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President : SIR JOSEPH P. MACLAY, BART.

VOLUME XXXIII.

Tin Ore Mining at Kotchiu, Yunnan, China.

BY WM. SEMPLE (Assoc. Member),

Illustrated by Lantern Views. Ladies' Night.

READ

Tuesday, October 11, *at* 6.30 *p.m.*

CHAIRMAN : MR. J. B. HALL (Member of Council).

The CHAIRMAN : Owing to the author being abroad, the paper will be read on his behalf by Mr. Adamson, who has been in correspondence with him on the subject and has had the photographs which were sent from China reproduced on lantern slides, and these will be shown on the screen.

IN fulfilment of a promise to our Hon. Secretary, I am writing an account of my experience in connection with the mining of tin ore, illustrated by photos showing views of the mines at the top of the mountains and of the surrounding country, also of the pumping engines and the laying of the pipe line up the mountain, which was found to be very hard and difficult work. It might be well to explain where Kotchiu is, as I expect the name will be unfamilar to many. I was not aware there was such a place on the map until I received instructions to put down the pumping plant on behalf of Messrs. Shewan Tomes & Co. The mining village of Kotchiu lies in the south-west corner of the Province of Yunnan, about

800 miles distant from Hong Kong, and the journey is very interesting. It is useful to have a knowledge of French, as you have to pass through French territory in order to enter the province of Yunnan, otherwise travellers have a very trying time at the "Service de Surete" with their passports, as the French police are very particular and want to know all about you and your people for several generations back; this is as bad as solving a problem in the differential calculus. Fortunately I knew the language well and was saved a lot of trouble, especially in getting the pumping machinery through the French customs—I may say this is a very tedious job on account of the red tape which surrounds it. It is astonishing how few of the French people understand English, although the volume of business passing through their port of Haiphong is quite considerable and they seem to have the idea that all Britishers can speak French. I remarked, however, that it was just as necessary for them to speak English as for us to speak French. They are beginning to wake up to that fact now as I found quite a few English-speaking Frenchmen on my last visit. The railway to Yunnan was laid by French engineers, and it is quite an engineering feat, as the country the line passes through after leaving the French frontier at Lao-ky and entering Chinese territory is a very hard and difficult one to surmount, being one mass of mountains, which make the railway practically a scenic wonder, and if the weather is favourable when I am travelling down in March on my way home to Vancouver I will take a series of negatives and send them to the Institute, as it is highly interesting from an engineering point of view. After reaching Mengtze the railway stopping place, in order to travel to Kotchiu, the rest of the journey may be made either on pony back or in a chair. I prefer the latter as the trails across the mountains are very dangerous, and unless one is a good horseman it is not advisable to ride. The whole journey takes about 7 hours, and the descent to the valley of Kotchiu is very pretty; climatic conditions here are ideal with only a variation of 10 degrees, summer and winter.

It is difficult to get any information as to when the tin mining really started, as no authentic records seem to have been kept, and the only data I could find was on a tablet in one of the temples, which gives the date as about 400 years ago. All the mines are situated on the tops of high mountains or in the gulches between them. From my own observation I find that Alluvial mining was carried on extensively in the earlier years, the ore being plentiful and easy to get at, it is said by some of

the old miners here that when mining was first started it was to obtain silver, and during prospecting the great tin ore beds were discovered, and the abundance of tin ore in this district is really remarkable. Although Alluvial mining was carried on extensively the miners opened tunnels in order to search for a finer grade ore, and some of these extend into the mountains from two to four thousand feet, from three to ten thousand men being employed. The largest mining firm here is the Yunnan Tin Trading Co., who are at present having the large pumping plant installed, in order to enable them to work the whole year round, and supply sufficient water for ground sluicing on their open mines at Malaga Hill. The tunnels going into the mountains are not more than four feet square, and go down at an angle of 45 degrees; they are very poorly ventilated, the miners are all small men, and the average age is from twelve to twenty-five years, while, owing to the bad living conditions, the mortality among them is very high. It is a pathetic as well as an interesting sight to see these miners go down the mines with their little sacks and native picks to dig the ore. When the sacks are full they weigh on an average 130 lb., and the miners make an average of four journeys a day. The ore is principally earth ore, and when it comes out of the mines, it is crushed by native methods, either by hardwood clubs or a stone crusher driven by large water-buffaloes, then it is all hand washed, the ore receiving about forty washings before it is smelted. The native furnaces are very interesting—they are built with mud bricks and have a little over a ton capacity. The air blower, supplying air to the furnace, is native made, the barrel consists of a large piece of timber hollowed out and fitted with a piston, the air suction valves being of buffalo hide and the air discharge going direct into the bottom of the furnace; the whole apparatus is worked by manual labour, and it takes from eight to ten hours to make a cast: the smelted tin is run into sand moulds, the amount of metal obtained runs from 92 to 99 per cent.

The Yunnan Tin Trading Co., have a large and up-to-date smelting and concentrating plant, which was built by the Germans about ten years ago, and run by their own men. On the outbreak of war the Chinese took it over and have never used it until quite recently, when they put it under an American administration, and, when working fully it will handle 1,000 tons of ore a day. The greatest trouble they have is in the refining of the tin, due to the percentage of lead and arsenic being

high. Formerly it used to be shipped to Hong Kong, and re-melted and refined before being put on the market, thus adding unduly to the cost; to overcome the difficulty they have engaged an American mining engineer as well as a smelting specialist to give attention to all the work near the mines and bring the tin up to the required standards to compete in the open markets of the world. Whether they will introduce modern methods of mining remains to be seen: I doubt very much if it would pay owing to the large overhead expenses in bringing machinery up the mountain, transportation being a very difficult and dangerous problem judging from my own experience in bringing the pumping machinery across. The cost of transportation alone was $40.000, this gives an idea of the very wide margin of costs firms have to work upon when doing business in this province. But when once the Chinese wake up to that fact with the possibilities of development, and put down good roads and make the interior safe for foreigners to live in (although they will certainly need foreign help to develop their resources and make conditions good generally all round) then the future of this province will become very bright.

After giving this general description I will now add a few more intimate details. When I arrived in Mengtze and made a survey of the roads over which I had to take the machinery across to Kotchiu; I wondered how I was going to do it, as some of the trails up the mountains ascended to an elevation of 2,000 ft. and came down 1,500 ft. to Kotchiu. Some parts of the machinery weighed 4½ tons, and I was up against a tough proposition, but I thought to myself it would never do for a Glasgow man to say he was beat, so I just put "a stoot hert tae a stye brae" and overcame all the troubles. I constructed a set of trolleys with large hard wood wheels and axles and adapted them for bulls to pull, the reason for making them of wood was the state of the roads, some parts being cobble stone and some parts mud. When the weight came on the axles there was enough resiliency in the wood to prevent damage to the machinery when going over the cobble stone roads; they also helped to keep a better grip of the roads; iron wheels would have been very dangerous and a slip would have precipitated the whole load down the mountain side. These trails being at most only 7 ft. broad. I must say it was a wonderful sight to see the bulls pulling the heavy loads up the mountain trail, unfortunately I had not my camera at that time to photograph them, as it would have been interesting to obtain a series of views.

Up till a few months ago this part of the country was infested with brigands, and many an anxious hour they gave me, the Tin Co., who were installing the plant, guaranteed to protect the road with their own private soldiers, and in order to do so they formed a series of military posts. So far so good, for a month work went along smoothly and after that things began to happen. After the bull drivers passed the first post the soldiers began to charge them 10 cents a bull for beer money, to let them pass, and between the first and second posts they would be stopped again, while if they had no money a bull would be kept back for ransom; finally the brigands came along and took the whole lot away and it cost us $500 to get them back. Twice this same thing happened and I was getting somewhat worried over it, as fighting was going on all the time between the soldiers and the brigands. Being the only foreigner here at the time I was in a very precarious position, latterly I got into touch with the military commander, and put the whole matter up to him to give me the necessary protection for the transportation, and I must say he was a gentleman over the whole business. He took the matter up very thoroughly, as he sent out a regiment of soldiers and cleared off all the brigands, after which I had no further trouble, and managed to get all the material over without a single breakage in transit. The only breakage I had during the whole of the work was two delivery flanges on the economiser sections, this happened on the railway, and being too far away from Hong Kong to get them repaired I made a small cupola with a little air blower I had, then made a mould for the two broken flanges and cast a new piece on, both repairs turning out satisfactorily.

