duction to the volume to contain them is three-fourths completed, and will be finished in time to transmit it to the Government Printing Office by the last of July or middle of August.

The 5-inch altazimuth was used during the year principally as a zenith telescope, in connection with the prime vertical transit. I am not making zenith-telescope observations exclusively with it, but only of those stars that are observed with the prime vertical, and which permit of being observed by Talcott's method.

This observatory is the only one in this country equipped with a prime vertical transit and for that very reason the major portion of the data we are securing for the study of the variation of latitude is made with it.

George A. Hill,
Assistant Astronomer.

ANNUAL REPORT OF THE SECRETARY OF AGRICULTURE, 1901.

The Fifth Annual Report of the Secretary of Agriculture, Hon. James Wilson, is considerably longer than in former years, reflecting thereby the great growth and development which has attended this Department during his administration.

WEATHER BUREAU.

He announces an important extension of the forecast field of the Weather Bureau, which now includes reports from certain points in the British Isles and on the continent of Europe, from the Azores, Nassau, Bermuda and Turks' Island. The Atlantic forecasts based upon these reports now form part of the regular night forecasts issued in Washington. Three new forecast districts have been established—in Boston, New Orleans and Denmark. An extension of the forecast to farmers through the Rural Free Delivery is contemplated. Substantial improvements are reported in the Department's system of wireless telegraphy, of which the Secretary states in conclusion:

> While there is much experimental work yet to be done before the present system is reliable for intership communication, or before any two systems can work within the same field without each rendering the other useless, such progress has been made by the Government experimenters that, with no interference by private systems, stations can be successfully operated over at least 150 miles of coast line, and they are now in operation on the North Carolina and Virginia coasts, and soon will be instituted between the Farallone Islands and the mainland and Tatoosh Island and the mainland, on the Pacific coast.

ANIMAL INDUSTRY.

A large portion of the report covers the subject of animal industry. The grand total of animals and animal products exported during the year exceeded $250,000,000 in value. This vast foreign market is only preserved to our producers by the indefatigable efforts of the Department and the rigid inspection exercised through the Bureau of Animal Industry. This Bureau inspected for export 385,000 cattle, 228,000 sheep and 48,000 horses and mules, and nearly 1,000 vessels carrying live-stock. Imported animals were also inspected to the number of 342,000, and, where necessary, quarantined. The Secretary suggests that with the enormous interests our stock-raisers have at stake, and inspection or quarantine affording, after all, a relative, not an absolute guarantee of protection, it might be well for this country to follow the example of Great Britain and exclude live-stock from other countries entirely. The meat-inspection service involved the inspection at time of slaughter of nearly 37,000,000 animals. Of the more than 5,000,000 cattle inspected, the condemned carcasses were about one-fourth of 1 per cent.; of the 6,500,000 sheep, one-tenth of 1 per cent.; and of 24,000,000 hogs, one-third of 1 per cent. In the control of indigenous diseases, 1,500,000 inspections were made and over 45,000 cars disinfected in the Texas fever

service alone. In the repression of scabies in sheep nearly 8,000,000 animals were inspected and over 1,000,000 dipped under the supervision of the Department inspectors. In combating the disease known as 'black leg' the Bureau distributed over 1,500,000 doses of vaccine, the result being to reduce losses in affected herds to less than 1 per cent., where formerly it was in most cases about 10 per cent. To aid in detecting tuberculosis in cattle and glanders in horses, over 44,000 doses of tuberculin and 7,000 doses of mallein have been supplied. The Secretary points out the serious evil resulting from a system of State inspection, which, if it became general, would effectually prevent the marketing of live-stock in some sections, and would destroy much of the usefulness of the Federal inspection. He regards the present conditions as so menacing to the interests of the cattle industry in the West and Southwest, that he has requested the Attorney-General to cooperate in bringing the matter before the Supreme Court for decision as to the constitutionality of these State laws. This request has been favorably received and the assistance of the Department of Justice promised.

PLANT INDUSTRY.

The organization of the Bureau of Plant Industry is reported. It has brought together in one group investigations in plant physiology and pathology, botany, grasses and forage plants, pomology, and the experimental gardens and grounds including the experimental farm at Arlington, and the introduction of foreign seeds and plants.

