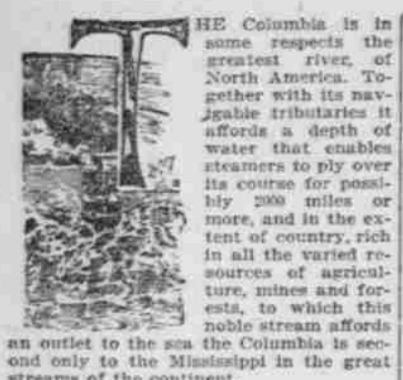


TO PASS THE CASCADES

The Government System of Canals and Locks at This Point.

MOST IMPORTANT PUBLIC WORK ON THE COAST

Obstacles the United States Engineers Have Overcome—Improvement of the River Channel Below the Rapids—Early Promised Completion of the Work.



HE Columbia is in some respects the greatest river of North America. Together with its navigable tributaries it affords a depth of water that enables steamships to ply over its course for nearly 2,000 miles or more, and in the extent of country, rich in all the varied resources of agriculture, mines and forests, to which this noble stream affords an outlet to the sea the Columbia is second only to the Mississippi in the great streams of the continent.

It was in 1856 that Lewis and Clark and their brave associates first followed the Columbia river from its headwaters in the Rocky mountains to tide-water at the present site of Astoria. One of the strongest arguments of the United States in the claim of this country for all of that territory west of the Rocky mountains and south of the 49th parallel of latitude, in the dispute with England over the northern boundary line, was the claim that this territory properly belonged to the American people, owing to its early exploration by Lewis and Clark. The strength of the position of the Columbia river as an open highway to the sea was fully recognized by both nations at the time, and it was the realization of the importance of this stream to the gov-

ernment whose territory it crossed that long prevented England from acknowledging the claims of the United States to the ownership of the rich territory now included within the states of Oregon, Washington, Idaho and Western Montana.

THE SNAKE.

The Snake, about 14 miles east of The Dalles, the Columbia is joined by the Snake, a stream second in importance only to the great river which pours its waters into the sea at Astoria. The Columbia and the Snake furnish free navigation from The Dalles to Lewiston, a distance of nearly 200 miles. Far to the south of Lewiston steamers of deep draft ply regularly on the Snake, and even as far as American Falls, where the Oregon Short Line extension of the Union Pacific crosses this stream, the depth of water is sufficient to float vessels of considerable tonnage. With the exception of the obstructions to navigation at the Cascades and the dalles, the Columbia and the Snake afford uninterrupted navigation from the Pacific ocean to Lewiston, a distance of nearly 400 miles. The removal of these obstructions will enable steamers to ascend the Columbia from its mouth to Priest rapids, a distance of nearly 20 miles. The great improvements which will afford passage for steamers around the obstructions at the Cascades, and which are now approaching completion, will be fully described in the present article. The proposition to surmount the obstacles to passage around the obstructions at the dalles by the construction of a boat railway has now assumed such shape that the commencement of active work on this much-needed improvement in the near future is practically assured. The people of the vast territory for which the Columbia is the great natural highway for traffic confidently look forward to the opening of this stream by the completion of the great public works at the Cascades and the dalles, and with the early promised completion of the canal and locks at

dalles is encountered. At the dalles for a distance of 11 miles the river rushes between precipitous walls of basaltic rock, and at points along these rapids it is but a stone's-throw from one bank of the stream to the other. Above the dalles the Columbia is navigable for steamers of moderate draft to the little dalles, a distance of 10 miles. For hundreds of miles beyond the little dalles, at which point a series of rapids furnish obstructions to navigation, the river is navigable by large steamers along most of its course, and as far north as the point where the Canadian Pacific railroad crosses the Columbia this stream carries a sufficient depth of water to float as large steamers as regularly ply on the Mississippi.

CASCADE LOCKS AND CANAL.