It was a great experience, especially away up in the wilds when it was just a case of do or die, and I am pleased to say we erected the whole of this plant without a single accident. The boilers installed are Babcock and Wilcox cross tube type with Green economisers and induced draft; personally I can speak well for these boilers, they give such efficient service and very seldom go back on you if you are hard pressed for steam. I wonder they are not more widely adopted in the Mercantile Marine; of course they require a little more attention, but the extra labour is well repaid in service. The pumping engines are the Worthington-Simpson non rotative type, triple expansion cylinders, 13 in., 21 in., and 34 in. diam. × 24 in. stroke, surface condensing. They are expected to deliver 3,000 metric tons of water in 24 hours to an elevation of 2,700 ft. I understand they are the largest pumps of their kind in China, and I

have no doubt they will stand up to their work and give satisfaction. The complete plant is expected to be in operation by the end of January.

I made several tests of the coal here, and the best I could get was 9,000 B.T.U. and that should give an evaporation of 7½ lb. of water from and at 212° Fah. per lb. of coal burnt, it may be possible to do better than this when the final temperature of the feed water through the economiser is known; however, when the plant is under test I will make careful observations and tabulate the results to put them on record. This description of the plant has been included with my experiences up in Yunnan, as it was thought it might be of interest and help to explain the work it had to do. In conclusion, I may say as it is my first attempt at a paper, I had some diffidence in writing it, seeing so many of our members are eminent men in the profession, and I trust my effort will be received with kind appreciation of my desire to contribute from my experience some details for our Transactions.

Mr. Wm. McLaren, assisted by Mr. Green, will now place the views on the screen. I may add that Mr. Semple is going to Vancouver. It was intended to have the paper in March, but the photographs did not arrive in time and it had to be postponed till the re-opening of our session.

The views are as follows:—

The first view shows Mr. Semple in the garden of his quarters. The main entrance to the Tin mines from which two small tunnels branch off inside. The native ore dressing and washing plant, with a general view on the mountain top. The pumping station. The pumping engines. The corner where the pipe line starts to go up the steep ascent. The pipe line continuing up the ascent. Two views of the pipe line up the mountain. Chinese fitters working, and in the foreground the Consul-General and Mr. Semple. The fitters at work, and a view of the mountains show how steep they are. Mountain scenery. General view showing the position of the pumping station and concentrating plant. Kotchiu from the south end. View of the plain taken at an elevation of 2,000 ft. The north end of the plain. Eastern end with a large tree used as the execution tree. Main entrance to the Tin Company's works and the soldiers' watch tower. The clock tower and the smelting works. General view of the whole plant. Rear view of dressing plant, showing elevator to take ore up to the crushers. Works and plant with mountains shown on the east. Smelting

furnaces erected by the Germans. Terminus of the aerial tramway. Engine-room of concentrating plant. Ore dressing and crushing plant. View showing native smelting furnace.

Main Entrance to Mines.

Pipe Line.

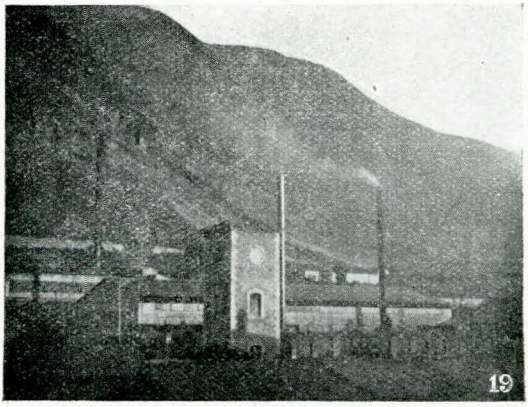
Chinese Fitters Working, and in the Foreground the Consul-General with Mr. Semple.

The Fitters at Work, and a View of the Steep Mountains.

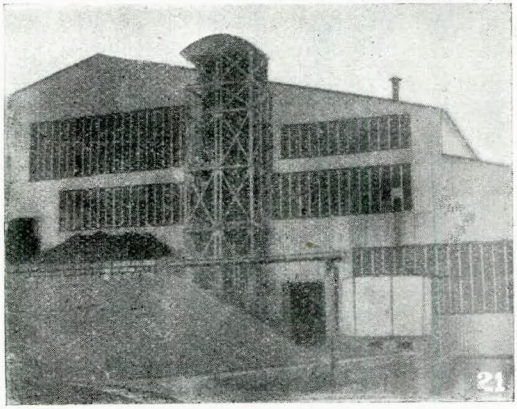
General View.

Kotchiu from the South End.

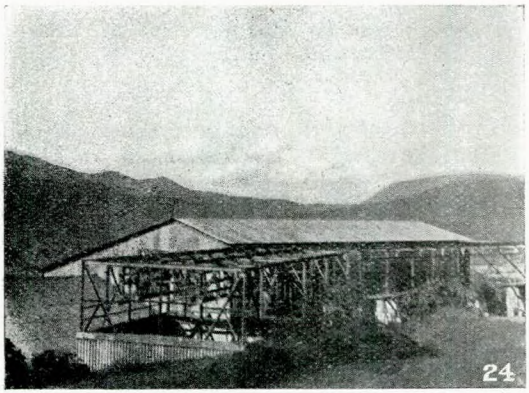
Main Entrance.



The Clock Tower.



Rear View of Dressing Plant.



Terminus of Aerial Tramway.

DISCUSSION.

The CHAIRMAN: I feel sure we are all delighted with the interesting paper which has been read to us, and with the views that have been shown on the screen, the cloud effects especially being well developed. The photographs show the difficulties of getting the machinery up to the mines, and we are proud to hear of the success which has attended the arduous task undertaken by one of our Associate Members against great odds in an unknown country. We should have been pleased had Mr. Semple been here to-night, as a little descriptive matter would have been helpful to add light to some of the views.

Mr. BROOK-SAYERS: I do not know if there is extant any idea of how the tin came to be in the top of the mountains. It is extraordinary that 92 to 99% of metal has been obtained. Referring to the difficulties due to the presence of brigands, only those who have been abroad erecting machinery can fully appreciate this. I had an experience myself when I was in Portugal, erecting machinery with Portuguese workmen. I had to go to a town 70 miles west of Lisbon, to get materials in connection with plant for electric lighting. I was also expected to go to the Town Hall to get about £140 for the workmen's wages, and return by rail. I was given this money in sovereigns, and just as the train was starting two peculiar looking characters got in and we had not gone far before I realised that they were after the money. I was preparing to cope with them, but fortunately got through all right.

Mr. W. MACLAREN: I appreciate a short paper, especially when it is well illustrated. It is a pity the author is not here, as we might have got some valuable information from him. It would be interesting to know whether he was trying to keep faith with the Institute in producing a paper within the first 12 months of his election as member. I think he has done remarkably well. One thing which strikes me is that it must be very galling to a Britisher to observe the terrible conditions under which these miners have to work. In view of the author's remarks and the photographs, it is a pity that the proprietors could not afford a fan to ventilate the shafts. Even though the miners be Chinese, they are surely worthy of a longer life than they have, under the ruling conditions. One wonders if it is possible to get any improvement of these conditions locally, or whether it has to be put before the Chinese authorities. I have

pleasure in recording my appreciation of the author's attempt, which has resulted in a very interesting evening.

Mr. J. A. Bjorkman: I have listened to Mr. Semple's paper with deep interest. I notice that the Yunnan Tin Trading Company's smelting and concentrating plant was installed by Germans, and up to the outbreak of the war was run by them. The same plant is now run by an American specialist. As the Yunnan Tin Trading Company is one of the largest in China, I think in view of the industrial and economic conditions prevailing in this country at present, it might prove of interest to our members if Mr. Semple could tell us whether this is only an isolated instance, or whether more companies are acquiring the services of foreign experts, and if so, whether British brains and capital are receiving a fair percentage of the work in this great, and, to Western minds, practically virgin country.

