

WELDED JOINTS IN SHIP CONSTRUCTION.

THE "FULLAGAR" AFTER ELEVEN YEARS' SERVICE.

THE first sea-going vessel welded throughout was the motor vessel *Fullagar*, and as she has now been in service for eleven years, her behaviour during that period should be of the utmost importance to ship-builders and the classification societies. The vessel has justified the confidence of those who fostered the welded construction and helped by tests and various experiments to convince the builders, Messrs. Cammell, Laird & Co., Ltd., and Lloyd's Register of Shipping, to whose classification the vessel was built, that the vessel would be successful.

The motor vessel *Fullagar*, since re-named *Caria*, and later *Shean*, was built by Messrs. Cammell, Laird & Co., Ltd., Birkenhead, and was launched in February, 1920. The vessel was constructed throughout by electric welding in place of riveting, and the Quasi-Arc Company's methods and electrodes were used exclusively. Her dimensions are as follows:—Length between perpendiculars, 150 ft.; breadth moulded, 23 ft. 9 in.; depth moulded, 11 ft. 6 in.; depth to quarter deck, 15 ft. 6 in.; hold capacity, 26,000 cub. ft.; gross tonnage, 398; and speed, ten knots.

The *Fullagar* on completion was classed 100 A.1, electrically welded, subject to annual survey, experimental, and went into the service of her owners, Messrs. T. & J. Brocklebank, Ltd., Liverpool, in July, 1929, and later, was acquired by the Manx Isles Steamship Company, Ltd., and re-named *Caria*. During the vessel's career with these companies she passed through very strenuous services in the coastal trade, carrying various cargoes such as steel plates, coal, maize, etc., and has on several occasions been in service during heavy weather, whilst other vessels of the same size remained in port.

Effect of Grounding on Welded Joints.

The vessel has been aground through stress of circumstances several times, and on each examination later in dry dock the keel and bottom plating were found to have withstood the excessive strain of grounding without any ill effects to the welded joints, and on no occasion was there any leakage through the shell.

The forward length of bilge keel on the starboard side had been carried away and the welded angle lugs attaching the bilge keel to the shell were bent. Efforts were made to dislodge these lugs from the shell by hammering, the result being that the heel of the lug itself fractured without disturbing the welding. A collision caused serious indentation to the shell plating abreast the after cargo and also in way of the engine room on the starboard side. Here again the welded joints remained intact, whereas a riveted ship in similar circumstances would have had the rivets "started" and an immediate repair would have become necessary.

The vessel had been surveyed annually and her class 100 A.1 maintained, the ship being in a sound condition, in spite of the very strenuous services and rough usage she had experienced.

In June, 1924, a serious accident occurred to the vessel which has in a striking manner proved the superiority of a ship welded with "Quasi-Arc" electrodes over a riveted ship.

The vessel went aground on a sand bank in the Mersey during a voyage from Liverpool to Belfast, when fully laden. She floated off on the next tide and as she was perfectly watertight proceeded on her voyage and discharged her cargo at Belfast. It was then found that she was damaged to a considerable extent, but as the shell was watertight it was decided to take her back to Liverpool under her own power. When docked the vessel was thoroughly examined and by using sights the bottom was found to be set up 11 in. from bilge to bilge over a length of roughly 70 ft. and from the evidence of inside structural work she had been set up more but had settled when placed on the blocks.

"A Remarkable Test."

Whilst in dock in this condition the vessel was thoroughly examined by Lloyd's surveyors, representatives of the underwriters and owners, also Admiralty officials who were greatly interested, and the opinion was expressed that not only had the welding stood a remarkable test, but, which is of greater importance, that had she been a riveted ship she would have been a total loss.

Afterwards the vessel proceeded under her own power to Leith where an official survey was held and the scheme of repair decided upon.

