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INSTITUTE OF MARINE ENGINEERS
INCORPORATED.

SESSION



1896-7.

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

Volume VIII.

SIXTY-SIXTH PAPER

(OF TRANSACTIONS)

AN ASSISTANT CYLINDER
FOR VALVE GEARS,

BY

Mr. BASIL H. JOY

(ASSOCIATE MEMBER).

READ AT

THE INSTITUTE PREMISES, 58, ROMFORD ROAD, STRATFORD

ON MONDAY, 25TH JANUARY, 1897.

PREFACE.

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58, ROMFORD ROAD,

STRATFORD, E.,

January 25th, 1897.

A meeting of the Institute of Marine Engineers was held here this evening, presided over by Mr. J. R. RUTHVEN (Convener, Papers Committee), when Mr. BASIL H. JOY (Associate Member) read a Paper on "An Assistant Cylinder for Valve Gears." The Paper was excellently illustrated by means of a lantern and lime-light, the views being thrown on a screen.

The Paper was followed by a brief discussion and further explanation given by the author in reply to questions raised in the course of the evening.

JAS. ADAMSON,

Hon. Secretary.

INSTITUTE OF MARINE ENGINEERS INCORPORATED.

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

AN ASSISTANT CYLINDER FOR VALVE GEARS.

BY MR. BASIL H. JOY

(ASSOCIATE MEMBER).

READ AT 58, ROMFORD ROAD, STRATFORD,

ON MONDAY, JANUARY 25TH, 1897.

CHAIRMAN :

MR. J. R. RUTHVEN (*Member of Council*).

IN preparing a paper on this subject for this Institution, I have endeavoured, as far as possible, to steer clear of a paper which my father read on the same subject before the Institution of Naval Architects in the spring of 1891; and, although I have found it impossible in preparing a thoroughly comprehensive description of the Assistant Cylinder, to avoid a certain amount of information that may have been contained in that paper, I feel justified in repeating it, as it is necessary to properly follow the various steps by which we arrived at our present position, and much of it is personal experience, and I have also been able to add the results which the additional five years have given us.

The name Assistant Cylinder seems to exactly indicate the purpose and application of this device, in the same way that the term balance cylinder at once shows what that device is for. The Assistant Cylinder is simply to assist the valve gear, and the amount of assistance can be very accurately adjusted to the requirements. The object of a balance cylinder is to balance the actual weight of the valve, and can, of course, be exactly proportioned to that work.

Now let me see how the idea originated. Balance cylinders have been in use for a great number of years; I am unable to discover the first application; but I know they were used as early as 1851, by Messrs. Denny & Co., and they seem to have gradually, and almost unconsciously crept into general use, evidently owing to their acknowledged necessity, as the valves of low-pressure cylinders were, even in those early days, found to be heavy and cumbrous things for the valve gear to keep on starting and stopping, and the balance cylinder was devised to do something towards relieving the gear; but, inasmuch as there is always a constant pressure, or nearly so, on the piston of the balance cylinder, no account could be taken of the momentum of the valve, but only of its actual weight. It will be admitted then, that a balance cylinder goes only a very little way in the right direction, and now in these days of high piston speeds, when we may have a valve weighing five or six cwt., travelling through a stroke of six inches, and having to be stopped and re-started some seven or eight hundred times per minute, it will be seen what an enormous task the valve gear has to perform, and one can hardly wonder at the great amount of trouble which has been experienced with them of late years. If only a record of breakdowns were obtainable, it would make very interesting reading when considered in relation to the subject of this paper. No such returns are, however, to be got, and it is only necessary to recall those cases which have come under one's own notice, in actual experience, or in the papers, to recognize the fact that the valve gear of the present

day is at once a very ill-used and much over-wrought piece of machinery. In a paper read only about three months ago before the Institution of Mechanical Engineers on "Breakdowns," out of a total of 1,000, which came under the author's notice, no less than 213 were to valve gears, 60 being to eccentrics and rods, being 72 per cent. more than those to any other part of the machinery, which fully confirm those remarks, more especially as Mr. Longridge in that paper says: "As most of the breakages of valve gears, to which no cause could be assigned; were really due rather to inability to endure the ordinary conditions of work than to the action of any abnormal stresses."

We may take it, I think, that about the year 1887 things began to come to a crisis. Speeds in both war and mercantile ships of our own and other nations were jumping up by leaps and bounds, and the abandoning of horizontal engines, and the general adoption of the vertical overhead engine of the present day exaggerated the evil, by compelling the use of short strokes and high number of revolutions to attain these great speeds, and valve gears were the greatest sufferers. My father had for some time had his attention fixed on this subject, being, of course, very much in touch with it, and he considered that the right way to meet the difficulty was by some method of driving the valves, other than by valve gear, in the ordinary acceptance of the term, *i.e.*, a mechanical connection. With this end in view, he schemed what he called the "Steam-moved Valve," of which Fig. 1 is an illustration. The valve itself is driven by a steam cylinder, controlled by the main valve gear; but inasmuch as this gear has only to drive the small valve, it has very little to do, and can therefore be made very small and light, and the conditions are so far satisfied. The difficulty then arose as to how the main valve was to be held and prevented from running away from what must be called the main valve gear, and the motion rendered positive. And this was a poser, until, by a process of compromise and combination, the steam cylinder was

coupled direct to the ordinary valve gear, through the main valve, and the small valve was driven by steam, admitted by its own piston, instead of by a small separate gear, and hence arose the Assistant Cylinder.

This was in 1889, and Messrs. Laird Bros. here became interested in the subject, recognising the necessity for some such appliance, and Mr. Rutsey Bevis brought his practical experience to bear, and gave us invaluable assistance in bringing the device down to its present form, and it was to him we were indebted for many suggestions and the continued opportunities we had of carrying out our experiments. Fig. 2 represents the earliest form in which the cylinder was tried in July 1889, on the engines of H.M.S. *Skipjack*,—a torpedo gunboat as this type is called,—735 tons, 4,500 I.H.P., speed 22 knots nominally, making 312 revolutions per minute, and here it is interesting to note how we began with the more complicated form, expecting that that would give us the best opportunities for adjustment &c, coming down to our present simple form, only after endless experiments and non-success. The small valve was driven up and down at the required times by steam admitted by the piston uncovering small ports in the cylinder walls, and allowing steam to enter the top or bottom of the cylinder as required. We got some most extraordinary cards from this machine which none of us could make much of, as it was impossible to tell which was the steam and which was the exhaust line, and taking only one line on the card at a time did not help us, as they crossed and re-crossed so frequently that it was quite impossible to follow them out to a definite and satisfactory conclusion; there was, too, a continual knocking in the cylinder which we at first put down to water, but finally came to the conclusion it was due to the small valve hammering up and down in the chest, and that the recoil from each end kept the valve in a continual state of vibration, so not allowing the proper entrance of steam to the cylinder; and adjusting the length of the stroke by means of the stops and locknuts shown on the covers did not help, while the application of springs to the ends

of the valve seemed only to accentuate the evil,—and this we were able to prove by attaching little spindles to the ends of the valve as shown at C, and leading them through the cover, this showed very distinctly the erratic movement of the valve. The ships were, however, successfully passed through their trials, and our immediate attention was directed from them, owing to their being out of the contractors' hands, to the now historic ships by the same builders, belonging to the Chilian Navy,—the *Almirante Lynch* and *Almirante Condell* which made themselves famous by sinking the rebel ship *Blanco Encalada*, while at anchor in harbour, by torpedo attack, in the last revolutionary war, they themselves, owing to their high speed, escaping almost unscathed.

We have now been forced to the conclusion that a small independent valve would not do, and that there must be a mechanically controlled valve. This seemed to point to too much complication, till we tried the cylinder in its form Fig. 3, this did away with the small valve, and we got perfect balance of the piston owing to having steam pressure all round, but the difficulty of accurately fitting the lid on the upper end of the cylinder, was a great objection to this form, though we got vastly improved and quite intelligible diagrams from it (see Fig. 3A) and while not what we now look for, owing to the almost equal M.E.P. for both top and bottom of the cylinder, that is, for the rising and falling of the valve, yet this style seemed to be doing very good work, and we were encouraged to go on, and we reached the cylinder in its present form, which consists simply of a cylinder cover, and piston having no loose parts and no valves or other complications. I may now leave its history and come down to the practical application

Referring to Fig. 4,—the piston has ports cast in it leading one to the top and one to the bottom of the cylinder. There are two ports on opposite sides of the cylinder, connecting with these as required, and as soon as the engine begins to move, the steam entering as

shown by the arrow, flows down through the port into the bottom of the cylinder and forms a "charge" of steam which drives the piston up till the steam enters at the other port, into the top of the cylinder which cushions and drives it down again, and so on. This has now become a steam engine with proper valve and gear, and therefore positive in action and regulated as to time and speed,—so much so, that in a set of compound six cylinder engines, one of these cylinders,—6 in. diameter,—attached to the valves (one piston and the other flat), of one set of engines, having by some accident had steam admitted when the valve gear was uncoupled to allow of some repairs, the valve evidently started away at apparently full speed, and continued working thus until a man could get up to the top platform and shut the stop valve. An examination of the engine showed that the maximum valve stroke must have been very slightly exceeded, as the brass bush showed marks of having been struck by the piston, but no damage was done to the engine whatever, except that the collar which coupled the two lengths of valve spindle was slightly sheared, and had to be drilled out, showing that the reciprocations had probably been considerably in excess of their normal working speed of three hundred, and also what perfect control the cylinder had over the valve, and how exactly suited it is for the work which it has to perform, as under ordinary conditions the speed of reciprocation would have been adjusted to what was required, by means of the stop valve controlling the admission of steam to the Assistant Cylinder.

We have had it urged against this cylinder that the valve requires no driving down, but will fall of its own weight. This is so, of course, when it is once started, and at slow speed, but there is always a very considerable momentum on at each end of the stroke, which, in the ordinary course, would have to be taken up by the valve gear, and this the Assistant Cylinder is designed to take up, and to give the valve a start only on its downward stroke, and then come to the assistance of the gear, by arresting it gently before it gets right

down to the bottom, so relieving the valve gear of all this strain. The diagrams, Figs. 5, 6, and 7, very clearly show how this is effected. Fig. 5 is a card taken from the engines of the *Sussex* at sea; Figs. 6 and 7 are analyses of the same card, taking the steam line on one side of the piston, and the exhaust line on the other. This then shows the amount and period of assistance and resistance for driving and cushioning the valve at each part of its stroke, Fig. 6 being for the rising and Fig. 7 for the falling stroke. The total amount of assistance is to the total amount of resistance as 6.25 is to 1,—the resistance coming on at 80 per cent. of the stroke when rising; the total amount of assistance being to the total amount of resistance, as two is to one,—the resistance coming on at 62 per cent. of the stroke when falling. Fig. 8 is a series of these cards, taken at full, half, and slow speed, which show the effect of linking up on the cylinder. It will be seen that when the engine is linked up, the valves will be travelling more and more slowly, and will, therefore, be requiring less and less assistance from the Assistant Cylinder, and this will be automatically provided for by the shortening of the stroke of the piston, by which means the steam ports will get less and less opening, till finally, at dead slow, there is only the vacuum acting on the piston, so that the engineer need take no notice at all of his Assistant Cylinder, whatever he is doing with his reversing engine. I have the original cards here, for the members to see afterwards, if they wish. These cylinders, I understand, were fitted in place of 10 in. diameter balance cylinders, as originally intended, the valve and gear weighing 16 cwt., with a $6\frac{1}{2}$ in. stroke, and 210 revolutions.

I would here like to say that I was enabled to take these diagrams by the kindness of Captain Lambert and Mr. Fisher, of the L.B. & S.C. Ry. Co.,—both, I believe, members of this Institution,—who very kindly allowed me to make a trip on their company's twin screw s.s. *Sussex*, from Newhaven to Dieppe and back, in September last, in order to take them, and gave me

every assistance; I am also indebted to Messrs. Denny & Co., the builders of the ship, who very kindly placed their indicator gear at my disposal, and gave me all the information and help in their power; and I beg to take this opportunity of thanking Messrs. Denny & Co., Capt. Lambert, Mr. Fisher, and Mr. Monypenny, the chief engineer of the ship, for all their kindness and courtesy in granting me such facilities for taking these cards.

Having now described the *raison d'être* and principles of the machine, I will quote some of the practical results which we have got from our seven years' work.

Messrs. Laird Bros. have, since the *Skipjack*, &c., been regularly employing this cylinder on all their high-speed engines, and though we have never followed the performance of any of them very closely, I presume, from their continued application, amounting to a total of 256,000 I.H.P., that they are deriving considerable benefit from them.

The Italian Government, too, has ordered them to be fitted on all engines built for them, and have now got a considerable number at work.

The first case in which we could point to any real and tangible advantage in this system, was in the case of the L. & Y. and L. & N. W. Railway Co.'s steamers running between Fleetwood and Belfast, under the superintendence of Mr. A. F. Gibson, of Fleetwood, to whose courtesy I am indebted for the information about the performance of these boats. The first two twin screw boats he had, the *Duke of Clarence* and *Duke of Lancaster*, built by Messrs. Laird and the Barrow Shipbuilding Co., respectively, were fitted with Assistant Cylinders and gave no trouble. In the Spring of 1895, a third boat came out and she was fitted with 13in. diameter balance cylinder, of which Fig. 9 is a sketch. After running for a few months, Mr. Gibson communicated with us as to whether it

would not be possible to replace the balance cylinders of the third boat by Assistant Cylinders, as she was not doing so well as the others. We replied that we should be very glad to have it done, and it was finally arranged that the balance cylinder should be cut off at C on the illustration, and an 8in. diameter Assistant Cylinder fitted on the flange left, as in Fig. 10, and Mr. Gibson reports, in July last, that there is a marked improvement in the running of the engines. He also further reports in October, "I am pleased to tell you that your Assistant Cylinder, as fitted on our three twin screw steamers, continue to give us every satisfaction, and it is my intention to specify these for our next new steamer." To Mr. Gibson then is due our first definite knowledge that an Assistant Cylinder was really an improvement on the old balance cylinder, and since that experience we have gone ahead fast.