Plant Physiology and Pathology.—Investigations in plant physiology and pathology have been lately devoted to the study of cotton diseases, diseases of orchard fruits, and of forest trees and construction timber. An interesting discovery to cotton-growers is reported of a cowpea resistant to the fungus that destroys the cotton roots. The cowpea being used in rotation with cotton, the securing a resistant cowpea will be of the greatest possible value to cotton-growers. Remarkable success is reported in experiments in plant-breeding to secure samples of cotton resistant to wilt and other diseases. Numerous valuable hybrids have also been developed. One from an American upland cotton and an Egyptian variety promises to be greatly superior to either parent. The Department has been for several years trying to secure by breeding a race of oranges resistant to frost. A cross of hardy Japanese with the Florida sweet orange has resulted in the hardiest evergreen orange known, and there is promise of ultimately securing a fruit both hardy and of good quality. Considerable success has also been attained in breeding raisin grapes resistant to the disease known as 'coulure.'

Botanical Investigations.—In botanical investigations important work has been done on seeds, improvement of crops, and methods of crop production in our tropical possessions, and prevention of losses to cattle in the West from eating poisonous plants. The low germination of commercial samples of Kentucky blue-grass seed was investigated. It was found that there is a stage in harvesting this seed when heating takes place in the tops of the grass, piled in windrows, which tends to destroy the germination of the seed. This can be avoided by methods of handling the grass, but the Department is experimenting with machinery which will dry the moist seed without permitting it to heat. Comparative experiments regarding the relative value of American and European clover seed give results strongly in favor of the former, at least under conditions prevalent in this country. A remedy has been found which, when promptly administered, is effectual in the treatment of animals poisoned from larkspur and poison camas.

The agricultural conditions of our new possessions are being thoroughly studied, and special attention is being given to the production in these possessions of tropical crops, for which the United States pays out millions of dollars annually. Raising coffee in Porto Rico has been the subject of special study. Our annual importations of this valuable crop now amount to $70,000,000. The Secretary asserts that much loss has resulted to the cattle industry in the West in recent years, owing to the injudicious management of ranges. The Department's experiments show that much could be done, under proper control, to restore the ranges to their original condition, and he recommends action by Congress, giving the President authority to secure for the experimental needs of his Department such tracts of public range lands as may be necessary.

Pomological Investigations.—The pomological investigations have been especially directed to the extension of the fruit markets abroad and to the encouragement of the domestic production of fruits hitherto largely imported. Prune-growing has been made the subject of special study; also the growing of European grapes in the South. Attention is called to the rapid increase in our exports of apples since the magnificent showing of this fruit made by this Department at the Paris Exposition.

Arlington Farm—Tea Experiments.—Progress is reported in preparing the Arlington farm to serve in conducting experiments, as an adjunct to the Department. The Secretary cordially commends the experimental work now carried on at Summerville, S. C., under the direct supervision of Dr. C. U. Shepherd. About 4,500 pounds of high-grade tea, which found a ready market, were produced here during the year.

Introduction of Valuable Seeds and Plants.—Great activity has characterized the introduction of valuable seeds and plants from abroad, with most satisfactory results. The development of the rice industry in Louisiana and Texas since the introduction by the Department of the Japanese rice, during the past three years, has been remarkable. At the same time our imports of this product have decreased from 154,000,000 to 73,000,000 pounds. The United States imports yearly nearly $800,000 worth of macaroni. Macaroni wheats have been introduced in the past two years very successfully into the Dakotas and also into Kansas and Nebraska. Fully 90 per cent. of the date palms introduced in recent years from Africa are now growing vigorously in Arizona and southern California. This year a collection of the choicest varieties in Egypt have been obtained. Progress is reported in the introduction of Egyptian cotton. The imports of this product now amount to about $8,000,000 yearly.

Congressional Seed Distribution.—In regard to the Congressional seed distribution, the Secretary states that he has endeavored to meet the wishes of Congress in every way possible and to secure seeds of as high a character as can be obtained under the conditions under which the work is done. It has been arranged to send out cotton seed, tobacco seed, sorghum seed, and sugar-beet seed, and grasses and forage plants, under the direct auspices of the Department, and not through the contractor.

BUREAU OF SOILS.

The Division of Soils has recently been made a Bureau and has received increased financial resources, which enable it to extend its scientific investigations, as well as its practical operations.

