

RIVER IMPROVEMENT.

ACCORDING to the memorial to congress of the waterway convention of 1885, the Columbia river and its tributaries extend for a distance of over one thousand miles within the United States, and constitute the natural outlet for twenty-five thousand square miles of agricultural land. This great river runs east and west, parallel with the lines of commerce and emigration, and flows into the ocean at a point where winds, currents and latitude combine to make a center of shipping. But this important waterway can not be economically navigated at present, and the question before us is to make it economically navigable. This question should be constantly agitated in every prudent way, until something comes of it.

As all the inhabitants of the watershed of the Columbia are deeply interested in the proper solution of this problem, I venture, as one of them, to submit some views for discussion, premising that they are not original or novel, except as applicable to this situation. As a physician can not properly diagnose a case without the aid of his patient, who alone feels the pains of illness, so an engineer can not determine what line of action is best to reduce the forces of nature, until he knows the extent to which they are refractory. As persons who are subject to contingencies must needs be close observers, they can not only accurately describe the inconvenience but can often suggest a remedy that is worthy of consideration. If every person, therefore, who has given the subject of river improvements much thought would publish his views, the result must be the collection of much valuable information for those upon whom the duty of adopting definite plans will devolve. I will be brief as possible, and confine myself to outlines, as details would be impertinent before the scheme has obtained a hold upon public favor.

The difficulties in the way of economically navigating the Columbia river appear to be, (1), a bar, near the mouth of the river, at a point out to sea where the conditions are favorable for precipitating the silt borne down by the current of the stream; (2), sand islands, spits and shoals inside the heads and below Astoria, with a tortuous and shifting channel; (3), a series of rapids and a barrier of rock at the Cascades, one hundred and sixty miles above its mouth; (4), formidable obstacles at the Dalles, two hundred and twenty miles above the mouth, consisting of rapids, falls and very swift currents, occurring along a distance of about thirteen miles where the channel is contracted between perpendicular walls of basalt; (5), minor rapids at intervals between Celilo, at the head of the Dalles, and the point where the river enters British America.

These obstructions will be discussed *seriatim* in connection with a suggestion for a remedy in each case.

The obstructions between Astoria and the offing are serious in character, and difficult to deal with on account of the magnitude of the contending forces—the river on one side and the ocean on the other—and the

breadth of the field upon which the contest occurs, rendering it difficult to make an alliance with either against the other. The problem is complex, and human wit and effort seem inadequate to deal with it. I propose, therefore, to avoid a direct conflict with such Titanic forces, and to flank them by a canal. The canal scheme, as to this situation, being novel, may be defended both by statements as to its merits and by objections to accepted plans. Affirmatively, then, the canal is intended to connect Young's bay with the open ocean, and will flank all the obstructions between Astoria and the offing, rendering further attention to them unnecessary. The engineering difficulties are the excavation of a waterway through the alluvial soil of the delta, and the construction of an artificial harbor at the sea end.

I furnish herewith, partial details of a floating break-water, but the canal scheme does not depend upon that, as a break-water could be constructed in the ordinary way. Experiments with the break-water could be conducted first, and the canal undertaken when the harbor was a success. The canal and harbor once established the Columbia river becomes accessible at all stages of tide and in all stress of weather for vessels of the deepest draft. I believe the cost of construction will be less than the ultimate cost of the experiments proposed for the betterment of the channels inside the heads, and below Astoria. In the first work the benefit is complete and permanent, and in the second it is partial and temporary. I say partial because it does not propose to modify the outer bar, and I say temporary because I claim that it is impossible to erect, upon the insecure foundations of the mouth of the Columbia, a structure that can long withstand the impact of storm waves from the ocean, and the eroding effects of the currents of the river.

I believe a safe harbor can be made at the sea end of the canal, by the use of pontoons anchored in lines about the space where smooth water is desired.



This engraving, taken from the plans of the inventor, shows the idea very clearly. The pontoons are shaped something like a locomotive snow plow. Being anchored abreast they operate by splitting the waves and