The Hon. Secretary: I am quite sure Mr. Semple will be glad to answer any questions. He expects to leave for Vancouver, but meanwhile if any questions are put forward it will show him that we appreciate the venture he has made. A great point with the Institute is the interest and encouragement which we have always given to our members, especially our juniors when they present their first papers or give their first speech.

The Chairman: In regard to the question about German brains, every engineer who has been abroad will be able to answer the question for himself, and whether cheapness pays in the long run. I know from experience that unless the Germans had been backed up by capital from home, they would often have failed in their undertakings. British engineers have always had to depend on their own capital, without that help from the State or the banks at home, as was given by Germany. The German's business is to get a footing in a new foreign market, and when that has been accomplished the financial concerns at home subsidise the project.

A Member: I have recently returned—a few months ago—from abroad, and I can assure those concerned about the competition of the foreigner that British machinery is always taken first, and there is no sign of other machinery superseding it.

Mr. F. O. Beckett: I was late in arriving, and did not hear the lecture or see the slides, but I have heard the remarks about competition in China. As regards the point, concerning the re-

lative quality of British and foreign machinery, you will obtain weak or strong machinery according to the price you pay, irrespective of the country of origin. In Egypt I have seen some boilers thrown out, the construction of which was a disgrace to the producing nation. In this country we do not turn out such articles. Some years ago the Midland Railway Company sent some of their men to Roumania with six locomotives. I well remember the occasion, owing to the difficulties of trans-shipping the engines; they had to be hauled ashore by means of a Chinese windlass. Those six locomotives are still working to-day, although the owners have had a good many foreign built locomotives since, which have not lasted as long as the first six. A drawback from which British engineers suffer is due to their lack of a knowledge of foreign languages, and this ought to be seen to all round.

Mr. G. J. Wells: Germany has great advantages over her competitors. All countries are competing for China, not least among the rivals being Japan. I think we ought to express greater admiration for the yellow races. I also think it is time we were getting our young men to learn other languages. The Germans have shown us during the war how they have benefited by coming here and studying our ways and acquiring first-hand information through their knowledge of our language. The cheapness of foreign materials has been referred to. On one occasion I was in Stettin—incidentally I noticed that all the inspectors could speak English—and I discovered that a vessel built in the German yard actually cost more than if she had been built in our country. The only fault I have to find is that their mixtures of metal will not stand the wear and tear.

The Chairman: In my opinion there are languages which we ought to acquire; and quite agree that languages are necessary, but do we try to learn the languages we ought to. I remember meeting some time ago a visitor from a Japanese Dockyard. He opened a conversation with me by saying: "Pardon me; I do not speak good English." Although he had only been in England five or six weeks he was able to converse interestingly. The great drawback to a lot of our learning has been on the tutorial side. Our professors and tutors have wanted to teach languages in their own way. You will find that foreigners have learned our language in their own individual way. They may not learn the grammar, but they do learn the language. Again our custom is to get into a country and try to maintain that glorious standard—we are Englishmen and let that be all-suffi-

cient! I think this paper brings it home to us, and to-day, when we are supposed to have the "Entente Cordiale" in existence, we ought to speak French at least. If we had a knowledge of both English and French we could go a long way round the world without difficulty.

The Hon. Secretary: As has been said, we have had a short paper this evening. It is an advantage, in that it allows longer discussion. When I look back on the early days of the Institute it is gratifying to notice how those who were rather diffident in coming forward as juniors in our early years, through the encouragement they received have since become good speakers. I think the paper to-night is an encouragement to young members to write papers, and if they prefer it, to have them read amongst those of their own grade, as far as can be arranged. In connection with our paper to-night, there are many lessons we can learn. I would emphasise what Mr. Semple says about French, but would add we have also been very backward in regard to learning our own language. I think everyone ought to choose one foreign language and learn it well, yet not neglect his own. Great mental profit is gained by study—not only technical, but general knowledge. Another lesson is to put our energies into our work. We shall never achieve our aims as a nation while the "Ca' Canny" policy is in evidence. Other nations have small chance with us if we put our natural force into our work. Referring to the remarks which have been made as to the quality of machinery, if we put good work and materials into our productions, we can hold our own. Regarding keenness and observation: tenders were invited from several firms for a certain contract. In the ordinary course of events the contract would have gone to the firm giving the lowest tender. It happened, however, that a member of the staff of the firm placing the order had discovered that the firm quoting, had previously supplied material and fixtures which had failed to stand the test of longevity, and he reported this to his principals. It was by his shrewd observation that his firm was warned in order that care and caution should be exercised before settling the contract. A mistake was made in our intercourse with Germany some 20 years ago in *re* their system of moral philosophy, when they tried to impress their style of "progress" on our minds, and some of us lifted our voices against it. We know how many works and by-products in this country were subtly acquired, and the results that came to light during the war. I shall be very pleased to pass on to Mr.

Semple any questions put forward to-night, or which I may receive later from members present.

Mr. G. J. Wells: In view of the remarks regarding the superiority of British engineering, I would like to mention two or three things from recent experience, which throw some light on the reasons why British firms may lose orders. A certain firm contracted to supply an engine and a condenser, but the delivery was not made until months after the contract date, causing considerable inconvenience to the purchasers. Another firm promised to supply an air compressor. On making enquiries some time after delivery was due, an excuse was made to the effect that owing to unavoidable delays the work had not been started. Another firm undertook to supply a turbine pump, and in this instance also delivery has not yet been made, though much overdue. Again, a set of surveying instruments was ordered recently, and only one instrument has so far been delivered, and of German make.

What we want to do is first to bring ourselves to task, and realise that the efficiency of the country is of the first importance. If we want to do well we have of course to create sales, but we fail because we have nothing to offer when the opportunity occurs. It is necessary to face the position and frankly admit the results of our observations.

The Chairman: I quite agree that Mr. Adamson's words are worthy of being well considered, and Mr. Wells has added to them. I am not going to take advantage of my position, as Chairman, to open a political discussion. I will, however, suggest how it comes that we are experiencing these trade difficulties to-day. Many years ago a controversy raged around Free Trade and Protected Trade, and that, I think, has a bearing on the subject; we may be all satisfied that freedom of trade is the correct thing, but if some countries agree and other countries do not, competition is one-sided, and free trade countries immediately become a dumping ground. Unfortunately the trade unions have not looked sufficiently far ahead. They overlook the fact that trade unionism, as we know it in these days, does not exist in competing countries abroad, where they are working 57 hours a week for 1/3 an hour. We do not want to see any man's wages cut down to a rate which he cannot live on, but what we certainly have to look forward to, is, that the people who are demanding these better conditions cannot expect to get work for them-

selves unless we as a nation can compete under equal conditions. When once we all realise this we shall have no difficulty. When freedom of trade exists throughout all countries, so soon shall we be able to enlarge our trade to at least its pre-war proportions.

Mr. HENNIG: I have much pleasure in proposing a vote of thanks to Mr. Semple for his paper. It has been most interesting, and I am sure everyone present has enjoyed it, also the excellent slides. I would like to couple Mr. McLaren's name with this vote of thanks for his able assistance with the lantern; also Mr. Green who has lent a hand.

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Visit to H.M. Fuel Research Station.

By the courteous invitation of Sir George Beilby, Director of the Fuel Research Board, we paid a visit on October 14th to the experimental station at East Greenwich, off Blackwall Lane, near the Blackwall Tunnel. On our arrival we were met by Comm. Shaw, who allocated to the staff the duty of escorting us around in small parties, to admit of the details of the various departments being clearly seen and explained in transit.

Taking the laboratory first, we were shown the instruments used to determine the different parts composing various kinds and qualities of fuel found in the different districts throughout the Kingdom. By analysing and testing, the best and most economical method of treating fuel to reach the highest resultant value is obtained; and not only is the fuel subjected to test, but the by-products obtainable from it under the most favourable conditions—thus the pathway to economy is laid. Incidentally the waste and extravagant abuse of coal are impressed upon our attention, and the national importance of the work carried on at the station became manifest—intensified in view of the present conditions affecting both our home necessities and our export trade.

