Draft of paper for
XX International Reunion for The History of Nautical Science
Funchal, 15-17, November 2023
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The First Ship Launching by Cradle in Japan

Contents

Abstract

From the first half of the 17th-century to the middle of the 19th-century, the Government of Tokugawa Regime took a policy to isolate the country of Japan from foreign countries. So, as it was not required to navigate in ocean-going western style ship, The Japanese used, for domestic navigation, only traditional and unique Japanese type sailing ships, which bottoms were relatively flat and did not require any kind of launching by cradle.

The Russian frigate *Diana* was lost off shore of Izu Peninsular by reason of an earthquake and a big tsunami in 1854. In order to call for a ship from Russia to return rescued *Diana's* people to their home, one schooner was built on a shore of Heda Village of Izu Peninsular.

The ship was launched by a cradle first time in Japan, and she was given a name *Heda*.

In this paper it is tried to reconstruct the launching of the *Heda* by a cradle.

1. Introduction

The Government of The Tokugawa Regime prohibited to enter foreign peoples to Japan, except Chines, Korean, and Dutch those who had permission, and also prohibited all Japanese to go to foreign countries. It was generally considered that such policy, which may be called "Sakoku, or National Isolation", started when Portuguese ship was prohibited to enter into Japanese port in 1639 and ended when Japan concluded Treaty of Peace and Amity with United Sates of America.

In Japan where trading with Foreign countries was quite limited, European style sailing ship, whose technical basis of naval architecture Japan had never acquired, was never built during the period of the Sakoku.

Before the trading with overseas was prohibited, one kind of sailing ship called Mestizo Type (Fig.1) which was basically an oceangoing Chinese or Southeast Asian Jank, adapted some characteristics of European sailing ship was used. The name "Mestizo" was originated from Portuguese or Spanish word to indicate a person of mixed races of different origins. This type of ship disappeared by the Sakoku policy.

Fig.1 Painting of Mestizo Type *Arakisen* with the date of 1622, preserved in The Nagasaki City Museum

Even during the Sakoku period, domestic marine transportation flourished in Japan, as it is an island country. Ships used for the domestic navigation were uniquely developed only in Japan, which had no keel nor ribs and had low freeboard (Fig.2).

We can have an image of them with a length of 20-30meters, a width of 6-8 meters, and a tonnage of 100-150tons. This kind of ships relatively did not have much elements which could cause instability of hulls at launching in com-

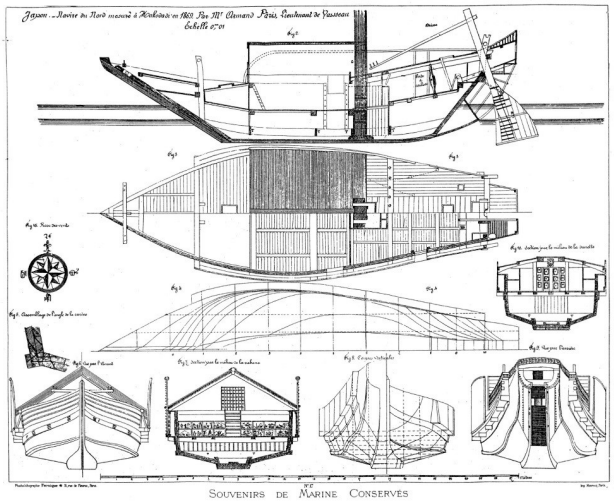

Fig.2 Japanese unique ship "Bezaisen", from "Paris' Souvenirs de Marine",1868

parison with western ships which have a keel and tall frames on it. The Japanese ships were constructed on planked ground and launched on some number of round timbers laid at right angles to the longitudinal direction of ship by means of pulling by workers without help of cradle. (Fig.3)

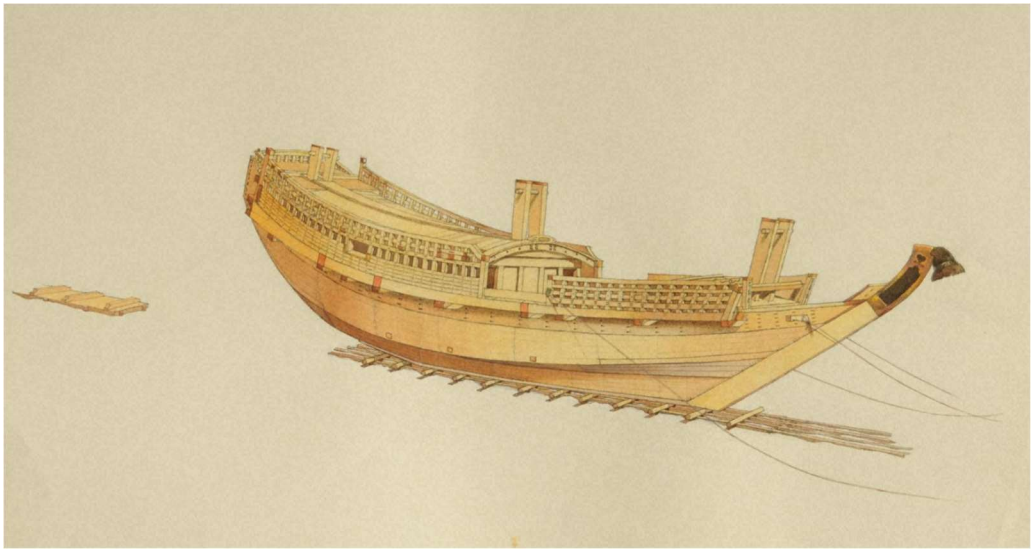

Fig.3 Drawing of Japanese ship being pulled for launching.
courtesy of The Museum of Maritime Science, Japan

