ERRATA.

Vol. VII. Paper No. LVIII. "Internal Friction."

Page 13, line 29, "other services" should read "other surfaces."

,, 97, ,, 11, "into" ,, ,, "on to."

,, 97, ,, 25, "slow" ,, ,, "low."

,, 97, ,, 31, "with such" ,, ,, "when such."

,, 101, ,, 29, "25 °/₀ less than that" ,, "25 °/₀ less that, &c."

INSTITUTE OF MARINE ENGINEERS

INCORPORATED.

SESSION 1896-7.

President:—Sir Edwyn Sandys Dawes, K.C.M.G.

EIGHTH ANNUAL VOLUME

COMPRISING THE

PAPERS READ,

AND DISCUSSIONS HELD DURING THE SESSION,

ANNUAL REPORTS, FINANCIAL STATEMENT,

PRESIDENT'S ADDRESS, LECTURES, &c.,

Catalogues of Books and Property,

LIST OF MEMBERS, OBITUARY.

EDITED BY

The Honorary Secretary.

INSTITUTE OF MARINE ENGINEERS

INCORPORATED.

SESSION 1896-7.

VOLUME VIII.

INDEX.

INSTITUTE OF MARINE ENGINEERS

INCORPORATED.

SESSION 1896-7.

Order of Papers Received and Read.

February 1st, 1896—February 1st, 1897.

NO.	TITLE.	AUTHOR.	DATE READ.
LX.	Liquid Fuel	H. C. WILSON (Member)	Stratford, 24th Feb., '96
LXI.	Engineers and the R. N. R.	F. COOPER (Member)	do. 24th Feb., '96
LXII.	White Metal for Bearings	R. DAVISON (Member)	do. 27th April, '96
LXIII.	Water-Tube Boilers	E. PETERSEN (Member)	do. 30th Mar., '96
LXIII.A.	*Boiler Scale and Incrustation	J. HAWTHORN (Member)	do. 23rd Nov., '96
LXIV.	Bearings of Marine Engines	J. DEWRANCE (Member)	do. 14th Dec., '96
LXV.	Electrical Welding	S. F. WALKER (Member)	Cardiff, 23rd Dec., '96
LXVI.	Assistant Cylinder for Valve Gears.	BASIL J. JOY (Assoc. Memb.)	Stratford, 25th Jan., '97

* Intended for the Graduate Section, but delivered as a lecture at a general meeting, by request, and afterwards written out for the Transactions.

INSTITUTE OF MARINE ENGINEERS

INCORPORATED.

SESSION 1896-7.

Authors of Papers Received and Read.

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F. Cooper .. (Member)	Engineers and the R. N. R. ..	LXI. ..	Stratford, 24th Feb., '96
R. Davison.. (Member)	White Metal for Bearings ..	LXII. ..	do. 27th April, '96
J. Dewrance (Member)	Bearings of Marine Engines ..	LXIV. ..	do. 14th Dec., '96
J. Hawthorn	*Boiler Scale and Incrustation ..	LXIII.A..	do. 23rd Nov., '96
B. J. Joy ..	Assistant Cylinder for Valve Gears	LXVI. ..	do. 25th Jan., '97
E. Petersen	Water-Tube Boilers..	LXIII. ..	do. 30th Mar. '96
S. F. Walker	Electrical Welding	LXV. ..	Cardiff, 23rd Dec., '96
H. C. Wilson	Liquid Fuel	LX. ..	Stratford, 24th Feb., '96

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INSTITUTE OF MARINE ENGINEERS

INCORPORATED.

SESSION 1896-7.

President—SIR EDWYN S DAWES, K.C.M.G.

Volume VIII.

(OF TRANSACTIONS)

REPORT OF THE PROCEEDINGS

AT THE

ANNUAL MEETING

HELD AT

58, ROMFORD ROAD, STRATFORD,

ON FRIDAY, 12TH MARCH, 1897.

INSTITUTE OF MARINE ENGINEERS

INCORPORATED.

SESSION  1896-7.

PROGRAMME OF THE

EIGHTH ANNUAL MEETING

On Friday, 12th March, 1897,

AT

58, ROMFORD ROAD, STRATFORD.

Chairman—ALDERMAN G. W. KIDD *(Vice-President).*

7.30 The CHAIRMAN.

7.35 Appointment of Scrutineers.
Proposer, Mr. A. WALKER.
Seconder, Mr. PILLANS SCARTH.

7.40 The Annual Reports.
Mr. JAS. ADAMSON
(Hon. Secretary).
Mr. GEO. SLOGGETT
(Hon. Sec., Bristol Channel Centre).
Mr. JOHN GRIFFITHS
(Hon. Sec., Southampton Centre).

7.55 Financial Statement.
Mr. ROBT. LESLIE *(Hon. Treasurer).*

8.0 Adoption of Reports.
Proposer, Mr. JAMES BLAKE.
Seconder, Mr. J. E. ELMSLIE.

8.10 Vote of Thanks to the Retiring President (Sir Edwyn S. Dawes).
Proposer, Prof. A. C. ELLIOTT, D.Sc.
Seconder, Mr. E. B. CAIRD.
Response, The PRESIDENT.

8.30 Vote of Thanks to Office Bearers and Council.
Proposer, Mr. T. F. AUKLAND.
Seconder, Mr. J. G. HAWTHORN.
Response, The CHAIRMAN OF COUNCIL.

8.40 Vote of Thanks to the Auditors.
Proposer, Mr. FRANK COOPER.
Seconder, Mr. H. C. WILSON.
Response, Messrs. N. S. HAWKS and J. F. REDMAN.

8.50 Vote of Thanks to Hon. Solicitor.
Proposer, Mr. ROBT. LESLIE.
Seconder, Mr. S. C. SAGE.
Response, The HON. SOLICITOR.

9.0 Technical Education.
Mr. JOHN ADAMSON
(Convener, Educational Committee).
Mr. F. W. SHOREY.

9.10 Report of Scrutineers.
Messrs. G. INGLIS and A. JOHNSTONE.

9.15 Vote of Thanks to Scrutineers.
Proposer, Mr. J. T. SMITH.
Seconder, Mr. J. E. ELMSLIE.
Response, Messrs. G. INGLIS and A. JOHNSTON.

9.20 Appointment of Auditors.
Proposer, Mr. C. NOBLE.
Seconder, Mr. A. ROBERTSON.

9.25 Vote of Thanks to Chairman.
Proposer, Mr. W. C. ROBERTS.
Seconder, Mr. E. B. CAIRD.
Response, The CHAIRMAN.

INSTITUTE OF MARINE ENGINEERS

INCORPORATED.

SESSION 1896-7.

President:—SIR EDWYN S. DAWES, K.C.M.G.

REPORT OF THE PROCEEDINGS

AT THE

ANNUAL MEETING

HELD ON

FRIDAY EVENING, MARCH 12th, 1897.

CHAIRMAN:

ALDERMAN G W. KIDD *(Vice-President)*.

The CHAIRMAN: The business before us to-night is to receive the reports for the last session, and to elect the Office Bearers and Council for the new session. I will now call upon Mr. A. Walker (Member) to propose the appointment of two Scrutineers, to examine the voting papers, and report the result to the meeting before we close.

Mr. A. WALKER: I beg to propose that Mr. Geo. Inglis (Member) and Mr. A. Johnstone (Member) be appointed Scrutineers.

Mr. PILLANS SCARTH (Member): I beg to second that appointment.

The CHAIRMAN, having put this to the meeting, declared the appointment carried.

Messrs. Inglis and Johnstone having accepted the duty, retired to make their report.

The CHAIRMAN: I now call upon the Honorary Secretary to read the report of the session's work.

The HONORARY SECRETARY then read the report as follows:—

EIGHTH ANNUAL REPORT.

The Session 1896-7, which closed on January 31st, has been progressive in respect to the increasing membership and to the increased facilities given to the junior section, while the papers and discussions have been full of interest and value, and the social events in connection with the Institute have been well up to the standard of former years, at least.

The membership at the close of the financial year stood at 1,031, made up as follows:—

783 Members, showing an increase of	..	61
84 Associate Members, „	..	6
75 Associates, „	..	11
65 Graduates „	..	32
*24 Companions, „	..	3
Total	.. ..	113

Since the last report the loss of thirteen members by death have unhappily to be recorded:—

ARCHIE BLACK (Member), a well-known member who carried on business in Antwerp for many years, and died there in June, 1896.

*Being a transfer from Hon. Membership in accordance with the resolution passed at last Annual Meeting.

ARCH. CAMPBELL (Companion), son of the late Malcolm Campbell, and one who took a deep interest in the Institute, and rendered great help in connection with our social functions, died at Camden Town, London, N., June, 1896.

Capt. CHAPMAN (Companion), who was Marine Superintendent for the Royal Mail S.P. Co., and took special interest in the Southampton Centre, died January, 1897.

L. P. COUBRO (Member), formerly a Member of Council and one of the original subscribers to the Institute, who worked faithfully and heartily in its interests until failing health caused him to seek refuge in another climate to recruit; to our loss he did not revive, but died in Australia, May, 1896.

IVIE DOUGLAS (Member), well-known to members resident in Forest Gate, where he died, on November 16th, 1896.

J. J. GRAHAM (Member), Chief Engineer of the P. & O., S.S. *Carthage*, was killed by accidentally falling to the bottom of the Merryweather Dry Dock, Bombay, December, 1896.

T. HENDERSON (Member), whose special work and efforts in connection with improvements in fire-bars are well known, died at Liverpool, July, 1896.

J. T. HOWIESON (Member), for many years in the service of the British India Co., chiefly on the Indian Coast Service, died at Kirkcaldy, Fifeshire, February 27th, 1896.

A. INGLIS (Associate Member), who was employed in the P. & O. Co.'s service, S.S. *Ravenna*, in China, fell overboard, the result of an accident, and was drowned while at Shanghai, in August, 1896.

E. JOHN (Member), who formerly held the office as Representative to Council for the Bristol Channel Centre, died at Cardiff, February 1st, 1897.

J. MILNE (Member), Chief Engineer, in the service of the British India Co. for about 20 years, died at Brisbane, Queensland, August, 1896.

J. STEPHEN (Member), in the service of the P. & O. Co. for many years, Chief Engineer S.S. *Peshawur*, died at Singapore, January, 1897.

A. WATSON (Member), died at Manor Park, after a brief illness, on January 31st, was one of the early enrolled members of the Institute.

It is with great regret and much sympathy with the relatives and friends these names are inscribed on the roll of our past membership. We have also to regret the resignation of four members.

PAPERS AND DISCUSSIONS. Seven papers, besides lectures and notes on special subjects, have been read and discussed, the details may be seen on reference to the statement of the events which have been held during the session. Members who have papers in preparation are desired to communicate with the convener as soon as possible to admit of a syllabus being arranged and printed well in advance, thus adding to the convenience of all concerned.

The contributions from sea-going members are not so numerous as in former years. It would be of great interest in our transactions to have the majority of the papers by sea-going members, and on subjects with which they are familiar; such papers should be distinctive of our Institute.

Interesting papers might be written on the comparison of sister vessels—of similar engines in different ships, and other combinations in different circumstances, the behaviour of engines, ships, and propellers in all weathers and under different management. These and many other subjects, and also original suggestions, plans, and arrangements, are suggested for consideration.

Breakdowns and the consequent repairs constitute good material. Details of all kinds should take up a larger share of the papers. Many members, no doubt, have ideas that only require to be discussed to make them of great value to all.*

The discussions on the papers should be joined in by all who wish to improve their understanding of their profession. If possible, remarks should be written out to ensure accuracy in the printing of the transactions, and if members, on reading the press notices of the papers and discussions, would place on record and forward their remarks at once, these could be embodied in the transactions,—as of necessity these are published much later *in extenso*.

TRANSACTIONS.—The volume now closed forms the eighth of the set and will be bound uniform with its predecessors. Members returning their papers, may have them bound for 3/6 each complete, on application to the convener; seventy-two bound volumes have been sold during the session. Some of the early papers are out of print. The price of bound vols., complete, is 12/6 each to members.

The READING ROOM AND LIBRARY have been well utilised, and the former has been kept well supplied with papers and magazines during the year, and the latter has been added to by a few volumes. Several donations have also been received for the Library Fund from members whose names are recorded in the cash statement.

The MUSEUM, has also been enriched by gifts from members, these are acknowledged in the Property Inventory. Some of the donations are extremely interesting and valuable.

RECREATION.—The Annual Dinner, of which the report has already been published, was held in June, and

*See also President's address for suggestive material as well as definite subjects.

the Conversazione in December, when the President delivered his address. The report of this event is published herewith. The billiard table is open for the use of members, and has been well patronised in the evenings.

Educational.— The drawing classes have been carried on during the session, on Tuesdays and Thursdays, by Mr. W. J. Nowers Brett; lectures have been delivered on occasional Tuesday evenings, and, in order to preserve these for the general benefit, several friends have given donations to form a special fund for publishing reports in connection with the Graduate section, to avoid encroaching on the general funds of the Institute, for this purpose Messrs. A. Beldam, Thos. Johnson, H. E. Lester, and Thos. Perkins have kindly contributed specially £5 5s. towards this fund, which however, requires expanding to meet the claims upon it. A deputation from the Council had an interview with the Technical Instruction Committee of West Ham in December, when the claims of Engineering and Naval Architecture were urged upon their attention with the object of obtaining the best possible recognition of the higher scientific education being placed within the reach of young engineers in the Technical College about to be erected in Stratford.

Press Cuttings.—The subject of technical education has provoked a large amount of correspondence and comment in the Press during the past year, and much material on this subject has been preserved for reference, as well as press notices of other matters of general interest. Contributions are invited from members for the scrap book kept for this purpose.

The Addresses of many members who have removed or gone abroad without notifying change of address, are unknown, and attention is directed to this overlook, that the consequent trouble and expense due to such may be removed.

Recommendations made to the Board of Trade three years ago, on the subject of the minimum qualifications necessary for engineers of the mercantile marine, have not yet been actually adopted and passed into law, but it is hoped that in the interests of the whole community, the points especially recommended will soon be put into force. There are indications that the President of the Board of Trade is dealing with the question, and we look forward to the publication of a Bill shortly, which will include the following points: —

Minimum service in the workshop of five years.

The introduction of a third-class certificate.

The necessity of defining the meaning of nominal horse-power.

The recognition of the engineers as officers of the ship, and as such the representation of the engine department on enquiries affecting the department.

Subsequent discussions held during the session evoked the following resolutions, and as the question of N.H.P. is involved in another Bill, at present engaging the attention of Parliament, the Board of Trade is again specially invited to the subject.

Resolution—"That, in the opinion of this meeting, "it is highly necessary to amend the present regulations "as to second-class certificates for engineers with regard "to service in the workshop, where the minimum service "should be five years, and that the attention of the "Board of Trade should be called to the desirability of "creating a third-grade certificate, which should be "granted to those who have served at least five years in "an engineering work, and one year at sea, and pass "the prescribed examination."

The colonial Parliaments have had under consideration the subject of N.H.P., qualification of engineers, and

other matters, and the results have been in many respects satisfactory, although we may not agree with all the terms of the Bills passed for the Colonies.

The discussions held in connection with these matters will be found in the transactions, where the following Resolution is recorded as passed :—

Resolution—"That having read the altered regula-"tions with respect to service and qualifications for "engineers' certificates, including that of third engineer, "in the Bill which has been passed by the New Zealand "Legislature, we fully endorse those clauses relating to "service in the workshop and at sea; but we do not "altogether concur in those relating to the number of "engineers to be carried, neither do we think that the "number of engineers should be rated by the power "alone, and we also agree that the present anomaly of "N.H.P. should give way to some other means of en-"abling the power of the engines to be determined, and "consequently the effect of its bearing on the status on "the second engineer's certificate."

It is gratifying to observe that the subject of the engineers of the Royal Naval Reserve is being dealt with in the Naval Estimates. Our President and others interested in the subject are to be congratulated on the fact that their efforts have so far met with recognition, the paper and subsequent discussions and correspondence on the Royal Naval Reserve materially assisting this.

It is no less pleasing to observe that the conditions and positions under which the Engine Department of H.M.'s Navy are operated have been receiving more attention and consideration on the part of the Government, and that some considerable improvements are on the eve of being made, both in respect to the engineers and their staff of artificers and stokers.

The appointment of a representative engineer on the Board of Admiralty appears to be most desirable.

It is a matter of congratulation to the Institute and the country that the Director of Naval Construction has been restored to health and duty, and in recognition of this, it is proposed that Sir William H. White be elected a life member.

On behalf of the Council,

JAS. ADAMSON,

Honorary Secretary.

MEETINGS HELD DUR

DATE.	NO. OF PAPER.	SUBJECT.
1896.		
February 24 ...	60	Liquid Fuel .....
Do. ...	61	Engineers of the Royal Naval Reserve.....
March 9 ...	60	Discussion—Liquid Fuel.....
Do. 13 ...	—	Annual Meeting ....
Do. 16 ...	61	Discussion—Engineers, R.N.R. .....
Do. 23 ...	61	Do. do. .....
Do. 30 ...	63	Water-Tube Boilers ....
April 13 ...	63	Discussion—Water-Tube Boilers .....
Do. 27 ...	62	The Application of White Metal.....
June 17 ...	—	Annual Dinner .....
July 22 ...	—	Visit to People's Palace and East End Exhibition
September 28 ...	—	The Correspondence, conducted by the Board of Trade, on the subject of the Qualifications necessary for Marine Engineers
October 12 ...	—	Adjourned Discussion—Qualifications of Marine Engineers
Do. 26 ...	—	Do. do.
November 9 ...	—	New Zealand Shipping and Seamen's Act, Amendment Bill.
Do. 23 ...	63A	Boiler Corrosion and Incrustations (Lecture) .....
December 4 ..	—	Conversazione and President's Address .....
Do. 14 ...	64	The Bearings of the Marine Engine .....
1897.		
January 11 ...	—	Discussion do. .....
Do. 25 ...	66	Assistant Cylinder for Valve Gears .....
February 22 ...	65	*Electrical Welding .....

* Read at Cardiff in December, 1896, hence included in Session 1896-7.

ING SESSION 1896-7.

