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(Illustrated articles are marked with an asterisk.)

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No. 1130.

For the Week Ending August 28, 1897.

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THE RELATION OF THE BEET SUGAR FARM TO THE FACTORY.

In view of the widespread attention which is now certain to be given to the cultivation of the sugar beet, it is well to sound a note of warning with reference to one or two elementary facts, the neglect of which may bring much loss and disappointment to the well meaning but misguided husbandman. In the first place it must be remembered that there are many localities which are quite unsuited to sugar beet culture, and that these may occur within districts which are within the sugar belt, and are, generally speaking, well adapted to beet crops. It is therefore desirable that the farmer should make several tests in different parts of his farm before he commits himself to the hazard of a full crop. It will not be necessary to plant any considerable areas; small, detached patches will give him sufficient specimens to determine the value and quality of the crop. When it has been proved that his land is suitable, the next step is to ascertain the cost of delivering the beets to the nearest factory, and whether it is such as to allow beet farming to be carried on at a profit.

As there are only a few localities in the United States where beet sugar factories exist, it will be necessary to erect factories to receive and work up the crops, and it is in making the selection of sites that the greatest forethought and care must be exercised. The factory must be centrally located with regard to the beet-growing district, and at the same time it must, if possible, be situated upon a railroad or have connection through its own private side tracks. If the enterprise is to compete successfully with others, it should have the various materials of manufacture, such as limestone, fuel and water, within easy reach, and, of course, the nearer the factory is to the markets, the larger the net profits which will accrue to the farmer from his crop. It will be evident, from the recent description which we gave of the process of manufacture, that it requires a plentiful supply of water, fuel and limestone. If any or all of these have to be brought from a considerable distance, it can be seen that the profits of the undertaking will be seriously reduced. The necessity of rail connection is further evident when we bear in mind the large amount of residue in the shape of filtered cossettes. This is a valuable feed for cattle, and with reasonable transportation afforded it could be disposed of at profitable prices in the outlying country.

When it has been proved that the soil is suitable, that the materials of manufacture are near at hand, and that a market can be depended upon, any agricultural district may lay out its beet farms and build its own factory with a certain assurance that it will prove a profitable, and, what is better, a permanently profitable, investment both for capital and labor.

REPAIRS TO DRY DOCK NO. 3 AT THE BROOKLYN NAVY YARD.

Great interest attaches to the repairs which are being carried out on the new dry dock, known as No. 3, at the Brooklyn Navy Yard. Judged from the engineering standpoint, the problem is an entirely new one, and as there is no case just like it on record, the engineers will have to act entirely on their own initiative. For this reason the plans will, of course, be somewhat experimental and liable to modification as the work proceeds. In reply to our request for the detailed drawings of this work, the Assistant Secretary of the Navy, Mr. Theodore Roosevelt, informs us that the department does not wish to publish the drawings of the proposed work at the present stage, especially in view of the experimental nature of the work, as above referred to.

Dry dock No. 3, it will be remembered, is the one which subsequently to its opening developed a serious leak along one side near the entrance, which an examination by a diver showed to result from injury to the outside apron. The floor and sheet piling at the edge of the apron were found to be broken, and it was supposed that the dredge which was used in opening the entrance from the East River had struck the apron and injured it sufficiently to allow the entrance of water within the sheet piling. The depth of water (thirty feet) and the nature of the repairs rendered it impossible that the latter should be carried out under water, and accordingly the engineers are making provision for laying bare the bottom of the entrance for a distance of ninety feet back from the caisson gate. This will enable a thorough inspection to be made, not only of the broken apron but also of the side walls, back of the abutments, and of the various walls of wing piling which run out transversely to meet the great inclosing wall of sheet piling which encircles the whole dock. In carrying out this plan the engineers are building a massive cofferdam across the dock entrance, which will have sufficient strength to hold back the waters of the East River until the investigation and repairs are completed.

