

## THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

### SECTION D—MECHANICAL SCIENCE AND ENGINEERING. II

*Recent Developments in Details of Construction of Brick Pavements on Green Concrete Foundation and Sand-Cement Superfoundation:* WILLIAM C. PERKINS.

Discussion of new methods of constructing brick pavements. Two methods of construction: (1) The laying of the brick directly on the green concrete, commonly called "the monolithic construction." (2) The laying of the brick on a superfoundation of cement-sand commonly called "the semi-monolithic construction."

Advent of a brick 3 inches in depth due to the new methods of construction and discussion of the advantages of a 3-inch brick.

Discussion of the details of construction of the monolithic type.

Discussion of the details of construction of the semi-monolithic type.

(Slides will be used showing the different steps of construction.)

*The Causes of Cracks in Cement-Concrete Pavements:* A. T. GOLDBECK.

This paper gives data on the relative effect of moisture and temperature in causing cracking of concrete pavements. The results of laboratory tests on the effect of moisture on concrete are given as well as the results of field measurements on concrete roads. Likewise some results of friction tests of concrete slabs on various sub-bases are presented and applied in analyzing the effect of expansion and contraction in causing cracks. Finally, the effect of lack of uniform support by the sub-base in causing longitudinal cracks is pointed out.

*A Condition Survey of Concrete Roads in the United States:* A. N. JOHNSON.

*The Necessity for Adequate Methods of Waterproofing in Road Construction:* B. A. MEYER and C. J. MORRISON.

A wheel and a road may be considered as two elements of a machine and the ideal requisites for each determined to be:

1. Perfectly hard and perfectly round wheel.
2. Perfectly hard and level road.

The ideal road can not be maintained, but can be approached by constructing a moderately hard road which resists wear and disintegration.

In order to fulfil their requirements roads must be water-proof so as to protect them from the flow-

ing, undermining and penetration of water. Principles of waterproofing are simple, but are neglected. Illustrated by drawings and pictures.

Roads are constructed under five general conditions:

1. On level ground.
2. On inclined ground.
3. In cuts.
4. On embankments.
5. On side of slopes.

Each condition requires a different method of waterproofing, and waterproofing is dependent upon:

1. Location of drains.
2. Construction of road.
3. Treatment of surface.

Comparative costs of construction and maintenance show that at the end of five years the total cost of a non-waterproof road and that of a semi-waterproof road are about equal, but that the former is practically useless while the latter shows little deterioration.

Similar comparisons for waterproof roads are not yet available.

*Columbia River Highway:* GEORGE C. WARREN.

The fourth session was held in the morning, Friday, December 29, in the engineering building, Columbia University, Vice-president, Dr. Henry M. Howe in the chair, with an attendance of about 45.

The program of the session, which was devoted to general engineering, was as follows:

*Modern Methods of Precise Leveling in the Coast and Geodetic Survey:* WILLIAM BOWIE.

*Development of the Systematic Hydrographic Survey:* N. H. HECK.

Difference in popular and scientific attitude toward the two branches of the Coast and Geodetic Survey work.

Lack of appreciation of hydrographic problems with reasons. Conservatism of sea reacts on survey methods. Instances.

Numerous sources of possible error to be eliminated. Pressure of commercial needs interferes with experimental work.

Closer attention to care in location. Elimination of errors due to currents in certain offshore areas. Startling results of a simple change. Improvements in depth measurements. Possible errors in a long-established method.

Failure of vertical method of developing all bottom contours introduced need for wire drag method. Mathematical definition. Aims and classification.

Practise in deep water work. Outline of nature of problems in close to bottom wire drag surveys. Surface observation insufficient. Analysis of action of wire in striking an obstruction with observed phenomena. Geological phase. Experiments and conclusions.

Estimate of value of method and results. Improvements in apparatus and instruments. Standardization of measurements. Definite recognition of need for experiment and research in all branches will lead to continuous improvement in results.

*The Engineer and the Newspaper:* HENRY A. WISE WOOD.

Herein Mr. Wood first recounts the origin of the practise of engineering science as a civilian occupation. He then describes the slow development in printing during the first eighteen centuries, commencing with the manufacture of paper, and relates to the improvements as they took place up to the nineteenth century, when the engineer took the art in hand, transforming it from a hand-worked to an automatic basis. Mr. Wood then dwells on the more extensive improvements made in printing during the nineteenth century, particularly in the printing press.

Having brought the press to its present state of perfection, he enumerates the other improvements in printing. In connection with the composing room he expounds the revolutionary advantages of the linotype, and in disclosing the improvements made in the stereotyping room he explains the processes which transformed it from a hand-worked into an automatically-operated department—the autoplater, introduced early in the twentieth century, being the principal factor.