Had the plating and framing been riveted in the usual manner, the unfair shell plating would have been removed and faired, and the floors, etc. faired in place, but in view of the fact that the shell plating was welded with "Quasi-Arc" electrodes and perfectly sound, none had to be removed and the

bottom as a whole was forced back into line by means of shores and hydraulic jacks from the deck beams. The welding throughout was then examined and found to be quite sound.

As was to be expected, the setting up of the bottom to such an extent, 11 in., and over such a large area, 1,500 sq. ft., caused considerable disturbance to the frames, floors, keelson, etc. These, however, have been partly set back and partly renewed, and made sound and seaworthy: in regard to the keelson, this has been deepened for a considerable portion of its length by the addition of two 8 in. by 3½ in. bulb angles placed back to back on top of the rider plates.

In forcing back the excessive deformation of the plates into their original position, the welds have withstood the reversal of the abnormal stresses equally with the solid plate, which is all one could wish to claim for any form of joint.

Classification Maintained.

Notwithstanding the drastic experience to which the ship had been subjected, it is very interesting to note that the vessel's classification standing at Lloyd's Register Book as "100 A.1, electrically welded, subject to annual survey, Experimental," has been retained without qualification.

A further important point to note is that this vessel, originally designed as a coaster, after passing through all her vicissitudes, is still in such a satisfactory and seaworthy condition that permission was given for her voyage across the Atlantic, and through the Panama Canal to the North Pacific Coast, where she has since

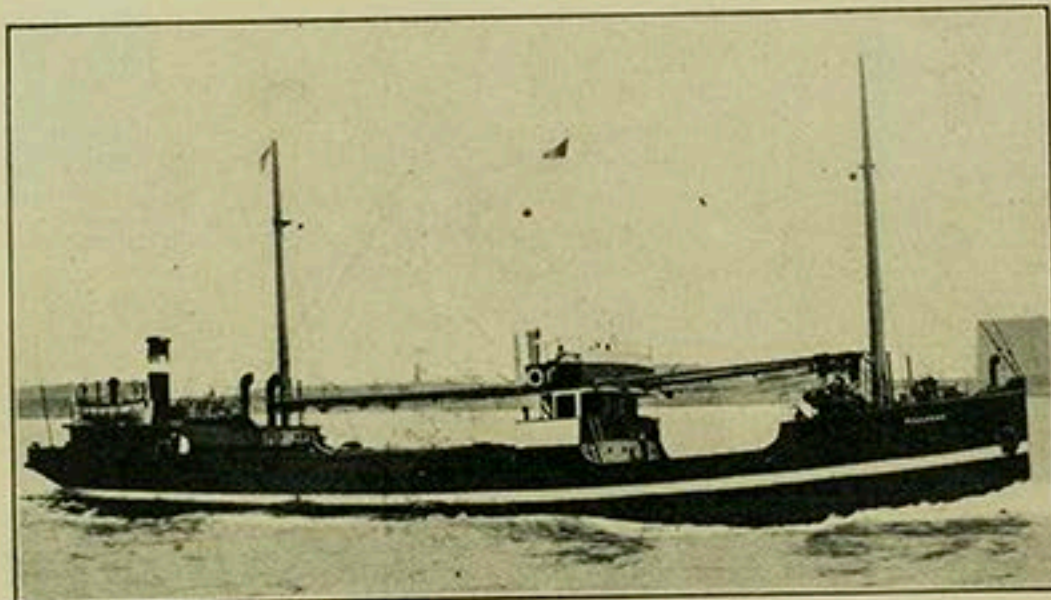


Fig. 1.—The Motorship "Fullagar," the first sea-going vessel to be welded throughout.

been employed in the cement carrying trade, the new owners being the British Columbia Cement Company of Victoria, British Columbia, who have re-named the vessel *Shean*. The owners stated that on October 24, 1930, the *Shean* met with an accident, and the following particulars of the occurrence were given.

