CASCADE LOCKS.

BY EDW. R. BISHOP.

On November 5 of last year occurred the ceremonies which formally opened for business the Cascade locks on the Columbia River—a proceeding of great moment to the Pacific Northwest and one which will make a reality of the long dream of an "open river to the sea." Few in other parts of the country appreciate the magnitude of these locks, rivaling those at Sault Ste. Marie in size, and affecting a territory about double the area of the State of New York. The value of opening the river was appreciated in Congress at an early day, and work on the locks was commenced twenty years ago, a small appropriation having been made for the purpose, but progress was very slow till 1892, half of the work being executed since that time.

Their completion at this date is due in a large measure to the efforts of Major Thomas H. Handbury, who succeeded, in 1888, Captain Powell, in charge of all the government improvements on the Columbia River. He called attention to the meager appropriations which had been made—the annual average for the twelve years the work had then been in progress having been only $95,000—and stated that, at this rate, twenty-four years would be required before the locks could be opened to commerce. A board of engineers was convened to discuss the details of construction, and it indorsed all Major Handbury's plans. Former designs were used, with the exception of some modifications as experience had proved to be necessary, chief among these being the substitution of a dry stone wall for timber cribbing along the sides of the canal and of steel gates in place of those of wood. In 1890 a revised estimate of the work was submitted. The appropriations up to that time had been $1,880,000, and Major Handbury calculated that $1,745,000 more would be required, and experience proved this figure to be practically correct. An appropriation of $326,250 was made in 1892, with a provision for letting out the work by contract, and in November of that year Messrs. J. G. and I. N. Day secured the contract and at once began work.

The location of the Cascade locks is one to gladden the heart of any lover of the beauties of nature, as it is in the midst of the magnificent scenery for which the Columbia is famous. The great river breaks through the Cascade Mountains at this point. As one gazes at the rugged mountain peaks with their mantle of perpetual green on all sides of him, and downward to the mighty rushing waters at his feet, boiling and eddying in a way that recalls the rapids at Niagara, it forms a picture that will linger long in his memory.

When the finishing touches have been put upon the locks, in the way of beautifying the premises, the view will be improved, not marred, by man's handiwork, as there are no factories or other unsightly buildings to form a blemish on the scene.

The only other obstructions on the Columbia are the Dalles Rapids and the Celilo Falls. These are to be overcome by a boat railway, twelve miles in length, the right of way for which has already been condemned, and, as the work can be completed in less than two years, the country beyond will not long be deprived of any advantages to be derived from the locks. The Dalles, the present limit of navigation, is 200 miles from the sea, but with the completion of the portage road an uninterrupted trip may be made by boat, from the Pacific, up the Columbia and the tributary Snake River for a distance of 500 miles, or, continuing up the Columbia, through Washington to the head of navigation in British Columbia, a point over 600 miles from the sea.

The Cascade locks constitute a work of which the country as well as those engaged in their construction may well be proud, and by many they are considered the largest in the world. A claim for this distinction is also made for the Soo locks, whose gates are 40 feet high, with a span of 100 feet. The span and height of the large gates at the Cascades are 56 feet and 90 feet respectively, thus being higher and narrower than those at the Soo, the claim of greater size being based on the fact that the area is considerably in excess of that of the rival gates. A factor which required careful consideration in designing these locks was the great variation in the height of the river, the difference between high and low water being 55 feet. At the Soo and many other locks the water varies only a few feet in height. This condition made it necessary to construct a series of three sets of gates, increasing in height from the lower entrance to the huge upper guard gate, only two sets being used at one time. When the river is low, the upper guard gates remain open continually and the lower sets are operated, and vice versa, when the water rises sufficiently to drown the lower gates, they are swung open and the work is done by means of the others.

The upper approach is formed by a fine wall of masonry extending from the guard gate in a long sweep of 1,200 feet. The bank back of it is riprapped in a substantial manner.

