

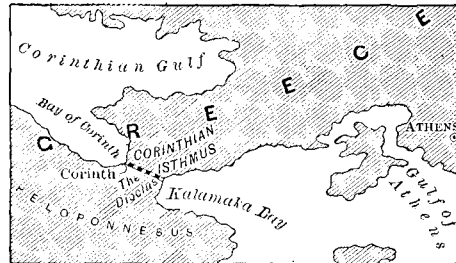
SHIP-RAILWAYS—ANCIENT AND MODERN.

BY F. L. HAGADORN.

LAND portages have been familiar expedients with explorers, navigators, traffickers, and strategists in all climes and in all periods of the world's history. Expeditions of the gravest magnitude have not infrequently depended for their success upon the passage of brief portages from stream to stream, or from sea to sea. In arctic regions or in tropical, at the sources of the Ganges or the Nile, the Amazon, the Orinoco, or the Mississippi, in Africa or in America, the pioneers of commerce and civilization have in all time recognized the necessity and practicability of alternate land and water transit, and have provided themselves accordingly, suiting the means at hand to the ends in view.

The ancients were familiar with appliances, which have not all come down to us, for the transportation of great masses of material. Herodotus, for instance, describes "a monolithic temple," estimated at 5000 tons in weight, which he supposed was carried the whole length of the Nile (2800 miles) to its present position at the delta. According to the *Encyclopædia Britannica*, "the city of Corinth enjoyed in prehistoric times two advantages especially important in the infancy of navigation. On the long gulf which stretches from Corinth westward vessels could sail for above one hundred miles without losing sight of land; and secondly, the natives of Corinth were skilled in dragging vessels of all kinds across from sea to sea, thus saving them the dangers of a perilous voyage around the Peloponnesus." This was a portage over the same ground where subsequently the Athenians (550 years B.C.) built the "Dioclus," a veritable ship-railway, of polished granite, provided with suitable cribs and rollers, which they operated for three hundred years. The distance from Corinth to Athens in a direct line was less than fifty miles, while the route by sea was something like five hundred, and as the navigators of that period generally made it by hugging the shore, it was considerably more. The wars in which Athens found herself engaged at this period of her history necessitated the building of what in those days were immense ships of war. A reliable authority gives their

average dimensions as follows: length, 149 feet; beam, 18 feet; draught, $8\frac{1}{2}$ feet; height above the water-line, 11 feet. They were propelled by long sweeps in three banks, one above another, and by sails supported by two or three masts, one of which was square-rigged, and the others provided with lateen-sails. The measurement of these war ships was 232 tons gross register, and their displacement weight



THE DIOCLUS.

must have been at least 450 tons. The exigencies of war frequently required these vessels to be transported over the Corinthian isthmus by means of the "Dioclus," to which I have referred, the maximum elevation to be overcome being 259 feet, speed and safety being matters of prime necessity.

The Turks in the Middle Ages were known to have transported their war ships overland, and the King of Sweden constructed a ship-railway between Strömstad and Idelfjal, over which he transported several war ships.

But the most successful and formidable expeditions ever undertaken for the transportation of heavily freighted vessels overland were those of the Venetian Republic in 1438-9, under the engineer Sorbolo. The city of Brescia, which had given its adhesion to the Venetians, was closely besieged by the Milanese, and every device for its relief seemed to be hopeless, as the enemy had intrenched himself in winter-quarters upon the intervening mountains, and had a formidable flotilla in possession of Lake Garda, the largest of the Italian lakes, some thirty-five miles in length by about eight in width, and 320 feet above the sea. To send an army by land the Venetians would be com-

pelled to make a detour around the northern end of the lake, and then force their way through the mountains. But such was their well-known prowess upon the seas that to possess themselves of Lake Garda would be to throw dismay into the camp of their enemies, and open up an unobstructed route to the beleaguered city.

