SCIENCE

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THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

SECTION D, MECHANICAL SCIENCE AND ENGINEERING.

THE meetings were held in the engineering building of the University of Pennsylvania. The following officers were elected to serve during the meeting:

Councilor—F. W. McNair, president Michigan College of Mines, Houghton, Mich.

Member of the General Committee—H. S. Jacoby, professor of bridge engineering, Cornell University, Ithaca, N. Y.

Member of the Sectional Committee, 1905 to 1910—A. M. Greene, Jr., professor of mechanical engineering, University of Missouri, Columbia, Mo.

The secretary of the section was elected press secretary; vice-president and chairman of the section D. S. Jacobus, professor of experimental engineering, Stevens Institute, Hoboken, N. J., was forced to be absent, owing to illness in his family. The sectional committee appointed Calvin M. Woodward, ex-vice-president of the section, to act as chairman of the section for the meeting.

The program had been arranged so that papers pertaining to civil engineering, mechanical engineering, metallurgical engineering and general engineering, and to engineering education, should be read at separate sessions. The program of Wednesday morning, December 28, was devoted to civil engineering. The first paper on the program was by C. G. Elliott, expert in irrigation and drainage investigations of the Department of Agriculture, Washington, D. C., and was on 'Irrigation and Drainage Investigations of the Department

of Agriculture.' He showed that while chemical analysis may show that two soils are equally rich in plant food, yet on account of unfavorable water conditions, one of them may be quite unproductive, and the different portions of even the same field may vary in their production on account of differences in the water content of the soil. The supply of water and the control or regulation of its quantity in soils of different classes under varying climatic conditions for the production of crops of a first-class character present an important field which now occupies the attention of the irrigation and drainage investigations. The objects of this work are to ascertain the best methods and provoke their use in applying water to soils where it is deficient, conserving and regulating its quantity, removing surplus from saturated soils and reclaiming and protecting lands from overflow, all of which invokes a variety of engineering practise. The soil water necessary for the growth of plants is held about soil drains in films and is removed from the soil by capillarity, plant absorption and surface evaporation only. Irrigation must supply this amount when deficient, and any surplus must be removed by drainage. The water-holding capacity of different soils is an important subject for investigation. The part of the engineer is to provide means for supplying, regulating and controlling the soil water to meet the needs of the various kinds of soils encountered and plants grown therein, and includes a study of the movements of water, both by capillarity and by gravity.

Henry S. Jacoby, professor of bridge engineering, Cornell University, Ithaca, N. Y., presented 'Some Notes on Reinforced Concrete Arches,' giving the results of his study and investigations during the past year and supplementing his previous papers.

E. J. McCaustland, assistant professor in civil engineering, Cornell University, Ithaca, N. Y., next presented a paper on 'Tests of Reinforced Concrete Beams,' in which he presented the data and conclusions obtained from the tests to failure of twenty-three beams of concrete, reinforced by plain and various forms of patented bars of steel. They were 6 by 8 inches in size and 6 feet long. Plain square steel rods were used, varying in sizes from $\frac{3}{8}$ to $\frac{3}{4}$ inch and placed either $1\frac{1}{4}$ or 2 inches from the lower face of the beam. The beams were made of a very lean concrete (1 cement, 2.5 sand and 9 broken limestone), so that in all cases the steel reinforcing bars developed full strength of the concrete before reaching the elastic limit. Deflections were measured, and also the extensions of the lower fibers. A careful watch was kept to determine the appearance of fine cracks. The loads were released after each reading so as to measure the set. Tests of the beams with plain square bars showed poor adhesion and the early development of fine cracks, so that the smallest percentage of reinforcement seemed sufficient. The beams having reinforcement $1\frac{1}{4}$ inches from the lower face showed greatest strength. In the second series sets of beams were laid up with reinforcements of Ransome bars, Johnson corrugated bars, Kahn bars, corrugated bars with iron stirrups, Thatcher bars, and two beams with plain bars for comparison. The ratio of reinforcement was made about 0.58 per cent. and the center of the steel bars was placed $1\frac{1}{2}$ inches from the lower face of the beams. The extensibility of the reinforced concrete in these tests was one in 1,621, while that of the plain concrete was one in 11,000. The results show the superiority of the corrugated bars under ordinary conditions. They also draw sharp attention to an interior weakness in a reinforcement having diagonal wings rigidly attached. The tests show the folly of at-

tempting to reinforce a concrete which will not of itself develop a fair degree of strength, and they throw very serious doubts upon the wisdom of using certain types of diagonal reinforcements in beams. The paper will probably be published in the *Engineering Record.*

Owing to the absence of Mr. Richard L. Humphrey, consulting engineer, of Philadelphia, his paper on 'Some Notes on the Manufacture and Testing of Cement' was read only by title.