AUTHOR.	CHAIRMAN.	WHERE HELD.
Mr. H. C. WILSON ... ... (Member)	Mr. W. C. Roberts, R.N.R. (Vice-President)	Institute Premises, 58, Romford Road
Mr. F. COOPER ... ... (Member)	Do. do.	Do. do.
Mr. H. C. WILSON ... ... (Member)	Mr. T. F. Aukland... ... (Companion)	Do. do.
——	Mr. A. J. Durston, C.B., R.N. (Past-President)	Do. do.
Mr. F. COOPER ... ... (Member)	Mr. T. F. Aukland... ... (Companion)	Do. do.
	Do. do. ...	Do. do.
Mr. E. PETERSEN ... ... (Member)	Mr. J. H. Thomson ... (Chairman of Council)	Do. do.
Do. do.	Mr. A. J. Durston, C.B., R.N. (Past-President)	Do. do.
Mr. R. DAVISON ... ... (Member)	Mr. T. F. Aukland... ... (Companion)	Do. do.
Mr. W. I. TAYLOR ... ... (Convener)	Sir E. S. Dawes, K.C.M.G. (President)	King's Hall, Holborn Restaurant, London
	Mr. A. J. Durston, C.B., R.N. (Past President)	People's Palace, Mile End Road
Reference to Paper by Mr. S. C. SAGE (Member)	Mr. J. F. Flannery, M.P. (Vice-President)	Institute Premises, 58, Romford Road
Do. do.	Mr. J. R. Ruthven ... ... (Member of Council)	Do. do.
Do. do.	Do. do.	Do. do.
Do. do.	Do. do.	Do. do.
Mr. J. G. HAWTHORN ... (Member)	Mr. J. H. Thomson ... (Chairman of Council)	Do. do.
Mr. W. I. TAYLOR ... ... (Convener)	——	Town Hall, Stratford
Mr. JOHN DEWRANCE ... (Member)	Mr. A. J. Durston, C.B., R.N. (Past-President)	Institute Premises, 58, Romford Road
Do. do.	Mr. S. C. Sage ... ... (Member of Council)	Do. do.
Mr. B. H. JOY ... ... (Associate Member)	Mr. J. R. Ruthven... ... (Member of Council)	Do. do.
Mr. SYDNEY F. WALKER...	Mr. T. F. Aukland... ... (Companion)	Do. do.

INSTITUTE OF MARINE ENGINEERS.

INCORPORATED.

GRADUATE SECTION.

The Drawing Classes are held on Tuesday and Thursday evenings, from 7.30 to 9.30, from October to March inclusive. Lectures have also been delivered, per Programme, at the Premises, 58, Romford Road, Stratford.

DATE.	SUBJECT.	LECTURER.	CHAIRMAN.
October 1	Social Evening and Prize Award	———	Mr. G. W. Manuel, R.N.R. (Past President)
,, 13	Opening Lecture	Mr. JAS. ADAMSON (Hon. Secretary)	Mr. W. J. N. Brett (Member)
,, 20	Ships of our Navy (with Illustrations by Lime-Light)	Mr. J. F. FLANNERY, M.P., J.P. (Vice-President)	Mr. J. M. Gray (Member of Council)
,, 27	Freehand Drawing	Mr. JOHN ADAMSON (Member of Council)	Mr. W. J. N. Brett (Member)
November 3	Coal Testing—with Experiments	Mr. J. H. THOMSON (Chairman of Council)	Mr. John Adamson (Member of Council)
,, 10	Building of a Dynamo	Mr. E. SHEPPARD	Do. do. do.
,, 24	Life of Nasmyth (Part I.)	Mr. T. F. AUKLAND (Companion)	Mr. Jas. Adamson (Hon. Secretary)
January 18	Mechanical Drawing	Mr. W. J. NOWERS BRETT (Member)	Do. do. do.
February 16	Magnetism	Mr. E. SHEPPARD	Mr. W. J. N. Brett (Member)

W. J. N. BRETT (Member) *Teacher.*

JOHN ADAMSON (*Convener, Educational Committee*).

The CHAIRMAN: The general report has now been submitted to the meeting for consideration, and in the absence of Mr. Sloggett (Hon. Local Secretary), from Cardiff, I will call upon Mr. Jas. Adamson to read the Bristol Channel Centre report.*

The HONORARY SECRETARY: I regret exceedingly that Mr. Sloggett is not present with us to-night. We are not without a representative, however, and we welcome, with pleasure, the presence of Professor Elliott, President of the Centre. The report submitted by the Centre is as follows:—

INSTITUTE OF MARINE ENGINEERS.

INCORPORATED.

BRISTOL CHANNEL CENTRE.

ANNUAL REPORT

FOR THE

SESSION 1896-7.

There are fewer events to be recorded in the history of the Bristol Channel Centre for this session than in former years. The meetings have been somewhat less frequent, and the social gatherings not quite so numerous. This, however, does not necessarily signify any diminution in the vitality of the Centre, nor retrogression as regards its position. As a matter of fact its status has been fully maintained and its influence considerably extended, and what has been done cannot fail to have an ultimate beneficial effect.

* Printed in proof along with the general report in the hands of the meeting.

Several papers have been read and discussed, two of them having been contributed by local members, viz.: "The Application of White Metals," by Mr. R. Davison, and "Electrical Welding," by Mr. Sydney F. Walker.

At the invitation of the members of the Bristol Channel Centre, a Reception and Grand Smoking Concert was held at the Park Hall, Cardiff, on June 24th, 1896, in honour of the visit to the district of the members of the North-East Coast Institution of Engineers and Shipbuilders. The President of this Centre (Professor A. C. Elliott, D.Sc.) presided at the gathering, which was attended by Mr. Thos. Richardson, M.P., the Right Hon. Lord Windsor (Mayor of Cardiff), the members of both Institutions, the officers of the local, regular, and auxiliary forces, and the principal representative men of the district. The following letter has since been received by the President from Mr. J. Duckitt, Secretary of the North-East Coast Institution:

4, St. Nicholas Buildings West,
Newcastle-upon-Tyne,

Prof. A. C. Elliott, *29th July*, 1896.
President, Bristol Channel Centre,
Institute of Marine Engineers, Cardiff.

Dear Sir,

In accordance with a resolution passed at a general meeting of this Institution, held in Cardiff, on Thursday, 25th June, I am requested by the President and Council to convey to you and your Committee the hearty thanks of the members of the Institution for the cordial welcome you extended to us, and the most hospitable manner in which you entertained us on our visit to Cardiff and the Bristol Channel Ports on Wednesday, 24th June. This practically being our first summer visit outside our own district, I have pleasure in stating that the kindly way in which we have been received is most gratifying to the Institution as a body.

I am, Sir,
Faithfully yours,
JOHN DUCKITT,
Secretary.

A very enjoyable summer excursion of the members was made in August, 1896, to the Forest of Dean. The very extensive old iron workings of the Romans were inspected, and on the assembling of the company at the ancient Speech House of the Forest, a most appropriate and interesting paper on "Iron and Steel" was delivered by Professor Elliott.

The Sixth Annual Dinner of the Centre was held at the Royal Hotel, Cardiff, on the 31st October, 1896, and was largely attended.

The above meetings are separately reported herewith.

The result of the Annual Election of the Office Bearers and Committee of the Centre for the Session, 1896-7, was as follows :—

President : Prof. A. C. Elliott, D.Sc.

Vice-President : Mr. D. Gibson.

Hon. Treasurer : Mr. C. L. Ryder.

Hon. Secretary : Mr. George Sloggett.

Representative to Council : Mr. D. McCallum.

Members of Committee :

Mr. J. Chellew.	Mr. T. McCallum.
„ R. Davison.	„ W. Simpson.
„ Jas. Ferrier.	„ A. E. Smithson.

The membership roll has increased, but has been partially counteracted by the removal of several members from the district. Owing to this latter cause, Mr. C. L. Ryder, in December, 1896, resigned the position of Hon. Treasurer to the Centre, which he had held for some years. The vacancy thus caused has not since been filled up.

The Centre is fortunate in continuing to retain as their President Prof. A. C. Elliott, while he also evinces the same interest in its welfare as hitherto.

The meetings are still held at the University College, Cardiff, by the courtesy of the Council.

On behalf of the Committee,

GEORGE SLOGGETT,

Hon. Secretary, B.C.C.

INSTITUTE OF MARINE ENGINEERS

INCORPORATED.

BRISTOL CHANNEL CENTRE.

DATE.	BUSINESS.	AUTHOR.	CHAIRMAN.	WHERE HELD.
1896				
Mar. 4	Nominations for Annual Election			
	"The Application of White Metals" ..	Mr. R. DAVISON ..	Prof. A. C. Elliott	University College, Cardiff.
,, 18	Paper: "Liquid Fuel"	Mr. H. C. WILSON	Do.	Do. do.
Apl. 15	Discussion ditto	.. ..	Do.	Do. do.
,, 29	"Water-Tube Boilers"	Mr. E. PETERSEN .	Do.	Do. do.
June 24	Reception and Grand Smoking Concert in honour of the N.E. Coast Inst. of E. & S.	.. ..	Do.	Large Park Hall, Cardiff.
Aug. 15	Visit to Forest of Dean			
	Paper on "Iron and Steel"	Prof. ELLIOTT ..		SpeechHouse, Forest of Dean
Oct. 31	Annual Dinner	.. ..	Do.	Royal Hotel, Cardiff.
Dec. 23	"Electrical Welding"	Mr. S. F. WALKER	Do.	University College, Cardiff.
1897				
Jan. 13	"Bearings of Marine Engines"	Mr. J. DEWRANCE	Do.	Do. do.
Feb. 24	"Valve Gears"	Mr. B. H. JOY ..	Do.	Do. do.

INSTITUTE OF MARINE ENGINEERS

INCORPORATED.

BRISTOL CHANNEL CENTRE.

SIXTH ANNUAL DINNER.

Few more enjoyable and successful social re-unions take place in South Wales and the West of England than that afforded by the Annual Dinner of the Bristol Channel Centre of the Institute of Marine Engineers, the latest of which was held at the Royal Hotel, Cardiff, on Saturday, 31st October, when Professor A. C. Elliott, D.Sc., presided over a goodly company, including the Deputy-Mayor of Cardiff (Alderman David Jones, J.P.), Mr. John Gunn, J.P. (President of the Cardiff Chamber of Commerce), Captain W. R. Corfield (President of the Cardiff Shipowners' Association), Rev. Canon Thompson, D.D. (Vicar of Cardiff), Mr. James Adamson (Hon. Sec., London), Mr. David Gibson (Vice-President, B.C.C.), Messrs. J. Chellew, R. Davison, Jas. Ferrier, John McCallum, W. Simpson, and A. E. Smithson (Members of Committee), Mr. David McCallum (representative to Council), Mr. C. L. Ryder (Hon. Treasurer), Mr. George Sloggett (Hon. Secretary), Mr. T. J. Leaning (District Superintendent, Great Western Railway), Mr. J. A. Jenkins, B.A. (Registrar, South Wales University College), Mr. A. K. Hamilton (Lloyd's), Mr. W. R. Hawkins (Secretary, Cardiff Chamber of Commerce), Monsieur Barbier, Professor Galloway, Mr. C. A. Heywood, Dr. J. Ll. Treharne, J.P.,

Professor Hughes, M.B., Mr. E. Handcock, Junr., Mr Ivor James, Dr. MacCormack (Newport), Mr. Alderman Trounce, J.P., Mr. Huddart, Captain T. H. Sloggett, Messrs. J. J. P. Burt, Chas. Radcliffe, R.N.R., T. W. Wailes (Denny Gold Medalist, 1895-6), Albert Evans, R.N.R., John Lockie, Wh. Sch. (Editor of the "Steamship"), Ivor J. Williams, D. Dill, and J. T. Harris (Swansea), A. S. Jackson, Caswell Henderson, T. C. Calder, G. Rutherford, Sydney F. Walker, W. Rutherford, R. J. Field (Messrs. Field and Sloggett, Commercial Dry Dock, Cardiff), Bonnyman, Campbell, Dobson, Richards, Marquand, Goldsbrough, J. Boddy, A. Kendrick, W. Kendrick (West Clowes), Bowden, T. Williams, Blacklar, J. Williamson (Newport), J. F. Walliker, W. Aisbitt, and others.

The dinner was admirably served in the Banqueting Hall of the Royal Hotel.

After the loyal toasts had been submitted from the chair, and duly honoured,

Mr. JOHN LOCKIE proposed "The Ports of the Bristol Channel." He observed, in doing so, that he was afforded much pleasure in joining, on that occasion, so large an assembly of marine engineers. He was one of the original members of the Institute of Marine Engineers, and he was bound to say the parent society might envy her go-ahead son, the Bristol Channel Centre. She was, however, proud of him, that he had grown so finely. He was the worthy son of a worthy sire; and he was sure their Honorary—and he would say their honoured—Secretary, Mr. Adamson, must feel very gratified at seeing so large an assemblage of marine engineers on this occasion. To the marine engineers the prosperity of the Bristol Channel ports was largely due. He was one of a band of engineers who came recently to Cardiff to receive its kind hospitality, and to see what there was to be seen. They were shown wonderful docks, coal tips, and steel works, and, so far as its hospitality was concerned, Cardiff nearly killed its

visitors. They were told that New York was a greater port than Cardiff. Nothing of the sort, they all knew that Cardiff was the greatest port in the world. Chambers of Commerce had done a great deal for the Bristol Channel ports. The Chairman of the Cardiff Chamber, who was to respond to the toast, was a Scotsman who came South many years ago, in the days of small things in Cardiff, and he was sure they were all pleased to see him that night. The prosperity of the port of Cardiff was largely due to another cause; they had had noblemen who had given their time, wealth, and social influence to its development. Lord Bute and Lord Windsor had acted nobly. Burns had said—

> The rank is but the guinea stamp;
> The man's the gowd for a' that.

But whether a man was a person of rank or a commoner, if he exerted his talents and influence to benefit humanity, he was one to be held in honour and respect. Such men were Nature's noble men. In conclusion, he would express a hope that the Welsh valleys would continue to send forth good, level-headed, energetic business men to be shipowners, dockowners, merchants, and marine engineers, men who would develop the resources of the Bristol Channel ports, and carry forward the banner of Progress.

Mr. John Gunn, in responding, observed that he was one of those who believed that every port in the Bristol Channel relatively benefitted by whatever came into the Channel. The coal exports alone from the Bristol Channel represented about one-half of the exports of the United Kingdom. Of nearly thirty million tons of coal exported from the kingdom, the Bristol Channel ports were responsible for 14,500,000 tons, by far the largest proportion of which Cardiff contributed. If there was one regret in connection with that marvellous product, Welsh steam coal, it was that those who had invested in its development were not receiving reasonable recompense for their investment. He hoped the day was not far distant when there would be an improvement in this respect, and when everybody engaged in

the industry would get a reasonable and fair reward for his labour. He heartily congratulated the President upon the continued prosperity of that Centre of the Institute of Marine Engineers, and also upon the success which marked the Professor's work at the University College of South Wales. He (the speaker) had always recognised the value of technical education. For nearly twenty years he advocated it at meetings of the Associated Chambers of Commerce, urging the absolute necessity of such systematic training if our youths were to be equipped for the battle of life against foreign competition. He cordially wished the Institute a full measure of success. In his opinion, marine engineers were not fairly treated by the Admiralty and other authorities. There were remedies possible, and it rested with societies like theirs to seek to apply them, so that the engineer whose skill, whether afloat or ashore, demanded the highest recognition, should be fairly valued.

The Rev. Canon THOMPSON, D.D. proposed "Greater Cardiff," and the Deputy Mayor (Ald. DAVID JONES) acknowledged the toast.

Dr. J. Ll. TREHARNE, J.P., proposed "The Institute of Marine Engineers." He said the other day Cardiff received a visit from a society representing organizers of technical education in different parts of the country, when those gentlemen argued that while we had fallen behind other trades and professions, in shipbuilding and marine engineering we were a long way to the fore yet. If that was so, and he did not doubt it, it was largely due to the existence of societies like the Institute of Marine Engineers. They were told that the parent society had a young and vigorous offspring in the Bristol Channel Centre. He believed there was another son at Southampton; and they would not be offended with him when, as a medical man, he said he hoped there would be a large increase of family before many years were over. One of the most encouraging signs of the times was that members of the professions should bind themselves together as institutes to discuss matters

closely concerning their status and their professional work. This was especially important in the case of marine engineering science, which had gone, and was going, through rapid phases of development, and the problems of which were fraught with questions affecting the lives and the well-being of so many persons, and the interests and safety of vast properties. He had pleasure in associating with the toast the name of a distinguished professor, so honourably associated with the University College of South Wales and Monmouth, and so able an exponent of engineering science, Professor Elliott, and also the name of one of the originators of the Institute, Mr. James Adamson, Hon. Secretary.

Professor Elliott, rising to respond, was very cordially received. At the outset he read a telegram from the Southampton Centre, conveying best wishes for a successful gathering. It seemed to him, he said, extremely appropriate that a medical man should propose this toast. The two professions were not unakin. The human frame divine had some not-distant analogy to the steam engine. It had, for example, a circular current—a circulating pump and valves—of the utmost delicacy and the most complicated mechanism, involving all the mechanical powers we could think of, and possibly some that had not yet been developed. It had a furnace wherein was burnt the carbon which came from food—its fuel—and it burnt that carbon in a furnace with the oxygen of the air, and it respired waste products. The Bristol Channel Centre claimed to have done fairly good work during the past year. They have thrown themselves into the great discussion which had overflowed the columns of the technical papers, the banks of the technical societies, and the premises of the daily press. He referred to the controversy on water-tube boilers. From time to time the Admiralty had been introducing, in manner experimental, water-tube boilers to replace the Scotch marine boiler, and in some circumstances the Admiralty loco. type of boiler. The controversy fairly boiled over when it was announced that the swiftest cruisers ever built were to be boilered each with 48

Belleville boilers. Mr. A. J. Durston, their ex-President, was mainly responsible for that great departure. The Institute of Marine Engineers, as a whole, sided with him in this, and so did the Bristol Channel Centre. It was very pleasant to know that one of these cruisers had partly gone through her steam trials, and had shown, almost indisputably, that the belief of Mr. Durston in the Belleville boiler was fully justified. The detractors on the one side, and the advocates on the other, had had their innings. For the most part the innings had been on the side of the detractors. These cruisers were not, they said, to get 18,000 H.P., far less 25,000, which would blow up the boilers. He left them to judge whether the blackest of these prophecies had been fulfilled. During the past year the tendency in marine engineering circles had continued in the direction of increased boiler pressure. It was becoming more and more apparent that if they continued on these lines some change must be made. There were evidences that the water-tube boiler was creeping into the mercantile marine, and he was afraid—from the point of view, that is, of the makers of the old Scotch boiler who had sunk a vast capital in machinery especially designed for that type—that it had come to stay. In at least one case in the merchantile marine the pressure had gone up to 250 lbs., with a quadruple engine on five cranks. For years he had advocated quadruple engines on four cranks, and this was a step in advance even of that. He was proud to say that the Institute of Marine Engineers had had something to do with it, and that it was associated in no small degree with a member of the Bristol Channel Centre. In conclusion, the President of the Centre expressed his gratification at the continued personal interest in the Centre displayed by Mr. Adamson, whose name was also associated the toast.

