utilities of cities. A few of the Western states have already recognized this, and have incorporated in their constitution the doctrine of perpetual state ownership of water.

The benefits which have followed the unaided development of the past justify the nation's aid and cooperation in the more difficult and important work yet to be accomplished. Laws so vitally affecting homes as those which control the water supply will only be effective when they have the sanction of the irrigators; reforms can only be final and satisfactory when they come through the enlightenment of the people most concerned. The larger development which national aid insures should, however, awaken in every arid state the determination to make its irrigation system equal in justice and effectiveness that of any country in the civilized world. Nothing could be more unwise than for isolated communities to continue to learn everything experimentally, instead of profiting by what is already known elsewhere. We are dealing with a new and momentous question, in the pregnant years while institutions are forming, and what we do will affect not only the present, but future generations.

Our aim should be not simply to reclaim the largest area of land and provide homes for the largest number of people, but to create for this new industry the best possible social and industrial conditions; and this requires that we not only understand the existing situation, but avail ourselves of the best experience of the time in the solution of its problems. A careful study should be made, both by the nation and the States, of the irrigation laws and conditions here and abroad. Ultimately it will probably be necessary for the nation to cooperate with the several arid states in proportion as these states by their legislation and administration show themselves fit to receive it.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

SECTION I, SOCIAL AND ECONOMIC SCIENCE.

Officers for the Denver meeting were: *Vice-President*, John Hyde; *Secretary*, Raymond A. Pearson; *Member of Council*, E. T. Peters; *Sectional Committee*, C. M. Woodward, H. T. Newcomb, John Hyde, R. A. Pearson, Marcus Benjamin, F. R. Rutter and L. F. Schmeckebier; *Member of the General Committee*, F. H. Hitchcock.

Nine meetings were held and at each a full program was presented. Unusual interest in some papers was shown by the discussions. The average attendance was probably the largest in the history of the Section. The majority of papers treated of subjects which are of special interest in the West—one entire day, including an evening session, being given to the consideration of the economic and social aspects of irrigation.

The vice-presidential address of Professor C. M. Woodward, 'The Change of Front in Education,' was published in full in a recent number of Science. Other papers were as follows:

'Scientific Men of Colorado': Dr. Marcus Benjamin, Washington, D. C.

This paper had for its purpose the presentation to the Section of the records of various scientific men of Colorado, and consisted chiefly of summaries of the excellent work done by the graduates of the Scientific Department of Columbia University, formerly known as the School of Mines, towards the development of the mineral resources of Colorado, as well as of the improved methods in metallurgical science invented by them. The sketches were some twenty in number and included the careers of such men as M. W. Iles, M. C. Ihlseny, W. B. Devereux, H. V. Furman and Richard Pearce. Brief mention was also made of such scientists as the late Senator N. P. Hill, who was referred to as the only chemist ever elected to the United States

Senate; Regis Chauvenet (a son of W. M. Chauvenet, who was president of the Association in 1870), president of the Colorado School of Mines, and others who have taken a conspicuous part in the development of scientific thought in Colorado. The paper closed with a brief appeal for the preservation in a suitable building of the remains of the former inhabitants of Colorado and the Southwest.

'Dangers from Inaccuracy in Presentation of Transportation Problems': JAMES H. BLODGETT, A.M. Division of Statistics, Department of Agriculture, Washington, D. C.

Projects for transportation of water, both for personal use and for irrigation of crops, are necessary on a scale requiring municipal or corporate association of effort. In transportation of food and other commodities the railroad and the steamship form the present culmination of carriers. Water-works for cities, or for agriculture, canal and ship enterprises call for government aid. Railroads once largely aided by public appropriations depend mainly on sales of bonds and stocks to investors. In some propositions to the public, error is combined with truth to a dangerous extent. Two groups of erroneous statements are now particularly prominent, even in school books, in regard to interior waterways: One relates to a presumed project for a ship canal between the Black and the Baltic seas, officially disclaimed by Russia; another as to interior waterways between Boston and Galveston, really no more than three feet deep in the shallowest part, and between the mouths of the St. Lawrence and the Mississippi, no more than six feet deep for long distances, with short narrow locks. The Chicago Drainage Canal has as yet no commercial relations. The limit of urban population is liable to be determined by the water supply. The extent of cultivation upon Western plains is already limited by the availability of water. It is a question whether taxation does not tend to increase faster than average incomes or than market values of property. Municipal repudiation ought to be unknown. Many municipalities have reached the legal limits of taxation and of indebtedness, but under popular demand constitutions have been amended and new municipal organizations have been superimposed to place additional taxes on the property. In Illinois, for example, most of the following series of taxes may represent separate authorities levying independently.

(*a*) National, (*b*) state, (*c*) county, (*d*) township, (*e*) school district, (*f*) city, incorporated town, village, in addition to school tax, (*g*) township high-school district, (*h*) drainage district, (*i*) sanitary district, (*k*) townships or road districts, for hard roads.

Most of these separate agencies can incur debt not to exceed five per cent. of the valuation, making possible a very large aggregate obligation resting upon the taxable property. Township high-schools, drainage districts, sanitary districts, hard-road districts, are not numerous, but they are possible in any part of the State under general laws.