2. Shipwreck of Russian Frigate *Diana*

Before Japan began the National Isolation, at least three western style sailing ship were built in Japan. Two of them were more or less 100 tons ships built by English William Adamus who drifted to Japan in Dutch ship *Liefde*. Another was galleon *San Juan Baptista* which was built under supervision of Spanish Sebastian Vizcaino and had more than 500 tons in order to dispatch Tsunenaga Hasekura with Vizcaino and Jesuits to Rome through Mexico and Spain.

However, these cases did not leave any meaningful evidence regarding construction and launching. We don't know if cradle was used or not.

After the middle of the 19th-century, when European and American warships appeared in Japanese waters, governors of The Tokugawa Regime and some feudal lords who felt threat from those large and strong ships tried to constructwestern style like ship, through trial and error in their own way, however, never was used cradle for launching.

Russian Admiral Jevfimij Putjatin, who came to Japan on board the frigate *Diana* of about 2000 tons in order to make a Treaty of Peace and Amity between Japan and Russia, began negotiation at Shimoda which is located at the end point of Izu Peninsular in 1854. Soon after beginning of the negotiation, a huge earthquake and tsunami occurred on 23 December, and the *Diana* was damaged and some mariners were lost and wounded. The negotiation was

suspended and for purpose of repairing, the *Diana* went towards Heda Village which is located at a root of west side of the peninsular. However, on the way to Heda Village she met a violent storm and sank in spite of Japanese effort of rescue.

The Treaty was signed finally and the two countries agreed that a new ship would be built at Heda Village in order to be sent to Russia for asking a larger ship to return the survived five hundred people to the mother country. From deposited drawings of ships in the *Diana*, one drawing of a schooner *Opuit* of approximately 100 tons was selected. Japanese shipwrights were called and they worked on a construction of a western style sailing ship for the first time under command of the Russians. After approximately one hundred days, the schooner was successfully launched, using a cradle and The Admiral Putjatin named her *Heda* in commemoration of the Heda Village and its people. The government of The Tokugawa Regime seized this opportunity to learn practically how to construct and launch western style ship and did not hesitate to cooperate the construction. The Tokugawa government and some feudal lords sent their officials and shipwrights to observe the construction of the *Heda*, and consequently ten sister ships were constructed and one simple drawing of them remained. Even though any official record nor report was not remained, some tentative drawings and memorandums regarding the *Heda* were preserved in the Heda Local Shipbuilding Data Museum and a good water-colored picture was preserved in the library of Toyo Bunko. Based on these documents and also one Russian report of an official of the *Diana*, this paper reports on the first ship launch by a cradle in Japan.

3. Important developments of launching of ship by cradle in Europe

In 1607, one picture of a cradle for galley with an Italian name "*letto*" appeared and was explained how to use this cradle for launching in a book titled "*Nautica Mediterranea* (1)" written in Italian language by Bartolomeo Crescentio and published in Rome.

A definite picture with explanation not for galley, but for carrack type ship, Portuguese *nau*, appeared nearly ten years after the *Nautica Mediterranea*. It was presented by Manuel Fernandes in his manuscript book "*Livro de Traças de Carpintaria* (2)", in which a cradle for the *nau* used for Indian Route was described and given a name "*vasadura*". This was an equipment made of many large wooden pieces, and it is hard to know how to use it practically.

In the history of the cradle, after the massive *vasadura* for the *nau,* a cradle which had a clear description appeared in so-called "*Album de Corbert* (3)" in 1670 in France. In its Planche 29, a warship is just being launched on a cradle whose dimension is comparatively smaller than the ship's size and names of every part of the cradle is given. Two pontoons, which are floating in front of the ship, and many men are pulling the cradle by ropes being passed through large pullies. Because of this pulling of the cradle, it is suggested that this launching is not a modern

free sliding launching. Bilgeways called "*angilles*" in this book played roll of sledges, and because there were no sliding planks under these bilgeways, they would go down directly passing on many balks laid on ground.

A cradle which had timbers to support hull like poppets and stopping-ups of modern cradle came into a picture of an unfinished manuscript "*Arte de Fabricar Reales* (4)" written by Antonio Gastañeta in ca.1688 in Spain. Though this picture was drawn from a relatively technical point of view, any specific name is not given to this equipment, however, a name "*charancha*" is given to poppet and lashing by ropes (called "*trinca*" in Spanish" rousture" in French), which was typical in French cradle, is shown. In explanation of launching, ledges (called "*basos*" in Spanish) and launching ways (called "*imadas*" in Spanish) are mentioned and those may remind us French free sliding in later days, however, capstans, windlasses, large pullies, and etc. which might be considered necessary for pulling a cradle were also mentioned for preparation of launching. These circumstances make us believe that the launching of the *Arte de Fabricar Reales* cannot be a modern free sliding.