The *Shean* struck a rock cliff in the Saanich Inlet, near Victoria, when going at full speed, and had 10,000 bags of cement on board. The photographs show the extent of the damage, and on examination, it was found that in no case did the plates tear apart at the welds, but above and below in the solid plate. Lloyd's and the underwriter's surveyors have stated that the relatively slight amount of damage was a remarkable tribute to the welded vessel.

Had the vessel been riveted, the damage would have no doubt extended beyond the fore peak bulkhead and caused flooding of the cargo space, in which case the cargo would have been irretrievably ruined, whereas less than 400 sacks were damaged, also the vessel would have probably sunk, as she had about 16 ft. of water under her amidships and further aft. The vessel has since been repaired in strict accordance with her class, has passed her tenth annual survey satisfactorily, and is in good condition.

The above is the second occasion on which this vessel has sustained damage which would have resulted in a riveted vessel becoming a total loss.

After more than eleven years' prolonged exposure of the welds to corrosive action of sea water, it is impossible to trace undue corrosion of metal in any part of the structure, which is so satisfactory that Lloyd's have agreed to a Biennial Survey.

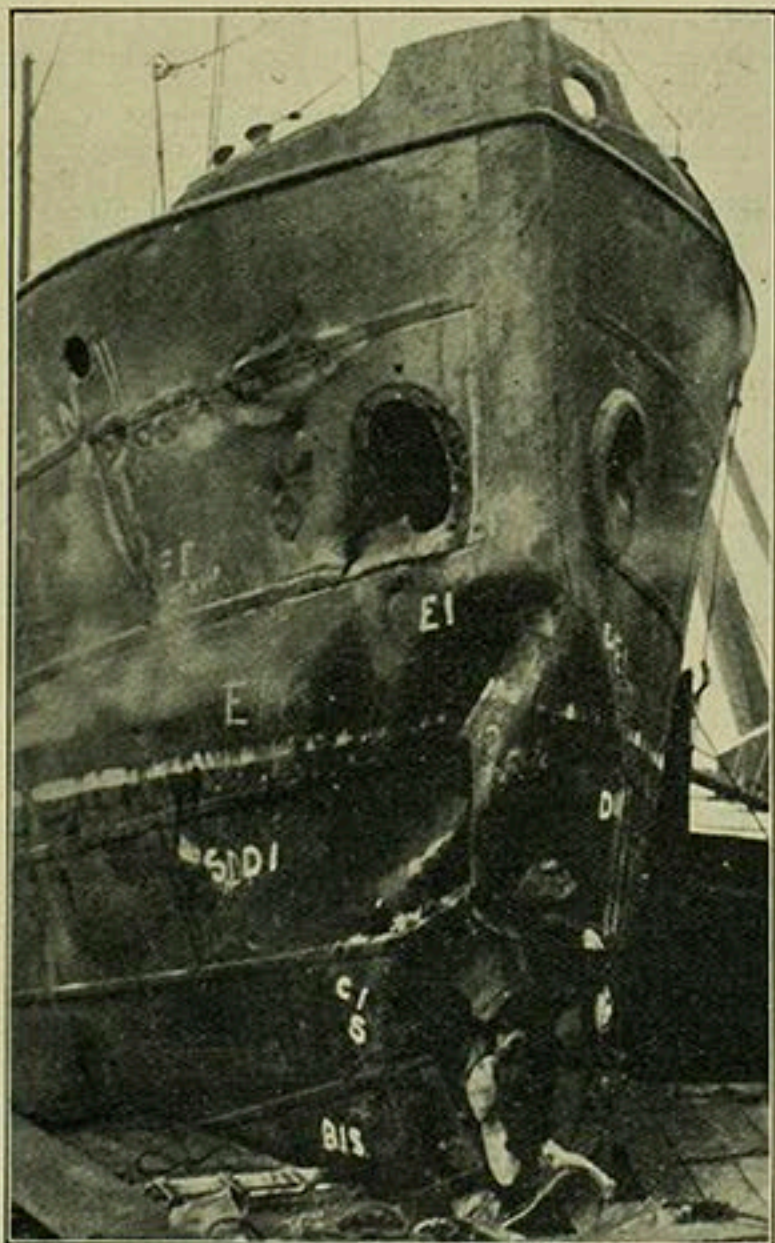


Fig. 2. — Renamed "Caria" and "Shean," the "Fullagar" met with an accident in the Saanich Inlet, near Victoria. At the time she had 10,000 bags of cement on board and was travelling at full speed.