From the laboratory we were led up to the section where different classes of coal are crushed and placed in separate heaps, portions of which are used for testing, and portions stored in sealed boxes. A map of the district from which each sample is obtained, with a diagram showing the geological strata, is also kept for future reference. Great care is taken that the samples represent the actual seam of coal, and not picked

portions. We know from our own experience how it may differ by sectional disturbances. The use of coal for domestic purposes is as a rule wasteful, in that valuable by-products go off into the atmosphere, or cling to the chimney, causing pollution of the air around. Various plans have been proposed to lessen or eliminate this, one of which would be to place a fuel on the market to give heat without smoke. Investigations in connection with smokeless solid fuel produced by low temperature carbonisation have been of service in directing attention to the obtaining of gas and by-products at lower temperatures (500° to 600° Cent.) than generally used in gas works (1000° to 1700° Cent.); and at the same time produce a coke containing about 10% of volatiles and eminently suitable for fuel. Attention is not confined to research work on coal only, but peat and alcohol are included. Samples of the former were on view, from the raw fuel to the by-product, tar, which appeared an ideal liquid for coating purposes. The samples of alcohol were *non est* so far as could be seen.

The heating of the retorts and furnaces at the station is by means of water gas with a calorific value of 290 to 300 B.T.U.'s per cubic foot. The gas producer is in the main building, also the scrubber and cooler with the gas holders adjoining. A Cochrane boiler is fitted for steam supply throughout the station, also a water-tube boiler and a Lancashire boiler are also used for testing and experimental purposes in *re* the qualities and peculiarities of different fuels.

The engines installed for the work of the station are a gas engine of 100-h.p. with dynamo to supply current throughout the station; an internal combustion engine which formerly held a place in a submarine, now has a dynamo attached. There is also a storage battery ready for service when required.

A very interesting part of the station is that devoted to the making of briquettes in the horizontal steel retorts heated by water gas. The finely crushed coal is placed in cases, which are sub-divided into square sections; these are exposed to the heat for the stipulated time, the furnace doors are then opened and the briquettes turned out, ready for use. We witnessed the operation and had the opportunity of examining the furnaces and retorts from the ground floor to the roof.

The station is roomy and well ventilated; attention has been paid to these essentials of good work, whether this lies in the

region of the office or laboratory, or in that of the engine-room and furnaces.

We are indebted to the Director and his staff for the informative visit, and also to the kind hospitality which at the close provided the refreshing tea to speed our parting.

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ADDRESS OF THE PRESIDENT,

Sir Joseph P. Maclay, Bart.

Delivered Tuesday, November 1, 1921.

The Part Played by the British Mercantile Marine in the Great War.

May I express my high appreciation of being your President. I quite realise that I am in the train of a large number of eminent men, and I realise, too, that you favoured me with the invitation to be your President because I occupied the position during the war as Minister of Shipping. I am glad the necessity for that position has passed away. I know that the work of the Ministry was commented on not always favourably. I would like to say here from my own experience of the officers and men of the Mercantile Marine, that without their able assistance we should never have been able to carry out our programme. They evinced the greatest desire to help during the War.

When Mr. Adamson communicated with me regarding the Presidency, the situation was novel to me. When an address was suggested I thought "What could I say to a body of technical men to interest them, seeing that their knowledge of the Marine Engineering profession is so far in advance of mine? I only know when the ship doesn't go, and I want it to go!" I then thought it might interest you to-night if I gave you, instead of an address of a general character, some particulars of the work done by the Mercantile Marine during the War. Only by these figures can we appreciate the tremendous power of the British Mercantile Marine. I thought it would interest not only myself to collect these figures, but you members of the Marine Engineering profession also.

In midsummer of 1914, the inhabitants of the British Isles little dreamed that in the early days of autumn they would be

engaged in the greatest war of history, a war which imperilled not only Great Britain, but the continuance of the British Empire.

Germany, one of the greatest nations of the world, which, during the previous 50 years had developed her resources probably more quickly than any other nation, and which had obtained by the genius and enterprise of her people a front place in commerce in almost every country, dissatisfied with only commercial supremacy and inebriated with ambition, desired also to obtain world-wide political supremacy and power.

Systematically developing its plans over a long period of years with devilish cunning, and believing in 1914 that the time had come to carry out its great purpose, Germany forced war on Europe, bringing into the fray ultimately one by one, practically all the civilised powers of the world.

Its leaders had made calculations which they believed would bring to them victory, but in their unholy ambition they had forgotten that apart from the power of other nations there was a God who controlled all.

It will ever stand to the credit of Great Britain that in 1914, she was so unprepared for war, and nothing was further from the nation's dreams; although it may be questioned if in view of what we know to-day about the preparations of Germany, the British Government had not a responsibility for its lack of knowledge and unpreparedness.

With the coming of the war, all the great services possible to the State were immediately called into requisition, and it is my purpose to-night to say something of the part played by British shipping.

I would remind you that the Mercantile Marine of Great Britain has been built up not by Government help and subsidies as in many other countries, but by the genius and enterprise of great ship builders, engineers and shipowners, together with the courage and ability of those who go down to the sea in ships.

During a long period of years, every invention or improvement had been taken advantage of, and in 1914, Great Britain possessed not only the largest amount of shipping afloat, but her Mercantile Marine was composed of the finest ships of every type.

On the outbreak of war, the total number of ocean-going steamers under the British flag (over 500 tons gross register)

was about 5,000, with a gross tonnage of about 18,500,000 tons. Some 350 of the largest were almost immediately requisitioned by the Government for use as Auxiliaries for purely Naval purposes. This number gradually increased until it reached its highest point towards the middle of June, 1916, when 1,181 vessels of 3,531,029 gross tons were so employed. In this were included all types of ocean-going vessels, and the services they rendered were many and varied.

Armed Merchant Cruisers, Armed Boarding Steamers, Mine Sweepers, Air Service Auxiliaries, Mine Carriers, Mine Layers, Fleet Messengers, Army Escorts, Colliers, Frozen Meat Ships, and Hospital Ships, &c.

From the middle of June, 1916, the number so employed on Naval services gradually decreased until at the date of the Armistice they had been reduced to slightly under 500 vessels of a gross tonnage of about one and half million tons (oilers excluded) but it is to be noted that from the beginning of 1917, when 857 ocean-going vessels of 2,511,189 gross tons were employed, many services previously rendered by ships under direct Naval control were carried out in requisitioned vessels running under Government commercial auspices.

The foregoing did not constitute by any means the total Mercantile craft which rendered direct assistance to the Navy, as at one time no less than 457 small vessels were also employed on Naval service.

Further, 45,000,000 tons of coal for British Naval and Military purposes were conveyed during the war in requisitioned British steamers, and a further 20,000,000 tons for Allied purposes.

The demands by the Navy for fuel oil grew rapidly during the war, and although by Armistice time the Government owned no less than 122 oil carrying vessels and had on requisition 110 privately owned of a total gross tonnage exceeding 1,000,000 tons, this was insufficient to meet the requirements of the Navy. In order to meet these requirements, the expedient was adopted of fitting the double bottoms of merchant vessels trading on convenient routes for the carriage of oil fuel. 758 vessels were so fitted, providing an oil carrying capacity in their double bottoms of 656,424 tons. 102 of these vessels were lost by war and marine risk, and the total number in service at the Armistice was 656, with a capacity for oil of 570,739 tons.

Military Service.—Let me now deal with the requirements for tonnage for military service. On the declaration of war, arrangements for the cross Channel transport to France of the Expeditionary Force were instantly made, and on the night of August 5th 1914, 250 ships were requisitioned for this purpose. The embarkation commenced on August 9th, and the despatch of the first Expeditionary Force in 14 days was completed according to programme.

Like most other services, those of the Army Sea Transport grew beyond all calculation, and by the end of the year 1914, 946,000 individuals had been transported between the United Kingdom and Overseas destinations. By the end of 1915, this figure had grown to over 4,000,000, by the end of 1916 to 9,000,000, by the end of 1917, to 16,000,000, and by the date of the Armistice, to about 24,000,000.