Blaise Ollivier, French naval architect dismissed launching by pulling cradle's head and by pushing its sternpost at the same time as an old-fashioned style, and he recommended a free sliding to go down by ship's own weight, as a new style in his book "*Traité de Construction* (5)" written in ca. 1735. The free sliding begins immediately when stopping ropes are cut and triggers are removed. Ollivier distinguished *angille*, which had two meanings of bilgeway and of cradle before he did it, from cradle, and gave cradle a different name "*berceau*". And Ollivier determines the *angilles* as "they are two long wooden pieces and bases of *berceaus*, on which a ship is launched. Someone calls them *coites*, but the name of *angilles* is more common". And he determines that the *berceau* is a kind of sledge to launch a ship into water or also to land it, and the cradle (*berceau*)is composed of bilgeways(*angilles),* shores, vertical beams and cutlasses (note: Cutlasses are wooden pieces to be set on poppets to fit the cradle tightly to bottom of ship, having a shape of curved sword, cutlass.). Thanking to the bilgeways, the cradle could slide freely on the timbers laid at right angles to the length direction of ship without being caught by their edges.

In the second half of the 18th-century, the English cradle and the French cradle had own characteristics respectively. Swedish naval architect Frederik Henrik af Chapman shows these two cradles and Dutch manner of launch without cradle, highlighting their differences in his "*Architectura Navalis Mercatoria* (6)" published in 1768 (Fig.4). One conspicuous characteristic of the English cradle is spars bolted to ship's hull, and that of the French is lashings of ropes. The Dutch way of launch without cradle was adapted by French shipbuilders of private dockyards in 19th-century, because of its cost saving method, and also was praised in English books of naval architecture in those days.

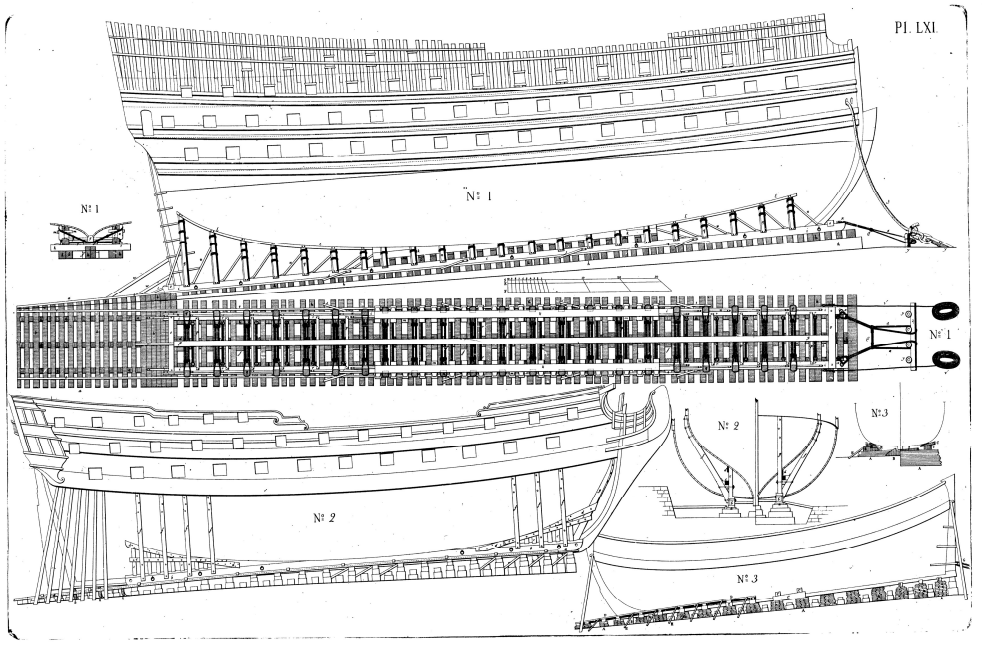

Fig.4 Launching ways of three countries from Chapman's *Architectura Navalis Mercatoria*, 1768

In the 19th-century, the English cradle lost spars and got poppets and stopping-ups similar to the French cradle, but not having lashings on. The improved English cradle was presented in David Steel's "*The Elements of Naval Architecture*(7)" published in 1805 in England. Under soles of bilgeways, sliding planks to facilitate free sliding are shown. In many English books of the 19th-century regarding to shipbuilding which contain pictures of cradle, James Peake's "*Rudiments of Naval Architecture* (8)" published in 1859 shows us a sketch of a typical cradle of that period (Fig.5). In the almost same period of the publication of this book, the *Heda* was launched by a cradle for the first time in Japan.