'The Census of Cuba': VICTOR H. OLMSTED, Assistant Director of the Census of Cuba.

The prospective establishment of an independent government in Cuba made information necessary concerning the numbers and distribution, the education, the racial divisions, etc., of its population. The American authorities, after deliberate consultation with eminent Cubans, decided upon a census of the island. The knowledge already had of the temperament of the people, and of the probable obstacles to speedy work, indicated that conditions in Cuba were unfavorable to census-taking on a scale so comprehensive as that of the United

States; hence only the more important data concerning population, education and agriculture were collected. The work was intrusted chiefly to Cubans. The prevailing idea was that the census was to be of Cubans, by Cubans and for Cubans, and that its successful accomplishment would indicate their capacity for the subsequent establishment and maintenance of civil government. This decision was enthusiastically received by Cuban press and public. President McKinley's proclamation, August 17, 1899, declaring the census a preliminary step towards the establishment of self-government, completed the obliteration of all suspicion of American motives theretofore prevalent throughout the island. The Assistant Director, who was placed in full charge of the census, reached Havana August 20, 1899, established a temporary office, and began dividing the island into districts, a task difficult and arduous, owing to a lack of accurate geographical data. By September 15 the island had been divided into 1,315 enumeration districts—afterwards increased to 1,607. Large numbers of educated Cubans, then out of employment, furnished an excellent field from which to select enumerators.

In cases of doubtful literacy, persons were required to read and write in the presence of the enumerator, and, as to illiteracy statistics, the Cuban census is probably the most accurate on record. The enumeration was fully completed by the time required, November 30, 1899. Delay in a few remote districts alone prevented a much earlier completion. The complete results are published in Spanish and English separately. The volume of 800 pages contains information not elsewhere obtainable concerning Cuba and the Cubans.

'Mechanical Tabulation of the Statistics of Agriculture in the Twelfth Census of the United States': H. T. Newcomb, Editor *Railway World*, formerly Expert Chief of the Division of Agriculture in the Office of the Twelfth Census.

The public demanded of the twelfth census a more extended, elaborate and detailed investigation of American agriculture than had been undertaken by any of its predecessors. Previous censuses had collected the basic facts necessary to answer the inquiries of the public, but had never been able to undertake the complicated and extensive tabulation necessary fully to develop the information that they might have been made to supply. An investigation and tests prescribed by law finally led to the adoption of the Hollerith electrical tabulating machinery. This is controlled by cards to which the facts from the schedules returned by the enumerators are transcribed by means of perforations. Two kinds of cards were used: one providing for a description of single farms, and the other for the acreage, production and value of each of the separate crops raised on each farm. The facts indicated on these cards are all stated quantitatively and the perforations were made by machines somewhat similar in their manner of operation to a typewriter. About 115,000,000 crop cards and nearly 6,000,000 farm cards were necessary, and the former were punched at the rate of about 2,000, the latter at the rate of about 1,000, per day's work. These cards were fed into the tabulating machines, which consisted each of from three to ten connected adding machines impelled by electrical currents transmitted through the perforations. Several counting devices impelled in the same way were also added to the machines for different phases of the work; at one time as many as nineteen. In running cards through the machines an average of over 10,000 per day has been attained in the later months. The Division of Agriculture employs twelve of these tabulating machines for the farm cards and eighty-six for the crop cards.

The great advantage of the Hollerith tabulating machinery, aside from its precision, lies in the possibility of making a single transcription of data and but one handling of schedules serves for the most complicated tabulations and for those in which the same facts are classified and aggregated according to many different and conflicting elements. It also has the merit of simplifying the work of a large office and reducing the greater portion of it to the grade of factory work.

'The Single Tax': HON. JAMES CROSBY, Denver.

To the thoughtful mind the political outlook at the opening of the new century is profoundly interesting. The nineteenth century was a wonderful century, but in one sphere of human development it was a disappointment. With all our boasted progress, we have not made better citizens or a more contented people. Industrial slavery must be abolished before the social organism can be restored to health, and the single-tax philosophy contains the proper remedy. Single-taxers maintain that the reason the wages of labor do not increase as material progress advances is because rent, or the price paid for the use of land, is continually increasing. The land upon which Chicago now stands was not worth an old shoe one hundred years ago. To-day millions could not buy it. The land upon which Denver is built was valueless fifty years ago. To-day it is worth millions, and as the city grows, wages will not increase, but we all know that the value of land will. By collecting this ever-increasing rent and using it for the benefit of all the people we abolish land monopoly and solve the problem of the persistence of poverty amid an advancing civilization. This single tax is not a tax upon land, but upon land values, an entirely different matter. We are frequently told that the single tax would bear with great severity upon the poor farmer. This criticism would be just if we proposed to tax land, but it is not true if land values are taxed. For while most of the land is in the country, most of the land values are in the city. Under the single tax system the farmer would pay very little tax. Land values are easily collected. Land cannot run away, nor can it be hid when the assessor appears. Everywhere, in all times, monopoly of the land upon which all must live and from which all wealth is produced, is the basis of social and political disorders. The single-tax system, if adopted, will destroy industrial slavery and will usher in a period of peace and prosperity for all.

'The Road Problem': JAMES W. ABBOTT, Special Agent U. S. Office of Public Road Inquiries for the Mountain Division, Denver.

