

S/S "EMPRESS OF AUSTRALIA"  
EX "TIRPITZ"

BINES Connected directly to the Primary Wheels of the "Tottinger" hydraulic transformer & are therefore not affected by propeller thrust.

The blading of turbine rotors consists of 4 rows of impulse blades mounted on 2 wheels and 55 rows of reaction blades mounted on the rotor drum.

Steam enters nozzles on the after end of the turbine casing & the rotor revolves in one direction only.

The impulse blades are mounted on wheels having a diameter of 3000<sup>7</sup>/<sub>16</sub>" (9'-10") and when running at 900 revolutions the speed at periphery would be 30,000 ft-per min or 500 ft-per second.

The reaction blades have tip diameters varying from 5<sup>7</sup>/<sub>2</sub>" to 90<sup>2</sup>/<sub>2</sub>" diam and periphery speeds of from 13,550 ft-per min or 226 ft-per sec to 21,320 ft-per min or 355 ft-per sec.

The drum carrying the reaction blading is a single forging machined inside & out. At the 1<sup>st</sup> stage it has a diameter of 36.6" and a thickness of 3.35". At the 2<sup>nd</sup> stage the diameter is 51.2" & thickness 1.97" and at last stage the diameter is 67" with a thickness of 2.56".

The rotor shafts secured to either end of the drum are of forged steel having a tensile strength of 28-32 tons. The diameter at the bearings is 17.75" and the length of each bearing is 33<sup>1</sup>/<sub>2</sub>" and taking the weight of the rotor as given by the Seattle Surveyor to be 21<sup>1</sup>/<sub>2</sub> tons this would give a pressure of only 40.6 lb per sq inch of bearing surface.

The distance between ~~the centres~~ of the rotor shaft bearings is 17'-8<sup>3</sup>/<sub>4</sub>" or between centres 20'-5<sup>3</sup>/<sub>4</sub>".

BINE It was originally thought that the forward  
PUSTS thrust on the turbine due to the steam pressure would be counterbalanced to a certain extent by a backward



pull on the primary wheel at the transformer. This however did not prove to be the case as after the vessel's initial run from Stettin to Southampton it was found that the white metal in the thrust shoes taking the forward or steam thrust had worn  $\frac{1}{10}$ " on each turbine thrust-block, & that the shaft collars were badly scored.

The thrust-blocks were originally of the horse shoe type having 4 shoes and 5 collars on shaft.

Subsequently these blocks were replaced by ones of the "nichell" type, one collar on the shaft being utilized for this purpose, one collar being turned off to allow space for the thrust-block and the remaining collars being left as they were.

The turbines were originally designed for a maximum speed of 800 revolutions per minute, the Pottinger transformer reducing these revolutions to 160 at the screw shaft and also effecting the reversal of the screw shaft. It would now appear that since oil firing operations have been perfected that a greater turbine speed can now be obtained.

From the partial examination made whilst at Southampton in April 1921 it would appear that radial & longitudinal blade clearances were ample and in my opinion the design of the rotor & its shaft is such as to preclude the possibility of whipping whilst running at 900 revolutions per minute.

The general overhaul & tuning up which was carried out at Seattle last month with regard to the port turbine would appear to have met the case & the same might be done to the Starboard turbine at an early opportunity. The turbine thrust-blocks do not appear however to be of suitable proportions and this matter evidently requires early attention.

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