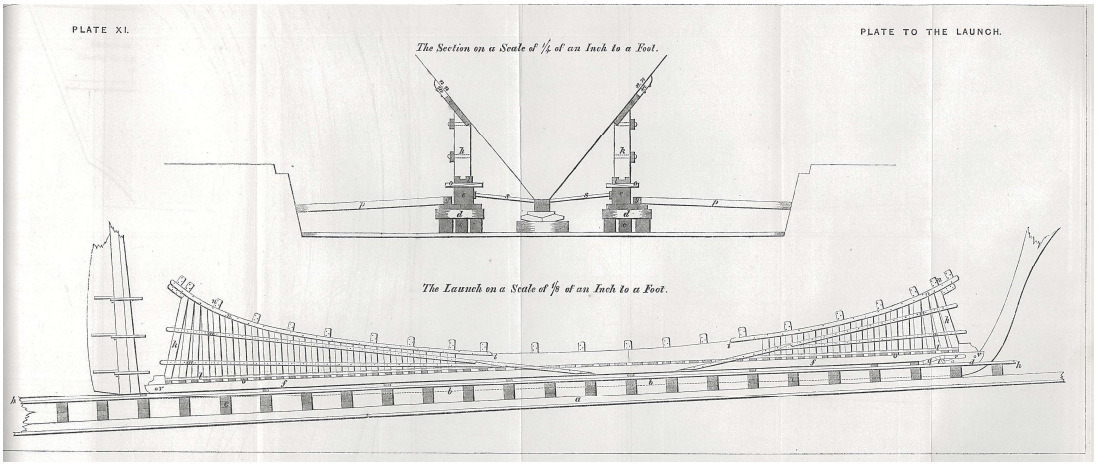

Fig.5 Sketch of a cradle from "*Rudiments of Naval Architecture*", 1859

4. The first launching of ship by a cradle in Japan: Launching of the *Heda* in 1855

1) Historical materials relating to the launching of the *Heda*

Fig.6 The Roll of the Construction of Russian Warship *Heda* at the Heda Inlet.
The roll starts from①,and continues to②and③, always moving the right side to the left side of each picture. Courtesy of Toyo Bunko for Fig.6 and Fig,11

The most important material to reconstruct launching of the *Heda* is a roll shape document which presents some members of the *Diana*, a scene of launching of the *Heda*, the *Heda* herself in sailing, Admiral Putjatin with his officers, and Russian flags (Fig.6). This roll was painted in water color by Magodayu, Kishi in ca.1856, and has the name of "The Roll of the Construction of Russian Warship *Heda* at the Heda Inlet" (9) and is preserved in Toyo Bunko. It is known that Kishi copied original pictures which were lost.

In the depiction of the scene of the launching of the *Heda* , we observe some exaggerations, mistakes, and impossibilities, however, we cannot identify if they had already existed in the original picture(s) or were caused in copying process.

In Heda Village, Numazu City, Shizuoka Prefecture, The Heda Local Shipbuilding Data Museum (hereinafter called "The Museum") was built for commemoration of the construction of the *Heda*, and it displays drawings and models of the *Heda*. Two memorandums written by shipwright Touzou Ishihara who filled an important role in the construction of the *Heda* are preserved in a storehouse of the Museum. They have not so much difference, and I have used the one whose cover has the title "U, Shougatu, Ansei 2nd (note: The date of this month and the year in the Japanese Calendar corresponds to February, 1855 of Gregorian Calendar.), Daiku (note: Daiku means Carpenter.) Touzou (10)" (Thereafter is called "Memorandum of Touzou".) (Fig.7, photographed by the author) for the purpose of the reconstruction of a cradle and standing ways for launching of the *Heda*. The

Japanese word “Sukuneru” is a Phonetical imitation of “schooner”, and “sen” means “ship”.

There is one 1:10 scale drawing of arrangement of frames of the *Heda* with stocks under her keel [11] which might be drawn by Touzou, in The Museum (Fig. 8) The drawing was taken photo, and from the photo, a side view of the stocks was sketched by the author.

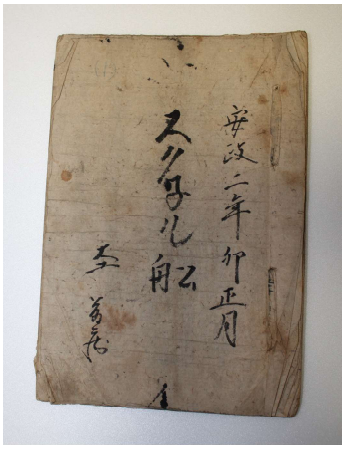

Fig.7, The cover of the Memorandum of Touzou

Finally, drawings of the *Heda* herself was needed. The Tokugawa government constructed ten sister ships of the *Heda* in order to master technic for building western style sailing ships and this prototype was named “Kimisawa (or Kuntaku) Type”. This naming came from the name of the county to which Heda Village belonged. A drawing of the Kimisawa Type (hereinafter called “Drawing of Kimisawa Type”) exists in “History of Japanese modern shipbuilding, and Attatched drawings [12]” edited and published by The Shipbuilder’s Association of Japan, in1911.

As the Drawing of Kimisawa Type must have been derived from the drawing of the *Heda*, this Drawing can be used for the reconstruction of the cradle instead of drawing of the *Heda*. The Drawing of Kimisawa Type is very convenient, because three views of the ship of this Drawing are drawn in one paper (Fig.9)

