There is, however, a serious difficulty with the data from both sources. This difficulty lies in the fact that the average number of daughters per mother is extremely small. The average number of daughters per mother in Pearl's experiment was 2.85, while in mine it varies from 2.6 in the early years to 6.75 in later years. Because of the small size of the families it is possible to fit any family into a place in either scheme, since the ratios expected for the various matings differ only slightly from one another. In spite of the doubt raised as to the *mode* of inheritance of winter egg production it is clear that this character is inherited, for high and low fecundity lines are readily established by suitable matings along family lines.

H. D. GOODALE

MASSACHUSETTS AGRICULTURAL EXPERIMENT STATION

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SECTION D—ENGINEERING

THE first session was held on the morning of Friday, December 28, in Thaw Hall, University of Pittsburgh, Vice-president Dr. Henry S. Drinker in the chair, with an attendance of about thirty. It was announced that the Sectional Committee had recommended for election to the General Committee, for the office of vice-president, Dr. Ira N. Hollis, of Worcester, and for the office of secretary, Dr. Frederic L. Bishop, University of Pittsburgh. The following officers were elected by the Section:

Member of Council—Dr. George F. Swain, of Harvard University and the Massachusetts Institute of Technology.

Member of General Committee—Charles Henry Davis, of Cambridge, Mass.

Member of Sectional Committee—William Bowie, of Washington, D. C.

The program of the session was as follows:

Railroad track, its defects and abuses, and their amelioration: G. H. BARBOUR. *Historical:* The age of the drawn and that of the driven wheel; ancient English tramways; the institution of that distinctively American principle now governing the construction of railroad track as now practised by all the steamroads in the world, wherein the equipment upon its track constitutes a flexible superstructure upon an elastic roadbed. *Defects:* Weak rails; narrow railheads; excessive deflections; joints. *Abuses:* Worn and ragged wheels; improper wheel spacing; dynamic augments; lateral thrusts. *Amelioration:* Increased bearing on ballast; decreased depth of ballast; augmentation of rail; increased lateral strength; broader head; more frequent lateral fastenings; maintaining height of rail at the minimum.

The scientific principles of building codes: J. A. FERGUSON. A good building code occupies a very responsible position among the vital issues of municipal welfare. Properly planned, a building code should insure safety to life, limb, health and property, and should function to minimize loss or injury to either. Progress in the arts has introduced many new factors in the occupation of buildings, which necessitate the scientific handling and classification of the requirements and progress in building has made it possible to classify the various forms of building construction into distinct groups. The same progress has made it possible to classify occupancies and construction of buildings and to specify the minimum allowable construction for the various occupancies. This it is now proposed to do in one notable case for the city of Pittsburgh, Pa. Other phases of this subject are susceptible of scientific definition, and in order to properly regulate buildings it is becoming increasingly necessary to classify and define in a scientific manner all subjects. The paper gives typical arrangement for a code and explains the reasoning upon which it is based as well as for the classification of other regulatory provisions in a good building code.

Relative efficiency of different methods of repairing bituminous macadam and bituminous concrete pavements: GEORGE H. BILES. The bituminous macadam and bituminous concrete pavements in their various stages of disrepair offer excellent opportunity to the highway engineer for study and experiment. The methods of repairs to pavements of these types have advanced to such a degree in recent years that there are innumerable instances where pavements have been reclaimed by scientific analysis of the causes of deterioration and by efficient application of the principles of repair applicable to each case. Central bituminous mixing plants are advisable where the amount of yardage and its accessibility warrant as in cases of municipalities. In most other cases,

general repairs can be made successfully with cold bituminous preparations.

The efficiency of the application of cold bituminous materials for surface treatments on gravel and broken stone roads: Julius Adler. In the development of bituminous surface treatment practise during the past ten years, the most important step forward has been the recognition of the fundamental necessity of a road well built in every respect, and having a mosaic surface especially adapted to receive the bituminous material. In the selection of the latter, a greater and desirable degree of uniformity of practise will follow upon a clear understanding of the characteristics which identify them as most suitable to serve the two functions of: (*a*) Priming; (*b*) smoothing and rendering impervious the road surface. The precise limits of suitability of bituminous-treated roads can hardly be determined definitely in traffic units because of the difference in materials in use, and combined traffic and climatic conditions. From an economical standpoint, they represent a high annual maintenance charge which is an argument in favor of their use in the preservation of existing roads, rather than in a program of new construction. The full possibilities in their use, however, will not be realized until high-grade original construction, scientific selection of materials and systematic maintenance are all combined.

Present status of granite block pavements: C. D. Pollock. This paper describes the improvement of the granite block pavement from its early form to the latest types of smooth surface, close jointed pavements. The latest and best joint fillers are shown and likewise the various cushions or beds for the blocks. The great improvements which have been brought about in making granite blocks and also in laying this pavement, in recent years, are due entirely to the cooperation between the engineers and the quarrymen. The engineers learned enough of quarrying to draw specifications calling for the best practicable block and the quarrymen have exerted themselves to make that block.

