INSTITUTE OF MARINE ENGINEERS

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SESSION 1916-17.

President: SIR JAMES MILLS, K.C.M.G.

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Paper of Transactions No. CCXX.

Power Driven Tools.

Mr. J. Hamilton Thomson (Member) the author of the paper on this subject read at the Institute on Tuesday, January 11th, has sent the following reply to the discussion: —

I may say frankly that I am disappointed in the discussion that my paper has evoked; I had hoped that this Institute as a body of practical men would have assisted to specifiy in general terms a minimum outfit of power driven tools for a modern ship, instead of a "lathe of a size 12in. to 5in. and the old-fashioned grindstone, no doubt out of date, but good enough for the ordinary ship."

A member remarks that the engineer is known by his tools; I prefer to think that we are known by our work, and the wonderful work turned out by many an engineer with only hammer, chisel, scraper, and file, is worthy of all admiration. However, this is an age of machinery, and the cry is for the same results

in a fraction of the former time, so why condemn the marine engineer to spend eight hours physical labour over a job that a power driven machine can do in one, and with practically no physical labour at all? If I for one moment thought that in advocating power tools on board a ship I was going to increase the hours of work of the engineering staff, I should never have taken up the subject, even in "a full-powered ship trading out in the tropics where only four engineers are carried," I maintain that the staff could turn out twice the work in half the time, given suitable tools, and that a considerable amount of the present overwork would be done away with. Marine engineers are not ready and willing to do work which can and ought to go ashore, but the occasions are numberless when they would rather do the job themselves for the simple reason that they know it will be done as they want it, and they know it will not come to the ship the night before sailing and involve all hands in a rush job for the last night in port. The shore workshop can only work to sizes and guages given, and no one will contend that they have the same advantage as the man who has the job beside him for which the repair is intended. Some importance appears to be attached to the space occupied, and the weight of power driven tools, why I do not know, as one member remarks: modern ships are so roomy that it is not a difficult matter to find a suitable place for power tools, this is particularly true of the modern cargo boat, no one can go down the engine-room of such without being at once struck with the immense space available, and as regards weight—well, one ton of extra machinery is doubtless one ton less cargo—theoretically-practically one extra ton in a modern cargo boat bears about the same proportion as a fly to an elephant.

I take it to be generally admitted that if power tools are desirable they are so in a modern passenger boat; here also the question of weight is so trivial as not to be worth consideration, particularly so seeing that few passenger boats ever carry their maximum cargo; but it is in the large passenger boat that space, where one wants it for the tools, is difficult to arrange, there is such demand upon it in the engine-room for the high power propelling machinery and the long array of auxiliaries. Even so one usually finds odd spaces where a tool could be conveniently installed, though it will be admitted that such spaces are easier to find after the ship is in commission than in the drawing office or builders' yards; and I should here like to comment on how little the practical experiences of sea-going

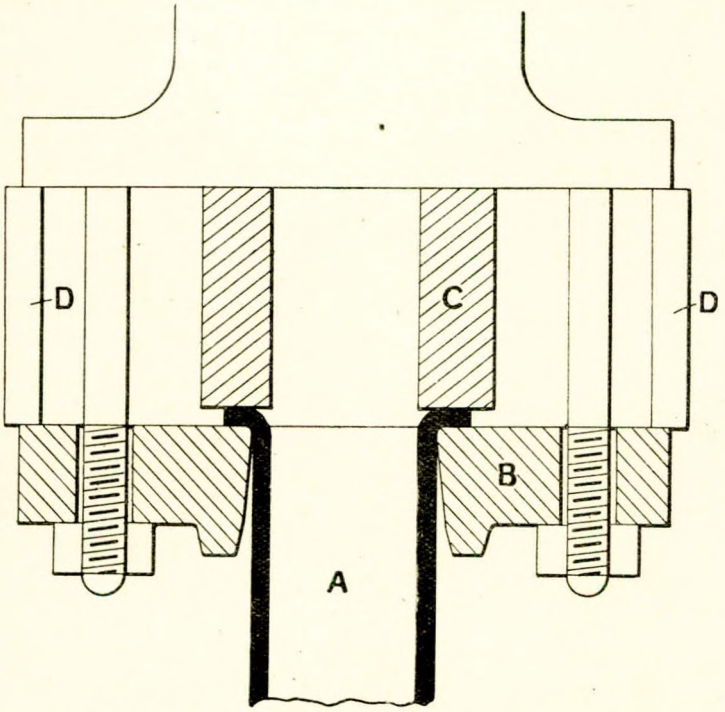
engineers are utilised as regards improving the small details on board ships. I believe that in many of our shipbuilding yards encouragement is given to anyone who can suggest a new idea or an improvement. I am over twenty years at sea and have never known of such encouragement offered, either to myself or any marine engineer I have met, from a shipbuilding firm.