Soil Survey.—An extensive review of the work of soil survey shows that the areas surveyed and mapped during the year exceeded 3,500,000 acres, making a total of nearly 6,000,000 acres surveyed during the

past two years. The field work, including preparation of reports, transportation and supplies, has cost an average of $3.26 per square mile, or about 51 cents per hundred acres. A part of the expense has been paid by state organizations, and effective cooperation has been had with the stations. The demands for soil survey in various parts of the country continue to be received in excess of the ability of the Bureau to comply. The Secretary enumerates sundry important results in the work of the survey, but dwells especially upon what has been achieved in connection with tobacco. Especially successful have been the experiments made by the Bureau in the growing of a fine type of Sumatra leaf on certain soils in the Connecticut Valley. During the past year nearly 43 acres have been grown under the direct control of the Department experts. An interesting feature of the experiment is that the bulk of the cost, estimated at $20,000, has been invested by the farmers themselves, and it is gratifying to record that their enterprise has been rewarded far beyond their expectations. The recommendations of the Department have also been followed in the methods of curing tobacco in Pennsylvania, with the result of effecting a saving from the ravages of the black rot, exceeding one-half million dollars. Urgent demands for assistance in the tobacco industry have reached the Department from New York, Wisconsin, Texas and Florida. Referring to the reclamation of alkali lands, to which attention has frequently been called in the reports of the soil survey, the Secretary says that he is more and more convinced that, to carry the lesson home to the individual it will be necessary for the Department itself to undertake a practical demonstration of the efficiency of drainage. The necessity of a special study of climatology in connection with the soil work is pointed out. "The time has come," says the Secretary, "when the work should be taken up on a scale commensurate with the extension of at least two or three crop interests. It is certain that the immediate benefit to the farmers will amply repay expenditure."

WORK OF THE BUREAU OF CHEMISTRY.

In this Bureau investigations into the composition, nutritive value and adulteration of food products have been continued. This work during the year was devoted particularly to the study of preserved meats, the composition and nutritive value of the preserved article being compared with the original, and the preservatives, if any were employed, determined. Food products imported into this country, and suspected of adulteration or of containing injurious constituents, have also been examined. The Secretary is authorized to inspect, through the Bureau of Chemistry, American food products intended for export. Unfortunately, Congress has not provided appropriations adequate to the proper execution of this law. The Secretary adds that it is important that our food products going abroad be pure and wholesome, and that we should protect our exporters against discrimination in foreign countries.

In connection with the Bureau of Forestry, the chemist is taking up the work of forest chemistry, and is studying forest trees in their relation to the soil and the products they yield. Among the chemical industries immediately dependent on forest productions are the tanning industry, manufacture of wood pulp, production of wood spirit, charcoal and other products. The sugar laboratory of the Bureau continues to study all the chemical problems relating to the production of sugar-producing plants and the manufacture of sugar. The chief part of this work is devoted to the study of sugar beets. The work that the Bureau of Chemistry is doing for other departments of the Government is considerable and con-

stantly increasing. By agreement with the Secretary of the Treasury, the chief of the Bureau has been designated as supervisor of sugar tests in the laboratories of the appraisers in the ports of New York, Philadelphia and Boston. The other departments to which the aid of the Bureau of Chemistry has been extended are the War Department, the Post-Office Department, the State Department and the Department of the Interior.

In cooperation with the Office of Public Road Inquiries, a laboratory for the study of road materials has been organized in the Bureau of Chemistry. The prime object of this laboratory is to aid road-builders in selecting the best available materials in their localities.

WORK OF THE BUREAU OF FORESTRY.

Another of the newly organized bureaus is that of Forestry. The Secretary reports that this Bureau is cooperating with the Federal Government, with several States and many private owners in handling their forest lands. Altogether, assistance has been asked for a total area of 52,000,000 acres, of which 4,000,000 are held by private owners. The work of forest management is reviewed in some detail. During the year nearly 800,000 acres under private owners were examined by representatives of the Bureau, and four detailed working plans, covering 226,000 acres, were prepared. The working plan for the Black Hills forest reserve was completed and working plans were undertaken for the Prescott and Big Horn and the Priest River reserves.

