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Contents:

(Illustrated articles are marked with an asterisk.)

Table listing various articles such as 'Improved Cotton Press', 'Popular Errors in regard to the Patch', 'Nitro-glycerin Explosions', etc., with corresponding page numbers.

THE NEW COMMISSIONER OF PATENTS.

The President has appointed GENERAL MORTIMER D. LEGGETT, of Zanesville, Ohio, U. S. Commissioner of Patents. He will enter upon his duties immediately upon being confirmed by the Senate.

THE PROPOSED FAIR OF THE AMERICAN INSTITUTE IN 1876.

The proposition to hold a grand International Exhibition in New York city, under the auspices of the American Institute, in 1876, on the occasion of the centennial celebration of the birth of our Republic, has long been entertained by the Board of Management.

The occasion selected for this grand project is very appropriate, and must at once challenge the support and insure the sympathies of all patriotic citizens. We hope that something worthy of the country, and in keeping with the high reputation of the Institute, will be accomplished.

We had occasion, recently, to speak of the importance of scientific administration and to deplore the lack of this potential energy in the public and private affairs of our country; and we are forcibly reminded of this topic when we contemplate the immense undertaking the Institute has proposed to itself.

In a circular, prepared no doubt for the information and instruction of Members of Congress, entitled, "The American Institute and its Mission," we find an interesting account of what the society has accomplished towards the encouragement of American industry.

These fairs had small beginnings but they have shown a steady growth, and the last one was the best of all. Considering the limited means at their disposal and the want of a suitable building in which to hold their exhibitions, it cannot be denied that the managers have produced results very creditable to their administration and full of encouragement for the future.

The circular speaks of the valuable scientific library of ten thousand volumes, to which the members of the Institute have free access; and of the four clubs now in full operation, the proceedings of which have an enormous circulation throughout all parts of the Union.

whose proceedings are so extensively read, and in this respect it challenges competition.

We understand that the Institute has in real estate and government securities property of the value of three hundred thousand dollars, and this amount is now steadily increasing from the proceeds of the annual fairs and the interest on bonds.

The hundredth anniversary of our independence can be celebrated by the Institute without an appeal to Congress. It is the obvious duty of the citizens of New York to put up a suitable building for annual fairs and permanent libraries and collections. It is an unspeakable disgrace to us that such an edifice has not long since been constructed and filled with models of machinery and specimens illustrating the material wealth of our country.

The Paris Exposition of 1867 was the last and best of its kind. We shall never see anything like it again. The building covered forty acres of land; the park outside embraced eighty acres more, and there was an island of fifty acres in the river Seine set apart for agricultural implements.

"In the hands of the long-tried and experienced management of the Institute, the World's Fair of 1876 will, without doubt, eclipse those of the Old World." The committee who have the matter in charge would do well to follow the example of the English Commissioners, many of whom had served in 1851 and 1862, who, when the question of another World's Fair, in 1872, was proposed, unanimously decided that such a project, in the present age of industrial progress and invention, was impossible.

The true plan for the exhibition managers of the American Institute, is, therefore, to profit by the teachings of the English Commissioners, and to abandon the idea of an International World's Fair. They will be much more likely to obtain money from our citizens when they ask for a million dollars, than when they come before the public with plans involving an outlay almost as great as the cost of the Pacific Railroad.

MECHANICAL POWER.

We have often been obliged to correct errors in thought arising from the fact that many of the words used in scientific discussion still do double duty, retaining not only the meaning formerly attached to them in the times when knowledge was comparatively imperfect, but being also used to express ideas obtained through more modern research.

The term "power" is such a word, and perhaps no other in the language leads to greater confusion in thought among those who have not made the sciences of physics and mechanics special studies. It is with the intent to give clearer notions of the proper use of this term that the present article has been written.