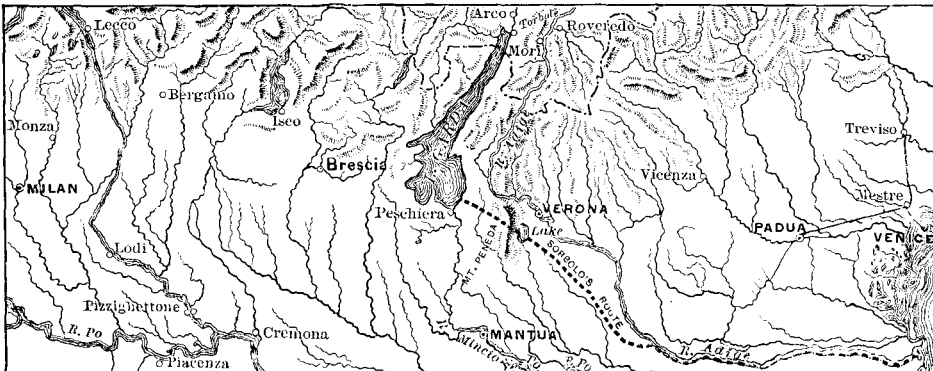
The most learned and experienced engineers of Venice had discussed for many days, in the presence of the Senate, a variety of expedients for effecting the desired object, and the one finally adopted surpassed in boldness anything of the kind that had ever before been attempted. It was nothing less than to convey a formidable fleet of some thirty well-armed ships bodily over the mountains and launch it upon the lake, unobserved by the enemy.

Sorbolo, who was the author of this suggestion, was a modest little sub-engineer of Candia, who had been quietly engaged in superintending some works of considerable magnitude in the service of the republic, and had also spent several years as a soldier, and knew how to handle men. As the result of a brief interview with the Doge and his counsellors he obtained permission to lay his plans before the Senate. Diminutive in person and feeble in speech, he seemed a pigmy in the midst of the dignified Senators by whom he was surrounded, but at a signal from the Doge he came forward, amid the breathless attention of the body, and with the utmost composure, said:

"Most Serene Prince, and Senators of Venice, I have come to unfold to you a plan which I have conceived whereby you may afford the necessary relief to the

noble city of Brescia, by placing a flotilla of ships upon the Lake Garda. It is well known that the passage by the Mincio is closed, owing to the treachery of the Duke of Mantua. Therefore there only remains the Adige available for the purpose which I am about to submit to this reverend assembly. I know the stream as well as I know the Grand Canal. In winter it is swollen by the rains from the mountains, and is deep enough for the passage of the largest galleys. I therefore humbly suggest that up this river a fleet of vessels be sent to a point fifty miles distant from the Gulf of Venice. From thence there is a long level plain of country, across which it were a very easy task to carry the largest ships, provided men and oxen were furnished. The chief difficulty which will beset the path is presented in the mountain of Peneda, which rises to a great height from the shores of a small lake through which I propose to pass. But this will not present an insurmountable difficulty. Having crossed the mountain, Lake Garda is only twelve miles distant."

He closed abruptly, not having the eloquence to dilate upon his theme, while the venerable Doge and Senators looked aghast upon each other, wondering if they were not in the presence of a lunatic. But before a word was spoken, Sorbolo drew forth from a small box which he had brought with him the model of a galley, and placing it upon a cradle of the kind he proposed to construct, proceeded to demonstrate the means by which to transport it overland. The plan was so feasible that every member of the body was captivated with it. Sorbolo was dis-



SURVEY OF SORBOLLO'S ROUTE FROM THE GULF OF VENICE TO LAKE GARDA.

missed with the compliments of the Doge, the scheme was promptly accepted by the Grand Council, and the necessary instructions given for the preparation of a fleet suitable for the enterprise. The deliberations of this august body were always in secret, and Sorbolo had divulged his plans to no one else. Six first-class galleys and twenty-five light barks, fully officered and manned, were placed at his disposal, fitted out with all the appliances for a naval conflict—cannon amply provided with stone balls of the period, large stores of cross-bows, arrows, lances, javelins, and provisions, not only for the expedition, but also for the besieged city, to all of which Sorbolo had added hundreds of pickaxes, spades, vast coils of cordage, and a considerable number of heavy windlasses. Trusty agents were in the mean time sent ahead to assemble a thousand yoke of oxen and their drivers on the plains of the Adige.

By the kindness of the present American Consul at Venice we are enabled to give an accurate description of the vessels employed by Sorbolo, and we have also from another source (see page 375) a reliable survey of the route he took. The larger galleys were 147.6 feet in length by 40 feet breadth of beam; displacement, loaded with munitions of war, over 300 tons; equivalent to a gross register by modern standards of 175 tons. They were manned by at least 150 sailors, with accommodations for at least 150 marines or soldiers.