Forest investigations include the study of commercial trees and economic tree-planting, of forest fires, grazing, lumbering, forest productions, and other important lines. The region containing the proposed Appalachian forest reserve was examined in cooperation with the United States Geological Survey, and nearly 10,000,000 acres were mapped, lands classified and the forests carefully studied. The Secretary regards the creation of the proposed forest reserve as urgent in order to protect the headwaters of important streams, to maintain the already greatly impaired supply of timber and to provide a national recreation ground. Upon the request of the Secretary of the Interior, the effects of grazing and forest fires were investigated on twelve of the forest reserves.

In the study of economic tree-planting in cooperation with farmers and others in making forest plantations, 46,145 acres were examined and plans were prepared for nearly 6,000 acres, while 148,000 applications for tree-planting plans were received.

THE OFFICE OF EXPERIMENT STATIONS.

The Secretary reports, as the result of a broad inquiry made through the Office of Experiment Stations, that by far the largest part of the work of the stations has direct relation to the important agricultural interests of the communities in which they are located.

The work of the stations is becoming better understood by the farmers, and a broader, deeper foundation of scientific inquiry is being laid each year. Cooperation between this Department and the stations continues to increase, and the value of these cooperative methods to the agricultural interests are very generally acknowledged. As a result of the practical confidence so attained, Congress and the State Legislatures have shown a disposition to be liberal with this Department and with the stations. The movement for the separation of the office of director of the station from that of president of the college has advanced, and at present there are but eleven States and Territories in which the college president exercises the functions of director

of the station. At the same time, the amount of teaching required of station officers has been materially reduced.

The experiments of the station in Alaska, with headquarters at Sitka and subsidiary stations at Kenai, on Cook Inlet, and at Rampart, in the Yukon Valley, are regarded as distinctly encouraging. From all the evidence received at the Department, it seems clear that agriculture may be sufficiently established in this Territory to serve as an important aid to the mining, lumbering and fishing industries. During the year a station has been established in Hawaii. Among the first work at this station was the planting of taro, with the special object of studying the diseases seriously affecting that crop. Probably 50 per cent. of the working population in these islands depend on taro for their daily food, and, owing to these diseases and the attendant deterioration of the crop, the price of taro has increased 500 per cent. in the last decade. Some other diseases of fruits and vegetables call for study, and poultry experiments have been inaugurated with a view to increasing the supply of poultry. It is reported that live chickens sell in Honolulu at $15 a dozen and eggs at 40 and 50 cents a dozen. Hogs bring from 10 to 17 cents a pound on the hoof, and experiments have been undertaken in the feeding of swine with various tubers and roots.

The station at Porto Rico has not yet been fully established, owing to the difficulty of securing suitable land for the purpose. In the meantime, such investigations will be undertaken as can be pursued on lands leased or loaned by persons ready to engage in cooperative work with the station director. Some preliminary investigations in coffee culture have already been arranged for.

The Secretary earnestly recommends that the annual appropriations for all these stations be increased to $15,000, the same as the National Government contributes at present to all of the other stations in the various States and Territories.

The Philippines.—He regards it as extremely desirable that agricultural investigations should be undertaken in the Philippine Islands under the War Department and in cooperation with the Department of Agriculture. In furtherance of this work, the Secretary recommends an additional appropriation of $15,000 for the ensuing fiscal year 'to institute agricultural investigations in the Philippines and, if feasible, to locate and maintain an agricultural experiment station there.'

Agricultural Education.—An increase in college-extension work in agriculture is noted and stress is laid on the movement for the establishment of secondary schools of agriculture and the introduction of the elements of agriculture into the rural schools, as hopeful signs of progress in agricultural education. The Secretary suggests that his Department, already giving aid to rural schools in various ways, should take a still more active part in encouraging this work. He recommends encouragement by distributing seeds and plants to establish school gardens, by furnishing schools with collections of specimens of insects, of plant diseases, and other illustrative material, and by supplying the teachers with such publications of the Department as may be useful to them.

Aid to Farmers' Institutes.—He reviews very fully the great development in the work of farmers' institutes. In 1899 over 2,000 farmers' institutes were held in this country, attended by over half a million farmers. These were held in forty-three States and Territories. The Secretary thinks that there is room for much useful work by his Department in aid of this and other movements for the education of our farmers in the improvement of our agriculture. He

has therefore asked for a special appropriation of $5,000 to enable the Office of Experiment Stations to enlarge its work with a view to giving definite aid and encouragement to farmers' institutes in the different States.

