

S.S. "EUCLID" - No. 69360 in the Register Book.

This vessel was built in 1911 by the Northumberland S.B. Co.Ltd., Newcastle-on-tyne, and is owned by the Liverpool, Brazil and River Plate S.N. Co.Ld. (Lampert & Holt, Managers). Her moulded dimensions are 410' x 51'8" x 30'6". She is of the Shelter Deck type having a steel Shelter Deck with two Steel Decks below, and a freeboard of 4'-3" corresponding to a draught of 26'7" was assigned. The class assigned was 100A1 "Shelter Deck" With Freeboard. The "EUCLID" is therefore a true Shelter Deck vessel with a tonnage opening fitted aft, and it may be mentioned that three sister vessels have been built, two of which had their tonnage openings closed, thereby receiving a substantial increment of draught.

This vessel left Liverpool on a voyage to New York on Saturday, the 22nd January last, and at once encountered the violent gale which was experienced at that time. On Sunday, she encountered fresh winds and heavy sea and pitched heavily. On the Monday, 24th January at 8 a.m. a transverse fracture was discovered in the steel weather deck amidships, this deck also being badly buckled, and the vessel proceeded at half speed. On Wednesday, 26th January, it was found that the transverse fracture was getting worse, very high seas being encountered and the vessel pitching, pounding, straining and labouring heavily. On Thursday, the 27th, the gale seemed to

reach its height, the entries in the Log speaking of "tremendous confused seas", "Fierce hurricane", etc. the vessel steering wildly and scending violently. On this day it was found that the transverse fracture amidships was getting worse, and on the following day the vessel was put about to return to the Clyde. During the remainder of the return voyage, the weather was rough but the ship eventually reached this port and was taken to Meadowside Wharf. A copy of the extract from the Chief Officer's Log Book is enclosed herewith, marked "A".

The ballast loading at the time of this voyage is shown diagrammatically on Sheet "B". It will be seen that the double bottom was entirely full and that 28 tons of water were carried in the after peak. The remainder of the loading consisted mainly of coal which was concentrated amidships before and abaft the engine and boiler space. It will be seen from the diagram that in the hold 695 tons of coal were stowed forward of the machinery space and 630 tons aft. 676 tons were stowed in the shelter tween decks and 970 tons in the ^{tween} decks below. The limit of stowage of this coal ~~was~~ forward of the boiler room bulkhead ^{was} 62'10", and aft of the engine room bulkhead ^{was} 36'10". The loading of the steamer therefore, including the engine and boiler space, ^{and excluding water ballast} was concentrated in a length of 151'-8" amidships.

The vessel was examined by the Society's Surveyor when, amongst other damage, the following was found.

On the starboard side amidships abreast of the funnel, the shelter deck sheerstrake and strake below were found bulged outward and the plating fractured, the fracture extending the full depth of the sheerstrake and half the depth of the strake below. The plating of the deck below

On the port side, the shelter deck sheerstrake was opened up at a joint abreast of the boiler casing and the plating was buckled. The shelter deck plating on the port and

starboard sides abreast of, and immediately forward, of the machinery casing was found much buckled and in some places fractured, on the starboard side there being a fracture extending over a distance of about 6' across two strakes, and, on the port side, a fracture about 4' in length across one strake. In the line of the fractured sheerstrake

plating on the starboard side, the shelter deck stringer and stringer angle were found fractured. The flanged plate girders under the shelter deck were found torn, from the deck to the lower part of the girder, on the port and starboard sides between the end of No. 3 hatch and the aft end of boiler casing. Aft the machinery casing the shelter deck plating was found fractured at the forward corners of No. 4 hatch.

© 2020

Lloyd's Register
Foundation

W1288-0056 3/8

On the deck below the shelter deck, the plating was found considerably buckled and strained. On sketch "C" will be found a diagrammatic representation of the damage so far as its longitudinal disposition is concerned.

The result of the survey held on the vessel, and the arrangements made for its repair are detailed in the Surveyor's Report but it was thought advisable to make a strength calculation for the vessel in the condition in which she was when the damage was sustained, and this has been done. Making the ordinary assumptions, the strength of the vessel was investigated first of all on the basis of the scantlings as determined by drilling etc. at the time of the voyage, and, second, as based on the scantlings as approved. This was done because it was observed that some deterioration had taken place in the thickness of the deck plating where fractures had occurred. In each of the above mentioned cases, the stress figure of the vessel due to sagging was ascertained, the loading being as given on Sketch "B", and also with the vessel loaded as on Sketch "B", viz., the actual conditions, but in addition with the end holds filled in with such an amount of homogeneous cargo as would bring her down to the load water line. The results of these various calculations are set forth on Sheet "D".