In a paper on 'The Menace to the Entrance of New York Harbor,' by Lewis M. Haupt, consulting engineer, Philadelphia, after reviewing the different projects which have been carried on by the general government for the improvement of the channels leading into the lower bay, the author showed by means of charts that in the past century the inlet to Jamaica Bay has moved seven miles to the west, and also that the spit at Sandy Hook has advanced about a mile, and is now moving into the bay, depositing half a million yards of sand every year. It was held that these encroachments upon the entrance to New York harbor formed a menace which could no longer be overlooked. The author found a remedy in a single reaction training wall which would concentrate the ebb of the currents and prevent the continued deposit of drift which threatens to convert Coney Island and Manhattan Beach into lagoons. The estimated cost of this would be but one-half of the present contract for dredging the channel, which it is stated can not be maintained, as it fills up very rapidly. The paper was subsequently read before Section E; and extracts of it were published in the New York daily papers and caused much discussion in both engineering and commercial circles.

At the conclusion of this paper, Section D joined the meeting of Section I to listen to a paper and discussion on 'Specialization in Manufacturing' by Alexander E. Outerbridge, Jr., metallurgist of William Sellers & Company, Incorporated, of Philadelphia. The paper gave data from actual experience, showing the enormous economies, as well as limitations, of the modern methods of concentrated effort and capital in a single production, as compared with older methods in general practise. The paper will be found in full in the January issue of the *Annals of the American Academy of Political and Social Science.*

On Wednesday afternoon after luncheon the members of the section, in charge of competent guides, visited the new electric power station of the Philadelphia Electric Company. This station presented a notable illustration of the many uses of concrete, of which the most novel was probably the installation of the high tension wires and fuses in vertical cases made of monolithic concrete construction.

Later the members visited the high pressure fire service plant of the city of Philadelphia. This plant is notable in that the large triplex power pumps are operated by gas-engines supplied with artificial gas from the city mains. No standby losses are incurred, full pressure is available in two minutes from the time the fire alarm is sounded, which is much sooner than the company can get to the hydrant nearest to the fire. The quantity of water is much larger than could be obtained by the normal number of fire engines, while ample provision in the way of valves has been made for the bursting of mains.

On Thursday morning, owing to the absence of the author, paper number seven, on 'Some Notes on Ventilating Problems,' by Charles B. Dudley, of the Pennsylvania Railroad Co., Altoona, Pa., was read by title only. It was followed by an interesting paper by C. J. Zintheo, professor of farm mechanics, Iowa State College, Ames,

Ia., on 'American Machinery as a Factor in Agriculture':

"Farm machinery has made it possible to develop the vast agricultural resources of the country. During the first two hundred years after the Pilgrim Fathers settled on the American shore, the resources of the country failed to bring about any increase of importance in commerce or in the products of agriculture. As late as 1845, people did not raise enough wheat for their bread. With the advent of the steel plow, the self-binding harvester and the steam threshing machine, there was a marked change in the producing power of the American people. Our food supply increased from 4.33 bushels of wheat per person in 1845 to 5.50 bushels of wheat in 1859; to 7.45 bushels in 1869, and as high as ten bushels in 1889. During the same time the population on the farms had decreased to 80 per cent. in 1850 and 33 per cent. in 1900. The American farmers of to-day with one third the labor of the country produce enough food to support, not only themselves, but the other 67 per cent. that live in the cities, and exported farm products during the year 1904 to the value of the enormous sum of $960,000,000, according to the United States Secretary's report. This same report states that in 1830 it took over three hours' labor to raise one bushel of wheat; in 1896 it took ten minutes. In 1830 the labor in one bushel of wheat cost 17¾ cents; in 1896 it cost 3½ cents. In 1850 the labor represented in a bushel of corn was four and one half hours, while in 1894 it had been reduced to forty-one minutes. (This has been greatly reduced since then by the introduction of the more modern corn harvesting machines.) In 1860 it is estimated that the labor in one ton of hay in bales represented 35½ hours, while in 1894 this labor was reduced to 11½ hours, or from a cost of $3.00 in labor to $1.29 in labor. The report estimates that in the year 1899 the agricultural implements in the United States saved in human labor the sum of $681,471,827. This country is the greatest maker and user of agricultural implements in the world, and this is largely due to the fact that this country is the most prosperous agricultural country in the world. It has enabled the farmer to pay the high price for labor caused by the competition of our manufacture, and has taken away from farm life much of the drudgery and manual labor and made it in the best sense an intellectual pursuit. Improvements in machinery have brought about a steady decrease in the cost of production, notwithstanding the steady rise in wages. To give an idea of the vast sums of money invested in farm machinery, take, for instance, the following states: Iowa has $57,960,000 invested; New York, $56,006,000; Pennsylvania, $50,917,240; Illinois, $44,977,310; and Ohio, $36,354,450. The total value of implements on farms in this country is $761,261,000, an average of $133 per farm and 90 cents per acre of farm land. The American farmers buy annually $100,000,000 of farm implements. New designs of farm machinery are being constantly added, so that the farm machinery is surely the greatest factor in the development of American Agriculture."