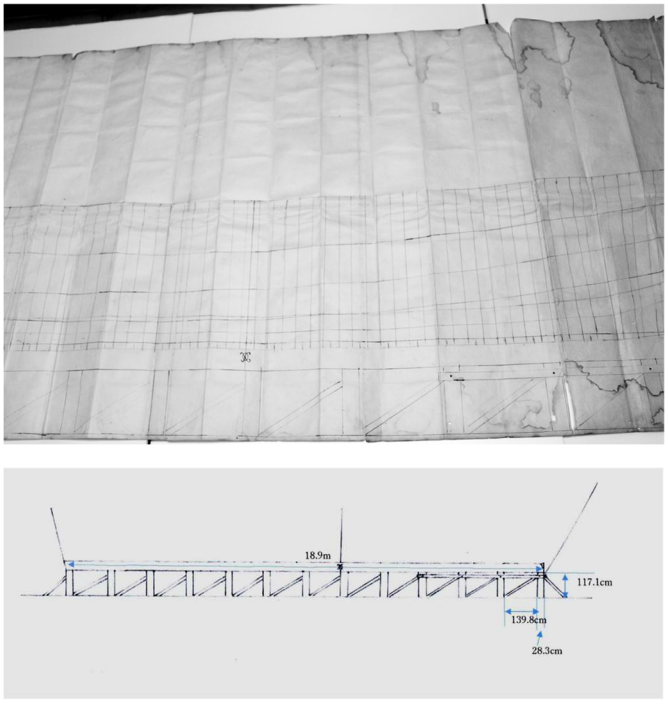

Fig.8, Photo of the Touzou’s drawing (1/10), courtesy of the Museum
the sketch of the stocks drafted by the author

Furthermore, main measurements of the Kimisawa Type (or the *Heda*) are described as follows (The original numbers given in Japanese measurement system are converted to the numbers in the metric system):

-the length of the ship: 24m61cm,
-the length of the keel: 18m96cm,
-the maximum width: 7m04cm,
-the depth: 3m,

-the length between the centers of two frames: 53cm in the middle,
-the length between the centers of two frames: 39.4cm in the bow and in the poop,
-the length between the centers of two beams: from 61cm to 137cm.

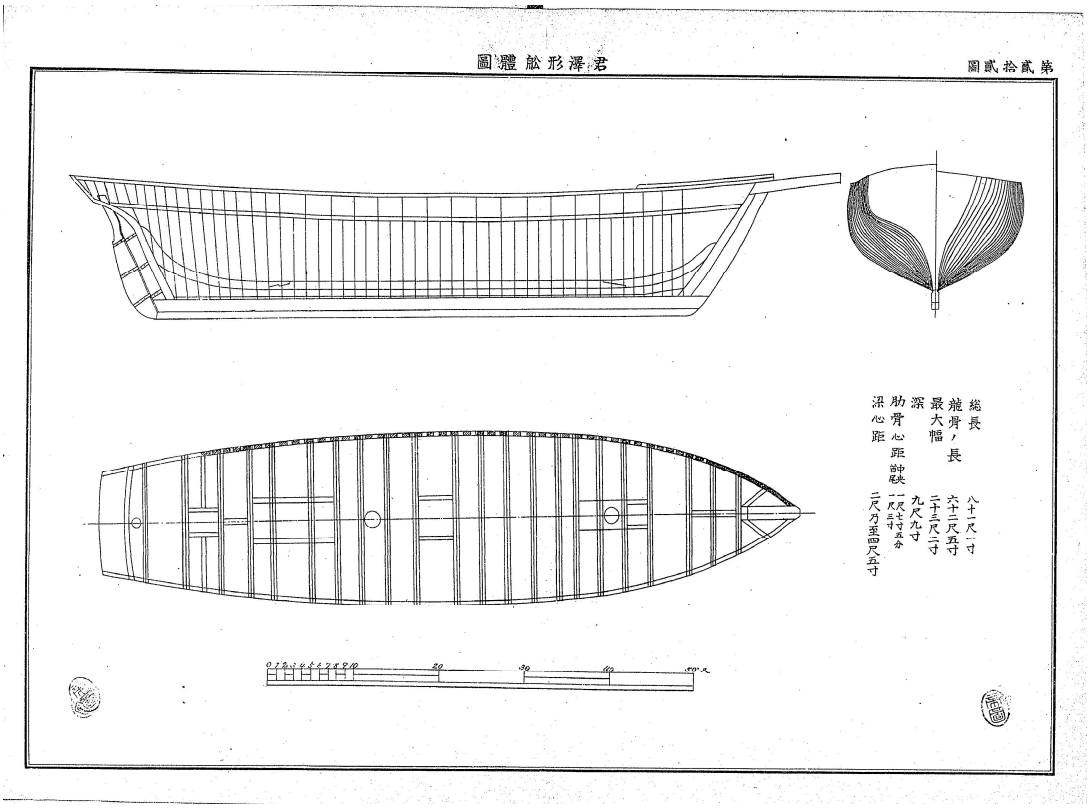

Fig.9 Drawing of the Kimisawa Type (public domain)

2) Report of the Captain Corocolitzoff

Alongside with the Japanese documents, as Russian document, a report which Russian Captain Alexandre Corocolitzoff of the *Diana* left make us imagine vividly the launching of the *Heda*. From a translation of the report written in Russian language to Japanese by Noritaka Kitazawa, a part related to the launching is extracted as follows:

> "Along with completing the construction of the schooner, Japanese increased interest how we would launch her. Though they could not imagine how it would be done, also it was sure for them that it could not be adopted a Japanese way of sliding ships on round timbers (note; see Fig.3). For launching, in accordance with our advice, they prepared sliding bed (or sledge on which ship was laid), and ways of two lines of square timbers on ground, and a frame in length of 9.1meters. This frame was helpful to extend the sliding ways to water of 3.6meters depth. However, Japanese could not understand totally what would happen by these preparations. (note; the length translated to English foot are converted to metric one.)

Therefore, when we began to explain to Japanese how to set the schooner on the sledge, and why the schooner would take only some minutes to reach at water, they burst out laughing innocently. ----

We made effort to inform them all things as many as possible what had to be done until launching of the schooner, handing over drawings, sails, riggings, and all articles to Japanese.