Most shipbuilders gradually develop a stereotyped arrangement of engine-room for their various classes of vessel, and if it were customary to fit adequate power tools, suitable spaces for them would gradually be evolved, and more readily so if the experience of marine engineers was made use of. It is desirable that power tools should be grouped together; but if this is not found practicable there is no reason why they should not be placed in separate positions; almost every ship has electric current, and therefore so placing the tools merely involves a separate motor for each, which is the common practice in modern workshops, and so not a very big consideration. If separate motors are to be fitted I would suggest: that a portable electric driller could be supplied which could also be attached to a fixed standard; such an arrangement would give the advantage of a power driven drilling machine as well as a portable electric drill; the total cost should not exceed that of an electric driven machine.

I do not consider that we as practical engineers need worry over the subject of space and weight from the point of view of the owners "balance sheet" *re* cargo carrying, what we are concerned to prove is, that power tools will pay from an engineer's point of view, as regards the efficiency of the machinery and the cost of repairs, and that the tools at present supplied are not adequate or selected with due regard to the size of the machinery on board, or the many varied functions that we desire the power tools to perform. To take one point alone: there is not one lathe in a hundred on board ship with a power drive suitable for all the diameters the lathe will accommodate, from say an $\frac{1}{8}$in. up to the largest that can be got in with the gap removed.

I have much pleasure in forwarding a letter and sketches I have received from a gentleman who has read the paper, as these are of general interest to us. I would like to emphasise the fact that the tool, in spite of its size and weight is fitted in a yacht, where, if anywhere, space is limited.

I was interested in the remarks of a member *re* the brazing of pipes on board, and agree that brazing on a flange is not a very difficult job, but there is considerable risk of an amateur burning pipe or flange. The temporary repair of any ordinary sized copper pipe, cracked in at the neck, is very simple, and does not entail carrying any spare flanges or other special gear, briefly it is as follows:—Saw the old flange off and bore out the remains of copper pipe and old spelter, soften the end of the pipe by heating to a dull red and quenching in cold water, put the flange over the pipe and bead down the edge, thus practically making what is known as a Pope's joint, the sketch



A—Beaded over copper pipe. B—Original flange bored out.
C—Distance ring, made from a winch piston or anything else available.
D—Iron heels opposite each bolt put in if there is a danger of serious buckling of the flange.

shows a section of the repair when completed; most pipes have sufficient give to allow for the small length which has been

removed, if not, a hard-wood ring will make it up for low pressures, or an iron ring for high pressure. The beaded edge should be worked up to a flat surface with the hammer and finished off with the file; should the flanges be of light section it will be necessary to fit heel blocks between their outer edges opposite each bolt.

I have to thank the members for the reception accorded my paper, and in particular Mr. Adamson for his kindness in reading it on my behalf.

SFAX, TUNISIA,
N. AFRICA.

Dear Sir, *15th April*, 1916.

Your paper on "Power Driven Tools on Board Ship" being of great interest to me, I take the liberty of sending you particulars of a tool that I got out in conjunction with Messrs. Drummond, especially for ship work.

