RESULTS OF TRIALS AND EXPERIMENTS

MADE ON

H. I. M. FIRST CLASS BATTLESHIP "YASHIMA."

S. SASOW, MEMBER INST. N. A.

Report of official speed trials taken on July 13th and 14th 1897, off the mouth of the River Tyne, over the 9.6-knot course.

The trial with forced draft was the first taken, and four consecutive runs were made over the 9.6-knot course, two with and two against the tide, the results are given in the table below.

No. of run.	Time on course mins. secs.	Revolutions.	Speed in knots.	True mean speed.
1st, North	29 7	120	19.782	19.227
2nd, South	30 27	122	18.916	
3rd, North	30 5	121½	19.146	
4th, South	29 1	121½	19.85	

Speeds were taken as the 1-knot posts were passed, during each run and the mean of these 4 knots gave a speed agreeing very closely with that on the longer course.

The average indicated horse power during the forced draft trial was 14.075; the pressure of air in stokeholds never exceeding 1½ inches of water. The sea was smooth and a gentle breeze was blowing.

On the following day the natural draft trial was made with open stokeholds the vessel running for 6 hours continuously.

Four consecutive runs were again taken with the results shown below.

No. of runs.	Time on course, mins. secs.	Revolutions.	Speed in knots.	True mean speed.
1st, South	34 17	109	16.801	17.35
2nd, North	32 29	106	17.731	
3rd, South	33 5	108½	17.41	
4th, North	34 42	108¾	16.6	

The true mean of the above speeds was 17.35 Knots, and this was fully maintained till end of the trial, the average horse power during the runs was 9570. On both trials the vessel was run at her designed load draft of 26 ft. 5 inches with all her weights or their equivalents on board. The weather was again favourable and the sea smooth.

After the completion of the trial with natural draft, turning circles were tried with various degrees of helm. With 10 degrees of helm the circle made by the vessel had a diameter of 1050 feet, or about 2½ times her length and she turned through 180° in 1 min. 26 secs; as the helm angle increased the diameters grew less till with the full helm angle the circle had a diameter of only 720 feet or about 1½ times the length of the vessel; the time of going through 180° being only slightly less than with 10° of helm. The heel caused by turning in such a small circle was of course considerable and was 5 degrees with 10° of helm and 10½° with full helm.

The rudder was put over from hard a port to hard starboard in 16 seconds and from midships to hard over in 8½ seconds with the steam gear.

II°—INCLINING EXPERIMENT TAKEN SEPT. 6TH 1897.

Condition of Ship.

Boilers :—

Six completely filled, four empty.

Fresh water tanks :—

Partly filled.

Feed water :—

Forward reserve feed tank filled.

After reserve feed tank empty.

Bilges :—

Dry throughout.

Stores :—

Greater part on board, say 30 tons, to finish.

Coal :—

About 1080 tons on board.

Ammunition :—

All except 12 tons on board, part still on upper and main decks.

Boats :—

All in place.

Inclining weights :—

25 tons on upper deck.

Men :—

About 300 workmen and about half of crew.

Sundries :—

About 2 tons of tools, benches &c, on board and about 2 tons of mooring hawsers.

Draught :—

26'-6" fwd. 27'-4" aft. = 26'-11" mean.

Density :—

35.15 c.ft. per ton.

Displacement :—

$$\frac{12725}{35.15} \times 35 = 12,680 \text{ tons.}$$

Weights shifted :—

25 tons through 55'-0" gave a mean reading of 5½ in. on pendulum, 12 ft. long

$$\text{Hence } GM = \frac{25 \times 55 \times 12 \text{ ft.} \times 12}{12,680 \times 5\frac{1}{2} \text{ in.}} = 2.72 \text{ ft.}$$

i.e. Metacentre, above base 29.72Centre of Gravity above base 27.00*Normal Condition.*

Items to go in	Tons.	Distance of centre of gravity above base line.	Moment.
Water in 4 boilers to working level	66.8	11.5	768
Water in condensers and pipes	25.0	16.0	400
Stores and provision to complete	30.0	25.0	750
Ammunition to complete	12.0	12.0	144
Crew and effects to complete	30.0	36.	1,080
	<u>163.8</u>		<u>3,142</u>
Items to come out			
Coal 1080-700 tons	380.0	30.5	11,590
F. water 93-54	39.0	25.6	998
Reserve feed water	32.0	1.75	56