The center of interest is the great gates. Designed after long study, and, though so large, executed with all the nicety of clock making, these creations of steel, which are so well hung as to fit together with perfect accuracy, are truly fine specimens of what engineering skill can accomplish in this line. The steel is all of American manufacture, having been made by the Maryland Iron Works, at Sparrow's Point, Md., to whom the contractors give abundant measure of praise for the excellent quality as well as the accuracy of the work.

Like most steel gates, these form a perfect arc of a circle—a form not practical for those of wooden construction, as strength would have to be sacrificed to obtain the shape. The total weight is supported at all times by a pivot and anchor, exactly on the principle of the hinges of an old-fashioned garden gate. The pintle or pivot at the bottom, on which the gate swings, is of forged steel, hemispherical in shape, and is 9 inches in diameter. The upper hinge is made by a heavy collar forging, from which radiate six bolts, each 4½ inches in diameter and 22 feet long. These are embedded in the massive masonry for their whole length, and each terminates in an iron casting 2 feet square. It was necessary to make each of these bolts of sufficient strength to support the whole strain of the gate, for, as it opens or shuts, the pull is transferred from one radius to another, each in turn for a small part of the journey receiving the full weight.

Many gates are so constructed that, when the water presses upon a fraction of the area, the strain is distributed over the whole, but those of the Cascade locks differ from this, each girder taking the strain separately. Of course, with this system, the connecting surfaces, being so long, may not be absolutely straight, but the pressure is so distributed that any slight depression of one surface is met by a corresponding elevation on the opposite, and no leakage occurs.

Many people suppose that the gates, when shut, rest solidly upon the bed of the chamber, but, far from that being the case, there is an open space directly beneath. The contact which prevents the water from finding its way into the chamber is made in a different way. Extending along the bottom of the inner surface of the gates there is a depression which, when the gates close, fits against a series of castings bolted into the concrete of the floor. In these castings is embedded a long strip of heavy rubber. It is not calculated to have the pressure of the water on the gates transmitted in any great degree to this rubber, but it forms a connection between the two surfaces which is well nigh watertight. In many locks timber takes the place of this rubber surface. As the gates swing together, the surfaces connecting the two are steel bars extending the whole 90 feet of their height, and they meet with an accuracy that is amazing to anyone not accustomed to the exactness of engineering work. The different sets of gates are identical in design, though they vary greatly in size.

The masonry on all sides forms a striking illustration of what man can accomplish, stone fitting stone with perfect accuracy, and the whole built on lines in which not even an instrument can detect an error. Such work is very costly and has consumed the major part of the money spent on the locks. All the stone used in the construction of the locks was quarried on the spot or brought by scows from a point a few miles up the river. It is a basaltic lava, pleasing in appearance, and forming a building material eminently fitted for the purpose. It is estimated that 2,400,000 cubic feet of stone have been laid in this work.

The contract was not taken to complete the plant for a certain sum, but it was specified that the contractors were to be paid by the number of cubic yards of excavation, by the cubic feet of stone laid and pounds of iron used.

The lock chamber is 475 feet long by 90 feet wide—sufficiently large to accommodate several river boats at once. The bed is of concrete.

The main culvert which conducts the water to fill the chamber extends the whole length of the latter, being built in the wall, and is about 10 feet square—a passage of sufficiently ample dimensions to accommodate a team with a load of hay, and one which carries a tremendous quantity of water. Eleven filling culverts empty the contents of the main culvert into the chamber, each 3 × 5 feet in size. On the opposite side, the main culvert opens directly into the chamber, as the wall will not be completed till a future appropriation, though the present condition does not interfere with the operation of the locks. The total lift is 24 feet and about half an hour is required to put a boat through the locks. The gates can be opened and closed in one minute.