The renaissance of road building began during the first half of the eighteenth century. Metcalf in England, and, contemporary with him, Tresaguet in France, were the pioneers in this movement, and were followed later by Telford and Macadam, whose methods, with slight modifications, are still used. It is a singular coincidence that correct road-building practices were evolved just before the beginning of the railway era. In the United States the first attempt at better roads was made by toll-road companies; later came the National 'Cumberland Road,' which was the beginning of an excellent system of government military roads constructed at public expense. While in Europe the railway and highway systems expanded together, in the United States the railway displaced the highway in public attention; and, with the beginning of the railway era, national appropriations for road building were discontinued. Then followed a very remarkable period of conquest of the wilderness, during which the highway question received almost no attention. The

period of awakenment on this important subject began a few years ago, and probably received its first strong impulse from the League of American Wheelmen. Many states have appropriated money to aid in building state highways: New Jersey, New York, Rhode Island, Vermont, Maryland, California and many other states now have highway commissions. Wherever state funds are appropriated, the laws require the counties to share in the expense. The most striking feature of the reports of the highway commissioners is the demand for state highways, notwithstanding the requirement for contribution by the counties. The controlling reason for this demand appears to be the fact, now universally recognized, that the building of these improved State highways has vastly enhanced the values of contiguous and neighboring property. The United States Department of Agriculture, through its office of Public Road Inquiries, took up this matter a few years ago, and has been engaged in disseminating among the people information upon road conditions in Europe and America and in teaching improved methods.

'Farm Ownership and Tenancy in Delaware. A Study of Farm Tenancy': Le Grand Powers, Chief Statistician for Agriculture, U. S. Census.

The growth of farm tenancy, which has been noted in many States of our nation during the last thirty years, is a part of a social movement profoundly affecting the status of many families in the United States. It was the appreciation of this fact that led the government, by the tenth and subsequent censuses, to collect statistics relating to the subject. According to the twelfth census of the United States, there were in the state of Delaware, June 1, 1900, 9,687 farms. The number has steadily increased since 1850. In that year there were 6,063; in 1860, 6,568; in 1870, 7,615; in 1880, 8,749; in 1890, 9,381. Of the farms of 1900, 4,876, or 50.4 per cent., were operated by tenants; 4,680, or 48.3 per cent., by individuals who owned the whole or a part of the land they tilled; and 131, or 1.3 per cent., were cultivated for their owners by salaried managers or overseers. A large number of the last-mentioned class were farms connected with public institutions, or the property of corporations, and most of the others were holdings of wealthy individuals and were operated as much for the pleasure as for the profit of the owners. During the last twenty years there has been a steady decrease in the number of farms operated by their owners, accompanied by a more marked increase of those operated by tenants. This actual and relative increase in the number of farm tenants has taken place under circumstances which have operated to assist a large number of families in rising from wage service to farm tenancy or ownership. None of the facts presented indicate the existence of a movement in Delaware toward the concentration of the ownership of farm property or its transfer to the hands of a fixed class of non-resident landlords. They lead to the conclusion that the titles to rented farms in Delaware are vested in a large number of persons, the majority of whom have, at some time in their lives, operated the farms now owned by them. This conclusion is warranted by the results of the investigation of the twelfth census concerning the ownership of rented farms. The ownership of rented farms is held under conditions that insure to capable and industrious wage-earners or tenants greater opportunities of becoming farm owners than ever existed in this country before 1850, or than is presented at this time in any other nation on the globe.

'What Next? Is it Socialism?' Walter S. Logan, New York.

The present is industrial chaos. Where organization comes out of the chaos it is

warfare. On the one side are the employers of labor, on the other side the laborers; on the one side the people who receive dividends, on the other the people who receive wages. What is being fought over is the proceeds of labor. We have built up our economic civilization on the principle that the relation between one man and another should be dependent upon voluntary agreement between them. But now it has come to be a relation not between man and man, but a relation between class and class. The community founds itself upon the relationship. More men are now employed by single corporations than were working for wages in the whole United States a hundred years ago. Such is the present situation. It is admitted on all sides that it is intolerable. Socialism is defined to be the ownership and operation by the State of all cooperative industries within its jurisdiction—the industrial condition wherein the State is the only employer of labor and the only wage payer.

The advocates of socialism in picturing its blessings, assume that it is practicable—an assumption that has not been subjected to the test of trial. But great modern combinations have come upon the scene—so great and so extended that they approach in the complexity of their activities and the magnitude of their undertakings the functions of government itself. A paid servant only is watching other paid servants, and the eye of the master is almost as remote from the hand of the servant as it would be if the state itself were master. The success of the modern industrial combinations would seem to indicate that the state might succeed pretty well in operating its own industries. If socialism as a practical proposition is thinkable to-day, it is because these combinations have made it so. For good or for evil, they will leave us as a legacy the assurance that industrial operations approaching in extent the operations of government itself can be successfully inaugurated and profitably carried on. As to the ultimate result, I have no opinion whatever to express. As to the immediate result, however, I have a very decided opinion. I believe we shall have, in the immediate future, not state socialism, but a more socialistic state. I agree that socialism must come if it is the only way to secure industrial peace and protect the masses of the people, but it is far from having been demonstrated yet that it is the only way to do this. I am not prepared to say that we have found another and better way, but I have confidence enough in our race's destiny to believe that we shall.