A call for tonnage in the early stages of the war, which required many vessels, consequent on distance, was to bring from Britain's colonies—from Australia, New Zealand, India, China, Canada, South Africa, and the islands of the sea, wherever flew the British flag, the sons and grandsons of Empire, flocking homewards to the old land of their fathers to give their help in its time of trial and need.

It is difficult to give a figure for the total quantity of stores moved for the Army, the items being so much mixed up with civil shipments, but taking only the quantity of completed Army stores landed in the theatres of war the figures are:—

To the Armistice 49,000,000 tons weight, equal to 122,000,000 shipping tons; or if we take up to November, 1920, 56,000,000 tons weight, equal to 140,000,000 shipping tons.

During the latter stages of the war, no less than 90,000 tons of Army stores were being sent to France only each day.

In this connection it is interesting to note the development of ports consequent on the war. The facilities of places such as Dover, Folkestone, Plymouth and other useful British ports, specially in the English Channel, were developed and taxed to the utmost, and other places scarcely previously recognised as ports were brought into service. For instance Newhaven prior to the war was used only for passenger and cargo services to France with an occasional small collier with coal for Sussex towns. During the war about 6,000 tons weight of Army stores per day were sent via Newhaven, on which 40 cross Channel ships were based. In addition, the port was used as a fuelling base for

destroyers, mine-sweepers, hydroplanes, aeroplanes, and as a base camp, and a little place like Littlehampton—practically unknown except as a seaside resort—handled about 7,500 to 10,000 shipping tons of Army stores per week.

For the movement of horses and other animals the demand during the war for shipping facilities was enormous.

About 2½ millions were carried by sea for Army purposes. Many of these were for very long voyages, such as Australia, to Mesopotamia, India, Egypt, &c., also from the River Plate to Egypt, France and the United Kingdom, &c., and when the British Army in France was growing daily and obligations in the Near East were being undertaken, 40,000 horses and mules were being brought monthly from U.S.A. and River Plate to the United Kingdom.

The shipments for Army account were of a very varied nature. Camels were shipped in large numbers, and on one occasion for military-political purposes British shipping was called upon to provide a vessel to convey the holy carpet and pilgrims to Jeddah for the annual pilgrimage to Mecca. The only ship readily available at the time was an ex-German steamer, and as it was not advisable to use a ship with a German name for the purpose, the name was changed.

Submarines.—Of the many difficulties and dangers encountered in the carrying out of these large shipping programmes, by far the most serious, was the rapid development of the submarine campaign by Germany, until early in 1917, it became apparent that we had reached the crisis of the war, and when in May of that year the losses under the British flag alone amounted to about 500,000 tons, there was reason for the deepest anxiety.

Up to the beginning of 1917, the construction of Mercantile ships had practically been suspended in favour of ships for the Navy, but when the seriousness of the losses by submarine attack was realised, the British Government started to build on their own account, together with Naval vessels, a large fleet of steamers suitable not only for Government purposes, but for the ordinary requirements of the nation.

Not only were ships built in British yards, but every possible berth in yards in Canada, United States, China and Japan were secured. In the United States alone, contracts were placed for 171 steamers, representing over 1,000,000 tons deadweight, but

when the United States entered the war, all vessels building on British account were seized by the United States, and so this large tonnage was lost to us.

Happily, however, with the introduction of the great convoy system in 1917, which humanly speaking, saved the war, together with increased protection against mines, the losses by submarine action became less serious, and the Naval Authorities as the war further progressed, got far towards the mastering of this, the gravest of perils.

The position was also greatly helped by the coming into the war of the United States, bringing with it the possibility of additional convoy protection as well as great shipbuilding development.

Let me here enumerate some of the outstanding achievements of the British Mercantile Marine.

1. The supply of tonnage for Naval purposes, without which the Navy could not have carried on—armed cruisers, &c., as already stated.

2. The immediate transportation on declaration of war of the Expeditionary Force to France, including stores, guns, and personnel of every character.

3. The bringing of the fighting men from the colonies, &c.

4. The transport of troops, horses, stores and necessaries of war to Gallipoli, Egypt, Mesopotamia, &c.

5. The keeping of our own country supplied from overseas with food and other necessaries of life.

6. The supply of tonnage to our Allies for food and war requirements.

7. The transport of United States troops and war stores.

Let me give you some figures.

During the actual period of the war and till November, 1920, the troops and personnel transported to and from all the fighting fronts, including France, Gallipoli, Egypt, Mesopotamia, &c., from and to Great Britain, India, Australia, New Zealand, Canada, the Cape, &c., amounted to—

1. Troops and Personnel	28,719,315
2. Sick and Wounded	3,221,992
3. Nursing Sisters and Civilians	929,521
4. Refugees	133,510
5. Prisoners	336,398
Total numbers moved	33,340,736
Horses, Mules, &c.	2,400,654
Vehicles	553,829

An enormous total.

Let us now look at the losses of shipping during the war by submarine and other risks, including only vessels of 500 tons gross and over. The dates indicate the period of the rise and decline of the power of the submarine:—

	Tons gross.
From August to December, 1914	865,000
,, January to December, 1915	1,418,000
,, ,, ,, 1916	1,578,000
,, ,, ,, 1917	4,079,000
,, ,, November, 1918	2,003,000
Total	9,943,000

New vessels, however, built and secured from all sources were added to the extent of about 5,000,000 gross tons together with a considerable amount of foreign shipping, and there was on the British register at the close of the war 3,825 vessels over 500 tons gross register, representing in all, about 14,500,000 tons.

The real losses, however, were much more than the mere figures indicate, because whereas the losses were in many cases drawn from the liner class of ships, the replaced tonnage was of the simplest kind.

Details of the actual manner in which all the vessels on British register over 500 tons gross at a given date were employed are interesting. In August, 1918, shortly before the war ended, the number was 4,050, engaged as follows:—

			Gross tons.
1.	For British Naval purposes ...	580 vessels	2,000,000
2.	For Military purposes	500 ,,	1,850,000
3.	For Allies purposes	650 ,,	2,000,000
4.	For the Colonies (not available for direct war purposes) ...	120 ,,	450,000
5.	Trading abroad and coasting (not available for war purposes)...	750 ,,	1,700,000
6.	Repairing	250 ,,	1,150,000
7.	Government Commercial Services	1,200 ,,	5,850,000
	Total	4,050 vessels	15,000,000

Thus the total tonnage available in August, 1918, for all the general requirements of Great Britain was only about 6 million

tons, and it was to this 6 million tons, together with some assistance from foreign tonnage that Britain had to look to meet her needs.

It has also to be borne in mind that loss of time to ships during the convoy period was enormous, consequent on times of waiting to suit convoy sailings and much reduced speeds.

Imports had to be reduced to the extreme limits on which the country could subsist and purchased, regardless of cost, as far as possible, from the countries oversea nearest to Great Britain.

No British ship was allowed to load a cargo without Government approval, and the great lines had their sailings all working under Government requisition drastically cut down. Before the war there were about 114 sailings per week to India, China, Japan, Australia, Africa and South America alone. Those were reduced gradually till they reached about 20.

The shrinkage of imports was enormous.

In the year before the war, 1913, they amounted to 54,500,000 tons. By 1917 they had fallen to 35,400,000 tons gross, while for 1918, they were estimated at 30,000,000 tons gross (excluding oil for the Navy).

Let me now tell you of the nature of the imports during these years which is even more interesting.

	1913.	1917.	1918. (estimate).
	Tons.	Tons.	Tons.
1. Food	18,000,000	14,300,000	13,000,000
2. Munitions and War Material	Nil	16,850,000	14,000,000
3. Civil Supplies (Cotton, Wool, Tobacco, Paper, &c.) ...	36,500,000	4,250,000	3,000,000

In 1916 our imports really only included 9% of ordinary civil supplies, and 91% consisted of food and munitions.

Previous to the outbreak of war this country had received a large percentage of her imports by foreign ships.