The illustration on the pamphlet will not convey to you much idea of the latest improved type of tool, the illustration being the first one that was made—the latest type is provided with an electric motor and a three-speed gear box which enables a very wide range of speeds being attained, so that any work can be undertaken.

I enclose you a photograph of the latest design of the machine, curiously enough, however, shipowners fight shy of installing tools for repair purposes, why, I have never been able to understand, as my experience as a shipowner has been that repairs undertaken in foreign ports are very costly and the workmanship very inferior. The machines, however, have found favour with S. American railway engineers, where same have been installed in isolated places, long distances away from locomotive and carriage shops. I hear the tool has enabled all sorts of repairs being undertaken by a single mechanic. Several of these tools have been installed on war ships, the names of which, for obvious reasons, I refrain from mentioning.

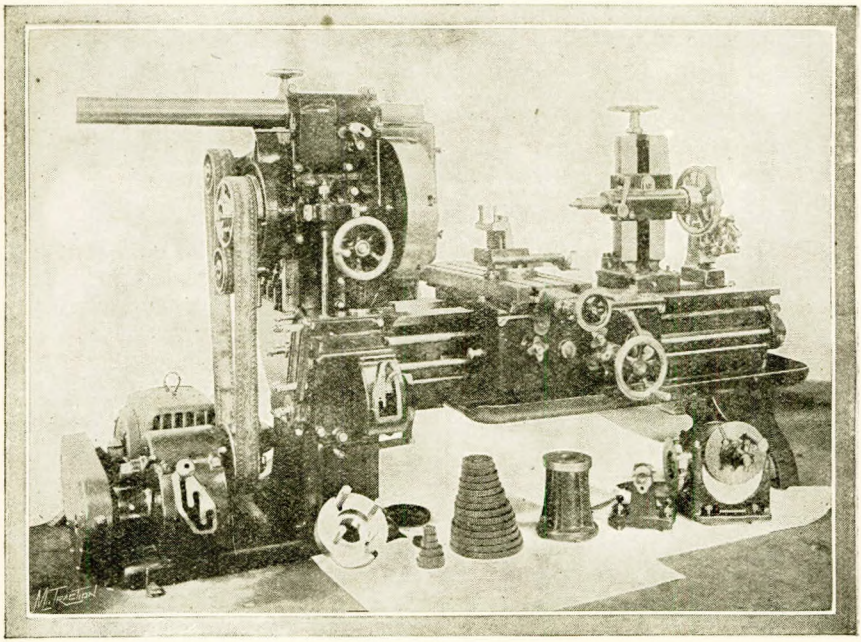
I only hope that the few particulars that I am sending you will be of interest to you.

I remain, Yours truly,

BARRETO,

(Member of the Royal Yacht Club.)

This machine has been designed and built by Messrs. Drummond Brothers, Ltd., from sketches and specifications of the Baron Barreto; the first of these tools being made as a special universal repair machine for use on the Baron Barreto's Steam Yacht *Sea King*.



The experiments made in course of construction of the machine show unusually valuable qualities in the tool for steamship or general repair work or manufacturing. One of these tools, for instance, would make in itself quite a complete installation in a motor garage or repair works, the one tool being capable of handling any machining required with a large range of size, the machine turning any diameter from the smallest, say $\frac{1}{4}$in. to $\frac{1}{2}$in. up to 36ins., being correctly speeded for this great range of work, having twelve speeds in approximate geometric progression, ranging from 270 revolutions per minute to five revolutions per minute. As a lathe its centre height can be varied from 7ins. to 18ins., and it is as easy, quick and convenient to handle as any ordinary screw-cutting lathe,

