INSTITUTE OF MARINE ENGINEERS
INCORPORATED.

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President: JOHN CORRY, ESQ.

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# NINETY-SEVENTH PAPER

(OF TRANSACTIONS)

# THE CHINESE JUNK

BY

**Mr. W. G. WINTERBURN**

(MEMBER).

READ

AT 58, ROMFORD ROAD, STRATFORD, E.

ON MONDAY, SEPTEMBER 23RD 1901.

# PREFACE.

58, Romford Road,

Stratford, E.

*Sept. 23rd*, 1901.

A Meeting of the Institute of Marine Engineers was held here this evening, presided over by Mr. W. C. Roberts (Chairman of Council), when a Paper on "The Chinese Junk" was read by Mr W. G. Winterburn (Member).

It was originally intended to re-open the Session by another Paper, but as Mr. Winterburn was at home from Hong Kong, and had arranged to return to the East in the beginning of October, this Paper was taken first.

The Author of the Paper presented an excellent model of a Chinese Junk to the Institute, and was awarded a hearty vote of thanks for the gift.

JAS. ADAMSON,

*Hon. Secretary.*

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# THE CHINESE JUNK,

BY

MR. W. G. WINTERBURN (Member),

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CHAIRMAN:

Mr. W. C. ROBERTS (Chairman of Council).

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At the present moment, when so much interest is being centred in China, the writer, having spent a number of years in that country, closely connected with engineering and shipbuilding, thought that this subject might prove interesting to the members of the Institute.

In a paper by our Hon. Secretary, entitled "Seaborne traffic," we were told that the Chinese appear to retain the same style of ship which they had 3,000 years ago. A few sketches of junks are here appended, and a model offered to the Institute, which will help to illustrate the subject.

In general proportions and in details the model is a correct presentment of the trading ship of South China; the underwater lines are not correct, the actual vessels being much finer both in the entrance and the run.

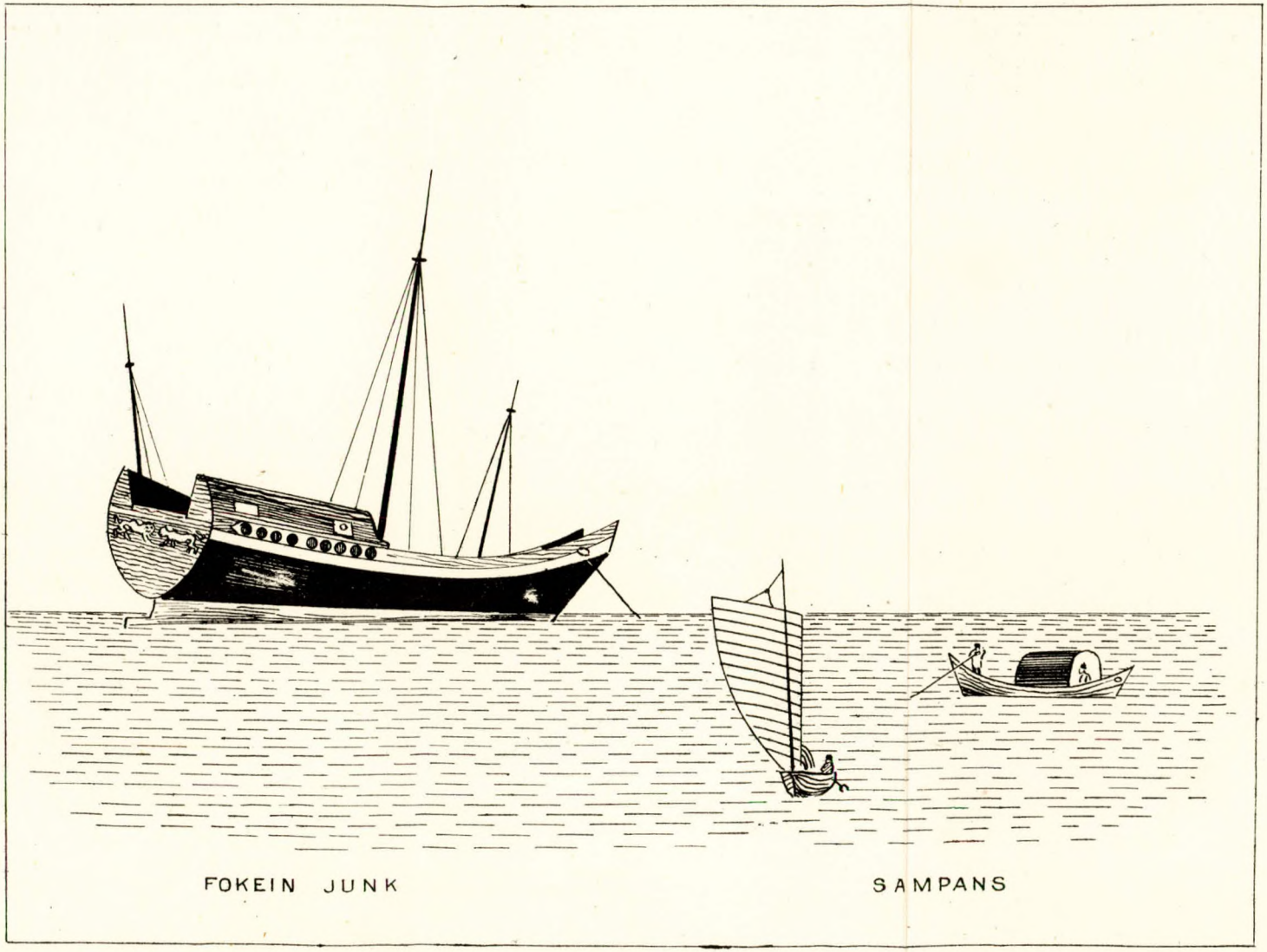
The ratios of this vessel are as follow :—

$$\frac{\text{Length}}{\text{Breadth}} = \frac{3{\cdot}6}{1} \qquad \frac{\text{Length}}{\text{Depth}} = \frac{5{\cdot}4}{1}$$

The length is given between perpendiculars and the breadth and depth moulded. These vessels are being built to-day, side by side with steel steamers of the most modern type, and it is quite conceivable that very little alteration has been made in the design for many ages.

