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Contents:

(Illustrated articles are marked with an asterisk.)

Close of Another Volume.

The next issue of the SCIENTIFIC AMERICAN closes the first volume of 1871.

Subscribers who commenced with the volume, and paid for half a year, are reminded that the time for which they prepaid will expire with the next number. We hope every one of these six month subscribers will renew before the 1st of July.

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THE PROPOSED CENTENNIAL EXHIBITION IN PHILADELPHIA, IN 1876.

The Forty-first Congress, at its third session, passed an act "to provide for celebrating the one hundredth aniversary of American Independence, by holding an international exhibition of arts, manufactures, and products of the soil and mine, in the city of Philadelphia, in the year 1876." The act specifies that this exhibition shall be held under the auspices of the Government of the United States, which shall be represented by a Commission, composed of one delegate from each State and Territory, to be appointed within one year from the passage of the act, by the President of the United States, upon the nomination of the governors of the States and Territories respectively. This Commission is empowered to prescribe all necessary regulations for holding the exhibition, and these regulations the President is authorized to make public by proclamation, and to communicate to the diplomatic representatives of all nations.

The project of holding a centennial exhibition was first suggested by the American Institute of New York, and strenuous efforts were made to induce Congress to make the metropolis the site for the building, but the Philadelphians carried the majority; and as the law has now been passed, it would be better for all parties to submit to its requirements, and take hold with energy upon the work. We took occasion, when the subject was first suggested, to point out the immense labor and expense involved in the undertaking.

Such an exhibition, in order to be successful must be administered with great executive skill; it must enlist the sympathies and coöperation of the leading minds of the nation in every department of industry. The commissioners to be appointed by the President ought to be representative men, and not politicians. What we fear is that there will be the same greedy clamor for office that there always is whenever an appointment is placed within the gift of the executive, and that persons will be smuggled in who are wholly unfit for the grave responsibility that will rest npon them.

The Legislature of each State ought to make adequate appropriations to defray the expenses of a Commission, upon which shall devolve the duty of bringing forward the best illustrations of the productions of the State. The expense ought not to be great, as most exhibitors will prefer to pay their own charges, and the chief duties of the Commission would be clerical.

There ought to be an advisory committee in each State, upon whom would devolve the selection of proper articles for exhibition. This committee could be charged with the duty of collecting statistics, and the publication, if necessary, of a report upon the productions of the State they represent.

The Commissioner recommended by the Governor and appointed by the President, ought to have the power to organize advisory committees of experts upon each specialty, and to accept or reject articles intended for the Fair, upon the decision of such advisory boards. This was the course pursued by Mr. Derby in the case of the Paris Exhibition, and nothing was forwarded to Europe unless it had been referred to the highest authority in the land. Similar action must be taken here to avoid a disorganized mob of people from monopolizing all of the space that may be allotted to each State respectively. A mere collection of mouse traps is not what we wish to see in Philadelphia, but the best products of the soil, mine, mill, and every industry that can be sent forward through the agency of a competent Commission.

The State Commissioners ought to be appointed at once in order that the work of organizing committees in each county, and advisory boards in the large towns, may be started preparatory to the collection of material and statistics.

Let each State vie with each other in the generous rivalry in order to show the world what has been the progress of the Republic in the hundred years of its existence. There is no doubt that we have "builded better than we knew," and there are vast stores of hidden wealth that we can know nothing about, until a competitive examination is made.

Where all the money is to come from to put up the requisite building in Philadelphia, we leave in fraternal kindness to the enterprise of the City of Brotherly Love. The cost of a structure large enough to hold all that our own people and the representatives of other nations will wish to send, will be something prodigious. The value of the building and its contents in Paris, in 1867, was estimated at one hundred million dollars. We do not wish to intimate to our neighbors that they will have this sum to raise, but the information is thrown out as an important statistical fact for the benefit of whom it may concern.

There is no time to be lost in the organization of the local board of managers, and as soon as they have decided upon a plan of operations, they ought to be met by the cordial support of citizens everywhere. The exhibition is intended to be a national one—it ought to be so regarded everywhere, and all local jealousies must be suppressed for the general good of the country.

REPAIRING ROADS.