'Economic Work of the United States Geological Survey': L. F. SCHMECKEBIER, PH.D., United States Geological Survey, Washington, D. C.

The economic work of the United States Geological Survey consists of work in economic and mining geology, investigations relating to water supply and irrigation, the survey of forest reserves, the preparation of a topographical map of the United States, and the gathering of statistics relating to the mineral production of the country. In the field of mining geology the Survey works upon the general principle that it should endeavor to accomplish for the mining industry as a whole what the individual engineer or mine owner could not succeed in doing by his unaided exertions; in short the Survey undertakes to furnish the prospector and mining engineer with an accurate basis upon which their work may be founded. The hydrographic work falls into three general classes: (1) Work of a strictly engineering character, having to do with the measurement of surface streams and the conservation of water supply through the storage of flood water; (2) examination of the underground structure and the permeability of the water-bearing rocks; and (3) general reconnaissances for the pur-

pose of obtaining information as to the method of utilizing water supply for power, irrigation and domestic purposes. In the survey of the forest reserves every factor bearing upon the character and growth of the forest has been studied. The following points have been especially emphasized: The character of the soil; the forest litter; the depth of humus; the character and density of the underbrush and young growth; the range in size of trees of the principal species; the total height, clear trunk and apparent age and soundness; the effect of fires on reproduction; the proportion of dead standing timber; the character of the cutting; the means of transportation; the local demand for lumber; the effect of sheep pasturage; the use of water for irrigation and milling; and the extent and distribution of land more valuable for agriculture than for timber. The Survey is engaged in the preparation of a topographic map of the United States, which in addition to being a necessity for all other investigations undertaken in the field, has in itself a great economic value in all works of an engineering character. The statistics of mineral productions are compiled direct from reports made by the producers themselves.

'The Soil as a Social and Economic Factor': Frank K. Cameron, Ph.D. Soil Chemist, U. S. Department of Agriculture, Washington, D. C.

This paper was a presentation in general terms of the work which has been done and is being done upon soils from the point of view of the natural scientist. An outline of the work of the Bureau of Soils in the U. S. Department of Agriculture is given. The point is then made that such work can never, in itself alone, lead to the best development and management of soils, for it is in fact an economic problem, and the work of the physical scientist can only serve as a basis or point of departure from which the economist may attack the problem. The causal relations between the character of the soil and the population it supports are brought out and the importance of the soil as a factor in the social and economic status of the community is insisted upon. A plea is made for more attention to the subject from experts in these lines.

'Woman's Suffrage in Colorado': J. E. Le Rossignol, Professor of Economics, University of Denver.

After the enactment of the Woman's Suffrage Law, in the year 1893, many women devoted themselves with enthusiasm to the theory and practice of politics, especially in the agitations concerning populism and free silver. Afterwards a number of leading women broke away from the regular political factions and formed organizations such as the Civic Federation, which took an active part in the municipal election of 1895, and in 1897 they secured the election of an independent ticket. Since then there has been a tendency for women to return to the regular party organizations. It is difficult to give an estimate of the value of woman's suffrage to Colorado, because of diversity of opinion on the subject, and because it is as yet impossible to prove either the success or the failure of the system from the point of view of social expediency. The woman vote is large. Women have not been injured by the franchise. The character of the leading women politicians is high. Women are not, as a rule, clamorous for office. Since 1894, ten women have sat as representatives in the Legislative Assembly, and three women have successively occupied the position of State Superintendent of Education. Women have also served acceptably as members of the various state boards. Women have exerted a civilizing influence upon the character of political meetings, and they have at times exerted an influence toward secur-

ing the nomination of respectable candidates. Some reforms have been accomplished, wholly or in part, through the influence of women. A considerable proportion of women voters are as yet somewhat independent of party control, forming an unknown quantity which disturbs the calculations of party managers, and whether called independence or fickleness, may be regarded as counting against rather than for political trickery and corruption. People who expected that society would be immediately regenerated through the influence of woman's suffrage have been grievously disappointed, and many of them, both men and women, consider the experiment a total failure. Such people have expected too much and are too impatient. No remarkable reforms have been accomplished, but it is safe to say that woman suffrage has done no harm, that it has done some good, and that it has been adopted by Colorado 'for better or for worse.'

'The World's Bread Supply': EDWARD T. PETERS, Division of Statistics, U. S. Department of Agriculture.