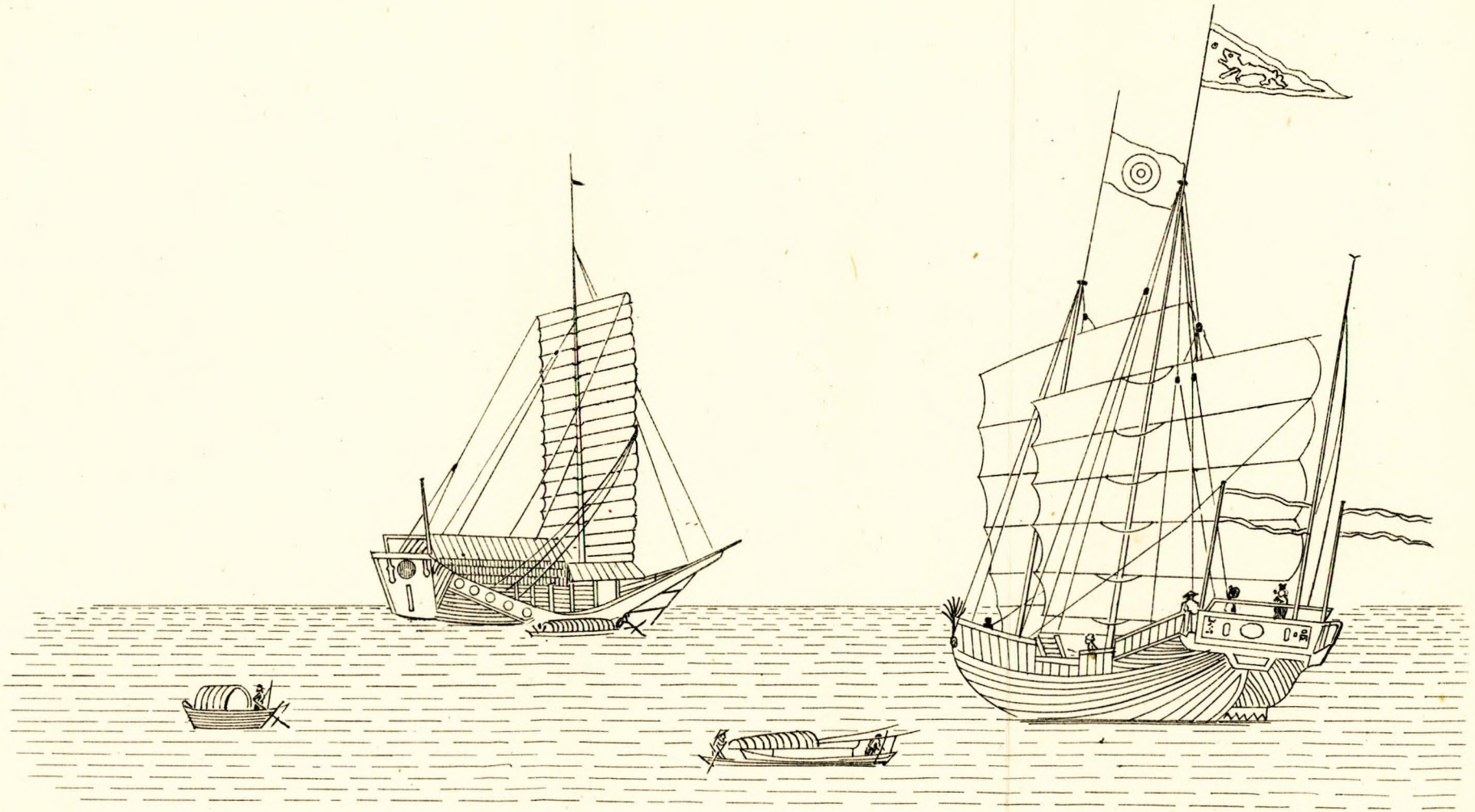
There are Sinologues who claim every new invention as only a resurrection of something Chinese, and it is a fact that many so-called modern ideas are found utilised in their vessels and have been in vogue with them from time immemorial. They discovered the Mariners' Compass, also the principle of the balanced rudder. On the West River may be seen the prototype of the Turret ship, bearing an extraordinary resemblance to our North of England monstrosities; and if the gallant Captain, who a year or two ago discovered and published the fact that sails perforated with holes were more effective than whole canvas, were to visit the Yangtse he would see more of that kind of sail than any other; some indeed are so ragged that there is more space than cloth. This is only in keeping with most things in the Middle Kingdom. Their cities, pagodas, ramparts, and walls, are all permeated with "the breath of things which have had their day; a flavour typical of Cathay," and whatever is, has come to stay.

But the Chinamen is very much alive, nevertheless. Conservative as he is, if the laws of his country permitted he would not be slow to accept novel ideas after he has seen them put into practice. The Chinaman does not experiment, it does not pay; he discovers things by accident or evolution and adopts them, and if an imported improvement is demonstrated to be such, it is a mistake to suppose he will have none of it. Critics may point to the Woosung railway as a contradiction to this, but the tearing up of that line was