Early History of This Great Work—First Appropriation. THE proposition to build a canal around the obstructions in the Columbia river at the Cascades was first proposed by Colonel Michler in 1857. The following year the government made the first appropriation of \$50,000 for the commencement of work on this important undertaking. The first plans of the engineers contemplated the construction of a timber crib breakwater structure, 2500 feet long, to extend from the lower entrance of the canal for a distance of 500 feet. The lift to the upper river through the canal was to be overcome by two locks, each 200 feet by 56 feet in size, and the guard gates of each to be 15 feet high. At the time this first appropriation was made by congress, Major, now Colonel,

recommended that no excavations be made along this bank. Along the opposite shore of the state of Washington was a channel too narrow to be encroached upon. In 1859 the question of the construction of the canal was again referred to a board of engineers. This board was enabled to examine into the subject of prosecuting this work to better advantage than the previous board, owing to the additional knowledge of the Columbia at the Cascades which had been revealed, and at this time they formulated a plan which has since

the proposed improvement, and the engineers would then be able to make a close estimate of the extent and cost of carrying these improvements to a successful consummation.



WORKING ON UPPER BULKHEAD, JUNE 4, 1881.

BELOW THE RAPIDS.

Improvements of the River Channel for the Passage of Boats. THE board of engineers, after a most careful discussion of the subject at issue, made the following unanimous report. They concluded that actual construction work on the canal ought to await the improvement of the river channel from the foot of the main rapids to the lower steamboat landing. The reasons from which this conclusion was deduced fully satisfied the government of the practicality of the board's suggestion, and work on these proposed improvements was at once commenced. The effect of removing the rocks, reefs

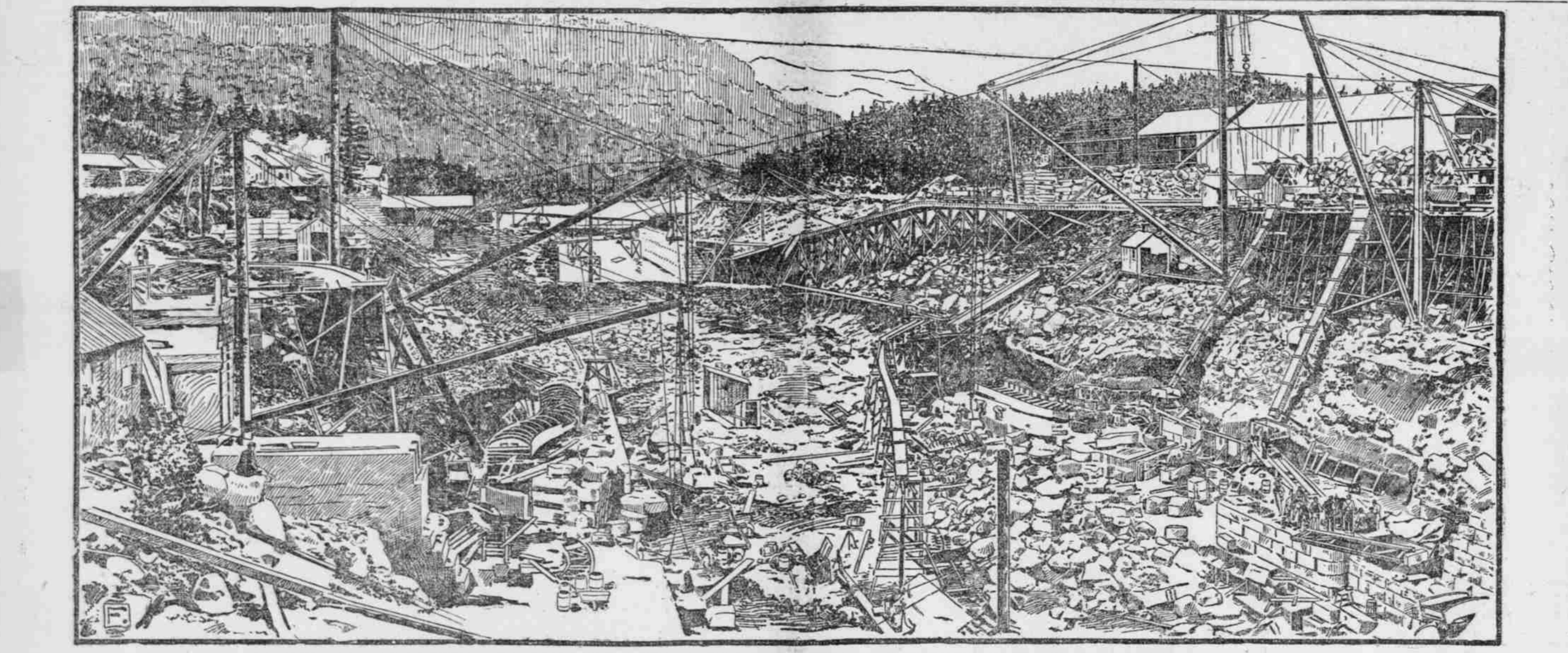
breakwater of crib work, filled with stone. This mode of construction is not permanent, and if built at all the board reported that it should be built of rubble masonry, for the construction of which there is an abundance of suitable material in the immediate vicinity. The top of this breakwater the board reported should be at least two feet above the highest stage of water that dash against it, and it should be stepped off to accommodate these varying heights. This wall it was proposed should rest almost entirely on an artificial foundation of rip-rap and crib work. The latter, for the sake of permanency, was not to be carried up any higher than to a point within one foot of the low-water stage. It is clear to the engineers, that the construction of this artificial channel with breakwater will be expensive, and it will form an engineering problem difficult of solution, and would require a long time to carry the work to a successful completion. It would, moreover, seriously dimin-

