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Port BOMBAY.

2nd MARCH 1946

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This is to Certify that

H. P. SOUTHWELL

the undersigned Surveyor to this Society did at the request of the Manager, Engineering Department, Royal Indian Naval Dockyard, Bombay, attend on board the T.S.S. "WAYLAND" ex "ANTONIA" 13867 tons gross ~~mt~~ for the purpose of generally examining and ascertaining the cause of the fractures in the centre strakes of shell plating of the two double-ended main boilers.

~~These boilers are double-ended Multitubed boilers each with 8 separate combustion chambers and 8 furnaces. They were built in 1921.~~

The undersigned Surveyor examined the fractured shell plating of both double-ended boilers, when the following conditions were observed or reported to him.

These two boilers are double-ended Multitubed <sup>or</sup> boilers each with 8 separate combustion chambers and 8 furnaces. They were built in 1921.

It was stated that when the boilers were hydraulically tested recently, after the renewal of a number of wasted and broken bottom -row screwed stays between the boiler shell and the wing combustion chambers, a large number of screwed stays in the top rows between the shell and the wing chambers fractured under test. About the same moment it was found that the boiler shell plating was leaking from a fine crack which radiated from a new screwed stay in the bottom rows; - which crack had not previously been seen.

It was further stated that these new stays were larger than the old ones and that the increased diameters of the holes for them had been obtained by tapping with successively larger-sized taps until the required diameter was reached.

Upon examination of these boilers it was observed:-

That the steels which are fitted under the 4 low combustion chambers in each boiler are at least  $3/8$ " clear of the chamber bottoms

This Certificate is

"While the Certificate is executed, it is to be whatever to the entry in the Register of Shipping or the Committees or

and upon the terms of the Rules and Regulations of the Society, which provide that:

of the Society use their best endeavours to ensure that the functions of the Society are properly and that neither the Society nor any Member of any of its Committees is under any circumstances liable for any inaccuracy in any report or certificate issued by the Society or its Surveyors, or in any other publication of the Society, or for any error of judgment, default or negligence of any of its officers, or the Surveyors, or other Officers or Agents of the Society."



T.S.S. "WYLAND" ex "ANOTONIA"

That there was no scale on the surfaces of the combustion chamber plating or the top faces of the angle bars on the stools, although these faces could not be scraped or cleaned with ordinary boiler cleaning scaling tools. It may be assumed from these conditions, therefore, that the chambers bear on the stools when the boiler is under steam, so that the heat stresses in the boiler produce a downward movement of the two centre chambers of at least  $3/8$ th of an inch.

That several cracks in the shell plating radiated from the bottom screwed stays. The direction of all these cracks is reconcilable with the vertical sheer and bending stresses, the worst crack being horizontal and the others radiating diagonally from the lower sides of the holes. In one case, there is a horizontal crack running from one of the broken top screwed stays.

There is very little scale in these boilers and it was stated, and it appeared, that no chipping had been necessary. The water has been treated with lime and soda only and there is no evidence of the excessive use of soda nor is there any salt scale or any excessive scale of any kind. No rivet heads are missing and there are none of the obvious signs present which normally indicate caustic embrittlement or intercrystalline fracture.

It is recommended, however, that some of the fractured stays which were removed from the bottom wing rows should be submitted for examination by an experienced metallurgist with a view to determining whether there is any cause for their failure other than fatigue. An examination under a magnifying glass reveals a thin coating of fine scale over the greater part of the fractured surfaces, indicating that they stays were already fractured or partly fractured, and had been so for some time.

If it is found that caustic embrittlement of the shell plating and stays has not occurred, the indications point to fatigue due to alternating heat stresses which would, normally, concentrate in the screwed stays between the wing chambers and the shell. Because of the angle at which the wing stays are fitted, and for other less apparent reasons, the stays in the bottom rows would suffer first, and consequently, the shell plating into which they are fitted.

It is accordingly recommended that, before any decision is arrived at on the matter of permanent repairs, the following physical tests be carried out in an attempt to determine whether the plate is fatigued and whether this condition extends beyond the location of the present cracks.

(1) The centre stay in the row above the one now showing cracks should be removed and the hole cleaned out with a tapered reamer. A special reamer to suit this taper should be made and driven into the hole in an endeavour to produce a fracture or fractures.



T.S.S. "WAYLAND" ex "ANTONIA"

(11) A hole about 1" diameter should be drilled about 1/2" clear of the end of the major fracture on the port side of the port D.E. Boiler. The horizontal axis of this hole should be in line with the line of the crack. This hole should also be reamed with a tapered reamer and a suitable tapered drift driven into it.

Any further recommendations will depend upon the result of these tests and upon the metallurgical examination of the broken screwed stays.

*W. S. Southwell*

Surveyor to Lloyd's Register.



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