In 1913 37% was carried in foreign ships, but this source rapidly declined, and

In 1917 only 18% was carried in foreign ships, and

In 1918 (estimate) 15% was carried in foreign ships.

Allies.—We now come to details of what was done by British shipping for our Allies. It has never been sufficiently realised how we starved and denied ourselves that we might save them. In 1918 France had the equivalent of over one million tons gross of British shipping in her services.

43% of her total imports were carried in British ships.

50% of her import of coal (1,600,000 tons a month) was carried in British ships.

492,000 tons of cereals out of 784,000 tons imported into France were carried in *three months* alone.

France had the benefit of coal at bunkering stations abroad which were kept supplied by British ships.

France had over 400,000 tons of neutral tonnage obtained by British coal pressure, &c., forced into her service.

The total tonnage in service of France in 1918 was of:—

French National tonnage	1,600,000	tons gross.
British and other tonnage	1,700,000	,, ,,
	3,300,000	,, ,,

Italy.—Italy had the equivalent of over half a million tons gross of British shipping in her service.

About 45% of her total imports were carried in British ships.

75% of the coal supplied to Italy was carried in British ships.

462,000 tons of cereals out of 936,000 tons in all were carried to Italy in three months alone in British ships.

Italy had the benefit of coaling stations abroad supplied by British tonnage.

300,000 tons gross of neutral tonnage obtained by British coal pressure, &c., was in her service.

The total tonnage in service of Italy was:—

Italian National tonnage	1,075,000	tons gross.
British and other tonnage	1,000,000	,, ,,
	2,075,000	,, ,,

America.—And now let me tell you what we did for the United States of America.

In the Spring of 1918, it was the intention of the U.S.A. Government to send 120,000 troops a month to Europe, of which number the British Government undertook to provide shipping for 60,000 a month, which was considered to be the maximum number which could be transported without imperilling the food and munition supplies of the Allies.

The German advance in March, 1918, altered the position, and the U.S. Government undertook to send their troops as fast as shipping could move them, Great Britain agreeing to provide every possible ship suitable for the conveyance of American troops, irrespective of the risk to the food situation.

This necessitated almost a complete revision of the convoy system, and a reshuffling of the world's tonnage. All suitable ships from other routes were diverted to the Atlantic, and the slower less suitable ships for the Atlantic were taken from that route.

The numbers of U.S. troops moved in British ships to Europe in the immediately succeeding months were:—

May	147,861
June	156,940
July	188,585
August	180,135

Thereafter the numbers fell off on account of the influenza epidemic and the non-availability of troops, but in all, over 1,000,000 troops were conveyed from the U.S. in British ships during 1918.

The extent of the sacrifice involved will be appreciated when it is realised that 124 additional ships were put into service between March and August, and that on the average every American soldier carried, shut out two tons of essential cargo.

In addition to the above the United States had an average of 500,000 tons of British shipping in her service during 1918: the American Army was supplied with very large quantities of imported timber, munitions, etc., and the United Kingdom co-operated with the U.S.A. in obtaining neutral tonnage by which means America obtained nearly 1,000,000 tons of neutral vessels for her own purposes.

For our other Allies, Belgium, Greece, etc., there was also much sacrifice.

I have not so far told you of the reduction in British exports during the years of war. Unfortunately figures in weight are

not available and I refrain from giving values, as they are so misleading. The reduction, however, was enormous—probably two-thirds.

These figures convey some slight indication of what was accomplished by British shipping.

When we look back on these anxious eventful days, one wonders how it was all done, but Britain gave up everything for the war, and its Mercantile Marine bore a tremendous burden. Without it, humanly speaking, the war could not have lasted beyond a few months. Not only was Great Britain incapable of maintaining its people from its own home products, but as we have shown, all our Allies became dependent upon British shipping for remaining in the war, by making the supply of their necessary requirements possible.

One is often tempted in these days to think that some of our Allies have too soon forgotten all that this country of ours did for them. It does not appear too much to say that British shipping was the key of the situation, and that without Britain, more especially some of our early Allies would quickly have gone down before the enemy and probably have become third or fourth rate powers.

After the Armistice in November, 1918, the demand on British shipping continued for a considerable period almost as great as during the war. Tonnage available was far short of needs. Armies, horses, and millions and millions of stores of every character had to be moved.

Between the Armistice date and 31st July, 1920, in personnel alone there was carried:—

From.	To.		
France	... United Kingdom	... British and Imperial troops (including leave men	3,248,196
Mesopotamia, Salonika, India, &c.	,, ,,	British and Imperial troops (including leave men	289,525
France and other theatres...	,, ,,	British & Allied Invalids	253,489
Germany, Holland, &c., ...	,, ,,	Prisoners of War ...	165,994
United Kingdom	Various theatres ...	British and Imperial troops	1,649,961
United Kingdom and France,	Canada	Troops and Families ...	312,483
,, ,, ,,	Australia and New Zealand	,, ,,	229,874
,, ,, ,,	U.S.A.	American Troops ...	141,843
France	... China ...	... Chinese Coolies ...	89,958
Basra and Egypt ...	... India ...	... British & India Troops	299,841
Vladivostock ...	... Europe ...	... Czecho-Slovak & other Allied troops... ...	22,734
Other moves		Miscellaneous	1,164,875
			7,868,763

Although the numbers thus carried after the Armistice were not quite so large, the work of carrying was in a sense greater. This was due to the fact that the repatriation of the armies involved a heavier proportion of long journeys, and the number to be moved included large numbers of women and children, who occupied proportionately more space aboard ship than troops.

It is specially worthy of note, that within 12 months after the signing of Armistice, the repatriation of the colonial forces was practically completed, although the maintenance of armies of occupation at various places and the replacement of the war personnel by the post-war personnel still involved large movements of troops by sea.

Immediately war ceased the general requirements of the country had the fullest consideration.

Notwithstanding all the Government requirements, it was a matter of great satisfaction that within a week or two after the Armistice, it was made possible for practically every British Line to resume operations, and the old flag was quickly again flying on every sea.

True, certain other nations had not failed to take advantage of the difficulties of Great Britain during the war, and started lines to secure what had been British trade, and unhappily, a number of those still remain.

I now come to shipbuilding.

I have no doubt it will specially interest this meeting to have some information regarding the shipbuilding programme in connection with the British Mercantile Marine, carried out during the war, and also its after disposal.

When early in 1917 the Government entered upon mercantile shipbuilding, it was decided to immediately proceed with cargo carrying ships which could be completed in from six to eight months, and to inaugurate a programme of standard ships, plain cargo boats designed to be built in the quickest time with a minimum expenditure of material and labour.

Differences of opinion existed as to the advantage of a programme of standard ships, yet on the whole, shipbuilders loyally accepted the position and put their facilities at the disposal of the Government, or in other words, they did as a matter of fact, sub-ordinate their private interests to what was regarded to be the public good, although in one or two instances, shipbuilders did not think it was to the public good.

The advantages of standardisation as a war emergency measure are found in the fact that there was only a limited amount of labour and material available, and that by reducing the sizes of sectional material to be used in the building of ships, the labour involved was reduced: for instance, a cargo carrying ship of 8,000 tons d.w. had before the war, something like 30 to 40 different sizes of sectional material in her hull. The standard ship of the same dimensions had only eight to ten, and these sizes were made available, not only for this size of ship, but also for other sizes as well. In other words the naval architect designed the standard ships in accordance with the sections which were available, and which were interchangeable. In addition to this there was, of course, standardisation of auxiliaries such as deck fittings.

The main advantage to be gained was, however, in the standardisation of the engine. Whereas, previously, each hull had its own particular type of engine, and, consequently, oftentimes hulls were waiting for as long as six months before the engines were completed, owing to precedence of naval work and other work in the engine shops, hence the adoption of a standard type of engine made it possible to place the engine in any hull of the type for which it was intended.

The original programme of standard ships arranged for five types to meet the national needs. These five types, although of varying sizes were fitted with only two types of engines and boilers. The advantage of this is obvious.

