THE DE BAY PROPELLER.

Since the first introduction of the screw propeller, innumerable modifications of the original idea have been made, yet it is admitted that with the propellers in ordinary use, the full efficiency is not utilized. Among mechanical appliances for motive force, none has been more closely studied than this, yet the results of these studies have not been as satisfactory. When the De Bay system, which it is the purpose of this article to describe, was devised, it was so great a departure from custom and theory that few believed any great advantage would result. The system has gradually developed, however, from theory to experiment, from experiment to practice, and now even such an authority as *Iron* is forced to admit that the results of practice, as far as they have gone, stamp the invention as an important practical advance in screw propulsion.

The invention dates back no further than 1876. In that year Mr. De Bay took out a patent for a new form of propeller by means of which he designed to obviate the loss of power caused in the action of ordinary screws by the tangential current thrown off by them. This his invention claims to effect by the employment of two screws working in opposite direction, the blades of each screw having portions cut away to permit of the projections on those of the other screw passing through them. Our engraving which represents the propeller as fitted to the s.s. *Cora Maria*, illustrates the manner in which this is effected. The currents set in motion by the one screw are met by those produced by the other, the result being that the whole body of water is thrust directly astern in a line with the axis of the ship. The different motions to be imparted to the two screws must, in all cases where duplicate engines are not provided, necessitate the use of gearing; and against the prejudice that has so strongly prevailed to the employment of such an arrangement on board ship Mr. De Bay has had to struggle for some years. When he first submitted his invention to the notice of leading marine engineers and scientists, he was met not only by the objection to gearing of any description, but also by opposition on the ground taken by most of them, whose views were that the propeller itself was so weak that it would not bear any rough usage, such as it would be sure to meet with in a sea-voyage. He was also told that, granting its immunity from such dangers, it would be almost certain to be fouled by anything floating with which it might come in contact.

There were, however, a few less prejudiced persons who looked upon the invention with more favorable eyes, and in 1878 the company which had been formed for its development resolved upon having a series of trials made with the steam-launch *Eagle*, which was fitted with the propeller, and they entrusted the experiments to Mr. Folkard, M. Inst. C. E. The results reported by that gentleman induced the directors to try further experiments on a larger scale, and a screw collier, the *Elaine*, of about 600 tons burden, was fitted with the De Bay propeller, and made a successful run through rough weather from the north of England to the Thames. On her arrival there, however, it was found that the gearing had been so badly made that it was impossible to continue to drive the propeller with it.

The directors then had a series of trials of models conducted by independent and disinterested experts, in order to test the power of the De Bay propeller against that of the best known form of the ordinary screw. The result of these experiments showed a gain of 40% obtained by comparison with a model of the Griffith screw as fitted to the *Lord Warden*. So encouraging was this result that the steam yacht, *Iolair*, of 40.37 tons and 20-horse power, was hired and fitted with the De Bay propeller and improved gearing. The results of the trials conducted by Mr. Folkard as the company's consulting engineer showed a superiority over the ordinary screw equivalent to a saving of nearly 30.5% in coal consumption. It was then decided to give the propeller the crucial test of a long ocean voyage in a large ship, and the *Cora Maria* was selected for the purpose. Her length is 235 ft.; main breadth, 31 ft, and depth 18 ft. 3 inches. She is fitted with two compound, inverted, direct-action, surface-condensing engines. The cylinders are 28 inches and 54 inches in diameter respectively, with a length of stroke of 3 ft., her power nominal being 110 horse power; her tonnage, net register, is 831 tons; displacement on 18-ft. mean draft, 2,800 tons; her ordinary screw had a diameter of 13 ft. 2½ inches, and a mean pitch of 19 ft. 6 inches; her De Bay propeller has a diameter of 11 ft., and a mean pitch of 18 ft.

A series of trial-runs was made with her at Cardiff last autumn, in order to obtain data as to her speed with the ordinary screw with which she was then fitted. These trials having been concluded, she was fitted with the De Bay propeller, as is illustrated in our engraving. The trials which followed gave very remarkable results, as will be seen from the following comparative statement, which we extract from Mr. Folkard's report:—

Four runs over course of 21-fifth miles, two with tide and two against. (Force of wind two to four.) Sea calm. The figures in the first column show the results of a trial made on the 10th of July, 1880, with the ordinary screw; and those in the second column the result of a trial made on the 10th of August, 1880, with the De Bay Propeller. Force of wind, three.