By the courtesy of the Naval Construction and Armaments Company, of Barrow, I am able to show a view of the engines of one of these ships showing the Assistant Cylinder in position.

For the next view, Fig. 11, I am indebted to the Fairfield Company, of Glasgow. It shows another method where we have replaced a Balance Cylinder by an Assistant Cylinder, and the view pretty clearly shows how it was done; the balance cylinder had been cast and fitted on the cover before it was determined to fit an Assistant Cylinder, which was then fitted completely inside the balance cylinder using the original top cover flange as the holding-down flange for the Assistant Cylinder. This, of course, gave us no comparative results, but still it showed us something, it showed us that the Assistant Cylinder is a much smaller and lighter piece of machinery than a balance cylinder. The following is an exact comparison of the weights and costs in the two cases. The total weight of a 14in. diameter balance cylinder, piston and cover, is 604lbs., and the total weight of an Assistant Cylinder for the same valve is 340 lbs.,—only some 56 per cent.,—while

the actual cost of manufacture, from estimates made by our manufacturers, of which I have the originals here, are:—for a balance cylinder, including cylinder, piston, three rings, bolts, studs, nuts, and cover, is £19 17s. 6d., while that for the Assistant Cylinder, taking cylinder, cover, piston, two rings, bush, studs, nuts, and bolts complete, is £15 15. 0d.,—so that for Government work there is the very important factor of saving in weight, which can be further increased by making it in brass, as shown in Fig. 12, and where the overhead room is limited we can often dip it into the casing, as shown, so that the occasions upon which it cannot be used are very rare, and for commercial ships the very slightly increased first cost due to the royalty will very soon be recouped by the great saving in repairs which will be effected, as there is hardly any wear on the gear at all, what little does appear after a long period being distributed evenly over the eccentrics, top and bottom

The cylinder may very easily and cheaply be fitted to existing engines, as well as to new ones, and, by slightly modifying the design, to horizontal as well as to vertical, and to other types than marine; in the total of 470,000 I.H.P. to which we have had it applied, among others, is the yacht *Valiant*, and a mill engine of which I am able to show a photograph,—and for this class of work it is especially useful, as it assists the movement of the valve for reversing.

We are, unfortunately, unable to make a standard of stroke and diameter, with a view to cheapness of construction, as there are so many different conditions entering into the calculation of diameter of cylinder required for a valve of a given stroke; for instance, a low-pressure cylinder of 60 in. diameter may be a tramp, working with 140 lbs. of steam, and 60 revolutions, or it may be a Government ship, working with 180 lbs. of steam, and 200 revolutions, each having a 6 in. stroke, but requiring a different diameter of cylinder.

In designing the size of cylinder, it is quite impossible to calculate exactly the amount of work which the cylinder has to do, as is evident from the following figures, taken from a paper read before the International Engineering Congress in 1893, in Chicago, where the author gives the following stresses on the valve spindle of a piston valve weighing 800 lbs. :—

Actual Stress on Valve-spindle shown by Dynamometer.	Theoretical Stress.	Revs.
4100 ..	400 ..	50
4450 ..	900 ..	175
4680 ..	1600 ..	100
5170 ..	2500 ..	125

The great difference between the real and the theoretical stress is here due, no doubt, to the tightness of the packing and rings, and want of, or faulty, lubrication, and other causes which, of course, cannot be calculated. And while theoretically the perfect performance of the functions of a valve gear are latent in this cylinder, it is nevertheless impossible to guarantee the exact elimination of all work to be done by the gear, and we therefore fit a stop valve to allow for these variations, yet a case might occur in which the exact balance was arrived at, and the valve gear would have absolutely nothing to do.

I now come to the question which I feel sure some of you will have had in your minds all along—namely, that of the amount of steam used. The cylinder on the *Sussex* is, I find, indicating 15 I.H.P., and is therefore taking that amount of work off the main engines, this is, of course, being paid for in the boiler department; but it must be apparent that if steam is applied directly to the valve, with the sole object of driving it up and down at the required time, it is more efficient than the same amount of steam applied through the main valve, piston rod, crank shaft, eccentrics, and links, and then to the valve,—the driving of the valve being an incidental and subsidiary function,—and the

starting and stopping of the valve must surely have a very considerable brake-action on the shaft, and must tend very much to increase vibration, while for high-speed engines every pound of steam that can be got into the cylinder is required to rotate the shaft, the valve having its own special motive power, which there is no difficulty in making very ample. This statement is, I think, fully confirmed by the knowledge that we have never had a complaint of any sort from any one of the engineers, owners, or superintendents of the ships using it, of the amount of steam consumed, in fact, the question is very seldom raised. In this particular case, the engines run with the stop valve only two turns open for the two cylinders which it supplies.

In conclusion, may I be allowed to say that while making the most of all the advantages which I honestly believe this system to possess, and laying before you all the points that have come under our notice which may be of interest, I have endeavoured to avoid, as far as possible, all appearance of this is the "Best and goes furthest;" but, as it is impossible to give lists of comparative figures, I have been obliged to rely upon the opinions of practical men who have come in contact with it, and I can only hope that the subject has been of interest, even of value, to the members of this Institution.



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1896-7.

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

Volume VIII.

DISCUSSION
ON THE
SIXTY-SIXTH PAPER
(OF TRANSACTIONS)

**AN ASSISTANT CYLINDER
FOR VALVE GEARS,**

BY

Mr. BASIL H. JOY

(ASSOCIATE MEMBER).

READ AND DISCUSSED AT
THE INSTITUTE PREMISES, 58, ROMFORD ROAD, STRATFORD,
ON MONDAY, 25TH JANUARY 1897.

DISCUSSION CONTINUED
ON MONDAY, FEBRUARY 8TH, 1897,

READ AND DISCUSSED AT
THE UNIVERSITY COLLEGE, CARDIFF,
ON WEDNESDAY, FEBRUARY 10TH, 1897.

INSTITUTE OF MARINE ENGINEERS
INCORPORATED.

SESSION



1896-7.

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

DISCUSSION

ON

AN ASSISTANT CYLINDER FOR
VALVE GEARS,

(PAPER BY MR. BASIL H. JOY)

(ASSOCIATE MEMBER)

AT

58, ROMFORD ROAD, STRATFORD,

On MONDAY, JANUARY 25th, 1897.

CHAIRMAN :

MR. J. R. RUTHVEN (*Convener, Papers Committee*).

The discussion on this paper was mostly of a conversational character, and related, for the greater part, to various details of the diagrams and drawings exhibited on the screen. Mr. Joy frequently illustrated his explanations by means of sketches on the black-board.

The CHAIRMAN: I suppose, Mr. Joy, you have entirely abandoned the first design you showed us?

Mr. Joy: Yes. I only included that design for the purpose of showing the way in which the assistant cylinder was evolved. The paper is scarcely one that lends itself to discussion, in the ordinary sense. I should, however, be only too pleased to answer any question, or to furnish any further information that may be desired.

The CHAIRMAN: I should like to ask Mr. Joy if he has any data as to the result of using this assistant cylinder—whether the economy in steam is shown.

Mr. Joy: We have no actual figures proving one way or the other. We have not been able to get any definite figures as yet, but I think the economy is shown more in the saving of wear and tear than in the saving of steam.

Mr. Joy subsequently sketched two indicator diagrams on the blackboard, and after pointing out certain peculiarities in the lines, invited suggestions as to the probable causes. He said he had copied these cards from his pocket book, and must confess he did not understand them. Several suggestions were offered as to how the peculiar curves referred to were produced, and one member hinted that they were possibly due to defects in the mechanical arrangements by which the cards were taken.

Mr. Joy replied that he thought the causes of the curious features presented by these cards had not yet been explained, and suggested that yet another point for consideration was as to the proper method of analysing these cards, in order to obtain a fair measure of the work done in the cylinder.

Two further indicator diagrams were subsequently sketched on the blackboard by Mr. Joy, and some conversation ensued as to the causes of certain loops formed.

Mr. Joy then invited an expression of opinion on the part of those present as to the kind of packing-rings most suitable for the pistons. His firm had tried gun metal rings, but they wore out very quickly. In one ship they had recently put in white metal, and made a good tight fit in the cylinder; but he did not yet know with what result. He should like to know if any gentleman present ever tried white metal for piston rings.

Mr. J. T. SMITH (Member of Council): I should say cast-iron is the metal for that ring. I have not seen white metal tried in a piston ring. I have seen white metal tried in a feed pump. It does not do there at all, but breaks up.

Mr. J. B. JOHNSTON (Member) suggested that the valve-spindle should work in guides, and said that owing to the absence of proper guides, the spindle often wobbled about, and led to trouble.

Mr. Joy: Is it not the custom now—the modern practice—to put guides?

Mr. JOHNSTON: It is simply a round bush with a single bracket; but I suggest a good flat surface.

Mr. Joy: I think it is very generally done now, but, anyway, the very long piston of the assistant cylinder forms a very efficient guide.

Mr. JOHNSTON, referring to the loop in the last indicator diagram sketched by the author, suggested that it might be due to water caused by condensation.

Mr. Joy: I should be very glad of any hint with regard to piston-rings. I agree with Mr. Smith that cast-iron is the best, and we are going to fit them in the next case.

Mr. McLAREN: Would it be possible to make the steam port in the form of a jacket, right round the cylinder, and then drill holes from the inside, so as to give the area? That would give surface to the rings.

Mr. JOY: I think that a suggestion which is worth consideration. (Of course, the area would require to be calculated out very carefully and the expense would, I am afraid, be somewhat against it.

The CHAIRMAN said: I think we are all very much obliged to Mr. Joy for bringing this paper before us. It is a matter that we do not see very much of, but we are very pleased to hear what he has done. Perhaps he might have told us a little more. He has not told us how to arrange this idea. I suppose he prefers to keep that to himself. I should like to know the size of the cylinder for a certain size of engine, but I have been unable to obtain this from the explanations given, and in regard to it I am as wise as ever. But I think there is a good deal in the idea. I should now like to take the sense of the meeting as to whether we should have another night for the discussion on this paper.

Mr. J. T. SMITH: I should be very glad to have another night for the discussion.

Mr. JOY: I am afraid the subject itself is not one that will call forth very much discussion. There are not many who have had experience of the system. At the same time I should be very pleased to come here another night. With reference to one remark that fell from the Chairman, I may say that the diameter of the cylinder usually depends upon how much you are prepared to pay for it. It will be a case of more or less assistance, but we have a regular formula based upon steam pressure, revolutions, valve stroke and weights, treated with constants for the various cylinders and for piston or flat valves.

The CHAIRMAN: If it is the feeling of the meeting I propose that the discussion on this paper be adjourned until this night fortnight—Monday, Feb. 8th.

The CHAIRMAN then proposed a hearty vote of thanks to Mr. Joy for his paper, and for the manner

in which he had brought the subject before the meeting.

The motion was seconded by Mr. JOHNSTON, and carried unanimously.

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

ADJOURNED DISCUSSION

ON

AN ASSISTANT CYLINDER FOR
VALVE GEARS,

MONDAY, FEBRUARY 8th, 1897.

CHAIRMAN:

MR. T. F. AUKLAND (*Companion*).

The discussion was again altogether conversational in character. Mr. Joy sketched a number of indicator diagrams upon the blackboard, and invited questions or suggestions with regard to various features of these diagrams. The possibility of some of the peculiarities to which Mr. Joy called attention being due to the arrangement of the mechanical apparatus for taking the diagrams was again suggested, but, by means of the blackboard, Mr. Joy explained in detail his reasons for believing that the probability of error from this cause was reduced to a minimum.

Much interest was also manifested in a large drawing of Joy's Assistant Cylinder, fitted with a moveable slide for showing the working of the piston. Several diagrams sketched on the blackboard were criticised, with a view to the explanation of abnormal appearances. Two of these were specially noted, one

having been taken on the trial trip, and the other five years later, showing great differences in the formation of the figure.

Fig. 5A shows a pair of cards taken from H.M.S. *Mars*, and these show the sort of card is considered the correct one. It will be noticed there is quite a little assistance for the downward stroke and a lot for the rising stroke, and if cards like this are being got the cylinder is bound to be doing good work.

Altogether the proceedings were most interesting and instructive to those present.

On the motion of Mr. RUTHVEN, seconded by Mr. WILSON, Mr. Joy was accorded a hearty vote of thanks for again attending, and for the interesting hints and information which he had afforded.

A vote of thanks to the Chairman for presiding concluded the meeting.



P R E F A C E .

CARDIFF,

10th February, 1897.

A meeting of the Bristol Channel Centre of the Institute of Marine Engineers was held in the University College this evening, the President, Professor A. C. ELLIOTT, D.Sc., occupying the chair.

Nominations for the annual election of office-bearers and committee were made as follows: Messrs. M. W. Aisbitt, J. Chellew, R. Davison, W. Dobson, A. C. Elliott, Jas. Ferrier, R. J. Field, D. Gibson, L. G. Laurie, J. McCallum, D. McCallum, T. A. Reed, W. Simpson, A. E. Smithson, George Sloggett, H. G. Symonds, T. W. Wailes, and J. F. Walliker.

Mr. BASIL H. JOY read a paper on "Assistant Cylinders for Valve Gears." He illustrated his subject by an extensive and admirable series of lime-light views, and was listened to with the greatest interest throughout.

The discussion which took place follows.

GEO. SLOGGETT.

Hon. Local Secretary.

INSTITUTE OF MARINE ENGINEERS
INCORPORATED.

SESSION



1896-7.

Bristol Channel Centre.

Local President—PROFESSOR A. C. ELLIOTT, D.Sc.

DISCUSSION

ON

AN ASSISTANT CYLINDER FOR
VALVE GEARS,

PAPER BY MR. BASIL H. JOY

(ASSOCIATE MEMBER).

CHAIRMAN:

PROFESSOR A. C. ELLIOTT, D.Sc.