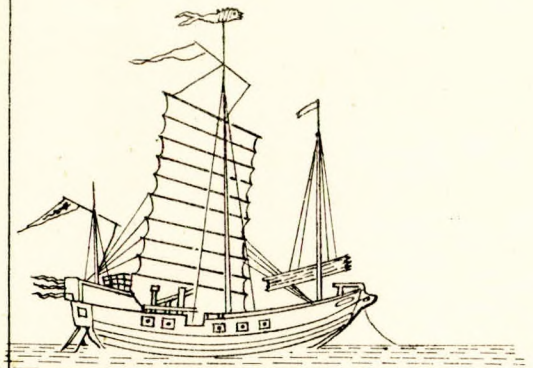
FOKEIN JUNK

SAMPANS

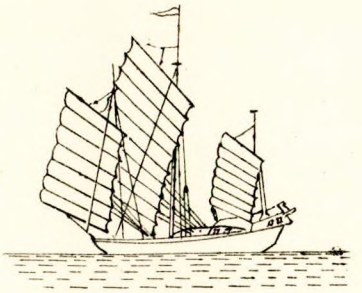


PEARL RIVER JUNK

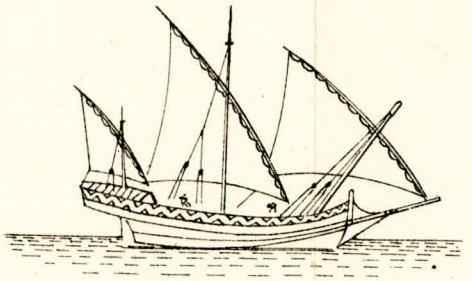
MANDARIN JUNK



KWANG TUNG JUNK

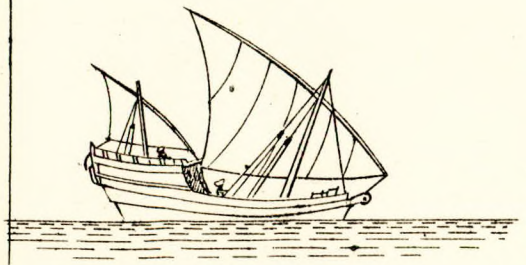


HOIHOW JUNK

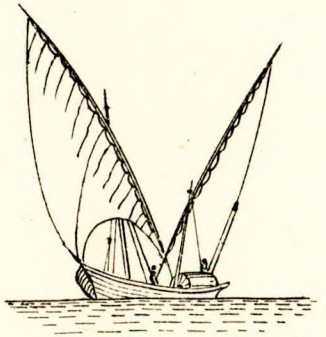


BARBARY FELUCCA

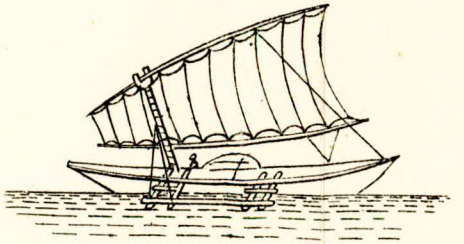
CAIQUE



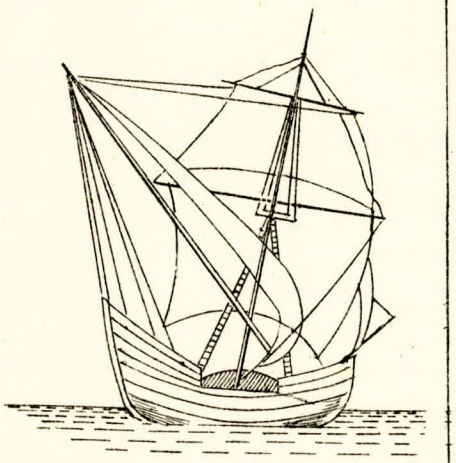
ARAB DHOW



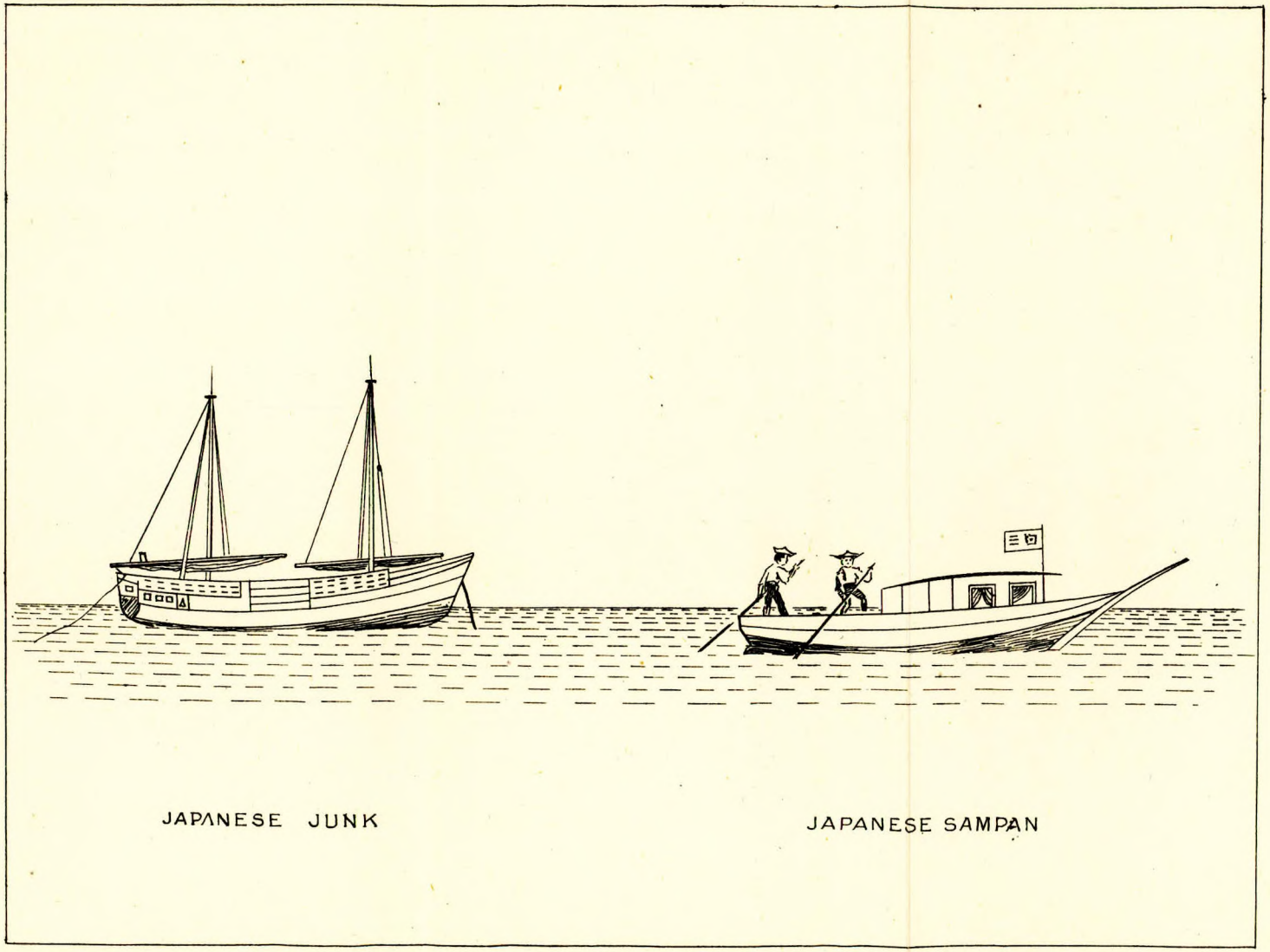
EGYPTIAN BOAT



PACIFIC ISLAND, PROA



LEVANTINE CAIQUE



JAPANESE JUNK

JAPANESE SAMPAN

no more due to the wishes of the populace than was the erection of the Griffin on the site of Temple Bar the desire of the inhabitants of the Strand.

