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AN ACCOUNT OF THE CHINESE NAVAL ARSENAL AT
FOO-CHOW: TRANSLATED AND ABRIDGED FROM M.
GIQUEL'S PAMPHLET.¹

By Commander CYPRIAN BRIDGE, R.N.

DURING my service in China, I have had the good fortune of making the acquaintance of Lieutenant Giquel, of the French navy, whose name is pre-eminently distinguished amongst those of the group of able French Naval Officers who have lately exercised an important influence on the course of affairs in more than one ancient State in the far East. With his permission, I make use of an account published by him of the arsenal at Foo-Chow, and of the work done there. The importance of this establishment, and the results achieved in a very few years, are too striking to render necessary any apology for bringing them to the knowledge of the members of the Royal United Service Institution.

Object of the Arsenal.

The arsenal of Foo-Chow is not, as this designation might seem to imply, an establishment intended for the manufacture of arms and munitions of war. It is a collection of building-slips and workshops designed for the construction of ships, and having annexed a factory built for the rolling of iron in bars and sheets. The object in view in establishing it has been to furnish the Chinese with ships of war and transports, to instruct them in the methods of building and managing these vessels, and to take advantage of the metallic wealth, notably that of iron, possessed by the province of Fohtsien.

Reasons for Selecting the Port of Foo-Chow.

The harbour can be easily defended, as the entrance of the Min River is studded with islets and elevations well adapted to the reception of forts, and, some ten miles higher up, the hills along which it runs contract its course sufficiently for the laying down of a few torpedoes to render its passage absolutely impossible. The anchorage, quite accessible to vessels with a draught of water of 22 to 23 feet, was found to suffice for ships of the dimensions which it was decided to construct, and they could be moored alongside the frontage of the arsenal at the quays, which was necessary to facilitate the work of construction. Beforehand it was known that the province would

¹ "L'Arsenal de Fou-tchéou, ses résultats." Par Prosper Giquel, Lieutenant de Vaisseau, Directeur. Shanghai: 1874.

furnish iron, piles for the foundations of the workshops, that the coal of Formosa was not far off, and that manual labour was cheap.

Negotiations relative to the Establishment of the Arsenal.

M. Giquel had made the acquaintance of a distinguished Mandarin, his Excellency the Viceroy Tso-Tsong-Tang, when at the head of a Franco-Chinese corps, he had been engaged, in company with the troops under his Excellency's command, against the rebels in the province of Che-Kiang. On the conclusion of the campaign, at the end of 1864, the Viceroy had requested him to furnish a plan for the construction of a naval arsenal. The one submitted was not definitely approved of till the end of 1866, when the contracts between M. Giquel and the Chinese Government were signed.

Programme of Foundation.

The programme drawn up was as follows:—

1. Establishment of workshops and slips suitable for the construction of ships and their engines.
2. Establishment of schools for the education of leading men in the constructor's department, of captains, and of engineers for the ships.
3. Engagement of a sufficient number of Europeans to conduct the works and to instruct the Chinese.
4. Laying down of a patent slip, on Labat's system, similar to that at work at Bordeaux, for the repair of vessels.
5. Establishment of an iron-foundry for rolling bars and sheets out of the pigs of rough iron furnished by the province, and the old iron that can be procured in China.

Beginning of the Works.

At the beginning of 1867, some preliminary works, such as the quarters for the *personnel* and the storehouses, were taken in hand; but it was only in the month of October in the same year, on the return of M. Giquel from a voyage to France to collect the necessary *matériel* and the staff, that the works of the arsenal, properly called, made a real start. The residents of Foo-Chow still remember the surprise and doubt experienced by them when they saw the bare paddy-fields upon which the works had to be erected. None of the plant purchased in France had arrived; the founders of the undertaking were at a port without resources in the shape of machinery and European implements. However, it was necessary to set to work; a small square hut, the only one on the ground, served as a smithy; in it were built two forges, and from them were turned out the first nails. With native carpenters, pile-drivers were constructed for driving the piles, and the laying down of a slip was proceeded with, on which, three months afterwards, the director—with appropriate solemnities—laid the keel of a transport. During this time, the embanking was vigorously pushed on by means of 1,200 men; for it was necessary to raise the ground five feet to elevate it above the highest rising of the river; and as the very natural impatience of the Chinese had to be

allayed when they wished to see results without delay, the construction of a series of wooden workshops was begun, in which were placed a part of the machines and tools as they arrived from France. These workshops still exist, and the arsenal presents the somewhat common spectacle in new establishments abroad, of buildings run up in haste standing beside permanent structures built with a perfect luxury of materials and workmanship.

Workshops and Building Works.

The following is a list of the shops, factories, &c. :—

The *Iron-works* (*usine métallurgique*), in which are the buildings for the large forges and rolling-mills, include a space of 5,011 square yards. The large forges are provided with six steam-hammers, one single-action hammer, with a power of 138 cwt., made at the arsenal, one double-action Farcot hammer; the remaining four are single-action and smaller. There are sixteen fires for heavy jobs and six reheating furnaces. This factory has up to the present (February, 1874) turned out the forgings for nine marine engines of 150 horse-power, including the shafts and cranks. There have also been forged the large pieces, such as bower anchors of 27 cwt. and boats' davits, required as ships' fittings.

The *Rolling mill* (*atelier des laminoirs*) has six furnaces and four apparatus—one for sheet-iron, one for stout iron and angle-iron, one for small sizes, and the fourth for copper. They are worked by an engine of 100 horse-power. They can, working day and night, turn out 3,000 tons of plate iron a year.