The CHAIRMAN said the paper had been both interesting and profitable. To some of them the subject was not entirely new. Mr. John McCallum had from time to time propounded his views as to driving the valves, as it were, altogether independently; and he (the Chairman) had, on more than one occasion, said this was possible if they controlled the valves of the driving engine by the engine itself. But this by the way. It seemed to him that Mr. Joy had laid his finger upon a very weak spot in the marine engine. Take for example the trials of H.M.S. *Terrible*. The *Terrible*

broke down in the first place from the over-pressure of her eccentrics, and in the second place through the cutting of the valves on their faces, both in the intermediate and low pressures. Then the speeds were increasing to such an extent that it was necessary to take into serious account the matter of vibration. It seemed to him the Joy invention went in the direction of moderating the vibration due to the slide-valve. In a big engine the slide-valve was not the simple thing they were inclined to think it was. A valve six or seven feet square, weighing half a ton or even a ton, was almost an everyday occurrence. In such a case he had been in the habit of reckoning the inertia stress as about equal to the weight of the valve, and the friction stress as also about equal to the weight of the valve, so that at the bottom they had about three times the weight of the valve, and about three times the nominal load would come upon the gear. He did not know how far Mr. Joy's investigations confirmed this, but if he was anything like being right, it showed what a serious matter this question of driving valves was becoming, and they must settle down to the fact that, driving big slide valves, it was a difficult business to apply the piston valves even to intermediate pressure, and apparently altogether impossible to the lower pressure cylinders. Then, even admitting that Mr. Joy had successfully dealt with the outstanding features of the motion of the slide valve, if they were to make progress in the future they must have something better than the ordinary system of relief boxes and that sort of thing, and adopt some mechanical means, worked out in a similar way to that selected by Mr. Joy. As to Mr. Joy's statement that the engine was easier to reverse with the assistant cylinder attached, this should be taken for granted. If the engine was stiffer to reverse after the application of the assistant cylinder than before, he should say the assistant cylinder was no good, and was thereby demonstrated to be no good.

Mr. DENHOLM YOUNG confessed to having had something like a bias against the assistant cylinder

before he heard Mr. Joy's paper read. That was, doubtless, due to his not having given the subject the consideration which it deserved. Mr. Joy had spoken of the great number of breakdowns owing to valve gear troubles. He (the speaker) presumed these breakdowns were the natural consequence of certain complications in machinery which could not be got rid of. The assistant cylinder took the strains off certain portions of the gear, but by it they were undoubtedly introducing an additional mechanical complication which had its own independent risks of breakdown. He agreed with Professor Elliott that they had to face the question of very serious strains in the case of their valve gears, more especially in quick-running engines, and even, also, in the case of slower speed cargo boats. Grunting was often complained of in connection with their gears; but, doubtless, Mr. Joy's invention was a step towards perfecting the steam engine as a machine.

Mr. W. SIMPSON said no doubt something was required to take the pressure off the valves, and more especially off the faces. He thought they could arrange for the eccentric straps with surface enough to carry the weight of the valves and the pressure they had to sustain, if the surface was put on there; he thought a sheave could be made to carry it. But if they could devise something like what Mr. Joy had done, to take the pressure off the face, it would be better than taking the weight.

Mr. T. A. REED said that groaning seemed to be a matter of friction, and he could not see how the assistant cylinder did away with that. As to breakdowns in valve gear, they were usually due to want of proper design. Where ample allowance was made for the strength of the valve gear and the surfaces there were no breakdowns.

Mr. JOHN McCALLUM said that Mr. Joy's connection with valve gear permitted him to speak with authority upon this question. The chief object of the paper was

to show how necessary it was there should be some assistance in taking up the weight of heavy valves. Where the utility of the balance cylinder was in the old days it was hard to discover. It had connection with the condenser, and it had steam connection, but these were uncontrolled. Now, by his invention, Mr. Joy seemed to have used this power of steam and controlled it, and made it efficient in taking up the weight of the valve. He agreed with Mr. Joy that the assistant cylinder obviated a lot of groaning. Groaning always happened on the off-stroke. If there was a tendency for the valve to fall off its face, it was always on the off-stroke. One of the diagrams showed a long-necked bush connecting the valve chest with the assistant cylinder chamber. He should like to have Mr. Joy's experience as to keeping this passage, or chamber, quite distinct from the other, because he had always found that without a flat gland there, there was always a danger of the steam floating through. It was so closed and covered in that they could form no opinion as to what was going on between the chamber and the low-pressure casing. He quite agreed that Mr. Joy had improved on the balance cylinder, adapting the steam methods used in the cylinder, but having them under control. He also took it that in controlling the throttle valve he controlled the admission of the steam.

After a few words from Mr. APPLEBEE (Electrical Engineer to the Cardiff Corporation),

The CHAIRMAN asked Mr. Joy to refer, in his reply, to the question of coal consumption after the application of the assistant cylinder.

Mr. Joy, proceeding to reply on the discussion, said it had been gratifying to him to hear this subject discussed in so friendly a spirit. Professor Elliott had spoken of the cutting of the valve face as a serious trouble. He must at once say the assistant cylinder would do nothing to obviate that difficulty. Then as to the momentum at the bottom being about three times

the weight of the valve, well, this varied with the speed, but it was pretty nearly as Professor Elliott had said. Three or four times they usually took it. As to the weight of valves, they had some assistant cylinders fitted on to valves five tons in weight, but they were only going at 78 revolutions. As to the unsuitability of the piston valves on the low pressure engine, it was a system that now-a-days was largely adopted, but there was no doubt enormous leakage. No form of relief frame on the back of flat valves had been devised which seemed to be satisfactory. Messrs. Hawthorn, of Newcastle, found it answer very well, but he never heard anyone else say anything in its favour. There was a fortune for the man who would design a good form of relief ring. There were flat valves with 205 lb. of pressure on the back of them. In some cases they worked very well; in others they did not. A Glasgow firm had nothing but flat valves throughout their fleet of 14 steamers, working up to 180 lb. pressure, and they never had a bit of trouble. As to the assistant cylinder and reversing, there was no doubt it was an assistance for two-thirds of the stroke, but not for the other third. *They would remember, by the diagram, the steam port opened before the valve got to the bottom of its stroke. With that steam port open, the tendency of the steam would be to drive the piston upwards, but in that particular position the tendency of the reversing arrangement might be to take the valve downwards. On the whole, they got an advantage of about two-thirds.

One gentleman had said the assistant cylinder entailed the introduction of extra complication. †Well, and if their engine was a plain one, with no balance cylinder at all, he was bound to admit they got an extra cylinder and piston, but if they had a balance cylinder there was nothing extra except a stop valve. He agreed with Mr. Simpson that it was more the pressure on the back of the valve than the actual weight of the valve on the eccentrics that caused the trouble; and Mr. Simpson.

*Fig. 4. †Figs. 10, 10A, 10B.

indicated that with large sheaves the trouble would be obviated. Well, certainly, but could they be got big enough? It was the indirect motion through the eccentrics, the rods, and the links, to the valve spindle, that gave the real trouble. If they could get a motion from their eccentric straight up to their valve, they would have much less trouble than at present. It was the roundabout motion that was the cause of most of the trouble. Mr. Simpson thought that with the assistant cylinder fitted they could do with less surface. Well, that was what he (Mr. Joy) wanted to test, if some one would lend him an engine to experiment with. A member said that friction was the cause of the groaning. That was quite true. An enormous amount of friction on the valve face would cause the valve gear to be overstrained, and produce groaning; but the assistant cylinder, while not reducing the friction, took it off the valve gear, and therefore prevented the groaning. Something had been said that, according to the illustrations, the assistant cylinder seemed only to have been fitted on low-pressure engines, but as a matter of fact it had been fitted on to engines of all three pressures. They had it on steam yachts of 400 H.P., and on battleships up to 17,000 H.P., for speeds of 62 revolutions up to 420 revolutions. The long neck-bush referred to by Mr. McCallum was always pounced upon as a source of weakness. They always gave a long sleeve between the two chambers, and he instanced a case in which exhaustive measures were taken to detect leakage between the high-pressure casing and the assistant cylinder in engines which had been running for two years and a half, and there was practically no leakage, the assistant cylinder being opened up to the atmosphere. He contended that in these were similar conditions; instead of having the high-pressure in the assistant cylinder and the low-pressure down below, it was high-pressure steam in the valve-chest, and atmospheric pressure in the assistant cylinder. This showed there was practically no leakage. Some gentleman had queried the exact method of control. The supply of steam was taken from the engine side of the throttle valve, and when the valve was closed

there was no passage of steam to this bush; it simply controlled the supply of steam; it did not touch the exhaust, which went straight away to the condenser any how. As to the consumption of coal, they had not been able to get a test. It would be a difficult thing to test. The consumption would have to be compared with revolutions to make the test a fair one. As further illustrating Mr. Gibson's report on the working of these cylinders on his boats, he was able to show Fig. 10B, which illustrates the engines of his S.S. *Duke of Lancaster*, and Fig. 10C illustrates the ship herself, she being 1,500 tons, 5,000 I.H.P., with a speed of 19 knots.

Mr. T. REED: It is more a case of the up-keep of the engine?

Mr. JOY: That is so. I am prepared to admit that the assistant cylinder would cost a little extra in the first instance, and a little steam to use it, but in the course of a few months you would find a saving.

With regard to piston rings, we have just heard that the white metal rings are not a success, and we are now putting in cast iron about $\frac{5}{8}$ in. wide. We have also just heard that a recent application to an old set of engines has given most remarkable results in reducing the vibration of the engines.

A MEMBER: What is, roughly, the cost of fitting one?

Mr. JOY replied that, generally speaking, they could supply a six-inch diameter cylinder, with piston rings, for £21.

A cordial vote of thanks was passed to Mr. Joy for his excellent paper, on the proposition of Mr. T. A. REED, seconded by Mr. AISBITT.

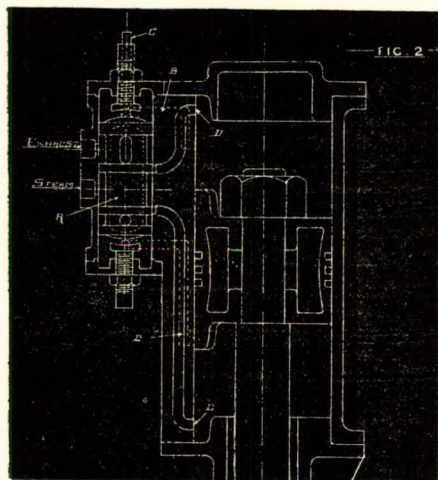


Fig. 2.

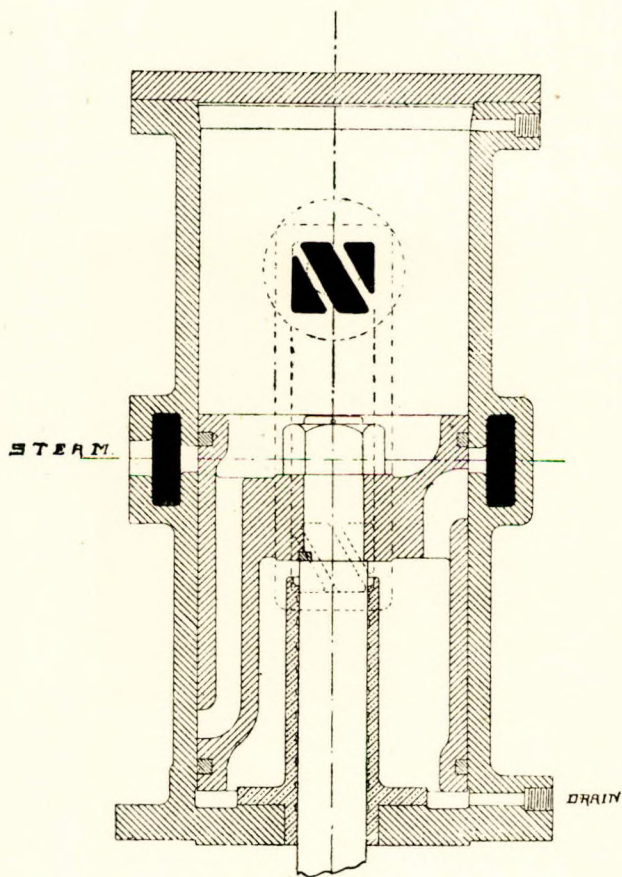


Fig. 4.

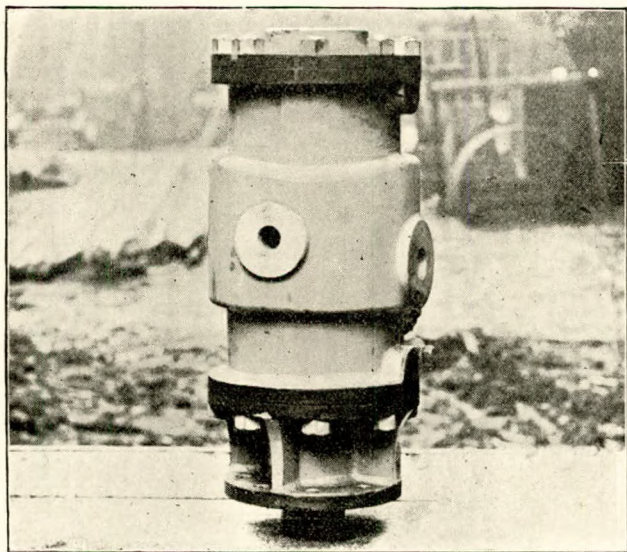


Fig. 4^a.

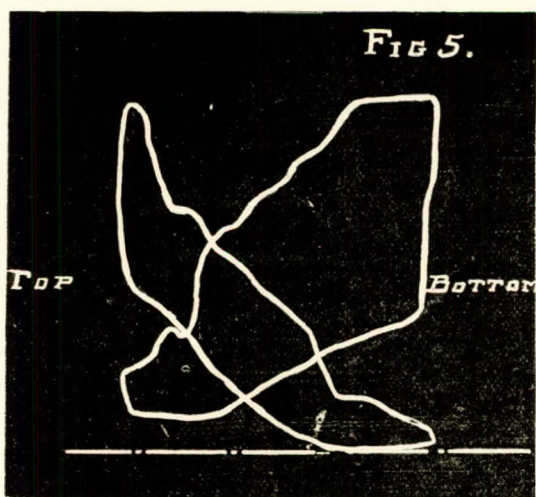


Fig. 5.