The delta of the Pearl River is probably the greatest shipbuilding district in China, and it is here where the contrast between the old and the new is most marked. In Hong Kong may be seen on the stocks, junks, extraordinary shaped cargo boats, beautifully modelled wood steamers, steel stern-wheelers, steam yachts, gunboats, and the most up-to-date small cargo and passenger vessels. The Chinese themselves, without foreign assistance, are capable of building, and do build capital small wood steamers up to 400 tons; this, too, in Canton, where it is not so easy to purloin drawings and ideas from European shops, because there are none there.

Not only the large centres of population, but many of the riverine villages have important shipbuilding industries; Macoa turns out an enormous number of junks and sampans every year; Whampoa was a large shipbuilding place in Captain Cook's time, and according to students of Chinese lore, before the flood. It is curious that a tradition exists that once "ages ago there lived a good patriarch of his village who dreamed several times that there would be a great inundation; he warned his neighbours, but they only scoffed; he gathered his family round him, and such of his friends who believed, and they took their goods and chattels, with provisions, live stock, &c., up the highest mountain in the vicinity. The flood came on the appointed day and devastated the country. But the good man and those with him were saved;" and ever since, on the anniversary of the event, all those who can do so celebrate it by ascending the highest hill in the neighbourhood, and there indulge in kite-flying and other innocent amusements which the Chinese delight in. This legend is good for the Hong Kong High Level Tramway Company, for on this festival each year their resources are taxed to the utmost in carrying passengers to the Peak.

One of the reasons why the Southern district is peculiarly the home of native shipbuilding is that timber is always obtainable; China itself is an almost treeless country, but the magnificent woods of the Phillipines, the Straits, and Borneo, all find a central market here, and the Chinese, natural mechanics as they are, have in successive generations of carpenters produced workmen who can handle these timbers better than anyone in the world. To enter into a description of the various woods in use would not convey much information; suffice it to say that hardwood of a specific gravity of about ·9 is employed for frames, beams, and planking; China fir for small masts and spars and the linings of vessels; teak for frames and planking; camphor for natural crooks; and Oregon pine for large spars. Junks are seldom copper sheathed; when the bottom gets foul the vessel is beached and careened, and the wood scorched with fire; this kills the *teredo navalis*, the greatest scourge in tropical waters, and also loosens the barnacles and renders scraping easy; a coat of tar is then laid on, and the "docking" is finished.

Oregon pine has come into vogue for planking during late years, but it is only recommended for cheapness, as it is peculiarly susceptible to the attacks of white ants; these pests will consume the whole of the inside of an Oregon pine beam, leaving only a shell, then depart for fresh fields, and China pine planks contiguous will be found untouched.

The white ant will eat any wood, but, like all gourmands, has its preferences, and it is cheaper in the end to use the kinds which are not too high up in its menu. When once a vessel has become infested the best remedy is to sink her for 48 hours, rather a costly cure, but the only effective one.

Clumsy as are junks in appearance, it is wonderful how easily they are handled; the lateen rig is light and easily controlled, and it is admirable to see the sailor-like way in which a tack is made, the man-at-the-

wheel being generally a woman with a baby strapped on to her back, with a small boy to help run the tiller over. The enormous rudders, when unbalanced, are perforated with diamond shaped apertures which reduce the effort of putting "hard over" to a minimum, while not much affecting the efficiency in steering, the stream lines, owing to the viscosity of the water, being deflected almost as well as though the small holes were non-existent. Another feature of the rudder is the provision made for lifting and lowering, so that when a vessel is beached or sailing on light draft the rudder can be adjusted to suit the circumstances.

The windlass for hoisting anchors and working cargo is as simple as any device can be; sailors grasp the upright handle, plant one naked foot on the lower, then turn, using both arms and legs; four men on a windlass will rapidly move heavy weights, but the expenditure of muscular energy is of course great.

Cannon on deck is very necessary in these days of piracy in Chinese waters, and, unlike those found on the city walls, are generally in working order; the high poop reminds one of the Spanish galleons of the middle ages; it is the home of pigs and fowls as well as a colony of women and children.

The watertight bulkhead has always been a feature in Chinese naval architecture; it is no uncommon thing to see a junk come into harbour with one end completely gone, mast and everything; there is generally one bulkhead forward and one aft, but sometimes the cargo space is sub-divided also. During the typhoon season these vessels come to grief in great numbers, as, in spite of their strong construction and skilful handling, they are, on account of their shape, much at the mercy of the elements.

Like our own coast, each district has its peculiarity of build and rig. The sketches represent junks of various parts of China, and a few other types of Oriental craft

are added for comparison. Ningpo affects a small open craft with three masts, the front one raking forward. Tientsin owns the largest class, mostly five-masted; these vessels make voyages as far as Borneo and the Straits, and are not so heavily armed as the ships of the South, piracy not being so rampant in their native waters.

One feature, common to all, is the eye in the bows, "No got eye no can see, no can see no can savvy." Hundreds of miles from land they may be met with, and with the assistance of the eye and the compass, whose needle points south, and the stars and the sun, they mostly reach their destination; and if they fail it is due to "Bad Joss."

Last year an unfortunate Frenchman started to sail one to the Paris exhibition, but had to be towed into Colombo, and not having the wherewithal to pay for the salvage the junk got no further.

The methods Chinese use in building their craft are pure rule-of-thumb, or, more correctly, old experience. One building yard is renowned for snake boats, another for lorchas, and so on. The keel is laid, frames set up "allee same before," and the owner's only anxiety is to see that he gets the scantlings agreed upon, the model being left to the builder.