In a paper on 'A Method of Determining the Moisture Existing in Steam at Atmospheric Pressure,' D. S. Jacobus, professor of experimental engineering, Stevens Institute of Technology, Hoboken, N. J., illustrated with blue prints and described the method which he had adopted for determining the dryness of steam. It consisted of mingling a known weight of superheated steam with a known weight of saturated steam at atmospheric pressure. The steam was still superheated after mingling and its temperature was measured. Careful measurements were made to

determine the radiation of the apparatus. From data thus obtained the amount of moisture in the saturated steam was determined. This method is similar to that employed by Mr. George H. Barrus in one of the older forms of his calorimeters. The particular problem to be investigated was how much moisture would be contained in steam at atmospheric pressure after it had passed through two separators of a certain form. The tests showed that the steam at atmospheric pressure leaving the separators contained about one tenth of one per cent. of moisture, a result which was within the probable error of the instrument, for which reason it was fair to conclude that the steam was dry.

The paper will be published in the *Engineering Review.*

G. W. Bissell, professor of mechanical engineering, Iowa State College, Ames, Ia., next presented a paper on 'Hot Blast Heating and Ventilating,' giving results of experiments on the heating and ventilation of the new engineering building of Iowa State College. This building is equipped with Sturtevant hot blast apparatus, the Paul system of vacuum steam heating, and the Powers system of temperature regulation. The total steam condensation was measured hourly, and continuous records were kept for two months. Forty-three separate tests were made at steam pressures, varying from 5 to 25 pounds and with air pressures varying from 0.6 to 1.5 inches. The paper gave a series of tests showing the coefficients of condensation with one or more sections of coils in use, and at different steam pressures, and with different quantities of air being forced over the coils. The paper was published in the *Engineering Review.*

In a case where a man was killed by the bursting of an elbow on a steam main near which he was working, the question arose as to the number of pieces into which such would be broken if it were struck with a hammer when under steam pressure. D. S. Jacobus, professor of experimental engineering, Stevens Institute of Technology, Hoboken, N. J., presented the results of tests which he had made on fittings of the same size and weight as the one which caused the accident and on some similar fittings. The former was an extra heavy elbow for a three-inch standard pipe. The smaller fittings which were tested were of two-inch standard size and of the ordinary weight. In the tests, the elbows were broken by hitting them with a hammer swung by hand when they were subjected to pressures of 80 and 100 pounds per square inch. The hammer, together with its handle, weighed four pounds. The fittings were struck on the outside directly over each of the screw threads at points directly opposite the neck and in the plane passing through the pipe centers. The extra heavy three-inch elbows broke in two nearly symmetrical halves, the plane of breakage being that passing through the pipe centers. The two-inch fittings of ordinary weight broke in two to four or more irregular pieces. The paper was published in the *Engineering Record.*

L. E. Löewenstein, of the Department of Mechanical Engineering, Lehigh University, South Bethlehem, Pa., next presented a paper on 'Some of the Scientific Features and Development of the Steam Turbine.' As the author is the American translator of Professor Stadola's German work on this subject, the paper was of much interest to the audience which heard it.