821 vessels were ordered by the Government in the United Kingdom and abroad, not including those ordered in the United States, to which reference has been made. Of those, immediately after Armistice time, 279 were transferred to private owners before completion, without financial gain or loss to the Government. 126 contracts were cancelled, involving expenditure by way of compensation of about £500,000. The remaining 416 vessels were completed to the order of the Government. Of these 23 were lost by war and marine risk, 15 were transferred to Admiralty service as oilers, and the balance of 378 were sold to private owners.

Of the vessels sold, 311 ran on Government account for an average period of 12 months prior to sale, the remaining 67 being sold during construction and taken over by the new owners on delivery by the builders.

The following is a comparison of the estimated total cost and sale prices of the 378 vessels: —

		£	£
1.	Total cost of 258 ships built in United Kingdom	36,481,000	
2.	Total selling price of (1) ...	47,591,000	
3.	Total *profit* on ships built in United Kingdom		11,110,000
4.	Total cost of 120 ships built outside United Kingdom ...	26,884,000	
5.	Total selling price of (4) ...	18,289,000	
6.	Total *loss* on ships built outside United Kingdom ...		8,595,000
7.	Net profit on whole of the 378 ships built and sold, excluding any allowance for depreciation		2,515,000
8.	Net profit (approx.) allowing depreciation at 5% per annum ... ... (Average of 311 ships at date of sale was 12 months).		5,122,000
9.	Estimated total cost of cancellation of orders in connection with shipbuilding programme		500,000

It is to be remembered that the financial advantage of the construction of these vessels was not limited to the net profit made by their sale.

These vessels helped materially to meet the increasingly urgent demand for tonnage in the latter stages of the war, and had they not been built their place could only have been filled by the securing of any free vessels which might have been available. Practically all British vessels were already under requisition, and it would have been from neutral sources only that any considerable amount of tonnage could have been obtained. The construction of the standard vessels therefore enabled a very large saving to be effected in hire money. The

minimum saving, if calculated on Blue Book Government rates, and the more probable saving at neutral rates, would work out thus:—

Saving in hire at Blue Book rates on—

311 vessels for 1 year. Estimate ...	£11,000,000
311 vessels for 1 year at neutral rates...	£27,000,000 or 43% of the total cost price of the 378 vessels built.

Thus concluded the shipbuilding programme of the Government after the war. Perhaps the American policy with its disastrous results has somewhat influenced me in giving these details.

Let me now refer to the manning question.

Recruiting from the Mercantile Marine.

A large number of Admiralty owned ships and certain merchant ships on special service were manned by Mercantile Marine ratings, who accepted Naval discipline. The figures are not available for later dates, but as early as January, 1916, the number of men in service on this basis was officers, 1,108; engineers, 2,349; ratings, 17,454.

In the Mercantile Marine itself it is estimated that the maximum number of ratings during the war was between 190,000 and 200,000, and that the total number employed during the course of the war was about 300,000.

The number of lives lost by enemy action and at sea between 4th August, 1914, and 31st December, 1918, was:—

At sea	15,555
Killed by bombs	4
Executed	1
Died in interment	69
	15,629

In addition, 6,331 passengers lost their lives at sea by enemy action.

An interesting event and exciting one to those directly engaged was the removal of ships from the Baltic.

At the time of the Bolshevic revolution there were in the Baltic 67 steamers of a total gross tonnage of 151,258 tons, 53 of these successfully run the German blockade at the entrance to the Baltic and reached the United Kingdom, and formed a most acceptable addition to British shipping.

THE FUTURE.

General.

I think to-night you would wish me to say something of the possible future of our great shipping industry.

What the future has in store one would not venture to prophesy. Happily the British shipowner is a born optimist, otherwise he would at present be a very anxious man.

It is not essentially because of profits that Britain has for so long taken the lead in the shipping world, as from a financial standpoint shipping has been less lucrative than many other forms of investment. Good years do come, but these are comparatively few compared with lean years. The fact is that the sea is in the blood of the Briton, and he loves it as no other nation does.

At present the world is faced with a superabundance of tonnage and greatly restricted trade.

When war broke out in 1914, the total gross tonnage of British steam vessels of over 100 tons gross amounted to 18,892,000 tons, and the sailing tonnage to 365,000 tons. Including the Overseas Dominions, the tonnage owned in the British Empire amounted to 20,524,000 tons of steam vessels, and 521,000 tons of sailing vessels, while the tonnage controlled by other nations aggregated 24,880,000 tons of steam vessels, and 3,164,000 tons of sailing vessels.

At the end of June, 1921, the latest date for which figures are available, notwithstanding the restricted output in the United Kingdom during the war, British owned steam tonnage amounted to 19,320,000 tons, or, including Oversea Dominions, 21,589,000 tons. These figures include over a million tons of ex-German ships allotted to Great Britain. At this date (June, 1921) the sailing tonnage belonging to Britain amounted to 252,000 tons, the total for the British Empire being 482,000 tons.

The tonnage possessed by other countries at same date amounted to 37,258,000 tons of steam tonnage, and 2,646,000 tons of sailing tonnage, so that since 1914 the amount of steam

tonnage under all flags has increased by 13,442,000 tons by June, 1921. After making allowance for ships constructed during the last quarter, the world's total of steam tonnage on the 30th September, 1921, is probably about 59,000,000 tons—an increase of about fourteen million tons.

Further, it is estimated that there is at present building in the United Kingdom about 3,283,000 tons gross of steam vessels (including 1,188,000 tons, the construction of which is either postponed or delayed), and in other countries about 2,210,000 tons, including about 375,000 tons on which work has been suspended.

While the amount of tonnage has thus largely increased, trade has greatly decreased. Imports into this country in 1913 amounted to 56,023,000 tons, while exports amounted to 93,624,000 tons. In 1920 imports amounted to 45,542,000 tons and exports to 41,175,000 tons. As with Britain so has it been with other European countries, but in some the reductions have probably been considerably greater. In this country there are hopes of improvement with falling prices and larger output, but for some time to come. Russia, Germany and Austria must of necessity be small purchasers, while the spending power of our late Allies France and Italy must be greatly restricted. In all other countries there is also serious difficulty with finance and exchange, and a considerable period must elapse before the world can get back to anything like normal conditions.

It meantime looks, so far as shipping is concerned, as if it must be a case of the survival of the fittest, but with a free field and no favour, the British shipowner need have little fear.

Since the war period, the delays in ports have been excessive, especially consequent on labour restrictions, but those are gradually being overcome, and will, it is hoped, soon very much pass away.

Increase of coal export would probably help the shipping position of this country more than anything else. Before the war, comparatively few ships left the United Kingdom without outward cargoes, which paid a very considerable portion of the cost of the working of ships, in many cases round about two-thirds, whereas to-day, especially for tramp tonnage, outward freights are almost unobtainable, and in consequence, British imports are being carried by tonnage which has to proceed in ballast to loading ports, thereby throwing the full cost of shipping on our imports and enormously increasing the price of raw material.

The British Empire depends on its shipping, and it is to be feared that if Britain loses her position on the seas, it will be together with the decadence of the Empire.

Some nations are legislating and threatening legislation which may seriously affect British interests, and it is the duty of our Government closely to watch other countries, if our Mercantile Marine is to prosper in the future.

Nothing could have been more fortunate for the British Empire than the fact that for a period handsome profits were made by shipping companies, as otherwise to-day, money would not have been available for the reinstatement of fleets which were desolated during the war.

Building prices continue high, and are probably still round about three times pre-war figures. The result is that the giving of orders has practically ceased, and only after prices considerably recede can there be hope of renewed prosperity for our shipbuilding yards.

A wonderful development has taken place in recent years in the use of oil fuel by steamers. In 1914 only about 350 burned oil, whereas something like 2,600 are now fitted.

It may be that this development may help the adjustment of the shipping position in the not distant future, and more certainly so if the new Diesel engine, for which so much is claimed, proves to be a success.

The whole question, however, of cost of production must be carefully considered by masters and men together, if Britain is to continue to hold the first place in the shipbuilding and engineering of the world.

