mittee. The cause of the disease is found to be physiological, not caused by any organism, as it was thought before. A remedy for the disease is still being investigated.

There are several botanists in Tokyo outside of the above-mentioned institutions. Dr. Okamura, who is the lecturer of the Fishery Institute of the Government, is making continued studies on the marine algæ of the Japanese seas. He has just issued the first fasciculus of his 'Algæ Japonicæ Exsiccatæ,' which contains fifty species. Dr. T. Itō, who studied botany at the University of Cambridge some fifteen years ago, is making extensive systematic studies on the flora of Loochoo islands. A part of the work was published in a late number of the Journal of the College of Science, Imperial University of Tokyo.

The works of the Japanese botanists are often published in the Journal of the College of Science, Imperial University of Tokyo, as well as in the leading foreign journals. The shorter papers appear in the *Botanical Magazine*. The magazine is published monthly, partly in Japanese and partly in the European languages. It is the organ of the Tokyo Botanical Society. The Society has about three hundred members, living in various parts of Japan. Among them we find many high and common school teachers. There are two series of small pamphlets published monthly with figures and descriptions of Japanese plants. One contains figures, with brief descriptions and remarks of the flowering plants and ferns of Japan. The other contains those of the lower cryptogams. The illustrations and descriptions in the former are made by Mr. Makino. The latter is contributed to by many Japanese botanists and edited by Professors Matsumura and Miyoshi.

A still larger work on Japanese botany has just begun to be published. This is the 'Icones Floræ Japonicæ,' a large-sized pamphlet with minute and careful drawings and descriptions of Japanese plants, compiled by the Botanical Department of the University. Volume I., Part 1, has lately been published. Mr. Makino is now engaged on the work. All the drawings and descriptions are made by his own hand.

In closing I must not neglect to make a brief statement of the Botanical Laboratory in the Agricultural College of Sapporo far north in 'Hokkaido,' the Yezo Island. The director of the Botanical Laboratory and the Botanical Garden is Professor Miyabé. He studied at Harvard University some ten years ago. The herbarium of the Laboratory has a complete set of the plants of the Yezo Island, besides other Japanese and foreign plants. Professor Miyabé is interested in fungi and plant diseases. Several works in this line have been done both by him and by his students. Professor Miyabé also studied the Laminariaceæ of the northern seas. Two new genera have been established by him in this single family.

Japan is a long country, though narrow, extending from 51° north to the tropics. The variety and richness of the flora are incomparable. Though the phanerogams and the ferns of the empire are pretty well known, many lower cryptogams have not been thoroughly investigated.

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SCIENTIFIC BOOKS.

Reservoirs for Irrigation, Water Power, and Domestic Water Supply. By James Dix Schuyler, M.Am.Soc.C.E., etc., etc. New York, John Wiley and Sons, 1901. $5. Pp. xvi + 414. 174 figs., with maps and appendix.

The subject of reclaiming by irrigation the extensive arid tracts of western North America is pressed upon the attention of the general public, and also upon that of the engineering and financial world, with increasing emphasis from year to year. Private capital is urged to

provide reservoirs and irrigation works and has already done so to some extent, and the question of aid from the national government in extending the work is under debate. Much light is shed upon what has already been done in this direction, as well as upon what is proposed and is under way, by Mr. Schuyler's interesting book, which embodies the material used in his reports to the U. S. Geological Survey in 1896 and much additional matter of more recent date.

The book is unquestionably a valuable one for civil engineers, giving, as it does, a description of the principal dams built, and now projected, in the western portion of the United States; and also some account of large dams in foreign countries, already completed or in progress, such as those at Assuan and Assiout in Egypt; giving also (to quote from the title page), "A discussion of the available water supply for irrigation in various sections in arid America; the distribution, application, and use of water; the rain-fall and run-off; the evaporation from reservoirs; the effect of silt upon reservoirs," etc. In some cases details are presented in great fullness; and illustrations, views, profiles, maps and plans occur in profusion throughout the work, thus greatly enhancing its value. As an instance in point, it may be noted that in the description of the Sweetwater dam, in southern California, built after the design, and under the superintendence, of Mr. Schuyler himself, there are fourteen distinct illustrations (views at different stages of construction, sections, maps, etc.), the description itself occupying seventeen pages.

This same dam offers a striking instance of the benefits obtained by the erection of such a structure. During the thirteen irrigation seasons up to 1900 'the impounded water has created values aggregating several millions of dollars, reckoning all improvements made in the district directly dependent on it for water supply.' Domestic water supply is also furnished to a population of from 2,500 to 3,000 people. The cost of the dam was $234,000 and the area at present irrigated from it is 4,580 acres.

The dams described are classified according to their mode of construction and may be briefly referred to as follows:

'*Rock-fill*' dams are composed of stones deposited loosely together in a trapezoidal form, water-tightness being provided by a sheathing of plank on the upper side, or by an earth facing. This plan originated some fifty years ago in the mining regions of California, when the transportation of cement into remote districts was very expensive, or impracticable. Later construction employed a concrete 'skin' on the upper side; or a central and vertical steel plate, covered on both sides with hot asphalt and burlap, and then imbedded in a wall of concrete. Sometimes the steel plates formed a facing on the upper side.