Everything was in readiness by the middle of December. The command of the fleet was given to Pietro Zeno, but the operations on land were intrusted entirely to Sorbolo. On reaching the mouth of the Adige ample water was found, but so swift was the current that six weeks were occupied in moving the fleet fifty miles. And then the labor began of transporting the ships across the country, the soldiers and sailors of the expedition being ignorant up to this time of any such intention, and regarding it now with incredulity. But Sorbolo's measures were carefully matured, and he set quietly to work to put them into operation. The platforms and cribs were put together and secured under the vessels as they rode at anchor, the oxen were attached to the cables, and one after another the largest of the vessels were hauled high and dry upon the shore. It required 600 oxen to draw each of the

larger galleys out of the water, but half the number were sufficient to move them on the land. Their appearance on the shore, with their tall masts towering far above the trees of the forest, presented a remarkable spectacle. The singular procession was soon in motion, however, marching slowly and steadily through the country, levelling a road before it as it proceeded, until at the base of Mount Peneda, which rose abruptly in the way, and seemed to interdict all further progress. Here appeared to be an insurmountable obstacle. But Sorbolo's plans had taken it all in, and with a small party of his peasants and soldiers, armed with picks, spades, and axes, he proceeded to the bed of a small mountain torrent, and having diverted the stream, soon levelled a road to a less abrupt acclivity, and after a few days of needful rest the expedition were again cheerfully in motion, singing their songs of triumph as they went. The windlasses were now put into requisition, and the oxen driven around by another route. One mile only of this ascent was to be accomplished, and the men soon discovered that there was nothing impossible in the plans of Sorbolo. One by one the fleet were assembled upon the crest of the mountain, and now the perils of the descent were before them. The oxen were again employed in bringing the vessels to the rocky verge whence the descent was made, and from the base of which there were twelve more miles of level country to be traversed. The windlasses had now to be peculiarly braced, and their action reversed with great caution. One vessel only met with a disaster, but this was so complete that safety was insured to all the rest. From this time forth every man seemed to act as if the success of the undertaking depended solely upon him, and the orders of Sorbolo, which entered into every detail, were implicitly respected and obeyed. Before the close of February every vessel floated quietly in the harbor of Torbole, less than three months having been consumed in the journey, half of which, it must be observed, were occupied in encountering the adverse currents of the Adige.

The Milanese were incredulous of the rumors that were brought them. Even the citizens of Brescia, who were eager for such intelligence, could not credit it, and even detained the messenger as a spy until his tidings could be confirmed. But

the triumph of Sorbolo was complete, although the forces of Zeno were not sufficient for those of the enemy which were brought upon him. The Venetian fleet were utterly destroyed, the men, however, escaping to the shores, and taking with them a great proportion of the immense stores previously landed, made good their way to unite with Sforza, who had opened a line of communication with Brescia by the way of Tenna, which he had invested and reduced, the Brescians themselves having by a successful sortie arrived in time to share in the ultimate success of the adventure. The Venetians in the mean time, and as a part of these operations, managed to despatch another fleet over the mountains, more powerful than the first, sweeping the Milanese from the face of Lake Garda, and triumphantly completing the enterprise initiated by the genius of Sorbolo. Nothing of the kind in the world's history had ever before been attempted in war or peace, and after the lapse of more than four centuries of time it stands to-day without a parallel.

It is a matter of history also that, after fully relieving the unfortunate Brescians, Sforza followed up his successes from one stronghold to another until before the walls of Milan, which he finally reduced, demanding the daughter of the Duke in marriage, and ultimately seating himself upon the ducal throne.

We have now to deal with mightier elements. A new contingent has sprung into existence. Colossi of the East and West are encircling the world with ribs of steel and flashes of electric fire. Giants are possessing the earth, and giant undertakings, demanding the energy of giant intellects and the exercise of giant powers. The "ship of the desert" is no longer a camel, but a locomotive; news does not travel by courier, but by electricity; and in the near future burden trains are to be borne from ocean to ocean over roads of steel, and freighted with the Leviathans of the deep.


