AN INTERESTING POWERFUL STEAM DREDGER FOR HARBOR WORK.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The construction of the new docks at Liverpool for the accommodation of the transatlantic liners, combined with the deepening of the navigation channels and the existing basins to facilitate the passage of heavy-draft vessels, has been attended with several engineering difficulties. One of the most predominant problems is the vast amount of dredging that has to be carried out, a by no means easy task, in view of the fact that the bed of the river is composed of sandstone, rock, and clay. To enable this work to be carried out expeditiously and effectively, a more powerful type of dredger has become necessary, and this has recently been carried out in the construction of the vessel "Vulcan" by Messrs. Ferguson Brothers, of Glasgow, which is one of the most powerful of its type that has ever been built.

The "Vulcan," owing to the complex nature of the work that has been undertaken, possesses several interesting features. It is of the center-ladder barge-loading type. The boat measures 207 feet in length; beam, 42 feet; molded depth, 14 feet; and is fitted with triple-expansion engines developing 1,250 I. H. P. and propelled by twin screws.

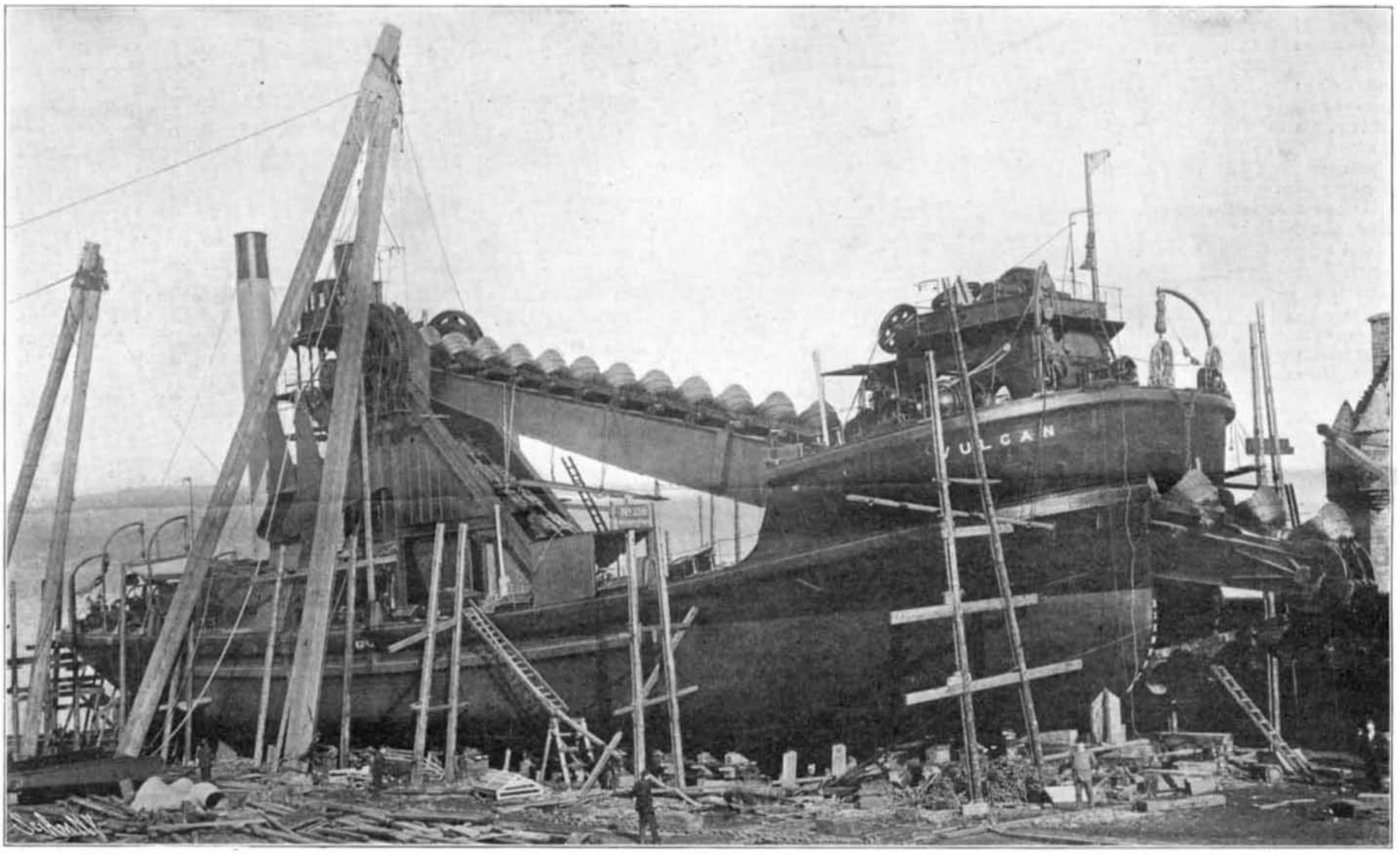
The vessel has been specially designed for carrying out dredging operations of hard material and working close up against the harbor walls. It is capable of cutting its own flotation and of dredging in any depth from its floating level down to 56 feet, the maximum depth, and at which level it has a dredging capacity of 1,000 tons per hour. The bucket ladder is carried out in advance of the hull a sufficient distance to render it possible to dredge close up against the sea walls and piers, when buckets are lowered to a depth of 48 feet.