The cofferdam consists of three lines of heavy sheet piling, which extend in a curved form clear across the entrance from wall to wall. The inner wall will be about 90 feet from the caisson; 13 feet in front of this will be another wall, and 13 feet beyond this a third wall. The curve will, of course, be convex to the thrust of the water, to which it will present an arch effect, though not much reliance will be placed upon the latter in estimating the strength of the dam. The three walls will be strongly braced in the direction of the thrust of the water, and the whole interior space will be filled to above the water line with carefully rammed puddled clay.

The dam will possess considerable strength on account of its arched form and the interior trussing, and it will be further reinforced and rendered watertight by two embankments of clay and gravel, which will start at the water line and slope away to the bed of the river on the river side of the entrance, and on the inner side will finish against a fourth wall of sheet piling, which will be driven across the entrance about 30 feet from the toe of the apron. In making a junction with the sides of the entrance it has been necessary to cut into the concrete walls (which are carried upon piling), so as to allow the sheet piling of the cofferdam to be driven up to a snug connection with the sheet piling of the entrance.

From the above general description, it will be seen that in cross section the proposed cofferdam is not unlike the familiar earth dam used in reservoir construction. When it is completed and the water has been pumped out of the dock, a full examination can be made of the origin and extent of the leak.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

BY MARCUS BENJAMIN, PH.D.

The forty-sixth meeting of the American Association for the Advancement of Science was held in Detroit, Mich., during the week beginning with August 9. The sessions were held in the beautiful building of the Central High School, which occupies an entire square, facing Cass Avenue, between Hancock and Warren Avenues, and it is safe to say that at no recent meeting of the association have any such commodious and delightful quarters been assigned to it. The first general session was convened at 10 o'clock in the morning of August 9, in the auditorium of the high school, when the association was called to order by Secretary Putnam, who presented Dr. Theodore Gill, the senior vice-president, who had succeeded to the presidency in consequence of the death of Prof. Cope. Dr. Gill declared the meeting opened and introduced Mr. W J McGee, who, as senior vice-president, would occupy the chair, on account of the inability of Dr. Wolcott Gibbs to be present. An invocation was made by the Rev. Frank J. Van Antwerp, and appropriate addresses of welcome were made by the Hon. William C. Maybury, Mayor of Detroit, and the Hon. Thomas W. Palmer, former United States Senator from Michigan, who aptly defined science as "the classification of phenomena to the end that principles may be established and declared, from which may be deduced rules of action that shall be applicable to particular cases."

To these words of welcome Mr. McGee made a pleasing rejoinder, after which formal announcements of important matters were presented by the permanent secretary and the local secretary. The general session then adjourned and the sections assembled for organization. This effected, the members separated for luncheon, but later in the afternoon gathered again to hear the vice-presidential addresses.

The presiding officer of the section on mathematics and astronomy was Prof. Wooster W. Beman, of the University of Michigan, Ann Arbor, who spoke on "A Chapter in the History of Mathematics." This address was a sketch of the development of the geometric treatment of the imaginary, particularly in the latter part of the eighteenth and the first part of the nineteenth centuries. The speaker referred, in opening, to the fact that the square root of a negative quantity appeared for the first time in the Stereometria of Heron of Alexandria, B. C. 100. From this date the development of the use of the square root applied to a negative number was briefly traced through several centuries, accompanied by quotations and arguments from the various writers who attempted the problem.

Section B, on physics, was ably presided over by Prof. Carl Barus, of Brown University, Providence, R. I., whose address was on "Long Range Temperature and Pressure Variables in Physics." The first part of his address contained a history of the various attempts to provide suitable apparatus for high temperature measurement. He then considered the applications of pyrometry, referring at great length to the variation of metallic ebullition with pressure. Results already attained show an effect of pressure regularly more marked as the normal boiling point is higher. Igneous fusion was considered in its relation to pressure and with regard to the solidity of the earth. The question of heat conduction was taken up, and the results deduced by various writers as to the age of the earth discussed. High pressure measurement was dealt with. Passing from this subject, the entropy of liquids was considered. This subject of the heat produced by sudden compression of liquids is in its infancy, and only a year ago were any results of a satisfactory nature obtained. The paper ended with a reference to isothermals and several kindred subjects, all of them slightly dwelt on.

