deflecting their course, so that the halves of two waves meet midway between two pontoons, and spend their momentum in the concussion of their equal forces. The inventor supposes one line of pontoons is sufficient, but if, in practice this supposition should prove erroneous, a second and a third line may be used. I am inclined to believe that two or three lines of small pontoons would be more economical in maintenance than a single line of large ones, while equally effective of the object sought. The small pontoons would be less liable to drag their anchors or go adrift, and would have less ability to injure vessels colliding with them than the larger ones. I quote here the claims made for this device by its inventor, Mr. E. C. Greenway Thomas:

1. *Comparative Indestructibility.*—Meeting waves and currents, not with one long, unbroken front, as is the case of most break-waters and harbor works, but in detached portions, and not resisting, but cleaving and evading the force of the waters, it is less likely to be injured by violent storms.

2. *Economy in Manufacture.*—Being constructed of few and simple parts, affecting only the upper part and not the whole depth of the water, and covering but a small portion of the area it affects, it will cost less in manufacture than any other break-water known.

3. *Economy in construction.*—As it can be put together in a short time, and anywhere, and no work beyond that of mooring need be executed on the spot where it is required, there will be no necessity for the employment *in situ* of an engineer or other expensive skilled labor, and the usual costs of construction are thus very largely avoided.

4. *Economy in conveyance, Portability.*—The parts, when taken to pieces, lying flat upon one another, will occupy small space, weigh little, and can be easily and inexpensively conveyed by land or sea.

5. It is available in exposed positions, where the continued violence of the sea greatly impedes, and, in fact, almost renders impossible, the construction of any other form of harbor work, but where a short time would suffice for the putting down of the Greenway break-water, which is taken ready made to the spot.

6. It can be kept in store in any quantity at any of our naval arsenals for any length of time, and will thus be in readiness for any emergencies.

7. It is available in any depth, thus rendering easy the construction of shelter harbors in deep water, with access during all tides. It might be used in one long line of defense for many miles of endangered coasts. Finally, it is claimed that it will not cause the accumulation of silt, and thus ruin the port it is intended to benefit, as has been the case with many expensive constructions.

Assuming that the Greenway break-water will produce the useful effects claimed for it, it would also possess many other advantages, amongst them the following: the positions of the pontoons could be shifted as defects in their operation were noted, the lines being doubled or trebled at the more exposed points, and spread out where less resistance was encountered. Vessels could go through very much smaller openings than those required in break-waters of solid materials, as collisions would not be fatal. The openings, being so much narrower, could be more numerous, and situated so as to facilitate the entrance of vessels from any direction. A disabled vessel could even drift through the line of pontoons to a position of safety behind them, without suffering irreparable injury.

The next great difficulty met with in navigating the Columbia is encountered one hundred and sixty miles inland, at the Cascades. The project of a canal has been wisely adopted here, and is in such a forward state, that, according to the report of Major W. A. Jones, U. S. engineers, with sufficient appropriations, it could be opened for traffic within two years. After the completion of the canal, the other difficulties at the Cascades can be overcome by the use of steel cables, as hereinafter described.

At the Dalles, two hundred and twenty miles above the mouth of the river, exist the most serious obstructions yet encountered. A canal at this point has been rejected by engineers as practically impossible, on account of the immense cost and the very long time required for the completion of the work. The next scheme would be to warp boats through by means of steel cables, first having removed dangerous obstructions by blasting. I believe there is a probability that this might be accomplished. Boats have been repeatedly taken downward under steam, without accident, and I claim that this fact alone raises a strong enough presumption of the feasibility of the cable system, to justify a particular examination of the river on that theory. If navigation through the Dalles could be secured for only a few months in the year, during medium stages of water, simultaneously with the opening of the locks at the Cascades, it would prove of universal benefit to the upper country. If a careful survey, made by men who fully appreciate the importance of an open river, and who are vitally interested therein, should determine that the obstacles to the use of cables are insurmountable, then it seems to me that the scheme for a boat railway presents the cheapest and quickest way out of the difficulty. I feel certain that any plan which proposes to accomplish less than the transfer of loaded boats, however attractive it may be in theory, will be found insufficient in practice. Plans for the boat railway, with detail drawings and estimates, have been made under the direction of Major W. A. Jones, U. S. engineers, and are exhibited in executive document number one hundred and fourteen, first session of the forty-ninth congress. The scheme involves two systems of inclines, one at Celilo falls and one at the Dalles proper. The cost is estimated at one million three hundred and seventy-three thousand dollars. As Major Jones puts this project forward for "agitation and discussion, refraining from recommendation until it has been discussed and treated in the usual way," he would doubtless be glad to hear suggestions in regard to the same from persons whose interests are affected.