Mr. JAMES ADAMSON conveyed an expression of the regret of the President of the Institute of Marine Engineers at his inability to be present there that evening. He (Mr. Adamson) knew the President would

have derived much pleasure from seeing so excellent and representative a gathering. The Council of the Institute also desired him to express their high appreciation of the vitality displayed by the Bristol Channel Centre, as was apparent, not only in its proceedings, but also in the eminently successful character of its annual dinners. If they in London seemed to lag behind, they looked to their son, the Bristol Channel Centre, to stir them up. The Bristol Channel Centre had ably backed up the efforts of the parent society in trying to secure a better position and a better regard for the requirements of the marine engineer, and, through such better regard—a better service to their employers—the shipowners. Hitherto they had not succeeded in their endeavours, but he found that in New Zealand an Act had been adopted, which covered the whole of the points for which they had been contending. First, that engineers should be rated upon the Articles as officers. Second, that in all cases where there were enquiries by the Board of Trade affecting the engine-room department, an engineer should be upon the Board. Third, that all engineers who went forward for a Board of Trade certificate should have served five years in a workshop. Other points conceded were—that there should be a third-class engineers' certificate, and the substitution of indicated H.P. for the 99 nominal H.P. It was time to put a stop to this anomaly as to N.H.P. in this country; but while our Board of Trade had its considering cap on with regard to all these matters here, they became accomplished facts in New Zealand, or would be accomplished by the beginning of the year 1897. The Council of the Institute had arranged to again approach the Board of Trade and urge them to cast aside their considering cap, and put on the cap of action. He (the speaker) was present last year when Mr. Wailes received the Denny Gold Medal, and Dr. Elliott had indicated that this year it was possible a similar compliment would be again paid to Cardiff. Unfortunately for this view, things had so transpired that the medal had been sent to Hong Kong. Concluding, he had the utmost pleasure in wishing continued activity and usefulness to the Bristol Channel

Centre, and personally he desired to express his warm appreciation of the language and sentiments expressed by Canon Thompson in his allusions to the Institute in connection with another toast, and in remembrance of his utterances at the last year's dinner, he hoped the good wishes expressed would bear good fruit.

Capt. CORFIELD proposed "The President, Dr. Elliott," whose keen interest in the Institute and the Bristol Channel Centre he warmly eulogised, amid the endorsing plaudits of the company. With regard to the observations of Mr. Adamson, he (Capt. Corfield) pointed out that on the Cardiff Marine Board they had engineers. They certainly ought to be on such Boards.

The toast was drunk with musical honours, and Dr. Elliott briefly responded.

During the evening instrumental and vocal music was rendered by several friends, a ventriloquial entertainment adding to the pleasure and enjoyment derived from the former, the whole evening's proceedings being a great success.

The CHAIRMAN: You have now heard the reports so far as they have been prepared, the Southampton Centre report has not yet come to hand, but it may arrive in the course of the evening. Meantime, these are before you, and I will call upon the Honorary Treasurer to submit the Financial Statement.

The HON. TREASURER (Mr. Robert Leslie): The Balance Sheet and Statement of Receipts and Expenditure are in the hands of the meeting, and I need not read the figures, but if there are any questions to ask, let them be put forward. There were a lot of members in arrears, but since notices were sent out a good deal of money has come in. I am glad to say we are therefore in a much better position now than we were some months ago. We have got a good freehold building and a balance at the bank, we are therefore well off.

The CHAIRMAN: I take it that there are no questions on the reports, so I will call on Mr. Blake.

Mr. JAS. BLAKE (Member): I am afraid that I have been asked to perform a rather formidable task, judging from the amount of literature that has been put before us However, I beg to move the adoption of the reports, and I would like to say that I think the members of the Institute have every reason to be satisfied with the nature of the reports submitted. They seem to be very comprehensive and very clear, and they certainly give us a very good idea of the work that is being conducted here, and also at the Bristol Channel Centre. We have been disappointed in not getting the Southampton Centre report, but I have no doubt that it will be found of the same satisfactory nature. I think the financial statement which has been given to us by Mr. Leslie is also very satisfactory. It shows a balance on the right side. One feature in connection with the financial statement is that it bears the signature of a firm of chartered accountants, which is a guarantee of its accuracy, and

forms a safeguard to the interests of the members. The membership of this Institute differs in some respects from that of kindred societies, inasmuch as our members are distributed over a large area, and many—perhaps the majority—are in foreign parts. I am very pleased to see that the reports have been drawn up with such care, because I have no doubt that our fellow members will be very pleased to see these reports, and will note with satisfaction the amount of work that is being done. A prominent place has been given to the recommendations forwarded to the Board of Trade with regard to engineers in the mercantile marine, and I have no doubt that those recommendations will have effect. It has given us great pleasure to note that Sir William White has returned to his duties ; and I also think that we must feel highly honoured that we are to have his name added to our list of life members, having regard to the position that he occupies as Chief Constructor of Her Majesty's Navy, and also having regard to the influence he exerted and the assistance which he rendered us during the time he was President of the Institute. It appears to me that the officials of the Institute have done their duty faithfully and well, both with regard to the financial statement and the matters referred to in the reports, and I have no hesitation in moving that those reports and the financial statement be adopted for printing in the transactions.

Mr. J. E. Elmslie (Member) : I have very much pleasure in seconding the motion for the adoption of the reports, and after the remarks made by Mr. Blake I do not think there is much I need add. The proposal to elect Sir William White a life member will give very great satisfaction to the members; and with regard to the proposals of the Council as to an alteration in the conditions on which engineers' certificates are granted, I hope that the Council will continue to press that matter on the Board of Trade until their suggestions are carried into effect.

The motion was carried unanimously.

REVENUE

Dr. *1st February, 1896, to*

To **General Expenses**—				£	s.	d.	£	s. d.
Bank Charges				0	14	4		
Postages				14	9	3½		
Telegraph Address				1	1	0		
Travelling Expenses—	£	s.	d.					
Glasgow	3	8	0					
Cardiff	1	16	0					
				5	4	0		
Medal Inscription				0	2	6		
Clerical Work				2	0	0		
Stationery and General Printing				23	2	2		
Law Charges:—Registration of increase of Membership				2	15	2		
Assistant Secretary's Salary				100	0	0		
Chartered Accountant's Fee				10	10	0		
							159	18 5½
,, **Rates, Taxes, &c.**—								
Rates and Taxes				24	16	9		
Gas				12	15	0		
Water				4	2	0		
							41	13 9
,, **House Account**—								
Caretaker's Wages				55	13	0		
Coals				5	14	0		
Sundries				2	14	7½		
Expenses—engaging new Caretaker				1	10	3		
							65	11 10½
,, **Insurance**							1	14 6
,, **Advertisements**							9	10 0
,, **Depreciations**—								
On Furniture				14	12	7		
On Additions to Building				26	0	6		
							40	13 1
,, **Expenses Reading Room**							10	2 11
,, **Papers and Discussions**—								
Printing and Lithography				204	1	11		
Reporting				23	4	0		
Postages				28	18	10½		
							256	4 9½
,, **Drawing Class**—								
Expenses				9	10	0		
Less Fees received				5	2	6		
							4	7 6
,, **Transactions Section**—								
Expenses of Bound Volumes less Sales							2	12 0
,, **Recreation Section**—								
Expenses—Dinner				165	10	10½		
,, Conversazione				88	11	8½		
,, Opening Session				1	14	2		
,, 1895 Conversazione				1	12	9		
							257	9 6
,, **Interest**—								
Denny Gold Medal							10	0 0
,, **Bristol Channel Centre**							8	6 6
,, **Southampton Centre**							38	14 0
,, **Balance** (excess of Income)							82	10 11½
							£989	9 10

We have examined and compared the Cash Books and Vouchers kept by the Honorary Treasurer, and find them to agree with the cash balance.

ACCOUNT.

31st January, 1897. **Cr.**

	£	s.	d.	£	s.	d.
By **Entrance Fees**—						
Members	64	0	0			
Associate Members	5	5	0			
Associates	8	10	0			
Graduates	16	0	0			
Companions	3	0	0			
				96	15	0
,, **Subscriptions**—						
Members	663	3	2			
Associate Members	34	3	9			
Associates	19	10	6			
Graduates	10	13	4			
Companions	19	18	0			
	747	8	9			
Less **Subscriptions in Advance**—						
Members	£145	14	7			
Associate Members ...	2	1	3			
Associates	2	5	10			
Graduates	2	5	10			
Companions	7	14	0			
	160	1	6			
				587	7	3
By **General Revenue**—						
Sale of By-Laws, &c.	1	5	6			
Receipts—Billiard Table	8	16	9			
				10	2	3
,, **Donations**—						
Building Fund	10	0	0			
Library	2	0	0			
				12	0	0
,, **Recreation Section**—						
Sale—Dinner Tickets	90	3	0			
,, Conversazione	112	14	6			
Donations—Dinner	77	12	10			
,, Conversazione	2	15	0			
				283	5	4
				£989	9	10

N. S. Hawks, } *Auditors.*
J. F. Redman, }
Robt. Leslie, *Hon. Treasurer.*

THE INSTITUTE OF MARINE ENGINEERS. (SESSION 1896-7).

BALANCE SHEET, 31st JANUARY, 1897.

Liabilities.

	£	s.	d.
To Sundry Creditors	44	9	8
,, Denny Gold Medal, and Interest to date ...	261	13	4
,, Subscriptions in advance for Session 1897-8 ..	160	1	6
,, Revenue Account— £ s. d.			
Balance 1st February, 1896 . 1581 11 11			
Add Excess of Income, 1896-7 82 10 11½			
	1664	2	10½
	£2130	7	4½

Assets.

	£	s.	d.	£	s.	d.
By Cash at Bank				116	1	0
,, Petty Cash in hand				1	2	6½
,, Freehold of Institute Buildings, 58, Romford Road, at cost, with extensions...				1500	0	0
,, Furniture, &c., at Institute—	£	s.	d.			
Balance 1st February, 1896 ...	289	14	11			
Additions...	2	16	10			
	292	11	9			
Less Depreciation 5%	14	12	7			
				277	19	2
,, Additions, Alterations and Repairs to Institute—						
Balance 1st February, 1896 ...	254	8	7			
Additions	5	16	9			
	260	5	4			
Less Depreciation 10% ...	26	0	6			
				234	4	10
,, By Insurance unexpired				0	19	10
				£2130	7	4½

We have examined the above Balance Sheet with the Books and Vouchers, and certify it to agree therewith. The Subscriptions in arrear have not been taken into credit in the above account. The Deeds of the Premises in Romford Road are in possession of the Bank.

WALTER W. FEAST & Co.,
Chartered Accountants,
6 & 8, Eastcheap, London, E.C.

Professor ELLIOTT (Vice-President): I rise with great pleasure to discharge a very pleasant duty. I move that we accord a hearty vote of thanks to Sir Edwyn Dawes, the President of the Institute, for his conduct in the chair during the last twelve months. The record of his term of office is to a certain extent, I think, uneventful, but that it has been marked by sound and sure progress you will all agree. The sin of selfish adherence to precedent cannot be charged against this Institute. In electing Sir Edwyn Dawes to the presidency, the Institute invited a man distinguished in the development of marine policy rather than an engineer; and looking back at the close of Sir Edwyn's presidency I think that that course has been fully justified. Sir Edwyn Dawes has played on many occasions an important part in the development of the policy of the mercantile marine, and he has shown that it is not necessary to be a professional politician in order to give expression to a sound judgment, and no uncertain one, on Imperial and colonial affairs as affected by the development of the mercantile marine There is no doubt that the country at large does not know to what extent it is indebted for its advance and defence to the mercantile marine, and those connected with it. I was reading the other day an admirable memoir of that late distinguished naval officer, Sir George Tryon, who, in an unguarded moment, confused the radius of a circle with the diameter and brought a great blot on an otherwise remarkable career; and I was reminded in that memoir of the fact that we are dependent, in the matter of our daily bread, for six tenths of it upon the mercantile marine. Our situation in that respect does not come home to us in our daily life, because things go on all right and we take no notice of them; and that remark applies to many of our relationships, but that it will come home to us in a very terrible fashion has been shown both by Sir George Tryon and by Sir Edwyn Dawes on several occasions. What will happen in the event of war nobody knows. It will be something terrible, and something that must be faced; and to get food conveyed to this country in the face of great difficulties we shall

have to rely on the marine engineer and upon the gentlemen at the head of the great mercantile concerns. It is very desirable, therefore, that we should recognise men like Sir Edwyn Dawes in a position of that kind, and the Institute should recognise his position and his power for weal or woe, both in times of peace and in times of emergency. He has brought the shipowner into closer touch with the marine engineer, and I have no doubt that that will be shown in the history of the Institute. The interests of the marine engineer and the interests of the shipowner are one. I have very much pleasure in moving that we record a hearty vote of thanks to our President, and wish him long life and prosperity; and, if it be not presumptuous, I would like to remind Sir Edwyn Dawes that he will still be a Past-President, and that we shall be very glad to welcome his kindly co-operation in the years to come, as we have willingly acknowledged his services in the year that has passed.

Mr. E. B. Caird (Member): I have very much pleasure in seconding the vote of thanks to our President. I think we owe a great deal for the interest he has taken in the Institute and its members; the successes of the session are largely due to him, and I am sure we have all been very much interested in every word that has fallen from Sir Edwyn Dawes when he has been among us, and the Institute ought to be proud of having had such a man at the head of its affairs.

The resolution was carried by acclamation.

The Chairman: Gentlemen, you are aware that Sir Edwyn Dawes is not here to acknowledge this vote of thanks, but the resolution will be conveyed to him, and a letter has been received from him which I will ask Mr. Adamson to read.

The Hon. Secretary read the following letter:—

23, Great Winchester Street, E.C.,

March 10th, 1897.

Dear Mr. Adamson,

I believe my term of office, as President of the Institute of Marine Engineers, expires this month, and I cannot allow the occasion to pass without expressing my sincere thanks for the very hearty support I have received from the Council, Mr. Taylor in the social events, and yourself in the performance of the very pleasant duties which have devolved upon me. I had some misgivings when accepting the invitation, but it has been a great pleasure to me to do what little I could to advance the interests of the Institution, which is fulfilling a most useful and indeed a national work. I shall always take a warm interest in the proceedings of the Institute, and heartily wish it continued success.

Yours truly,

(Signed) EDWYN S. DAWES.

Mr. J. D. Churchill (Member): I move that that letter from Sir Edwyn Dawes be placed on the minutes.

Mr. Sage (Member of Council) seconded the motion, which was at once agreed to.

Mr. T. F. Aukland (Companion): It is my pleasing duty to propose a vote of thanks to the Office Bearers and Council, and the reports that we have heard read must, I am sure, have greatly pleased every one present to-night. The increase in the membership certainly denotes, I think, progress of a very marked kind. At the same time we are exceedingly sorry to hear that we have lost so many members by death, especially one who I know was very active among us some years ago. All this good work which has been done by the executive

of the Institute certainly demands our extremely hearty thanks; and without going through the numerous items I think I may just refer to the question of engineers in the Royal Naval Reserve, which is a question of a most important kind, because in the event of war breaking out, while we should certainly not lack for ships, we should lack for men. It is therefore most necessary that engineers in the Royal Naval Reserve should have the opportunity of working on board Her Majesty's ships so that in times of emergency they should be able to do their duty in a way to be of the best service to their country. There is another point: I should like to say how extremely pleased we must all be that Sir William White has been able to return to his duty; and I am very pleased indeed at the proposal to elect him a life member of the Institute. All this work referred to in the reports that have been read could not possibly have been carried out had it not been that the gentlemen who have been in office have had their hearts thoroughly in their work. They have been men of considerable ability, and they have carried out their respective duties in a very hearty manner. I therefore move that a very hearty vote of thanks be accorded them for their services.

Mr. J. G. Hawthorn (Member): I have very much pleasure in seconding this vote of thanks, and after the very eulogistic manner in which it has been proposed by Mr. Aukland, there is very little left for me to say. I can, however, speak with a certain amount of feeling on this subject, for in the early history of the Institute there was a lot of work to be done. I had the honour of working on the Council for three successive years, and I can speak from experience of the work that had to be performed. The many hours' work, the care and consideration that were given to matters of detail, and the hearty good fellowship with which all worked together with only one aim and object in view, showed that every individual member went there with the intention of doing his level best in the interests of the Institute. It is also very pleasing to see so many new members of Council. I think a little fresh blood on the

Council occasionally very desirable, for not only should a larger number of members take some share in the responsibility of carrying on the work, but also acquire a more intimate knowledge of the internal working of the Institute, and the more the members generally acquire this knowledge the less chance there should be of outside grumbling. We are a migratory race, and as such it is essential that we should have the fullest confidence in our office bearers. Many members do not get here once in twelve months, and the confidence which we feel in the office bearers leads every member to rest satisfied that everything will be carried out in a regular and proper way. I have, therefore, very great pleasure in seconding the vote of thanks to the retiring Members of Council and Office Bearers.

The motion was carried unanimously, and

Mr. J. H. Thomson (the Chairman of the Council), in acknowledging the vote, said: I am sure it must be very gratifying to my fellow members of Council, as it is to myself, to hear the remarks that have been made by Mr. Aukland and Mr. Hawthorn. It must be a great source of encouragement to those who remain on the Council and also to those who are elected to-night, to go on in the work in a hearty spirit, seeing that their services are so much appreciated. Mr. Hawthorn has a good idea of the internal work to be done because he took a very active part in the early days of the Institute. It is not necessary for me to make a long speech, and on behalf of my fellow members I thank you very much for the kind remarks you have made.

Mr. F. Cooper (Member): I have much pleasure in rising to propose a vote of thanks to the two auditors —Mr. Hawks and Mr. Redman. We desire to thank them for having spent their valuable time in auditing the accounts, and also to express our satisfaction with the accounts. I am sure you will all bear me out when I say that these accounts have not only been audited, but that they have been seen and criticised.

Mr. H. C. Wilson (Member): I have much pleasure in seconding this vote of thanks. We all know it is very necessary that accounts should be audited, and we have some idea of the responsibilities of auditors. The success of the Institute has been in a very large measure due to the strict way in which the accounts have been kept and carried through.

The proposition was unanimously adopted, and

Mr. Redman briefly returned thanks. After expressing regret at the absence of Mr. Hawks, he observed that the accounts of the Institute were kept in a most creditable manner, under the supervision of a firm of chartered accountants.

The Hon. Secretary then read a letter that had been received from Mr. Hawks by the Chairman.