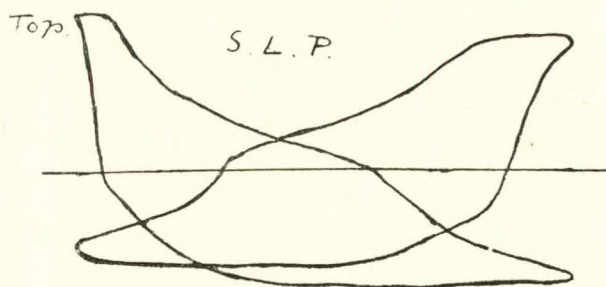


Fig. 5^a.

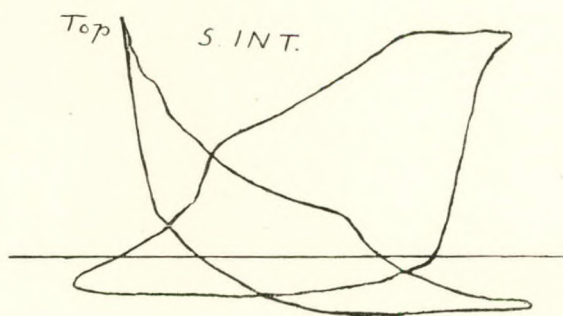


Fig. 5^a.

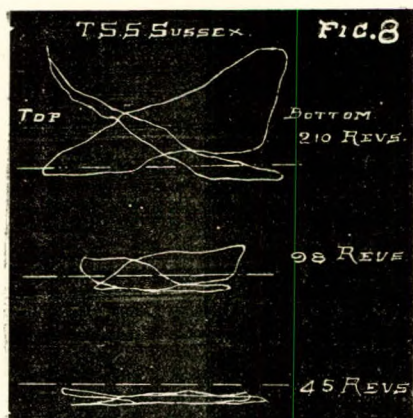


Fig. 8.

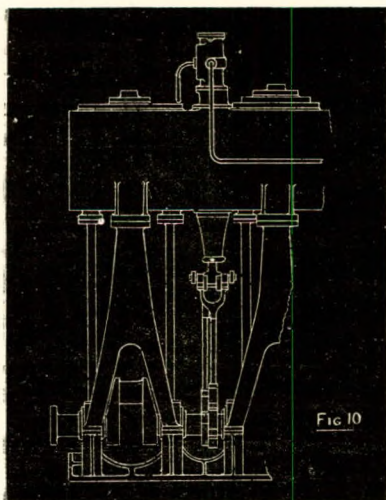


Fig. 10.

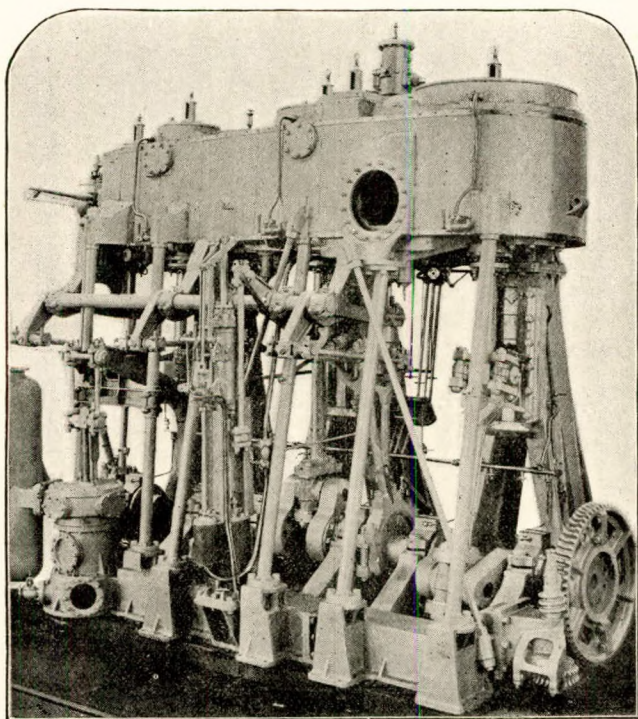


Fig. 106.

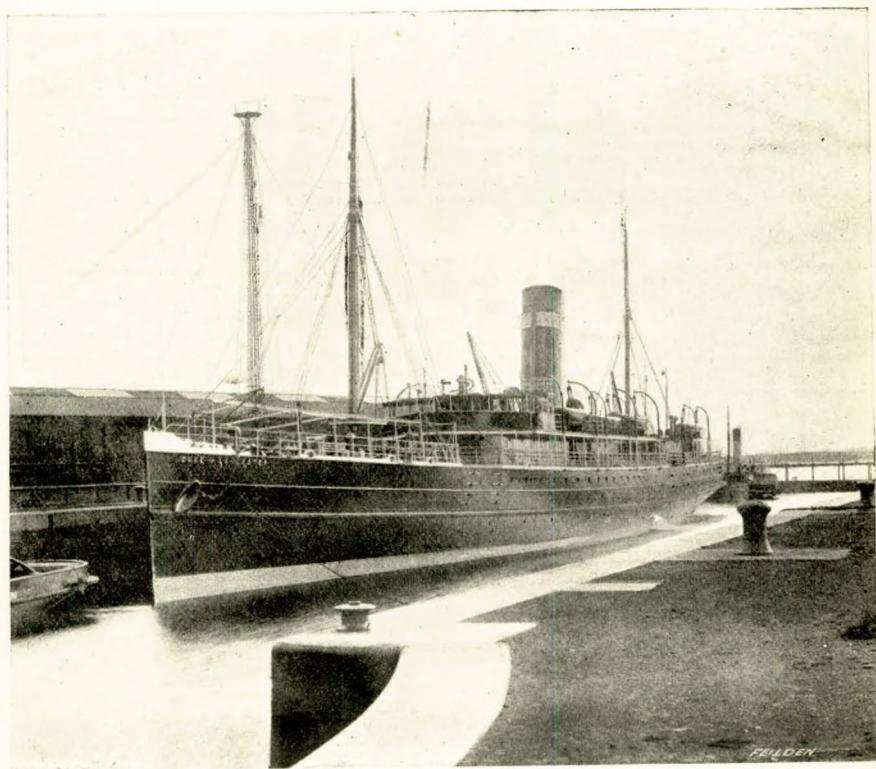


Fig. 10c.

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Incorporated July, 1889.

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479	Craig, Junr., W. J.	53, Earlham Grove, Forest Gate, E.
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127	Crook, C. A.	58, Tyrwhitt Rd., St. John's, S.E.
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623	Davies, G. E.	B. I. S. N. Co., Bombay
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838	Dix, H.	
1088	Dingle, A. F.	158, Kingston Road, Portsmouth
403	Dobbie, J. G.	B. I. Engineers' Club, Calcutta
1119	Dobson, Thos.	6, Glanop Terrace, Cardiff
1178	Dodds, W.	51, Guildhall Street, Folkestone, Kent
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666	Dorward, Ed.	27, Cairnie Street, Arbroath, N.B.
250	Donbavand, C. J.	293, West Green Road, South Tottenham, N.
912	Double, F. W.	56, Hillside Rd., Stamford Hill, N.
173	Drewry, T.	P. & O. S. N. Co., R. A. Docks, E.
24	Duff, T.	Dumbarton Ironworks, 167, Charles St., New York, U.S.A.
610	Duncan, D.	B. I. S. N. Co., Bombay
205	Duncan, R.	16, Argyle Road, Ilford, Essex
821	Dundas, G.	Glenesk, Denzil Avenue, South- ampton
907	Dunn, J.	Public Baths, Latchmere Road, Battersea, S.W.
686	Dunlop, David	Shipbuilder, Port Glasgow, N.B.
1198	Dunlop, Jno.	4, Neville Road. Forest Gate, E.
442	Dunnet, W.	P. & O. S. N. Co., R. A. Docks
944	† Durston, c.B., A. J.	Admiralty, Whitehall, S.W.
204	Du Sautoy, C. S.	Sunnyside, Portswood Road, Southampton

† Life Member by Election.

NO.	NAME.	ADDRESS.
381	Eaglesome, H.	B. I. S. N. Co., Calcutta
676	Eames, R. H.	94, Tressillian Rd., St. John's, S.E.
294	Edgar, G.	10, Clytha Crescent, Newport, Mon.
942	Edmiston, J. B.	1, Highfield Road, Walton, Liverpool
911	Edwards, W. W.	21, Northcote St., Roath, Cardiff
743	Elkin, W.	Government Dockyard, Calcutta
352	Elliott, D.Sc., Pf.A. C.	University College, Cardiff
940	Elliott, E.	B. I. Engineers' Club, Calcutta
536	Elliott, R.	8, Amblecote Road, Grove Park, S.E.
1106	Elliott, W.	c/o Messrs. Ralli Bros., Narain- gunge, E. Bengal, India
690	Elmslie, J. E.	94, Sarsfield Road, Balham, S.W.
1073	Elmwood, R. H.	32, Disraeli Road, Forest Gate, E.
497	Erskine, G.	Bd. of Trade Office, Glasgow, N.B.
546	Evans, L.	Maritime Buildings, Newcastle- on-Tyne
650	Evans, W.	Bute Chambers, Docks, Cardiff
804	Evans, W.	19, Terminus Terr., Southampton
249	Fairles, G. W.	Lurgashall, Petworth, Sussex
215	Fairley, J.	Blair Villa, Auchamore Road, Dunoon, N.B.
336	Farina, A. J.	63, Quayside, Newcastle-on-Tyne
858	Farquharson, A.	Core, Port Gordon, Banffshire, N.B.
400	Fawdon, H. W.	17, Mowbray Street, Heaton, Newcastle-on-Tyne
23	Fenton, W.	
998	Ferguson, C.	57, Dalhousie Street, Glasgow
59	Ferguson, F.	5, Elm Road, Seaforth, Liverpool
1185	Fernandes, H. J.	c/o Messrs. Gillespie Bros., 23, Crutched Friars, E.C.
280	Ferrier, J.	30, Plasturton Gardens, Cardiff
309	Field, R. J.	375, Cowbridge Road, Cardiff
633	Findlay, T.	159, Harold Road, Upton Park, E.
50	Fish, T. W.	Lloyd's Registry, Calcutta
776	Fisher, Alex.	Post Office, Point, Natal, Africa

NO.	NAME.	ADDRESS.
1188	Fitzgerald, J. C.	27, Trafalgar Street, Greenock, N.B.
1018	Finlayson, P.	145, Abbotts Road, Bromley, E.
1147	Finlayson, W.	Colombo Ironworks, Colombo
422	Flannery, J.F., M.P.	9, Fenchurch Street, E.C.
206	Fletcher, W. R.	Kattendyk Dock, West Quai, Antwerp
806	Forbes, H.	18, Ordnance Road, Southampton
805	Forbes, J. H.	18, Ordnance Road, Southampton
509	Ford, William	Pelham House, Hainault Road, Leytonstone, E.
1007	Forrest, R. C.	23, Chobham Road, Stratford, E.
480	Fortune, W.	12, Trelawne Road, Leyton, E.
708	Foster, W. E.	Hawkhurst Cottage, Gillingham Road, New Brompton, Kent
1177	Fowles, R.	31, St. George's Avenue, Upton Park, E.
751	Fox, Crosby	537, Manchester Road, Cubitt Town, E.
685	Fox, Samson	Leeds Forge, Leeds
305	Fraser, G. C. H.	P. & O. S. N. Co., R. A. Docks, E.
254	Fraser, H.	Millwall Boiler Works, E.
609	Fraser, J. D.	Port Trust, Karachi, India
851	Fraser, W. G.	13, Park Road, Portswood, Southampton
1101	Froom, G. B.	66, Sandmere Road, Clapham, S.W.
331	Fuller, C.	H.M. Indian Marine, Bombay
1110	Furieux, J. B.	Victoria Works, Gateshead-on-Tyne
91	Galley, J. G.	181, Neville Road, Upton Park, E.
558	Gallon, J. W.	43, Fairland Road, Stratford, E.
670	Gamble, E. G.	28, The Chase, Clapham Common, S.W.
177	Gardiner, W.	46, Durham Road, Manor Park, E.
158	Gatrell, M.	12, First Avenue, Manor Park, E.
742	Gearing, E.	Fenshurst, Clarence Drive, Harrogate
850	Gay, A.	26, Terminus Terrace, Southampton

NO.	NAME.	ADDRESS.
1170	George, R.	14, Chaseley Road, Stepney, E.
39	Gibb, A.	30, South Street, Greenwich, S.E.
218	Gibbs, A. W.	20, Benthall Road, Stoke Newington, N.
549	Gibbons, C. A.	P. & O. S. N. Co., R. A. Docks, E.
193	Gibson, D.	18, Wordsworth Avenue, Cardiff.
809	Gibson, F. R.	90, St. Andrew's Rd., Southampton.
643	Gifford, P.	2, Woodrow Circus, Pollokshields, Glasgow
501	Girdwood, A.	39, Kilmaurs Road, Newington, Edinburgh, N.B.
62	Girvin, J.	Carrickfergus, Ireland
808	Glass, J. H.	4, Queen's Road, Southampton.
1104	Glassford, H.	B. I. S. N. Co., R. A. Docks, E.
965	Gold, J.	20, Windsor Terrace, Gateshead-on-Tyne
1100	Good, F.	62, Cathedral Road, Cardiff
432	Gordon, G. H.	P. & O. S. N. Co., R. A. Docks, E.
611	Gordon, J. H.	B. I. S. N. Co., Bombay
1064	Gatheridge, T. R.	
490	Granger, G.	13, Clarendon Road, Walthamstow
828	Grant, A.	Bon Accord, Oxford Avenue, Southampton
108	Gray, J. M.	4, Ladbrooke Crescent, Notting Hill, W.
1043	Greene, W. S. C.	47, Edward's Square, W.
5	Greer, D.	1, Denmark Terrace, Harvey Road, Leytonstone, E.
872	Greig, G.	Asiate S. N. Co., Calcutta.
1159	Greig, G.	201, Manchester Road, Cubitt Town, E.
807	Griffiths, J.	39, Park Road, Portswood, Southampton
857	Groundwater, S.	c/o Messrs. S. C. Farnham & Co., Shanghai, China
791	Guthrie, Alex.	107, Avenue Road, Southampton
986	Guy, W. J.	4, Old Park Terrace, Wednesbury, Staffordshire
980	Hale, C. W.	13, Albert Villas, Colham, Bristol