In his annual address as president of the British Association for the Advancement of Science, delivered at the Bristol meeting of that body in 1898, Sir William Crookes sounded an alarm as to the future of the world's wheat supply. He pointed out that the bread-eating populations, consisting of the people of Europe and of European settlers and their descendants in various parts of the world, are increasing in a geometrical ratio, and from the figures he presented, he reached the startling conclusion that, by 1931, the number of bread-eaters will have become so great as to require the produce of all the land in the world available for wheat-growing, unless there shall, in the meantime, have been an increase in the average production per acre, which, at the time of his address, he estimated for the world at large at 12.7 bushels per acre. The conclusions reached by Sir William, as to the future wheat-exporting capabilities of the United States, have seemed to some writers to fall so far short of the truth as to make his conclusion in regard to the world at large seem unworthy of serious attention; but an article by Mr. John Hyde, statistician of the Department of Agriculture, published some time ago in the *North American Review*, if it does not entirely support Sir William's view, yet shows by an overwhelming array of well-considered facts and figures that the optimistic expectations of some of Sir William's critics are wildly extravagant. In considering the average capacity of the earth to support civilized populations, it is to be remembered that, with the rise in the general standard of living which was a conspicuous feature of nineteenth-century progress, bread became a smaller and smaller proportion of the total consumption of the people. Wants have greatly multiplied; and as these wants require the produce of land for their satisfaction, the average area required for the support of an individual is now much greater than it was one hundred years ago. Moreover, if the standard of living is to rise still higher, that average area must, in the absence of increased yields per acre, become greater still, and a still smaller proportion of it will be devoted to the production of bread. 'Man shall not live by bread alone' is receiving, with the advance of civilization, a more and more liberal interpretation, and this fact has a vital bearing on the capacity of the earth for supporting population. Population cannot increase beyond a certain point without arresting the improvement in the standard of living and starting a movement in the opposite direction, unless a means can be found of obtaining from the soil increasing yields. The point at which such increasing yields will become the only alternative to starvation may not be quite so near as Sir William

Crookes believes; but it is near enough to impress us with the vital importance of using to the utmost every agency by which skilled and scientific agriculture may be substituted for the loose and wasteful systems of the past, and also to emphasize the necessity of protecting the world's forests, conserving its waters and employing every other means by which the area of land available for productive purposes can be increased. Doubtless there is a limit to the number of human beings that the earth is capable of supporting in comfort, but science, skill and foresight may place that limit in a sufficiently distant future to remove all occasion for anxiety on the part of the earth's present inhabitants or their immediate posterity.

'The Interdependence of the Sciences': Dr. Max West, U. S. Industrial Commission, Washington.

This paper will be published in Science.

'The Present Status of Commerce in the Educational Policy and in the Administrative Organization of Modern Nations': John Franklin Crowell, Ph.D., Bureau of Statistics, U. S. Treasury Department.

This paper presented the results of an analysis of the courses of study of representative institutions, both in this country and abroad, in which higher commercial instruction has been given. In some respects our own schools are modeled after the institutions of continental Europe, but to a much greater extent they are the outgrowth of two tendencies in our national life—the expansion of our universities and the increasing influence of business men in public policy. A comparison of several of the more important higher schools of commerce in Europe and at home shows that there are five double groups of subjects regarded as essential to a comprehensive commercial curriculum of higher grade. These are: (1) Geography and history, (2) languages and methods, (3) science and technology, (4) economics and statistics, and (5) law and sociology. The preponderating influence of one or another of these groups is determined by the general character of the college. In some institutions the type of training offered is professedly technical, in others it is practically a commercial substitute for a liberal education. The liberal and the professional purposes are probably least dissociated in the curriculum of the Wharton School of Finance and Economy at the University of Pennsylvania, the oldest of the higher schools of commerce in this country.

The practice has prevailed of organizing a commercial curriculum of four years out of subjects hitherto taught in other departments. However necessary this may have been to meet a growing demand for special instruction of a higher commercial character, it has made the fundamental educational mistake of failing sufficiently to differentiate the field of commercial phenomena from that of industry on the one hand and finance on the other. There is accordingly much confusion, that must retard greatly the rate at which the field of commercial knowledge shall be reduced to scientific consistency. It is to the solution of the distinct problems of commerce that education must devote itself if it means to organize commercial experience for the aid of individual enterprise and of national prosperity. The scientific classification of commercial phenomena is preliminary to the solution of these inherent problems.

A truly scientific course in the study of commerce must fill four conditions:

1. The classification of the facts and methods of modern commerce.

2. The formulation and solution of commercial problems.

3. The grounding of the student in economic principles and in their ready application to commercial situations.

4. The mastery of knowledge relating to the history and development of commercial policy as embodied in the economic progress of modern nations.

This is the least that scientific thought can ask of higher commercial education.

'The Development of the Mineral Resources of Colorado': CHARLES W. COMSTOCK, Professor of Mining Engineering in the Colorado School of Mines.

The paper began with a few figures showing Colorado's position in the mineral-producing world, especially with regard to gold, silver and lead. The relative change in importance of silver and gold in the state's wealth was brought out. The figures showed that 49 per cent. of its production had been silver and 35 per cent. gold. The statistics of 1900 show 25 per cent. silver and 57 per cent. gold. The all-important point in the history of gold and silver production is the increased economy in the mining and the treatment of ores. This is indicated by the lower grade of the ore mined now as compared with earlier years. Even in Cripple Creek, the newest of the producing district, it is striking. The causes leading to these reductions are cheaper labor, cheaper fuel, lower freight rates, cleaner work and close attention to details. One of the potent factors in developing low-grade ores has been the improvement in ore-dressing machinery and methods, together with a more general dissemination of information with regard to this very important subject. The figures from one instance of actual practice show that proper mechanical preparation makes a change from a loss of $5 per ton to a profit of $2. The paper closed with a brief reference to the zinc problem which has been an absorbing one in Colorado for more than fifteen years.