Mr. N. S. Hawks (Member) in writing said that being unable unfortunately to attend the meeting to join Mr. Redman in reporting their views as Auditors, he desired to say that the amount received in subscriptions was much less than it should have been, due to so many members having fallen into arrears, probably inadvertently, himself among the number, and suggested that the Treasurer should issue notices reminding members of their subscriptions being unpaid before arrears accumulated and came upon members to the extent they had done. The subscriptions would thus be received with greater regularity. It would be observed that the cost for printing the Transactions showed an increase of £75 over the previous year, this appeared heavy but it might be looked upon as showing high efficiency and an increase in the backbone of the Institute, and therefore not to be grudged but rather looked upon as a mark of progress. It was suggested that the auditors should examine the books monthly in place of quarterly and report to the Council pointing out where expenditure might with advantage be decreased or even increased, the auditors could then fulfil an important duty to the

Institute apart from the work of the Chartered Accountants whose duties were more concerned with the style of book-keeping and making-up the balance sheet than in advising as to the expenditure of the funds.

Mr. J. F. REDMAN (Member) added that the books were clearly kept and the vouchers had agreed with the accounts.

The CHAIRMAN suggested that the foregoing letter should be referred to the Council, and this suggestion was at once adopted.

Mr. R. LESLIE (Hon. Treasurer) : I have the pleasing duty of proposing a hearty vote of thanks to our Hon. Solicitor (Mr. Neely.) We have not had much to do with him of late, but we know that he is always ready to do whatever may be required of him when the time comes.

Mr. S. C. SAGE (Member of Council) : I rise with very much pleasure to second that motion, and we have some reason to be thankful that we have had no great amount of work for our solicitor to do. It is possible, however, that we may give him some work with reference to the arrears of subscriptions before many years are over.

The motion was carried.

Mr. JOHN ADAMSON (Member of Council) the Convener of the Educational Committee, then read a statement with reference to Technical Education as follows : You will have noticed that with the consent of the Council, who I am pleased to say were always unanimous, we made a slight departure in the engineering and drawing classes. We opened the session 96-97 with a social evening for members and their friends and, as you may be aware, it was a complete success. We doubled the number of students who, under the tuition of Mr. Brett, have made good progress. I felt that the

educational department should be brought into the foreground and not left in the background, and to this end we introduced lectures on occasional Tuesday evenings, which were apparently much appreciated by the students, and I would here take the opportunity of thanking those gentlemen for helping me with their lectures in making this session a success and of real educational value. We intend in the session 97-98 to continue those lectures, and if possible to begin mathematical classes, but we are hampered for money. The funds of the Institute, for a very good reason, are not available for this purpose, and I would appeal to individual members to help us to carry on our educational work in a manner befitting this great Institution. I look upon the Graduates with very much the same eyes as a church looks upon its Sunday school scholars. Their association with this Institute are formed when young and they never forget it and they will become the backbone of it when we are no longer able to carry it on. We ought to encourage the young to join and also make the Institute pleasant to them; there is no better way of doing this than by making it an educational centre in fact, as well as in name. Gentlemen, the Technical Institute which the Council of West Ham are wisely building, and which I am sure has the sympathy of this Institution, will fill a much needed want in this large and growing community. I trust the Technical Committee will see that it fulfils the high purpose for which it is built, and to do this they must aim at a high standard of education; no rudimentary curriculum will suffice. They must not forget that in this district are many engineering and other establishments, and where monster ironclads are built for this and other Governments, where engineering and chemical science are an every day practice, and which have helped so largely to build up the fabric of this great empire. If this supremacy is to be continued they must educate the rising generation to a high standard, and I hope the day may not be far distant when engineers may be turned out of the proposed Institute for the Navy and the other branches of Her Majesty's

service where engineering science is required. I am sure if the Technical Committee aim at this high standard of education, the Institute of Marine Engineers will do its utmost to help them in their efforts.

Mr. F. W. Shorey (Member of Council) : I have been asked to make a few remarks with regard to the deputation that waited on the committee in connection with the proposed new technical institute. Our thanks are due to Mr. Alderman Kidd for giving us the intimation regarding the erection of this building in Stratford, and we might induce the committee in charge to devote some of the building for classes in connection with marine engineering and naval architecture, and so the duty devolved upon us of waiting upon the committee, when we were fortunate in having with us one of our members who could speak well—Mr. Flannery. He laid our views before that committee in a clear, lucid manner, and showed what we wanted. We were received very kindly, and I think we may see some good results from that deputation.

Mr. C. Noble (Member) : Seeing that the auditors have carried out their duties so well, I have very great pleasure in proposing that Messrs. Redman and Hawks be again elected auditors.

Mr. Alexander Robertson (Member) seconded the motion, which was carried.

The Scrutineers then presented their report, announcing the election of the following Office Bearers and Members of Council, the latter being given in alphabetical order : —

President: Mr. J. FORTESCUE FLANNERY, M.P.

Honorary Treasurer: Mr. Robert Leslie.

Honorary Secretary: Mr. James Adamson.

Members of Council:

†Mr. John Adamson.
† ,, A. G. Crichton.
† ,, J. R. Ruthven.
† ,, S. C. Sage.
† ,, W. I. Taylor.
* ,, J. Bigmore.
*Mr. A. Blair.
* ,, J. Blelloch.
* ,, A. Campbell.
* ,, J. Richardson.
* ,, F. W. Shorey.
* ,, J. T. Smith.
*Mr. J. H. Thomson.

Honorary Minute Secretary : Mr. C. G. Newby.

† Non-Retiring Members * Members declared Elected.

BRISTOL CHANNEL CENTRE.

President: PROF. A. C. ELLIOT, D.Sc.

Vice-Presidents:

Mr. DAVID GIBSON. Mr. T. W. WAILES. Mr. J. F. WALLIKER.

Representative to Council: Mr. M. W. AISBITT.

Honorary Treasurer: Mr. A. E. SMITHSON.

Honorary Secretary: Mr. GEO. SLOGGETT.

Members of Committee:

Mr. J. CHELLEW.
„ T. A. REED.
„ W. SCOTT.
Mr. W. SIMPSON.
„ H. G. SYMONDS.
„ R. WILLIAMSON.

Mr. J. T. SMITH (Member of Council): I have very much pleasure in proposing a hearty vote of thanks to the scrutineers.

Mr. JOHN E. ELMSLIE (Member): I have very much pleasure in seconding the vote of thanks proposed by Mr. Smith. These gentlemen undertake on our behalf a very tedious and troublesome job, and one which most of us, though ready to undertake it if called upon to do so, would very much prefer should be undertaken by another. In fact, counting votes in another room is hardly a pleasurable way of taking part in the annual meeting. Under these circumstances I think these gentlemen have well earned the vote of thanks proposed, and which you will no doubt accord them.

The motion was carried unanimously.

Mr. INGLIS thanked the meeting for passing the vote so cordiaily and Mr. JOHNSTON said it had given him great pleasure to render this small service to the Institute.

Mr. W. C. ROBERTS (Vice-President): I beg to propose a vote of thanks to our Chairman. I need not dwell upon the many excellencies of Mr. Alderman Kidd

who is very well known to the majority of us. His multifarious duties are, for the most part, of a most onerous character, but he is always willing to give his services at any time where they may be required, and I have very great pleasure in proposing a hearty vote of thanks to him for the manner in which he has presided over our meeting to-night.

The motion was put by the Hon. Secretary and carried with cheers.

The CHAIRMAN : I heartily thank you for your kind vote, and as Mr. Roberts has said, I am always prepared to do my "little bit" if I can, whenever I am called upon. I have many functions to fulfil but this meeting has been one of the pleasantest. It was mentioned in the annual report that the Board of Trade has taken up this question of a third engineer's certificate, and I think it is absolutely necessary, having regard to the great advance in the science of marine engineering since the time that I was at sea, that there should be more certificated men on board ship than there were at that time, and men below the rank of second engineer should also have certificates. I was pleased to learn that the Royal Naval Reserve engineers are likely to be recognised, and I believe that that will be an incentive to many engineers in the mercantile marine to study their duties more than they have done in the past. It is not every engineer that goes to sea who makes a love of his profession, and the one who goes simply for a living, and for a living alone, is not likely to rank very high as an engineer. With regard to the Technical Institute, it will cost when finished something like £50,000, but we hope that by the time it is finished nearly the whole of that amount will have been paid, we hope indeed to start practically free of debt and with an income of something like £6,000 a year. If that work is carried out in a proper manner there will be an opportunity of engaging some of the best professors of the day, even if we have to pay a large sum for their services. I think it will be a calamity if we start to go

into elementary work—I think that that would be fatal to the Technical Institute. We ought to aim at something very much higher, and we cannot get the men we ought to get unless we pay for them. The influential deputation from this Institute that waited on the Council with reference to the new Technical College was received with all the respect due to the representatives of this Institute, and with regard to the speaker selected by the deputation, if you had searched England through you could not have found a man to state the case for this Institute better than did Mr. Flannery on that occasion. That was the impression of the whole of the committee, but I wish to remind you that the Council is composed of 48 members and there are some of all sorts. There is nothing definite settled yet, but I do know that before anything is settled there will be another meeting with the deputation from this Institution to talk the matter over. I hope that the interests of marine engineering will be kept well to the fore and that we shall ultimately get the Institute classes up to the high standard that we are looking for. I believe that you as an Institute will have every consideration shown you, and I hope that in the end it will come out even better than I expect myself.

The meeting then concluded.

INSTITUTE OF MARINE ENGINEERS

INCORPORATED.

SESSION 1896-7.

Southampton Centre.

President—C. S. Du Sautoy, Esq., R.N.R.

ANNUAL REPORT.

During the year just concluded, the Southampton Local Centre has been proceeding steadily on the lines indicated in previous reports, and the Society's rooms have been kept open each evening for the use of members, whilst numerous additions have been made to the Scientific Reference Library.

In order to maintain the interest in the Centre during the summer months, when the Society's rooms are not available, the Committee arranged for an excursion to the New Forest, on July 21st, the members proceeding by brake to Bolderwood, where a very enjoyable day was spent, and the wish was expressed by those present that the feature might be made an annual one.

We have lost by death one of our Local Honorary Members, Capt. Chapman, Marine Superintendent of the Royal Mail Steam Packet Co., and report this loss with much regret.

There has been no change made in the Office Bearers during the past year, each of the gentlemen on the Committee for 1895-6 remaining in office for 1896-7.

INSTITUTE OF MARINE ENGINEERS.

INCORPORATED.

SOUTHAMPTON CENTRE.

THE FOLLOWING IS THE LIST OF MEETINGS HELD AND PAPERS READ DURING THE SESSION:—

DATE.	SUBJECT.	AUTHOR.	CHAIRMAN.	PLACE OF MEETING.
1896.				
March 25	"Liquid Fuel"	Mr H. C. WILSON (Member)	Mr. Lawrence Steele, R.N. (Vice-President)	Arts' Society Hall.
April 1	"Engineers and the R.N R."	Mr. F. COOPER ... (Member)	Mr. C. S Du Santoy, R.N.R. (President S. Centre)	Do. do.
April 15	"White Metalling"	Mr. R. DAVISON ... (Member)	Do. do.	Do. do.
July 21	'Summer Outing"	—	Do. do.	The New Forest.
Dec. 9	"Bearings of the Marine Engine'	Mr. JOHN DEWRANCE (Member)	Do. do.	Arts' Society Hall.
1897.				
Feb. 17	"Assistant Cylinder for Valve Gears."	Mr. BASIL JOY ... (Associate Member)	Do do.	Do. do.

JNO. GRIFFITHS, *Hon. Local Secretary.*

ANNUAL CONVERSAZIONE

AND

PRESIDENT'S ADDRESS.

The Eighth Annual Conversazione was held on Friday evening, 4th December, when the Town Hall, Stratford, was the scene of a brilliant gathering. The assembly was, without doubt, the ladies' night, notwithstanding the fact that it was made the occasion for the delivery of the Presidential address.

Arrivals commenced about six o'clock, and from 6.30 to 8 there was a steady flow of visitors, until there were about 450 ladies and gentlemen, including Sir Edwyn Sandys Dawes, K.C.M.G. (President), Messrs. A. Beldam, G. W. Manuel, A. J. Durston, R.N., C.B. (Past-Presidents), Professor A. C. Elliott, D.Sc., Messrs. J. F. Flannery, M.P., Alderman G. W. Kidd, A. W. Robertson, W. C. Roberts, R.N.R., Arch. Thomson (Vice-Presidents), Messrs. J. H. Thomson (Chairman of Council), J. W. Richardson (Vice-Chairman), Messrs. John Adamson, J. Blelloch, A. Campbell, A. C. Crichton, J. M. Gray, J. R. Ruthven, S. C. Sage, F. W. Shorey, J. T. Smith, W. I. Taylor, W. White (Members of Council), Messrs. R. Leslie (Hon. Treasurer), Jas. Adamson (Hon. Secretary), C. G. Newby (Hon. Minute Secretary), &c.

The stairs and corridors, were carpeted in dark red, and ferns and palms were arranged with artistic negligence, in embrasures and recesses. In an ante-room experiments with electricity were shown by Mr. James Wimshurst (Companion). Youngsters sitting on a table became charged with electricity, and their excess of cordiality in inviting everyone to shake hands was understood and appreciated—by electric shock. It was, too, a somewhat fearsome spectacle to see blue lights issuing from their hands and feet. Included in the exhibition

in this room was an indicator which showed the angle of heel of a ship in a sea-way. This proved particularly attractive to many members. Along the walls near the entrance were a number of exhibits. On the left of the entrance, drawings by students attracted considerable attention, and called forth encomiums upon their general excellence. Very interesting was the exhibition of some beautifully finished working models of Blake-Knowles marine pumps, kindly lent by Messrs. Blake and Knowles. Several very interesting samples and specimens of Electric Welding were exhibited by the Electric Welding Company, and on the right of the entrance one of Wimshurst's Improved Ship Clinometers might be inspected, and near it was a splendid case of tools exhibited by Messrs. Buck and Hickman. There were also exhibited some photographs taken by the X rays by Mr. A. A. Campbell Swinton. In the embrasures of the windows were shown pictures of ships and people popular in the engineering world. Arranged on a special stall were a number of valuable gifts recently presented to the Institute by Mr. Fawdon. The collection included a large crocodile, a kangaroo, a case of brilliantly-plumaged birds, an armadillo, two ribs and part of the backbone of a whale, &c. The front of the platform was tastefully arranged with greenery, while the council chamber was admirably adapted as a refreshment room.

Proceedings commenced about half-past six, with tea. Mr. H. L. Balfour, at the organ, played most deliciously Gounod's march, "Irene," (an air with variations), "Where the bee sucks" (Arne-Benedict), and Suppé's overture, "Poet and peasant." Following the recital, a concert was given. Miss Marie Riversdale and Mr. Roland Henry gave a clever medley, "Naming the baby." In this they introduced most of the popular tunes of the day. A violin solo, with organ and piano accompaniment, was rendered by Mr. T. E. Gatehouse, with much expression. Glassophone solos, played by Professor Nelson, were greatly appreciated. He gave (a) "A whisper, and I shall hear," and (b) "Dresdina."

Major J. H. Taylor played skilfully Sullivan's "Lost chord" as a cornet solo, and was succeeded by Professor Rowley, an excellent lightning cartoonist. This gentleman gave very rapid sketches of General Booth, Lord Roberts, Lord Wolseley, Sir Henry Irving, Mr. Chamberlain, and Mr. Gladstone. A serenata by violin and cornet, with organ accompaniment, was given with exquisite effect by Mr. Gatehouse and Major Taylor. Miss Marie Riversdale and Mr. Roland Henry followed with a selection from "Little Christopher Columbus." Mr. T. E. Gatehouse concluded the programme with a fantasia on Scotch airs. Following the concert came the presidential address, which was delivered from the platform by Sir Edwyn S. Dawes, who was received with cheers.

President's Address.

The Institute of Marine Engineers, established for the purpose of drawing members of the profession more closely together and increasing the *esprit de corps* amongst them, may specially be regarded as educational, and this has throughout been exhibited by the excellence of the papers read by members at its meetings, and the interesting character of the discussions upon these papers which have followed.

It is highly gratifying to note the steady increase in the membership, as shown by the annual reports of the Honorary Secretary, and this is especially so in the case of graduates and junior members for whom classes and lectures are now provided for their instruction and encouragement.

Another interesting feature is the interchange of papers and of courtesies between this Institute and kindred societies at home and across the seas, inasmuch as each country now has its representatives on the roll book.

Engineering, long neglected in our national educational system, is now recognised in many of our

universities as a science and an art. At Dublin, Durham, Montreal, Calcutta, Madras, Bombay, and probably at other Colonial Universities, there are faculties of engineering in which Bachelor and Masters' degrees are conferred. At King's College, London, there is a department of engineering, and at the universities of Edinburgh, Glasgow, Manchester, (Victoria) South Wales and Monmouthshire, and the Royal University of Ireland, the subject of engineering is taught in its various departments—civil, mechanical, mining, electrical, military, sanitary, and marine, the last being that now occupying our attention.

In embryo the marine engineer may be said to have existed from the time when the first mechanism was applied to the propulsion of vessels, whether by oars, or masts, yards, and sails—although disowned by your motto "*nec remis, nec velis*"—but his special work dates from the introduction of machinery impelled by steam, about a century ago. Scotland and the United States—the Clyde and the Hudson—were the first cradles of the craft, and with her craftsmen, Scotland, in earlier days, largely manned the marine engineering of the world, and educated its marine engineers.

The mention of the Clyde and the Hudson naturally recalls to all Engineers the well-known names of Symington and Fulton, the pioneers of steam navigation. It is not my intention, however, as a shipowner, and before an audience like this, possessing such an intimate acquaintance with the historical development of marine engineering, to enter into the well-known details of its progress. It is my object, rather, to draw some attention to the important duties which now devolve upon your profession in all that concerns the strength, the security, and the general well-being of the nation.

The sufficiency in number and efficiency in physical and mental power of our marine engineers are essential, 1st, in the naval defences and commercial development of the Empire; 2nd, in the intercommunication between

Great Britain and her colonies; and, 3rd, the importation of food for the increasing population of our islands, and the raw material needed for our industries.

Little more than a single generation has passed away since the nation contentedly imagined that the wooden walls of old England and her gallant seamen provided every security for defence. We gloried in the achievements of Drake, Hawkins, Anson, Jervis, Howe, Nelson, and other of our grand old sea captains, and confidently looked to a continuance of the same immunity from attack solely from the superiority of our seamanship; but what a revolution in maritime affairs this short interval has brought about!