In a third paper by Professor Jacobus, the angular displacement of the revolving fields of two alternating current electric generators when connected in parallel was determined by actual measurements and compared with the computed amounts. The results were found to agree very closely with each other. The generators on which

the tests were made were of 1,500 kw. capacity and were located at the Manchester Street Station of the Rhode Island Co., Providence, R. I. Large counterweights had been placed on the engines in order to reduce the amount that they shook the building. It was shown theoretically that when the generators were coupled together with the counterweights opposed, or at 180° from each other, the angular displacement was about twice what it would have been without the counterweights. The maximum displacement due to counterweight action and to irregularity in the effort exerted on the crank shaft was found by theory to be 3.2 pole degrees and by observation from 3 to 4 pole degrees. The amount of angular displacement was observed to be the same, irrespective of the position of the counterweights, but when the counterweights were opposed the displacements occurred every stroke, or about 94 times per minute, whereas, when the counterweights were together, or nearly so, the displacements occurred at less frequent intervals, or about 30 to 40 times per minute. As the total displacement of the two fields from their true positions, as observed, was about the same irrespective of the relative positions of the two counterweights, it follows that this displacement was produced as much through governor action as through any variation in the turning effort during a single revolution.

On Thursday afternoon, under the able guidance of Professor Marburg, the members of the section were guests at luncheon of the contractor for the Belmont Filtration Plant. After enjoying the social features of the afternoon, the members of the party were conducted through the gate house, filtering galleries, and had the details of the operation explained to them in much detail by Mr. John W. Hill, chief engineer of the bureau of filtration, and his son. The observations of the afternoon made the succeeding illustrations of the evening much more real and valuable to those who had the privilege of hearing both the afternoon demonstrations and the evening lecture.

The Thursday evening session of Section D was devoted to three extremely valuable papers by notable engineers of the city of Philadelphia, on subjects which are of much interest, both to engineers and citizens of Philadelphia and to engineers and scientists at large. They were very fully illustrated by lantern slides. The first was by J. W. Hill, chief engineer of the Bureau of Filtration of the Department of Public Works of Philadelphia, and was on 'The Philadelphia Filtration System.'

The second paper of the evening was by Wm. S. Twining, chief engineer of the Philadelphia Rapid Transit Co., and described and illustrated 'The Subway and Elevated Railroad of the Philadelphia Rapid Transit Company.'

The third paper was by George H. Webster, chief engineer, bureau of surveys of the board of public works of Philadelphia, and was on 'Modern Engineering in the City of Philadelphia, under the Direction of the Bureau of Surveys.'

These papers were both most entertaining and instructive, and showed the great advances which have been made in the practical applications of engineering science in the municipal affairs of the city of Philadephia in providing for the citizens a healthful water supply, rapid and convenient methods of transportation, and up-to-date and modern methods of keeping records and performing the routine work of the office of city engineer in a large municipality.

The first paper on the program of Friday morning, December 30, was by Arthur H. Blanchard, assistant professor of civil engineering, Brown University, Providence, R. I., and was on 'The Development

of the State Highway System of Rhode Island':

"The first tangible step towards the establishment of a state system of continuous highways in Rhode Island was the passage of an 'act to provide for the construction, improvement and maintenance of state roads' by the General Assembly in 1902. The salient features of the 1902 act are as follows: the construction and maintenance of the state highway system is vested in a board, consisting of five members, who serve without remuneration: the chief engineer is appointed by the board; the entire expense of construction and maintenance of standard roads is borne by the state, resulting in a maximum benefit to the state as a whole and to the urban as well as the rural communities (the fifteen trunk highways comprising the state system of continuous roads have a total mileage of 249 miles, 18.89 of which was contracted for by the state in 1903); an annual appropriation of $5,000 for general office expenses is included in the act: annual construction appropriations are based upon the annual reports of the board ($100,000 in 1903 and $100,000 in 1904); cost of extra width, in excess of fourteen feet, is to be borne by the towns concerned. The standard macadam road consists of 14 feet of 6-inch macadam, built in two courses of broken stone, with dust used as a top dressing only, the surface being in form, the two intersecting planes having a tranverse slope of three fourths of an inch to the foot. By the knowledge obtained from road metal tests made at Washington, together with information gained from observations on how the material actually wears and binds in practice, the board hopes to reach satisfactory conclusions with reference to the rocks that may be used for road building purposes in Rhode Island. The recognition of the injurious effects of narrow tires upon macadam roads resulted in the passage of an act in 1902 to prohibit the use of narrow tires after April, 1905. It is believed that a rigid enforcement of this law will materially reduce the cost of maintenance of the state roads."