'Protection of Communities by the Forest': GIFFORD PINCHOT, Forester, U. S. Department of Agriculture.

The relation of the forest to the community penetrates every portion of communal life on the material side. To follow it in detail would be to describe the modern community with a minuteness which has perhaps had little approach. For the general theme it is sufficient to say that the communal life of modern civilization as we know it would be impossible without the forest.

Forests protect communities especially by safeguarding the drainage systems on which they depend either for navigation or water supply, by fixing the drifting sands which have already overwhelmed so many towns and villages, by securing the prosperity of the tributary territory upon which the communal prosperity itself must hang, and finally, by providing the recreation grounds without which much of communal life must be flat, stale and unprofitable. The town or city forest is an institution of the highest beneficence which has yet only begun to appear in America. Examples are not uncommon abroad of towns free, either partly or wholly, from communal taxes by the revenues of their forests; and this is perhaps the least of the services which they render. Cheap and abundant supplies of wood come to the citizens from their forest lands, but best of all, the forest serves as a playground and breathing space whose influence penetrates to every portion of the community. Public spirit could take few directions more useful to the citizens, towns and villages of this country than to provide them with self-supporting recreation grounds of the forest type, for there is a quality of renewal inherent in play time in the forest which follows no other kind of rest from work.

'Leasing and Disposal of the Public Lands': C. E. WANTLAND, Denver.

The United States owns about half a billion acres, the net cost to date of the remaining lands being probably about $250,000,-

000. To maintain the Land Department, an expenditure of about $2,000,000 per annum is necessary. In the western states there are about 500,000,000 acres, about 400,000,000 million of which are used for grazing purposes by 25,000,000 cattle and sheep under conditions gradually growing worse. If leased, the revenue in ten years, in connection with the net receipts from sale of public lands, would double irrigated lands in the West now estimated at 10,000,000 acres. In the eleven western states we have only 250,000 farms, and 50 per cent. of the people live in towns and cities, while about 75,000,000 acres of public lands can still be reclaimed if the water which now runs to waste can be stored. Congress has failed to realize the great importance of the subject and very little constructive legislation has been secured. Forest reservations, the Carey Grant Act and the recent Free Homes Bill were secured after great difficulties. Public lands should be leased for short terms in limited quantities and at low rates. Owing to different conditions in the different states, leases should be issued on a county local-option basis, after careful classification of lands by commissioners and approval by stockmen. Funds should be used for reducing county taxes, for surveys and reservoir construction. The majority of stockmen are now in favor of a good lease plan, fair to all concerned. The Homestead law should be amended to enable settlers by a combination homestead and lease privilege to control enough land to make a living on, and the Government should advertise the facts about public lands for the benefit of people who want new homes. The Desert Land Law should be repealed. Forest protection and the reclamation of the arid lands will bring great prosperity to the country. The landless man of the east must be placed upon the manless land of the west.

'Irrigation': F. H. Newell, Hydrographer, U. S. Geological Survey.

The western half of the United States consists for the greater part of vacant land belonging to the nation and at the disposal of Congress. With this enormous area, aggregating fully one-third of the United States, it would be supposed that settlement would progress rapidly and population increase with stupendous strides. As a matter of fact, however, the past decade has not been marked by notable developments, but, on the contrary, it appears that the settled area has to a small extent actually diminished. As a rule the soil and climate are suitable for the production of large crops, were it not for the scarcity of moisture. The pioneers and their successors have taken out almost innumerable ditches and have diverted the smaller streams, demonstrating the practicability and profitable character of agriculture by the artificial application of water. In all, about ten million acres of land have been brought under cultivation by means of works built largely by farmers acting in partnership or in associations. Irrigation development when brought about in this manner has been extremely profitable. But, contrary to the experience of the farmers, large irrigation enterprises have almost invariably been financial failures. This anomalous condition, where enterprises succeed in a small way but fail financially on a large scale, merits careful consideration. There are upwards of seventy million, or even a hundred million, acres of arable land which might be reclaimed and made into homes by utilizing the waters of the large rivers or of the floods which now run to waste. The reason for the failure of the large enterprises lies for the most part in the difficulty of securing immediate settlement and of obtaining experienced farmers who can practice irrigation with success from the outset.

One of the great questions now before the people of the country is how to dispose of the crowded and surplus population around the great manufacturing centers and to render the idle laborers producers of wealth instead of helpless consumers. The public lands in the past have proved the great outlet for superfluous labor, especially at the periodical occurrence of hard times. Vast areas of fertile public lands still remain, but these cannot be utilized until the problem of supplementing the deficient water supply can be solved. This problem of water supply for the arid lands is one which must be taken up by the publicist and statesman. The engineering features are comparatively simple, but the great question to be solved is as to who is to pay for the original outlay. The public at large is undoubtedly the gainer, since by the creation of prosperous homes upon the public domain the commonwealth is strengthened, and commerce and manufacture increased. A similar question with regard to the building of light-houses and the improvement of harbors has been answered by the national government taking charge of the matter, and it is urged by many who have studied the matter thoroughly that Congress, the custodian of the public lands, must take cognizance of present conditions and not only modify the land laws to suit the conditions of the arid West, but also provide means by which large rivers may be made available and floods held so that the farmers by their own work may be able to utilize the waters, as has been done by their predecessors.