Mr. Wood then passes on to the newspaper's latest achievement, the stereotyper's dry matrix, with which the history of printing ends. And he closes with a prophecy that the next step forward in printing will be taken in the printing-press department.

*Independent Laboratories in the Engineering Industries:* CLAYTON H. SHARP.

The university is the proper place for pure scientific work; that is, work done without any commercial motive. The large manufacturing organizations have recognized the importance of industrial laboratory work and many of them have organized extensive laboratories for their own purposes. The small manufacturer, being unable to establish an efficient laboratory of his own, may take his work either to a technical school or to an independent industrial laboratory. The technical school is, however, unsuited for many classes of in-

dustrial work through limitations of equipment and because, being organized for purposes of education, industrial work does not fit properly into its scope. The best solution of the laboratory problem of the small manufacturer is recourse to independent laboratories, adequately manned and equipped and supported by the work which they do. Such laboratories may offer facilities quite comparable with those of the laboratories of the great corporations and should, if adequately supported, prove an important factor in industrial progress.

*A Study of the Relation between Tension and Magnetic Permeability:* JAMES T. ROOD.

Magnetic curves are commonly assumed to hold irrespective of conditions under which material is to be used. Is this correct?

Does tension effect permeability of magnetic materials?

Does this change with material?

What is the magnitude of this change?

Tests on cast iron showed permeability unaffected by tension.

Tests on wrought iron showed permeability considerably affected by tension. To top of knee of  $B$ - $H$  curve, tension below a certain amount increased permeability, greater tensions decreased permeability. Above knee, all tensions up to elastic limit decreased permeability. Higher the stress, the greater the percentage decrease; higher the degree of saturation, the less the percentage decrease.

Tests on steel showed permeability to be affected in the same manner as wrought iron.

With these materials the increase and decrease in permeability may be as high as 20 per cent.

Effect seems to increase as elasticity of material decreases, but cast iron is an exception.

The presence of carbon may be a determining factor.

*Notes on the Theory of the Air Core Auto-transformer:* WALTER L. UPSON.

The theory of the auto-transformer, especially the non-ferric type, is worked out by the method of complex quantities. It is pointed out that the resistances and leakage reactances of air-core transformers being constant and the magnetizing current being directly proportional to the impressed voltage, the characteristic performance is entirely dependent on the voltage and when known for one value of voltage may be immediately found for any other voltage.

A brief discussion of the peculiar characteristics of this apparatus is indicated by theory is

given, and an example is worked out from assumed constants.

The paper is of a preliminary character, intended to open up the general problem and suggest what may be expected by a more exhaustive study from the experimental standpoint.

*Medical Engineering*: P. A. MAIGNEN.

Medical engineering is defined as medicine viewed from the angle of engineering.

The author refers to the great interest manifested in our days in sanitary science (preventive medicine) and in medical subjects generally.

He defines engineering and points out the necessity for the engineer to be ingenious.

The various divisions of therapeutics—natural, applied, empirical and rational—are referred to.

Serum therapeutics is criticized.

The excessive fear of microbes is disapproved, but it must be recognized that more than half the diseases are of bacterial origin and that we must declare war against the bacteria, and carry it on with appropriate weapons on the surfaces without injuring the healthy tissues.

The author points out the procrastination of the sick, and the desirability of the state paying the physicians in civil life, as it already pays the army and navy surgeons. The education of the people in the rudiments of antiseptic therapeutics is also recommended.

The discovery of an effective, non-poisonous germicide is explained, and it is suggested that antiseptic surgery, which has been somewhat neglected of late, will return to the front.

He gives the formula of the new antiseptic, which is  $3\frac{1}{2}$  times stronger than carbolic acid and may be taken internally in the respiratory and alimentary tracts.

A few words about tuberculosis and cancer close the paper.

*Mathematical Education for Civil Engineers*: D. J. MCADAM.

The paper does not undertake to discuss the mathematical curriculum in our engineering schools as a whole, but points out some defects in the teaching of the standard subjects, algebra, the geometries, the trigonometries and calculus.

These defects are: (1) Wrong or defective statement and development of the fundamental propositions such as, for instance, in the definition and development of the trigonometric functions in trigonometry, and the proof of the rules for differentiation in calculus. (2) Insisting on secondary rules and formulæ with as much zeal as on the primary and fundamental. For instance, the mul-

tiplicity of formulæ in plane trigonometry, which should be developed from half a dozen, and in spherical trigonometry, which could be developed from less than half a dozen. (3) Burdening the student with useless details. Thus, in algebra he is required to commit the quotient having given dividend and divisor, and he is to remember four rules for solving a quadratic trinomial instead of one.