Total revolutions on 4 runs	4,279	3,314
Average do. per minute	66.72	65
	lbs.	lbs.
Steam pressure (average on 4 runs)	74.7	74.5
Vacuum do	25.58	24.25
Indicated horse power...do	584.51	585
Time	Min. Sec	Min. Sec.
1st run, with tide	12 5	9 4
2nd " against	20 27	16 42
3rd " with	12 3	9 6
4th " against	19 56	16 10
Speed	Knots per hour.	Knots per hour.
1st run	10.924	14.5
2nd "	6.450	7.9
3rd "	10.904	14.5
4th "	6.630	8.1
Turning the circle	lbs.	lbs.
Steam pressure	72	69
Vacuum	25	24.5
Revolutions	64	61.5
Time	Min. Sec.	Min. Sec.
To port	4 44	4 33
To starboard	6 51	5 4

Almost immediately after her trials with the De Bay propeller, the *Cora Maria* left for Alexandria and the Danube—Mr. Hiscock accompanying her as the engineer nominated by the company to watch and report on the working of the propeller and gearing during the voyage. The gearing with which she was then fitted, and which had been designed by Mr. Hiscock, failed to give satisfaction—not, however, from defect in design, but from faults arising from too hasty construction.

During the voyage to Alexandria, with 1,700 tons of cargo, thence light to the Danube, and home with a heavy freight of grain, that gentleman reports the propeller never to have caused him any trouble, and the saving of fuel he was able to compute, fully bore out the results obtained at the trials at Cardiff. The form of gearing adopted was considered to have proved itself unreliable; and Mr. Hiscock, on his return, designed a set of mitre-toothed gearing. The under shaft, which is of steel, and carries one of the screws, is a continuation of the main shaft, though of less diameter; and it passes through the hollow shaft of phosphor bronze carrying the other screw. The first-motion wheel is keyed on to the main shaft, and transmits a reverse motion to the third-motion wheel on the hollow shaft through the intermediary or second-motion wheel.

All these wheels, which were of three ft. six inches diameter, were cast of crucible steel; and all their bearings were upon a solid cast bed-plate firmly seated on the frames of the ship.

With this improved gearing the *Cora Maria* was fitted when she returned from her second voyage to Bremerhaven and back, on which the propeller was tested severely by meeting in the northern seas with the most tempestuous weather Captain Cawley, her commander, had ever experienced. Taking on board, at Cardiff, a cargo of coal of over 1,700 tons, the *Cora Maria* left that port for the Thames on the 6th of last month, and met on her journey up channel with the heavy storms which raged on the 7th and 8th of that month. Although considerably injured in her upper works by the force of the sea, the ship made a good run round to the Thames, beating all the steamers which started with her. A few days after her arrival, a large party of engineers and gentlemen connected with the shipping interest were present on board to observe the behavior of the propeller during a run from Gravesend to the Maplin and back. On this occasion the verdict was that there was a total absence of the vibration caused by ordinary screws, no stern wave or wash was perceptible, and the motion more resembled that of a sailing ship than that of a screw-steamer. The vessel's speed, as far as it could be tried in a heavy tideway and shallow water, fully bore out the results of the Cardiff trials.

The report of their consulting engineer has satisfied the directors that the De Bay Propeller Co. that owing to the success of the new gearing they have no further difficulties to overcome. During the trial on the Thames just referred to, although almost new and severely tried by the passage from Cardiff, it worked smoothly and without a sign of heated bearings. The owners of the *Cora Maria* are now so satisfied of the advantages of the De Bay propeller that they are taking steps to have it fitted to other vessels of their fleet. As further experience demonstrates the advantages and reliability of the system, we may expect that an invention which claims to have saved—as in the case of the *Cora Maria*—nearly 50% of fuel (even if that instance should prove to be exceptionally favorable) must sooner or later be widely adopted. The gain to commerce with such conditions will be so apparent to our readers that we need give no figures to illustrate it, and, after running nearly 12,000 miles of ocean journey without the least mishap, Mr. De Bay has fully removed the grounds for the fears expressed as to the weakness of his propeller.—*Mining and Scientific Press.*

The first iron bridge built in Idaho has just been completed across Snake river at Blackfoot. It is composed of five spans, each 100 ft. in length, while on the east side is about 60 ft. of approach built of timber, and on the west side about 25 ft., making the entire bridge 585 ft. in length. There are six piers or cribs, which are built of heavy timbers 12 inches square and filled with rock, over 100 cords of rock being used for that purpose, the weight of the cribs being estimated at 75 to 125 tons each, besides the weight of the bridge.

Endowment of Scientific Research.—At the recent anniversary meeting of the Royal Astronomical Society of London, in addition to the ordinary business, a resolution was carried by a large majority to the effect that a general meeting should be held within two months, to take into consideration the question of the endowment of scientific research, and to express the feeling of the society on the subject.

Bleaching Albumen by Means of Electric Light.—The albumen, from which the bood corpuscles have been entirely removed, is subjected to the action of an electric light, the rays of which are properly collected by means of lenses, etc., and will be bleached within 24 hours. The albumen may be in a dry or fluid state.

Electric Lighthouses.—The French government proposes to employ the electric light in 42 lighthouses along the coast, where oil has till now been used. Up to the present time there are but seven electric lighthouses in the whole world, three of which belong to France.