During the war period, when the blood of Britain's sons of all classes flowed together and countless thousands filled common graves in foreign lands, the sympathy between all sections of our people was deep and real. Unhappily influences have since come in which seem somewhat to have checked that sympathy, but notwithstanding, there is to-day, a widespread and growing desire among all classes to work together in harmony. What is good for one should be good for all, and the war has not served its full purpose, if it has not taught all of us to have greater thoughtfulness and consideration for the interests of others.

I hope I have not wearied you by giving so many figures, but it is the only way to bring home to you the vastness of the operations on which we were engaged during the War.

Mr. H. A. Ruck-Keene: I have much pleasure in proposing a hearty vote of thanks to our President for his excellent address, which will be read by our Members all over the World with great interest.

Sir Joseph Maclay follows a long list of distinguished men who have been our Presidents, and when your Council asked him to become our President, we felt that he would be conferring an honour on the Institution if he should, as he did, consent.

Sir Joseph, as you all know, made a very great reputation as Controller of Shipping, which he conducted with diligence and economy, and he is now again endeavouring to help the country by trying to reduce the income tax to a proper level as a member of the Economy Committee. Let us hope that his efforts will be as successful in the latter case as in the former.

We feel that Sir Joseph's acceptance of our suggestion is only another instance of his great capacity for persauding all branches of the community to come together in harmony. I believe it was a tradition at the Ministry of Shipping that no matter who Sir Joseph wanted and no matter where that man was, everything else had to be scrapped to keep the appointment with the Controller of Shipping. We, therefore, welcome him as our President, and we hope that he will be as successful with us in furthering that spirit of comradeship to which I believe a good deal of his success at the Ministry of Shipping was really due.

Mr. F. M. Timpson: I have very much pleasure in seconding this vote of thanks. We have listened to-night to a story of stirring achievement in the war upon which we entered for the preservation of this country, and but for the display of ability, as shown by our President, it is doubtful whether we should have come through. Referring to the previous mention of the Income Tax, no doubt much more can and will be done to remove the present heavy burden on industry, and it is gratifying to know that our President is so closely associated with the matter. We have been favoured with a long line of distinguished Presidents, none more worthy than the present.

The President: I thank you for your kindness. I was interested in the comments of the seconder of the vote with reference to the revision of the Income Tax. I think the greatest service we can give to the State is to keep it out of everything to do with the trade of the country. I think the Government of any country has already enough to do in its supervising capacity. I think it is the duty of every Government to see that the utmost efficiency of the nation is secured. Take one instance alone, the

coal industry—I do not think we get the greatest efficiency out of that industry. May I hope and trust that in the days to come the Government will keep its hands off industry. Essential as Government control may have been during the War, I do not think any leader of industry to-day wants to have anything to do with the Departments he dealt with during the War.

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Review of Books added to Library.

MARINE TURBINE GEARS (*The Power Plant Co.*)—We have received from Messrs. The Power Plant Co., of West Drayton, a very interesting little book dealing with their Reduction Gearing. It contains much useful information of a practical nature, such as Instructions for the Care, Maintenance and Running of Gears, how the gears should be erected, what clearances to allow, nature of lubricating oil to be used, permissible bearing temperature, etc. One chapter of the book is devoted to the Michell Thrust Block, as manufactured by the firm, and we are clearly shown the details of its construction, how it should be adjusted and what attention it should receive when at work. Numerous plates and diagrams of gearing and details are given.

MARINE DIESEL ENGINE AND SEMI-DIESEL ENGINE OPERATION AND MANAGEMENT (*By Engr.-Lieut. H. Atkinson, R.N.V.R.*). (*E. and F. Spon*).—This little work is a useful addition to the literature of Internal Combustion Engines, especially as it deals more particularly with the mechanical injection type, and embodies the practice of Messrs. Vickers, Limited. Hints are given regarding the operating and adjusting of Diesel and Semi-Diesel engines and their auxiliary machinery.

METALLURGY OF STEEL (*Bennett College Reference Library*).—This book is a very useful contribution on the subject, and deals in a clear and up-to-date manner with the structure of steel ingots, the heat-treatment of steel and its importance, the methods of testing, including Izod and Brinell tests, and with the various mechanical properties of steel. Numerous illustrations are given, showing the micro-structures of different steels, and the changes in micro-structure affected by heat-treatment.

DETAIL DESIGN OF MARINE SCREW PROPELLERS (*By D. H. Jackson*) (*Sir Isaac Pitman & Sons*).—The general theory and design of screw propellers is clearly set forth in this work. It

also deals with the necessary pattern-making, moulding and machining. Many useful formulæ are given.

MEX FUEL OIL (*By The Anglo-Mexican Petroleum Co., Ltd.*). —This book demonstrates the value of Mex Fuel Oil as a fuel for general use on land or at sea. After a short description of the oil, and how it is produced and distributed, we have pointed out to us its general advantages and its superiority over coal as a fuel. Numerous burners and burning systems are described and illustrated, and are followed by chapters showing its application to vessels in the Royal Navy and in the Mercantile Marine. Several descriptions are given of rivet heating furnaces, bolt making furnaces, forging furnaces, etc. Various types of Diesel and Semi-Diesel engines are described and illustrated, and a specification of Mex Diesel Oil is given. A number of useful tables are inserted, and the book will prove a very handy work of reference.

Election of Members.

Members elected at a meeting of the Council, held on Tuesday, 31st October, 1921 :—

Members.

Lewis James Calcaterra, 60/63 Sda. Zerafa, Marsa, Malta.
Matthew Cargin, 69, Lamb Street, Walker, Newcastle-on-Tyne.
Peter Mackinnon Currie, *c/o* The Manager, The Royal Bank of Scotland, 3, Bishopsgate Street, E.C.
John Dixon Daykin, The Nigerian Dry Dock and Engineering Co., Lagos, Nigeria.
Jacques Joseph Depauw, 17, Rue de la Giroplie, Antwerp.
William Arnill Roxburgh Douglas, 6, Bridge Street, Sydney.
George Henry Franklin, 38, Audley Gardens, Seven Kings, Ilford.
Thomas Hetherington, 46 Colworth Road, Leytonstone, E.11.
Robert Henry Jacobsen, 353, Allison Street, Govanhill, Glasgow.
William Henry Jonathan Jones, "Lochinver," Winchester Road, Shirley, Southampton.
John Christopher Roach Kent, Bute Gas Works House, East Moors, Cardiff.
Peter Low, 8, Richmond Buildings, Avonmouth.
Robert Reid McBeath, 40, Upton Avenue, Forest Gate, E.7.
Donald MacGregor, 3, Inniskilling Road, Plaistow.

Charles Egbert Reynolds Sams, Runnymede Lodge, Egham, Surrey.
Henry Bissel Spiers, 16, Strand Road, Calcutta.
George Storey, 3, Mount Road West, Sunderland.
Thomas George Thomas, Clarence Chambers, 19, James Street, Bute Docks, Cardiff.
Guy E. Williamson, North London Ironworks, Wenlock Road, City Road, N.1.
John Fenwick Wilson, Mount Stuart Dry Docks, Cardiff.
Daniel Emil Erickson, 49/51, Eastcheap, London, E.C.3.
William Hector Fraser, *c/o* Lloyd's Register, 71, Fenchurch Street, London, E.C.3.
Robert Moffit, B.Sc., 62, Barnmead Road, Beckenham, Kent.

Associate Members.

Andrew G. Phemister, B.Sc., *c/o* Messrs. Butterfield and Swire, Shanghai, China.
John Wignall, 80, Milton Street, Fleetwood, Lancs.

Associates.

Frank Arther Hooley *c/o* Liddell Bros. & Co., Ltd., 47, Szechuen Road, Shanghai.
Percy Wallace, 46, Westoe Lane, South Shields.

Graduate.

Howard Kenneth Sankey, H.M.S. *Fisgard*, Portsmouth.

Student Graduate.

George Porter Fowlie, 90, Bedford Road, Aberdeen.

Companion.

Henry Gaus Scott, 28, Somerby Road, Barking, Essex.

Transfers from Associate-Member to Member.

Capt. A. F. C. Timpson, M.B.E., 4, Coventry Road, Ilford, Essex.
Alfred B. Singleton, Etsa, Minia, Upper Egypt.