*The Effect of Such Teaching*.—(1) The student is made to carry in his mind—temporarily—such a mass of detail that he proceeds to forget it all, including the fundamentals.

(2) The student fails to get a mathematical education at all. He fails to grasp the true mathematical import who does not find in it a means of taking a few fundamental principles and with them working wonders.

(3) Such study of mathematics defeats the aim of even those who would have mathematics studied as a means of discipline. No study can be truly disciplinary which instead of awakening love and enthusiasm, begets discouragement and disgust.

*The Remedy*.—If teachers insist on following the text-book, then the remedy is in having prepared sets of books, which would present only fundamental propositions as primary, and give these secondary propositions as exercises.

In the calculus it is suggested that we have a set of small volumes, the first developing the fundamental propositions, the other volumes, each after unfolding the fundamentals, should follow this with problems wholly worked by the calculus.

*Apparatus and Process for the Treatment of Western Grown Flax Straw for the Manufacture of Paper*: GEORGE D. BURTON.

*State Engineering Experiment Station and Government Promotion of Industrial Research*: PHINEAS V. STEPHENS.

This paper discusses a system of state industrial research in state engineering experiment stations connected with a well organized and equipped engineering school and established under federal aid and supervision. The stations to be also supported and directed by the state for the purpose of prosecuting research in pure and applied science relating to industrial development, transportation, sanitation, irrigation, the utilization of our natural resources and the general problems of public welfare. The system includes the actual cooperation of the Department of Commerce and also that of engineering and scientific societies, manufacturers, foundations and individuals interested in scientific and industrial development.

The plan provides for the training of engineers as scientists and research experts, the use of graduate students for research and the employment of research experts as lecturers and instructors part time in the regular courses of engineering and science in the schools where the stations are established. There is included a universal research library system, making easily available the important information resulting from the researches in the proposed engineering experiment stations.

The fifth session was held in the evening of Friday, December 29, in the auditorium of the United Engineering Society building at the invitation of the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers. Vice-president Dr. Henry M. Howe presided. The attendance was about 325.

The program of the session, which was devoted to the subject "Interrelationship of Engineering and Pure Science," was as follows:

Address by Dr. Henry M. Howe, vice-president, Section D, A. A. A. S., and past-president, American Institute of Mining Engineers.

Address by Dr. Bion J. Arnold, retiring vice-president, Section D, A. A. A. S., and past-president, American Institute of Electrical Engineers.

Address by Clemens Herschel, president, American Society of Civil Engineers.

Address by Dr. Ira N. Hollis, president, Worcester Polytechnic Institute, and president, American Society of Mechanical Engineers.

The session was followed by a reception, dance and collation tendered by the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers to the American Association for the Advancement of Science.

ARTHUR H. BLANCHARD,  
*Secretary*

#### MINUTES OF THE COUNCIL

THE council met in the U. S. National Museum, Washington, D. C., on Tuesday, April 17, 1917, at 4:45 P.M., Mr. Humphreys, vice-president, in the chair. The following members were present: Messrs. Van Hise, Pickering, Nichols, Cattell, Fairchild, W. A. Noyes, Merritt, Kober, Humphreys and Howard.

The committee, on policy submitted a report through its chairman, Mr. Nichols, and,

on recommendation, the following actions were taken by the council:

On nomination, Mr. E. L. Thorndike, of Columbia University, was elected vice-president and chairman of Section H, in place of Mr. E. B. Titchener, declined. On nomination, Mr. E. K. Strong, of Nashville, was elected as secretary of Section H for the unexpired term of one year, vice Mr. MacCurdy, resigned.

On motion, the following societies were admitted to affiliation with the American Association for the Advancement of Science with privilege of the waiving of the entrance fee to such of their members as may join the American Association for the Advancement of Science during the current year:

Society of College Teachers of Education,  
National Society for the Study of Education.

On motion, the general secretary was instructed to inform the officers of the National Education Association that the American Association for the Advancement of Science would welcome the National Education Association as an affiliated society. It was moved to amend the original recommendation of the committee on policy to include also the American Association of University Professors in the above action.

On motion, it was resolved that the general secretary be authorized to prepare and publish, with the assistance of the permanent secretary, a membership list of the American Association for the Advancement of Science provided it could be done without expense to the association.

An informal report was made by Mr. Nichols to the effect that the proposed alterations to the constitution and the formulation of by-laws were in definite shape and would be ready for presentation at an early date. It was, on motion, resolved that, upon the completion of the committee's work, the results be published in *SCIENCE* with such memoranda as may be desirable, this publication to be at least one month prior to the Pittsburgh meeting. On separate motion, it was resolved that the publication carry with it an invitation for comment from members.