This is an operation which is or should be performed immediately after the settling of the ground in the spring. In agricultural districts it is often deferred till later in the season. In this case the labor of putting a road in good condition is often doubled. It is as true of roads as of raiment that "a stitch in time saves nine," and if for the word stitch we substitute ditch, the old saw will be even more forcible in its meaning.

Winter makes sad havoc in the earth roads which intersect the country in all directions. His frosts upheave, and the springs wash out deep gulleys and ruts, and when at last the reign of frost is over, that which was straight is all crooked; level places are changed into alternate rises and depressions, stones are left on the top, and, in short, these roads become sloughs of despond in which loaded teams wallow in despair, and where wagons are left standing for weeks up to the hubs in mud, simply because it is beyond the power of horse flesh to extricate them.

If, when the mud has dried, the ruts were filled at once, and the ditches at the wayside opened, much would be gained, but as this is generally neglected, the June thunderstorms have things all their own way. Sluices are filled, bridges undermined and washed away, and, finally, when the "road master" summons the inhabitants to turn out and work on the road, they find plenty to do. The road is at last put into passable condition, and remains so till the fall rains and the marketing wagons again cut them all up, and the snow following hides them from view till the ensuing spring.

That this is only a fair picture of the majority of the roads in the Northern States, we know from experience; and those of the South and many parts of the West are even worse, if all accounts of their miserable condition during the winter rains are to be credited.

There is, perhaps, some excuse in the pressing work of spring for the delay in road repairing. We believe, however, that the custom is maintained more through habit than necessity.

An old farmer once remarked to us that there is no other work done by farmers that pays so well as road making; but there are few of them that are far sighted enough to see that the saving effected by good roads in the current expenses of repairs in wagons and harnesses, and the increase of loads which can be carried, pay liberally for the work, which they do grudgingly, when at last it is performed.

GUESS WORK AND REAL WORK.

"I guess that will work," says A. "I will try it and see." "This will work, says B, "provided that in my reasoning I have not omitted any element essential as one of the premises upon which I build my reasoning and calculations. I will try it and see whether I have omitted any essential."

A represents a large class, and B a smaller class, of men, which together make up the entire group of humanity. Individuals of the first class sometimes blunder upon successful inventions, sometimes, by lucky hits, make fortunes, sometimes entertain correct views. But in all that they do there is an element of uncertainty, a feeling of insecurity that is never allayed except by final results. In blundering along, they expend money and time, which frequently are more valuable than what they can hope to obtain by any success they can achieve. They wander off into by paths, and finding they are wrong, guess another is right, and so keep on guessing through life, sometimes guessing right, sometimes wrong, sometimes reaching that which they sought, but oftener fain to content themselves with something they did not contemplate in the outset of their career.

There are the men who expend all their capital in erecting factories, without knowing where the money will come from for stock and machinery. They are the men who, when an invention is only half completed, stake their all upon its success, regardless of future contingencies for which they can foresee no provision. They are the men who give credit without good security; in short they are the men who strew the shores of life's great sea with wrecks, broken up and helpless; to be pitied, but never repaired.

It is a pleasure to turn from this sad picture to another and brighter phase of human character, to the class, B, the members of which never count chickens in the shell; to the men who never guess but reason, step by step, to their conclusions, the men who have invented the machines and processes that have revolutionized the world's industry, the men who have developed science and art. Wherever they are found, whether in schools, pulpits, counting houses, or work shops, they are doing the real solid brainwork of the world.

They live in no fool's paradise. No false haloes cluster around the realities of life to blind them. No superstition is accepted by them as a substitute for a belief founded upon facts and reason. By them every proposition is scrutinized with rigor, and nothing bearing the semblance of truth, but false under the surface, is allowed to pass unchallenged.

They are men who, knowing truth may exist in human life and character, are not suspicious without reason, but who nevertheless are seldom deceived. Their faith in truth is not destroyed by their own falseness. They seek truth for its own sake, and search for it eagerly and long, early and late, but never guess at it. Their search is thorough, systematic, and organized. They are slow to assent to anything laid down as a general principle, but once assenting, are steadfast in their adherence, for their belief is founded upon knowledge, not guesswork.