The next two papers on the morning's program were on 'Lines of Progress in Aeronautics,' and were intended to supplement the series of papers on this subject which were presented at the St. Louis meeting of the association. Calvin M. Woodward, dean of the School of Engineering and Architecture of Washington University, St. Louis, Mo., described the efforts which had been made and stated some of the reasons why they had not met with greater success at the Louisiana Purchase Exposition during the past year. Being a member of the committee of the World's Fair on the subject of aeronautics, he was able to speak with positive knowledge.

The second paper was by Mr. K. Dientsbach, of New York, who is the American correspondent of *Illustrierte Aeronautische Mitteillungen*. He reviewed the recent progress made in aeronautical science by Maxim, Langley, Zahm and the Wright Brothers.

In the absence of the author, the paper by David Todd, director of Amherst College Observatory, on 'A Twelve-ton Observatory Dome of Thirty-five Feet Diameter,' was read only by title.

Clarence A. Waldo, professor of mathematics at Purdue University, Lafayette, Ind., presented samples of 'A New Engineering Product, and Some of Its Problems.' The product consisted of metallic materials formed into hollow shapes, such as flasks, floats, spheres, bottles and the like. It was much to be regretted that the exact method of manufacture was not described, and the 'problems' which had been met were only stated and their solution not given.

A. J. Wood, professor of experimental

engineering, Pennsylvania State College, State College, Pa., next read a paper giving the results of his experiments on 'Tests of Cold Drawn Steel Elevator Guides.' He stated that many engineers were of the opinion that the cold rolling improved the tensile strength of steel more than did cold drawing. The paper called attention to tests recently made by the author showing the comparative strengths in transverse loading of hot-rolled and planed T-shaped elevator guide-bars supported on 24-inch centers, as compared with cold-drawn bars made from hot-rolled bars. The open hearth steel which was used contained from 0.12 to 0.15 per cent. of carbon. The hot-rolled bars weighed $14\frac{2}{3}$ pounds per foot, and after rolling 14 pounds per foot. The autographic stress-strain diagrams of the bar show that the actual elastic limit was increased from 13,900 pounds with the hot-rolled bars to 35,000 pounds with the cold-drawn bars, and that the yield point was increased from 17,500 to 38,500 by the process of cold-drawing; that the cold-drawn steel not only deflected less under a given load, but that it suffered less permanent set. The paper will be published by the *American Machinist*.

The last paper of the morning was by C. M. Woodward and was on 'The Track Pressure Resulting from an Eccentric Weight.' The paper elicited considerable discussion from the mathematical engineers who were present. It will be published by the St. Louis Academy of Science.

The session of Friday afternoon was devoted to engineering education. The vice-presidential address of the retiring vice-president, Calvin M. Woodward, dean of the School of Engineering and Architecture, Washington University, St. Louis, Mo., on 'Recent Progress in Engineering Education,' was true to its subject, and as it has been presented in the pages of SCIENCE for January 6, 1905, nothing further need be said.

Edgar Marburg, professor of civil engineering, University of Pennsylvania, next described the new engineering building of the University of Pennsylvania. It is expected that it will cost $700,000, and with its new additional equipment will cost $800,000. It will be capable of providing for 500 engineering students in civil, mechanical and electrical engineering. One of the noteworthy features is that of a large number of small rooms each containing comfortably not over fifteen students. These are to be used for recitation rooms and quizzes. Larger assembly rooms for all the sections of the class are also provided, where one of the instructors can lecture to the class as a whole. This system of instruction and also the details of the building were discussed at considerable length by the educators present.