Though they thanked us for all these, they pleaded us to complete launching the schooner before our leaving for our home (note; There were chances to ask other foreign ships to let them on board.). To their entreaty, the Admiral answered that if they could set the schooner on the sledge until our departure, we could launch her. --- On 14th, April the schooner launched. All the Russian people who were staying in Japan would not forget this day forever.

All the Japanese officers who were in the Village gathered on board of the schooner from the morning.

But the Japanese people who did not believe to launch her in this way could not make up their mind to fabricate a block of cradle and remained an audience as those who had never seen preparation of a block of cradle.

Therefore, all the preparation of the launching was done by ourselves and I could perceive their guilty feelings by an atmosphere. To see this preparation, Japanese expected to happen something mysterious. If it occurred, unfortunately for us, that the schooner did not go down the ways, we would lose totally our prestige as naval architects right in front of them. ----

As soon as a high tide arrived, the first order was given and we began to remove shores by knocking them. Japanese, who were terrified and in doubt what would go to happen, withdrew themselves farther from the schooner. Afterward, when we cut stopping ropes and moved a long lever lightly, the schooner went down on the sliding ways slowly at first, and gradually speeded up under cheers of the mariners a board all at once. Finally, the schooner entered into water and began to sway relaxedly. [13]"

Fig.10, One scene of the Roll (Fig.6) which shows a scene of the launching of the *Heda*.

3) Description on slipways in the Memorandum of Touzou

At the beginning of the Memorandum of Touzou, a slipways is described as follows (Measurements originally given in Japanese Shaku are converted to Metric one.) :

> "The site has an inclination of 1.8cm for every 30.3cm and tamped down and has a length of 24.2m and a width of 10.9m, making an area of 234.7 m^2(*sic*). In this site, fifteen pine or cedar timbers of 30.3cm square with a length of 7.58m are laid vertically to the length direction of the site. Between the timbers, sand and pebbles are put and well tamped down. On the sand and pebbles, cedar planks of a thickness of 10.6cm are fitted in, and on the middle of these planks, other planks of a width of 48.5cm and a thickness of 21.2cm are nailed. On the latter planks, thirteen wooden trapezoid shape pieces are set (note; these thirteen pieces are keel-blocks). (note; an explanation on the scaffolds for the construction of the ship, which consist of twelve long pillars and twelves short pillars, is given is omitted.) These trapezoid pieces have a length of 60.6cm at their heads, a thickness of 25.5cm, and a length of 121.2cm at their bases. The trapezoid pieces are set up, mortising into holes of 9.7cm depth cut on the cedar planks so as to bear the keel. The keel has a length of 18.9m, a thickness of 25.5cm, and a height of 43cm (note; this height seems to include a false keel). "

The reconstructed slipways is shown in Fig.12, utilizing the Drawing of Kimisawa Type. By reason of this utilization of the Drawing, the keel, which actually has an inclination of 6/100 with the ground, appears horizontal with the ground in the Drawing. Only five square timbers, three under the stem and two under the poop, are drawn of the actual fifteen ones, omitting other ten. The timbers of the scaffolds are omitted also, and with regard to the shores, only four are drawn under and side of the hull in the sectional view.

Fig.12,13, 14, 15, 16, and17 are drawn by the author.

In the case of the *Heda*, each keel stock was made of one wooden trapezoid shape piece, not being made of some layered square pieces. And it is seemed that these pieces were inserted in narrow and shallow holes made in the cedar planks put on the sand and pebbles and supported by short shores, in order to knock down them easily at the time of the launching (Fig13).

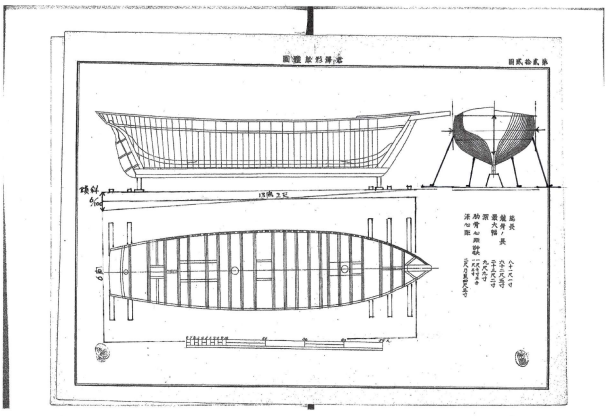

Fig.12 The site with slipways and shores

It seemed that the keel stocks did not have differences of heights between them according to Fig.8, because the slipways itself had the slope of 6/100, which was sufficient for a schooner of about 100tons to slide down freely.

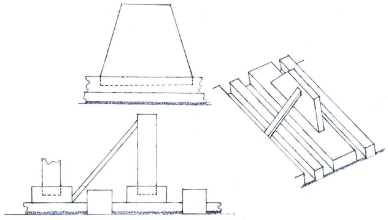

Fig.13 Keel stock

4) Preparation and assembling of the sliding ways and the cradle

In the above report, the Captain Corocolitzoff mentions the “ways of two lines of square timbers on ground“. These ways can be interpreted as sliding ways. Being based on that he says two lines of square timbers, and being based on the depiction of the Roll, one line of these sliding ways is not composed of some layered planks, but consists of one square timber.