NO.	NAME.	ADDRESS.
253	Halkett, J. P.	Glengall Ironworks, Millwall, E.
248	Hall, J. P.	Carville, Lawrie Road, Sydenham, S.E.
535	Hall, J. C.	
951	Hall, J.	B. I. S. N. Co., R. A. Docks, E.
962	Hamilton, W. D.	22, Generals Castanos, Bilbao, Spain
46	Hammett, H.	3, Mansfield Road, Ilford, Essex.
991	Hanna, J.	
499	Harbland, G. H.	33, Dacre Road, Plaistow, E.
914	Hardy, T.	33, Plasturton Avenue, Cardiff
339	Harrap, G. F.	34, Queen St., Cannon St., E.C.
1008	Harper, C. W.	6, West High Street, Inverurie, N.B.
853	Harris, A.	73, Queen Victoria Street, E.C.
488	Harris, G. A.	40A, Ashburnham Grove, Greenwich, S.E.
825	Harris, H. A.	25, Bugle Street, Southampton
689	Harris, J. T.	The Hall, Headcorn, Kent
180	Harris, W.	39, Albert Road, Forest Lane, Stratford, E.
337	Haslam, Sir A. S.	North Lees, Derby
904	Hawkes, T. A.	Wear Engine Works, Newport, Mon.
668	Hawks, N. S.	27, Atherton Rd., Forest Gate, E.
6	Hawthorn, J. G.	41, East India Dock Rd., Poplar, E.
227	Heap, H.	69, Crowther St., Burnley, Lanc.
78	Henderson, D.	Cardrossbank Villa, Cardross, N.B.
340	Henderson, J. F.	
1011	Hendry, J. R.	2, Rosefield Street, Dundee, N.B.
401	Hicks, G. W.	67; Grove Green Road, Leytonstone, E.
1193	Higgins, A.	48, Osnaburgh Street, Regent's Park, N.W.
901	Hill, A. E.	40, Brandenburg Rd., Chiswick, W.
863	Hindmarsh, M.	The Laurels, Cavendish Grove, Southampton
898	Hislop, J.	B. I. Engineers' Club, Calcutta
176	Hodgson, S.	76, Scarboro' Street, W. Hartlepool

NO.	NAME.	ADDRESS.
228	Hollman, H. W.	Billiter Buildings, Billiter St., E.C.
675	Holt, W.	69, Bute Street, Cardiff
919	Hooper, W. H.	
586	Hopkirk, W.	Seafield, Barrhead, Glasgow, N.B.
574	Horn, W.	19, Fairland Road, Stratford, E.
226	Hossack, W.	Orton, Fochabers, Scotland, N.B.
371	Houfe, W. W.	13, Knutsford Terrace, Kowloon, Hong Kong
1172	Hough, E. R.	101, Leadenhall Street, E.C.
975	Howell, W.	16, Argyle Road, Ilford, Essex
84	Hudson, C.	Woodlands, Disraeli Road, Forest Gate, E.
717	Hughes, W. O.	15, Gertrude Road, Liverpool
1076	Hughesdon, H.	37, Cambridge Street, Southampton
1086	Hume, G.	22, Billiter Street, London, E.C.
88	Humphries, W.	
715	Hunt, A. J.	
1181	Hunter, John	B.I. Engineers' Club, Calcutta
1013	Hurst, J.	Tilbury Docks, Essex
887	Inglis, D. J.	Heysham Villa, Heysham Road, Southampton
993	Inglis, W.	67, Capel Road, Forest Gate, E.
21	Inglis, G.	67, Capel Road, Forest Gate, E.
642	Irwin, J. H.	Mowbray Terrace, Sunderland
17	Ives, H.	23, Pigott Street, Limehouse, E.
1027	Jacks, T.	
655	Jackson, A. S.	Lloyd's Bank Buildings, Mount Stuart's Square, Cardiff
710	Jackson, F.	Victoria Foundry, East Moors Road, Cardiff
590	Jackson, N. J.	Carsay Cottage, Tayvallish, Loch- gilphead, N.B.
1092	James W. G.	29, Mornington Rd., New Cross, S.E.
748	Jarrett, W. G.	7, Duke Street, Deptford, S.E.
1037	Jeff, R.	4, St. Margaret's Road, Plum- stead, S.E.
537	Jeffrey, E.	P. & O. S. N. Co., R. A. Docks, E.
419	Jobling, J. C.	Blackwall Ironwrks., Blackwall, E.

NO.	NAME.	ADDRESS.
131	Johnstone, A.	York Villa, South Birkbeck Road, Leytonstone, E.
210	Johnson, F. B.	
520	Johnston, J. D.	43, Osborne Road, Truebrook, Liverpool
328	Johnston, H.	H. M. Indian Marine, Bombay
730	Johnston, J. B.	Cockpen, 1, Primrose Terrace, South Woodford
350	Johnstone, J.	11, Bloomfield Road, Plumstead, Kent
333	Jones, C. J. J.	H. M. Indian Marine, Bombay
652	Jones, C.	10, Glynrhondda Street, Cardiff
656	Jones, E.	Mount Stuart Dry Docks, Cardiff
361	Jones, H.	Arcade Chambers, Newport, Mon.
810	Jordan, W.	21, Exmoor Road, Southampton
149	Joy, D.	Manor Road House, Beckenham, Kent
469	Jurd, A. E.	10, Oxford Street, Southampton
323	Kaye, A. W.	32, Plashet Road, Upton, E.
946	Keay, R. D.	24, Woodstock Road, Poplar, E.
900	Kellard, G.	39, Livingstone Rd., Southampton
583	† Kelvin, Lord	Glasgow University
706	Kelly, R.	401, East India Road, E.
635	Kendall, W. T.	7, Manor Road, Tilbury, Essex
496	Kendrick, A.	c/o Messrs. Gibbs & Co., Cardiff
740	Kendrick, W.	Gordon Road, West Cowes, I.W.
163	Kent, J. M.	P. & O. S. N. Co., R. A. Docks, E.
399	Kerman, T.	West Bute Street, Cardiff
729	Key, W.	Castle Street, Tayport, Fife, N.B.
107	Kidd, G. W., Ald.	229, Romford Rd., Forest Gate, E.
153	King, G.	143, Breakspear Rd., Brockley, S.E.
671	Kidd, J. McF.	30, Cecil Road, Upton Manor, E.
731	Kinghorn, J. W.	13, Craya Central, Hong Kong
238	Kingswood, R. W.	84, Chapel St., Newhaven, Sussex
216	Kirkland, J.	69, Margery Pk. Rd., Forest Gate, E.
140	Kirkwood, J.	P. & O. S. N. Co., R. A. Docks, E.
104	Kirkwood, R. A.	Clinkeehan House, Clones, Ireland
811	Kydd, Alex.	37, Cambridge Rd., Southampton

† Life Member by Election.

NO.	NAME.	ADDRESS.
373	Lamont, W.	Colombo Ironworks, Colombo
840	Lane, J.	12, Oxford Avenue, Southampton
275	Lang, J.	23, Cave Road, Plaistow, E.
947	Langdon, W.	Woodside, Salcombe, S. Devon
1055	Lapsley, G. S.	57, Forest Drive, Leytonstone, E.
605	Latta, J. G.	77, Billiter Buildings, London, E.C.
517	Laurie, Alex.	
279	Laurie, L. G.	Messrs. Laurie & Co., Newport, Mon.
1097	Law, J. N.	107, Albany Road, Cardiff
765	Lawrie, J.	Government Marine Surveyor's Office, Singapore
1091	Lawrie, W.	545, Romford Road, Forest Gate, E.
824	Leather, J.	9, Northbrook Road, Southampton
385	Lee, R. E.	41, Mount Stuart Square, Cardiff
874	Lee, R. F.	14, Grindon Terrace, Sunderland
864	Leevers, J. E.	55, Gordon Avenue, Southampton
781	Leighton, H.	The Hawthorns, East Boldon, Durham
7	Leslie, R.	1, Argyle Road, Ilford, Essex
255	Leslie, J. I.	26, Victoria Street, Abroath, N.B.
542	Leslie, W.	c/o Messrs. D. Watson & Co., 1 Clive Row, Calcutta
1022	L'Estrange, A.	Kelvinsfort, Sligo, Ireland
933	Lindsay, A.	91, Khedive Rd., Upton Manor, E.
711	Lister, C.	35, Radnor Street, Peckham, S.E.
839	Liston, A. G.	Parker's Hotel, Southampton
604	Livesey, G. F.	Calle Prat 67, A Carsillia 138, Valparaiso
172	Lockie, J.	2, Custom House Chambers, Leith,
412	Lockhead, D.	P. & O. S. N. Co., R.A. Docks
599	Loudon, T.	36, Park Grove, Whiteinch, Glasgow, N.B.
122	Love, W.	
545	Lovett, J.	27, Handfield Road, Waterloo, Liverpool
48	Lowe, J. Y.	B. I. S. N. Co., R.A. Docks, E.
1096	Lowdon, D.	23, Kingsland Crescent, Barry Dock, Cardiff

NO.	NAME.	ADDRESS.
992	Lyle, J.	Lyn Cottage, Daniel St., Newport, Mon.
1112	McAdam, D.	Marybank, March St., Peebles, N.B.
720	Macdonald, Alex.	Douglas Cottage, Stanley, Perthshire, N.B.
881	Macdonald, A.	57, First Avenue, Manor Park, E.
968	Macdonald, J.	Harbour Office, Hong Kong
372	Mackie, A.	36, Westdown Road, Leyton Road, Stratford, E.
378	Mackie, R.	2B, Margery Park Road, Forest Gate, E.
65	Mackintosh, E.	9, Shore Street, Inverness, N.B.
812	Mackintosh, R.	51, Bugle Street, Southampton
931	Mackintosh, A. R.	Clive Ghat Street, Calcutta
905	Mackechnie, C.	2, Hamburg Villas, Cowslip Road, Woodford, Essex
362	Maclachlan, J.	28, Chapel Street, Liverpool
38	Maginnis, A. J.	94, Glenpark Road, Forest Gate, E.
699	Mahany, R.	559, Barking Road, Plaistow, E.
213	Mair, D.	Eildon, Catford, Kent
70	Manuel, G. W.	2, Dock Chambers, Cardiff
423	Marquand, A. J.	121, Chestnut Avenue, Forest Gate, E.
81	Marshall, R.	136, Willingham Street, Grimsby
979	Martin, W. C.	Mersey Chambers, Liverpool
746	Mason, C. E.	Twyford, R.S.O., Berks
1200	Mason, G. F.	15, Hereford Road, Seaforth, Liverpool
500	Massey, W. H.	2, Kingsdown Rd., Leytonstone, E.
941	Mathias, J. R.	91, Lynhall Road, Leyton, E.
473	Mather, A. H.	Upper Edmonton, Middlesex
756	Matthew, W.	6, Billson Street, Cubitt Town, E.
954	Maud, C. K.	4, Ulster Street, Belfast
959	Mayne, G. W.	368, Dumbarton Road, Glasgow, N.B.
550	Maxton, J.	P. & O. S. N. Co., R. A. Docks, E.
35	Mackellar, M. C.	Bute Docks, Cardiff
622	McCaig, R.	
203	McCallum, D. B.	

NO.	NAME.	ADDRESS.
202	McCallum, J. A.	Bute Docks, Cardiff
201	McCallum, J.	Bute Docks, Cardiff
243	McCartney, J.	A.U.S.N. Co., Brisbane, Q'nsland
584	McClelland, Alex.	Jessamine Villa, Auchamore Rd., Dunoon, N.B.
1077	McCcoll, H.	Avendale House, Milford Haven, Wales
571	McCcoll, J.	Glenrose Place, Ardley Road, Rothsay, N.B.
977	McCulloch, W.	
636	McDonald, H.C.	8, Tusker Street, Maze Hill, Greenwich, S.E.
659	McDougall, J.	
430	McEachran, C.	Greenock, N.B.
27	McIndewar, A.	B.I.S.N. Co., R. Albert Docks, E.
379	McInnes, K.	27, Salisbury Road, Forest Gate, E.
531	McIntyre, L.	12, Morley Road, Barking, E.
582	McIntyre, W. D.	Strathleven Plee., Dumbarton, N.B.
865	McKay, Alex.	28, Queen's Terrace, Southampton
390	McKenzie, C.	B. I. S. N. Co., R. A. Docks, E.
1051	McKenzie, K.	31, Ferry Road, Renfrew, N.B.
135	McKenzie, T. A.	17, Victoria St, Forton, Gosport, Hants
719	McKissack, W.	4, Muir Street, Silvertown, E.
667	McLachlan, A.	47, Deanery Road, Stratford, E.
115	McLachlan, J.	43, Chobham Rd., Leytonstone, E.
409	McLachlan, J.	Thistle Works, Paisley, N.B.
507	McLachlan, J.	3, Ravenstone Road, Stratford, E.
1150	McLaren, W.	103, Milton Avenue, East Ham, E.
861	McLean, G.	26, Denzel Terrace, Southampton
199	McLean, N. K.	Endrick Villa, Cann Hall Rd., E.
763	McMillan, A.	103, Whiteville Rd., Forest Gt., E.
141	McOnie, J.	34, Claremont St., Glasgow, N.B.
165	McPhail, P.	142, Upland Rd., E. Dulwich, S.E.
1145	McPhail, R.	17, Albany Street, Leith, N.B.
264	Meiklereid, D.	Glenvarlough, Leyland Rd., Lee, S.E.
167	Melsom, C. L. E.	32, Angell Road, Brixton, S.W.
118	Menzies, Alex.	Arleadie Bank, Banchory, N.B.
1017	Mills, A. E.	4, Victoria Terrace, Clifton, Bristol