At our annual dinner, on 17th June last, I ventured to intrude upon you my own impressions when witnessing the bombardment of Sebastopol by the combined fleets of France and England forty-two years ago. Magnificent and picturesque were those old wooden ships, and although many of them, not having steam power, had to be towed into action, all beholders deemed them invincible; but how soon after this we were rudely awakened to the fact that wood could not contend with iron and steel, and that steam machinery, hydraulic power, electricity, and the other mechanical forces, unknown to our forefathers, would now have to play an equal part with seamanship and navigation in our struggles for naval supremacy.

Never in the history of England has the nation more consistently demanded that the strength of our naval forces should be increased in proportion to the growing requirements of our commerce and expanding Empire. This demand, which makes for peace as well as security, may be regarded as distinctly emanating from the people, and indicating their perception of the seriousness of any naval weakness. If proof was needed that the demand was the result of an intelligent appreciation

of the position, and not merely spasmodic, it is evidenced by the ready acquiescence of all parties, apart from all parliamentary distinction, in granting the additional expenditure asked for by successive governments.

The absorbing interest in this question has to no small extent of late been further stimulated by Captain Mahan's remarkable work, "The Influence of Sea Power upon History," and his demonstration that the possession of colonies unsupported by a powerful navy becomes a source of weakness. The Government having conformed to the national will, our naval architects and marine engineers, fulfilling their part, have for some years been exercising their inventive faculties in the direction of producing more efficient types of vessels required to fulfil the varied duties cast upon our naval services, and year by year we see ships of greater destructive power added to our fleet.

Our modern warship, whether ironclad, cruiser or torpedo boat, is a mass of machinery, not only the propulsion, but the steering, lighting, pumping, anchoring and ventilating of the ship, with the manipulation of the heavy guns, more or less appertain to the duties of the marine engineering staff, whose professional acquirements are indispensable, whether in conflict with the elements or the enemy. In these emergencies success depends not only on the courage and efficiency of those on deck, but equally on those below and unseen, who have, with a cool head and a strong heart, to remain at their posts obediently and intelligently regulating and controlling the complicated machinery upon which the movements of the ship depend.

In engineering there is little romance. Poet and philosopher find the subject too material and practical for their taste; all the more gratefully, therefore, do we

welcome the following brilliant lines from the pen of Rudyard Kipling :—

Lord, send a man like Robbie Burns to sing the Song o' Steam !
To match wi' Scotia's noblest speech yon orchestra sublime
Whaurto—uplifted like the Just—the tail-rods mark the time,
The crank-throws give the double bass, the feed-pump sobs an' heaves,
An' now the main eccentrics start their quarrel on the sheaves :
Her time, her own appointed time, the rocking link-head bides,
Till—hear that note?—the rod's return whings glimmerin' through the guides
They're all awa ! True beat, full power, the clangin' chorus goes
Clear to the tunnel where they sit, my purrin' dynamoes.
Interdependence absolute, foreseen, ordained, decreed,
To work, ye'll note, at any tilt an' every rate o' speed.
Frae skylight lift to furnace-bars, backed, bolted, braced, and stayed,
An' singin' like the Mornin' Stars for joy that they are made ;
While, out o' touch o' vanity, the sweatin' thrust-block says :
" Not unto us the praise, or man—not unto us the praise !"
Now, a' together, hear them lift their lesson—theirs an' mine ;
" Law, Order, Duty and Restraint, Obedience, Discipline !"
Mill, forge, an' try-pit taught them that when roarin' they arose,
An', whiles I wonder if a soul was gied them wi' the blows.

We have been contrasting the marvellous ironclad of to-day with the wooden battleship of barely thirty years ago, but no less striking is the contrast between the huge steam liners which now maintain swift and regular communication on our ocean highways and the sailing vessels which, notwithstanding their small size and scanty equipment, formerly penetrated to the most distant parts of the globe in pursuit of trade and discovery.

Our surprise and admiration must ever be great when we recall the dangers and hardships attending the voyages of discovery by the intrepid old navigators, Columbus, Cabot, De Gama, Baffin, Davis, Cook, Tasman, and others, in their small sailing vessels, not larger than a moderate sized yacht of the present day. Their surprise and admiration, however, would be still greater could they now witness the daily departure of our leviathan steam liners from London, Liverpool, Southampton and elsewhere, crossing the ocean at high speed, becoming increasingly greater year by year under the inventive powers of our engineers, and carrying

their "townships" in numbers, with a degree of safety, comfort, and even luxury, which the highest flights of imagination in those days could never have foreseen.

In every direction there are now admirably organized and well appointed lines of steamships keenly competing for the patronage of the public, not only at both ends of the service but at the ports along the whole course of their itinerary, their administrators are ever being stimulated to further exertion in the direction of improvement by the pressure of competition and public criticism. On the great trunk routes to America, Canada, Africa, India, China, and Australasia, besides services to nearer countries, the steamers employed are every year becoming larger, swifter, and more luxurious. These great floating hotels, which reduce the perils and discomforts of the sea to a minimum, are, by encouraging travel, thereby tending to bring the peoples of the world into closer and more friendly relations with each other, breaking down the prejudices and distinctions of race and more vividly demonstrating the common interests of mankind.

Although Johnson, in 1825, earned the premium of £10,000 for his experimental voyage by steamer to India, the same year in which the first locomotive ran between Stockton and Darlington, marine engineering as a distinct science can hardly be dated earlier than 1838 when the first steam vessel crossed the Atlantic. From that time also commences the history of many of our leading and still progressive Steam Shipping Companies, which have since performed with increasing efficiency the invaluable work of communication between Great and Greater Britain.

In 1839, the mail services to the West Indies were inaugurated by the formation of the Royal Mail Steam Packet Company. The following year saw the incorporation of the Peninsular and Oriental Steam Navigation Company for India, China, and the East generally, the Cunard Company for America, and the Pacific Steam

Navigation Company for South America. At subsequent dates mail services to Canada, the West Coast of Africa, South Africa and Australasia were established, and at the present time there is a complete network of steamship lines connecting not only all parts of the British Empire, but every sea-board of the habitable globe.

For a time England possessed almost a monopoly of these ocean communications, and where steamers of other countries were employed the engineers were usually Scotch or English. This is so no longer. France, Germany, Austria, Spain, Italy, and Holland now compete with us by means of their own well-organized and more highly subsidized shipping companies, which trade not only to their own but to our possessions. More recently Japan has made extraordinary strides in the same direction, whilst Russia has gone a step further, and besides its mercantile steamers has its volunteer fleet, semi-commercial, semi-military in character, and all our foreign competitors employ marine engineers of their own nationality.

But apart from these regular steamship services, there exists a vast fleet of cargo steamers, preponderantly large, under the British flag, engaged not in any particular trade, but in the interchange of commodities wherever and whenever the demand for profitable employment arises; they travel like the swallows in search of food, and like them are influenced by the seasons. Coal, railway material, cement, and other cheap and bulky products, provide their outward cargoes, their homeward freights being grain and the raw materials used in our manufactures; but to attempt to describe the work which is found for the "Tramp," as these steamers are called, in contradistinction to the "Liner," would be impossible in a short address. The cheapening process in their construction and coal consumption which is ever going on, now permits of the transference of commodities at marginal differences of value so small in comparison with what they were, that the bulk available for transportation ever continues to

increase, steam, with telegraphic communication, thus tending to equalize prices all over the world. Sailing ships, however, not being able to compete either in efficiency or economy are gradually becoming fewer, as evidenced by the fact that whereas in 1874 the steam and sailing-ship tonnage was about equal, it is now in the proportion of about 24 to 1.

The principal work of these cargo steamers is, as said before, the importation of food for the people and the raw material for their industries—cotton, wool, jute, &c. Broad and bulky, for economically carrying heavy burdens, their movements are slow, and between the Liner and the Tramp we may draw the same comparison as between carriage and cart horses. But upon the successful performance of their work how much depends, for whilst the swift liner contributes to the luxury of travel, the cargo boat provides the very means of subsistance.

Our population is about two and a half times as large as it was when England was last engaged in a naval war; we are now dependent upon foreign countries for considerably more than half our food supplies, whilst directly and indirectly the industries of our people, in somewhat the same proportion, are dependent upon our external commerce.

Statisticians inform us that we seldom have more than two or three months' supply of food in the country, and, consequently, if by any political complications the useful work of these cargo steamers of bringing in fresh supplies of food and exchanging manufactured products were stopped, the condition of the people would be too terrible to contemplate, for our large population would then become a source of weakness, instead of strength.

Such a contingency, however, has to be kept prominently in mind, and looking to the fact that our marine engineers form so important a factor in its consideration, the question is clearly one that is not irrelevant to the

present occasion, and one which should be thoughtfully discussed in time of peace, instead of being left to the panic which would inevitably arise were we to be involved in a great maritime war.

Appreciating this extreme danger, we have taken, and are continuing to take, extraordinary measures to increase our navy, and the annual expenditure under this head, which may be termed national insurance, now exceeds eighteen millions a year. Notwithstanding this heavy expenditure, however, and even the addition of further millions in the same direction, the fact remains that the late Admiral Sir George Tryon and other competent naval authorities have clearly demonstrated that it would not be possible with any navy, however strong, to prevent the capture or destruction of many of our merchant ships.

If the statement of such experts is correct, which there is no reason to doubt, what would be the result? The United States lost their ocean-carrying trade, not by the comparatively small depredations of the Alabama, but because the excessive "War Risks" Insurance drove their trade into neutral vessels. What they lost then they have never regained, but they had not to face the far more terrible contingency of a starving population, deprived of work, as we should have, and should not their experience be a lesson and a warning to us.

I agree entirely with that able and gallant admiral, whose tragic death we all deplore, that in the event of war it would be the duty and the interest of the nation, on carefully thought-out and well-defined conditions, to assume the "War Risks" connected with our commerce, and thus conserve our maritime interests. The responsibility, and even the cost might be very great, but in comparison with the sufferings arising from an insufficiency of food for the people, the stoppage of their industries, and the loss of our carrying trade, they would be insignificant.

This question is too large and complicated for me to attempt to deal with in detail; but I venture to express the hope that the members of the Institute of Marine Engineers may regard it as coming within the scope of their deliberations, and bring it up for discussion at one of their meetings. The Government has at its disposal ample means for obtaining information, and a small committee of members of the Admiralty, of shipowners representing liners and cargo steamers, and of underwriters at Lloyd's, if appointed to consider and recommend what measures should be adopted in event of war, would be useful in the highest degree.

A very usual toast at Corporation dinners in the City of London is, "Ships, Colonies, and Commerce," and it has been my purpose to show how closely the marine engineering profession is bound up with these three great interests; but it cannot be made to stop there, for as we advance in civilization our various industries, professions, and interests, become so interwoven, that it is impossible to define where the influence of each begins and ends.

Mr. Rudyard Kipling's words on the marine engine, "Interdependence, absolute, foreseen, ordained, decreed," come in here to help us.

As each piece of machinery fulfills its own part in the complete and harmonious working of the engine as a whole, so is it in the body politic; and although the various parts cannot be gauged, measured, and corrected by dynamic laws or mathematical calculations, they are governed by laws no less absolute. As knowledge increases, and the peoples of the world are drawn closer together by the frequent intercommunication, we may hope there may be a recognition of one of the most important of these, namely, the interdependence of all communities.

Our national aim is to make the interdependence of Great and Greater Britain full and complete, working

harmoniously like one of your grand marine engines. A greater ideal would be that all civilized countries should realize this mutuality of interest. Even as variations of climatic influences and geological productions create healthy commerce, so racial characteristics would tend to harmony, as a result of closer intercourse, were this law of interdependence of the human race universally acknowledged. If ever that consummation be reached, the science you are promoting will have played no unimportant part in its attainment.

In conclusion, gentlemen, I beg to express my sincere thanks for the kindness which you have shown to me during my year of office, an office which I recognise you gracefully invited me to fill, not from any merit of my own, but as a compliment to shipowners generally, whose interests are so closely allied with your own. The very friendly relations thus shown to exist between us, I hope, may long continue. (Cheers).

Mr. A. J. Durston, C.B., R.N. (Past-President), amid hearty greetings, proposed a vote of thanks to the President, referring to the great work he had been instrumental in accomplishing as a merchant prince and pioneer in the extension of commerce and trade with India and the Colonies, associated with the late Sir William Mackinnon, the founder of the British India Company, with the present Chairman of that company, and others, who were connected with the great enterprises which had made Britain what it is. The Institute of Marine Engineers and its members were specially gratified by the acceptance of Sir Edwyn Dawes of the office of President, both because he held one of the foremost places in the shipping interest of the kingdom, and holding such a position he was a large employer of the forces which brought the Institute of Marine Engineers into existence, and kept it going; he had thus a two-fold claim to the hearty reception which had been accorded to him as President. The address delivered had been full of suggestions and hints which were worthy of serious attention, and it

might with advantage to the nation be considered in detail, and the recommendations brought forward as suggested by Sir Edwyn.

The vote of thanks was carried with loud acclamation and applause.

The PRESIDENT thanked Mr. Durston and the meeting for the vote of thanks awarded amid so many pleasant features, and in responding, said he was unaware of the presence of an authority on the Navy such as Mr. Durston, he having slipped in while he was speaking, but he was glad to see and welcome him, and thank him for his words, and the audience for their responsive echo. (Cheers.)

Commencing shortly after nine, dancing was kept up, with great spirit till the small hours of the morning. Mr. W. I. Taylor was master of ceremonies, assisted by Messrs. George Neill, George Threlfall, and William White.

INSTITUTE OF MARINE ENGINEERS

INCORPORATED.

SESSION  1897-8.

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Hon. Minute Secretary:

MR. C. G. NEWBY.

INSTITUTE OF MARINE ENGINEERS

INCORPORATED.

SESSION  1896-7.

President :—SIR EDWYN S. DAWES, K.C.M.G.

GRADUATE SECTION.

The following Lectures were delivered during the Session, on occasional Tuesday evenings, specially to the Junior Members attending the Drawing Classes, held on Tuesday and Thursday evenings, and by special desire they are reprinted from the local press in order that they may be of more extended service, and at the same time show to the general membership that of the rising generation, young engineers are receiving attention, and are having facilities placed within their reach to bring them into close touch with the Institute, even while serving their apprenticeship.

Donations are invited in order to further extend the work of this Section.

JOHN ADAMSON,
Convener, Educational Committee.

JAS. ADAMSON,
Honorary Secretary.

INSTITUTE OF MARINE ENGINEERS

INCORPORATED.

SESSION 1896-7.

GRADUATE SECTION.

SOCIAL MEETING TO INAUGURATE RE-OPENING OF SESSION.

CHAIRMAN:

MR. G. W. MANUEL *(Past President)*.

The Opening Meeting in connection with the Graduate Section, was held at 58, Romford Road, Stratford, on Thursday evening, October 1st, 1896.

The CHAIRMAN opened the proceedings by expressing pleasure at the evident marks of improvement in the work of the students. The awarding of prizes was one of the duties of the evening, and this would be a stimulant to those about to enter the classes for the coming session, to make the best endeavour to secure a prize at the end of the term.

Everyone could not obtain a prize, and the work of the few who obtained prizes did not represent the work of the session. He looked upon the whole of the work of the students as gratifying to the master and to those under him. It often happened in after life that the prize student was outstripped by the student who did not

get a prize, who with patient perseverance and average ability had secured the best and highest positions to be gained in the business of life. He did not wish to damp the ardour of the brilliant prize student, but rather to incite him to keep on, and give a word of encouragement to the ordinary student. It was evident they could not all reach the top, but whatever duties they had to do in after life, do them to the best of their ability, giving their masters their best services; and in whatever station they were called upon, try to improve it, and leave it better than they found it. As to their reward, that was certain, to some greater than others, but it would be sufficient for all their needs, and they would lie down at night with the self-consciousness which possessed the village blacksmith, who could "look the whole world in the face, and owe not any man." With regard to the drawing they could not attach too high an importance to it, both mechanical and freehand, or over-estimate its value in after life, either as a skilled workman, a civil, or a marine engineer. He thought the Institute of Marine Engineers had greatly added to its usefulness by undertaking the training of students to draw correctly, with a view to future usefulness in the workshop, and in the mechanical working of marine engines at sea. In the workshop the workman with a knowledge of drawing was of the greatest value to the master engineer, and in the steam vessel when any breakdown occurred in foreign parts, the engineer who was a good draughtsman was of great value to the owner of the vessel, being able to send home correct dimensions of any parts that were required; in fact, drawing and designing were the basis of all engineering work. He need not go further than his own experience to show the advantages of an early knowledge of drawing, which greatly assisted his success as a young engineer. In the begining of life we were all very much the creatures of circumstances, and most men's success was largely due to the circumstances in which they were placed. His earnest advice to the students was, "acquire knowledge, and so prepare yourselves for whatever may follow," so that when the circumstances did arise they would be in

the best position to embrace them, and not let them slip through their grasp, for they often did not return. Having traced his own advancement up to the position he now holds in the P. & O. Co., the speaker went on to say that an early knowledge of technical education had enabled him to do duties which he could not otherwise have done. His name had been mentioned as an opponent of technical education, but he still held that it was of primary importance to remain five years in the workshop, and acquire the art of drawing in the school and evening classes. His advice to all young engineers was, first become good skilled workmen, acquainted with the various details and materials, and use those materials to the best advantage. Great engineers, past and present, bore testimony to the workshop being the best training ground combined with a knowledge of technical matters. It would be of very great value to the student, not only to have mechanical drawing but freehand, which they would find of great importance. He wished all the students a very industrious session, and that at the end they would find themselves better than at the commencement.

Mr. H. E. Lester, J.P. (Companion) said he was very glad to see such an assembly gathered to show their sympathy with the young students. Young people had to cultivate their minds, which were like the ground, the more they put into it the more they would get out of it. Their future was very much in their own hands; the present made the future. He hoped they would all secure the position they desired, and that they would gain splendid characters, then they would be able to look back and think they did what they could when they were able.