The '*hydraulic-fill*' dams were composed of earth and gravel deposited by 'sluicing' the material into position; that is, by washing down the soil by jets of water from higher elevations in sluices or pipes into the desired position. In this way, by proper management, the finer soil could be made to occupy the center of the dam or embankment, while the coarser gravel and stones formed the outer portions; and extreme cheapness of construction was often attained. Thus, the Tyler dam, in Texas, 575 ft. long and 32 ft. high, cost only $1,140; including the expense of pumping water to form jets for loosening and sluicing the soil. As the water drains off gradually the gravel, sand and clay are more compacted, it is claimed, and hence a more water-tight dam obtained, than if the material had been laid dry and then tamped.

Naturally, the chapter on the masonry dam, as being the most durable and stable construction, occupies a greater space in the book than any other. Here the usual arguments are presented in favor of the gravity dam, as against the horizontal arch; though the curved form is advocated in certain cases for esthetic reasons, and as providing for remote contingencies. A full description is given of that 'eighth wonder of the world,' the noted Bear Valley dam, in California, which with its very slender dimensions depends for stability solely on its arched form; this form having been given to it to effect a saving in the cost of masonry, since the cost of hauling cement to the locality was at that time (1884) $10 per barrel. The Sweetwater dam, already mentioned, belongs to this

class and was built in 1888. An interesting fact with regard to sedimentation in this reservoir is that during the twelve years of its use the bed of accumulated silt in the deepest part (some 90 ft.) was only 3 ft. in thickness. This is in great contrast with the rapid silting of Lake Macdonald, the reservoir created by the Austin dam of Texas, whose design and construction, and also final failure in April, 1900, are described by Mr. Schuyler.

Concrete dams are next taken up, including the structure of that type built for the Hydraulic Laboratory of Cornell University; in connection with which an account is given of the device adopted for 'concentrating the contraction due to temperature changes in the concrete to a central point of weakness.' The resulting fissure was filled up in cold weather and continuity thus secured.

In the chapter on earthen dams mention is made of the ancient 'tanks' or storage basins, of Ceylon, one of which was closed in by an embankment 11 miles in length and 200 feet high; also of several in India. The other earthen dams mentioned are in Colorado and California, one of them (5.5 miles in length) serving to close in the Buena Vista Lake Reservoir, which has great extent (25,000 acres) but is only about 7 feet deep. As a result of this, the annual loss of water by evaporation is estimated at 70 per cent. of its capacity. However, when the evaporation is most active, the loss is made good continuously by the influx from the river.

The Ash Fork steel dam in Arizona, described on p. 222, was erected in 1897 and is an unusual construction, consisting of a number of vertical steel frames or trusses, connected or 'bridged over' at the upper side by curved plates of steel which form a continuous and water-tight covering. The structure is 33 feet high, 184 ft. long, and cost $45,000.

Natural reservoirs are next mentioned; *i. e.*, ready-made reservoirs or depressions, waiting only for water to be turned into them from neighboring streams of sufficient elevation and for suitable provision for its regulated escape.

The last chapter, on 'Projected Reservoirs,' is of considerable length and full of detail, treating of many irrigation surveys and projects for impounding water, throughout the Western States and Territories. Several of the structures mentioned are already in process of construction. An appendix of various tables made for the U. S. Geological Survey, and contoured maps of reservoir systems, complete the work.

A very commendable feature of Mr. Schuyler's book, and one that will be appreciated by civil engineers, is the information given as to the *cost* of many of the dams and other structures described in the work.

I. P. Church.

Annual Reports of the War Department: Report of the Chief of Ordnance. Washington, Govt. Print. 1900. 8vo. Pp. 474. Numerous appendices and plates.

The reports of the War Department always contain much of interest to the general reader and to the thoughtful citizen, apart from their purely technical matter, as, for example, the accounts of work performed under the River and Harbor Bill. Those of the Chief of Ordnance are particularly interesting to the student of metallurgy and to the engineer as giving much valuable information regarding materials. Occasionally a side-light is thrown upon interesting phases of governmental and official administration; as where the report of the chief of a bureau permits the reader to see the hand of the politician in the determination of the location of important locks, in river improvements in the West and the reason for the displacement of a worthy and capable officer insisting upon correct business methods, or where, as in the report before us, the official documents reveal the fact that a Committee of Congress, composed mainly if not entirely of non-experts, or amateurs at best, decides to 'try an experiment' with Government funds, to the extent of many thousands of dollars, directly against the expressed opinion of the official expert advisers of the Department and of Congress, or where official and expert authorities are permitted to be accused of refusing to permit the civilian expert reasonable opportunity to display his talent, and the charge is left without complete and decisive investigation and report. Amateurism is not altogether a monopoly with departments.