The vessel is most strongly constructed, and has been built under Lloyd's special survey to class 100 A1. The hull is divided into fourteen watertight compartments. The two sides of the hull, which constitutes the bow well in the fore part of the vessel where the bucket ladder projects, are strongly connected by a raised forecastle, built of strong, heavy girder beams and bracing plates, carried across the vessel above the well. This forecastle is of sufficient height to allow of the bucket ladder being raised when desired for overhauling the lower tumbler, and to insure the sag of the chain of buckets being above the bottom of the vessel. The dredged material is discharged on either side through shoots, and the lifting and lowering operation of the shoots is accomplished by means of an independent engine.

The machinery for carrying out the actual dredging operation is of a particularly massive description, so that the hardest materials can be dealt with by the buckets. There is a two-speed gear provided, so that the dredging can be carried out at varying speeds according to the nature of the bed in which the apparatus is at work. The buckets each have a capacity for 21 cubic feet of material, and the connecting pins for the bucket chain are made of manganese steel.

The bucket ladder is suspended independently of the upper tumbler shaft, which is driven by large double friction spur wheels, and can be adjusted to convey the necessary power to the buckets according to the hardness of the soil in which the dredger is working. The bucket ladder is provided with a hoisting gear of heavy wire rope and tackle working in upper and lower sheave blocks, which are suspended from a crosshead fixed on a box framing structure built into the fore end of the craft. Strong forged side rods connect the lower sheave blocks to the bucket ladder. The wire cable is wound on a large grooved drum gear driven from a double-cylinder engine placed under deck. The gearing between engine and winding barrel is of the sun and planet motion type, controlled by double friction brakes actuated by a compound ladder lever for holding, heaving, or lowering the load as desired, the engine being free to run with or without the load. The deck is also provided with a large steam derrick, for overhauling the buckets and links and other general purposes.

The control of the vessel is maintained from a wheelhouse placed at the highest point of the dredger, which is at the top of the main gear framing. The propelling engines of 1,250 I. H. P. are fitted with steam reversing gear, and have auxiliaries of the latest design. Steam is generated in two cylindrical multitubular boilers. Aft of the bucket ladder are compartments for coal storage and feed tanks, for which there is a capacity of 100 tons and 50 tons respectively. The vessel has a speed of 8½ knots, which is half a knot above the contracted speed.



THE POWERFUL STEAM DREDGER "VULCAN" IN DRYDOCK.

The first unit of the central station of the Mond Gas Power and Heating Company, at Dudley Port in Staffordshire, from which producer gas at a nominal price is to be generated and supplied for manufacturing purposes over an area of 120 square miles, is completed. The whole installation comprises four units, each consisting of eight producers. Each producer is capable of gasifying one ton of fuel per hour throughout the day and night continuously. Steam is raised by vertical boilers arranged for burning small coal with forced draft, and also by gas. The pipes for supplying the gas from the generating station to the various industrial centers have been laid, and are mostly of the Mephan-Ferguson steel locking type. Operations will soon be commenced, and it is anticipated that the scheme will prove of vast utility to the manufactories, as the low price at which the gas will be supplied will render it cheaper than any other system of generating power.

THE INVESTMENT, SIEGE, AND CAPTURE OF PORT ARTHUR.

BY RICHARD BARRY, SPECIAL CORRESPONDENT AT PORT ARTHUR.

In all the long history of military exploits, there is not one that can compare, in point of difficulties surmounted, with the reduction of Port Arthur. That this fortress should have been taken by assault entitles the Japanese operations to rank with the finest work done by any army in any age; that it should have been taken in five months from the day on which the investment was completed (the day on which the Russians were driven into their permanent works) is an exploit which has never been approached. For, mark you, Port Arthur's defenses had been laid out on the most approved and up-to-date theories. Nature, moreover, has cast the topographical features of the place on lines that are admirably suited to defense. The harbor is surrounded by two approximately concentric ranges of hills, the crests of which are broken by a series of successive conical elevations. The engineers took the suggestion thus offered, and ran two concentric lines of fortifications around the city, building massive masonry forts on the highest summits, and connecting them by continuous defensive works. The inner line of the forts lay at an average distance of one mile from the city, and constituted the main line of permanent defense; the outer line, at an average distance of a mile and a half from Port Arthur. Beyond these again were the semi-permanent defenses. The positions of the various forts were chosen in such a relation to each other, that they were mutually supporting—that is to say, if any one were captured by the enemy, it could not be held because it was dominated by the fire from the neighboring forts; and, indeed, it often happened that the Japanese seized positions from which they were driven in this way.

In the majority of cases the slope of the hills was very steep, and what was even worse for the Japanese, smooth and free from cover; so that if an attempt were made to rush the works, a charge would have to be made over a broad, steep glacis, swept by the shrapnel, machine gun, and rifle fire of the defenders. Once across the danger zone, the attack was confronted by the massive masonry parapets of the fort, over which the survivors, cut down to a mere handful, would be powerless to force an entrance.

The defense of Port Arthur, however, did not stop at the outer line of fortifications, but extended no less than eighteen miles to the northward, to a point where the peninsula on which Port Arthur is situated narrows to a width of three miles. Here a range of conical hills, not unlike some of those at Port Arthur, reaches from sea to sea; and these had been ringed with intrenchments for troops and masked (or hidden) emplacements for artillery. Between Nanshan and Port Arthur the Russians had built four more