Nutrition Studies.—The dietary studies and experiments in cooking, digestion and metabolism, have been conducted in various parts of the United States in cooperation with experiment stations, agricultural colleges and universities. The results of nutrition investigations already made should, the Secretary thinks, be practically and beneficially applied to the feeding of men wherever a considerable number of persons are to be fed on a systematic plan. He instances the hospitals for the insane in the State of New York, the annual cost of food for which is over $1,000,000, and states that of the $26,000,000 expended for 100,000 persons maintained in the public institutions in New York State alone, $6,000,000 is expended for food. He urges investigations to determine the best dietary for the use of our soldiers and civil officers in tropical regions, and states that a special appropriation of $5,000 has been asked for the study of the food supply and consumption of people living in the tropics.

IRRIGATION MATTERS.

The Secretary devotes a great deal of space to a discussion of irrigation investigations. These have been conducted through the Office of Experiment Stations, and embrace (1) studies of irrigation laws and the social and industrial institutions of irrigated agriculture; (2) investigations of the methods by which water is conserved, distributed and used.

Titles to Water.—In reference to the first subject the Secretary states that the character of the titles to water finally recognized will do more than all other influences combined to determine whether the Western farmers ought to be tenants or proprietors. Naturally, this makes the disposal of the water resources of the West a matter of vital importance not only to the persons directly interested, but to the country at large. Every consideration which justified the general government in the control, the survey, and disposal of public lands, applies equally to the orderly and just establishment of titles to water by public authority, either state or national. He points out the confusion and trouble and almost endless litigation frequently attending the settlement of this question, and declares it to be absolutely necessary that some simple and final method of determining and protecting rights to streams should be provided. In the meantime the conditions, as they exist in arid states, are being carefully studied by the Department.

Improved Instruments.—Irrigation experts of the Departments have designed improved instruments for measuring water, by which registers are now furnished to irrigators at about one-half the cost of the foreign instruments.

Irrigation in Humid Regions.—Attention is directed to the growth of irrigation in the humid regions, and the remarkable fact is stated that in Louisiana more money has been expended on pumping-plants in the past two years than in any arid state. By irrigation, rice-growing in Louisiana and Texas has raised the price of land originally worth $5 to $10 per acre to $50 and even $100 per acre.

Legislation by Congress.—The Secretary expresses the belief that irrigation will, in the near future, become a subject for legislation by Congress, there being important reasons why it should have the attention of that body. At the same time, he says that those best informed believe that the uncertain character of water rights can only be remedied by a larger measure of public control and the making of certain classes of

irrigation structures permanently public works. These, it is urged, should not be owned by private parties, and the argument produced in favor of constructing reservoirs by act of Congress is the same which justifies setting aside forest reserves and the maintaining of a force to control them. On the other hand, the Secretary points out that an appropriation of money by Congress to construct such irrigation works will bring the country face to face with a new Government policy and will carry a larger measure of public control over the water resources of the West than has hitherto prevailed or been sanctioned by public sentiment.

Land Laws affecting Irrigation.—He reviews the influence of land laws on irrigation development, stating that laws which control the disposal of 500,000,000 acres of arid public lands must have a vital influence upon the success of irrigated agriculture. He condemns the desert-land act, stating that 640 acres is more land than a man of moderate means can cultivate under irrigation. Cutting down the entries from 640 to 320 acres is an improvement, but he believes in the entire repeal of the desert-land act and in requiring settlers or homesteaders to cultivate as well as live on their land.

The Grazing Lands.—Referring to the grazing lands, he says probably 400,000,000 acres of the public domain has no agricultural value except for pasturage. It is at present an open common, with no laws for its protection or disposal. He refers to the frequent conflicts of the farmers under irrigation with the range stockmen, and recommends, as a remedial and beneficial measure, the leasing of the grazing land in such a way as not to interfere with the homesteader. The rentals, he believes, would amount in the aggregate to a large sum, which could be appropriately applied to the reclamation of the irrigable lands. He points out that such leasing is not an experiment, as it has been successfully tried, although in a limited way, in Colorado, Idaho, Montana, Nebraska, Utah and Wyoming. He winds up the discussion of this subject by presenting the following conclusions:

1. That private enterprise will have to be supplemented by public aid in the construction of certain classes of irrigation works if we are to secure the largest development of Western agriculture.

2. That reservoirs located in the channels of running streams should be public works.

3. That the first step toward national aid for irrigation should be the passage of enlightened codes of water laws by the States to be benefited.