although by removal of two nuts and slide rest it is instantly converted to a boring and drilling machine with all conveniences usual on such tools. The placing in of the necessary upper bar and centre converts the tool to a milling machine of practically the usual form, the only differences being that the head raises and lowers instead of the saddle, a greater range of speeds is available than is usual on milling machines of the same size, and the table, working as it does on a heavy self-contained bed, is very much better supported. A powerful dividing head and supporting centre renders it, as a milling machine, capable of cutting spur, bevel, mitre and worm gears from the smallest size up to 40ins. diameter. The machine has been designed to have amply sufficient power, weight and supporting surface in the slides to work well on the largest work that can be placed on it; and this, in conjunction with the higher speeds, obtained as they are by a "direct" belt drive, being suitable for small work, renders the machine universally useful. The machine is as light and convenient in handling in each of its forms as any separate machine of that particular type, and is therefore a very different tool from the usual converted boring machine or similar makeshift with which it has nothing in common. The design is new, and each part has been carefully thought out and tried out for the various purposes it has to fulfil. The design of bed, the drive and the gear mechanism and other new parts are fully protected by patents obtained or pending. The length of the machine is 8ft. 9ins., width 4ft., weight 4,150 lbs.

Attention has also been called to the Holbrook lathe briefly described in the following paragraphs and illustrated.

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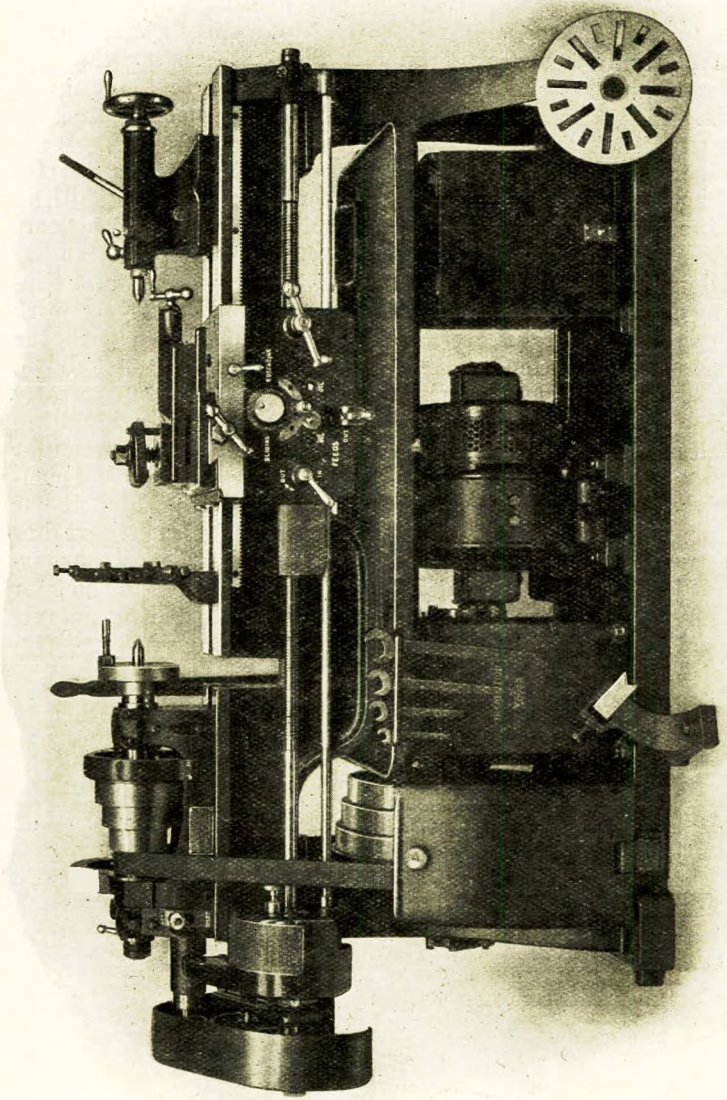

The Holbrook Motor Driven Lathe.

These lathes in 6 ins. × 6 ft. and 5 ins. × 5 ft. have been designed and built firstly for the purposes of the war. The 5 in. lathe was built first for the A.S. Corps, Mechanical Transport Section, and the 6 in. have been built for the Russian Government and the Admiralty, who have now a number on order. For the 6 in. lathe a 2 H.P. motor is required, and for the 5 in. a ½ H.P. motor, and the latter can be supplied with a foot motion containing the motor drive and the foot power drive in one unit.