When Commodore Vanderbilt penetrated the great American isthmus in 1849, on the outbreak of the California gold fever, he drove his little steamer *Director* up the rapids of the San Juan River, and dragged her bodily over the fallen trees and rocky portages, until he launched her safely upon Lake Nicaragua, and finally

employed the same means to place a larger steamer, the *Central America*, on the same lake. His engineers had reported the route impracticable—no one had ever attempted the ascent of the river—and they proposed cutting a canal. But he said he had "no time for such nonsense," and taking thirty men with him on the little steamer, made the route himself. Such are the men who accomplish things while others are discussing them.

It has transpired officially by recent correspondence in possession of the United States Bureau of Navigation that some of our existing railroads are capable to-day of conveying torpedo-boats from the navy-yards on the seaboard to the Great Lakes of the interior. And, as has been well remarked, "*the ship-railway is simply a proposition to carry greater burdens than have hitherto been carried on ordinary railroads.*"

The Baldwin Iron-Works of Philadelphia in 1832 considered it a great feat that they had constructed an engine which could draw thirty tons on a level, and the papers of the day contained the following announcement:

"NOTICE.—The locomotive engine, built by M. W. Baldwin, of this city, will depart daily, *when the weather is fair*, with a train of passenger cars.

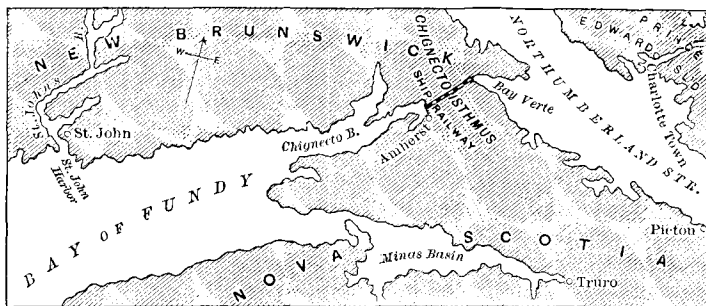
" On rainy days horses will be attached."

Now the same works are constructing ten-wheeled consolidated locomotives for the Dom Pedro Railway in Brazil, guaranteed to draw 3600 tons, with no reservation as to "weather."

With our modern appliances in view, the intervening space between the Atlantic seaboard and the Great Lakes is a mere portage; and the necessities of the hour require not only the safe and expeditious transit of war vessels and heavily laden propellers and barges over our inland peninsulas and isthmuses, but also from the ocean to the lakes; and for the southern routes from the West by the Mississippi and its affluents to the Gulf, and still on over the portages of the great isthmus to the South Seas, the long coveted "spice islands," and the continents beyond.

No one thinks now of voyaging around the southern capes of Africa or America. The paths of commerce are already across the continents. But these demand to be more and more facilitated.

If a vessel can safely carry a heavy freight over stormy seas, where half her hull is sometimes out of water, pound-



CHIGNECTO ISTHMUS SHIP-RAILWAY.

ed by the angry waves that break upon her decks, or drive upon her abeam, tossing her in their fury from crest to crest, and dropping her suddenly into great "troughs of the sea,"

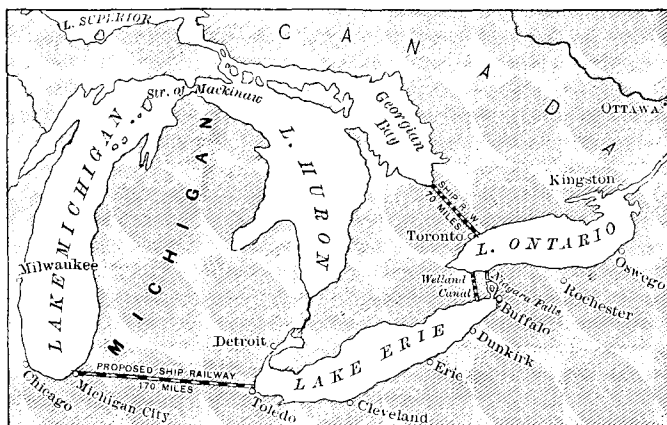
it is idle to suppose that she cannot safely carry her burden when lifted gently into a "cradle," and borne smoothly and steadily along over solid rails of steel.