In its primary philosophical significance the word power means ability to do any act of volition. In this sense the idea of power is connected with that of will, but the original meaning has been extended to the conditions of change in things animate as well as inanimate. When the conditions necessary for a given effect exist in connection with any body or mass of matter, we say that body has the power to produce the effect.

In the mechanical or dynamical sense, however, the word change in the definition of the term power is limited wholly to change of position in masses, or mass-motion, and the heat produced by friction. When we speak of overcoming resistance we are only using an expression which means the production of increased motion in masses of matter, or portions of masses, and the molecular motion of heat caused by friction.

In a static sense the word power is popularly used to express the "tendency to produce motion;" or, in other words, it is used as synonymous with force in ordinary language.

In mechanics, even by some eminent writers, the term is used not only in a general sense as ability to produce motion, or to perform work, but, in a specific sense, as ability to do some particular work under particular circumstances. In this sense it is used in the old saying, that "what is lost in speed is gained in power, and what is gained in speed is lost

in power." This is only true when the word power is used in a special sense. In this sense an engine that would pump a ton of water to the height of fifty feet in one hour, by a succession of impulses, might be entirely insufficient to raise it as a mass, unless a train of wheels or other device be employed to "change speed into power." Yet the power of the engine to perform work is the same in both cases, when the term work is understood in its general sense, as measured by the number of foot-pounds of resistance overcome per minute of time.

We think it is much to be regretted that the use of the word "power" is not restricted in mechanics to its dynamical meaning. Its use as a synonym for force is liable to mislead the mind and cause confusion on points of mechanical science requiring the utmost clearness of conception.

The term "mechanical powers," as applied to the elements of machines—the wheel and axle, inclined plane, lever, etc.—is singularly inappropriate, and has been discarded by some of the best writers on mechanics. No one of these elements is a mechanical power, in any just sense of the term. It is only by the addition of other circumstances that they even become instruments for the transmission of power.

The want of clear conceptions of the distinction between the meaning of the term power, when used in its dynamical sense, and the term static force, or pressure, has led to more absurdities than any other error in mechanical science. Some of these absurdities are apparent in the series of articles on "Perpetual Motion," now appearing in this journal.

OBJECT TEACHING AND SCIENCE.

The public are beginning to be awakened to the fact that technical education is the education they require, being in accordance with the conditions of modern civilization; and it is admitted that such technical education must be based upon a foundation of natural knowledge. The principles of the natural sciences must then, for the future, form an essential part of popular education; the only questions are, how far and in what manner are these sciences to be introduced?

Whatever is to be the amount taught, educators are agreed that the first steps in natural science, or, in other words, in systematizing natural knowledge, are to be taken as early as possible. Early impressions are the deepest, and every child before its school days is already an untrained student of nature. The foundations of technical education should, therefore, be laid in the primary school; but whether commenced thus early or not, the method will always be the same. The child must be encouraged and guided in its natural habits of observing, and it must be led to systematize its observations, connecting them together by a chain of reasoning into groups of related ideas. This method is simply that known as "object teaching;" and you may as well try to fly without wings, or to teach geography without maps or globes, as to teach natural science without objects and diagrams. There is not a teacher, now-a-days, but has heard of this object teaching; there are hundreds who have tried to utilize it; there are "colleges" in which it is professedly taught as a system; and yet there seems to be no method applied to the inculcation of natural science more misunderstood than this, and no teaching in our schools, at present, more utterly destitute of good results. Ninety-nine out of a hundred who talk so glibly of object teaching, forget that it is merely a method—a method that has for its end to inculcate knowledge; that this knowledge to be inculcated is the essential part of the lesson; and that a thorough acquaintance with the subject must precede any application of this mere method of instruction. To stand up and give a lesson upon a cat, without knowing the first principles of natural history, is simply to go through a farcical parody; and authorities who have no better conception of the purposes of object teaching than this, set the cart before the horse; or, rather, they never hitch on their should-be-useful animal at all, but ride off upon this hobby, leaving the load of knowledge it was meant to draw standing in the ruts—where it has been standing, as Professor Huxley admirably puts it, ever since the days of ancient Rome.