The motor gear-box contains the necessary speed-reducing gears, and the main spindle also carries two friction gears for the forward and reverse speeds; this shaft also carries the large speed wheel, and is well supported and revolves on Hoffmann's ball bearings.

Forward, stop, and reverse speeds are obtained through the motor gear-box, and are actuated by the lever at the back of the lathe, and it is not necessary to stop and start the motor when only short intervals of stoppage are required, as the lever can be placed in the stop position and the motor would then remain running but the lathe stopped. The reverse speeds are exceptionally useful when odd pitches or short lengths of thread are being cut, as the clamp nut does not need to be disengaged so the thread tool will enter, the thread being cut at the correct relative position.

The wooden cabinet contains the 22 change gears, which is divided to receive the respective wheels.

The fast headstock is exceptionally powerful, and is of massive construction.

Correspondence.

It was with great interest that I read Mr. Peter's paper on "Corrosion" published in the July transaction of the Institute. As a whole the paper treats the subject from an electro-chemical standpoint. This, however, does not cover the whole subject of corrosion and its prevention, especially the latter. The design, to a certain extent at least, may be a direct or indirect cause of corrosion, and, as prevention is better than cure, the design details should therefore be thoroughly gone into with a view to the prevention of corrosion as far as possible.

In his remarks, Mr. Peter, quoting Mr. Whyte's paper, states that corrosion was hastened by an applied E.M.F. Experiments have also shown that dezincification is accelerated by high temperatures in condenser tubes. This is a point not fully realised by condenser designers. The turbine designer has had a similar difficulty in the rapid dezincification of turbine blades at high temperatures, and in his case has only been able to reduce it by the use of special alloys. High temperature is without doubt very often the chief cause for the rapid external dezincification of the top row of tubes near the main eduction pipe, or the tubes in the immediate vicinity of the other exhausts and drains led direct into the condenser. Thus, in the design, care should be taken that high temperature steam or water does not impinge directly on the tubes, but first on baffle plates. These baffles should be designed in such a way that they do not cause back pressure, but rather direct the steam and so expand it in order that it impinge on a large area of tubes. By this means the local external dezincification is prevented and hence a very much longer "tube life" obtained.

*In order to illustrate this important point, I am forwarding you portions of two condenser tubes. These lengths were subjected to the direct impinging of an H.P. drain led direct into the condenser without a baffle. After only six months running this rapid dezincification of the tubes was found to have taken place. I trust that these specimens may be of interest to the members of the Institute.

JAMES WATT, Graduate.

Dunfermline, Aug. 26th.

* These can be inspected in the Juniors' Room.

The following is an extract from an interesting letter received recently from Mr. Norman Stewart, our Assistant Secretary, who has been promoted to Quartermaster Sergeant, Seaforth Highlanders: —

"We have been living out in the open all the time since I last wrote—in holes in the grounds, dug-outs, barracks—and now in the comparative luxury of tents. It was a great satisfaction, however, in spite of the discomforts, to be able to walk about on land occupied for so long by the enemy. Of course you will have read about the terrific bombardments, but no word pictures can describe their infernal din when such a bombardment is in progress, nor the appearance of the enemy trenches afterwards. The ground all round their first line trenches is simply a mass of shell holes, with no level ground at all in between, and in the trenches themselves nothing but smashed machine guns, mortars, defences, equipment, thousands of rounds of ammunition, not to speak of the remains of smashed humanity. Notwithstanding all this, a large number of their dug-outs remain almost intact and are fine pieces of workmanship. Our Battalion, although working in the most advanced positions, escaped with very light casualties, and indeed the losses in these operations, so methodical and sure, are not to be compared with those of the attack at Loos last year. I do not think enough recognition has been given in the press to the bravery of the South Africans. They are a fine body of men and everyone who has seen them in action agrees that they are the greatest fighters on this front. A big number of them—I have spoken to several—are Boers who fought against the British.