4. That the land laws should be modified by repealing the desert act and by requiring cultivation as well as residence on a homestead.

5. That the non-irrigable grazing lands should be leased in small tracts so as to unite the irrigable and the pasture lands.

WORK IN ENTOMOLOGY.

Under this head the Secretary reports the successful introduction and establishment in California of the fig-fertilizing insect, with the result that it has been thoroughly established at several points, and that the Division of Entomology is now ready to supply fig insects to any grower after he has succeeded in raising to the bearing stage caprifig and Smyrna fig trees. The discovery is reported, by an expert of the Division sent to Asia for the purpose, that the San José scale is not indigenous to Japan, but that it is so in north China. It has been found in a section of that country where there have been no fruit importations, and all fruits are of native sorts. Further, in this district, it was found to have a natural enemy—a ladybird beetle,

of which the expert in question has collected many specimens and forwarded them to Washington, and steps will be taken to acclimatize this important species. This importation will doubtless prove of extreme value to fruit-growers in this country. Another valuable importation of the ladybird beetle was of one which feeds upon several distinct species of plant lice accidentally imported into this country from Europe.

BIOLOGICAL SURVEY.

The Survey is engaged in mapping the natural boundaries of the crop belts of the country. Its aim is to furnish farmers with lists of products likely to be successful, so far as climatic conditions go, in different parts of the country. During the past season the work of mapping the life zones and crop belts has been continued, particularly in Texas and California. A fiber plant, closely related to the Mexican istle or Tampico plant, is found growing in great abundance over a large part of the arid Sonoran zone. In view of the great quantity of fiber of other species of agave imported into this country ($12,000,000 worth in 1900), the Texas species is likely to prove of great value.

In response to constant complaints, the Survey has prepared and distributed a circular of direction for the destruction of prairie-dogs, and is now conducting experiments in the Dakotas, Nebraska, Kansas and Texas, with a view to discovering remedial measures against this pest, cheap enough for general use. It has been discovered that the bullock oriole and the California least tit feed extensively on the orange and olive. In Texas, the large blackbirds, known as jackdaws, and which have been slaughtered in great numbers for the millinery trade, are particularly useful owing to their feeding habits in the rice and cabbage-growing districts. In addition to its other duties, the Survey is charged with the general supervision of matters relating to game protection. In aid of the preservation of native birds and game it has published bulletins on the laws governing the transportation and sale of game, digests of State game laws, etc. Carrying out the provisions of the Lacey act, the Secretary acknowledges his obligations to three other executive departments, the Treasury, Interior and Justice, to several railroad and express companies, and to many State officials and individuals. Under the system of permits established for the transportation of foreign wild animals and birds, 186 permits were issued during the year, covering the entry of 350 animals and nearly 10,000 birds. Numerous violations of the laws regulating interstate commerce and game have been reported to the Department and in many instances it has been called upon to assist in prosecuting the offenders.

THE DIVISION OF STATISTICS.

The work of this Division consists largely in the preparation of reports relative to the principal products of the soil, including the extent and geographical distribution of the area of production, the condition and prospects of the crops during the growing season, and the quantity, quality and disposition of the products harvested. It has included also reports on various branches of rural economics, such as transportation, wages of farm labor, cooperation in agricultural industries, etc. An urgent demand exists for broadening the scope of the work of this Division. But this cannot be done without enlarging its appropriations. Telegraphic interchange of crop reports has been arranged for with the governments of some of the principal grain-growing countries of Europe. In furtherance of the plan to place the crop reports in the hands of the farmers as early as possible, a system of cards containing the most important

points of the statistician's monthly report has been adopted. These cards are mailed promptly after the publication of the telegraphic summary to postmasters throughout the country with the request that they be promptly displayed in their offices. The Secretary recommends the enlargement of the Division under Bureau organization.

PUBLIC ROADS.

In establishing an Office of Public Road Inquiries, the object was to promote the improvement of public roads throughout the country. Efforts were first directed to ascertain the condition of the roads, the state of public opinion in regard to their improvement, the obstacles in the way, and the best methods to be employed in securing better roads—such has been the work of this office up to the present. For spreading information and awakening interest, nothing has been found so effectual as the 'object-lesson,' or sample roads, which, during the past year, have been built in nine States under the advice and supervision of the office. In building these sample roads, machines have been loaned by manufacturers and carried free by the railroad companies, while the local community furnishes material and labor. During the year, for the better carrying out of the work of the office, the United States was divided into four divisions, the eastern, middle, western and southern, each under a special agent.