It has been recently advocated that every public school should be supplied with a collection of objects to illustrate the fundamental facts of natural science. By all means let it be so; but let the first use to which these are put be to instruct the teachers themselves in what they will have to teach. Let them learn what there is in each object of educational value, and what are its worthless characters; let them recognize that no object is complete in itself, but is merely a part of a vast whole, and that their office is to lead the child to recognize its most important relations to other objects. In building up the edifice of knowledge, they must not use every rough stone indiscriminately, but they must teach the little builders to chip off the useless angles of selected pieces, and so shape them that every stone shall, at its proper time, fit into its proper place. If this be not done, the most instructive objects in the world will not raise a single line of substantial structure, but will rest upon the minds of the pupils as an unarranged heap of meaningless facts—facts which will not even be long remembered; and it is as well that they should not be, because utterly useless, being unconsolidated by any cement of reason.

We fear that no better end is attained by, or can be hoped for from, object teaching in our public schools, until, as we have said, the teachers themselves are thoroughly educated in the principles of natural science. To accomplish this, however, the ear of those who rule the teachers must be gained; and we raise the question whether the representatives of science should not have a voice in the management of our public school system? As object teaching is a mere handmaid of science, is of use only to give scientific habits of thought, and to convey a knowledge of scientific facts, and is worthless without science, the public should see that

its introduction into our schools be carried on under the advice of scientific experts, who shall direct what is best to be taught, and advise with the adepts in teaching how such knowledge may best be imparted. As a journal having the interests of science and education at heart, desiring to see science soundly popularized, and the masses made acquainted with its technical value, we make this suggestion, and furthermore ask: Is there any man of scientific attainments in the present Board of Education? Is there any scientific authority upon its general staff? And how many teachers favorably known to and having the confidence of the really scientific portion of the community are engaged in giving scientific instruction in our public schools?

SOCIAL SCIENCE.

Science, in the philosophical meaning of the term, is a collection of the general principles and facts relating to a subject, arranged in a systematic form. We do not, however, consent to apply this term to a collection of facts and deductions until the accumulation comprises the leading facts possible to be collected by the application of proper scientific methods. One would only be laughed at for styling ancient alchemy a science, though it was the beginning of one of the noblest of modern sciences. Facts, to become the proper basis of science, must be examined with careful scrutiny to exclude all which is only *seeming* fact, and to be sure that nothing creeps into the category incapable of demonstration.

A series of assumptions may form the basis of a beautiful system, but it is now universally agreed that assumptions are inadmissible where experimental knowledge is attainable. But experimental *knowledge* is only attained by well-conducted, accurate experiment. When a lad, the writer performed a series of experiments with some heterogeneous chemicals, culled from a quantity of old jars and bottles, without labels. He gained only the knowledge that such crude experiments are very dangerous, and gained it at the expense of a burned face and some other personal damage. Doubtless many interesting and important facts might have been demonstrated by the proper use of the substances referred to; but, in the hands of the inexperienced and unskillful, they were only capable of jeopardizing life and limb.

The history of the human race is spotted all along with results of just such crude experiments. At present, we are trying numerous social experiments on a grand scale. An explosion has just occurred in Europe which has cost two countries great bloodshed and misery. We ourselves recently came near to destruction by an explosion, the wounds of which will not be healed in half a century, and our experiment is not yet ended, nor by any means free from the liability of future disaster.

Looking over the history of mankind one may well ask, where are the carefully ascertained facts on which to build social science? Who were the master hands whose efforts demonstrated these facts to the world? If social science, properly so called, is a future possibility, is it, from the nature of the case, a *present* possibility? And are the so-called systems, for which their authors claim the proud name of "science," really worthy of the name?