ish the cross-section of discharge of the river, then already too small, and it would require constant dredging to remove the material which would be deposited in it by the continued degradation of the adjacent mountains, and moreover, it could not be enlarged at any time in the future. On the other hand, reported the engineers, if the system to accommodate the greatest part of the most useful navigation (for all stages of water up to 20 feet, at the foot of the main rapids) be adopted, it would be far less expensive to carry out, and the channel of the river below the rapids navigable at low and medium stages of water, the board further reported, need not be deferred by the improvement of the river or lower approach to the canal. It was the opinion of the board that the excavation of the canal prism might be continued, the stone for the locks could be

monies would meet the demands of navigation on the locks for all that is to come. In less than 12 years after the canal and locks had been finished an enlargement was demanded. Since that time new chambers have been converted into two of the same dimensions and lift, and the main or Indiana chute over the falls has been considerably improved. Yet with all this enlargement, the officer who had charge of this work and who was also a member of the board of engineers who examined into the feasibility of the proposed improvements at the Cascades, stated that it was his belief that in consequence of the delays which occur in passing the large number of accumulated vessels, from a sudden rise in the river, there would soon be another movement for a still further enlargement of the canal and lock capacity.

The old canal around the falls of the St. Mary's river, Michigan, was opened to commerce in 1858. The locks were combined, two chambers, 200x70 feet, and each of nine feet lift. It was also thought by the projectors of this improvement that these dimensions would suffice for all time to come. At the time these works were completed they were the largest canal works in the world. Fifteen years later congress made another appropriation for the commencement of work on enlarging these locks, and for the construction of an enlarged lock, work which was nearing completion at the time the Cascades improvement was under discussion. This new lock is 515x80 feet, and it has a lift of 18 feet. It seemed to the engineers that the whole tendency in the construction of ship canals around obstructions in the navigable streams of this country was in the direction of large lock chambers and higher lifts.

Having these facts in view, the engineers reported that there should be a single lock at the foot of the Cascades canal to accommodate the low-water system of improvement. The capacity of this lock should be 482x84 feet, of ample dimensions to accommodate one towboat and three barges. It should have a lift of about 21 feet. The clear gate openings should be reduced to 20 feet in order to determine the weight of the gates. It should be provided with a guard gate at its head and foot, so that it might readily be pumped out in case of needed repairs, or of vessels being wrecked within its walls. There should also be a guard gate at the head of the canal, the top of which should be at least two feet above the highest stage of water. In case the high-water system should hereafter be introduced, this guard



GENERAL VIEW OF CANAL, LOOKING WEST (DOWN STREAM)—MASONRY OF UPPER GUARD-GATE IN FOREGROUND.—Taken September 20, 1881.

ment whose territory it crossed that long prevented England from acknowledging the claims of the United States to the ownership of the rich territory now included within the states of Oregon, Washington, Idaho and Western Montana.