PUBLICATIONS.

In the performance of its duty to diffuse the information acquired through its several Bureaus, Divisions and Offices, the main dependency is upon the issue and distribution of publications. This work, therefore, affords a fair reflex of the intelligence and activity of the investigating branches of the Department. The Secretary deplores the fact that this condition has not been as fully recognized in the appropriations as it should be, and the work of publication has, therefore, not kept pace with the wonderful growth and development of the Department. He deplores particularly the unavoidable suspension toward the close of the year of the work of both printing and distribution, and that no less than thirty-five worthy employees had to suffer distress by being furloughed through no fault of their own. Notwithstanding these restrictions, there were issued during the year 606 separate publications, aggregating nearly 8,000,000 copies. Nearly 3,500,000 copies were Farmers' Bulletins, of which two thirds in round numbers were distributed under Congressional orders. With the increased appropriation and the accumulated copies, this year's supply of these bulletins will, under the present law, which assigns four-fifths, instead of two-thirds, to the use of Congressmen, make the allowance of each Senator, Representative and Delegate 15,000 copies. A special building has been rented to be devoted exclusively to the storage and shipment of Farmers' Bulletins, of which not less than 7,000,000 will have to be printed this year. The amount provided, however, for material and labor in their distribution is quite inadequate and must be supplemented by a special appropriation, if the demands of Congressmen are to be met. Referring to the great demand for the Year-book and the growth of the Department, the Secretary points out the inadequacy of the quota assigned the Department. When the edition of this work was 300,000 copies, 30,000 were placed at the disposal of the Department, the same as now, notwithstanding that the edition to-day is half a million copies. The demand for the publications of the Department continues to be greatly in excess of its ability to supply. Many of these—over 24,000 copies last year—were sold by the Superintendent of Documents. This is almost three times as many as the

sales made by that officer of the publications of all other Departments of the Government. A special appropriation has been asked for to carry on more effectively the work of illustration, which the condition of the appropriations in recent years has caused to be somewhat neglected. Over 140 persons are employed, including editors, proof-readers, artists, clerks and laborers, in the work of publications, and these are greatly hampered, owing to their segregation in different buildings in crowded and inadequate quarters.

ACCESSIONS TO THE LIBRARY.

Over 4,000 books and pamphlets were added to the Library during the year. These included many books of special value in the work of the Department and a large number of scientific periodicals. Every effort is made in the Library of the Department to meet the demands occasioned by the constantly broadening fields of investigation entered upon by the Department, and to aid educational and scientific workers engaged elsewhere upon kindred work. The Department Library is regarded as the headquarters of agricultural literature, and should be able to meet demands from without as well as within the Department. The Secretary calls attention to the danger of destruction by fire of the 70,000 pamphlets and books now in the Library, owing to the character of the building at present occupied by the Department.

ACCOUNTS AND DISBURSEMENTS.

Congress appropriated $3,303,500 for the United States Department of Agriculture for the fiscal year ended June 30, 1901, being an increase of $558,920 over the appropriation for the preceding year. When all accounts shall have been finally settled the payments will amount to about $3,220,000.

The regular appropriation of $15,000 for each of the 48 agricultural experiment stations in the several States was also made.

On June 30, 1901, the unexpended balance of the appropriations for the year 1899, amounting to $28,899.27, were covered into the Treasury.

During the year $6,340 was paid for rental of leased buildings in Washington. Owing to inadequate accommodations, Congress, at the last session, provided for the lease of additional buildings, and the rental for the fiscal year 1902 will exceed $10,000.

EXPORTATION OF AGRICULTURAL PRODUCTS.

The highest record previously attained in the export of agricultural products—in 1898—was surpassed by over $90,000,000 in the fiscal year of 1901, when a value of over $950,000,000 was reached. Of the merchandise sent abroad during the year, 65 per cent. originated on the farm. Of foreign customers for our agricultural products, the United Kingdom stands first, taking over 50 per cent. The next most important markets are afforded by Germany, France, the Netherlands and Belgium, in the order named. The Section of Foreign Markets has begun the preparation of a most comprehensive report on the character of our agricultural importations received by the United Kingdom, from countries other than the United States. The importance of this report is evidenced by the fact that, large as were our exports to the United Kingdom, they comprised only one-third of the foreign farm produce purchased by that country. Special statistics have been compiled by the Section of Foreign Markets relative to our trade in farm products with our new insular possessions. Our agricultural exports to Cuba, Porto Rico and the Philippines during the year comprised about 53 per cent. of the domestic merchandise sent to these islands. Our imports of agricultural products from these islands exceeded our exports by just $30,000,000.