It is customary to speak of the sea as "the native element" of the ship. But no vessel was ever yet built in the water. From keel to pennon she is the product of the land. The forests, the fields, and the mines have all contributed to her construction, and her domination of the waves is a battle and a struggle her whole life through. If she is disabled in her conflicts with the sea, she is

Sir John Fowler, who is now engaged upon the ship-railway for the isthmus of Chignecto, at the head of the Bay of Fundy, was in 1873 requested by the Egyptian

promptly restored to her native element (the land) and put in repair in order to renew the strife.

During the last decade engineers of high repute have been engaged in surveys and estimates for works of this character in every part of the world.



PROPOSED MICHIGAN PENINSULA SHIP-RAILWAY; ALSO SHIP-RAILWAY BETWEEN GEORGIAN BAY AND LAKE ONTARIO.

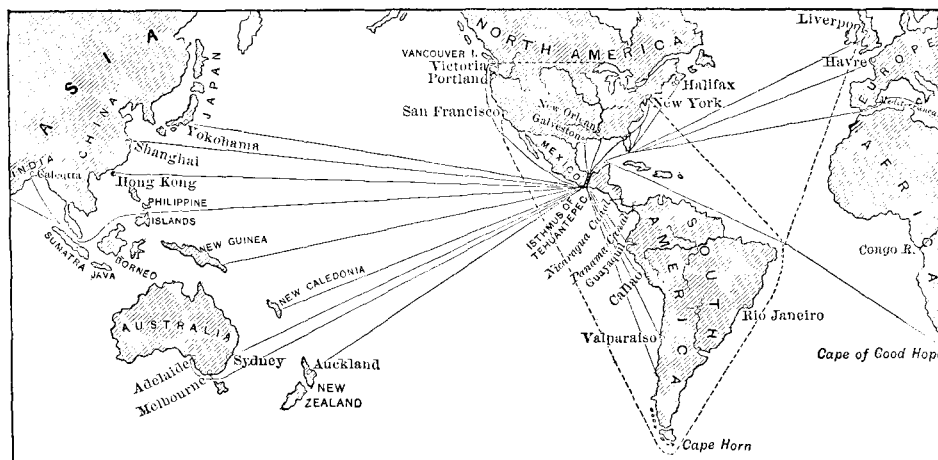
Khedive to prepare a project for the transport of steamers and other vessels around the first cataract of the Nile. He carefully investigated the alternative plans

for a canal or railway, and decided in favor of the latter; but financial complications of the government at the time prevented its construction. But the railway over the Chignecto isthmus is already under contract.

Another Canadian project is for a ship-railway between Georgian Bay (an arm of Lake Huron) and Toronto, on Lake



THE TEHUANTEPEC AND FLORIDA SHIP-RAILWAYS.



THE CENTRE OF OCEANS.

Ontario. The distance is about 70 miles, and it would save 500, and the devious navigation of the St. Clair and Detroit rivers and the Welland Canal. It would, moreover, land the products of the West at Rochester and Oswego, instead of Sandusky, Erie, or Buffalo.

Major Jones, of the United States Engineer Corps, has recently designed a ship-railway for the avoidance of the dangerous navigation at the Dalles, on the Columbia River, in Washington Territory. His plans are now under consideration of the War Department.

Another project is the Michigan Peninsula Railway, from Michigan City, opposite Chicago, to Toledo, on Lake Erie. The recent periodic disasters upon Lake Michigan have been of such a character as to attract unusual attention. These are to be attributed not only to the vastness of the lake, but to geodetic considerations and its peculiar shape and position. They must continue to increase, therefore, with the increase of commerce. The surveys for the proposed ship-railway are over a very practicable route, saving a distance of 700 miles of perilous lake and river navigation *via* the lakes Michigan, Huron, and St. Clair, the straits of Mackinaw, and the St. Clair and Detroit rivers. It would, moreover, lengthen the season of open navigation between Chicago and the East about a month each year. Its strategic importance would be great, as being entirely within our own control, instead of skirting the British lines through Huron and the St. Clair and Detroit rivers to Lake Erie.

A ship-railway has also been surveyed across the Florida peninsula to save the 600 miles of distance around and through the straits. This is a most practicable route, and the railway can be built for about one-half the estimated cost of a ship-canal.