The age is at present prolific of this class of men, and their labors are preparing the way for the final emancipation of the race from giant superstitions, and the strong chains of ignorance. The generality of mankind think the world very far advanced in civilization. Indeed, a popular but superficial writer has recently asserted that the world is suffering from over-civilization; but the class of men we have described, guessing at nothing, see that only the twilight has dawned upon the civilization of the ages to come. Knowing that their eyes shall never behold that brilliant epoch in the history of mankind, they still labor for the generations to come, blessing the present generation as well.

Well will it be when all men are no longer content with guessing, but strive to know, not in the sense of passive acceptance of creeds and formulæ, framed or thought out by others, but thought out by each individual. For when all men really think for themselves, and act upon their conclusions, there will be an end to the poverty, drunkenness, crime and most of the diseases which now curse the human race

THE ELECTRIC LIGHT.

The light produced from a powerful current of electricity, under favorable circumstances, is the most brilliant ever yet discovered by man. By actual experiment it has been shown to possess an intensity equal to one third of that of sunlight. The light emanating from an incandescent piece of lime under the action of the oxy-hydrogen jet, well known as the Drummond light, cannot compare with it in brilliancy, nor compete with it in point of economy. Though the first cost in the preparation of an electric light may exceed that of the Drummond light, the subsequent outlay is much less.

The light is produced by passing an electrical current between two pieces of charcoal a small distance apart, one connected with the positive pole and the other with the negative pole of a galvanic battery. In order to keep these burning charcoal points always at such a distance from each other as to produce the most brilliant light, ingenious machines called "regulators" are used. The principle involved in the construction of these machines is, that the nearer the charcoal points are to each other, so much greater is the flow of electricity. Now, increase in the flow of electricity in the conducting wire will produce corresponding increase of magnetism in an iron bar which it encompasses; therefore, one of the charcoal points is inserted in an iron cylinder, which plays freely up and down in the center of an electro-magnetic coil. As this coil exerts an attractive influence upon the iron, a weight passing over a pulley is attached to it, which, acting as a counterpoise, keeps it in equilibrium. The other point remains fixed. The result of this arrangement is that an increase of distance between the charcoal points gives a decrease in the flow, and consequently a decrease in the attractive power of the coil. The weight, for this reason, overbalances the attraction of the coil, and the charcoal point is drawn up until the increasing flow of electricity, caused by the decreasing distance between the charcoal points, shall have sufficiently augmented the attractive power of the coil as to restore the equilibrium.

The regulators employed in general use are much more complicated, but their principle is the same.

A machine has been invented in France by means of which this light may be derived from electro-magnetism. It consists of eight rows of powerful horseshoe magnets arranged around a hollow cylinder and having their poles towards the axis of the cylinder. The magnets are 7 in each row, 56 in all, and are attached to a stationary frame. The hollow cylinder has affixed a set of double coils or bobbins, 112 in all, so placed that, on revolving the cylinder, the ends of the bars, which are the cores of the bobbins, are in rapid succes-

sion brought in close proximity to the poles of the magnets, alternately approaching to and receding from them, with great rapidity. This causes a succession of almost instantaneous electrical impulses to be given to the wires coiled around the bars. Connecting this machine with the charcoal points and revolving it at such a speed as to make the flow almost continuous, for the light only shines while the current is passing, a steady light will be produced.

It has been found, by experiment, that if a speed sufficient to give 200 electrical impulses per second be given to the machine, the eye no longer takes cognizance of the intervals, and an uninterrupted light is the result.

A curious example of the correlation of forces is shown in the working of this machine. The cylinder, which is hung in its bearings so delicately that it would seem possible for a child to revolve it with ease, really requires a two horse power engine, owing to certain effects produced by the action of the magnets in connection with the coils. This force expended is represented in the light produced; the machine converting force into electricity, and electricity into light; as in the case of the galvanic battery, the force resulting from the decomposition of zinc is the producer of the light.

The uses to which this light may be advantageously applied are numerous. Its peculiar penetrating power renders it unrivalled for light houses and signal lights for vessels. Let the darkness be so great that it "can be felt," its light pierces it like a great silvery needle, and falls like a ray of hope upon the seething ocean, which, but for its warning, might have been the watching sailor's grave.