When constructing for Europeans they make the customary half-model, and submit it for approval; then lay down the lines in the moulding loft in the usual way; if the owner gets the lines drafted out first, then the builder makes his model to suit.

It would be difficult to find another place in the world possessing so many beautiful and powerful steam launches as Hong Kong, and quite three-fourths of these are constructed without European assistance, and often without supervision.

Being so well able to build vessels of foreign type suggests the query why the Chinese should continue to build junks? Here again is another example of official restrictions cramping natural enterprise.

The shipping cleared out of Hong Kong in 1899 amounted to 27,975 vessels, of which 22,501 were junks; the tonnage was respectively 8,563,127 and 1,846,749; the foreign built vessels averaging 1,226 tons each, and the junks 86½ tons. Now, foreign built vessels can only trade to the "open" ports, but there are numberless other centres of trade in China to which junks can ply; these pay Customs dues, assessed by the local Hoppo, and varying with his degree of rapacity and the astuteness of the skipper or shipowner; but the dues are invariably higher for vessels of foreign type. Customs' passes may be obtained at the port of departure, and are recognised by the officials of the Imperial Maritime Customs, who have no power to levy duties on cargo carried in native bottoms. Likin—another form of extortion somewhat resembling the octroi in France—can only be negociated by experienced native captains in native craft; other vessels may have transit passes, and everything in perfect order, but somehow they always meet with obstacles and reverses enough to dishearten the most persevering.

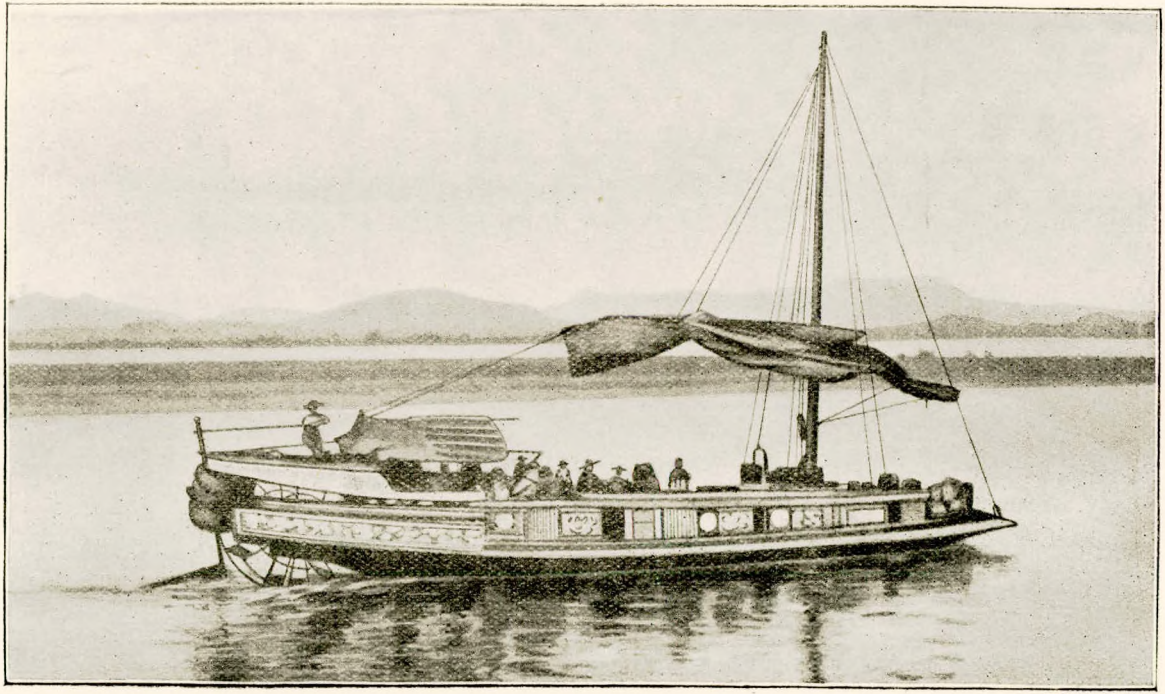
When clearing at the Hong Kong Harbour Office, a junk pays a fee of 25 cents., and receives a paper on which is stated the nature of cargo, alleged destination, and a recommendation to the crew to succour any distressed seamen they may meet, and to carry no stinkpots. No load line regulations, number of passengers and crew immaterial, food question the business of the master, no side lights—it costs oil to burn them—no vexatious rules and regulations whatever, and this the Chinaman dearly loves, for then he can economise to his heart's content.

On the rivers, steamboats are only permitted to stop at certain stations, yet passengers will travel twenty

miles in a direction opposite to their route in order to catch a steamer, in preference to trusting themselves and their belongings in native craft. Were all disabilities removed, we should soon see the picturesque, but antiquated, junk, as in Japan, relegated to the position our old collier brigs and schooners now occupy on the shelf.

Above Canton are numbers of sternwheelers, the wheels being rotated by coolies working on treadmills. Wooden chimneys were originally fitted, but the travelling peasantry were not to be deceived into thinking that they were steamers, so they were discarded. It is amusing to watch a race between these boats. The coolies, 15 to 20 to a wheel, bobbing up and down, yelling like demons, *pour encourager les autres*. The photograph is a snapshot of one of these vessels taken on the West River above Wuchow; she is crowded with passengers, and a close investigation will show the coolies working the wheel under the awning aft, the treadwheel drives the paddle by means of chains and sprockets similar to the ordinary cycle. Until this year the only type of sternwheeler on this river was that propelled by muscular force, although several shallow draft screw boats had recently been introduced and accustomed the natives to the use of steam.

For several years the river has been nominally open to foreign trade, but the native authorities succeeded so well in hampering new innovations that it is only recently that any kind of steam vessel managed to pay her way; as the obstacles were gradually removed the new mode of travelling increased in popularity to such an extent as to encourage a syndicate of three European Steamship Companies to place on the river a couple of large modern sternwheelers. These the writer's firm had the honour of building; they are of steel, 168 feet long, 31 feet broad, and 8 feet deep, have accommodation for three classes of passengers, and are fitted throughout with electric light; there is also forced draft for use when driving up against the rapids,



extensive cooking arrangements, and everything conducive to comfortable travelling; the appreciation of the Chinese is shown in the fact that these boats became at once the best patronized on the river.