NO.	NAME.	ADDRESS.
700	Mitchell, A.	63, Solon New Rd., Clapham, S.W.
426	Mitchell, D.	49, Milton Road, Gravesend, Kent
425	Mitchell, S.	49, Milton Road, Gravesend, Kent
493	Mitchell, W.	50, Victoria Road, East Ham
813	Mollett, F. W.	95, Avenue Road, Southampton
178	Mollison, R.	57, Forest Drive, West Leytonstone, E.
514	Moody, T. V.	7, The Grove, Gosforth, Northumberland
848	Moon, W. G.	48, Bridge Road, Southampton
1114	Mooney, J.	B.I. Engineers' Club, Calcutta
820	Moore, F.	c/o Messrs. Wilson & Co., Bahia
754	Moore, S. H.	9, Landseer Road, Bow, E.
392	Morgan, D. J.	Barry Dock, Cardiff
154	Morgan, G. Ll.	Myrtle Castle, Llanelly, Wales
530	Morgan, J. D.	Flatts House, Bishop Auckland, Durham
673	Morison, A.	22, Adelaide Road, Brockley, S.E.
640	Morrin, R.	15, Orwell Lane, Walton, L'pool
978	Morrison, R.	2, Forsyth Terrace, East Ham, E.
761	Munro, G. K.	17, Kelvinhaugh St., Glasgow, N.B.
410	Murphy, E. O.	S.S. <i>Empress of Japan</i> , Vancouver, B.C.
241	Murray, C. W.	Spear Villa, Bevois Mount, Southampton
428	Moss, T.	19, Victoria Road, Upton Lane, Essex
1026	Muir, J.	44, Dhurumtollah Street, Calcutta
983	Napier, A.	Cross House, Southampton
25	Newall, G. W.	19, Granville Terrace, Terrace Rd. Upton Manor, E.
757	Newall, J. M.	19, Brigade Terrace, N. Wlwh.
234	Newby, C. G.	51, Deanery Road, Stratford, E.
382	Niccol, D.	37, Kelly Street, Greenock, N.B.
738	Nicholl, E.	26, Mount Stuart Square, Cardiff
207	Nichols, F.	North Collingham, Newark, Notts.
220	Nicoll, J.	4, Fairfield Villas, Skirbeck Road, Boston, Lincolnshire

NO.	NAME.	ADDRESS.
80	Noble, C.	56, Selwyn Rd., Upton Manor, E.
134	Northcott, W. H.	Hatcham Ironworks, Pomeroy Street, S.E.
1015	O'Flyn, J. L.	4, Albany Road, Cardiff
19	Ogden, J. E. L.	Penshurst, Vernon Road, Leytonstone, E.
943	Organ, F. W.	7, Bryn Road, Swansea, South Wales
920	Oswald, J.	2, Abbotsford Place, St. Andrews, N.B.
217	Page, F. H.	140, Leadenhall Street, E.C.
723	Parkin, J.	9, Cambridge Road, Blackpool
356	Paterson, A. D.	9, Verulam Avenue, Markhouse Road, Walthamstow, Essex
934	Paterson, T.	Chingford Villa, Obelisk Road, Southampton
974	Paterson, R.	Commercial Hotel, Inverness, N.B.
225	Paton, W.	P. & O. S. N. Co., R. A. Docks
358	Pease, J. C. S.	Board of Trade Office, Middlesboro'
526	Perry, E. A.	
888	Peskett, F.	8, Oxford Street, Southampton
1034	Petersen, E.	54, Nelson Square, S.E.
355	Phillips, E. C.	79, Disraeli Road, Forest Gate, E.
75	Phillips, J.	55, Esmonde Rd., Bedford Pk., W.
1187	Phillip, Thos.	103, Clova Road, Forest Gate, E.
329	Pickard, T. F.	H. M. Indian Marine, Bombay
814	Piercy, J. J.	3, Moira Place, Southampton
533	Piercy, W.	21, Endymion Road, Finsbury Park, N.
621	Pinkerton, W. F.	B. I. Engineers' Club, Calcutta
325	Pirie, G.	B. I. Engineers' Club, Calcutta
889	Plowman, G. H.	57, Oxford Avenue, Southampton
883	Pollock, J.	91, Claremont Rd., Forest Gate, E.
780	Pollock, J.	
420	Pottie, G.	42, Mansfield Road, Ilford, E.
679	Power, G. S.	10, Hamoaze Terrace, Saltash, Cornwall
1084	Powel, H. C.	117, Queen Victoria Street, E.C.

NO.	NAME.	ADDRESS.
721	Pratten, W. J.	25, College Gardens, Belfast
847	Price, W. F.	40, New Road, Southampton
1105	Price, G.	39, Wellfield Road, Cardiff
772	Primrose, W. B.	B. I. Engineers' Club, Bombay
988	Prophet, W. W.	Princecliffe, Albert Rd., Southampton
69	Purves, D.	4, Westcliffe Road, Birkdale, Southport
37	Rait, H. M.	155, Fenchurch Street, E.C.
335	Ramsay, D.	
112	Ramsay, W.	P. & O. S. N. Co., R. A. Docks, E.
753	Ramsay, W.	c/o Messrs. Butterfield & Swire, Hong Kong
363	Randall, A. E.	P. & O. S. N. Co., R. A. Docks, E.
99	Randall, J. W.	P. & O. S. N. Co., R. A. Docks, E.
782	Rankine, D. A.	11, Oriel Chambers, Water Street, Liverpool
283	Raven, J. C.	5, Beauchamp Road, Riverside, Cardiff
1163	Reay, J. D.	Clutha Villa, Barking Road, E.
596	Redman, J. Fell	155, Osborne Road, Forest Gate, E.
593	Redman, W.	Harborough Villa, Stroud Road, Staines, Middlesex
831	Reed, E. C.	Riverside, Dartford, Kent
707	Reed, Sir E. J., K.C.B.	Broadway Chambers, Westminster, S.W.
192	Reed, T. A.	Bute Docks, Cardiff
985	Reeves, Wilfred	13, Marlboro' Crescent, Bedford Park, W.
16	Reid, D.	P. & O. S. N. Co., R. A. Docks, E.
150	Reid, J.	25, Pindrell Road, Brockley, Kent, S.E.
1006	Reid, J. S.	12, Montague Street, Glasgow, N.B.
1021	Reid, J.	P. & O. S. N. Co., R. A. Docks, E.
921	Reid, R.	5, Keston Villas, S. Tottenham
119	Reid, T. H.	62, New Road, Grays, Essex
779	Rennie, A.	B. I. Engineers' Club, Bombay
326	Rennie, D. C.	
539	Rennie, H.	B. I. S. N. Co., Calcutta

NO.	NAME.	ADDRESS.
303	Smith, J. T.	7, The Green, Stratford, E.
98	Smith, P.	3, Ferns Road, Romford Road, E.
589	Smith, S.	P. & O. S. N. Co., Royal Albert Docks, E.
930	Smith, T.	
263	Smith, W.	3, Crescent Road, Upton Manor, Essex
646	Smithson, A. E.	West Bute Street, Cardiff
709	Smyth, R.	509, Dumbarton Road, Partick, Glasgow, N.B.
195	Snell, R. G.	P. & O. S. N. Co., Bombay
346	Soper, T.	Deptford Pier, S.E.
1168	Soutar, C. C.	54, Cecil Road, Upton Manor, E.
958	Speedy, W.	c/o Lewis Brown, Esq., Colombo, Ceylon, India
939	Spiers, H. J.	The Retreat, Margate Road, Southsea
440	Spiers, R.	B. I. Engineers' Club, Calcutta
632	Stables, R.	2, Winchester Street, Silvertown, E.
130	Stark, H.	34, Mars Terrace, Crescent Road, Plumstead, Kent
233	Stark, Jas.	13, Stopford Road, Upton Manor
1107	Stark, J.	15, St. Vincent Place, Glasgow, N.B.
1154	Steel, J. F.	15, Three Mill Lane, Bromley- by-Bow, E.
817	Steele, L.	Limewood Hill Lane, Southampton
886	Stephen, D. W.	Board of Trade, Cardiff
856	Stephens, W. H.	Gordon House, Poplar, E.
734	*Steven, J.	B. I. Engineers' Club, Bombay
113	Stevenson, J.	22, Disraeli Road, Forest Gate, E.
257	Stevenson, J. B.	27, Robertson St., Greenock, N.B.
36	Stewart, Jas.	31, Lily Avenue, Jesmond, New- castle-on-Tyne
44	Stewart, J.	22, Dacre Road, Upton Manor, E.
92	Stewart, John	Egerton Lodge, Queen's Road, Tunbridge Wells, Kent
880	Stewart, S. T.	Milton Avenue, Southampton
467	Still, W.	162, Neville Rd., Upton Manor, E.
32	Stirling, J.	14, Elm Road, Walton, Liverpool

* It is with regret notice of the death of Mr. J. Steven has been received.

NO.	NAME.	ADDRESS.
693	Stockwell, A. C.	372, Stanstead Rd., Catford, Kent
424	Swift, J. C.	86, Montpelier Rd., Peckham, S.E.
393	Symonds, H. G.	Mount Stuart Square, Cardiff
1057	Tait, A.	495, St. Vincent St., Glasgow, N.B.
884	Tarrant, A.	52, Union Street, Ryde, I.W.
712	Tatam, F. R.	Inglehurst, Hadley Wood, Barnet
548	Taylor, C. W.	Boro' Foundry Engine Works, Temple Town, South Shields
818	Taylor, G.	4, Milton Avenue, Southampton
14	Taylor, J.	B. I. Engineers' Club, Calcutta
198	Taylor, M. B.	151, Claremont Rd., Forest Gate, E.
138	Taylor, W. I.	Maybank, Belmont Road, West Green, South Tottenham, N.
95	Taylor, W. M.	106, New Road, Grays, Essex
768	Taylor, W. A.	9, Harold Road, Upton Park, E.
397	Terry, S. H.	17, Victoria St., Westminster, S.W.
701	Thackrah, J.	Cassillia, No. 588, Valparaiso, Chili
619	Thearle, T. H.	31, Skelton Road, Forest Gate, E.
258	Thom, J.	Durris, Kincardineshire, N.B.
369	Thomas, W. M.	
971	Thompson, P. G.	62, Wrottesley Road, Plumstead, Kent
995	Thompson, G. W.	21, Mill Parade, Newport, Mon.
997	Thomson, H. T.	c/o Messrs. Turner, Morrison & Co., Calcutta
94	Thomson, Arch.	108, Fenchurch Street, E.C.
12	Thomson, J. H.	26, Ethel Road, Victoria Docks, E.
1078	Thorn, A. H.	Cape Verde Coaling Co., St. Vincent, Cape de Verdes
126	Thorburn, T.	P. & O. S. N. Co., R. A. Docks, E.
174	Thornton, R. P.	62, Teviot Street, Poplar, E.
945	Threlfall, G.	50, Fenchurch St., London, E.C.
770	Tinley, J. G.	5, Marine Parade, Holywood, Belfast, Ireland
762	Tod, J.	15, Pembroke Terrace, Cardiff
578	Tomlinson, J. H.	
568	Tosh, D.	24, Albert St., St. Pancras, N.W.
503	Tosh, W.	High St., Pittenween, Fife, N.B.
547	Tough, Alex.	2, Grant's Buildings, Bombay

NO.	NAME.	ADDRESS.
1199	Towers, W.	7, Disraeli Road, Forest Gate, E.
678	Trenergy, T.	28, Wellfield Rd., Walton, L'pool.
594	Tricker, C. H.	78, Dacre Road, Upton Manor, E.
1024	Troup, C. L.	157, Fenchurch Street, E.C.
917	Trowell, W. J.	37, Caroline St., Jarrow-on-Tyne
105	Turnbull, M.	72, Terrace Rd., Upton Manor, E.
842	Turnbull, R.	4, Ordnance Road, Southampton
843	Turner, H. T.	53, Bridge Road, Southampton
1161	Turner, W. H.	23, Cumberland Avenue, Sefton Park, Liverpool
620	Turner, T.	19, Latimer Road, Forest Gate, E.
789	Turner, W. J.	17, Orchard Place, Southampton
380	Tyler, G. B.	42, Pigott Street, Limehouse, E.
156	Tyler, J. J.	189, Malmesbury Road, Bow, E.
1025	Vicary, W. J.	150, Hollybush St., Plaistow, E.
852	Wailes, T. W.	23, Richmond Road, Cardiff
554	Walker, A.	135, Union Grove, Aberdeen, N.B.
755	Walker, A. O.	182, Lambeth Road, S.E.
292	Walker, S. F.	195, Severn Road, Cardiff
164	Walker, J. M.	13, Langland Street, Kilmarnock, N.B.
1093	Walker, A.	24, Leadenhall Street, E.C.
196	Walker, W. C.	13, Mansfield Road, Ilford, Essex
1056	Wallace, W. C.	20, Montgomery Road, Sheffield
1052	Walliker, J. G.	The Buttrills, Barry, S. Wales
1083	Walliker, J.	Alston, Penarth, South Wales
1109	Walters, W. H.	13, Mellor Road, Birkenhead
669	Ward, W. C.	
559	Waring, W.	140, Windsor Road, Forest Gate, E.
906	Washer, J.	R.M.S. Packet Co., Southampton
532	Watson, R.	Rose Hill Cottage, Campbeltown, N.B.
222	Watson, T. F.	Edith Villa, Shrewsbury Road, East Ham, E.
413	Watt, J. H.	P. & O. S. N. Co., R. A. Docks
504	Watt, R.	7, Byron Avenue, Little Ilford, E.
66	Weir, G.	Holm Foundry, Cathcart, Glas- gow, N.B.
49	Weir, J.	