CONCLUSION.

The report concludes with a review of the development of agriculture and commerce during the past twenty years, and of the contributions by the Department of Agriculture to the progress of events and the building up of domestic and foreign trade. The Secretary says that coincident with this growth numerous institutions have grown up in this country and abroad, devoted to the application of science to the service of agriculture, thus creating a great demand, at good salaries, for the right sort of men. Each nation is seeking to extend its productions, and is depending more and more upon the aid of science. Men combining knowledge with practical experience and ability are hard to get, and hence the Department has to face the necessity of paying much higher salaries, or of being compelled to either lose opportunities of getting the best men or to lose some of those who, under its training, have developed such qualities as make them exceptionally valuable.

He concludes by saying that he would urge upon Congress, in the strongest terms and for the best interest of the country, such liberality as will enable him to obtain and retain the best men that can be found to fill the important places at his disposal.

MEMBERSHIP OF THE AMERICAN ASSOCIATION.

THE following have completed their membership in the American Association for the Advancement of Science during the month of November:

Samuel L. Bigelow, Ph.D., Asst. Prof. Chemistry, University of Michigan, Ann Harbor, Mich.

Thos. A. Chittenden, Instr. in Mechanical Engineering, A. & M. College, W. Raleigh, N. C.

Patrick B. Delany, Electrician, Inventor, South Orange, N. J.

Wm. Fox, Asst. Prof. Physics, The College of the City of New York, New York, N. Y.

Manuel R. Gutierrez, Prof. Physics, Normal School, Calle de las Victimas, No. 1, Jalapa, Vera Cruz, Mex.

John J. Hollister, Mining Engineer, Gaviota, Santa Barbara Co., Cal.

John W. Leonard, Author-Lawyer, Wheaton, Ill.

Wm. L. Martin, Augusta, Ga.

George H. Maxwell, Chairman, Natl. Irrigation Ass'n, 1827 Phelps Place, Washington, D. C.

Charles P. Nott, Palo Alto, Cal.

C. Howard Parmly, Asst. Prof. Physics, The College of the City of New York, New York, N. Y.

Wm. B. Potter, Ch. Eng. Ry. Dept. G. E. C., Gen. Elec. Co., Schenectady, N. Y.

Ferdinand A. Schiertz, Rosario Mines Ltd., Guadalupe y Calvo, Chihuahua, Mexico.

Solon Shedd, Prof. Geology and Mining, State Agric. College, Pullman, Wash.

Dr. Edw. G. Spaulding, Instr. Philosophy, The College of the City of New York, New York, N. Y.

Dr. Edw. W. Taylor, Instr. Neuropathology, Harvard Medical School, Boston, Mass.

Jos. B. Tyrrell, Mining Engineer, 181 Metcalfe St., Ottawa, Canada.

SCIENTIFIC BOOKS.

Practical X-Ray Work. By FRANK T. EDDYMAN, B.Sc. (Lond.), F. I. C. London, Scott, Greenwood & Co.; New York, D. Van Nostrand Company. Price, $4.00.

This little book, as the name indicates, seems to be a thoroughly practical guide for the beginner in X-ray work. As would be expected, the scientific knowledge to be gained by even a careful study of the treatise must be almost entirely empirical. The scope and purpose of such a book quite preclude treating the physics of the subject in any but a statement-of-fact way.

The work is divided logically into three parts; the first part, wisely brief, treats of the history of the development of X-ray practice; the second, of the apparatus and of its management; the third, of practical X-ray work.

It is to be noted that Mr. Eddyman is a physicist and presumably trained in the science of the subject; also that he has charge of the radiographic work in a large hospital, and so has had ample experience in the practical application of X-ray diagnosis in surgical and medical cases. Such a combination is almost necessary if one is to prepare a book of real value on this subject. The author seems to have succeeded admirably, giving only enough of the pure physics to make the application of it intelligible, and