Mr. J. Fortescue Flannery, M.P. (Vice-President) said they were met to perform a most interesting function. He could not help contrasting the increase of facility for technical teaching that now existed with the time when Mr. Manuel and himself were boys. But for technical education and the night school, and their results, he would not, as far as could be seen, have been

addressing them. It was impossible to emphasize too much the importance of technical study to us as a nation and to individuals who were rising to become the future generation of engineers. He asked them to remember one principle in connection with study which applied more fully to engineers than to any other branch of scientific knowledge. To use the words of Lord Cross, "The man who knows how much he knows and how much he does not know, and who knows where to refer for the knowledge he does not possess, is a perfectly educated man. When they reflected upon the difficulty and impossibility of carrying in their minds the necessary figures and facts which go to make up modern engineering they would see that it was principles, scientific principles, which they must get into their minds. When they know where to refer for those facts they did not remember they had attained a reasonable amount of efficiency, and they could pursue their career as marine engineers with confidence of success in the years to come. Each year he became more and more impressed with the danger that this country ran from foreign competition. He saw many Japanese near his offices, and he found there was not a point about the construction of a ship or engine, or the smaller machinery, that the Japanese were not fairly acquainted with. It was true their knowledge was not complete, but it was enough to convince him and others who had the opportunity of observing them that their knowledge might be matured and ripened to such an extent that they would be strong competitors to this country in engineering and the construction of ships. That being so, it was the duty of those who had attained some proficiency in engineering to help those who were still studying the elements of engineering, and it was the duty of those who were students of the elements of engineering to remember that the future of the country, the manufacturing supremacy of the country, as well as their own personal success in life, depended upon the study, the perseverance, and the diligence of the rising generation of those who were engaged in manufactures. The Institute, in having organised these classes had made a start in a

direction which could not be too widely increased, and they had begun a course which must be persevered in to the extremity of success. It was the duty of the Institute to promote marine engineering in every possible way. The Institute had had a marvellous success, it had 1,200 members, and exercised an influence upon marine engineering, upon shipowners and ship builders, and manufacturing engineers, and, above all, on marine engineers. The Institute owed a duty to the younger members, as well as to the older ones, and to the students he would say, although they might regard men like Mr. Manuel as having gained almost the highest proficiency as marine engineers, yet they were still students; so that no matter how well they might learn, how thorough might be their knowledge as students, they had still before them a vast ocean of knowledge. He hoped the success of those who had attained prizes would encourage them to go on to greater success, and those who had not gained prizes to go on and attain success in the next effort. Then every member of this Institution would be glad it was formed, and would join with him in wishing well to those studying there, and benefit to them in their studies and their future life.

The CHAIRMAN proposed to Mr. Brett, the teacher, a hearty vote of thanks for his labours in bringing on the students in these classes. The prizes were the gifts of Mr. Leslie and Mr. Thomson, who showed by practical demonstration the interest they had in the education of marine engineers. He hoped the school would be increased by two more classes, one for mathematical subjects and the other for electricity, that the members of the Institute would follow the example set by these gentlemen.

The first prize was won by Mr. Edward A. York for proficiency in drawing and designing, and the second by Mr. J. T. Robertson, for proficiency in drawing. These young gentlemen were warmly applauded as they received the prizes at the hands of Mrs. Manuel.

On the motion of Mr. Lester, a hearty vote of thanks was accorded to Mrs. Manuel, on whose behalf the Chairman responded and said he would now like to hear the voice of one who had been one of the leaders of the Institute from the start, and the guiding helm in its onward movements, the Honorary Secretary, whom he called upon.

The Honorary Secretary said he endorsed the words that had been spoken that evening in reference to the students and the classes to which they should devote their attention. He was gratified to think that the Institute had advanced so far in improving the membership in its widest sense, the nation and the world at large. He thought it ought to teach them to encourage young men to go forward in the path that lay before them, and, if each one did his duty, he maintained that no fear should be entertained of the nations that had been named outstripping them in the competition. He was pleased to say that in addition to the amounts promised by Mr. Lester and the Chairman for the Educational work, Mr. Alderman Kidd had offered help also.

The remainder of the evening was pleasantly occupied by music, vocal and instrumental, rendered by the following ladies and gentlemen:—Misses Agnes Fairbairn, Frances Watkinson (vocalists); Miss Gertrude Lester (violinist); Messrs. J. Mackie, T. R. Simmonds, F. E. Simmonds (vocalists); Mr. W. G. Wiltshire (pianist).

The proceedings closed with votes of thanks to the Convener, Educational Committee (Mr. John Adamson) the musicians, and the chairman.

INSTITUTE OF MARINE ENGINEERS

INCORPORATED.

SESSION  1896-7.

GRADUATE SECTION.

OPENING LECTURE OF THE SESSION.

By Mr. JAS. ADAMSON

(HON. SECRETARY).

CHAIRMAN:

MR. W. J. NOWERS BRETT *(Member)*.

The Opening Lecture in connection with the Graduate Section was delivered at 58, Romford Road, Stratford, on Tuesday evening, October 13th, by the Honorary Secretary, as follows:—

It is said of a certain landed proprietor in the west of Scotland, that one day, when walking through his policies, he espied a well-known worthy of the neighbourhood, who was climbing over the dykes, making free of the land, and disdaining the pathway. Calling out to the intruder, "Hullo, that's not the way for you to go," he was met with the question "Does yer lordship ken whaur I'm gaun tae?" To this his lordship replied, "No." The answer elicited from the wall-climber was, "If ye dinna ken whaur I'm gaun, hoo the deevil can ye tell whether I'm on the right road or no." In what I am about to say to you young men

this evening, I wish to avoid any appearance of introducing the notice-board element, but knowing the objects you have in view in the main, I hope to be able to direct your thoughts into channels which will be profitable for you to enter, and gather treasure to add to your stock for future service in the pathway you have chosen, and to assist in helping to advance you one stage nearer that perfection we should all aim at. You are all here to-night, I apprehend, as seekers after truth, and that aspect especially which appeals to the senses dealing with matters of fact—which can be treated by the exact sciences and proved by demonstration. At the same time, the exclusion of that other aspect of truth which appeals to the moral faculties would be worse than a mistake on this opening night of our session; hence reference may be made during the evening to this aspect when occasion calls. Let us examine in the first place, briefly, how we gain our rudiments of knowledge, and how our knowledge is built up. In the early days of our existence we became conscious of the world external to ourselves by means of movement and the sense of touch. We recognise our own personality as something different from the things around us, when we, by an effort of our own will, can control our body and its various parts. We can begin to estimate distance and the nature and quality of matter in its various and varying forms. We have, for instance, the baby who cries for the moon. Possibly, when we were babies, we did the same; but now you have learned by experience that the sense of sight and the sense of touch differ to such an extent that the eyes may see what the fingers cannot touch. And so it is with each fresh experience of life. Those things which were incomprehensible gradually with our ripening intellect and advancement in knowledge become plain. I will make use of an illustration here which will serve to show how experience enables us to judge even simple things. They are only simple to us because we have gained knowledge of them step by step, and almost involuntarily. A boy and girl born blind were treated by a doctor, who had

hopes of their sight being given to them by means of an operation. This was successfully done, and the light gradually admitted to the room, as soon as it was safe. The boy had an orange placed before him, and he was told to take and eat it. Hitherto the sense of touch had been his guide, and now when he saw the orange and was told what it was, he placed his hand to his eye, expecting to obtain the orange, but not finding it, he worked his hand out bit by bit until he reached it, and secured the reward of his efforts. The girl was next brought forward, and another orange being held up for her to take, she placed her hand to her eye, expecting, as the boy had done, that the eye must touch the object. Not finding the orange, her hand was stretched out in a direct line to obtain the fruit. This experiment showed the natural habit of thought in the boy and in the girl, as well as the other points referred to. The boy sought to reach his conclusions step by step, while the girl went direct, and her sex is usually credited with that feature in reasoning—jumping to conclusions. You will see from this that it is only when we have experience and training that we can distinguish between things that are near and those that are far away. So in respect to matters with which we become gradually familiar in our business, and in our contact with the world. Here we remark that all the problems put before us should be carefully worked out with the understanding. The quickest way of reaching a conclusion is not always the best. It is seldom so to a learner, for more reasons than one. Do not conclude that a problem is in your grasp because you see the answer. Work it out stage by stage, and you will not only have it in your grasp, but you will have gained a great advantage by the mental exercise, and have improved your mental capacity by that exercise. Whatever you do, do it thoroughly. Remember that the stamp of your individuality is placed upon all you do; therefore, it behoves you to see that you need not be ashamed of it when completed. What is the reward? It is not the book or the article which comes into the possession of the prize-winner. The true reward is the

consciousness of duty done and work accomplished, and everyone who has that consciousness has enriched the world and made it the better for his having lived in it. The prize is simply the outward mark—the sprinkling which is a token of something more precious, more lasting—the consciousness that we are developing our better parts. Wages are a reward, and a reward which should be so closely associated with the consciousness of duty discharged as to be synonymous with it. Yet at the same time the value is not the same, and the reason why this is not the same carries us into the region of political economy, and would take too long to discuss at present. I seek more to impress the thought upon you that wages and the consciousness of duty discharged should be closely associated in your mind, and if you have such an impression, then it follows that where the consciousness of having done one's duty faithfully and diligently is wanting, the wages are undeserved, and consequently, those who take wages without this consciousness, are deceiving themselves and those who pay them the wages. I would go further than this, and say that the consciousness of duty honorably and faithfully discharged is always so much more valuable than wages that it should always rank first in our minds That is to say, we should always aim at being more valuable to those from whom we receive wages than the value represented by the mere money. And this for three reasons—I. The consciousness of one's obligations being discharged beyond even the ordinary term of duty makes us better men; II. The knowledge that our value is greater than that represented by the mere money standard gives us the consciousness that we are adding to the capital which enables the capitalist to extend his business and employ us in more extended fields, and also to employ more similarly placed to ourselves, thus giving additional comfort to many; III. The patriotic feeling engendered by the consciousness that we are enriching our country by our efforts, and helping to maintain its position in the world.

Another thought now rises before us, and it is this.

The moment a man begins to entertain a habit of looking upon wages as a more important factor in his calculations of work than the accomplishment of duty faithfully and diligently discharged, he begins to degenerate. The duty we owe in the station of life in which we are placed is more important to us than the mere monetary value which may be for the moment placed upon us, not only in respect of the present, but to the future. Although others may decide to give the least possible effort for the greatest possible wages, let it be ours to hold to the opposite view, and in due time we will have our reward.

With these few preliminary remarks, I now return to the reference made at first, that knowing the goal to which you are directing your steps, I might be able to give you a few hints for your guidance in matters of detail, as well as in respect to the main principle which I have endeavoured to place before you, and which has the broad moral aspect rather than the personal and selfish.

You are aware that at the present time there is a considerable controversy going on as to the value of a technical education as compared with workshop practice, and as to the time which should be spent in the workshop in order to become a proficient workman and an efficient marine engineer. A most interesting correspondence which has taken place within the last three years on the subject of a marine engineer's training has been published as a Parliamentary paper, through the instrumentality of Mr. Flannery, one of our Vice-Presidents. That correspondence reveals the fact that all those who are the best qualified to judge, and best able to give advice in the matter, are in favour of the original recommendations submitted to the Board of Trade by this Institute being carried out, and one of the strongest recommendations was to the effect that a five years' service in the workshop is necessary—all the more necessary now-a-days—in order to give those who seek to become proficient engineers guidance in respect

to the time service required on shore before they cast aside the trammels and float away to assist in safe-guarding the interests of the steamship owners, and in doing their utmost in economising their perishable property, at the same time being thoroughly qualified to rectify promptly and efficiently any defect or misfit which might arise. In an article I read recently in one of our technical journals it was pointed out that the education and training of engineers for the Royal Navy was a matter of paramount importance to the country, as upon them would depend very largely the success of naval engagements, and no doubt the eminence which was attained in the past engagements of our history was greatly due to the handling of the ships, the manipulation being then by means of sails and favouring breezes, or making the best of them, unfavouring though they might be. Now that the motive power is located away from the winds of heaven, it is more certain, and the responsibility of making and keeping it so rests with the engineer, who has metal and steam to deal with, where formerly dependence was placed upon sails and winds. We agree with the article most emphatically, and while doing so we cannot but draw a parallel between the Royal Navy and the mercantile navy. What is the difference? In the former case the plans and the whole management of the ruling powers are centred on the efficiency of ships and machinery for purposes of offence and defence. We do not seek war. Nay! It is our duty as a nation, with claims to civilisation upon us, to avoid war, if we can. Still we aim at keeping ourselves free from reproach, and able to hold our own as times are. In the latter case the plans and the management of our shipowners are directed also towards the efficiency of ships and machinery, in order to retain and maintain our insular independence and supremacy, and in doing so we have to consider the friendly rivalry and competition which exist between us and the other maritime Powers. It is no straining of the parallel to say that our merchant princes are now fighting for the national weal as much as the

nation itself would be were we unhappily at war. The difference lies in the want of bloodshed, except in the sense referred to in the song we had so well rendered at our social meeting—"Caller Herrin'"—the jeopardy due to the sea. Admitting this, it behoves each to do his utmost to look forward, and so acquit himself in his preparation for entering the service of the merchant navy, that when the time comes he will be qualified with both head and hands to do his duty, bearing in mind that the issue rests with him, the issue being the making constant and maintaining our national supremacy, as well as the advancement of his own individual gain.

In closing this preliminary to the lectures which are being prepared for the session, I have merely sought to place before you a few thoughts in a general way, leaving to some future opportunity details more immediately connected with the educational training you look for in connection with your future life work. Seek knowledge and understanding for their own sake first, trust to the material benefits following in due course. I need not, and I do not, tell you to avoid play; take your recreation, but let it be your servant to relieve you from the tedium of work, do not let it be your master. They who work hardest have the keenest enjoyment. I wish you all a prosperous session and every success in life.

A vote of thanks to the lecturer was accorded at the close.

INSTITUTE OF MARINE ENGINEERS

INCORPORATED.

SESSION 1896-7.

GRADUATE SECTION.

*BRITISH WARSHIPS, PAST AND PRESENT.

By Mr J. F. FLANNERY, M.P

(VICE-PRESIDENT).

Illustrated by Lantern and Lime-Light Views.

CHAIRMAN:

MR. J. McFARLANE GRAY *(Member of Council).*

A Meeting of the Graduate Section was held at 58, Romford Road, Stratford, on Tuesday evening, October 20th, when a Lecture, illustrated by views, was delivered by Mr. J. F. FLANNERY, M.P. (Vice-President).

The lecturer said the subject on which he had to address those present was one of national importance. Our warships consisted of battleships of from 14,800 to

*cf. "Construction pratique des Navires de guerre," by M. CRONEAU (Gauthier, Villars et fils, Paris).

15,000 tons displacement. Then came the cruisers and the gunboats, the torpedo boats, and the torpedo boat destroyers. The torpedo boat was somewhat going out of fashion, but men whose opinions were worth taking, he said, believed that it was yet destined to play a not unimportant part in naval warfare. The first vessel (illustrated) was the *Mary Rose*, of four centuries ago. This vessel had the military top, which, after hundreds of years, had been brought into use again. Coming to later periods, the *Victory*, which took so great a part in the Battle of Trafalgar, was next shown, and a large number of vessels in each class now in our navy were put upon the canvas, their construction, guns, &c., being lucidly explained. Referring further to the *Victory*, it cost about £70,000 to construct, whilst our late *Victoria* had cost very little short of a million. The vast use of a good navy was thoroughly demonstrated when the Japanese took the command of the sea in approaching China, which, large as it is, they succeeded in crushing without much fighting on land. He could not urge too strongly the truth that if we meant to maintain our supremacy we must, by adopting and utilising improvements in our ships, and in other ways, keep up our command of the seas.

Votes of thanks were accorded to the lecturer, the chairman, and the operator of the lantern and views.

INSTITUTE OF MARINE ENGINEERS

INCORPORATED.

SESSION 1896-7.

GRADUATE SECTION.

FREEHAND DRAWING,

By Mr. JOHN ADAMSON

(CONVENER, EDUCATIONAL COMMITTEE)

Chairman:

Mr. W. J. NOWERS BRETT *(Member)*.

On Tuesday evening, 27th October, the following Lecture was given by Mr. John Adamson:—

Freehand Drawing to the engineer student is of incalculable value, a fact that was testified to pretty plainly by the several gentlemen who addressed you on the opening night of this session. My intention to-night is to once more impress on your minds the many advantages which a knowledge of this art will confer on you in after years, and, with mechanical drawing and mathematical science, you will, with the manual instruction gained in the shops, be fairly equipped for the battle of life. I now wish to draw your minds away from the square and compass for a little while, and see if we cannot induce you to grant a little of your time to one of the most enjoyable of pastimes it is possible to imagine; by practicing it your

minds will become more and more enlarged, and a new source of enjoyment opened up to you, which will be pleasant and lasting in its effect.

Drawing, like writing, is an imitative art; letters are formed first, then combined into words, and those words form the means of explaining our requirements and communicating our ideas. In drawing, we produce the semblance of objects, and the combination of these objects represents circumstances, and realises to the mind the pictures formed thereon. A student should never rest satisfied with copying from the works of others, however beautiful they may be, any more than a person who has been taught to read or write should be content in always using the words and sentences that have formed the examples on which he has been instructed. Mastery of the pencil is brought about by long practice, and these appearances of facility are so many proofs that the master hand which accomplished them had been early trained and tutored in the more severe, but at the same time simpler manner of line. The master in using the pencil is said to paint with it; the best line for the pupil is the pure, simple line of equal pressure throughout, such as we find in the beautiful outlines of Flaxman. The power of making a line is of paramount importance; in all pencil or chalk drawing the shading and finishing are but a repetition of lines, and if one line cannot be made with an equal pressure of the pencil throughout, the evenness of tint necessary to produce the appearance of shadow cannot be arrived at. In a mass of shadow or shading, one line uneven in its form, interrupts the continuity necessary to produce the proper effect; and although we find that a certain amount of mechanical dexterity in handling the pencil is not difficult to attain, its necessity is not always sufficiently insisted upon in the first instance. The first step in drawing should therefore be to make a line. Let us then proceed to consider the best means of its production. A line is either straight or curved; in the case of a straight line, its place and length being determined, the student should make a mark at the point from whence it proceeds and

another where it terminates, and placing the hand so that it can command the line from point to point, he should pass the hand a few times between them until he feels he can make the line with certainty and precision; when such a line can be made with facility, something has been done and attained, a certain amount of connection between the mind and the hand has been established, and the hand is prepared to become the instrument of the mind. We will now proceed to consider the best method of producing a curved line; and I would here remind you that the eye of the student is very apt to be deceived by the rotundity of any object he may wish to outline. Curved lines are produced upon straight ones, the points and degree of curvature being thus more easily determined. In making a curved line, observe at what part there is the greatest deviation from the straight line; make a dot at such place, and draw your curve through it, but in other cases it will be best to draw them first in rectilineal angles, and to make the curves by taking off the points. By the adoption of these methods, certainty of hand is acquired, and freedom and vigor given to the drawing.