Our airmen deserve all the praise they get and more. The Hun air attacks used to be the prominent feature when I first came out, but only an odd one or two occasionally come over now, but they always get so hot a reception from our anti-aircraft guns and from our own airmen, that they usually go back with a rush and sometimes do not get back at all. Needless to say we were all very delighted about the Zeppelin being brought down near London. It must have been a fine sight, and I should think it would be visible from your present home. I wonder if you happened to see it?

Altogether our men are very hopeful and confident. They are in better spirits and more confident than they have ever been and that is saying a lot. It is wonderful to hear them singing as they go into action. They accept all hardships

with indifference and retain their sense of humour in times of the greatest danger. Of course everybody grouses at times, but it is in the true Bairnfather style, and his drawings are an exact reproduction of the sort of thing that anybody who has been out here sees happen almost every day.

As Q.M.S. of the Battalion, I have plenty of work to do. A good deal of it is outdoor work and I spend several hours a day either on horseback or on the bicycle if the roads are good.

With kindest regards and all good wishes."

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Steam Engine Efficiency.

By the courtesy of the authorities, a visit was paid to the East London College on October 3rd, when Mr. G. Jas. Wells kindly gave a demonstration to illustrate the methods of obtaining the data —referred to in his paper—for determining the efficiency of steam engines. Prior to the demonstration, Mr. Wells explained in the engineering department lecture hall of the College, the principles upon which the demonstration was based, and by means of lantern slides illustrated the various details of the operations and the utility of the results. Mr. Wells was very cordially thanked for the opportunity granted to the members who were able to avail themselves of the invitation, the acceptance of which had been a source of gratification. After the demonstration an examination was made of the testing apparatus, the machines and appliances fitted up for educational purposes. Several new developments are in course of erection to provide further advantages for the coming generation of engineers, to enable them to acquire technical knowledge and instruction.

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The Institute of Marine Engineers.

By The Hon. Secretary.

*The following was written by the request of the editor of *Syren and Shipping*, and was published in the special issue of that journal in April, 1916. It has been considered desirable to reprint it in our transactions, as it may be of interest to members who have been more recently elected :—

The Institute of Marine Engineers was founded at a time when great developments were taking place in connection with the machinery for steamers, and, no doubt, in consequence of these developments, the proposed society was hailed by the thoughtful marine engineer with that enthusiasm which brought it into being.

The official foundation took place on 1st February, 1889, when a reading-room was opened. The previous four months were spent by the promoters in the hard spade-work which is necessary as a preliminary to the seed-time, with a view to the harvest of results; and it may be claimed, on the testimony of those who are deeply concerned from the standpoint of observers, as well as those within the membership, that the results have so far justified the work bestowed, but greater are looked for in view of the strenuous times ahead for all hands.

The first paper read before the members on 5th April, 1889, at Stratford, was on "Steering Gear," and by a curious coincidence the last paper read at the old premises prior to removal to the new building was on a similar subject.

The articles of association state clearly the views of the early promoters, and the following paragraph sets forth the objects aimed at :—

"To promote the science and practice of marine engineering in all its branches. To enable marine engineers to meet and correspond; to facilitate the interchange of ideas respecting the improvements in, also original and improved methods of working machinery, and the publication and communication of information on such subjects. To maintain and improve the status of marine engineers and the profession of marine engineering and to afford facilities for education, study and self-culture to marine engineers, and to promote their progressive advancement in knowledge of their profession."

* Reprinted in the *Steam Ship*, August, 1916.

These objects have been upheld by successive councils in dealing with the operations of the Institute year by year.