NO.	NAME.	ADDRESS.
518	Weir, J. W.	
272	Wells, G.	Elysee Villa, Sea View, Portland, Dorset
1010	Westmoreland, F.G.	15, Enmore Rd., S. Norwood, S.E.
54	White, F. J.	4, Cypress Villa, Buckingham Road, Woodford, Essex
187	White, H. W.	17, Nightingale Square, Endle- sham Road, Balham, S.W.
143	White, W.	Whiteinch, Forest Drive, Ley- tonstone, E.
672*	White, K.C.B. Sir W. H.	Director of Naval Construction, Admiralty, Whitehall, S.W.
387	Whyte, J. A.	Inverleven, Dumbarton, N.B.
859	Wilcox, J.	19, Claremont Road, Seaforth, Liverpool
876	Wickham, W. H.	42, Waterloo Road, Freemantle, Southampton
1000	Wiles, F. S.	122, St. Mary Rd., Southampton
124	Wilkinson, G. E.	
285	Williams, A. J.	Hazeldene, South Church Road, Southend, Essex
129	Williams, Jos.	5, Grange Villas, High Road, Ilford, Essex
790	Williams, W. J.	51, Bridge Road, Southampton
841	Williams, W. H.	1, Milton Avenue, Southampton
528	Williamson, R.	Union Dry Dock Co., Newport, Mon.
1138	Williamson, W. A.	Bell's Asbestos, Eastern Agency, 3, Battery Road, Singapore
577	Williamson, R.	587, Barking Road, E.
639	Wilson, H. C.	6, Trump Street, Cheapside, E C.
125	Wilson, W. W.	P. & O. S. N. Co., Bombay
1045	Wilson, C. G.	75, Daere Road, Upton Manor, E.
1050	Wilson, A.	24, Norwood Street, Hull
996	Wilson, J.	c/o Messrs. Turner, Morrison & Co., Calcutta
899	Wilson, J.	B. I. Engineers' Club, Calcutta
429	Wilton, W. J.	Saw Mills, Belvedere Road, Lowestoft, Suffolk

* Life Member by Election.

NO.	NAME.	ADDRESS.
169 1171	Wiltshire, G. Wingate, W.	8, St. Andrew's Road, Plaistow, E. Killiam, Trinity Road, Tulse Hill, S.W.
157	Winterburn, W. G.	<i>c/o</i> Messrs. G. Fenwick & Co., Hong Kong, China
822 726 608 170	Withell, M. Wood, Alex. Wotherspoon, J. Wymer, F. W.	41, Ranelagh Rd., Leytonstone, E. Rosebank, Forest Hill, S.E. 29, The Green, Stratford, E.
543	Young, C. T.	Edenvale, Grove Hill, South Woodford
188	Young, J.	49, Margery Park Road, Forest Gate, E.
924	Young, J. D.	2A, Tower Chambers, Old Church Yard, Liverpool

LIST OF ASSOCIATE MEMBERS.

NO.	NAME.	ADDRESS.
1197	Anderson, J. C.	30, Willoughby Park Road, Tottenham, N.
1120	Appelbee, N.	Town Hall, Cardiff
902	Atkinson, R. C.	16, Globe Road, Southampton
1190	Axworthy, F.	38, Swanscombe Street, Canning Town, E.
100	Barelay, R. M.	B. I. Engineers' Club, Calcutta
1038	Barton, E. G.	63, Warwick Road, Stratford, E.
648	Black, R. F.	
465	Beckett, F.	204, Herbert Rd., Plumstead, Kent
565	Benson, W. F.	B. I. Engineers' Club, Calcutta
1079	Bowden, H. J.	49, Regent Street, Plymouth
1039	Buck, J. H.	48, Blythe Vale, Catford, Kent
792	Bull, A. R.	10, Anderson's Road, Southampton
836	Campbell, A.	9, St. John's Street, Southampton
875	Crabbe, W.	4, Queen's Terrace, Southampton
830	Cutler, G.	4, St. Mary's Road, Southampton
718	Croft, W.	P. & O. S. N. Co., R. A. Docks, E.
607	Deans, A. R.	25, Chantler Rd., Victoria Docks, E.
896	Denny, J.	Helenslea, Dumbarton, N.B.
973	Dingle, F. C.	Yew Tree House, Millbrook, Southampton
601	Dobson, W.	P. & O. S. N. Co., R. A. Docks, E.
1035	Douglas, J.	P. & O. S. N. Co., R. A. Docks, E.
445	Dow, J.	5, Franklin Terrace, Glasgow, N.B.
26	Ellis, T. H.	158, Great Dover Street, S.E.
936	Ferguson, J.	2, Margery Park Road, Forest Gate, E.
437	Gale, W.	12, Donnington Square, Newbury, Berks
451	Girdwood, J. F.	39, Kilmaur's Rd., Edinburgh, N.B.

NO.	NAME.	ADDRESS.
1069	Gover, F. C.	Harges Place, Harges, Kent
564	Hawker, A. E.	23, Edith Road, Hatcham, S.E.
456	Highet, J.	25, Regent Street, Greenock, N.B.
441	Hornbrook, R. H.	G.P.O., San Francisco, America
1152	Joy, Basil H.	85, Gracechurch Street, E.C.
795	Kenney, C.	32, Brinton's Road, Southampton
454	Leau, D.	Elizabeth Cottage, Beckton Rd., E.
466	Lilly, W. E.	Trinity College, Dublin
868	Lindsay, D.	46, Northbrook Rd., Southampton
447	Mackenzie, E. G.	B. I. S. N. Co., R. Albert Docks, E.
953	McCoy, J. R. W. L.	P. & O. S. N. Co., R. A. Docks, E.
449	McLachlan, J.	
598	McKenzie, A.	Haila Kandi, Cachar, India
471	McKersie, J.	12, Upper Frank Street, Belfast
613	Menzies, T. E.	20A, Highbury Grove, N.
444	Miller, A.	B.I.S.N. Co., R. Albert Docks, E.
1053	Milner, A. R.	Beaconsfield House, Matlock Bank, Derbyshire
647	Marsden, J. H.	9, Cromartie Rd., Hornsey Rd., N.
461	Montgomerie, J.	
793	Mooney, S. V.	48, Bridge Road, Southampton
1062	Morris, G. S.	10, North Brink, Wisbech
1032	Nairn, A. C.	P. & O. S. N. Co., R. A. Docks, E.
891	Parry, A. E.	Bushwood, Porstwood Lawn, Southampton
450	Patterson, W. W.	Oldlands Common, near Bristol
89	Phillip, T.	Portstown, Inverurie, Aberdeenshire, N.B.
705	Pratt, A.	89, Osborne Road, Forest Gate, E.
867	Price, E. C.	The Laurels, Cavendish Grove, Southampton
916	Robertson, H.	H.M. Indian Marine, Bombay
519	Robertson, W.	

NO.	NAME.	ADDRESS.
459	Sage, S. C. W.	Sunnyside, Lea Bridge Road, Leyton, E.
935	Scott, J.	3, Milton Road, Southampton
890	Shapter, F.	245, Shirley Road, Southampton
448	Shiedeaux, J.	28, Stafford Road, Forest Gate, E.
829	Slater, J.	Commercial Road, Southampton
602	Slater, W. J.	3, Hamilton Terrace, Southampton
976	Smith, J.	P. & O. S. N. Co., R. A. Docks, E.
414	Stalker, A. C.	9, New City Road, Plaistow, E.
200	Stevenson, A. L.	23, Benedi Street, Poplar, E.
1082	Stewart, H. A.	135, Sultan Road, Portsmouth
794	Stockley, H. C.	34, Livingstone Rd., Southampton
664	Taylor, Ed. J.	Tangier, Morocco, North Africa
1164	Taylor, F. G.	424, George's Street, Aberdeen, N.B.
452	Trenow, H. C.	35, Ashburton Road, Addiscombe, Croydon, Surrey
1019	Tucker, A. E.	149, High Street, Lewisham, S.E.
680	Turner, S.	Chaseley, Rochdale
510	Tyser, C.	Goldmines, Townsville, Queensland
452	Welsh, D. B.	P. & O. S. N. Co., R. A. Docks, E.
837	Wickens, W. H.	30, Rochester Street, Northam, Southampton
866	Willey, D. H.	8, Gloucester Sq., Southampton
541	Wood, F. G.	Roma Villa, Burnham, Somerset
438	Wymer, D. W.	West Lyn, Hatherley Road, Sideup, Kent

LIST OF ASSOCIATES.

NO.	NAME.	ADDRESS.
1001	Agar, J. A.	Rose Cottage, Wall End, E. Ham
477	Alder, J. F.	P. & O. S. N. Co., R.A. Docks, E.
1094	Anderson, P. A.	B. I. Engineers' Club, Calcutta
1195	Battle, A. E.	Kenilworth, Oakfield Road, Ilford, E.
1016	Beale, James E.	5, Marine Terrace, Sheerness
1033	Blackwood, J.	19, Knight's Road, Silvertown, E.
727	Bond, H. F.	146, Portway, West Ham, E.
573	Bourhill, F. W.	Forth House, North Berwick, N.B.
774	Brownie, J.	P. & O. S. N. Co., R. A. Docks, E.
1072	Brooks, A. A.	16, Chepstow Rd., Newport, Mon.
926	Bull, P. A.	27, Usher Road, Old Ford, E.
478	Campbell, R.	13, Morgan St., Canning Town, E.
1103	Cantounias, C.	B. I. S. N. Co., R. A. Docks, E.
484	Chisholm, C. J.	P. & O. S. N. Co., R. A. Docks, E.
463	Christie, G.	
1116	Claret, W.	11, Hartham Road, Bruce Grove, Tottenham, N.
869	Clay, R.	14, Custom House Street, Cardiff
873	Clay, W.	14, Custom House Street, Cardiff
987	Cleghorn, T. B.	3, Tidal Basin Road, Victoria Docks, E.
969	Collingridge, W. E.	Kenmore, Shepherd's Hill, High- gate, London, N.
485	Cordock, T. C.	45, Clifton Rd., Canning Town, E.
1028	Davies, J.	130, Candy Rd., Victoria Dks., E.
551	Donald, W. C.	37, Pekin Street, Poplar, E.
555	Farenden, W. C.	P. & O. S. N. Co., R. A. Docks, E.
1002	Foulds, J.	6, Antigua Street, Greenock, N.B.
561	Finnecey, P.	P. & O. S. N. Co., R. A. Docks, E.
937	Fraser, W. J.	193, Harold Rd., Upton Park, E.
773	Frater, T. S.	14, Dupree Road, Charlton, S.E.
458	Gale, J.	P. & O. S. N. Co., R. A. Docks, E.

NO.	NAME.	ADDRESS.
1059	Gaskin, W.	64, High Street, Johnston, N.B.
691	Graham, F.	P. & O. S. N. Co., R. A. Docks, E.
572	Harvey, G. F.	
695	Haynes, F. G.	P. & O. S. N. Co., R. A. Docks, E.
1165	Hodgart, A.	P. & O. S. N. Co., R. A. Docks, E.
684	Hogg, Stanley	17, Albion Terrace, Gravesend, Kent
1175	Hughes, A.	315, Victoria Dock Road, E.
1060	Jones, T. M.	5, Love Lane, Denbigh, N. Wales
1047	Kendall, H.	P. & O. S. N. Co., R. A. Docks, E.
1066	King, J. A.	25, Borthwick Rd., Stratford, E.
694	Kight, C. W.	111, Evering Road, Stoke New- ington, N.
1061	Laurie, W. K.	Tynrow, Thornhill, N.B.
1179	Lovatt, H.	4, Adamson Road, Custom House, E.
1058	Macdonald, J. A.	3, Quadrant, N. Berwick, N.B.
957	Madge, G. H.	
566	Malcolm, M.	B. I. Engineers' Club, Calcutta
787	Martin, J. C.	Luzon, Brixham, Devon
579	Mitchell, C. E.	Knox Road, Havant, Portsmouth
1174	Munro, F.	30, Pollock Street, Glasgow, N.B.
1030	Nicoll, W.	Skelmervie, Luthrie, Cupar, Fife, N.B.
457	Parsons, R.	P. & O. S. N. Co., R. A. Docks, E.
1148	Pyne, Ed. F.	14, St. Andrew's Rd., Plaistow, E.
1070	Randall, H. G.	26, Tisbury Rd., Hove, Brighton
1046	Reynolds, W. H.	Pirie Cottage, Brookhill Avenue, Belfast, Ireland
1071	Roberts, G.	1, Beachfield Terrace, Penzance, Cornwall
1063	Robertson, W. C.	Torone Cottage, Torry, N.B.

NO.	NAME.	ADDRESS.
616	Rooke, P. P.	11, Allhallows Street, Bideford, Devon
1146	Rogers, J. S.	11, Piercefield Place, Cardiff
1009	Rollo, W.	9, North Clairmont Street, Glasgow, N.B.
1067	Seabrook, J. A.	98, Fisher Street, Barking, Essex
597	Sheppard, E.	P. & O. Works, R. A. Docks, E.
588	Silley, J. H.	
981	Smith, R.N., E. C.	Sunnyvale, Gravesend
1048	Smith, W. K.	7, Clune Brae, Port Glasgow, N.B.
462	Stokes, C. R.	100, Drakefield Rd., Brockley, S.E.
1012	Stuart, A. R.	196, Hainault Rd., Leytonstone, E.
938	Stump, W. L.	42, Stavordale Rd., Highbury, N.
885	Terveen, J. H.	B. I. Engineers' Club, Calcutta
1192	Thomas, W.	62, Beauchamp Street, Cardiff.
1102	Thomson, J.	B. I. S. N. Co., R. A. Docks, E.
1122	Thomson, J. A.	11, Stopford Road, Plaistow, E.
750	Waite, E. W.	Penarth, near Cardiff
1031	Wass, W. E.	Orchard House, Melrose, N.B.
464	Watters, J. W.	
775	Welchman, S. L.	52, Freemasons Road, Custom House, E.
1040	White, T. A.	3, Berkley Terrace, Newburn
846	Williams, A. F.	21, Long Acre, Drury Lane, W.C.
697	Williams, C. T.	
1137	Wishart, Thos.	234, Crown Street, Glasgow, N.B.
1074	Wood, J. G.	Hatherleigh, Mordan, Surrey

LIST OF GRADUATES.

