

S.S. "Caronglen"  
Hull Dimensions 400 x 55 x 37.25 to upper deck  
Class 100 A-1 with preboard

Owners - Cam Line of Steamships Ltd

Built by Messrs Wm Pickersgill & Sons Ltd in 1926

This vessel is of the Complete Superstructure type with tonnage opening and has three Stut decks in the holds and two in the Machinery space. She is strengthened for navigation in ice and the frame spacing is 27" instead of 31½" as required by the Rules. The bracing only being reduced on account of the closer frame spacing.

Observations made of the behaviour of the Ship's Structure during the Voyage Reith - Portland - Harwich - Newcastle-on-Tyne

### Outward Passage

The Ship left Reith on February 27<sup>th</sup> in a partially loaded condition. The Cargo Consisted of Coal and Coke and particulars of the loading at the time of departure are shown on Page I.

The Mean Draught was 19'-5" whereas the Maximum Winter draught of the Ship is 25'-0 ¾"

The outward Voyage was described by the Master of the Ship as being fine for the time of the year.

The after hold, being the only one accessible, was carefully observed during the passage.

Four wires were arranged on each side of the Ship in this hold for the purpose of measuring any transverse movement of the framing and measurements were made at three equidistant points on each wire at frequent intervals <sup>of time</sup> during the passage.

The disposition and arrangement of these wires were as shown on Page II.

The recorded <sup>maximum daily</sup> movement of the framing together with extracts from the Ship's Log regarding the weather are as given on Page III.

It will be noticed that the maximum transverse movement measured was ¾ inch at Frame 4° 25' on the port side or a ratio of  $\frac{\text{Movement}}{\text{Length of frame}}$  equal to  $\frac{1}{630}$ .

The movement of the frames took place as the after end of the Ship was sinking in the water when rolling and pitching.

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Where these measurements were being taken the after part of the vessel, so far as could be ascertained, was not immersed at any time to a greater depth than the second deck, so that it would appear that when the vessel heels, as is stated frequently to be the case in heavy weather, the movement of the framing would probably be appreciably greater than measured on this occasion. 111

A diagonal wire was also arranged from a third deck beam knee to the tunnel top with a copper spring at the tunnel end of the wire for the purpose of measuring any warping movement, but no movement was visible.

Careful examination was made of the heads and heels of the pillars and the venting of the top and bottom of the Centre line bulkhead, with a view to ascertaining if there was any movement of the decks, but none was observed.

A number of rivets attaching the frames to the shell plating at the lower part of the frames above the ceiling, were started and leaking and in addition to three cement boxes fitted previously on the port side in the after hold, five were fitted on the port side and two on the starboard side in way of leaking frame rivets during this passage, making in all ten cement boxes in the after hold. Frame rivets in the bilge below the ceiling on each side of the ship were also slack and leaking. Most of the rivets affected are stated to be those which were removed at Keith in December 1927 and are situated towards the after part of the hold abaft frame N<sup>o</sup> 31 where the side of the ship is concave to the sea.

The third seam of shell plating above the bilge showed signs of leakage between frames N<sup>os</sup> 26 and 29, and 36 and 37 on the starboard side and between frames N<sup>os</sup> 26 and 32 on the port side.

The rivets attaching the frame to the brackets at the tops of the tunnel recess on the port side were slack.

No other defects were observed in the after hold.  
 { It would also appear to be likely that when the cement at the bilges is removed other defective rivets will be found.



(3)

The Bulwark rail Pan is fractured on each Side of the Ship about  
amidships. During the heaviest weather encountered on this passage and  
when the ship was on the crest of a wave the fractures were observed to open 1/2 of an inch and the adjacent butt  
of the bulwark plating was working.

The bulwark rails are said to have fractured during  
a previous voyage in the partially loaded condition when heavy weather  
was encountered.

The fore peak, shelter deck, Hatch coamings, bulkheads, Casings and tunnel  
were examined and found to be in order.

### Examination as the Cargo was discharged at Portland Wharf

The Ship arrived at Portland on Friday March the 9<sup>th</sup> and during the  
time she was at this port the Holds and tween decks Nos 1, 2, 3, & 4 and the deep tank  
were examined. The permanent bunker was full of coal.

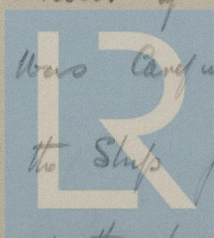
In No 1 Hold an old Cement box is fitted at the after end on  
the Starboard Side. This is stated to be in way of a leaking  
bulkhead frame joint. In the same Hold 3 rivets in the lower stringer  
Collar bulkhead bracket angle standing flange on the port Side were found to  
be slack.

In No 2 Hold one butt of Shell plating on each Side in the fore-  
strake above the bidge between frames Nos 134 and 135 was showing  
Signs of leakage and Cement boxes were fitted in way  
of same.

### Homeward Passage

The Ship left Portland on the 16<sup>th</sup> March and arrived at Newcastle  
on the 28<sup>th</sup> March fully loaded with Grain and general Cargo.  
After a passage stated by the Master as being fine for the time of the year.  
During the passage the behaviour of the Structure in way  
of the Engine and boiler spaces was carefully observed.

Wires were fixed on each Side of the Ship for the purpose of  
measuring transverse movement of the framing and stringers.



