8TH AUGUST, 1907.

FURTHER EXPERIMENTS WITH THE S.S. "KOOKOOBURRA."

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The author explained that this paper is really an appendix to the paper read on the 11th April, describing the machinery of the double-ended ferry steamer "Kookooburra."

At the time of reading that paper it was indicated that it had been decided to make and fit new propellers with a view of reducing the bow wave, which had been observed which was formed by the vessel when going at the higher speeds. This paper was merely for the purpose of putting on record in the Transactions of the Association, and thus making available to the members the full and complete information of the alteration and the results obtained.

The data is interesting because it gives the figures from actual trials of the same vessel and machinery under two conditions, and as a comparison between the results obtained from two propellers, it is especially interesting, as in this case there is one element in the design of the propeller, which is the same in both, i.e., the pitch. Usually in trials of vessels with different propellers, the results obtained are difficult to analyse, because, as as rule, the propellers are different in most of the elements of design, so that in looking over the results obtained in this case, it is to be kept in mind that the pitch is the same in both cases.

With the first propellers a section of one blade was submitted with the original paper. To make it more clear, he now submitted a drawing, Plate XXIV., Fig. 1, showing the design of the propeller in full. The first propellers had a diameter of 6′ 6″, 10′ 0″ pitch, with four blades each with 15·2 sq. ft. of surface, i.e., a total on the two propellers of 30·4 sq. ft. The revolutions as shown by the result of the first trials were 161 at the full speed with an I.H.P. of 644. At the 7′ 9″ draught it was found that the propeller blades were not quite immersed, and this seemed to cause a very considerable disturbance, especially when getting under weigh, and it was considered that to this might be due some of the bow wave, it was never considered that any alteration in the shape of the propellers would do away with that wave. It was only hoped that some reduction might be made with possibly a slight increase in speed. As the engines were designed for 175 revolutions, originally, in designing the new propellers, it was aimed at to get this speed.

The new propellers were finally decided to be designed as shown on diagram 2, having a dia. of 5′ 3″, pitch 10′ 0″, surface in each propeller 13·5. *i.e.*, a total surface of 27 sq. ft., *i.e.*, the diameter was reduced by 18″, the pitch remained the same, the total area was less by 3·4 sq. ft. The ratio of projected area to disc area of the blade is ·47 as against ·34 in the original propellers, and the pitch ratio is 1·94 as against 1·54. It is as well to note that there was no throw back of the blades as in the first propellers, and the thickness of the blade was made parallel, so as to present the same shaped face, pushing or towing, as shown on the section. The results of the trials are shown on Plate XXIV, Fig 2. The trials were conducted in the same manner as the previous test trials were, and were under the superintendence of Mr. Brown, of the Sydney Ferries, and Mr. Marshall, of the Board of Navigation, in addition to the engineering staff and assistants as before, the times and indicator diagrams being taken from each engine on each speed as carefully as in the previous case. The results

have been worked out and plotted on diagram, Plate XXV., which contains the curves of the original trial, and in red the curves showing the results under the new propellers. It was considered necessary to carry out the trials at a lower speed than 10 knots, as it was evident there would practically be no difference. Three separate different speeds were taken and a study of the curves in conjunction with the shape of the propellers will be interesting. It will be seen that considerable gain in revs. was obtained in speeds all through. This is due to the smaller dia., and reduced surface, and shows that these two elements have a bearing independent of the pitch in the control of the revolutions. The revolutions obtained at the high speed were 171, which is nearly the number originally aimed at. The mean speed on the full power trial was 12·435, just under $12\frac{1}{2}$ knots, this showing an increase of ·257, i.e., $\frac{1}{4}$ knot on the previous results. The mean I.H.P. was 656·1, which is an increase of 12·1 I.H.P. i.e., for an increase of 1·8 per cent., a $\frac{1}{4}$ knot extra speed was obtained. The next highest speed at 160 revs. gave 11·34 knots as against 11·14 at 140 revs. in the previous case. The I.H.P. 449, as against 427·4, a slight increase at this speed.

At the lower speed of 140 revs., 10·31 knots with 268·5, I.H.P., as against 10·1 knots with 120 revs., and 249·7 I.H·P.

These results are plotted on the curves, and show that for equal speeds there has been a reduction of 5·1% at 11 knots, and 4% at 12 knots, in the I.H.P. The curve of co-efficient of performance shows a distinct improvement; in the original trial the co-efficient obtained at the higher speed was 126·6. It has now risen to 133. At the second highest speed of 11·3 knots it is 146·1 as against 145·9, the improvement being very little, while at the lower speed of 10 knots it is 183 as against 186·6, practically the same.

The only peculiarity about the curves is the slip ratio. It will be seen that the new propellers give a higher percentage of

slip on the two lower speeds, as the full power is reached this slip decreases almost meeting the original.

The results show that the original propellers were not far wrong in their design, although the new propellers have made a distinct improvement. The fact that the curve of their performance follows so closely the curve of the performance of the original propellers show that not much further improvement could be expected with the present form of hull, and it also assists to prove what has been often shown that the results to be obtained from a good ordinary designed propeller, which is being designed with some idea of suiting the vessel and engines, that there is very little difference between it and any other special shape, that is to say, provided the propeller is reasonably adapted to its work, there is not much margin to improve on it, although he would like to hear from members any opinion they might have as the result of their experience in other cases.

S.S. "KOOKOOBURRA"—NO. 2 PROPELLER TRIAL.

Propellers 5ft. 3in. dia., 10ft. pitch.

Run.	A	B	C	D	E	F
COURSE.	Pinchgut to Bradl'y's	B to P	P to B	B to P	P to B	B to P
Time on Mile	5m 43s	5m 55s	5m 22s	5m 13s	4m 51s	4m 48s
Speed Knots	10·496	10·141	11·18	11·502	12·371	12.5
,, ,, (mean) ..	10·318		11	341	12·435	
Boiler Pressure... ...	165-170	180	175	170	175to165	163
Intermediate		15		35	53	54
Low		13" vac		0	7	4
Vacuum...		29"		28"	27"	26½"
Revolutions	140	140	160	160	174to170	170
,, (mean) ..	140		160		171	
Slip (per cent)	25%		28·2%		26·3%	
I.H.P. (Developed)—Mean of Two Sets.						
M. E. P. H. P. Cylinder	56·44	49·36	71·8	74·18	88·13	94·8
,, I. P. ,, ...	18·64	16· 2	28·5	28·52	35·48	38·6
,, L. P. ,, ...	5 815	4 35	7·13	7·16	11·88	11·62
Reduced to L.P. Clyi'd'r	20·33	17·24	27 28	27·66	36·83	38·62
I.H.P. H.P. Cylinder ..	111·0	97·5	162	167·5	214	228
,, I.P. ,, ...	96·	87·	168	168	219·3	241
,, L.P. ,, ..	83	62	117	117	208	202
,, Total	290	246·5	447	452·5	641·3	671
,, ,, (mean) .	268·2		449·7		656·1	
Cooeff. of Performance $\frac{D^2_3 S^3}{I.H.P.}$	183		146·1		133	

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