In looking over a volume which has lately found its way to our table, and which purports to be a treatise on Social Science,* we find much which gives a negative answer to the questions we have propounded. We find a negative answer, also, in the proceedings of so-called "Social Science Associations," and conventions, which contain little but disjointed theorizing upon assumed facts. We find a negative in the *status* of modern society in which suffering and misery are predominant, and much of which results directly from social organization. Mr. Carey, whose larger work—somewhat clumsily (we think) condensed by a female writer—forms the substance of the treatise under review, has acquired considerable reputation as a strong and fearless defender of the system of protection to American industry, and as a writer on political economy. His work entitled the "Past, Present, and Future" entitles him, in the opinion of the editor of the volume under review, to be called the "Newton of Social Science"—a proud title, indeed, were it fitly applied. A comparison, however, between the labors of the two men, so far as Mr. Carey's socialistic speculations are concerned, will show, that where one took his points of departure from experimentally-demonstrated and carefully ascertained facts, the other has made his deductions from the crude facts, the results of the turmoil of the jumbled elements of human society, as they have rushed together under the guidance of no directing mind.

Nor is Mr. Carey, in our opinion, free from the charge of building symmetrical theories, and regarding them as resting upon solid foundations, simply because their exterior presents a harmonious and firm appearance. Certain it is that his views have been strongly opposed by those who would have been convinced, had his system approached the demonstrative character of a science.

On page 27 of the work under review, we find the following paragraph:

"Seeking now to understand the history of man in past ages, or in distant lands, we must commence by studying him in the present; and having mastered him in the past and present, we may then be enabled to predict the future. To do this, it is required that we do with society as does the chemist with the piece of granite—resolving it into its several parts, and studying each part separately, ascertaining how it would act were it left to itself, and comparing what *would be* its independent action with what we see *to be* its societary action; and then, by help of the same law of which the

mathematician, the physicist, the chemist, and the physiologist avail themselves—that of the composition of forces—we may arrive at the law of the effect."

Now, we ask, how we are to ascertain what the "parts" would do when left to themselves? Have they ever been so left, or, if they have, has their action been studied by those competent to study, and recorded by those competent to record? Does history show us any record of man except in some sort of social organization, possessing in itself the evidence of its unscientific structure? Surely, then, the action of the "parts" isolated must be assumed, unless we are to isolate them and experiment with them, as we do with the components of granite. No chemist ventures to predict what will be the properties of the components of a substance. He first separates the elements and applies to them rigid tests, to gain the knowledge he seeks.

Those who seek to frame a social science are in a position precisely similar to that of a man who should seek, by the aid of a book of ancient alchemy and a collection of animal, vegetable, and mineral substances, to create a science of chemistry. History teems with lies. To sift its truth from its falsehood puzzles the profoundest minds. It is plain that it is not a reliable guide in the construction of a system to which the name of science can be appropriately applied. All the experiments in social organization, even approximating to the rigid conditions which make experiment of any value, are found in social organizations like the Oneida Communists, and others of a somewhat similar character, and these are so few, and are accompanied by such palpable errors, as to exclude them from the pale of scientific investigation. Where, then, are the data? From what are the general principles to be evolved on which to build a science? In all attempts of the kind we have met, the principles are assumed, and the facts culled from the imperfect records of the crude experiments in association, found in history. The book before us is not an exception, and though it is written in a vigorous style, and embodies much thought which is suggestive and instructive, we see nothing which entitles it to the name selected for it.

We have before avowed the belief that at present, at least, social science is not possible, and have entertained the doubt that the future will ever bring about a state wherein the elementary principles and facts necessary for such science will be obtainable. We may be in error in this opinion, but if so we are not alone in our mistake. We do not, however, on this account, deprecate the study of social organization, or political economy. We only wish to caution the student against mistaking assumptions for facts, and mere theories for the enunciation of principles.

THE FAILURE OF THE HON. OAKES AMES.