During the first session ten papers were read and discussed, the subjects being:—"Steering Gear," "Shafting," "Scientific Triunities," "Valve Gear," "Bilge Pumps," "Forced Draught," "Progress of the Marine Engine," "Marine Governors," "The Marine Engine Considered as a Machine," and "Ventilation of Engine-Rooms and Stokeholds." A very successful conversazione was also held in the Town Hall, Stratford. The meetings were at this stage held in a room rented for the occasion. The certificate of incorporation was granted by the Board of Trade in the year 1889. At the first annual meeting the late J. Macfarlane Gray advocated that class-rooms and competent teachers should be obtained for the instruction of young engineers. He pointed out that other nations were becoming more and more alive to the importance of training engineers, both in the scientific and mechanical departments of their business; so much so, indeed, that their education and training were made questions for the Government to consider and legislate for. It, therefore, he urged, behoved everyone interested in the progress and supremacy of the merchant navy to give attention to all efforts made to improve the marine engineer, and he pressed the view that in order to retain our national supremacy on the sea, very great efforts would require to be made so that marine engineers should be well equipped for taking positions requiring scientific and technical knowledge, coupled with good practical experience.

In order to carry on the operations of the Institute and give effect to the advice tendered that educational facilities should at once be placed within the reach of the rising generation of marine engineers, so far as was locally possible, a fund was immediately opened, and in February, 1892—when Lord Kelvin was president—suitable freehold premises were acquired in Stratford, where classes and lectures were conducted until the establishment of the local Technical Institution rendered the classes unnecessary. Other means were then adopted to assist and encourage the juniors to add to their educational acquirements by means of essays, experiments, and the examination of models, plans, specimens showing failures of material, etc. When the question of founding the Technical Institute was under discussion, a committee was appointed to urge upon the attention of the authorities the claims of engineering and naval

architecture, with the object of obtaining the best possible recognition of the need of placing the higher scientific education within reach of the young engineers and apprentices serving in the neighbourhood. The recommendation of the council of the Institute was given effect to.

The subjects for essays are indicated in the spring of each year to the various sections of the membership, including an open competition for apprentice engineers, the essays being due for completion and forwarding in autumn for the adjudication of the awards.

The subjects for the first set of essays were as follows:—

ASSOCIATE MEMBERS.—"The Turbine for Marine Work."

ASSOCIATES.—"Feed Heating, with Description of Types from Personal Observation."

GRADUATES.—"The Function of Air and Circulating Pumps."

By the good offices of the late Mr. James Dixon—then a past president of the Institute—and the Committee of Lloyd's Register, two scholarships of £50 each per annum, tenable for two years, were founded in 1907. The examinations are held in various centres to suit the location of candidates. The subjects on which the examination results are based are as follows:—Algebra, including quadratics; elements of statics; dynamics, thermo-dynamics, and hydrostatics; euclid, books I. to IV.; general knowledge, English grammar, and composition; mechanics, principles and problems; foreign languages (choice is given to each candidate and questions set accordingly); plane trigonometry, including logarithms; practical engineering and workshop practice.

Awards have also been given to graduates for essays on visits to the industrial exhibitions which have been held from time to time, in order to stimulate young engineers to make themselves acquainted with the variety of tools and appliances exhibited.

*The latest set of subjects set for papers and essays comprises the following:—

SEA-GOING MEMBERS.—"Hints and Deductions from Practical Experience, which may be Useful towards Improving Ship and Engine Design. Reports upon Consumption of Coal and/or Water per i.h.p. per hour."

* Session 1915-16. Subjects for 1916-17 see March Issue, also August and September Issues.

ASSOCIATE MEMBERS.—"The Sequence of Cranks in Multiple-Expansion Engines, and the Balancing of Powers."

ASSOCIATES.—"Nominal, Indicated, Brake, and Shaft Horse-Power. How ascertained and their relation to one another."

GRADUATES.—"The Thrust Shaft. Its Relation to the Work and the Power Transmitted. Design of an Ideal Thrust Block, with Description of Details."

OPEN COMPETITION.—"The Refrigerator. Different Systems and their Adaptability for various Services on Ship Board."

By the kindness of the late Dr. Peter Denny, LL.D., of Dumbarton, a gold medal award was established in 1891. The capital value (£250) was used in the purchase of the premises at Stratford, which were let on the removal to the Minories. The medal is awarded for the best original paper contributed each year on a subject considered of sufficient value to merit the award.