I have tried to impress upon you the necessity of drawing a line, and I trust you will not think me tedious; it is important still to mention that to draw a line successfully, much depends on the position of the body, the hand, and the arm. The pupil must sit as upright as he can, having the copy and the paper he is drawing upon in a direct line; he must be able to see the copy and his own drawing without having to raise or lower his head; he has no need to stoop over his work, it is bad for his health and also for the picture. We do not sit in the same position to draw as we do to write; the pencil is not subject to the same rules as the pen; it must be so held that if it was dropped it would fall on the paper at right angles to the line. By attending to this rule also you would have such a command of the pencil, that without moving the wrist you could reach either end of the line, or that position you wish to draw, without any danger of its being directed out of

its proper course. The student should make up his mind before he attempts to draw a line, where it is to begin and where it is to end; to draw a line at random, without a previous arrangement, trusting more to good luck than to skill for its being correct, and leaving out all consideration or enquiry as to its fitness until it is drawn, is the most discouraging practice that can be followed. We therefore earnestly desire to impress upon you all who may hope to draw well, not to allow yourselves to fall into a method which we must call most pernicious and unsatisfactory. To draw a single line requires the same care and judgment as a combination of any number of lines; each line must be drawn cleanly, and with a knowledge beforehand of its proper position. The same principle that regulates one regulates the whole; it is only a repetition of that principle according to the number of lines in the drawing. We wish to impress particularly this idea on your minds, if you wish to become at all proficient in this most delightful art. In every example the learner copies, he must examine and mark with care the character and extent of the angles or openings made by the meeting or intersection of any of the lines, whether straight or curved, of which example he may be about to copy is composed; and he must also be exact in determining the relative positions of the points in which these lines meet or intersect. When to these directions we have added the following: namely, that the learner must also observe the lengths of those lines which form the angles, we have given in very few words the instructions that he chiefly requires to enable him to draw forms, such as ornamental scrolls, flowers, leaves, single figures, etc., in delineating which he can have no assistance whatever from the rules of linear perspective.

Knowing from experience the necessity of repeating instructions, we trust you will consider us repeating in various ways the more important and essential regulations, which guide the mind and consequently the hand, as intended to convey a deep impression of their importance. Before commencing a drawing it should invariably be the practice of the student, when he has placed

his copy before him, whether it be a drawing or the object itself, to look carefully over it for a few minutes, and examine its contour—that is, the bendings of the curves, and the forms which a combination of these curves present. By this close examination of the subject his mind will receive such an impression of it that, as he comes to understand its form, first as a whole, and the details afterwards, the hand, which is only an instrument, will readily execute the suggestions which the mind has received. There are some who make the great mistake of supposing that the hand is to receive all the attention in training; on the contrary, let the mind fully understand the subject, and then the hand will need less practice. In short, educate the mind, and the education of the hand will follow. The value and importance of a correct and ready method of drawing the simple forms of objects cannot be over-estimated. He who is master of this enjoyable power can apply it to any branch of art he pleases. The greatest impediment to the progress of many a pupil is most likely to arise from his impatient desire to arrive, without a moment's delay, at the power of making a drawing. Irregular and misdirected efforts in copying drawings of cottages and stumps of trees, appear to be a much more pleasant task than the performance of exercises so arranged as to lead the student from the knowledge of one principle to an acquaintance of another; nevertheless, the latter is essential to him who wishes to be a master of drawing. The training of the hand and the eye, which such exercises are calculated to impart, will make the copying of a large number of simple figures as easy as it is to make alphabetical characters by the conjunction of strokes, pot-hooks, and hangers. Unacquainted with these elements, how much industry, and even talent, has many a youth thrown away? Let us take an instance of such a youth. He makes his earliest essays, it may be, at copying some finished production or some elaborate drawing or engraving. He tries his best to produce a neat and accurate copy, and he endeavours to give the details of his original with a praiseworthy degree of patient labour; but when all is

done that he is able to do, his copy proves to be a failure in some essential points. It is out of proportion; the perspective lines are not given correctly; the curve lines may not be zig zag, but they want the easy sweep of the example; they are full of shoulders and joints; and the perpendiculars are not upright, nor are the horizontal lines at right angles to them.

When the first ardour of execution has abated, he, perhaps, discovers these faults himself; and if he makes the common mistake of supposing that the art of drawing is a gift, and that the pencil is a magician's wand, manifesting its powers only in the hand of some rightful owner, he may then lose heart, and think that his faculties are not adapted for the pursuit of this noble art; if any of you have unfortunately stopped at this point let me tell you to take courage and recover your confidence; the good method of practice, and the intelligible principles which I have tried to explain and set before you, will so lead your hand and eye, that ultimately they will accomplish all you might desire.

Well directed application and study do wonders in other arts, and why not in drawing? What exercise does not a musician or a singer go through before he gets command of his fingers or voice? Who expects to arrive at that dazzling rapidity of motion visible in the touch of the violin player, certain and instantaneous though it be, by any other method than that of hard and constant practice? Would not he who should begin to learn the use of any instrument by attempting complete airs, and always turning aside from exercises which a master prescribes, be sure to end where he began and become no player? Think what an amount of labour is necessarily expended in the fingering by the young pianoforte player. Greatly less labour than is necessary in prosecuting many other arts will make an able draughtsman, and fit him for the performance of many useful works, and imbue him with those principles of drawing which are applicable throughout the whole range of this art. It is frequently asserted that the art

of drawing, like that of writing poetry, is a natural gift; and that unless you possess this you can never excel. It may be true that, to rise to the highest eminence in any science or art, requires a peculiar bent of the mind; but to acquire a useful practical knowledge of the art of drawing, it is by no means necessary that every one should be a genius.

With regard to the sister arts—poetry and painting—it may be truly said, in regard to their elements, at least, that every man is endowed with some ability to their acquisition and their application. Everyone, for instance, is poetical when he speaks on a subject with which he is acquainted, or in which he is deeply interested; and, in like manner, everyone is an artist, who is ready to make a sketch or a drawing of any object, which he wishes to explain to another, when he finds that language fails to convey his ideas. The art of drawing, therefore, may be attained to a certain, or I may say a sufficient extent, for all practical purposes by everyone who exerts the necessary attention and assiduity. The engineer, the tradesman, or the connoisseur, may, by the use of a few well-directed strokes of the pencil, convey any idea of his plans, operations, and views in relation to artistic productions, of which the most laboured and elegant composition, consisting of many hundreds of words, would fail to convey the slightest impression to the mind of the hearer or reader. This subject is such a large one that I have been only able to touch the fringe, and it would be imposible for me to do any more during the course of one evening as the time is limited, and although it was intimated on the opening night; business and other engagements have prevented me from preparing a lecture as popular as I should have liked, however, I trust I have created in some of you at least a desire to give a trial to this most delightful of all studies. For a few pence you can buy all the material necessary, and the pleasure of looking at a picture is doubly enhanced when it has been executed by your own hand. You have no idea of the pleasure it brings in its wake, the whole world appears to you in a

new light, and your mind and eye are taught to regard it from the standpoint of an artist, and you will see beauty in things you at one time thought commonplace. You will, no doubt, from what I have been trying to explain, see the advantages to be derived from being able to draw correctly. It will aid you in your career as an engineer; your mind and eye will have been trained to take in the form, size, and distance of any object placed before you, and the hand, the instrument of the mind, will, with facility, depict on the paper the impression that the mind has obtained of the subject. It may be that some, or all of you, will choose the sea as that branch of the engineering profession you wish to follow, and that you will rise to positions of responsibility. An accident may happen to the machinery placed in your charge, in some portion of the globe where repairs cannot be effected without the aid of the workshop, or you may have detected a flaw in some shaft, valve, piston, or rod that cannot be replaced till your arrival at home; you will then be able to send to your employers such representation of the part required, which can be got ready for your arrival, and thus save time and expense, that can only come from the pencil of a finished draughtsman, correct in every detail and ready to be fitted. Let me now impress upon you the necessity of beginning with the simple objects, and prepare the mind for the more complex subjects, and depend upon it, with care, attention, and practice there is nothing to hinder all of you from becoming proficient in the art of freehand drawing.

Now let me, in conclusion, remind you of the precepts I have tried to instil. Young students will find it, on the whole, the best thing they can do to strive to be clear, not affectedly clear, but manfully and firmly mean something and say something whenever you touch the paper. Yield neither to affectation nor speed, but trust to time and your own honest labour, to invest your work with the tenderness that comes of love, and the mystery that comes of power. If anything goes wrong with your work, no good will result from violent and hasty

efforts at correction; the cause of failure and the best mode of alteration should be thought over, and a little time allowed to elapse before repairs are attempted. A spoilt drawing should not be thrown away, but put out of sight for a while, and looked at again when another is in progress. Such records of failure are very instructive, and often contain good parts, and the examination of which will give encouragement, and conduce to the better success of subsequent attempts. It must be impressed upon beginners that they must not suffer themselves to be daunted by ill success at first; but like Antæus, who, wrestling with Hercules, rose with renewed vigour after every overthrow, they should gather fresh strength and resolution from their failures. Persistent efforts bring improvement in your work, and also give you the enviable position and power of justly estimating the excellences in the works of great artists. With this, moreover, will come tenfold increased facilities for discernment and enjoyment of the endless beauties of nature. A perception of the beautiful in art is equivalent to the possession of another sense, for it supplies a new power of reading and appreciating the beauties and sublimities of the natural world.

INSTITUTE OF MARINE ENGINEERS

INCORPORATED.

SESSION 1896-7.

GRADUATE SECTION.

COAL TESTING EXPERIMENTS.

By Mr. J. H. THOMSON
(CHAIRMAN OF COUNCIL).

CHAIRMAN:
Mr. JOHN ADAMSON *(Member of Council)*.

At a meeting held on Tuesday evening, February 9th, Mr. J. H. Thomson (Chairman of Council), gave a demonstration on the method of testing the evaporative qualities of coal. After describing the various parts of the testing apparatus, and explaining the principle on which it is arranged, a good many practical tests were made, in which, by a division of labour, a number of the students were able to take part. Some were engaged in pounding up and screening the samples of coal to be tested, whilst others were engaged in accurately weighing out and mixing the samples with the necessary oxygen mixture required for combustion, charging the retorts and attending to the fuse, measuring and taking temperatures of the water, taking the time and recording the results.

A record of most of the tests which have from time to time been made are kept in convenient form, and may be inspected by members at any time on application.

INSTITUTE OF MARINE ENGINEERS

INCORPORATED.

SESSION 1896-7.

GRADUATE SECTION.

THE BUILDING OF A DYNAMO.

By Mr. E. SHEPPARD.

Chairman:

Mr. JOHN ADAMSON *(Convener, Educational Committee).*

A Meeting of the Graduate Section was held at 58, Romford Road, Stratford, on Tuesday evening, November 10th, when a lecture on the Building of a Dynamo was delivered by Mr. E. Sheppard, as follows:—

I feel in duty bound to myself to beg of you to understand that I am not a professional lecturer, but a practical electrical engineer, and for that reason I ask your forbearance should I lack in the art of making myself explicit to you this evening. But at the same time, I take this opportunity of expressing the very great pleasure it gives me in being asked to contribute a scientific lecture to our younger members of the Institute. I hope I will be able to make this lecture pleasant to listen to, for I feel that it is a very strong subject put into very weak hands; however, I will do my best. I may tell you at once that it is far from my intention to lead you to believe that I am going to explain what electricity is, for I do not know. I have this consolation

however, that I don't believe anyone else does. I do know something about this element, and what it will do when I get it; it is on some of these effects I am going to speak to you this evening—these effects which form the most essential properties of a dynamo—leaving out all formulæ, etc., and afterwards applying these in the building of a chalk dynamo on the black board. Assuming you all know some of the properties of a magnet, that it has two poles, one a north and the other a south, and if allowed to swing freely by a thread or on a needle point it will set itself in one position, viz.: in the earth's magnetic meridian, and the end pointing towards the north is called the north pole, and the opposite the south pole, also that each pole has the power of attraction and repulsion. Either pole will attract smaller pieces of iron or steel, but a north pole will repel a similar north pole of another magnet, and a south a similar pole, but a north pole of one magnet will attract the south pole of another and be attracted by it. Leaving magnetism for the present, we will take up the subject of electricity. There are many ways of producing electricity, but to-night we will only deal with electricity generated by a dynamo, although to prove one or two of these effects it will be necessary to use electricity produced by chemical action, called voltaic or galvanic electricity. I would like to point out here that it is usual to speak of electricity by either of the above methods as a current flowing from the positive to the negative pole, but this is only assumed; nobody has ever proved that it does flow either in one way or the other. The latest theory is, and I believe all electricians are unanimous, that everything is full of this so-called electricity, but in its undisturbed state, and only wants shaking up. To enable us to follow the phenomenal effects of electricity, it is convenient to say that it flows from positive to negative. The first effect produced by electricity I shall call electro magnetism, a very important property of a dynamo. Good permanent magnets must be made of steel, as soft iron will only retain a very small percentage of the magnetism put into it, but if we drive a current of electricity through a coil of wire wound over a piece of

soft iron we are able to magnetise it to a much greater degree than a piece of steel or a permanent magnet of the same size. Such magnets are called electro magnets. But this magnetism only lasts while the current is flowing through the wire. Immediately the current stops the magnetism ceases, as will be seen by the following experiment. I have here a bar of soft iron which I will cover with this bobbin of wire, and you will notice that only while the current is flowing through the coil the iron acts as a magnet. Next, I shall deal with currents produced by induction, and this, as well as the electro magnet, is a very important subject, as it is the foundation of all dynamo electric machines. If we plunge a magnet into the centre of a coil of wire a current of electricity will be seen in motion. Let me connect the ends of our coil to the galvanometer. You notice a deflection on the scale as soon as I bring the magnet near the coil, and again when the magnet is withdrawn, a second flow takes place, but in the reverse direction as indicated by the deflections of the galvanometer being on the opposite side of the scale. I will not go into an explanation of this, I merely want to carry my experiments far enough to show the principle of the working and building of a dynamo. Before leaving this subject I must point out that it is not only necessary to move the magnet near the coil, but if the coil is moved near the magnet or in the magnetic field, so as to cut the magnetic lines of force, the result will be exactly the same. I will prove that by a coil of wire connected up to our galvanometer as before, and a magnet kept in one position, this coil is made to represent a single coil of a drum armature. You will notice when I turn the coil round in the magnetic field, so as to cut the magnetic lines of force, a current is set in motion as indicated by the deflection of the galvanometer on the scale. Now, let me explain what is meant by magnetic field or cutting lines of force. All round the poles of a magnet there is an unseen power, either of attraction or repulsion; the nearer the poles the stronger is the force, and a rough sketch on the black board will explain what I mean. Each one of the lines cut by a conductor causes

a flow of electricity in that conductor, and the greater the number of these lines cut per second, the greater the strength of the current. In the last experiment I moved the conductor in the magnetic field of that magnet, or, in other words, the conductor cut these lines of force, these are the foundation of nearly all dynamo electric machines. There are many different kinds of dynamos, but I am going to illustrate one to-night that I think is mostly in use at the present time, viz., a compound dynamo. You have seen that a coil of wire moved in a magnetic field sets in motion a current of electricity. The armature, a very essential part of a dynamo, is simply a number of coils which move in a strong magnetic field of very powerful electro magnets. But where does the current come from? You remember what I said, soft iron did not lose all its magnetism, that there is what is called residue magnetism left in it after it has been magnetised, and this is just sufficient to start the ball rolling, as we shall see. Now, let us start building our dynamo; and here again let me say although I have chosen a drum type armature, the fundamental principles are the same for nearly every kind of dynamo. First of all, then, we will start with the spindle, on this is built the armature, first the core, now generally made of iron discs or washers, keyed on the spindle, and then the conductors wound parallel to the spindle, either of insulated wire, or in the case of later types of machine, copper bars are used. Let us just for convenience sake only put one coil on our armature, and for our purpose three turns of wire will do, beginning at the top; then we run along parallel to the spindle, down at the back to the bottom, and along again on the opposite side, and so on. At present, we will leave the ends free. Next we will put on our field magnets, and these I will draw after Siemens' pattern, having the pole pieces at the bottom; this piece of iron is called the yoke; then you see we have a complete horseshoe magnet, and, as I said just now, there will be a residue magnetism left in the iron, and supposing by testing with a magnetic needle we find this to be a north and this a south pole, then there will be a magnetic field between the two poles, or, in

other words, there will be imaginary lines of force passing from north to south through the armature, and consequently through the conductor or the coil on our armature. While the armature is at rest there will be no variation of these lines of force in our coil. But if the armature is made to rotate, these imaginary lines of force will be cut by the conductors on it, which will set up difference of potential and cause a current of electricity to flow through the conductor. Let us follow our coil as it is made to rotate ; first, we will take the three top conductors, each one of these will cut a certain number of these lines that pass from north to south twice in every revolution, once as they descend to the bottom, and once as they ascend to the top, again thereby setting up a difference of potential, and causing a flow of electricity in the conductor. But we have the other side of our coil forming the three bottom conductors, which will be performing the same functions as the others at the same time, but the current flowing in the conductors at the top as they descend are in the opposite direction to that flowing in the conductors as they ascend. But it would take too long to go into this to-night, so we will pass on to the commutator. All the conductors are connected up to this in such a way that the current can be taken off by means of brushes, which press on the surface in the same direction, ready for use. Commutators are made of bars of metal, usually copper, called segments, each one is insulated from its neighbour, and there are always as many segments as there are coils on the armature, the beginning of one coil and the end of the preceding coil are connected to the same segment of the commutator. The brushes are usually now made of copper wire gauze. Our armature coil, having been connected up to the commutator, and made to rotate in the weak magnetic field, we should get, of course, only a weak current at our brushes, owing to there only being a weak magnetic field, that due to the residue magnetism in the iron of the field magnets. But if we drive this weak current through a conductor wound over and round the field magnets, we should by so doing make them into electrical magnets, or, as they are commonly

called, electro magnets, and increase the magnetic field, driving more lines of force through our coil, and in its turn increasing the current in the conductor, for the greater the number of lines of force cut per second, the greater the strength of the current. I will draw two or three turns of wire on our field magnets. These are called the field magnet bobbins or field magnet coils. We are now drawing towards the completion of our dynamo, so let us follow again the changes as they take place, and connect up, as it is termed, our dynamo. We will now imagine our armature to have conductors wound all the way round, and connected up to the commutator, as I have described, then as it revolves there will be a current of electricity generated in the conductors which is connected by means of the brushes. We will say, then, that it flows away from this brush, and call it the positive brush, through our field magnet coils, making a stronger magnetic field, then through the external circuit, viz., lamp, motors, or whatever it may be, back to our negative brush. There is one other thing we must add to our dynamo, and that is a second coil on our field magnets, as it is at present what we call a series machine. This second coil is of much thinner wire than the first, and it is called the shunt coil, because it is connected up across the brushes or as a shunt to the external circuit.

A hearty vote of thanks to the lecturer closed the proceedings.