As nearly all the timber used for shipbuilding in China is imported, and as the country possesses illimitable quantities of iron and coal besides other minerals, it is safe to prophecy that the day will come when shipbuilding will be one of the greatest industries of the far East. The natives possess all the qualifications for carrying on such work, and the opposition to opening up the country, disturbing graves of ancestors, etc., comes not so much from the masses as the classes, who incite the former to acts of violence.

The best smiths, fitters, moulders, and boilermakers from Burmah to Japan, are Chinese. In every foreign settlement, Borneo, Straits, Tonkin, Phillipines, we find Chinese artizans who have been trained under European supervision in Hong Kong or Shanghai, and have emigrated to those countries, where their services are always in demand.

All the foreign dockyards and engineering shops make a point of doing nothing but high-class work. Plant is already laid down sufficiently large to deal with considerable sized vessels. Still more is projected, and when the time comes for Trans-Pacific liners to be built in China, it will be found that the quality of the work will not be inferior to that of the Clyde.

# INSTITUTE OF MARINE ENGINEERS

## INCORPORATED.

SESSION  1900-1901.

President: JOHN CORRY, ESQ.

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**DISCUSSION**

ON

## CHINESE JUNKS,

HELD AT 58, ROMFORD ROAD, STRATFORD, ON MONDAY, SEPTEMBER 23rd, 1901.

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CHAIRMAN:

MR. W. C. ROBERTS (Chairman of Council).

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The CHAIRMAN: In opening the proceedings to-night, at the commencement of the second part of the current Session, as it has been customary to have a few remarks made on the general work of the Institute, I am pleased to say that satisfactory progress is being made; the membership is increasing, and we have Papers, Lectures and Experiments arranged for till the end of the year. The Tennis Club has closed a very successful session, and the members of the club look forward to their usual Social Meeting to be held here on Saturday, September 28th. The Annual Dinner of the Institute will be held in the Holborn Restaurant on Friday, October 11th, so that on the whole we may look forward to a successful Session, and we hope the attendance of members will be good.

Mr. G. W. NEWALL (Member of Council) said there were several questions which he should like to ask Mr. Winterburn. In the first place, what means had the Chinese in these boats of freeing the water from the bilges? Were there any mechanical appliances at all provided for this purpose? The author mentioned none in his paper, but presumably they were bound to get water in the bilges, and perhaps the author would state how it was got out. Another question was, could the author account for the prejudice common to all Chinese against steam and engines and machinery generally? Then again, as mechanics, how did the Chinese compare with Europeans? Take fitters, or turners, or boilermakers, for example, how did the author look upon them, and how did he compare them with similar workmen on this side of the world? Another point, were the Chinese capable of understanding machines when drawn out on paper? At times probably they would be required to work to drawings, and would it be possible for Mr. Winterburn to furnish the Institute with a sample of a workshop drawing with the Chinese notes, and dimensions, and measurements upon it? Then again, what kind of rule did the Chinese use? Was it like the English rule in feet and inches, or was it a kind of decimal rule, or on the metric system? If it was not like the English rule could he favour the Institute with a specimen? Were there any engineering shops in China where the whole of the people, from the manager to the office boy, were Chinese —where they were entirely Chinese right through? If there were Chinese draughtsmen did they attach to their machinery those curious arrangements that were to be found on all Chinese structures and works of art—pagodas, dragons, and the like? Mr. Winterburn referred to the fact that a great many of these vessels built by the Chinese went to the bottom owing to their shape. Had it ever been pointed out to them that if they built their vessels differently—that if they boxed in their decks and did away with the well deck—their vessels would be safer? And then, having been

connected with the drawing office for a good many years, he would like to know if Mr. Winterburn could tell them the secret of making Chinese ink?

Mr. ALDERMAN KIDD (Vice-President) asked if the author could give them some idea of the speed of these junks and how it compared with the speed of other vessels? Also whether the Chinese navigated with the same kind of compass as that used by Europeans? Perhaps the author could further inform them the number of hands employed on an ordinary sea-going junk, and the rates at which the crew were paid.

Mr. J. R. RUTHVEN (Member of Council), after remarking upon the interesting character of the paper contributed by Mr. Winterburn, said he had intended asking one question that had already been raised, and that was with reference to the speed of these junks. He (Mr. Ruthven) had in mind more particularly, however, the question of the resistance offered by these vessels, and it occurred to him it was a question that might be well worth studying. From what he had heard, some of these junks went at a great speed. Then with regard to sails, some few months ago a member remarked that we had not got very far away from sails for sailing vessels, and that he thought it was a pity to give up sails, he went on also to indicate that he had some idea of a new method of using such. That brought to his (Mr. Ruthven's) mind the subject of windmills. He did not remember ever having heard of windmills being used to propel ships When they remembered that a ship might only sail at ten knots an hour and that the wind sometimes travelled at fifty knots an hour, the thought suggested itself that if they could get the sails to move with greater velocity than the ships they might get more power out of the wind. The author referred to the use of manual force for propelling vessels, and in this connection he (Mr. Ruthven) had been interested in learning that more than 2,000 years ago a vessel was constructed 420 feet long, which was propelled by 4,000 rowers, the crew

consisting of 400 sailors and 3,000 soldiers—a total of 7,400. Four thousand rowers represented about 1,000 horse power, and should give a very good speed. Some years ago he had a very interesting communication from the late Mr. L. P. Coubro—one of the original Council of the Institute—who pointed out that when a lifeboat had rescued a crew or passengers it had plenty of power on board but very little skill, and he had an idea that some mechanical contrivance might be fitted in the boat so that all the people saved should also assist in bringing the boat ashore. Mr. Ruthven then referred to a patent that was taken out by a Mr. Allen in the year 1729. The method shown by Mr. Allen to propel boats by manual power was by means of two vertical pumps worked by men moving as in rowing; the pumps were near the stern and by means of bell cranks connected to a horizontal beam which was moved fore and aft alternately, giving a vertical movement to the pistons. The suction of the pumps was through the bottom, the discharge pipe directed aft, thus giving a force to propel the boat. By this means unskilled men could propel the boat in any weather, and with greater certainty and effect than with oars in rough weather. Alluding again to the possible use of windmills, Mr. Ruthven suggested whether they might not be so employed, plus some mechanical contrivance, so as to drive a ship against the wind.