"Where rolls the Oregon" is significant of the deep interest taken in the wilderness of the Columbia river's glades, when the untrodden savage and the no less relentless grizzly had undrugged sway over a country that is today the home of plenty and prosperity. The starting tales of the wilderness and ruggedness of the territory returned by the Columbia river told by the returning members of the Lewis and Clarke party filled the minds of the people of the settled portions of the United States with visions of a mythical region that was inconquerable with wonder and surprise. The subsequent accounts of this same country sent out by the Hanson's Bay Company and the company's emissaries, in which this same country was described as a wild, rugged district, not fitted for the permanent abode of man, attached to all of what was known as Oregon a romantic interest that was not satisfied until the first immigration, under the direction of Dr. Marcus Whitman, had found happy homes on the rich lands of the Willamette valley. Up to 1842, when Dr. Whitman made his memorable journey to Washington city for the express purpose of urging the matter of control of Oregon by the United States, the people of this country had no accurate information of this vast territory and the possibilities for development here, and it is to Dr. Whitman that the people of the United States look today as the one man who observes the distinction of having saved for his country the possession of that part of North America south of the 49th parallel of latitude and west of the Rocky mountains.

quents New York harbor. Inland from its mouth to the point where it receives the waters of the Willamette river, a distance of about 100 miles, the Columbia is navigable by the largest ocean-carrying vessels that visit the Pacific coast, and over this course the heavy shipping which regularly comes to Portland passes at all seasons of the year. Twelve miles south of the point where the Willamette river joins the Columbia, on the banks of the former stream, is Portland, the metropolis of the Northwest. For a distance of more than 100 miles south of Portland, the Willamette river courses through the rich valley of the same name, and for this distance it is regularly navigated by light-draft steamers. The Willamette valley is the oldest settled part of Oregon, and it is today the most thickly populated section of Oregon, Washington and Idaho. A few miles above the mouth of the Willamette river, a bar extends across the Columbia river, which prevents occa-

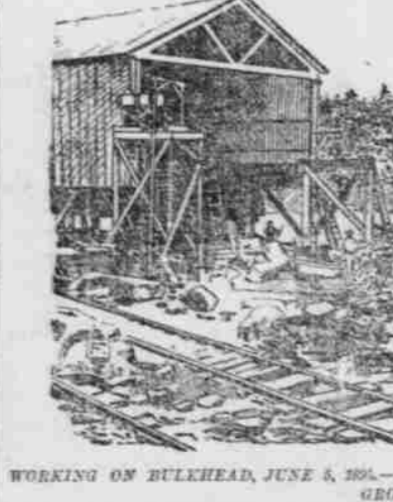
Wilson, the United States corps of engineers, was in charge of government works here, with headquarters at Portland. The subject of the construction of the Cascade canal and locks was referred to a board of government engineers in 1857. This board made a careful examination of the shores of the Columbia river at the Cascades, and after thorough research they selected the Oregon side as the best location for the construction of the proposed canal. The board thus approved the location proposed by Colonel Wilson, but they recommended that the size of the proposed locks be increased to 300 feet in length by 56 feet in width. This board estimated the total cost of overcoming the obstructions at the Cascades to be \$2,515,000.

In the same year changes in the plans of the canal were made by increasing the width of the canal from 20 to 26 feet, on the recommendation of Colonel Wilson. The chief engineer made his recommendation based on his opinion that the rapid development of the rich country east of the Cascade mountains would demand the use of larger boats on the river between Lewiston and Portland than it was then contemplated would pass through the canal, a forecast that was fully realized even before the completion of the O. R. & N. Co.'s railroad to Portland in 1852.

In the fall of 1873 Colonel Wilson was succeeded by Colonel Gillespie, and the active work of constructing the canal at the Cascades was begun in the same year. The first contract was let to Messrs. Hall & Platt, of New York who agreed to make the excavations both for the locks and for a certain part of the prism, and also the constructed part of the locks, for \$180,000, the amount of money in the hands of the engineers available for this work. In 1873 the matter of the construction of the contemplated improvements at the Cascades was again referred to a board of government engineers. The particular points to be determined by this board were whether the proposed breakwater would first be built, or the obstructions in the river below the rapids be first removed, and the settlement of the construction of this breakwater left to a future decision. The engineers finally decided that it would be unwise to commence the construction of the masonry of the locks until it could first be ascertained just what amount of the reefs below the proposed canal could be removed, and also to get the exact measurements of the depth of the river at its lowest stage after these obstructions had been removed. The board considered the great difficulty of improving the channel below the Cascades by the construction of the proposed breakwater for the purpose of creating a channel for high-water navigation between this breakwater and the Oregon shore. The board reported that the proposed breakwater could be made for improving this river channel, and that this amount spent on the river would determine the practicality