'Desired Requirements for Entrance to Engineering Colleges' was the subject of a paper by William Kent, dean of the College of Applied Science, Syracuse University, Syracuse, N. Y. He stated that the present requirements included English, history, mathematics, physics, science and modern languages, each of which cultivates a separate group of intellectual faculties. At Syracuse University a change has been made in the direction of broadening the entrance requirements so as to require six groups of study, and including free-hand drawing as one of the essential subjects. It is now proposed to make another change so as to require studies in seven groups, which, besides free-hand drawing, physics or chemistry, shall include one or more natural sciences. The following advantages are claimed for the proposed entrance requirements. First, the requirement of seven studies instead of eight makes it easier for high schools to give a thorough preparation. Second, it will decrease the

number of conditions of entering students. Third, seven subjects selected from the seven groups, each studied with proper thoroughness, give a more liberal and broader education than eight subjects from five groups, including electives which may be selected from the same five groups. Fourth, they include drawing and natural science, without which no one can rightly be said to have a broad and liberal culture. Fifth, by making options in language and in physics and natural science, the requirements favor those high schools which are equipped to give some optional subjects better than others. Requiring either physics or chemistry, and not both, is a convenience to the college, so that either physics or chemistry can be given in the freshman year to those students who do not present one or the other.

The last paper scheduled for the afternoon had been read at a previous session of the section and was on 'The Value of Courses in Agricultural Engineering,' by Elwood Mead, chief of irrigation and drainage investigations, U. S. Department of Agriculture, Washington, D. C.:

"Agricultural engineers have hitherto had little opportunity for practising their profession in the United States, the large areas of cheap land and crude and wasteful methods of cultivation preventing any large expenditures on engineering works for the improvement or reclamation of agricultural areas.

"These conditions are now rapidly changing. The building of canals and dams to irrigate the arid lands of the west, the construction of dikes and drains, and the installation of pumps to remove the surplus water from our swamp and overflowed lands are two of a number of lines of work which are opening up broad fields of usefulness and power to specially trained young men. Our agricultural colleges are recognizing this and beginning to provide adequate courses of instruction. Within the past year the Iowa State College has completed a commodious building, with a complete equipment for instruction in this branch of engineering. Wisconsin is erecting a building; Illinois, Minnesota, Nebraska and Wyoming have courses in agricultural engineering; while Colorado and California make irrigation engineering one feature of their courses in civil engineering. Special training in the administration of canals and in the laws and customs governing the use of streams is required by the irrigation engineer. This is being provided by the agricultural colleges and by the reports of the irrigation and drainage investigations of the Office of Experiment Stations, U. S. Department of Agriculture.

"Drainage engineering is becoming an important factor in agricultural production. The reclamation of the swamp and overflowed lands along our sea and gulf coasts will add nearly 100,000,000 acres to the productive area. Tile underdrains are being made use of to protect hillside farms from erosion.

"Modern farm machinery includes motors run by steam, gasoline, electricity and wind. Where farmers do not understand their care and management, there is great waste and loss. Although this country is the greatest maker and user of farm machinery in the world, the agricultural schools of the United States are far behind those of Europe in the training given on this subject."

The last session of the section was held on Friday evening, and, like those which had preceded it, was provided with a very full program. The first paper of the evening was by John Birkinbine, consulting engineer, of Philadelphia, and discussed 'The Iron Ore Supply of the United States and Its Movement.' The author stated that the advances made in iron manufacture

have been largely brought about by methods of transporting and handling 35,000,000 long tons of iron ore which form the product of the mines of the United States. So successfully has this transportation problem been solved to cheaply handle ores from the mines to cars and from cars through docks to vessels, again from vessels to stock piles or to cars, that a number of deposits of iron ore are lying dormant close to blast furnaces because cheap transportation delivered iron ore of superior quality to the furnaces at a lower cost than it is believed the local ores can be won and used. The excellent quality of the Lake Superior ores and their very low phosphorus and sulphur contents make these ores especially desirable. The ore from the Lake Superior region forms over three fourths of all the iron ore mined in the United States. A large portion of it is not touched by the hand of man from the time it leaves its bed in mother earth until it is charged into the throat of the blast furnace. Steam shovels, automatic chutes, drop bottom cars, mechanical handlers, bridge tramways, bins and skip cars take the place of manual labor and permit handling and transporting large quantities of iron ore at a marvelously low rate. By this means the American iron ores can be conveyed long distances from the mines to the point of consumption at an extremely low rate per ton.

The paper will be found on page 56 of the *Iron Trade Review,* March 16, 1905.