The section on chemistry was presided over by Prof.

William P. Mason, of the Rensselaer Polytechnic Institute, of Troy, N. Y. He spoke on "Expert Testimony." He covered the entire ground from the standpoint of practical experience, looking at the question both through the eyes of the lawyer and the expert, giving a compact syllabus, pointing out the province of the expert, reviewing errors that he might be subject to and suggesting the solution for numerous difficulties. His concluding remarks were: "The expert witness should be absolutely truthful, of course, that is assumed; but, beyond that, he should be clear and terse in his statements, homely and apt in his illustrations, incapable of being led beyond the field in which he is truly an expert, and as fearless of legitimate ignorance as he is fearful of illegitimate knowledge. Mounting the witness stand with these principles as his guide, he may be assured of stepping down again with credit to himself and to the profession he represents."

The subject of the address before the section on mechanical science and engineering was on "Applied Mechanics." Prof. John Galbraith, of Toronto, Canada, who presided over this section, said, in opening, that the subject of dynamics is too often treated as if it were a department of applied mathematics rather than of mechanical science. While it is necessary that the student of dynamics know something of mathematics, it is unnecessary that he should be an expert in refined mathematical analysis, but he should possess, in some degree, the mechanical instinct. The history of dynamics, from the day when the experiments were carried on with but the rudest machinery down to the present day, was touched on and the experiments employed described.

In conclusion he said: "The science of dynamics, as it is understood at the present day, includes among its fundamental principles, in addition to the law of motion, the principle of the equivalence of work and energy and the principle of the conservation of energy; energy being measured, however, only in terms of force and displacement, or momentum and velocity. The only actions known in dynamics are force and its integrals, impulse and work. To identify with these all the other actions involving the transfer and transformation of energy, such as the conduction of heat, chemical reactions, induction of electric currents, etc., forms to-day the severest task of mathematical physics."

Section E, on geology and geography, was to have been presided over by Prof. Israel C. White, of the University of West Virginia, but, owing to his attendance on the International Geological Congress, held this summer in St. Petersburg, he was not present, and Prof. E. W. Claypole was named by the council to fill his place. Prof. White's address was on "The Pittsburg Coal Bed," but it was not read at the time appointed, owing to some difficulty in regard to the receipt of the manuscript.

Dr. Leland O. Howard, of the Department of Agriculture, Washington, D. C., presided over the section on zoology, having been appointed to that place by the council at its meeting in the spring, when the death of Dr. G. Brown Goode was made known to that body. The subject of Dr. Howard's address was "The Spread of Species, by the Agency of Man, with Special Reference to Insects." He showed that natural spread was for centuries the rule, but that with the improvement of commercial intercourse between nations the agency of man has become predominating. He spoke of the intentional introduction of useful plants from foreign countries and of the occasional introduction of flowering species which escaped from cultivation and became weeds. The intentional introduction of wild animals has generally been disastrous. He instanced the introduction of the English sparrow, of the Indian mongoose into Jamaica, of the flying foxes from Australia into California, of the gypsy moth from Europe into North America. Accidental introductions have been more powerful in extending the range of species and in changing the character of the plants and animals of given regions than intentional introductions. The era of accidental importations began with the beginning of commerce and has grown with the growth of commerce. The vast extensions of international trade of recent years, every improvement in rapidity of travel and in safety of carriage of goods of all kinds have increased the opportunities of accidental introductions, until at the present time there is hardly a civilized country which has not firmly established and flourishing within its territory hundreds of species of animals and plants of foreign origin, the time and means of introduction of many of which cannot be exactly traced, while of others even the original home cannot be ascertained, so widespread has their distribution become.

Mr. W J McGee, of the Bureau of Ethnology, was the presiding officer of the section on anthropology. He spoke on "The Science of Humanity." Taking up the domain of anthropology, he showed that the study of man began with wounds and diseases, and grew into surgery and medicine. Then were developed physiology, pathology, etc.—sciences relating to the human body, which may be combined under the term somatology; then ethnology, the science of races and peoples, and finally psychology. All of these sciences relate to man considered as an organism, to his animal side. But there are other branches dealing with man as a sentient, volitient and intelligent being, such as esthetology, the science of the activities of mankind which are of a pleasurable character; technology, the study of the occupations and industries of man; sociology, which deals with the relations of men to men collectively; philology, the science of language and literature and of all human expression; sophiology, or the science of the essentially intellectual activities which form the motive and burden of expression, and their products comprise beliefs, opinions, knowledge, wisdom.