It has been used with success for illuminating mines. During the siege of Paris, the Prussians were much annoyed by one of these lights, which the Parisians had constructed and placed upon Fort Mont Valérien, and which effectively prevented any hostile movement being made by the Prussians under the cover of the night.

For stage effect, illuminating halls, streets, or other public places, and for microscopic or magic lantern exhibitions, it may be used.

The application of the electric system for illuminating Bergen Tunnel, through which the Erie Railroad and Delaware and Lackawanna Railroad traverse, we believe could easily be accomplished. Its adoption would relieve the thousands of passengers, which are carried through this tunnel daily, of the apprehension of accident which is irresistible to most persons as they enter the dark and cheerless cavern.

In fact, its uses are so numerous, and its effects so brilliant, that it is a wonder that it has not been more universally adopted.

SCIENTIFIC INTELLIGENCE.

OCCURRENCE OF AMBER IN SICILY.

It is remarkable that the Romans, who set great value upon amber, and obtained it at great expense and trouble from the Baltic, make no mention of the occurrence of this fossil in Italy. The probability is that they never discovered the locality nearer home. The first notice of the Sicily deposit was in 1808. The amber is found in clay, brown coal-like formation, and gray sandstone, referred by Hoffmann to the chalk period. In color and general appearance it closely resembles the products of the Baltic workings, the chief difference being in the species of insects found imbedded in the gum. These insects belong to the ancient inhabitants of the earth, and their race is now extinct. Well preserved leaves of plants, resembling the ferns of the coal period, have been found in the Sicilian amber. Many thousand specimens have been obtained from Catanea and Girgenti, two places famous for their mines of sulphur. A resident of Königsberg, Germany, who was recently in New York, informed us that the search for amber was now conducted upon more scientific principles, and the yield was increased accordingly. The mines are the monopoly of the governments, and the privilege of working them is leased to responsible companies. In this way, the industry assumes a business shape, and dealers in amber know what to depend upon. It is not likely that in our older geological formations we shall discover the fossil gum, but a search for it in more recent rocks may some day bring it to light. Its occurrence in a volcanic region like Sicily was unexpected, and hence the delay in finding it.

CHLOROFORM USED IN THIS COUNTRY.

Dr. Simpson, of Edinburgh, who first discovered the anæsthetic properties of chloroform, immediately wrote an account of his experiments to Dr. Charles T. Jackson, of Boston, who at once brought the letter into his laboratory, where a number of pupils were at work, and requested one of them to prepare some of it for the purpose of repeating the experiments. This was in December, 1847. One of the students prepared a small quantity, and it was administered to him on the 30th of December, 1847, by Dr. Jackson and one or two other physicians who were invited to witness the effects of the new anæsthetic. There was probably not an ounce of chloroform at that time in the United States, and it was therefore necessary to make it for this trial. Twenty-three years later, during 1870, Dr. Edward R. Squibb estimates the total quantity of chloroform sold for consumption in this country at 80,000 pounds. About one third of this amount, say 26,000 pounds, is used for anæsthetic purposes by inhalation. Next, it may be estimated that one and a half fluid ounces are used or wasted for each administration, and this would give 200,000 administrations, as a safe estimate for the whole country during the year 1870. Dr. Squibb puts down one death in 5,882 administrations in this country. No chloroform of any importance has been imported into the United States, or exported from it, within several years past, and there are but about four original sources of supply.

[The student who prepared the chloroform in Dr. Jackson's laboratory in 1847, and was the first in this country to take it for anæsthetic purposes, was Charles A. Joy, at the present time Professor of Chemistry at Columbia College, New York. —EDS.]

CARBOLIC ACID AND FLEAS.

A correspondent asks, if fleas are not insects? and if they are, why carbolic acid cannot be used to exterminate them from dogs? We must remind him of Goldsmith's elegy on the death of a mad dog:

"The man recovered of the bite,
The dog it was that died."

So many dogs have been killed by the application of too strong carbolic acid, that the remedy is looked upon as worse than the disease. In moderate quantities, it could be applied with safety, but, as we remarked on a former occasion, the torture of the poor dogs is often worse from the acid than it is from the fleas. Under any and all circumstances, carbolic acid must be used with caution, as it is a powerful poison.

DESTRUCTION OF ABBÉ MOIGNO'S LIBRARY.