The recent failure of the Hon. Oakes Ames has made quite a stir in business circles. An instructive moral may be drawn from it.

According to the *Springfield Republican*, the legitimate business of Mr. Ames and his brothers was never in a more prosperous condition than at the time of the failure. The profits of their shovel factory is estimated at \$1,000 per day, and the Ames Plow Company's business was also going on profitably and smoothly. The journal quoted says:

With the success of his first investments in railroad building in Iowa and in the Union Pacific Railroad, and the great power which such vast enterprises brought back to him, there grew up in Mr. Oakes Ames a real passion for gigantic operations among the material forces of our civilization. It came to be so strong that, as he once confessed, he could not resist the fascination of a brilliant opening for connecting States or cementing continents with railroads, founding a city, or reconstructing social order, with great money gains behind it. He had still on hand large railroad operations in Iowa and in the South; the Mobile and Chattanooga Road was under his patronage; he was a prime party in an organization for reviving and completing a new railroad from the Potomac across Virginia to the Ohio River; and his real estate investments were numerous and large in all parts of the country. The consequence was, of course, an ever-increasing mountain of debt. Every new scheme locked up more and more means; they gave him great values—a wealth of lands, bonds, and stocks—but from which he could not realize at present; and so he came to be a borrower for millions, and needing, for fresh investment and to renew falling notes, new loans of \$50,000 to \$100,000 daily. Naturally, lenders became distrustful, and he had to pay higher interest. He found it more and more difficult and expensive to borrow, and only some untoward circumstance has been wanting for many months to close the market against him. This came doubly in the suspension of Mr. Treadwell, of San Francisco, the great dealer of the Pacific coast in agricultural implements, owing the Ameses, as reported, hundreds of thousands of dollars, and in the decision of Mr. Boutwell and the Attorney-General, backed by public opinion, against the impudent demand of the Union Pacific managers, that the Government should put its bonds and their interest back of their own income and land-grant bonds and stock—in effect, to surrender the Government claim to them entirely—which impaired the market for all Union Pacific securities, of which Mr. Ames is still naturally a very large holder.

Now, in these facts is contained a lesson well worth pondering. The greed with which men seek to amass colossal fortunes, and the impatience of delay in the realization of their ambitious schemes, are characteristics of American business men, which have become vices. The old avenues of trade by which their fathers secured fortunes, and were able to keep them when obtained, are too slow for the average American of to-day. Gigantic risks are unhesitatingly assumed if they offer a chance of rapid accumulation. The spirit of speculation has possessed the commercial public, and men stop at no means, within the limits of the law, to hasten their progress towards wealth.

Hence we have the spectacle of men like the Hon. Oakes Ames unblushingly casting their votes in our legislative bodies for measures which indirectly aggrandize themselves,

and which have no other purpose. The interests of the commonwealth, duty to constituencies, official honor, all are forgotten in the mad scramble for wealth, and the power which wealth brings.

Is it to be wondered at, that in all this scramble and haste, men should frequently stumble and fall? Is it a wonder that confidence falters, and that men hesitate whom to trust? Is it a wonder that large monopolies are created; that the big fish eat the little ones, and that public and private morals deteriorate?

Did this affect only the personal interests of the men who thus seek to build their own fortunes at the expense of others, it would not be a matter of so great import, but when men like Oakes Ames fail, the industrial interests of the entire country suffer; credit is damaged, and general embarrassment is created.

We wish we could see a prospect of a more moderate ambition, and a return to the slower, but surer, paths to wealth in the immediate future; but in all the signs of the times we read no such pleasing augury. We must wait, therefore, till wisdom is obtained in the school of disastrous experience, and misfortune has cured the mania for rapid money-getting, now unfortunately so prevalent.

RAILROAD PROGRESS IN THE SOUTHERN STATES.

