatest importance that we should be able to detect the presence of added water, and to estimate, at least approximately, its amount. This (at least the presence of added water) Dr. Chandler considers may be done by taking the specific gravity of the milk and estimating the water it contains by evaporating a weighed sample to dryness. 'Pure milk,' he says, 'varies in specific gravity from 1·023 to 1·032, water being represented by 1·000.' And, again, 'It is found that good milk generally has a specific gravity of from 1·029 to 1·032. In testing milk, the lower number is selected as a fair gravity for pure milk; and whenever the gravity falls much below this the milk may be considered as containing an excess of water, and consequently poor in quality or adulterated.'

"Now, according to my experiments, the specific gravity cannot be at all relied on as a test either of freedom from adulteration or of natural richness. I give a single example. A sample of milk of known genuineness recently analyzed by me gave the following results: Casein, 4·26; fat 6·26; sugar, 5·13; salts, 0·60; water, 83·75; cream (by the lactometer), 17 per cent; specific gravity, 1·0246. It was, therefore, a very excellent sample, and rich in all the solid constituents of milk, especially butter, but had it been judged by its specific gravity, it would have been put down as of very inferior quality. Besides, even supposing the specific gravity to be a reliable test of quality, it gives us no indication as to whether the milk is naturally poor or has been rendered so by the addition of water, and the test, in my opinion, is therefore worthless.

"As to the estimation of the amount of water by evaporation, Dr. Chandler says: 'A perfectly reliable method, though more laborious, is to actually determine the percentage of water in the milk, by evaporating a weighed quantity and carefully drying the residue at 212° Fah. If a milk loses more than 88 per cent of water, leaving less than 12 per cent of solids, it may safely be pronounced to be adulterated.'

"From this view, I totally dissent; the presence of 88 per cent of water is an indication of inferior quality, but is certainly no indication whatever that water has been purposely added. In milk of known purity, examined by Dr. Voelcker, as much as 90·70 per cent of water was found; and this alone shows the untrustworthiness of Dr. Chandler's test—at least, as far as it refers to added water.