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NEW YORK, SATURDAY, JUNE 30, 1906.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

A LOCK CANAL FOR PANAMA.

Thanks to the arguments which have been advanced by the President, the Secretary of War, and the Chief Engineer of the Panama Canal, the Senate has voted for a lock canal across the Isthmus—a legislative decision which will probably be welcomed by the engineers who have been intrusted with the building of the waterway and by all Americans who have at heart a speedy termination of an undertaking that means much to the economic advancement of the country. The sharp conflict which has been waged by the advocates of sea-level and lock canals, and which has resulted in a delay both irksome and perplexing to the engineers at Panama, is now happily ended, and that project has been selected which, in the opinion of those most competent to judge, will most satisfactorily fill the immediate need of an Isthmian waterway.

Of the thirteen members of the International Board of Consulting Engineers, eight reported in favor of a sea-level canal and five in favor of a lock canal. Of the six members of the Canal Commission, five were in favor of a lock and only one in favor of a sea-level waterway. Now that the dispute has been settled, the recommendations of the President and Chief Engineer Stevens will no doubt be carried out. According to these recommendations, a gigantic dam is to be erected at Gatun, measuring 7,700 feet in length and 131 feet in height, which dam is to be composed of no less than 21,200,000 cubic yards of material, and upon which the permanence of the canal rests. To this dam a 500-foot channel will lead from the Atlantic. Three locks arranged in a double flight will lift ships from the sea level to the huge sheet of water impounded by the dam at an altitude of 85 feet. Through this great artificial lake, and through the waters that will spread from it back through the Chagres Valley, vessels may steam unrestrictedly at a speed which they could never possibly attain in the sea-level canal contemplated originally. After passing through the Culebra cut to Pedro Miguel, the vessels will begin their descent by means of a lock having a 30-foot lift, and will then steam through another lake formed by a dam erected in the valley of the Rio Grande. A double flight of two locks will drop the ships to Panama Bay. According to the President's recommendations, the canal will have a minimum depth of 45 feet, will be finished in nine years, and will cost $140,000,000.

We have already had occasion to comment on the economy and quickness of construction with which a waterway built on the high-level principle can be built. Chief among the advantages to be enumerated is the substitution for a forty-mile channel varying in width from 150 to 200 feet of two great artificial lakes yielding over thirty miles of deep water through which ships can steam at full speed, free from any risk of grounding or collision. More doubtful, however, is the expediency of building an earth dam at Gatun having the afore-mentioned length of 7,700 feet—doubtful because of the dam's ability to prevent seepage at the base. Still, it must be admitted that the success of the earth barriers at Wachusett in Massachusetts and San Leandro in California justifies the construction which the President and his advisory engineers have advocated.

To the engineer it must be gratifying that his professional opinion has triumphed over the sentimental clamor for a sea-level canal that could be completed only at enormous cost and a chafing delay.

REDWOOD IN THE SAN FRANCISCO FIRE.

In our issue of May 12, 1906, our San Francisco correspondent, in presenting his views of the great earthquake, condemned the use of redwood as a building material, and gave it as his opinion that it seemed fully as objectionable as pine in the "fierceness of its flame, quickness to ignite, and the intense heat of its combustion." He based his condemnation on his personal memory of the Chicago fire, where he had had ample opportunity of observing the inflammability of pine.

A member of the Redwood Association takes us to task for our correspondent's criticism, and furnishes us with letters that he has received from San Francisco officials, all of whom unhesitatingly declare that redwood is more refractory than pine, and some of whom even venture the opinion that the fire was stayed by buildings finished with redwood exteriors.

We are only too well aware of the merits of California redwood to decry its use in unmeasured terms, and too keenly alive to its admirable fire-resisting qualities to class it with pine for ordinary purposes. Still, we may be permitted to believe that any wood, subjected to a heat so fierce that the steel columns of a modern fireproof building sink and bend under it as if made of wax, must be regarded as unsafe, whatever its refractory qualities may be in comparison with other woods, and in that opinion no doubt every builder will concur. For all the safety which it gave, the redwood which was consumed in the great conflagration might just as well have been supplanted by pine or by material even more combustible.

Admitting the ability of redwood to withstand ordinary heat for a greater period than most woods (and this, we take it, is all that redwood advocates claim for it as a fire-resisting material) we must attribute the salvation of that portion of San Francisco which escaped to the very liberal use of dynamite. The fire was stayed in the very midst of redwood structures, it is true, but doubtless its course would have ended where it did, had these same structures been built of other material.

COMPARISON OF WESTERN IRRIGATION RESERVOIRS AND THE NEW CROTON DAM.

One of the most surprising features connected with the work of the Reclamation Service, as well as the one affording highest gratification, is the cost of structures compared with those which have become familiar to engineers in the East.

When the reclamation work was inaugurated, it was a matter of conjecture whether or not the standards of cost for dams, canals, etc., that had been established by engineering practice in the eastern part of the country, could be relied upon as a basis of estimates of the cost of the proposed western structures. As the work has progressed, it has become more and more evident that many classes of engineering work in the West can be performed much more cheaply than in the East, and at the same time the natural conditions are such that these structures are more economical and effective.

If we take, for example, the three great masonry dams now being erected for the purpose of storing water, viz., the Roosevelt dam in Arizona, the Pathfinder dam in southeastern Wyoming, and the Shoshone dam in northwestern Wyoming, we shall find that the effective storage capacity and costs are far below those of some of the great eastern dams like the new Croton in New York and the Wachusett in Massachusetts. The heights of these dams are as follows: Roosevelt, 280 feet; Pathfinder, 210 feet; Shoshone, 308 feet; new Croton, 297 feet; and Wachusett, 207 feet. These heights are measured from the foundation stones to parapet in each case, and they show that the Shoshone is the highest, while the new Croton is second and the Roosevelt third. If, however, the height above the river bed be considered, that is, the effective storage height, the new Croton is the lowest. The order is then as follows: Shoshone, 240 feet; Roosevelt, 230 feet; Pathfinder, 200 feet; Wachusett, 185 feet; and the new Croton, 157 feet. In other words, about fifty per cent of the masonry in the new Croton dam is below ground and is serviceable for foundation purposes only.