'The Scope of National Aid for Irrigation': FRED BOND, State Irrigation Engineer, Cheyenne, Wyo.

Irrigation laws are a necessary part of the statutes of every state any portion of which lies west of the 100th meridian, and they form a part of the statutes of those states. These laws are enacted for the purpose of governing the diversion and appropriation of water and its use, and state codes and state statutes alone define water rights and provide for their determination and administration. The general government has never undertaken to exercise any authority over water used in irrigation, but has left the control of the water in the arid region entirely to the states wherein found. Whatever might have been originally undertaken with advantage by the nation does not change present conditions, and it is now too late, even were such action desirable, to undertake the enactment of laws which will come into conflict with the long-conceded rights of the states to regulate and control these matters; nor can the government determine future rights or undertake their administration without creating a conflict between those state and national authorities which have the diversion of water directly in charge. The funds for irrigation development must come from some national resource, for the states are financially unable to raise them, and no matter how willing many of them might be, they are precluded from the undertaking because the limits of taxation permitted by their respective constitutions has been reached in providing means to meet ordinary state expenses. They are, however, not only ready and willing, but entirely capable of prosecuting the work to a successful conclusion, the means being found. The funds should come from such a source as would bring about the least possible interference with present conditions, and the appropriation or setting apart of the receipts from the sale of arid lands seems most completely to fill these requirements. The volume of work undertaken in any state each year may be limited by the receipts from the sale of public lands in such state for the year previous, a plan commendable in that interests not benefited are not required to render any assistance in the work. The amount ob-

tained in this manner from any one state would not be large, but would enable a beginning to be made and at the same time give the state an opportunity to demonstrate its fitness to continue in the work of its own development under these conditions.

A part of the discussion which followed this paper is given :

F. H. Newell: The proposition presented by Mr. Bond is one which has been fully discussed by committees in Congress. The general conception is not new, but the point which he emphasizes, of the importance of state control of national funds in irrigation development, is one which, it is feared, will prove a stumbling-block to progress. Relatively few of the states would be benefited if the proceeds from the disposal of public lands in each state were devoted exclusively to works in that state. This narrowing of development is undoubtedly the outgrowth of an attempt made to cede the vacant public lands to the states to be disposed of by the legislatures. This has been shown to be contrary to the whole spirit of national administration of the public lands ; these lands being held, not for the benefit of the states in which they are located, but for the making of homes by citizens. There is no apparent ground for the fear of conflict between national and state authority. There can be no question as to the importance of national development of vacant public lands, which still include nearly one-third of the United States. It is practicable for the government to erect storage reservoirs, and to divert large rivers to a point where settlers can take out the water and make for themselves homes as was done by the pioneers. The further limitation, however, which Mr. Bond seems to insist upon, that this work should be done by state officials, is one which is so opposed to all experience and precedents that it would doubtless weaken the movement in the minds of those who have studied the subject.

George H. Maxwell, Chairman of the Executive Committee of the National Irrigation Association, expressed the opinion that the paper by Mr. Bond tended to create an entirely wrong impression as to the relation of the national Government to irrigation development. No one, he said, contends or proposes that the national Government should undertake in any way to regulate the distribution of water in conflict with the laws of the state. It is proposed that the Government shall do two things: First, enlarge its policy of internal improvements to include water storage through appropriations under the river and harbor bill, the water so stored to be turned into the stream in the dry season and distributed under the state laws just as though nature had put it there. Second, build such reservoirs and irrigation works as may be necessary to bring water within reach of settlers on the public lands, reserving lands for which water is thus made available for actual settlers only, and charging the lands in proportion to benefits with the actual cost of the Government works. In carrying out this latter policy the Government occupies the relation to the states of a land owner, and will proceed just as any other land owner would do to accomplish the reclamation and settlement of his land. It is conceded in Mr. Bond's article that the national resources must provide the funds for this irrigation development. This being so, the national Government will administer their disbursement. It has steadily refused to cede the public lands to the states, because experience has shown that such a policy would result in the lands being improvidently administered or absorbed in large holdings by speculators. The same result would follow if the control of their reclamation were turned over to the states. The national Government will never appropriate money from any source for state engineers to spend to reclaim the public

domain. The sole ultimate object of the national irrigation policy is to make homes on the public domain, and when this has been done the national purpose has been accomplished. Until the home-builder is actually there, the national Government will never abdicate its functions or transfer to state politicians the administration of this great national trust.

'The Grand Canyon of the Gunnison.' Illustrated evening lecture by A. L. FELLOWS, Resident Hydrographer of U. S. Geological Survey, Denver.