In no one particular has the South so materially advanced as in the construction of new railroad lines. Perhaps she has thus advanced more in what she proposes to do and is doing than in what she has done. With many navigable streams flowing through their land, and the slow character of business dealings previous to the war, the people of the South did not so much feel the necessity of well-conducted railroads as in these days of rapid transportation and quickly-made fortunes. Hence, many of the railroads built and existing in the South previous to 1861 were poor affairs, and in many instances more progress has been made in improving the old than in constructing new lines. Instances there are, too, of tracks torn up in the military operations of the war, which, like their owners, have been reconstructed, much to their present benefit and future durability.

In 1864 there were 8,944 miles of railroads in the Southern States proper. Of these 296 miles were built during the war, viz.: in North Carolina, 47 miles; Tennessee, 43 miles; Alabama, 62, and Texas, 144 miles. Up to 1871 there have been built 1,461 miles of railroad. These figures are according to "Poor's Railroad Manual," which, however, takes no note of the fact, that to build the forty-seven miles in North Carolina, another railroad was torn up by the Southerners. In Virginia there have been 104 miles of new railroad built. This work is chiefly on the Chesapeake and Ohio road and the road from Richmond to York River; also some on the Alexandria, Loudon, and Hampshire road. A great deal has been done in renewing and rebuilding old lines. The amount of this last character of work is particularly noticeable on the lines controlled by General Mahone, from Norfolk to Bristol, Tenn.

Of new roads, and roads in progress, the Chesapeake and Ohio, which has so slowly dragged its weary length along, commands first attention. It is intended to be a great through line for grain and other freight from the Ohio River to tide water at Richmond or below. It is being built as fast as the nature of the country will admit. The contract stipulates that it shall be finished in running order by January 1, 1872. The entire length is 427 miles.

Another line of great importance is one proposed to run the entire length of the famous Shenandoah Valley to Salem. It has been placed under contract, but will be built slowly, unless taken in hand by the Baltimore and Ohio Railroad Co., which line it would benefit. Another line much talked of, but hardly to be built, is an air line west from Norfolk to Bristol, Tenn., partly in North Carolina and partly in Virginia.

In North Carolina there have been built 146 miles of new railroad, being on the Western North Carolina, Wilmington, Charlotte and Rutherford, and Williamston and Tarboro roads. The first pierces the Blue Ridge, and is to open up the fertile and beautiful mountain section of the State. Of roads in progress, the extension of the Western North Carolina down the French Broad, thus to connect with the East Tennessee Railroad, has been graded. A portion has also been graded of the Western Division of the same road to run directly west to the Georgia line, and there to connect at Dalton, Ga. The Wilmington, Charlotte and Rutherford Railroad is slowly progressing from Wilmington to Charlotte. The Chatham road has been built from Raleigh southwards thirty-one miles, and is to be extended to South Carolina. The Fayetteville and Coalfields Railroad is chartered to extend to Salisbury, but there is no work being done on it, and but little, in fact, on any of these routes. Lines are proposed from and to various points, but none of them are likely to be built in the present condition of the State finances. But little of the track in this State was torn up during the war; but many bridges burned have been rebuilt, and a new one of great strength and handsome architecture constructed across the Cape Fear, at Wilmington.

In South Carolina 128 miles of road have been built, being the air-line from Columbia to Augusta, and part of the road from Augusta to Port Royal. This latter road is to be finished in 1871. The Blue Ridge road, intended to cross the southwestern end of North Carolina to Knoxville, Tenn., has not progressed any since the war. The contract was at one time let out, but afterwards abandoned.

In Georgia 232 miles have been built, being chiefly the Macon and Brunswick road, and the completion of the Selma, Rome, and Dalton, from the Alabama line to the latter point. In progress the Brunswick, Albany, and Eufaula road is most

* Manual of Social Science. Being a Condensation of the "Principles of Social Science" of H. C. Carey, by Kate McKean. Philadelphia: Henry Carey Baird, 406 Walnut street.