INSTITUTE OF MARINE ENGINEERS

INCORPORATED.

SESSION 1896-7.

GRADUATE SECTION.

THE LIFE OF NASMYTH.

By Mr. T. F. AUKLAND

(COMPANION).

CHAIRMAN:

Mr. JAS. ADAMSON *(Honorary Secretary)*.

A Meeting of the Graduate Section was held at 58, Romford Road, Stratford, on Tuesday evening, November 24th.

The lecture consisted of Mr. Nasmyth's record of his life, in his own vivid words. The narrative, so far as the lecturer went with it, stopped with Nasmyth's introduction to Mr. Maudslay at his great engineering works; but though it dealt only with Nasmyth's youth —his formative period—it was a remarkable story of a laborious, energetic, and inventive youth. He made his own tools, and constructed a furnace, and made brass castings in his bedroom; learning chemistry, he made his own acids, and did not buy them; all through he relied upon himself. In connection with this, it will be

well to quote some of Mr. Nasmyth's own words: "I regret that the same system is not pursued by young men of the present day. They are seldom, if ever, called upon to exert their own wits and industry to obtain the requisites of their instruction. A great deal is now said about 'technical education'; but how little is there of technical handiness or head work. Everything is bought, ready made to their hands, and hence there is no call for individual ingenuity. . . . The eyes and the fingers, the bare fingers, are the two principal inlets to sound practical instruction. They are the chief sources of trustworthy knowledge, as to all the materials and operations which the engineer has to deal with. No book knowledge can avail for that purpose. The nature and properties of materials must come in through the fingers' ends. Hence I have no faith in young engineers who are addicted to wearing gloves. Gloves, especially kid gloves, are perfect non-conductors of technical knowledge. This has really more to do with the efficiency of young aspirants for engineering success than most people are aware of."

A hearty vote of thanks was accorded to the lecturer, who kindly offered to continue the subject at a subsequent date.

INSTITUTE OF MARINE ENGINEERS

INCORPORATED.

SESSION 1896-7.

GRADUATE SECTION.

MECHANICAL DRAWING,

By Mr. W. J. NOWERS BRETT

(MEMBER).

CHAIRMAN:

Mr. JAMES ADAMSON *(Honorary Secretary)*.

On Tuesday evening, January 18th, the following Lecture was given by Mr. Brett and was illustrated by diagrams on the black board :—

Machine Drawing is the description of the construction of a piece of mechanism, and should convey to the mind its details, its purpose in every detail, and its action in the aggregate as clearly as the page of a book conveys its matter to the mind when printed in the clearest type, and written in the simplest and most direct style. By that I mean that the best drawing need not be the most neatly executed—and expressing myself in that way it must not be understood that I depreciate neatness, but that it should be made truthfully and accurately upon the principles that form the basis of mechanical drawing. If we start from the point that it is governed by certain rules it will readily be perceived that it is not a natural accomplishment, and if you compare it

with freehand drawing you will find that where natural ability only requires training to ensure perfection, that same training without natural ability will not ensure quite the same success. With mechanical drawing there is no such natural drawback. An eye for symmetrical proportion is of great value and assistance, but the want of this can be replaced by extended experience and practice of drawing and the study of general engineering details. In short, it can be acquired by anyone totally devoid of the power of natural delineation. To the engineer the art of drawing correctly is of the greatest assistance. It ranges from the simplest sketch or diagram to the most elaborate drawing, full of detail, accurately drawn to size or scale, coloured to represent the materials, whose differing properties he utilises to the best advantage, and shaded to give each rounded or flat portion its distinctive appearance. It is the language of his profession. To the inventor it is also the means of practical expression, the initial stage in giving form to his thoughts and ideas, and it might be termed the intermediary between his theories and their practice. In fact, the man who is engaged in the business of mechanics is a very poor individual indeed if he be without the knowledge of expression by straight lines, circles, and radii. Machine drawing is applied geometrical drawing. In practice we have to utilise the principles of geometry in a very high degree, thus a knowledge of geometry is indispensible, and should be used as the foundation of mechanical draughtsmanship. In addition to its usefulness, geometry, both plane and solid, is a most attractive subject, and should be studied in company with Euclid, by which means we can answer the why and the wherefore of its problems. The student of drawing will find here a solution of any difficulty that may arise with lines, and their application to the construction and views of objects, and the study of the co-ordinate and oblique planes and the projection of geometrical figures will be found to be the best introduction to the finished plans, elevations, and sections of machinery. Therefore I would say to all those practising the art of drawing in outline,

study geometry concurrently with your practice, and you will find assistance ever at hand, for without its knowledge your progress will be slow, and you will have the greater difficulty in understanding the fixed principles of the construction of figures by lines. Mechanical drawing may be divided as follows:— hand sketching, detail drawings, general drawings, and finished drawings. Hand sketching should be practised from actual objects, either models or full-sized machinery, and will be found invaluable to the engineer in every branch of his calling. It will be most generally acknowledged that the good, finished draughtsman can make the best hand drawing. He is accustomed to work clearly and accurately, and he will give the same attention and care to the rough as to the finished article. When making a hand drawing, it should be as large as possible; every detail should be neatly drawn, and with a due sense of proportion, and where a crowding of parts is likely to occur, larger detail sketches should be separately shown. Great attention should be given to the best position of the moving gear, and to its projection to other views, and all angles of motion (such as the relation of the eccentric to the crank pin) should be shown clearly, and in addition should be descriptively noted. When putting in sizes, the figures should be distinct and evenly distributed over the different views, and it is always advisable when placing your dimensions to start from one end and work along to the other end, and from the bottom and work upwards, so as to ensure no accidental omission. This is a very good plan to follow. If sizes are taken indiscriminately an important one may be left out, and you can well imagine circumstances when it is not always possible to remedy an omission of this kind, and where considerable trouble, expense, and delay may be the consequence.

I would call hand sketching the first stage in mechanical drawing. The student might thus make his first impressions of mechanics upon paper, and the facility in using the pencil thus acquired will stand him

in good stead in after life in setting down his ideas when designing engines or other machinery. It is a fact—and I mention it only as showing the value of this kind of drawing—that the hand sketch of the great engineer showing the general arrangement with the few principal dimensions he has worked out, give him the credit of designing the whole thing, although the greater labour, the important working out of detail, upon which the harmonious whole so much depends very rarely receives the proper amount of credit due to it. The rough drawings of the early engineers—reproductions of which are sometimes published in the professional journals—are found quite as interesting to the engineering world as the rare manuscript of the author is to the literary person. Detail drawings are used to give enlarged views and dimensions to the various working parts and complicated portions of the machinery requiring, as it were, further explanation. In this way we are enabled to give separate study to its component parts, to work out the strength or more clearly define the functions of those sometimes comparatively indistinct details, whose perfections add so considerably to the value and the efficiency of the machine. We can compare the efficiency of a machine to the strength of a chain being that of the weakest link, and if a small detail is imperfectly thought out the perfection of the machine will be impaired, and it is surprising how a love for detail will enhance the reputation of a draughtsman. It is these detail drawings that are so much used in the workshops; they convey to the workman what he is to do, and how he is to do it in the most simple manner.

General drawings show by plan, front and back elevations, one or both end elevations and sections the complete machine drawn to scale. All details are correctly placed, and, as it were, fitted together. The clearances of working parts are arrived at, and the paths of motions are shown in dotted lines, and actual positions and particulars are found from data as the drawing progresses. In general drawings some

portions of the machine are hidden, and these can be shown either by dotted lines or by cutting sections through the material, and experience soon teaches which is the better of the two methods for any particular case. Where a drawing is the same on both sides of the centre line one side is sometimes shown in section if further explanation is deemed necessary. It is a good plan to carry the principal centre lines through from one view to another when making the drawing, and also in some cases to retain them so by inking in. The true forms of the smaller working parts can be more readily traced, and errors will not be so likely to occur. Before commencing a drawing, either detail, general, or finished, the centre lines must be measured and drawn accurately. They should be used wherever possible, and all data taken from them, and the student will find it necessary and profitable to practice this. Working neatly and quickly from the centre line can only be acquired in this way, and perfection in this important matter is one of the visible signs of progress and good draughtsmanship. Now let us consider the general drawing of a machine—and by way of instruction and utility I will take the steam engine—an engine of the marine compound type for preference. I will not deal here with formulæ or sizes, but will simply take the engine as an example for drawing only. Begin by drawing the centre lines—the horizontal representing the shafting, and the vertical the one passing through the centre of the cylinder, for the present, of one engine only. Using the centre line of the shafting as the starting point of our drawing, we proceed to mark upon the vertical centre line the length or throw of the crank, the diameter of the crank pin, and the length of the connecting rod decided upon. We can now draw the connecting rod and cross-head, and the top and bottom end brasses. We next proceed to draw in the piston rod, with its stuffing box and gland, allowing sufficient clearance between the cross-head and the gland studs. We have now reached our cylinder, and can fill in the thickness of metal of the cylinder bottom, and mark off the clearance allowed

between the cover and the piston, and the length of the stroke to the lower side of the piston, and draw in the piston and nut; then marking off the clearance at the top of the piston and the depth of the cylinder cover we have completed the height of our engines, and can draw in the cylinder and cover. It is now possible to mark off the centre line of the other engine, and to draw in its cylinder also. From this stage it is necessary to proceed with an end elevation of our engines, and to find upon it the true position of the connecting-rod, crosshead and piston, and so it is we are able to complete our drawing, borrowing from one view to complete another. The exact positions of the slide valve spindles and the eccentrics are a matter for arrangement with the journals of the shafting, and they are also affected by the area of the exhaust ports. The slide valves and their diagrams, the eccentrics, and link motions require special attention and study, and the position of the sheaves upon the shaft must be accurately fixed. The eccentric precedes the crank by an angle which is greater than 90°, the lap and lead of the slide valve determining the exact position of the eccentrics. The object of the link motions is to connect the slide valve of each engine with either one or the other of its eccentrics, and so reverse the motion of the engines, and the two valve motions are actuated by one movement, conveyed through the way shaft. To find the path of the slotted link, from the centres of the forward and back eccentrics, draw arcs with a radius equal to the length of the eccentric-rod at given equal distances on either side of the centre line, which will then represent the centres of the top pins of the rods, and with the same radius cut the centre line passing through the shaft, which will give the new centre for striking the arc of the slotted link. It is good practice for the student to draw exaggerated diagrams of the positions of the link motions, and by so doing thoroughly master their principle. The motion of the air, feed and bilge pump levers is drawn in dotted lines to show clearances and the centre line of the pumps—and this is an important

rule to remember when dealing with any similar motion—when produced passes through half the versed sine of the arc of motion of the end of the lever.

In the foregoing remarks I have endeavoured briefly to point out to you some of the rules it is necessary to follow in the drawing of a steam engine as a whole, but a considerable amount of study and practice is requisite to be able to accurately draw some of the details. I will mention one only—viz., the turning wheel and worm of the marine engine. There are so many rules applicable to the drawing of the teeth of the different kinds of wheels that a long address might be devoted to this subject, and I would ask you to study the form and the action of the teeth and the drawing of curves, such as the involute of a circle, &c. The length of the worm need only be slightly longer than its actual contact with the teeth of the wheel. First draw the centre lines—they appear in every drawing, no matter how unimportant—and mark off the pitch circles and lines, and the top and bottom of the threads of the worm. The worm can be considered as a rack, and on the plane through its axis draw the face of the thread at an angle suitable for gearing with an involute tooth, which is the simplest form of tooth for a wheel. Mark off the thickness in section of the threads of the worm, and complete as if it were a square thread screw. It is necessary to draw sections through various positions of the worm thread, to find the corresponding shape of the tooth to gear with it at those positions. I have briefly sketched the method adopted in this example to show that mechanical drawing in its details follows certain hard and fast rules. There are many small points to consider and follow in making a neat general drawing. I might mention some. Care and accuracy should be aimed at in inking in radii when drawing in small details, such as hexagon nuts, and a general drawing can be considerably improved in appearance by using shade lines, the light and dark lines representing the parts exposed to light and shade respectively, and this rule is always

observed—viz., that the rays of light are assumed to fall from the left hand top corner of the paper. This applies to all views of an object in the same plane. If the plane is changed the direction of the rays of light must be similarly changed. Sections are shown by parallel lines drawn at an angle of 45°, or if the sectional lines of another part run in the same direction, they can be drawn at an angle of 60°. The section lines of different, but contiguous, parts should be drawn to the same point. The last kind of mechanical drawing I will deal with is the finished drawing—finished in a greater or lesser degree with colouring or shading, or both. Shading requires a considerable amount of study, and should be practised upon simple objects first. To find the parts most affected by light or in deepest shadow a simple and well-known rule can be generally followed—viz., by making a diagram of the ray of light upon the plan. In applying the shading, dark, light, and medium tints are required. Lay on the dark strip, and while still wet put on the second wash of colour, working a little into the first, and so on, and by this means the shading is gradually softened. A well-known work in dealing with shaded drawings says:—"The parts near the eye are in high light and deep shade—the virtue being in the striking contrast of light and shade in the front of the picture; while those parts which are in the background have less contrast of light and shade in proportion as they recede from the eye, the parts in light being less bright and those in shade less dark. The effect of distance may be still further secured by a pale wash of Indian ink over the parts in the back of the picture, the effect of which is to tone down the lights, and to give to them the appearance of remoteness."

A drawing shaded with parallel lines similar to an engraving is very effective when neatly done, and will be found a good exercise for the drawing pen. When colouring a drawing a student must learn to lay on an even wash of colour, and if the surface is comparatively a large one it will be found that if the paper is damped

immediately before applying the tint he will have no difficulty in making it uniform and even. The colour should be worked in one direction, and all edges should be finished progressively. The tint should be pale for outside surfaces, and dark when showing sections, and on no account should the centre lines be put in until the washes of colour are completed. Lastly, and it is certainly not least in making a neat drawing, it is absolutely necessary to acquire a neatness in printing titles, writing notes of explanation or figuring in dimensions, and letters and figures alike should be made bold and clear.

The Chairman, after complimenting the lecturer, and expressing to him the vote of thanks accorded by the students, referred to the kindness and painstaking of Mr. Brett in conducting the drawing classes during the session. Commenting on the lecture, he emphasised several of the points, especially urging that great attention should be paid to clearness and distinctness of figures on sketches and drawings, bearing in mind that others besides the draughtsman required to read them, sometimes without the advantage of having seen the portion of machinery the sketch or drawing represented. In all pipe arrangements, regard should be paid to accessibility of connections, not having too many branches off one main, keeping in view economy, not only in respect to saving a few feet of pipe, but more particularly the saving of steam and fresh water at sea, and in bilge pipe connections and boxes, remembering that " bilge diving " in a heavy sea-way by engineers is an experience made more or less unpleasant according to the designer of the pipe arrangement. Many a deep and loud curse had been uttered by the engineer, whose searching into a rose box, with the bilge water rolling over him, had been made unnecessarily hard by the designer. Some of the young men might have in their future experience to remember this. It was urged that a designer should bear always before him that the portion of machinery he designs has got sooner or later to be overhauled and disconnected, and it is of the

utmost importance to consider the time and trouble to be saved by having every detail arranged and fitted with every regard to facility in disconnecting on board ship. It was evidence of bad design when a whole cylinder had to be lifted to get at a small chest. The importance of figures and system in taking and placing dimensions had been well urged, and it could be seen how serious it might be in a drawing otherwise neat and clear if one figure was omitted, and that figure possibly the key to all the others. Many an engine and machine had been constructed from a design traced in chalk on the door of the workshop by exceptional men, but it was well to be in a position to take advantage of learning the art and system of constructing a drawing on the lines laid down by their teacher, even if they were possessed of the talent of freehand sketching and designing by rough and ready methods. Before starting the drawing, the title or subject of the intended drawing should be written on the sheet, so that should it be laid aside for a time to give place to a more urgent demand, no difficulty would be met in taking it up again. Reference had been made to designing a worm wheel, and if the students had not already had the experience of drawing out in regular proportions toothed wheels and gearing, he suggested to Mr. Brett that such would be a very good exercise for the student.

The proceedings closed with a few words of acknowledgment from Mr. Brett, and a vote of thanks to the Chairman.

INSTITUTE OF MARINE ENGINEERS

INCORPORATED.

SESSION  1896-7.

GRADUATE SECTION.

MAGNETISM,

By Mr. E. SHEPPARD.

Chairman:

Mr. W. J. NOWERS BRETT *(Member)*.

On Tuesday evening, February 16th, a lecture on "Magnetism," illustrated by lantern views and experiments, was given by Mr. E. Sheppard, who said magnetism was a most important and a most interesting subject, full of opportunities of carrying out some beautiful experiments, some of which he hoped that night, and in some future lecture, to be able to show them. He described the properties of the lodestone, pointing out that it might be called a natural magnet. Taking up the more important subject of artificial magnets, he divided them into two classes, viz.: permanent and temporary magnets, and again sub-divided temporary magnets into magnets and electro temporary magnets. He explained what is meant by the expression "pole," or the "pole of a magnet," pointing out that in a badly constructed or badly shaped magnet, how it was possible to have more than two poles. Weber's molecular theory of magnetism was made most interesting by lantern views, showing the different positions of the molecules in a magnetised

and unmagnetised piece of iron. The first law of magnetism was dealt with—that of repulsion and attraction of like and unlike poles, being illustrated by means of a lantern view in the form of a small magnetic needle made to swing perpendicularly, and ingeniously fixed to a glass slide, upon which was drawn the points of the compass, the poles of the needle being distinguished by colours. He then explained the making and use of the magnetic needle, and by experiments showed the action of pieces of iron and unmagnetised pieces of steel, and illustrated upon the screen the methods used in making permanent magnets—the single touch, the double touch, the divided touch, and by the use of a current of electricity, he showed by Weber's theory that it was impossible to make a good permanent magnet of iron; and, magnetising a piece of steel, he explained experimentally how it was impossible to get magnets with only one pole, and that each broken piece of the magnet became in itself a complete magnet, which, when tested previous to being broken, showed no magnetism in that particular piece, but had now distinct and opposite poles. Two or three phenomenal facts of magnets were discussed, such as the increasing in length of pieces of iron when magnetised, a slight sound being heard immediately pieces of iron are subjected to a magnetising effect, and the influence of magnets through air and various substances. Mr. Sheppard concluded his lecture by explaining the difference between the lifting power and the force of a magnet.

The Chairman, after expressing a hearty vote of thanks to the lecturer, alluded to the molecular theory, and instanced its application to subjects other than magnetism. He impressed upon the students the necessity of grasping the idea of molecular movement, as it played an important part in the theories of heat and its action on materials, and the action of steam in the engine cylinder.