'Science in the Foundry' was the subject of a paper presented by Alexander E. Outerbridge, Jr., metallurgist of Wm. Sellers & Co., Incorporated, of Philadelphia, Pa. It was illustrated with lantern slides showing the interiors of foundries in several large industrial establishments, giving realistic views of immense molds and of castings made therein; of the modern 'overhead traveling cranes,' capable of raising fifty tons or more, and transporting these heavy castings and materials with safety and despatch over the heads of the molders and other workmen on the floor. Pictures showing the characteristic appearance of fractured bars of iron, and of castings of different kinds, ranging from tiny castings weighing a few ounces up to immense machinery castings weighing many tons, were thrown on the screen. Photographs of bars of cast iron which had been caused to 'grow' in cubical dimensions in a remarkable manner, while in the solid state; also photographs of a number of castings which had been increased in size by a novel treatment were shown—for which discovery the Franklin Institute recently awarded to the author the 'Elliot Cresson Gold Medal,' the highest in its power to bestow. Two bars of iron cast in one mold, and of precisely the same size, were presented for critical inspection, one bar remained exactly as cast, the companion bar had been caused to grow gradually in cubical dimensions until it is now 46 per cent. larger than the other, the weight remaining the same as before expansion. Both bars were 'machined' on one side to show the texture and metallic appearance; it was difficult to detect any change except the very apparent difference in size. This extraordinary change in bulk was produced by alternately heating and cooling the bar to a 'critical' temperature a number of times, in the manner which has been fully described in the 'Report of the Committee of Science and Arts of the Franklin Institute.' Important practical applications have already been found for this remarkable discovery. The speaker said that formerly there was no scientific method of supervision in foundry practise, and a chemist in a foundry would have been thought to be as much out of his proper sphere as the proverbial 'bull in a china shop'! That day has gone by, and the substitution of scientific system

for empirical methods in progressive foundries has gradually grown from very small beginnings until it has now reached a recognized position of importance. This is true not only in regard to the metallurgical study of pig iron for castings, but also in methods of molding and other cognate branches of the founder's art. The recent great improvement in the design and construction of molding-machines has led to the gradual substitution of machine molding for hand labor in a large and rapidly expanding degree. The scientific examination of molding sand and other materials used in molding has led to important improvements and economies. In fact, the influence of this newly awakened scientific interest in foundry improvement is extending in all directions. The result is that the manufacturer of machinery is enabled to obtain castings from foundries conducted on modern methods which are far better adapted to the work for which they are designed than heretofore, and he is, therefore, enabled to guarantee quality and strength with an assurance which he could not formerly give. From these observations it may be inferred that, although the field for cast iron has been invaded to a great extent by cast steel, the producers of iron castings have been spurred on to improve their product, and thus to keep in line with the progress of the age, and to show that in spite of this competition the field is still open for their occupation.

One of the most interesting papers of the Philadelphia meeting was on 'Recent Advances in the Mechanical Science Involved in the Coinage of Money,' by Edwin S. Church, superintendent of machinery, United States Mint, Philadelphia. It was illustrated by lantern slides and described in much detail the process of manufacturing money from the power plant with its large engines, through the various processes required in the coinage of money by rolling, stamping, punching and milling, and the great pressures which are necessary to effect the results. Mr. Church made the interesting statement that it was impossible for the new United States Mint at Philadelphia, with all its increased facilities, to supply the demand for copper cents during the two or three weeks immediately preceding the Christmas holidays, showing to what a large extent Christmas is the children's festival, and how largely it enters into the business of our country.

The sectional committee of Section D desires to express its cordial appreciation of the kindly attention and services rendered it by Professor Edgar Marburg and Professor H. W. Spangler, of the University of Pennsylvania, and to the engineers of Philadelphia who so kindly took part, either on the program or in the excursions, or permitted us to visit their works.

It is to be regretted that a larger number of the members of the association were not in attendance, and especially when it is remembered that there has been a large increase in the membership of both the association and the section within the past few years. Papers alone, even by eminent men, do not make a successful meeting. They may form an attractive program, but one of their chief objects is to elicit discussion, without which any program, no matter how good, is likely to fall flat. While there was some discussion over some of the papers presented at the Philadelphia meeting before Section D, neither the attendance of members nor the discussions were as plentiful as was desired. The sectional committee may procure and present a suitable program, but unless the members attend the sessions and take part in the discussions, its work will be largely in vain. It is to be hoped that the members of the association will make a special effort, even if it includes some sacrifice, to attend the meeting at New Orleans next December.

WM. T. MAGRUDER,
Secretary.