Arguing in this manner, he urged a closer study of the different branches of anthropology and claimed that in the near future its established subdivisions would be universal, thus affording an increasing knowledge of humanity.

The section on botany was presided over by Prof. George F. Atkins, of Cornell University, Ithaca, N. Y. His address was on "Experimental Morphology." It was highly technical, and treated of certain special phases of morphology. Indeed, it was rather devoted to a summary of experimental morphology as applied to the interpretation of the modes of progress followed by organs in attaining their morphologic individuality, in the tracing of homologies in the relation of members associated by antagonistic or correlative forces, the dependence of diversity of function in homologous members in external and internal forces, as well as the course which determines the character of certain paternal or maternal structures. His treatment of the subject was by the citing of numerous illustrations gathered from recent botanical literature.

One of the most interesting addresses was by Richard T. Colburn, vice president of the section on social and economic science, who spoke on "Improvident Civilization." He described at great length the history and devastating effects of war, and also such subjects as pernicious competition, spendthrift luxury, the blight of parasitism, and the role of superstition. The effect of improvident civilization on humanity was illustrated by the following description of the coming man. He said: "The coming man will be a big-headed, small-bodied, puny-limbed, bald, toothless, spectacled, and toeless creature subsisting on concentrated foods. The fate of that people where teeth and eyes decay and dentists and opticians flourish is not at all conjectural, It concerns the student of physiology and sociology alike to ascertain what causes are at work impairing the digestive organs, the teeth and eyes of civilized peoples, and in what respects the as yet uncivilized have a manifest advantage."

This completes the addresses delivered by the vice-presidents, and they served as it were to whet the appetite of the hungry scientists for the presidential address that followed in the evening.

No naturalist of modern time has achieved a greater reputation than Edward D. Cope, and it was fortunate for the association that Cope's fellow student and close friend during his scientific career should have been the senior vice-president on this occasion. It was eminently fitting, therefore, that Dr. Gill should present as a retiring address a memorial sketch of his friend. This address is being published in full in our SUPPLEMENT, but space must be found for two paragraphs.

"Prof. Cope," said Gill, "was one of the greatest naturalists our country has ever brought forth. From his early years he was an ardent devotee to the science of zoology and kindred branches. When but twenty years of age he prepared and published material on this subject which might well be worthy of a man of more mature years." Passing over the history of his life with its more than ordinary struggles and vicissitudes, together with an analytical account of his many contributions to his chosen work, Dr. Gill closed with the following:

"Prof. Cope found his life's study an art and left it a science.

"The subject which was to him the most interesting was the study of evolution and the origin of species. He was not satisfied with Darwin's theories. He believed that the peculiar habits of an animal, influenced by environments or conditions, would make felt its effect in future progeny. His ideas were original, but perhaps not entirely logical. For instance, he believed that the human arms were not developed in accordance with the growth of the skull. I believe that in reality he should have said that the lower limbs were lengthened. This is proved by comparison with the form of a child.

"He certainly was a man as wonderful as Huxley and Cuvier."

Dr. Gill's address was followed by the reception given to the members of the association by the citizens of Detroit.

During the days that followed much good work was done by the individual sections, and any attempt to select for mention papers that were read is practically impossible. It is sufficient to say that, owing to the presence of a large number of chemists and geologists, on account of the simultaneous meeting of the American Chemical Society and the Geological Society of America, the mention of papers before the sections on chemistry and geology was large and they were of more than common interest and value. The presence, also, of a number of foreign scientists who came to attend the meeting this week in Toronto of the British Association gave an additional distinction to the Detroit meeting.