It is interesting to note the comparative reservoir capacities. While the new Croton dam is the largest in the world from the standpoint of its amount of masonry, the storage capacity of the reservoir formed by it is by far the lowest of any of those above mentioned. In fact, from a standpoint of storage economy, the new Croton reservoir is one of the poorest that has been constructed in recent years. The dam contains 833,000 cubic yards of masonry, and was erected at a cost of $7,600,000. The capacity of the reservoir formed by it is 4,000,000,000 cubic feet, or a cost of $1,900 per million cubic feet storage. Similar figures for the Wachusett dam show that it contains 280,000 cubic yards of masonry, and was erected at a cost of about $2,000,000. Its storage capacity is 8,400,000,000 cubic feet, or a cost of $238 per million cubic feet storage. In contrast to these excessive costs, the three western dams appear remarkable. The Roosevelt dam, for example, contains 350,000 cubic yards of masonry, erected at a cost of $3,850,000. The capacity of the reservoir is 61,000,000,000 cubic feet, or fifteen times that of the new Croton, and about seven and one-half times that of the Wachusett. The cost of this dam per million cubic feet storage is only $63.16. Even more remarkable appears the Pathfinder dam. It contains 53,000 cubic yards of masonry, erected at a cost of $1,000,000. The capacity of the reservoir is 43,560,000,000 cubic feet, or more than ten times that of the Croton. The cost of the dam per million cubic feet storage is therefore only $22.95, as against $1,900 for the new Croton, and $238 for the Wachusett. Similar figures for the Shoshone dam, the highest in the world, are: Cubic yards of masonry, 69,000; cost, $1,000,000; capacity of reservoir, 20,000,000,000 cubic feet; or a cost per million cubic feet storage of $50.35.

These extremely low costs have seldom been equaled in the history of reservoir construction, and are due largely to the excellent natural facilities which are found in the rugged western country. From this fact it must not be inferred that these western structures are simple engineering works. On the contrary, owing to their isolated location, their inaccessibility by rail and often by wagon, and the erratic and torrential character of the streams, they involve problems which tax the skill and ingenuity of their builders to the utmost.

It is most fortunate that these reservoirs provide enormous storage at relatively low cost. Otherwise their construction would not be feasible, as the irrigated land could not bear the expense of the costly structures of the East with their limited storage capacity.

The Croton dam, if it had been constructed in Salt River Valley in Arizona for irrigation, would only supply 23,000 acres, and irrigators would have to pay $330 an acre for stored water, as against $20, the estimated cost from the Roosevelt dam.

SEEDS AND SUSPENDED ANIMATION.

It has often been observed that any sudden change in the superficial character of the soil is rapidly followed by an alteration in the nature of the plants growing thereon, new species appearing where the ground has hitherto been a stranger to them. Very many farmers, foresters, and scientific men—among others the French botanist Poisson—are inclined to attribute this phenomenon to the retention of seeds, bulbs, or spores of a former growth of vegetation in a quiescent state, these seeds and growths retaining their powers of germination even after several other successive crops of plants have grown above them. Most botanists, however, have doubted the possibility of seeds' retaining their germinating properties for so long a time, and have explained the sudden appearance of strange plants in different places by natural means of seed transmission, as, for instance, by birds, bees, currents of air, and the like. A remarkable fact was once observed by Th. v. Heldreich at the mountain called Laurion in Attica. After the removal of about ten feet of soil and rubble which had been undisturbed for ages, there suddenly sprang up a plant unknown theretofore in that region, viz., a glaucium or horned poppy, accompanied by a rich growth of the fly-catcher or *Silene juvenalis* Del, a plant quite a stranger to Attica.

This mystery of plant life has, so far, been a vexed problem, and several theories have been suggested for its solution. A French scientist (M. Fliche) has recently made some exhaustive studies in this connection, and has observed some interesting phenomena which have occurred with specimens of a southern European plant called wolf's-milk or cypress-spurge (*Euphorbia lathyris* L.). This plant is not indigenous in France; a few years ago, however, some Nancy botanists were astonished to find large quantities of this plant in full blossom in a district where it had never before been seen, namely, in a two-year-old clearing in the large forest of Hane in the canton of Petite Malpierre. Two years later the plants had entirely disappeared. Thick growths were found, however, a short distance off in another two-year-old clearing, but only a few specimens were encountered in another clearing which was a little over three years old. Fliche does not doubt but the gradual disappearance of the plants is due to the influence of steady forest growth, and not to any inferior seed or peculiar germinating powers thereof. In order to determine this point he made several special clearings on the spot, and the result of his experiments was fully to confirm his theory. As the part of the forest where the plants grew was very remote, and seldom visited by human beings, there was no question of the seeds having been carried there either intentionally or accidentally.

At this spot, over forty years ago, the remains of large Gallo-Roman iron works were found. Now Plinius states that the Romans used the *Euphorbia lathyris* for medical purposes; Fliche is consequently convinced that the plants were originally introduced by the persons living at the works, that the seeds lay hidden in the ground when the forest invaded the territory in the course of its growth, and that they did not awaken from their long slumber and again seek the surface till the axe of the modern woodman cleared the ground and paved the way for their resurrection. This opens up quite a new field for the student of Nature's mysteries, and doubtless, as time progresses, some close observer will discover more precise data with which to supplement these brief particulars.