Abbé Moigno, the genial editor of the journal *Les Mondes*, met with a severe loss during the siege of Paris. He says in his paper for March 2, 1871: "I had on Sunday, January 15th, written a severe article about the barbarity of the Germans in bombarding a city of two millions of inhabitants, when on Monday, the 16th, a bomb fell into my narrow apartment, and destroyed nearly everything in it, including a thousand volumes of books." It appears that he had just left his study, and his life was thus providentially saved. As a compensation to subscribers for the suspension of his journal during the siege, he proposes to send to all who request it, a copy of some of his printed works.

M. BECQUEREL, SR., NOT DEAD.

We learn from *Les Mondes*, of March 23, 1871, that the venerable Professor Becquerel is not dead, but is still actively engaged in the preparation of his work on the application of electricity to chemistry and physiology. It was the London *Athenæum* that started the report of his death, and hence the sketch we gave of his life. It is not often that a man in his eighty-fourth year displays so much industry and vigor as the senior Becquerel.

USE OF DYNAMITE IN ARTESIAN WELLS.

During the sinking of an artesian well in Holland, the borer struck a flint rock, very difficult to penetrate; and the engineers proposed to try the effects of dynamite as a substitute for the drill. A bottle, in which two copper wires were insulated by gutta percha, containing two pounds of dynamite, was let down to the bottom, and fired by a current of electricity; a loud report, and the discharge of a large volume of water from the well, indicated the force of the explosion, and it was only found necessary to repeat the operation twice to procure all the water required by the engineers.

DEATH OF PROFESSOR STAEDELER.

Dr. George Staedeler, Professor of Analytical Chemistry in Zurich, Switzerland, died on the 11th of January, 1871, at the residence of his parents, in Hanover. Professor Staedeler, in his early studies, passed through the usual routine of the pharmaceutical career, but passionate love for the natural sciences impelled him to enter the philosophical faculty at the University of Göttingen, and it was here that he laid the foundation for a distinguished sphere of usefulness. Under the instruction of Professor Wöhler, he applied himself chiefly to organic chemistry, and became a frequent contributor to the *Annals of Chemistry*, published by Liebig and Wöhler. One of his earliest papers was upon the preparation of chloral from starch. He was appointed Professor of Physiological Chemistry at the University of Göttingen in 1851, and, in 1853, received a call to Zurich as the successor to Professor Löwig. When the now famous Polytechnic School was established in Zurich, in 1855, Dr. Staedeler was transferred to the chair of analytical chemistry; and upon him devolved the task of constructing a working laboratory, in accordance with the wants of the new institution. The laboratory, built under his supervision, was at the time pronounced to be the best in Europe; and it has served as a model for nearly every laboratory that has since been constructed, either in Europe or America. Nearly ten years ago, Professor Staedeler contracted a disease of the heart, while on a tour in the Alps, and since that time his life has been a constant struggle between failing health and an impatient desire to carry forward important scientific researches. The ravages of disease finally compelled him to resign his professorship, and he returned to the house of his aged parents, where, surrounded by the friends of his youth, and watched by the tender care of his relatives, he finally passed away, after only a few days of severe illness, on the 11th of January, shortly before attaining his fiftieth birthday. His death will be a severe blow to the school where he taught, and to the science which has been so much enriched by his labors.

A GREAT SPEECH.

It is not often that such solid words of wisdom fall from the lips of man as were uttered by Mr. Peter Cooper, at the recent Annual Commencement of the institution founded by him. The occasion was one of unusual interest on account of the presentation of an address from the present and past pupils to the venerable founder of the Union. This address, unlike most similar productions, was remarkably well written, tender in the expression of affection, full of gratitude, beautiful in sentiment. It has been elegantly engrossed, and elaborately framed for preservation in the great reading room of the Institute, and is in better taste than any bronze statue or monumental device could have been. The thousands of grateful pupils say to the world "if you seek a monument look about you," and Mr. Cooper's name and fame is rendered more secure and imperishable in such a way than it could be in any other.