But the great work in all this programme, both as to the magnitude of its construction and its results, is the Tehuantepec ship-railway of Captain Eads, now in the hands of Captain E. L. Corthell as chief engineer. Speaking of this, the *London Times* says, "We have said this scheme is a bold one, but it is not more remarkable for its boldness, as well as for its originality, than for its engineering soundness, and for the perfectness with which every detail has been worked out and every possible contingency provided against."

There is no magic, mystery, or miracle in the evolutions of science or of nature. Columbus did not set out to discover a continent, but a western passage to India and the boundless empire of Cathay. The discovery of America was only an obstacle in his way. The spice islands and the South Seas seemed less accessible than ever; and not until centuries had elapsed, and the gold of California and Australia had given a new impetus to adventure, did the barrier appear surmountable. Cortez had surveyed in vain the valleys of Tehuantepec, and Magellan had discovered a strait too perilous and too remote. With the discovery of gold in California, however, the intrepid

Vanderbilt came upon the scene, driving his little steamer over the rapids of the San Juan River, as we have seen, and dragging her bodily over the portages of Nicaragua. But still the western passage to the Orient remained an unsolved problem, and the grand old "Commodore" abandoned the field to become a railroad king.

Five lines of railway have since reached from sea to sea—four over the wide stretches of the continent, and one upon

the isthmus—and still the old problem has remained unsolved, "the western passage to India and Cathay."

But it is possible that the comprehensive genius of Eads has at length revealed the long-sought passage to the Orient. To open this up to the commerce of the world is the great international mission of the two republics, Mexico and the United States. Suez is the centre of the old continents, but here is the centre of the oceans, the gateway of the world.

IN FAR LOCHABER.

BY WILLIAM BLACK.

CHAPTER II.—(*Continued.*)

THE BIT LADY.

PEACE reigns in Fort William now. Lochiel has no trouble with his clansmen; the government have no trouble with Lochiel; the garrison buildings have been turned into private dwellings; women sit on the grassy bastions of the fort and knit stockings, sheltering themselves from the sun with an old umbrella; in the square are wooden benches for looking on at the tossing of the caber, putting the stone, and other Highland games; in the fosse is grown an excellent crop of potatoes and cabbages; and just outside there is a trimly kept bowling-green, in which the club members practise the gentle art of reaching the tee when the waning afternoon releases them from their desk or counter. Indeed it is possible that Alison, who had visited Edinburgh once or twice, and had passed the lofty crags and castle wall of Stirling, may have been disappointed to find a place of fair historic fame with so little to show for itself; but if Fort William is not in itself picturesque, it is in the very midst of wonderfully picturesque surroundings. When they took her along to "the Craigs," and ascended the mound there, she was struck dumb by the singular and varied and luminous beauty of the vast panorama extending away in every direction. The wild hills of Lochaber were all aflame in the sunset light; dark amid trees stood the ruins of Inverlochy Castle; the shallow waters of Loch Linne stretched away up to Corpach, where a flood of golden radiance came pouring out of Loch Eil; while all along the west, and as far south as Ardour, the mountains

were deepening and deepening in shadow, making the glow in the sky overhead all the more dazzlingly brilliant. Alison, standing somewhat apart from her companions, and wholly silent and absent, was wistfully wishing that her younger sister could be here for but an hour, for but a moment. Would it not enrich those pale visions of hers which formed so large a part of her life? Perhaps her imagination was starved in so cold and colorless a place as Kirk o' Shields? And might there not be in heaven high hills like these, flame-smitten with rose and gold, and placid lakes reflecting their awful and silent splendor? The Lord had made man in His own image; was it not possible that in fashioning the earth He had given us glimpses of that distant and mystic region which to poor Agnes seemed so white and wan? Why should it be white and wan? The Lord was the King of glory. "Lift up your heads, O ye gates; and be ye lifted up, ye everlasting doors; and the King of glory shall come in. Who is this King of glory? The Lord strong and mighty, the Lord mighty in battle." Some strange kind of exaltation filled her heart, and flooded her eyes with tears. Those roseate summits seemed so far away; they were hardly of this earth; they were God's footstool, removed beyond the habitations and the knowledge of men. "Who shall ascend into the hill of the Lord?" When her cousin Flora came quickly forward in alarm, for she had happened to see the tears running down the girl's face, she found Alison all trembling, and quite unable to speak.

"Why, what is the matter?" said she,