Two joint sessions deserve a word. On Wednesday afternoon the section on geology met with that on anthropology, when papers were read discussing the possibility of the existence of preglacial man. The recent excavations in the Trenton gravel, accompanied by certain finds, had led the anthropologists to believe that possibly man could have existed in America prior to the glacial period. In several papers they presented their interpretations of their discoveries, but the geologists were unwilling to concede the assumptions claimed, and, although admitting that the geological horizon was not positively determined, still it could not be claimed as yet that evidences of preglacial man had been found in any geological formation that was beyond dispute of preglacial origin.

The other joint session was that of the sections on zoology and botany, before which Prof. Henry F. Osborn, of Columbia University, presented his paper on "Modifications and Variations and the Limits of Organic Selection," in which the present ideas of the Neo-Lamarckian school of the development theory were fully presented. Insomuch as this school flourishes most strongly in this country, its adherents had no difficulty in sustaining their grounds against their English confreres, who were represented by Prof. E. B. Poulton, of Oxford University.

It was admitted on all sides that, notwithstanding the comparatively small number of members of the association present at the Detroit meeting, the papers were of uncommon value, and, therefore, the meeting was a completely successful one.

Besides the usual minor excursions of the different sections to points of interest to botanists, geologists, chemists and others, the special excursion of the meeting, complimentary to the association by the citizens of Detroit, was made on Saturday, August 14, to Ste. Claire Flats. This trip enabled the members to view the character and extent of the river front of the city of Detroit, and also gave a comprehensive view of the magnitude of the shipping of the great lakes passing through this strait. This excursion carried the members of the association through the United States Ship Canal in Lake Ste. Claire Flats, and through the many islets which have been reclaimed from the shallows of that body of water.

The American Association came into existence in Boston, in 1848, and, in consequence, the scientific institutions and prominent citizens of that city extended to the association a hearty invitation to meet in Boston in 1898. This offer was accepted by the association, and it is proposed by the association to celebrate its fiftieth anniversary by a jubilee meeting, at which the addresses will take the forms of reviews of the progress of the sciences in America during the past fifty years; so that the memorial volume for 1898 will be the finest summary of American science in all its branches ever presented to the public. For this reason it is believed that the Boston jubilee meeting will be the greatest scientific gathering ever held in the history of the association.

The officers chosen for this meeting were: Prof. Frederic W. Putnam, of Harvard University, president.

Vice-presidents.—Mathematics and astronomy, Edward E. Barnard, Yerkes Observatory, University of Chicago, Chicago, Ill.; physics, Frank P. Whitman, Adelbert College, Cleveland, Ohio; chemistry, Edgar F. Smith, University of Pennsylvania, Philadelphia, Pa.; mechanical science and engineering, M. E. Cooley, University of Michigan, Ann Arbor, Mich.; geology and geography, H. L. Fairchild, Rochester University; zoology, A. S. Packard, Brown University, Providence, R. I.; botany, W. F. Farlow, Harvard University, Cambridge, Mass.; anthropology, J. McKeen Cattell, Columbia University, New York City; economic science and statistics, Archibald Blue, director of Bureau of Mines, Toronto, Canada.

Permanent secretary, L. O. Howard, Department of Agriculture, Washington, D. C.; general secretary, D. S. Kellicott, Ohio State University, Columbus, O.; secretary of the council, Frederick Bedell, Cornell University, Ithaca, N. Y.; treasurer, R. S. Woodward, Columbia University, New York City

Secretaries of the Sections.—Mathematics and astronomy, Alexander Ziwet, University of Michigan, Ann Arbor, Mich.; physics, E. B. Rosa, Wesleyan University; chemistry, Charles Baskerville, University of North Carolina, Chapel Hill, N. C.; mechanical science and engineering, William S. Aldrich, University of West Virginia, Morgantown, W. Va.; geology and geography, Warren Upham, St. Paul, Minn.; zoology, C. W. Stiles, Department of Agriculture, Washington, D. C.; botany, Erwin F. Smith, Department of Agriculture, Washington, D. C.; anthropology, M. H. Saville, American Museum of Natural History, New York City; economic science and statistics, Marcus Benjamin, U. S. National Museum, Washington, D. C.