As these sliding ways of two lines end at water’s edge, “a frame in length of 9.1meters” is set at the edge in order to have the schooner smoothly go into the water of the depth of 3.6m. A part of an assumed structure of the sliding ways is reconstructed in Fig.14, with a shape as much resemble as possible to the depiction of the Roll. Also, a part of an assumed structure of the bilgeways (or the base part of the cradle) is reconstructed in the same way in Fig.15.

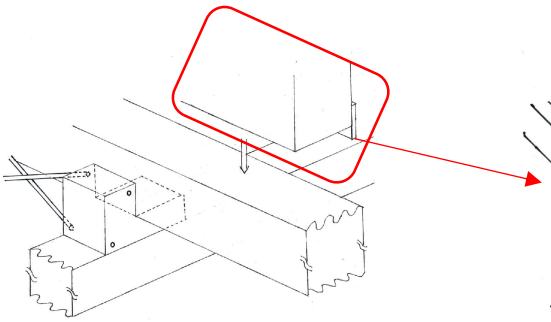

Fig.14 Structure of the sliding ways

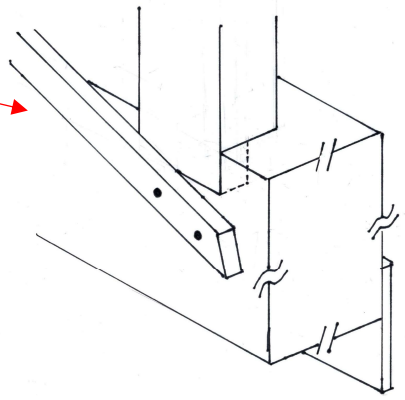

Fig.15 Structure of the bilgeways

An assumed sectional view of the cradle bearing the hull of the *Heda* and being laid on the sliding ways is depicted in Fig.16.

A side view of the cradle and the hull is shown in Fig.17.

One (or two) dog shores, which would detain the cradle and be freed by a trigger (Corocolitzoff calls it “long lever”.) until the launching, had to be put, however, it does not appear in the Roll. The cradle of 19th century may be defined as an integrated object of bilgeways, poppets, stopping-ups, and dagger planks for them.

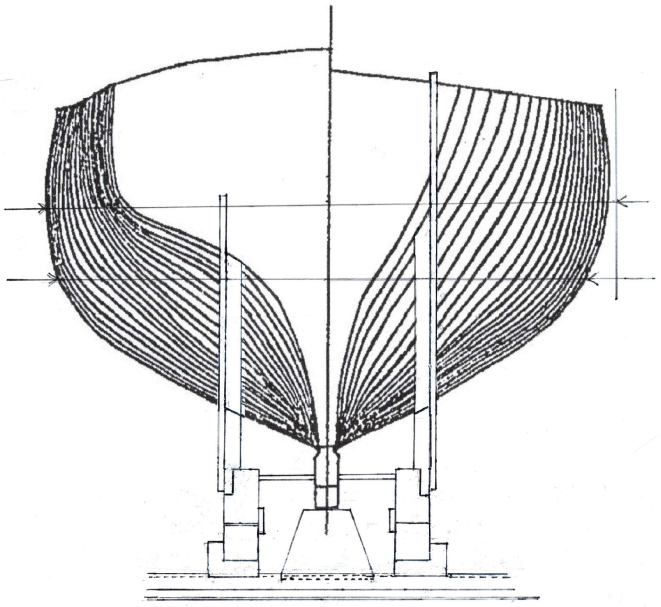

Fig.16 Sectional view of the hull, the cradle, the sliding ways, and the keel stocks