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173  
102  
275

11

Ek ramp  $L = 14.5' = 173$  P.S  
B/C ~ ~ ~ ~ ~ 173

SS + 86 = 278

Ek Stage  $L = 22.6' = 270$   
B/C ~ ~ ~ ~ ~ 18.0 - 216

15 ft



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The Disposition and Arrangement of these Vines and the points at which measurements were taken are shown on Print IV

The Musciman measured movements of the framing and strings  
are as follows:

The movements took place as the vessel sank in the water when rolling and pitching. The time taken for each <sup>of the above</sup> movements (Zero-Maximum-Zero) being about seven seconds. Heals were observed in four frame spaces in way of the side stringer on the starboard side of the engine room and appeared to be ~~caused~~ come through slack rivets in the stringer shell chocks which are covered by cement.



(5)

Stronger was seen to oscillate slightly as the ship rolled and pitched  
The seating of the evaporator which is built on to the framing on the  
port side was also observed to be moving  $\frac{1}{8}$ " in a vertical direction

The after peak was examined and the tank found in order.

The connection of the outer plate to the stem post on the port side  
was found to be leaking as was also the plate shoe at  
the bottom of the transom floor.

In No 1 frame four shell rivets on the port side and two on  
the starboard side and in No 2 frame six shell rivets on the  
port side and two on the starboard side were slack and  
leaking at about the level of the peak tank top.

The fractures in the bulwark rail were open  $\frac{1}{8}$  inch and  
were working to the extent of about  $\frac{1}{32}$  inch.

The fore peak shelter deck, lockhouses, casings and tunnel were  
examined and found to be in order.



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## Conclusions regarding observations made during the voyage after Hold

It is considered that the measurements of the Movement of the framing confirm the opinion expressed by Dr. Montgomery, Mr. Waldie Cairns and Self when a preliminary examination was made of the Ship at Ketch prior to Sinking, that the defects in the after hold are due to excessive <sup>and a high shear stress in the frame</sup> ~~pantry~~ <sup>side</sup> of the <sup>When rolling</sup> ~~ship's~~ <sup>and pitching in heavy weather with the hold not full of cargo, this</sup> ~~pantry~~ <sup>stresses being</sup> ~~and shear~~ <sup>accelerated by</sup> ~~insufficiency of~~ <sup>stiffness in the framing</sup>

When the measurements were being made the Stern of the vessel as far as could be ascertained, was not immersed at any time to a greater depth than the second deck, so that it would appear that when the vessel heels, as is stated to be frequently the case in very heavy weather with a head sea, the movement of the framing would probably be appreciably greater than recorded on this occasion.

The framing is composed of a butt angle frame and reversed angle forming a girder 7" in depth. ~~at about every third frame the fore and aft flange of the reversed angle is pierced at intervals by holes for taking the cargo rather than these holes being in the most effective part of the frame appreciably reduce its strength~~

This ship is propelled by steam turbines, the sea speed being  $11\frac{1}{2}$  knots, and in heavy weather - which is stated by the Master to be the rule rather than the exception in the North Atlantic - when the vessel is partially loaded, the propeller does not race as it would if reciprocating engines were fitted, and therefore on this account it is not necessary to reduce the speed of the engines. It is thus probable that, as the speed of the ship in heavy weather in the partially loaded condition is greater than it would be if she were propelled by reciprocating engines, the stresses in the structure will be correspondingly increased.



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~~With the Master and Chief Engineer of the Ship who stated that this was the case.~~

The result of the greater and more violent pitching would be an increase of painting of the framing especially aft where the form of the Ship's Side is Concave to the Sea.

~~Another result of the insufficiency of Stiffness in the framing is to increase the Shear Stress in the Vents connecting the Shell plating to the frames, especially at their lower ends of the frames in which vicinity the defects were found.~~

Bulwarks

The fractures in the Bulwark rail are not considered of importance.

Throughout the greater part of this hold the Ship is specially strengthened for navigation in ice.

N<sup>o</sup> 1 Hold

← The defects in N<sup>o</sup> 1 Hold are of a minor character and are considered not to be due to weakness of the structure: ←

N<sup>o</sup> 2 Hold

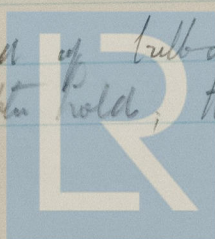
The defects in N<sup>o</sup> 2 Hold could be caused either through painting of the Ship's Side or through the Ship touching a quay wall which the Master states happens sometimes at berth.

If the loading of the Ship will permit, observations will be made in the hold during the next voyage.

Engine & Boiler Space

← The recorded movements of the engine and boiler room stringers are not considered to be excessive. The movement of the engine and boiler room framing, however, especially on the Starboard Side, is thought to be too great and may cause started rivets in the future.

The framing is formed of bulb angle frame and reversed angle as in the after hold, that in the boiler room



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being increased with in thickness. A Web frame is also fitted about the middle of the Machinery Space.

The Peaks in Way of the Side Stringer in the engine room, if coming through Stanchion rivets in the Shell attachment angles, appear to indicate excessive Shear Stress in these rivets.

After Peak The slight defects in the after peaks are not considered to be due to any weakness of the Structure.



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