The *Metal mill*, or coppersmith's shop (*chaudronnerie*), has one engine of 15 horse-power. Besides the current work of the arsenal, setting-up boilers sent out from Europe, fitting ships, &c., this shop has completed fourteen boilers, of four and five furnaces, intended for engines of 150 horse-power, with the necessary tubes.

The *Fitting shop* (*ajustage*) employs an engine of 30 horse-power. It can turn out machinery to the extent of 500 horse-power a year. It has actually turned out seven marine engines of 150 horse-power, and two others are in a forward state.

The *Setting-up shop* (*montage*) occupies a space of 950 square yards.

The *Foundry* (*fonderie*) has three smelting furnaces, capable of casting pieces of fifteen tons. It has turned out an average of twelve to fifteen tons of castings a week, such as cylinders, condensers, &c., for engines of 150 horse-power.

The *Chronometer shop* (*chronometrie*) is divided into three sections, one for the manufacture of chronometers, one for that of optical instruments, and a third for that of compasses.

The *Smithy* (*petites forges*) has forty-four forges and three steam-hammers.

The *Locksmith's shop* (*serrurerie*) occupies a space of about 600 square yards.

There are also a *Steam saw-mill*, a *Pattern shop*, and a *Joiner's shop*.

There are three *Building slips*, with sheds on both sides, and a large *mould loft*, in which the lines of ships can be traced the full size.

Masting sheers, able to lift weights of forty tons, and a *patent slip*, on Labat's system, complete the plant necessary for naval construction; the latter can haul up ships of over 300 feet length of keel, and 2,500 tons displacement. The ships on it are hauled up "broadside on."

In addition to the above, there are *Stores, Schools, and Quarters* for the staff of the establishment, both European and Chinese.

The total extent of the ground occupied by the arsenal is 117 acres.

There are three French schools—the *School of naval architecture*, the *Drawing school*, and the *Schools for apprentices*. There are also three English schools—the *Naval school*, in which mathematics and the theory of navigation, &c., are taught; the *Seamanship school*, on board the training-ship, *Kien-wei*, and the *Engineering school*.

In the latter schools, M. Giquel has had the assistance of some of our countrymen, Captain R. E. Tracey having been placed in charge of the training-ship, a post in which he has been succeeded by Captain P. P. Luxmoore, C.B.

The European staff consists of, at present, 52 persons. The native *employés* of this truly great establishment amount to 2,600 men.

During the astonishingly short time of seven years, M. Giquel has not only constructed an arsenal from its foundations, but he has actually built, and, in a great part, engined fifteen ships of war; one a corvette of 250 horse-power (450 I.H.P.). See accompanying list.

In a letter to me, dated August 29th, M. Giquel says:—"Instead of fifteen vessels, there are now eighteen launched; the three latter are similar to the one called *Foo-Po* [No. 4 in the list], and we have begun building composite vessels; two are at present under construction."

That M. Giquel has been able to do all this, in spite of the formidable difficulties in his way, is a remarkable proof of the energy and sagacity which he has brought to the direction of the important work he had undertaken. The very ground on which the arsenal is built had to be made. The soil of the site was alluvial, formed by a thick layer of solidified mud, covered with a coating of nearly liquid clay; a site about as unfavourable for a naval yard as could well be imagined. The freshets of the river obliged him to raise the level of the ground five feet above that of the original paddy field, on the unstable soil of which the works had to be established. He has succeeded wonderfully, and has not only placed the Chinese in possession of a valuable arsenal and a respectable squadron, but he has also taught many of them how to equip and manage the vessels which his ability has enabled them to construct.

List of Ships built at the Foo-chow Arsenal.

No.	Launched.	Name.	Class,	Displacement.	H.P.	I.H.P.	No. of guns.	Comple.
				Tons.				
1	June 10, 1869	" Wan-Nien-Teing "	Transport	1,450	150	150	6	100
2	December 6, 1869	" Mei-Yüne "	Gunboat	515- $\frac{100}{100}$	80	130	3	70
3	May 30, 1870	" Fou-Sing "	"	515- $\frac{100}{100}$	80	130	3	70
4	December 22, 1870	" Foo-Po "	Transport	1,258- $\frac{100}{100}$	150	150	5	100
5	June 18, 1871	" Ngan-Lan "	"	1,005- $\frac{100}{100}$	150	150	5	100
6	November 28, 1871	" Tcheun-Hao "	Gun-vessel	572- $\frac{100}{100}$	80	140	6	70
7	April 23, 1872	" Yang-on "	Corvette	1,393- $\frac{100}{100}$	250	450	13	200
8	June 3, 1872	" Fei-Yüne "	Transport	1,258- $\frac{100}{100}$	150	150	5	100
9	August 21, 1872	" Tsing-Yüan "	Gun-vessel	572- $\frac{100}{100}$	80	140	6	70
10	December 11, 1872	" Tcheun-Wei "	"	572- $\frac{100}{100}$	80	140	6	70
11	January 2, 1873	" Tsi-Ngan "	Transport	1,258- $\frac{100}{100}$	150	150	5	100
12	August 10, 1873	" Yong-Pao "	"	1,391- $\frac{100}{100}$	150	150	3	100
13	November 8, 1873	" Hae-King "	"	1,391- $\frac{100}{100}$	150	150	3	100
14	January 6, 1874	" Tchen-Hang "	"	1,391- $\frac{100}{100}$	150	150	3	100
15	End of February, 1874 ..	" No. 15 "	"	1,391- $\frac{100}{100}$	150	150	3	100

N.B.—Besides maintenance and repair of the training-ship and the steamers attached to the Arsenal.