Rattler tests for paving brick of various depths: William C. Perkins. Discussion of the rattler used for testing paving brick and a short history of same. The testing of paving brick of different depth and the theoretical determination of an allowance or differential for same. Discussion of a modification of the abrasive charge in rattler in the testing of paving brick.

Motor trucks and long distance highway transportation: Maurice B. Greenough. Statistics show that the railroads have nearly if not quite reached the limit of their capacity for freight hauling. At the same time there is a growing shortage of cars. They themselves have advocated the use of motor trucks on the public highways for short hauls to relieve congestion. Increased highway construction and organized effort to encourage the use of highways are essential to make the potential relief an actuality.

The construction and maintenance of highways under war conditions: Arthur H. Blanchard. Since the United States entered the war, motor truck transportation on country highways has rapidly developed due to the following causes: First, the marked increase in the tonnage and bulk of shipments; second, the lack of railroad equipment to efficiently handle freight and express transportation; third, the inadequacy of railroad terminal facilities; fourth, the United States government priority orders; and fifth, the intensified consideration of economic problems, the solution of which would lower prices of the necessities of life. Suggestions relative to construction and maintenance of highways under war conditions: (1) Maximum use of motor truck transportation of materials and machinery; (2) amendment of onerous traffic regulations which prevent economic use of motor trucks; (3) modification of state laws to permit construction and maintenance of highways by day labor; (4) award of contracts to responsible contractors on a cost plus a profit on labor and rental of equipment, all materials being furnished by the state or county; (5) modification of contracts and specifications which place all liabilities on contractors; (6) maximum use of labor-saving machinery; (7) maximum utilization of convicts and prisoners of war; (8) construction and maintenance of military highways by the United States government.

The second session was held on the afternoon of December 28 in the Lecture Hall of the Mellon Institute, Vice-president Dr. Henry S. Drinker in the chair, with an attendance of about one hundred ten. This meeting was a joint session with Section C; Society for the Promotion of Engineering Education; Engineer's Society of Western Pennsylvania; Pittsburgh Section, American Electro-Chemical Society, and the Pittsburgh Section, American Chemical Society. The program of the session was as follows:

Vice-presidential address, some needs of engineering: Dr. Henry M. Howe. Printed in the issue of Science for January 25.

Mechanical manufacture of window glass: DR. F. L. BISHOP.

A manufacturer's experience with graduate chemical engineers: S. R. CHURCH. Two years' experience with about one hundred graduate chemical engineers has suggested the following apparent deficiencies in training seemingly common to men from a large number of colleges:

1. Lack of judgment necessary to weigh correctly
   (*a*) the value or limitations of test data;
   (*b*) the degree of accuracy required;
   (*c*) the occasion for choosing quantitative or qualitative methods of analysis.
2. Lack of sufficient imagination to grasp the indicated possibilities for further work pointed out by experiments themselves partial or complete failures.
3. Lack of ability to write a report sufficiently well ordered and comprehensive to do justice to the merits of the work accomplished.

The writer favors the five- or six-year course for chemical engineers but urges that especially in abbreviated courses the student be given a better practical sense of commercial values.

A survey of high-school chemistry in Pennsylvania: ALEXANDER SILVERMAN. The report includes graphs and tabulated answers on college preparatory chemistry from 126 of 971 schools receiving information blanks. Answers cover length of course, when given, whether preceded or followed by physics, number of lecture periods per week, recitation periods, length and number of laboratory periods, number of sections of each and number of pupils per section, text-books employed, laboratory manuals employed, elements omitted, theories, laws and principles omitted. Also information about general science and other chemistry courses given, number of subjects taught by instructors together with number of hours of lecture, recitation and laboratory practise conducted. Further, the training received in preparation for teaching. The great lack of uniformity already observed leads the author to recommend standardization by a state commission, or preferably by the United States Commissioner of Education, with power to enforce standards so that colleges and universities may begin their work where the high schools end, thus avoiding duplication.

The following resolution was unanimously adopted:

Resolved, That the thanks of the Joint Conference be extended to the *New York World,* the *New York Times* and the *Jeweler's Circular* for cooperating with the chemists of the United States in the conservation of platinum by excluding the word platinum from their advertising columns.

The third session was held on the morning of Saturday, December 29, in the Applied Science Building of the Carnegie Institute of Technology, Vice-president Dr. Henry S. Drinker in the chair, with an attendance of about forty-five. The program of the session was as follows:

Solution of spherical triangles by diagrams: HORACE R. THAYER. All spherical triangles may be solved by the use of two simple formulæ. If now these be accurately computed and plotted, they may be employed to solve many cases which occur in practise with a minimum of cost, at the same time lessening the danger of serious error.