Another feature of the operations of the Institute of educational value consists of visits to works on Saturday afternoons during the summer recess. The regular meetings for the reading of papers and discussions are held fortnightly—present arrangements being monthly—on Tuesday evenings. The papers which have been read and discussed to date number 220, in addition to the Presidential addresses and lectures which have been delivered. The social side has not been overlooked, as its valuable aid was early recognised and encouraged by the establishment of a tennis club for the summer and of concerts for the winter months, entertainments of a homely character, provided by members who volunteered in turn to act as host, these serving as links of interest between the senior and junior sections. A reading-room was set apart for the juniors, a small workshop equipped with tools being also at their service. The library contains a large number of books on subjects of value to the members, who have the free use of the volumes.

The following paragraph is from the annual report for 1892, and may be quoted as specially appropriate in view of present conditions:—"Let us seek to encourage ourselves with the consciousness that our duty lies in the direction of improving, as far as may be in our power, the conditions which we find ruling

around us, holding together, and animating one another in the direction of the highest good for the benefit of all, maintaining at the same time the true relationships of life, which are allied to proper order and discipline."

The birthplace of the Institute was convenient for the docks, but as the area from which the members were elected widened, so arose the necessity for more central premises, and eventually sufficient funds were contributed to justify negotiations which resulted in the erection of the excellent building which is now the home of the Institute in the Minories, Tower Hill, where marine engineers are made welcome.

A memorial tablet was recently placed in the entrance hall of the premises to commemorate the steadfast attention to duty of the engineers of the *Titanic*. There is also a Memorial fund, the interest on which is used for benevolent purposes, mainly in connection with the Merchant Seaman's Orphanage, Snaresbrook.

The roll of past Presidents of the Institute contains the names of leaders in the commercial, industrial, and scientific world, and each of these has left his mark, not only in the transactions, but in the details of the operations in one way or another. That many of the leading shipowners have been presidents shows the confidence and interest taken in the Institute by those to whom the marine engineer is of inestimable value as the responsible and trusted officer who, in his department, has to exercise all his technical trained experience and knowledge to maintain the machinery entrusted to his care at the maximum of efficiency with the minimum of expense. The exhortation given by Mr. Macfarlane Gray is not less valuable now than it was when uttered; nay, we may say it has gathered force as we pause to consider the present and future outlook, when the whole force of the Empire is nerved to uphold the industrial and commercial capacity to the highest possible level in view of the keener competition looming on the horizon.

Many problems in connection with engineering still await solution, and much desirable knowledge is yet to be gained as we strive to reach perfection in all things. In such the marine engineer is keeping interested, and has to devote himself to those sections which more immediately concern his own special work. The process of decay and its arrest; the abnormal wastage which is found without obvious cause; the failure of apparently sound and tested material, are a few of the questions presented to him

in the course of his experience. He has to study answers given, and compare them with facts which have come under his own observation. Many thanks are due to the committees, composed of representatives of manufacturers and of users of different materials, as they have done much to solve problems and to improve conditions in the working of metals. The Advisory Council for Industrial and Scientific Research, appointed under the ægis of the Board of Education, ought to be of considerable assistance to the engineering and shipping industries, as well as to the whole industrial work of the Empire. The developments and changes in the driving power for sea as for land service, with its possible limitations; the economies which may be effected in the use of steam as a driving power, in the producer, in the passage ways, by conservation of the heat energy, and in the machinery itself; the various auxiliary details and their economic advantages under different conditions of service; general economics of the engine-room and stokehold, with the use of consumable stores in the daily routine, are some of the subjects which are presented to the mind of the marine engineer and occupy his attention in study. Probably the last few years have contributed more evidence than previously was in the public eyes to show the attention to duty, the resourcefulness, and the pluck of the marine engineer in getting the best out of the machinery entrusted to his care. All honour to those who have upheld the dignity of their cloth—in many cases at the sacrifice of their own lives.

J.A.

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