One of the most interesting things about the locks is the system of hydraulic engines which opens and shuts the gates, controls the valves and does all the work. In the mountains, 500 feet above, is a reservoir with a 10 inch pipe conducting the water to the engines This affords a pressure of 217 pounds to the square inch and effectually does away with a battery of boilers and with steam engines. Placed in pits in the masonry, the hydraulic engines occupy little space and perform the work in a perfectly satisfactory manner. There is an engine to each wing of each gate. The cylinder of the engines operating the large gates has a 13 foot stroke, and, with its diameter of 18 inches, affords a steady pull on the cables of about 55,000 pounds. The gates are opened and shut by a system of cables similar to that of an elevator, the principle being that a short stroke of the piston produces a long pull. The ratio in this case is one to four. The cables are 1¼ inches in diameter and are attached to the lower part of the gates. Those on the inside cross, as each engine opens its own gate and closes the opposite. Thus, for example, the south engine opens the south gate and closes the north gate. The piston rod extends from both ends of the cylinder and carries on each extremity a pair of wire rope sheaves. The reason for this arrangement of double piston rods and crossheads is simple. As the piston advances, the forward movement of the sheaves causes a pull on one side of a gate and the same motion of the rear sheaves of the opposite engine slacks off the cable on the other side of the same gate.

The valve which controls the admission of the water to each culvert has its exact counterpart in principle in the damper of an ordinary stove pipe, although it is so huge in size. It is supported by a 10 inch shaft and weighs 8 tons. The power to move it is derived from a separate hydraulic engine, with a 15 inch cylinder and 6 foot stroke, and is applied by means of a bell crank lever and long connecting rod. On each side are large hydraulic capstans designed to assist in moving vessels while in the canal.

Great credit is due to the engineers and contractors who have completed the Cascade locks for the high grade of work done and the harmonious way in which all have labored together. Major Handbury carries off the lion's share of the honor of having designed the improved plans, as well as having greatly accelerated the progress of the work. After his removal to the East, Major Post was put in charge and the completion was under the direction of Capt. Fiske. Lieutenant Harry Taylor, of the army, was the engineer detailed for the duty of seeing that the specifications were carried out to the letter. Messrs. J. G. and I. N. Day, the contractors, have executed the work with all possible celerity, having 900 men engaged for some time. A delay of several months was caused by the excessive high water of 1894, which also necessitated a heavy additional expense in guarding the work from great damage.

Like those at the Soo, these locks are operated by the government free of charge, under the direction of an army officer detailed for the service. Each vessel using the locks must fill in a blank furnished by the government, stating its tonnage, amount of freight, and number of passengers carried.

The amount of business which will be done by the locks is an interesting subject for the statistician, and, though many are the estimates advanced, there is as yet too much of the element of speculation about it to make a reliable report. The freight annually handled at one point on the upper river may be considered a valuable factor in making this calculation. The total incoming and outgoing freight at the Dalles, last year, was 53,450,000 pounds, besides 1,000 car loads of cattle and 10,000 sheep. With cheaper rates, adjacent counties will ship from here, and, considering that this is but one point on a river navigable for several hundred miles, we see that the total of the freight of this country is very large. Doubtless the railroads will still handle a large part of the business, but water transportation is always a most salutary regulator of freight rates, and everything consumed or produced in an area of probably 100,000 square miles will be affected by these locks, which open the great Columbia River to commerce. In particular will the vast quantity of wheat raised in Eastern Oregon and Washington feel the improved rates of transportation to the coast, whence it seeks a market in Europe. The people of the "Inland Empire" may well congratulate themselves on the completion of the Cascade locks.

A Mycological Club.

A mycological club has been formed in New York City. The object of this club is to bring together all those who are in any way interested in edible fungi, to study edible mushrooms and toadstools and those noxious and poisonous kinds that may be mistaken for them, and to disseminate all information concerning them, and to arouse a wider appreciation of a cheap food supply too often neglected in this country.

England has long considered mycology a profitable study and supports a number of flourishing societies. The Boston society was started in 1895, and its rapid growth encouraged the promoters of the New York society to start a like movement in New York. The members of the new society will make excursions in the parks of the city and the suburban districts, searching for different varieties of fungi. The specimens collected will be exhibited to the public and lectures will be given on them, some of the members explaining how to distinguish the poisonous from the edible variety. Lastly, it will show how to prepare them for the table. The society has at present rooms at 841 Fifth Avenue, New York City.