Conservation of fuel through smoke regulation: J. W. HENDERSON. Conservation that merely contemplates withholding the natural resources from use, keeping them in their natural state, can hardly be considered conservation in its broadest application. The logical starting point is that of "taking stock" of the natural resources. Having this knowledge, conservation can be carried on, on the basis of "the application of common sense to common problems for the common good." The needless waste of fuel and of recoverable by-products, in this country, has been conservatively estimated at one billion ($1,000,000,000) dollars annually. Investigations and experience demonstrate that the production and emission from stacks, of smoke prohibited by law, means *waste*—direct waste of combustible materials and their by-products and contributory, contingent waste of building materials, household goods, vegetation and of human energy, both physical and mental. In a few cases smoke regulation is under state control. Many foreign countries have placed it within the activities of their central governing powers. The work in Pittsburgh has proved that smoke regulation is a fuel conservation problem. Smoke means waste. Proper smoke regulation results in saving fuels. Conservation as proposed will induce complete combustion of them and stop the production of smoke. Smoke regulation is so closely related to conservation as to indicate the necessity of the government adopting it in its program of conservation. The work can not be of a constructive and permanent character if left to the fluctuating political activities of the cities, counties or states. The way to meet the requirements is to not make the smoke. This is accomplished by securing more perfect combustion. The subject deserves the attention of scientists and of practical engineers and of every thinking man and woman

who appreciates that there is an "inalienable right to life, liberty and the pursuit of happiness." Smoke regulation of the character indicated should be country-wide.

Modern tendency in locomotive design: L. E. Endsley. The locomotive of to-day is being scientifically designed and constructed in order to produce as efficient and powerful a locomotive as possible with the minimum of weight. Special grades of steel are used and some parts are being heat-treated in order to get a stronger part of less weight. To-day a horsepower is being developed in the modern locomotive with thirty per cent. less coal than that fifteen years ago. This has all been brought about by the addition of superheaters, brick arch, stoker, etc.

Measuring telephone transmission: R. L. Snyder. Brief review of the advance made in the art of measuring transmission over telephone lines. Notation of the characteristics of circuits which cause losses in telephone transmission. Pointing out that savings are accomplished by the advance in the art of calculating and measuring telephone transmission.

Industrial housing and town planning: George W. Case. Many of the industrial towns being built in America are laid out according to the Garden City idea, a method of city planning which originated in England. A Garden City plan is one in which sufficient ground is devoted to each house to provide, in addition to plenty of light and air, a garden for every family. The streets are generally laid out to curve with the contours, to reduce the amount of grading and allow the placing of houses to obtain the best architectural effects. Parks and playgrounds provide places for recreation and proper restrictions insure permanent homes. Under an enabling act of 1890 the British government lends money on long-term bonds, to be used in building houses for working people, on tracts laid out in the above manner. We need such a law, in this country, to properly develop the boundaries of our industrial cities, so they will not become slum areas and also to build permanent houses for our working people, in well-laid-out tracts, and finance them so that the payments can be made to fit the income of the wage-earner. The high labor turn-over, being experienced in our industries at the present time, is receiving much attention from employers, and those who are building houses, of the right sort, report substantial successes in stabilizing their labor forces by this means.

The electrical safety work of the Bureau of Standards: M. G. Lloyd. A study of the accident hazards connected with electrical work led the Bureau of Standards to formulate a set of rules for the construction and operation of electrical equipment which is known as the National Electrical Safety Code. These rules were published over a year ago after many tentative drafts had been criticized and revised by conferees representing the various utilities, inspection interests and state commissions interested in and affected by the rules. The Code has been cordially received and is receiving general application on trial with tentative and in some cases formal adoption by federal, state, municipal authorities and private bodies.

Higher harmonics of polyphase electrical systems: V. Karapetoff. Higher harmonics in a symmetrical m-phase system are considered for both the star and the mesh connection. It is shown which harmonics can not exist in the mesh voltage although present in the star voltages, and which harmonics give rise to circulating currents in a mesh. The phenomenon of oscillating neutral is explained and the effect of secondary mesh currents in furnishing transformer magnetizing currents is discussed. Polyphase magnetomotive forces are treated in the most general case when harmonics are present both in time and in space. Formulæ are given for the order of harmonics which produce gliding and pulsating M.M.F.'s.

Mineral composition of refractory silica brick: J. S. McDowell. Of the minerals tridymite, cristobalite and quartz constituting silica brick, tridymite has the lowest thermal expansion. An all-tridymite brick would, therefore, have the lowest spalling tendency. Microscopic analyses of brick burned from one to ten times show that at the slow rate of inversion of the quartz to tridymite, an all-tridymite brick would not be commercially practical. Analyses of two bricks, one made of Baraboo and the other of Medina quartzite, illustrate the greater rapidity of the inversions of quartz to cristobalite and tridymite with the finer textured Medina rock.

Why dams fail: Edward Godfrey. History of under pressure as an idea in the professional mind. Present status of the idea of under pressure. Loss of weight of dams and submerged piers discussed and compared. Tests of under pressure. Explanations of the failure of dams. The kind of masonry dams that fail. Inefficiency of some attempts at prevention of failure by uplift.

Arthur H. Blanchard,
Secretary