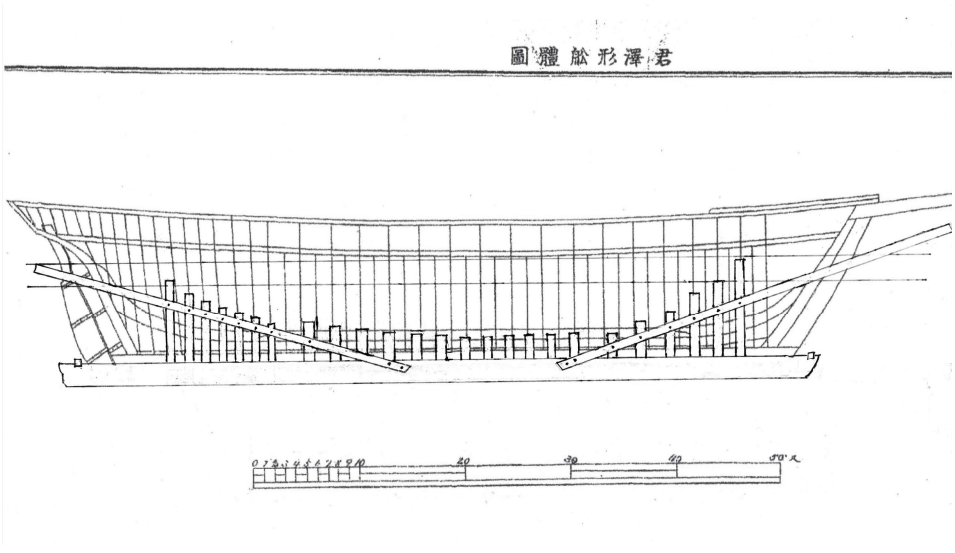

Fig. 17 Side view of the hull and the cradle

When these parts are prepared, the sliding ways are fixed on the "L" shaped pieces of timbers fastened to the surfaces of the slipways, being careful not to knock down the shores and the keel stocks. Nextly, the bilgeways are put on the sliding ways tentatively, and the pillars of the poppets and the stopping-ups are put in the holes made on the upper sides of the sliding ways also tentatively. Then heights and shapes of heads of the pillars are adjusted to fit the bottom of the hull not to have gaps and after the adjustment, the bilgeways are removed once more carefully from the sliding ways. On each face which touches with each other of these separated ways, grease and oil (in the case of the *Heda*, oil of turtle was applied) are spread so as to slide well. To get the cradle in its final position, all parts are newly assembled and put the dagger planks outsides, lashing firmly their both ends of the poop side and the stern side so as to press tightly the cradle to the ship. In order to prevent spreading out the cradle while it is sliding down, one square timber is secured to the front head and another to the aft head of the bilgeways. Ropes, whose one end is on board, are bound to the timber of the front head for recovering the cradle which will be separated from the ship after the launching. Some short shores are put horizontally between the bilgeways and the keel in order not to make the bilgeways get closer to the keel.

Three thick round timbers are put on gunwales, crossing deck, and the cradle is suspended by ropes hanged from these timbers. The frame, which has been prepared already, is settled at water edges to extend the sliding ways into water, and the two stopping ropes in two lines are bound to the heads of the bilgeways at one end, and are bound to two columns standing apart far from the water edge at another end.

5) Launching of the *Heda*

Now all preparations for the launching were ready, and just at the time of the high tide on April 26, 1855, by an order to start the launch, the stocks were knocked down by sticks beginning from the bow side one by one, simultaneously the horizontal short shores between the keel and the bilgeways were removed. Then, the shores which supported the ship were knocked down, and all weight of the ship, through the poppets and stopping-ups, transferred to the bilgeways and the sliding ways bore the whole weight of the ship and the cradle, only the stopping ropes and the dog-shore were preventing sliding down of the ship and the cradle. All the Japanese who were around the ship stepped back, fearing the ship fell down without the shores.

Then the Russians cut the stopping ropes at once and removed the triggers of the dog-shore, and the cradle with the ship began to slide down the sliding ways and entered into water.

Some of the Russian mariners who were on board began to dance for joy.

The most unrealistic depiction of the Roll is that the stopping ropes, which must have a

certain length before the cut, have their very short remained parts both on the cradle and on the columns now in the Roll. Where are cut ropes between the remained parts?

After the success of the construction of the *Heda*, Japanese constructed ten her sister ships, that is the Kimisawa Type and took one step closer to master construction and launching of western style sailing ships.

Two years after the launching of the *Heda*, "*Kaiseimaru*", a schooner different from the Kimisawa Type was constructed and launched by a cradle in Sendai, and one book also in a form of roll called "Picture of Launching of *Kaiseimaru* (14)" (Fig.23) is preserved in the Tokyo National Museum.

Fig.23 Picture of Launching of *Kaiseimaru,* public domein

End

Note :

(1) CRESCENTIO, Bartolomeo, "*Nautica Mediterranea*", Book I, Chapter XIV, p87 ,1607, Rome.

(2) FERNANDES, Manuel, "*Livro de Traças de Carpintaria*", MS52 XIX, text ff54r-56r, drawing ff79v'80r, Biblioteca da Ajuda, 1616. Facsimile edition of Academia de Marinha, 1989, Lisbon.

(3) Anonym," *Album de Corbert*", Planche 29, 1670, preserved in the Château de Vincennes, Paris. Facsimile edition of Omaga, 1988, France.

(4) GASTAÑETA YTURRUIBALZAGA,Antonio de,"*Arte de Fabricar Reales*", ca.1688, manuscript, conservado en el Museo Naval de Madrid, Facsimile and commented edition, 1992, Barcelona.

(5) OLLIVIER, Blaise, "*Traité de Construction*", ca.1735, manuscript, Transcription edition of Vincint, 2013, France.

(6) CHAPMAN, Frederik Henrik af, "*Architectura Navalis Mercatoria*", PL LXI,1768, Stockholm, Facsimile edition, 1971, London.

(7) STEEL, David, "*The Elements of Naval Architecture*", Plate IX, 1805, London, Facsimile edition, 1977, London.

(8) PEAK, James, "*Rudiments of Naval Architecture*", 1859, London.

(9) KISHI, Magodayuu, "The Roll of the Construction of Russian Warship *Heda* at the Heda Inlet", assumed ca.1856, preserved in Toyo Bunko.

(10) ISHIHARA,Touzou, "Sukuneru-sen", 1855, preserved in The Heda Local Shipbuilding Data Museum.

(11) ISHIHARA,Touzou (assumed), one of some untitled drawings, ca.1855, preserved in The Heda Local Shipbuilding Data Museum.

(12) The Shipbuilder's Association of Japan, "History of Japanese modern shipbuilding, Attached drawings", Plate no.22, 1911, Koudoukan.

(13) KITAZAWA,Noritaka, "Russian articles on the construction of schooner "Kheda" in Japan", Kaiji Shi Kenkyu No.51, 1994, Tokyo.

(14) Anonym, A part of "Monument of Shipbuilding in the Sabusawa Island, and others", 1893, preserved in The Tokyo National Museum",.

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