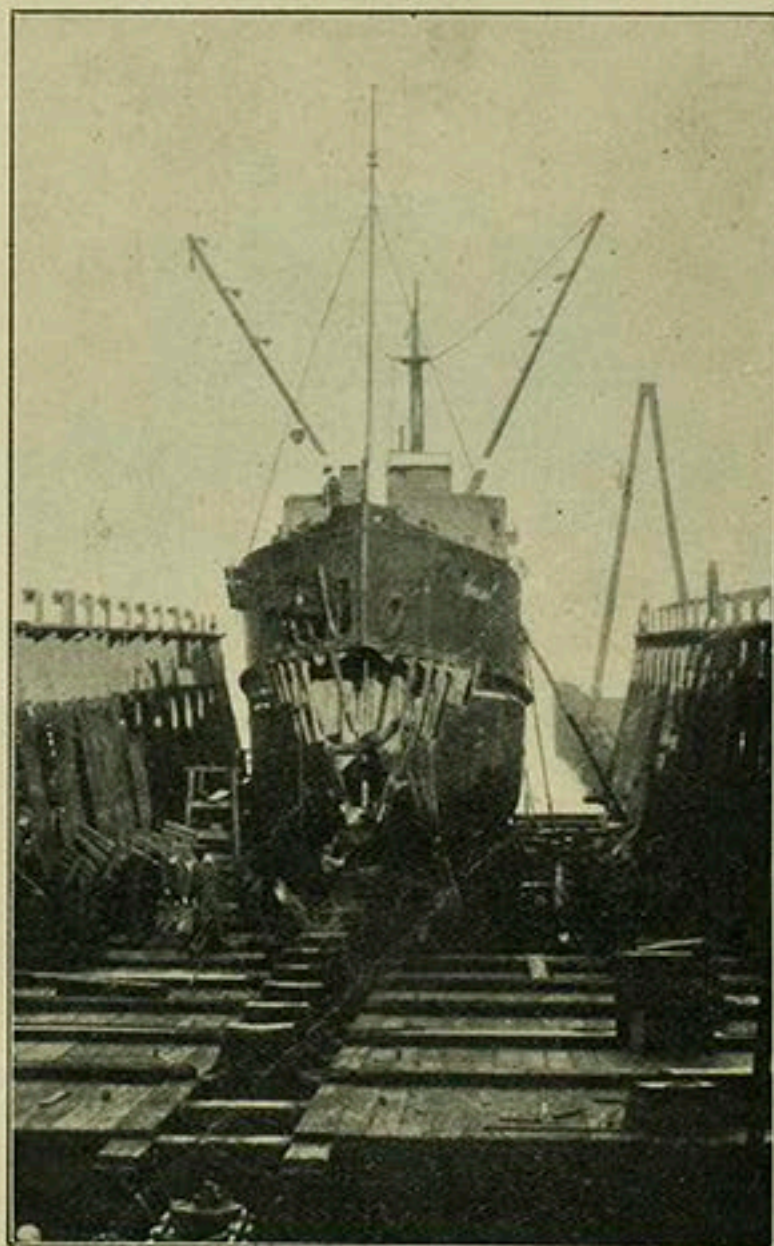


Fig. 3.—Both this illustration and Fig. 2 show the extent of the damage she sustained. Upon examination it was found that in no case did her plates tear apart at the welds, but above and below in the solid plate.

To the Chief Clerk Sumner

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24/4/31

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