Below the Black Canyon of the Gunnison, which is traversed by the D. & R. G. Railway in Western Colorado there remains still a portion of the Gunnison canyon which has been practically unknown, and a portion at least of which has never been explored until it was investigated by Mr. A. L. Fellows, resident hydrographer of the U. S. Geological Survey, and by one companion, Mr. Will Torrence, of Montrose, Colorado, in the month of August, 1901. This portion of the Gunnison Canyon is known in Hayden's survey as the Grand Canyon of the Gunnison, and although a number of efforts had been made to penetrate its secrets, these efforts have been without avail until the present attempt. This is the more extraordinary as there is no portion of Colorado that can compare with it in scenic grandeur, and the problems in geology that are presented are also of intense interest. The absolutely unexplored portion is of but a few miles in length, but there are some thirty-five miles of which very little is known. This is that portion of the canyon between the mouth of the Cimarron River at Cimarron and the mouth of Uncompahgre at Delta. The plateau which is cut by the Grand Canyon of the Gunnison is known as the Vernal Mesa, and appears to have been caused by an uplifting of the overlying strata by geological forces beneath. The sandstones of the surrounding region were uplifted several thousand feet above the adjacent territory, but these sandstones have been eroded from the region traversed by the canyon, and the canyon itself is eroded into the metamorphic granite and through crystalline rocks to a depth at present amounting to about 2,000 feet on the average below the surrounding territory. The walls are in many cases very nearly vertical, and at times are strangely marked by gigantic veins of quartz. The flora and fauna of the canyon do not differ materially from those of other Colorado canyons, the stream being lined by spruce and cottonwood trees, and the canyon being occupied, to some extent at least, by the usual fauna of the wilder portions of Colorado. The investigation was made in the interest of a survey that is being carried on by the hydrographic division of the U. S. Geological Survey under the general direction of Mr. F. H. Newell, for the purpose of determining the feasibility of diverting the water of the Gunnison into the Uncompahgre Valley for the irrigation of its lands. The trip was made, commenced on the 12th and ended on the 21st of August, 1901. The investigation resulted in the obtaining of practically all the data desired, over a hundred excellent views of the canyon being taken, and copious memoranda made concerning the nature of the rocks and other features of interest. The trip was an excessively hard one, and was made with the lightest possible equipment, the explorers being obliged to take to the river and swim some seventy-odd times, besides scaling the sides of the cliffs times innumerable.

'The Development of Irrigation in Colorado': L. G. CARPENTER, Director of Experiment Station and Professor of Irrigation, Fort Collins, Colorado.

'The Social and Economic Aspects of Irrigation': GEORGE H. MAXWELL, Chairman

of Executive Committee of National Irrigation Association, Washington.

RAYMOND A. PEARSON,
Secretary.

AMERICAN ORNITHOLOGISTS' UNION.

THE Nineteenth Congress of the American Ornithologists' Union convened in New York City, Monday evening, November 11. The business meeting of the Fellows was held at the American Museum of Natural History, and the public sessions, commencing Tuesday, November 12, and lasting three days, were also held at the Museum.

Dr. C. Hart Merriam, of Washington, D. C., was reelected president; Charles B. Cory, of Boston, and C. F. Batchelder, of Cambridge, Mass., vice-presidents; John H. Sage, of Portland, Conn., secretary; William Dutcher, of New York City, treasurer; Frank M. Chapman, Ruthven Deane, E. W. Nelson, Witmer Stone, Drs. A. K. Fisher, Jonathan Dwight, Jr., and Thos. S. Roberts, members of the Council.

The ex-presidents of the Union, Dr. J. A. Allen and Messrs. William Brewster, D. G. Elliot and Robert Ridgway, are *ex-officio* members of the Council.

Outram Bangs, of Boston, Joseph Grinnell, of Palo Alto, Cal., Dr. T. S. Palmer and Professor F. E. L. Beal, of Washington, D. C., and Dr. Louis B. Bishop, of New Haven, Conn., were elected Fellows.

Montague Chamberlain, of Boston, was elected to corresponding membership. Fifty-five associates were elected to the new class known as members, and eighty-three new associates were elected.

By the adoption of certain amendments to the By-Laws, at the present Congress, the following classes of members are now recognized by the Union, viz., Fellows, Honorary Fellows, Corresponding Fellows, Members and Associates.

Dr. J. A. Allen, in his paper on 'The Present Outlook for Stability in Nomenclature,' dwelt upon the American method and its gradual acceptance by foreign ornithologists as well as by workers in other branches of science.

Mr. E. W. Nelson described a collecting trip which he took through portions of Yucatan. In that country, occupied until recently by hostile Indian tribes, he discovered more than one hundred birds new to science.

Mr. Ruthven Deane exhibited books and other relics from his own library which were once the property of John James Audubon. What he had to say on 'Audubboniana,' was of historic interest.

The report of the Committee on Protection of North American Birds showed that satisfactory results had been obtained during the past year. Mr. Dutcher spoke of the great good for protection made possible by the 'Thayer Fund'—money raised through the efforts of Mr. Abbott H. Thayer. By its aid Dr. T. S. Palmer and Mr. Dutcher had been able to appear before legislative committees in many States, and new and better protective laws had been passed. Mr. Chapman referred to the present abundance of bird life on Gardiners Island, N. Y., the result of rigid protection.

Professor W. W. Cooke traced the routes of bird migration across the Gulf of Mexico, bringing out many new and interesting facts.

Excellent lantern slides from photographs of birds in life were shown by Rev. H. K. Job, and Messrs. Nelson, Chapman, Dutcher and Baily.

The New York Zoological Society invited the members of the Union to visit its park, and many availed themselves of the privilege November 15. Director Hornaday conducted the party through the grounds.

Following is a list of the papers read at the sessions.

'The Present Outlook for Stability in Nomenclature': J. A. ALLEN.