Mr. McLAREN (Member of Council), after a humorous reference to his experience of Chinese as greasers, said that in the course of his paper the author remarked: "It would be difficult to find another place in the world possessing so many beautiful and powerful steam launches as Hong Kong, and quite three-fourths of these are constructed without European assistance, and often without supervision." Would Mr. Winterburn tell them whether, in the construction of these vessels, the various parts were made to a specified template, or was it the system simply for one part to be made to fit the others? Were templates kept of all such work? The author also told them that the

watertight bulkhead had always been a feature of Chinese naval architecture. Were these watertight bulkheads constructed in an up-to-date style—according to the regulations ruling in this country as to strength? Mr. Ruthven had spoken of the use of manual labour to propel vessels. At Edinburgh there was an illustration of one method of propelling vessels by this means on a lake. The vessel consisted of a huge circular boat about one hundred feet in diameter, and it was fitted with four paddle wheels, each of which was worked by a crank. Each crank gave room for about ten men, and about 200 oars. This complement, when turning paddles and a strong pull on the oars, could send the boat round four miles per hour.

Mr. A. H. MATHER (Member of Council) said he thought they ought to feel very much indebted to Mr. Winterburn for bringing this fresh subject before them. The paper dealt with a matter that was certainly out of the usual course, and for that reason it ought to receive rather more attention. Reference was made in the paper to the characteristics of the Chinese. According to Mr. Winterburn the Chinese people themselves had no objection to modern improvements—railways and new machinery; the objections really came from the higher officials of the country. He (Mr. Mather) took it for granted that this statement described the actual state of affairs in China at the present time, so it would appear that if the people had their own way, instead of being ruled by their higher officials, Western ideas and Western improvements would make greater progress in the country. In an interesting paragraph towards the end of the paper, the author, after speaking of the absence of a load line, said there were "no vexatious rules and regulations whatever, and this the Chinaman dearly loves, for then he can economise to his heart's content." There were a lot of shipowners in this country who would like to economise to the same extent.

Mr. W. H. WALKER said that, being an old friend of

the author, and having, like him, been a resident in China, he had very much pleasure in responding to the invitation and adding a few words to this discussion. At the same time, he could tell them very little more than Mr. Winterburn had already said, and he asked to be excused if he anticipated that gentleman's reply. A question had been asked as to the character of the Chinaman as a workman. Humanity was much the same all over the world, whether men were picked up in Poplar or Canton. They taught the Chinaman something new, and he picked it up more or less intelligently, some doing much better than others. It was then a matter of evolution or natural selection. They kept on the best hands, but dropped those who were no good, and ultimately they got a shopful of handy, reliable workmen. One speaker had asked about Chinese draughtsmen. It might be interesting to the meeting to know that he (Mr. Walker) had had experience of Chinese draughtsmen, and he knew of one young man in particular—a young man who went to the Victoria College at Hong Kong—who, besides being a clever draughtsman, was also no mean mathematician. He was also a very well read young man. He was now at Shanghai, and was typical of what might be called the higher branch of the profession. Hong Kong, Shanghai, and Singapore were the three principal ports in which the Chinese artizan was now shining. We Westerners had gone out to the East and educated them, simply because we found them willing tools in our hands, and the only available tools for the moment. Unfortunately, we could not get these Chinamen to understand fully that better ships meant better management, and that was the principal reason why so few Chinamen ever rose to the point of becoming managers of modern ships. The Chinaman had his junk, and he wanted no better boat; indeed, he would not understand any better boat if he had it. The master of the junk was often a woman. She was the mother of the family, the whole of which had to be provided for, and in many junks there were two and three generations. This was one of the difficulties which

had induced the Government to leave them severely alone.

Mr. J. E. ELMSLIE (Member of Council) asked if canvas was always used for the sails of Chinese junks? He had seen sails made of strips of wood somewhat after the fashion of the laths of venetian blinds.

Mr. WINTERBURN said, in reply to the various questions asked during the discussion: Mr. Newall asks what means are provided for getting the water out of the bilges? Ordinary hand pumps are usually provided on junks for pumping the water out of the bilges, and very few vessels of the kind will be found without pumps. Mr. Walker has partly dealt with the question, how do Chinese mechanics compare with Europeans? Chinese workmen do their work very well after they have been taught, and they are not loafers. As mechanics they never initiate anything themselves; they are simply copyists. You have to teach a man how to do a job, and when once he has learnt it you must never expect him to improve on his ideas, although he will become very skilful in the application of them. But as workmen I like them very much, and we seldom have any trouble with them. Another good thing about them is that they have none of that trade union nonsense of one man being as good as another. The Chinese do not hold the opinion that because a man has served his time to a certain thing he must of necessity have so many cents. a day and work so many hours. When a man thinks he is going on well, and that as his work is appreciated he ought to get more money, he asks for more money. If the employer does not want to lose the man he gives him an increase of wages and the man stops. An ordinary fitter's pay is about 80 cents. a day (approximately, 1s. 7d.), but good hands would receive up to $1·50, and leading hands, $2 or more. Their guilds are powerful organisations, being trade protection and benefit societies combined. It does not do to offend the guild. Strikes are not unknown, but are rare, and the Chinaman as a

rule is reasonable. Another question is, Are Chinese workmen capable of understanding drawings? Well, yes. They are very good at working from drawings, but it is only the few who can calculate or make a drawing. In some offices at Hong Kong there are Chinese draughtsmen who are very smart at this work, but as a rule there are few Chinese who can be called draughtsmen. They are excellent tracers. The system of measurement used in China is feet and inches. There are plenty of engineering shops in China in which no Europeans are employed. In Canton there are some very large engineering shops.