The following observations are submitted on the results as ascertained. If this vessel had been loaded

with a homogeneous cargo uniformly distributed so as to bring her to her marks, the maximum stress would have been a tensile stress. This amount is usually accepted as corresponding to that produced by a bending moment represented by $\frac{WL}{35}$ where W is the loaded displacement of the vessel, and L is the length in feet. Adopting that supposition, the maximum stress for full loading would be approximately 10.2 tons per square inch on the plating of the shelter deck. There is reason to suppose, however, that the assumption mentioned above gives too high a result, and in 1923 Mr. Thomson, a Surveyor on the Chief Ship Surveyor's Staff, presented a paper to the Institution of Naval Architects, in which he gave results actually calculated by him for the loaded conditions with homogeneous cargo in the case of cargo vessels of varying dimensions. Taking his results as a test, the maximum stress in the case of the "EUCLID" would be a tensile stress of approximately 8.5 tons per square inch. In the discussion on this Paper, however, Sir Westcott Abell expressed the opinion that "Mr. Thomson's figures appear to be on the high side" and he himself gave a formula which, if adopted in the case of the "EUCLID", would produce a maximum tensile stress of approximately 7 tons per square inch. From the results given on Sheet "D", it will be observed that the actual stress of the "EUCLID" was considerably higher than that which would have been produced

in the worst conditions if the vessel had been fully loaded and in addition is reversed in sign. That is to say, the stress which produced fracture was not only much higher than is usually contemplated but was such as to put the plating in compression and not in tension. This greatly aggravated the severity of the internal stresses induced in the vessel by the exceptional weather conditions.

The coal as stowed in the vessel and as shewn on Sketch "B" amounted, with other items, to 4,225 tons and in order to complete the total deadweight of the vessel other 5,300 tons could have been taken on board. The case was next investigated by placing 5,300 tons on board in addition to the coal as stowed, the extra cargo being distributed forward and aft of the coal. The result of the strength investigations showed that, this being done, the maximum compressive stress was reduced from 10.2 tons to 4.8 tons per square inch.

The difference in the stress figures caused by the deterioration of the scantlings was approximately one ton per square inch for the worst conditions.

It is interesting to compare this case with previous similar cases of which the Society has taken cognisance. An almost exactly analogous case is that of the S.S. "KNIGHT OF THE GARTER", which was built

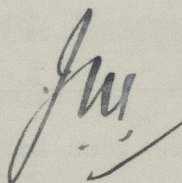
- 7 -

by Messrs. Chas. Connell & Co., Ltd. in 1901, and which sustained severe damage of a similar nature to that in the "EUCLID" when in a ballasted condition. She was surveyed in drydock in Cardiff by the late Dr. Thearle, who reported the case to the Committee in March, 1903. There is a remarkable similarity between the two cases for, in the case of the "KNIGHT OF THE GARTER", two ballast tanks were fitted, one forward and one aft of the machinery space, and, as in the case of the "EUCLID", the load carried was approximately one half the total deadweight. The stress on the bridge deck plating in way of the boiler opening was calculated and found to be 11.15 tons per square inch, (compared with 10.2 tons in the case of the "EUCLID", both being compressive) and Dr. Thearle draws attention to this fact. He also points out that if the deep tanks had been moved respectively further forward and aft of the machinery space, a material diminution of the stress figure would have resulted. It is a difficult matter to arrange for this to be done in a vessel having deep tanks but in the case of the "EUCLID" where the load consisted of coal, if Dr. Thearle's suggestion had been adopted, that is, if the coal in the 'tween decks, amounting to 1646 tons, had been distributed towards the ends of the vessel, the critical stress figure produced, namely 10.2 tons per square inch, compression would/

- 8 -

have been reduced to a moderate figure and in all probability no damage would have taken place. A copy of Bending Moment & Shearing Force Diagrams is enclosed on Sheet marked "E".

It should be added that Mr. George Nicol and Mr. J.R. Clark have been responsible for the whole of the calculations and diagrams in connection with the strength of this ship.



4th March, 1927.



© 2020

Lloyd's Register
Foundation

W1288-0056 5/8