The remarks of Mr. Cooper, in reply to the presentation address, were full of wisdom, and deserving of preservation in a permanent form. The venerable author would blush to have his words called a speech, and yet we venture to say that a greater speech was never heard in the large hall where have been assembled, from time to time, nearly all of the wise men of our country. Writers on political economy devote many pages to the elaboration of the laws of trade, the question of demand and supply, the relations of employer and employed, the rights of property, and the duties of men of wealth, but Mr. Cooper has condensed the whole matter into a few words, and if these words could sink deep into the hearts of all mankind, we should never again hear of the rich oppressing the poor, nor of the poor destroying themselves by "lock outs" and "strikes."

We advise every manufacturer, every mechanic, every laborer to procure a copy of this address, and trade unions could not do a better thing than to have it reprinted for gratuitous circulation among their members. It ought to have the widest possible circulation, and, to this end, we propose to give the greater part of it in our columns.

Mr. Cooper celebrated his eightieth birthday by making an additional gift of one hundred and fifty thousand dollars to the Union, for the foundation and support of a free circulating library. This act was all that was necessary to round up and complete the usefulness of the Institute.

The laboring poor can now obtain gratuitous instruction in every department of practical knowledge, and when unable to attend the exercises of the school, can still profit by the benefaction by carrying home with them the book required for their information. By such acts of benevolence, and by the gift of more than a million dollars for the free education of workingmen and toiling women, Mr. Cooper has earned the right to offer advice, both to the rich and poor. He shows how to earn a fortune and how to spend it. He says: "While yet a child, I learned that 'the hand of the diligent maketh rich,' and whatever of wealth I have achieved has been due, primarily, to habits of patient industry formed at the outset of my career."

He early learned that the great part of the poverty, vice, and crime which afflict the American people was due to intemperance, and he "carefully avoided all alcoholic liquors as the greatest curse of the young, and the most deadly foe to domestic happiness and the public welfare."

He next warns against hastily contracted debts, and suggests the wisdom of trying to keep a little ready money on hand for judicious investments. Debt is a slavery which every young man ought to avoid; or, if assumed, ought not to endure for one day beyond the shortest time necessary to set him free. "By shunning intemperance, and practising rigid economy, he was able to grow in prosperity and wealth, but the opportunities of acquiring knowledge were so limited, there being no free day or evening schools, that he found it far more difficult to learn what he wanted to know than to be industrious, temperate, and prudent. Hence he decided that, if he should prosper in the acquisition of worldly means, to found an institution to which all young people of the working classes who desired to be good citizens, and to rise in life, could resort, without money and without price, in order to acquire that knowledge of their business, and of science, which, in these days, is absolutely indispensable to a successful career."

Mr. Cooper never lost sight of this resolution during a business career of nearly sixty years; and all this time, he says, that he was "cheered, comforted, sustained and encouraged by the greatest of human blessings, a diligent, wise, industrious, faithful, and affectionate wife; and by the active co-operation of his children, who justly regarded, as the richest portion of their inheritance, that part of his wealth which he desired to consecrate to the public welfare."

Having thus given an account of the train of circumstances which led to the foundation of the "Union for the Advancement of Science and Art," Mr. Cooper closes with the following eloquent words:

"I do not pretend to prescribe any standard of expenditure for others, and I am quite ready to subscribe to the doctrine that a just and faithful trustee should be liberally paid for his services, and should not be restricted in the reasonable gratification of his desires so long as the rights to others are not thereby infringed; and I desire to give the fullest recognition to the sacredness of private property and the conservation of capital, as for the best interests of society and all the members thereof; but I cannot shut my eyes to the fact that production of wealth is not the work of any one man, and that the acquisition of great fortunes is not possible without the co-operation of multitudes of men, and that therefore the individuals to whose lot these fortunes fall, whether by inheritance or the laws of production and trade, should never lose sight of the fact that, as they hold them only by the will of society, expressed in statute law, so they should administer them as trustees for the benefit of society, as inculcated by the moral law.

"When rich men are thus brought to regard themselves as trustees, and poor men learn to be industrious, economical, temperate, self-denying, and diligent in the acquisition of knowledge, then the deplorable strife between capital and labor, tending to destroy their fundamental, necessary, and irrefragable harmony, will cease; and the world will no longer be afflicted with such unnatural industrial conflicts as we have seen, during the past century in every quarter of the civilized globe, and latterly on so great a