With the wind on either quarter the speed of a Chinese junk is very great; they will not go close up to the wind very well, and they are not very good before the wind. But with the wind on the quarter they go at a very high speed indeed. The number of hands carried varies a great deal and depends upon the number of the family concerned. The head of the family has to provide accommodation for them all. It is almost impossible to ascertain the rates of pay on native craft, the crew being mostly relations or dependants of the captain, and paid partly in rice. They are often working off some debt, or for other reasons are not free agents. Firemen and sailors on coast steamers get about $8 per month. They carry and pay for their own cook and have a galley to themselves. They all endeavour to do a little trade on their own account, and the companies are very lenient in allowing them to carry cargo on deck. Of course, they do a bit of smuggling as well. The Chinese compass is different from that employed by Europeans. The needle points south, and the compass is marked all round the edge with Chinese characters. About Hong Kong they also use the European compass. With regard to Mr. Ruthven's question, I do not remember ever seeing a windmill on a Chinese junk, nor have I ever seen a windmill ashore in China.

Mr. RUTHVEN: They have the wind?

Mr. WINTERBURN: Yes, but not so steady as in some other places. Sometimes it is a dead calm for weeks together. They have a typhoon coming along occasionally, and then they have plenty of wind. The sailors on the junks do not appear to have any particular accommodation anywhere on board. They live about the deck most of the time, even up north in cold weather. I have seen one junk where the deck planks were placed athwartships instead of fore and aft. The sails of junks are not always made of canvas. A kind of Chinese matting is sometimes used, and very frequently the sails are made of cotton, not canvas. There are no rules regulating the character of the watertight bulkheads constructed in junks, and there is no supervision over their construction except that exercised by the owners. The Chinese have a system of insurance, but there is great difficulty in getting information on this point. There are several native underwriting firms in South China. Each vessel is insured on its own merits, and consequently those interested are reticent when approached on the subject. There is no organised classification. The Chinese do not use templates in their workshops. They just fit one thing to another, and it depends upon the owner or the man supervising the work whether they make good fits or not. The Chinese have but one idea, and that is to economise in everything. Unless watched very carefully they will put in inferior materials and bad workmanship. When working in European shops their economical ideas disappear, and they become very extravagant, especially in the consumption of stores, &c. They do not seem to take any pride in their work for itself. When trained to do things well they continue the same from force of habit and because of the knowledge that rough work will not be passed. If they return to native shops they relapse into their coarse ways. There is no superfluous ornamentation about Chinese-made engines, which are copies of European engines. In order to save money they will, if allowed, make the oil boxes of zinc and cylinder lagging of kerosene tins. The engine will work just as well and appearance counts for nothing.

The CHAIRMAN, in closing the discussion, said he had been to China several times and had been on board some of these junks, but he had never been to sea with one. He had always understood, however, that they were very good sea boats, and as they could not go against the wind they did not ship a lot of water forward. Junks were generally fairly commodious and bulky, and their lines were pretty full. One of the paragraphs of the paper mentioned a tradition about a good patriarch who took all his friends and their goods up a high mountain when a great flood came and devastated the country down below. This reminded them of Noah's Ark, and they would find that even now the proportions of Noah's Ark had not been very much exceeded. Noah's Ark was about 300 cubits long, 50 cubits broad, and 30 cubits deep. On the basis of 22 inches to the cubit the Ark was thus 550 feet long, 92 feet broad, and 55 feet deep, so that she must have been a very considerable vessel. It was not recorded how Noah managed to build her, but it would seem that he must have been assisted by some of the people who were afterwards drowned. They had listened to a very interesting paper that evening, and he had no doubt they would desire to convey their thanks to the author.

Mr. JAMES ADAMSON, Hon. Secretary, said he was sure they all felt indebted to Mr. Winterburn for the paper he had read that evening, and as the author was on the eve of his departure from this country to resume his duties at Hong Kong, they all heartily wished him God speed on his journey. They were also indebted to Mr. Winterburn for the model he had presented to the Institute. It was hoped that their museum would continue to grow, and that Mr. Winterburn's example would be followed. It was originally intended to open the session on the second Monday in September with a paper from Mr. Newall on "The Uses of India Rubber on Board Ship," but it was afterwards considered that the second Monday in September would be too close to the Engineering Congress held in Glasgow, and as Mr.

Winterburn was leaving England in the ensuing week it was decided that he should read his paper at the present meeting ; Mr. Newall's paper being read at the next meeting on October 14th. In looking at the Chinese junk as a trading vessel, they had to bear in mind the fact that it was also, in most cases, the dwelling place of one or more families, and that the population of China included many families who lived entirely on floating structures of one kind or another. He had listened with great pleasure to Mr. Winterburn's interesting paper, and he proposed that a hearty vote of thanks be accorded to him.

Mr. ALDERMAN KIDD said he had very much pleasure in seconding the motion, and from what they had heard of the characteristics of the Chinese, they could imagine the amount of time and trouble that Mr. Winterburn had gone to in obtaining the information for the preparation of this paper. The author had told them that when the Chinese wanted more money in the way of wages they asked for it individually. That was not his (the Alderman's) experience with a Chinese crew some twenty-eight years ago when there was a strike about food, and they would have their exact allowance of rice before they started work.

The motion was carried unanimously, and

Mr. WINTERBURN briefly acknowledged the vote.

The HONORARY SECRETARY intimated that the experimental department would be opened on the first Monday in October, and on the following Monday Mr. Newall's paper would be read.

Mr. NEWALL said he had been asked to say a few words with reference to the work of the experimental department which opened on the first Monday in October, but he would simply express a hope that there would be a good gathering, especially of the junior members, and that the work which he proposed bringing

before them would do some good. Further, he would only ask them for their earnest attention.

A vote of thanks to the Chairman, proposed by Mr. RUTHVEN, concluded the meeting.

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Mr. C. HUDSON (Member) writes:—

With reference to the paper you kindly handed me some few days ago, on the "Chinese Junk":—in rubbing up my memory of associations in China of some 20 years ago, I am not so fresh on many points as I could wish. I can remember many of the ideas I have seen worked out in this country, both in bridge and ship construction, that I had seen in China; and of late years I have been associated with Chinese crews, and have found them excellent material to work with, both on deck and in the engine-room.

It appears to me that the average class we get in our company's steamers is directed by the desire to be as good as their fathers. For a considerable time I could not attach much weight to this thought, which arose through doubt of their perception of character. My interpretation of their desire to be like their fathers brings about this position—that each man's desire is to become a specialist of all that he considers necessary in his work. I cannot help thinking that this might be copied, like lots of other things that have to be done in ships and bridge building in this country.