Excess of water in 6 boilers	80.0	16.5	1,320
Tools etc on deck.	2.0	30	60
Mooring hawsers.	2.0	44	88
Workmen (about 300)	20.0	36	720
Inclining weights	25.0	45	1,125
Ammunition to go below (15½ tons)	580.0	560	
	16,517		
Condition as inclined	12,680	27.00	342,360
To go in	164		3,142
	12,844		345,502
To come out.	580		16,517
	12,264		328,985
<i>Drift mean</i> = 26' - 1½"			26.83
			29.72
GM.			2.89 ft.
<i>Deep Condition.</i>			
	Tons.	Distance of centre of gravity above base line.	Moment.
Normal.	12,264		328,985
Additional coal in lower bunkers.	67	27.5	1,942
" " upper "	381	33.	12,573
" " wing "	441	20.5	9,041
Water in reserve feed tanks	66	1.75	115
" (to fill F. W. tanks)	84	26.6	3,150
	13,303		354,706
<i>Mean draft</i> 27'. 11"			26.66
M above base			29.60
GM.			2.94 ft.

<i>Light condition.</i>			
Weight to come out	Tons.	Distance of centre of gravity above base line.	Moment.
Fresh water	54.0	26	1,404
½ Provisions and stores	93.0		1,984
Water in boilers	167.0	11.5	1,920
" condensers etc	25.0	16.0	400
¾ Ammunition	200.0	13.5	2,700
Cool	700.0	16.0	11,200
	1,239		19,608
Normal Condition	12,264		328,985
	11,025		309,377
<i>Mean Drift</i> 24' 9"			28.06
M above base			30.20
GM			2.14 ft.

III—First trial of steam steering engine worked by the wheel on bridge.

No. of men at wheel - - - - - 1.

How wheel is taken.	Time in Commence mt. of trial.	Time of end of trial.	Time in second.	Angles at wheel indicator.	No of revolution of engines at the end of each trial.	
					S	P
Mid to H.P.	4½ - 28' - 0"	4½ - 28' - 6"	6"	30°	89	88
H.P. to S.S.	4 - 28 - 6	4 - 28 - 22	16"	- 30° to + 30°	89	86
S.S. to H.P.	4 - 28 - 22	4 - 28 - 30	8"	+ 30° to - 30°	90	85
H.P. to Mid.	4 - 28 - 30	4 - 28 - 41	11"	30°	86	88

Second trial of steam steering engine worked by the wheel on bridge.

No of men at wheel - - - - - 1

How wheel is taken.	Time in Commencement of trial.	Time of end of trial.	Time in seconds.	Angles at wheel indicator.	No of revolution of engine at the end of each trial.	
					S	P
Mid to H.P.	4' - 37' - 0"	4' - 37' - 10"	10	35°	70	72
H.P. to H.S.	4 - 37' - 10"	4 - 37 - 18	8	- 30° to + 30°	70	74
H.S. to H.P.	4 - 37 - 18	4 - 37 - 27	9	+ 30° to - 30°	72	76
H.P. to Mid.	4 - 37 - 27	4 - 37 - 43	10	30°	75	78

Trial of hand steering wheel on upper deck.

No of men at steering wheel - - - - - 8

Time required to change steam to wheel - - - - - 1' - 47"

How wheel is taken.	Time in Commencement of trial.	Time of end of trial.	Time in seconds.	Angles at wheel indicator.	No of revolution of engines at the end of each trial.	
					S	P
Mid to H.P.	4' - 48' - 0"	4' - 50' - 48"	2' - 48"	35°	58	56
H.P. to H.S.	4 - 50 - 48	4 - 56 - 1	5 - 13	- 35° to + 35°	51	64
H.S. to Mid.	4 - 56 - 1	4 - 57 - 1	1 - 0	35°	50	64

Trial of hand wheels in steering engine room, when engines were running 100 revolutions per. min.

No of men at wheels - - - - - 6

How wheels were taken - - - - - Time in seconds.

Midship to Hard-a-port 50"

Hard-a-port to Hard-a-starboard 130"

Hard-a-starboard to Midship 32"

Time taken for changing steam steering to hand wheels in steering engine room is 5' 10" from the time of order given.

EFFECT OF INERTIA OF MOVING PARTS OF AN ENGINE ON PISTON AND CRANK PIN EFFORT.

By A. Inokuty M. E.

In high speed engines, the inertia of the massive parts directly connected with the piston and reciprocating with it, and also of the connecting rod and the unbalanced part of the crank, greatly alters the piston and crank pin effort. The following is an exact method of determining the various forces arising from the acceleration of moving parts.

The mechanics of the connecting will be considered first and then the result of it will be applied to the calculations of inertia effect of other moving parts.

Referring to Fig. 1, let $AB=R$ be the crank radius; $BC=L$ the connecting rod length; P any point in the centre line BC of the

connecting rod, distant l from the crank pin B . Let V be the velocity of the crank pin B ; $\theta =$ the angle CAB which the crank makes with the line of stroke AC ; $\alpha =$ the angle BAC ; and $t =$ the time measured from the beginning of