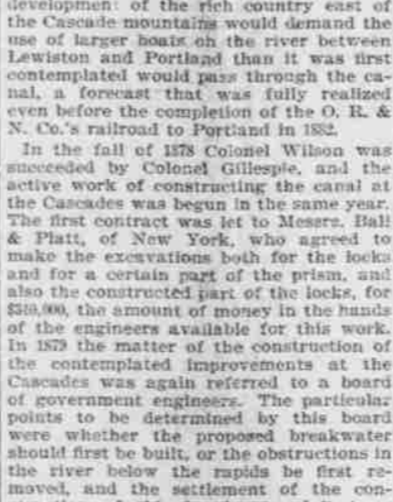
and other obstructions was to lower the water surface of the river at its lower stages, and the removal of the projecting points above the low-water mark was to increase the cross-section of discharge and reduce the velocity of the flow at the higher stages of the stream. The board reported that the amount of this lowering of the water surface could only be determined practically, as it would be impossible to calculate it with any degree of accuracy before the work was undertaken. The date of the final completion of the river work which would make the rapids navigable at low and medium stages of water, the board further reported, need not be deferred by the improvement of the river or lower approach to the canal.

THE VAST WATERSHED. The Country Drained by the Columbia and its Tributaries. It is with the navigable portion of the Columbia river that the main interest of the present article will center. The headwaters of this stream cover a stretch of territory extending along the western slopes of the Rocky mountains for a dis-



WORKING ON BULKHEAD, JUNE 4, 1881—MAJOR POST, U. S. ENGINEERS, IN FOREGROUND.

cutting vessels of deep draft from ascending above this point. This bar is of sand, however, and can be removed at a comparatively small expense when the commerce over this part of the river's course may demand it. The largest river steamers, however, pass over these shoals without difficulty. Fifty miles above the mouth of the Willamette, the first obstruction to free navigation in the Columbia is encountered. This bar is of sand, and it is at this point the entire volume of the stream passes through a narrow gorge, plunging in its course of six miles through this gorge over huge rocks and sunken boulders that give to the river the appearance of the wildest of mountain torrents, only on a much larger scale. Forty-five miles east of the Cascades the second obstruction at



VIEW SHOWING UPPER GUARD-GATE ABUTMENTS COMPLETED—4 FEET HIGH—CANAL WALLS, 2 FEET HIGH.

prepared, and timber for the gates purchased and seasoned. It would also be well to accumulate other materials, so that when construction of the canal was actually commenced the work could go forward with the greatest possible dispatch. The engineers were of the opinion that river navigation at the main rapids would be greatly improved by the removal of reefs and projecting points, so that boats could ascend to the main rapids, with possibly some assistance, during low and medium stages of water. They reported, however, that the extent and cost of these contemplated improvements could not be determined. They therefore recommended that an expenditure of not to exceed \$100,000 be made for improving this river channel, and that this amount spent on the river would determine the practicality

of the river to diminish the velocity at the lower approach.

THE GREAT LOCKS. Engineering Difficulties Encountered in Construction. In determining the dimensions of the locks in the proposed canal, the following historical facts were duly considered by the engineers on whom devolved the responsibility of making the plans for this great work. The Louisville & Portland canal was first opened in 1820. Its locks were combined, three chambers being in one, each of which had a lift of 8-2-3 feet and a capacity of 185x80 feet. It was thought by the projectors that these di-

gate would form the upper gates of the lift and guard lock which must then be constructed at the head of the canal. The prism of the canal, was recommended by the engineers to be 90 feet wide at the bottom. The sides, it was recommended, should be carried up vertically to within one foot of the low-water mark by strong timber cribs filled with stone, and then to a height of 11 feet by a dry stone wall. Here there should be a berm at least 15 feet wide. Above this should be a paved slope, one upon one landing up to the top of the canal embankments, which should be on a level with the top of the guard gate at the head of the canal.

WORK ACTUALLY COMMENCED. Assignment of Captain C. F. Powell to Take Charge in 1881. On October, 1881, Captain C. F. Powell, of the United States Engineers, was assigned as superintendent engineer in charge of the work of the improvements at the Cascades. Captain Powell had been assistant to Colonel Gillespie, formerly in charge of the work. Under Captain Powell's able and successful direction, the work of construction was carried on with large direct practical results. Over 100,000 cubic yards of rock were removed from the river channel below the locks, before 1885. In 1885, the project for the construction of this work was again submitted to a board of engineers for their consideration. The most important matter brought to the attention of this board was the one to determine the low-water level below the locks since the improvements made above