

pany. The cost to the Company of these entrance channels, dock gates, sea walls, basins and moles will be, when finished, about one million dollars, exclusive of the hydraulic lifts.

The following extract from Sir Benjamin Baker's description of the Chignecto Ship Railway, as published in the *Nineteenth Century Magazine* for March, 1891, cannot be improved upon, and it is, therefore, embodied in this paper:

Hydraulic Lifts.

"The hydraulic lifts, when raised, form a part of the main railway as regards line and level; and when lowered with the cradle the depth of water over the keel-blocks on the latter is that requisite for floating the vessel on the blocks. Walls of massive masonry, 56 feet in height from foundation to quay-level, surround the hydraulic lifts. The latter each consist of twenty hydraulic rams of 25 inches diameter and 40 feet stroke, enclosed in 26-inch diameter cylinders provided with stuffing-boxes at the upper ends, and with inlet pipes for the admission of water at a test pressure of 1,300 lbs. per square inch. On the top of each ram is a cross-head, from which hang two lifting links, connected at the lower ends with the gridiron upon which the ship and cradle rest when being lifted. The gridiron, 235 feet in length and 60 feet in width, consists of a very stiff combination of longitudinal and cross girders made of steel and firmly riveted together. When lifted to the level of the railway the ends of the cross girders are supported on the quay walls by iron chock-blocks worked by hydraulic power, so that the gridiron then in effect constitutes a solid part, as before said, of the main line. Hydraulic pumping machinery is provided of sufficient power to raise a vessel weighing 2,000 tons, or, including the gridiron and cradle, a total weight of 3,500 tons, the required height of forty feet in twenty minutes. Hydraulic power is also provided for capstans and winches for manœuvring the vessels, and air-compressors are furnished for clearing the pipes and cylinders quickly of water—a precaution specially necessary in a northern climate. Special arrangements are made in the engine-house to enable the engineman to ensure the equable and simultaneous motion of the ten lifting rams on each side of the deck, so that no straining of the gridiron may occur.

The Line itself.

"A double line of railway of the ordinary 4 feet 8½ inches gauge is laid along the top of the gridiron, upon which the ship-cradles are run. These cradles are provided in sectional lengths of 75 feet and 57 feet to accommodate vessels of ranging dimensions. For a ship of 2,000 tons dead weight three sections would be used. The cradles, like the gridirons, are formed of a rigid combination of steel girders carrying keel-blocks and sliding bilge-blocks of the usual lifting-dock type. Each 75 feet section of cradle is supported on sixty-four solid wheels of three feet diameter, having double bearings and four spiral springs of exceptional strength. Unlike ordinary ship cradles, therefore, a considerable amount of elasticity is provided in the present case. It need hardly be remarked that many interesting problems have had to be worked out in connection with these cradles which it is impossible to refer to here.

The Cradles.

Mode of operation.

"The order of procedure in raising a vessel and transporting it seventeen miles across this isthmus to the sea on the other side would be as follows: A vessel coming up the Bay of Fundy on the flood tide would pass through the gate entrance into the dock and wait its turn to be lifted. If the vessel were a 'trader' on this route, its dimensions would have been recorded, and the keel and bilge blocks would have been got ready on the cradle, telegraphic notice having been received of the probable arrival of the ship. If she were a 'tramp,' a ship's carpenter would have to go on board and take some leading measurements for the arrangement of the blocking on the cradle. The blocking being arranged, the cradle and gridiron would be lowered by the hydraulic rams into the water and the vessel would be hauled over it by capstans and winches in the usual way. The gridiron would then be slowly raised until the vessel rested on the keel-blocks throughout her whole length, after which the sliding bilge-blocks would be pulled tight against the ship's bilge by chains attached to the blocks and carried up to the quay on either side. Lifting would then proceed until