NO.	NAME.	ADDRESS.
922	Adamson, E. J.	1, Selbourne Gardens, York Road, Ilford, Essex
918	Arcus, J. W.	2, Plimsoll Street, Poplar, E.
1004	Armstrong, C. H.	472, Barking Road, Plaistow, E.
1014	Baker, V.	23, Gt. Winchester Street, E.C.
752	Barnes, C. W.	The Vicarage, Grove Rd., Bow, E.
967	Beamish, R. L.	2, Holmhead Place, Cathcart, N.B.
1068	Browning, W. E.	25, Claremont Rd., Forest Gte., E.
1130	Barelay, R.	34, Royal Rd., Custom House, E.
1143	Brown, H. E.	317, East India Road, E.
486	Cordock, C.	45, Clifton Rd., Canning Town, E.
760	Craig, A.	53, Earlham Grove, Forest Gt., E.
759	Craig, J. C.	53, Earlham Grove, Forest Gt., E.
1003	Cropley, W. W.	8, Knox Road, Forest Gate, E.
1194	Coleman, H. A.	5, Chauntler Rd., Custom House, E.
1158	Dancaster, E. J.	162, East India Road, Poplar, E.
1087	Davey, J. S.	Caroline Villa, Oliver Rd., Leyton
1127	Ditton, J. T.	19, Ferndale Street, New Beckton
483	Duckham, W.	112, Milton Avenue, East Ham, E.
1182	Ferguson, A.	140, Chobham Rd., Stratford, E.
1134	Fraser, R. L.	193, Harold Road, Upton Pk., E.
1125	Gilmour, R.	12, Selwyn Rd., Upton Manor, E.
832	Goddard, H. P.	70, Trinity Rd., Up. Tooting, S W.
112 ^v	Groombridge, E. G.	38, Sunnyhill Terrace, Loampit Hill, Lewisham
749	Hawks, J.	27, Atherton Rd., Forest Gate, E.
1153	Kerslake, H.	365, Barking Road, Plaistow, E.
1140	Kinley, E. F.	47, Crescent Rd., Upton Manor, E.
758	Lawson, A.	76, Disraeli Rd., Forest Gate, E.

NO.	NAME.	ADDRESS.
1124	Leau, L.	222, Beckton Road, E.
1080	Lintott, G. E.	179, Balaam Street, Plaistow, E.
788	Milvain, H. G.	36, Selwyn Road, Plaistow, E.
617	Morison, D. H. L.	
1128	McNulty, C.	55, Catherine St., Tidal Basin, E.
1129	Meredith, W. J.	6, Hooper Rd., Custom House, E.
1191	McLean, T. M.	20, Cann Hall Rd., Leytonstone, E.
771	Oag, J.	8, Chauntler Road, Victoria Docks, E.
925	Oswald, G. W.	
657	Owen, H.	18, Disraeli Road, Forest Gate, E.
1157	Pepper, W. E.	135, Brunswick Road, South Bromley, E.
1166	Pinn, F. W. J.	293, Victoria Dock Road, E.
1156	Pluck, R.	254, Green St., Upton Park, E.
928	Purvis, H.	13, Gower Road, Upton Lane, E.
1133	Radley, Thos.	21, Hartington Road, E.
728	Roberts, C.	Holly House, Amity Road, West Ham, E.
764	Robertson, A. M.	55, Clova Road, Forest Gate, E.
744	Robertson, J.	162, Romford Rd., Forest Gate, E.
745	Robertson, J. G.	162, Romford Rd., Forest Gate, E.
1144	Robertson, J. T.	4, Clova Road, Forest Gate, E.
1155	Robertson, B. B.	4, Clova Road, Forest Gate, E.
1142	Rogers, B. J.	47, Crescent Rd., Upton Manor, E.
1149	Roy, Lindsay	53, Groombridge Road, Victoria Docks, E.
994	Sellex, J. E.	41, Selborne Road, Ilford, E.
1132	Shayle, T. G.	3, Tidal Basin Road, Victoria Docks, E.
855	Simpson, W. B.	B. I. Engineers Club, Calcutta
1065	Smith, T. W.	Lynton, Tottenham Lane, Hornsey, N.
1139	Smith, H. W.	1, Coolfin Road, Custom House, E.

NO.	NAME.	ADDRESS.
1176 932	Stewart, J. Summer, J.	22, Dacre Road, Upton Manor 13, Osborne Road, Forest Gate, E.
1131	Taylor, W.	56, Randolph Road, Custom House, E.
1184	Watson, C.	38, Sebert Road, Forest Gate, E.
1141	Wehausen, E. M.	314, Victoria Dock Road, E.
1126	Wells, H.	Padnall's Farm, Chadwell Heath, Essex.
1125	Woodall, P.	57, Clifton Rd., Canning Town, E.
1005	York, E. A.	53, Warwick Road, Stratford, E.

LIST OF COMPANIONS.

NO.	NAME.	ADDRESS.
273	Alliman, A., Capt.	30, Great St. Helen's, E.C.
405	Angove, W., Capt.	Royal Albert Docks.
185	*Aukland, T. F.	80, Bishopsgate Street, Within.
1186	Ballantyne, R.	38, Langham Rd., West Green, N.
682	Barker, R.N.R. W., Capt	H.M.S. <i>Worcester</i> , Greenhithe.
87	Beldam, R.	The Limes, Hounslow.
844	*Blackmore, E., Capt.	63, Gloucester Place, Portman Square, W.
353	Colsell, F.	2, New London Street, E.C.
247	Crompton, R. E.	4, Queen Victoria Street, E.C.
151	Dick, W. B.	King & Queen Wharf, Rotherhithe.
835	Dixon, J.	L. & S. W. R. Co., Southampton.
28	Domoney, J. W.	Montrose, Balham Pk. Rd., S.W.
570	Fisher, J. A.	The United Asbestos Co., Billiter Street, E.C.
626	Fish, F.	281, Whitechapel Road, E.
51	Green, J. L.	London Zinc Mills, Wenlock Road, N.
1173	Hall, W. L.	Trenmere, Victoria Rd., Acocks Green, Birmingham.
627	Harrison, F.A., Capt.	66, Mark Lane, E.C.
569	Hay, G., Alderman	The Chestnuts, Broadway, Stratford, E.
109	Hay, J. W.	River Don Works, Sheffield.
786	Hill, T. R.	The Bow Foundry, Bow, E.
637	Hodd, T. H.	Lynn & Hamburg S. S. Co., Kings Lynn.
357	Hodgkinson, R.N., Com	23, Gt. Winchester Street, E.C.
316	Hughes, H.	59, Fenchurch Street, E.C.

* Life Companions by Election.

NO.	NAME.	ADDRESS.
354	Hurndall, W. F.	18, Billiter Street, E.C.
406	Hutchinson, W. E., Capt.	61, Poets Road, Canonbury, N.
317	Keenan, M.	Armagh Works, Tredegar Road, Bow, E.
1029	Lambert, H., Capt.	Cattray, Newhaven, Sussex.
103	Lester, H. E.	11, London Street, E.C.
603	Martell, B.	Lloyd's Registry of Shipping, London.
696	McGlasson, R.	39, Dagnall Park, Selhurst, S.E.
417	McKirdy, J., Capt.	Ravenscroft, Westcombe Pk., S.E.
297	Neal, W. G.	3, Amen Corner, Paternoster Row, E.C.
	Neely, John, <i>Hon. Solicitor.</i>	2, Coleman Street, E.C.
106	Newton, J.	29, Mark Lane, E.C.
102	Perkins, T. W.	11, London Street, E.C.
956	Plater, H., Capt.	18, Campbell Road, Bow, E.
698	Reaney, J. C.	101, Leadenhall Street, E.C.
110	Reid, W.	112, Fenchurch Street, E.C.
703	Russell, A. G.	Alexandra Dock, Kings Lynn.
910	Spence, J.	60, Clive Road, Canton, Cardiff.
79	Thomson, J.	11, Stopford Rd, Upton Manor, E. Chiswick.
1042	Thornycroft, J. E.	
892	Wait, A. M., Capt.	The Union S. S. Co., Southamp- ton.
894	Wilding, H.	The American Line, Caunt Road, Southampton.
923	Willock, F. G.	109, Hope Street, Glasgow, N.B.
376	Wimshurst, J.	4, The Grove, Clapham Common.



The Freehold Premises, 58, Romford Road, Stratford, Essex, were purchased in the month of January, 1892; fitted and stocked for occupation, and opened for the use of Members in February, 1892—the Third Anniversary of the Founding of the Institute.



INSTITUTE OF MARINE ENGINEERS
INCORPORATED.

SESSION



1896-7.

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

ADDITIONS TO CATALOGUE

OF

PROPERTY, READING ROOM,

AND LIBRARY

BELONGING TO THE

INSTITUTE.

ADDITIONS TO PROPERTY.

DESCRIPTION.	PRESENTED BY
Three framed Photos — Ship-lighting Plant	C. L. Troup (Member)
Billiard Table Cash Box ..	A. W. Robertson (Vice-President)
Jaw of a Shark	J. Blelloch (Member)
Portion of Fossilized Tree, from N. S. Wales	Do.
Framed Plan, Harbour Works, Table Bay	The Engineer to the Co.
Two Ribs and one Link of the Back-bone of a Whale ..	H. W. Fawdon (Member)
Eight-day Clock	G. Grinyer
Four framed Photos of Machinery — 2 Air Compressors, 2 Lathes	W. H. Northcott (Vice-President)
Model - Mathias' Patent Gear for quick-closing bulkhead doors	The Patentee (Member)
Stuffed Crocodile	} H. W. Fawdon (Member)
Do. Lizard	
Do. Armadillo	
One case Stuffed Birds	
Four Photos — Damaged Bow, S.S. <i>Scotia</i> (result of explosion)	C. A. Crook (Vice-President)
Two Models — Morton's Valve Gear	Lent by R. Bruce (Member)
Half Model of Steamer, in glass case.	Sir Edwyn S. Dawes, K.C.M.G. (President)
Oil Burners, as used on the <i>Volga</i>	} G. B. Froom (Member)
Photographs of Oil Wells ..	

J. H. THOMSON,

Convener, Property Committee.

*The following Papers have been contributed to the
Reading Room during the Session 1896-7.*

DESCRIPTION.	PRESENTED BY
Graphic	Purchased
Illustrated London News	do.
Engineering	do.
Engineer	do.
Shipping Gazette	do.
Times of India	W.W. Wilson (Mem)
Marine Engineer	The Editor
Steamship	do.
Sibley Journal of Mechanical Engineering	Cornell University
Transactions, American Society of Civil Engineers.	The Society
Do., Institute of Engineers and Shipbuilders in Scotland	do.
Revue Maritime	French National School of Naval Architecture
Shipping World	The Editor
Railway Review (American)	do.
Syren	do.
Practical Engineer	do.
Mechanical World	do.
Whitaker's Almanack	J.H. Thomson (Mem)
Hazell's Annual	J. Belloch (Member)
Scientific Year Book	Purchased
Magazines	Various donors
Iron and Coal Trades' Review.	The Editor
Engineer and Iron Trades' Ad- vertiser	do.
Engineers' Gazette	do.
Engineer	The United Asbestos Co. (per favour of Mr. J. A. Fisher, Companion)
Engineering	do.
Fairplay	do.

DESCRIPTION.	PRESENTED BY
Electrical Engineer	The United Asbestos Co. (per favour of Mr. J. A. Fisher, Companion)
Industries and Iron	do.
Mining Journal	do.
Colliery Guardian	do.
Electricity	do.
Indian and Eastern Engineer	do.
Architect	do.
Chemical Trades' Journal ..	do.
Machinery	do.
Iron Trade Circular	do.
Iron and Steel Trades' Journal	do.
Railway Record	do.
Country Brewers' Gazette ..	do.
Brewers' Journal	do.
Councillor	do.
Engineering Review	do.
Colliery Manager	do.
Electrician	do.
Textile Mercury	do.
Gas Engineer	do.
Hardware Trade Journal ..	do.
India Rubber and Gutta Percha Journal	do.
Shipping	do.
The Co-operative News	The Publisher
The Tool and Machinery Register	Britannia Works, Colchester
West Ham Library Notes ..	The Chief Librarian, West Ham Library
Catalogue of the Central Lending Library	do.

F. W. SHOREY,

Convener, Reading Room Committee.

ADDITIONS TO INSTITUTE LIBRARY.

1896-7.

NO.	DESCRIPTION.	PRESENTED BY
562	Transactions, Junior Engineers' Society vol. 1	The Council, Junior Engineers' Society
563	do. vol. 2	do.
564	do. vol. 3	do.
565	do. vol. 4	do.
566	Bulletin de l'Association Technique Maritime vol. 1	Association Technique Maritime
567	do. vol. 2	do.
568	do. vol. 3	do.
569	do. vol. 4	do.
570	do. vol. 5	do.
571	Year Book of Scientific Societies	Purchased
572	Transactions, Institute of Marine Engineers vol. 5	The Council of the Institution
573	do. vol. 6	do.
574	Illustrated Nautical Polyglot. .	Purchased
575	Transactions, Institute of Marine Engineers vol. 7	The Council of the Institution
576	Transactions N.E. Coast Institute of Engineers and Naval Architects vol. 12	do.
577	Transactions, Institute of Naval Architects vol. 37	do.
578	The Steamship	J. Lockie (Member)
579	Transactions, Institute of Engineers and Shipbuilders in Scotland	The Council of the Institution
580	Whitaker's Almanack, 1897 . .	J. H. Thomson (Member)
581	The Cunard Royal Mail St'm's <i>Campania</i> and <i>Lucania</i> . .	J. Weir (Member)
582	Hazell's Annual, 1897	J. Billeloch (Member)
583	Modern Marine Engines (Burgh)	do.

NO.	DESCRIPTION.	PRESENTED BY
584	Architecture Navale—Construction pratique de Navires de Guerre (Croneau)	Messrs. Gauthier et Fils, Paris, P'blis'rs
585	do. do	do.
586	do. do.	do.
587	Marine Engineers, their qualifications and duties (Constantine) <i>Donations to the Library—Cash.</i> *Session, 1895-6, G. F. Livesey, 10s. *Session, 1896-7, D. M. Cunningham, £2.	The Author

*Included in Revenue Account—respective Sessions.

ADDITIONS TO THE MALCOLM CAMPBELL MEMORIAL, 1896-7.

Lent by the Trustees—JAS. ADAMSON, *JOHN CLARK, and *A. H. COLQUHOUN.

NO.	DESCRIPTION.	PRESENTED BY
249	Drawing & Designing (Roberts)	The Author
250	Transactions, American Society Mechanical Engineers . .	J. Riddell (Member)
251	do. do.	do.

*Appointed in place of John Tait and Adam Laurie, deceased.

J. W. RICHARDSON,

Convener, Library Committee.



SESSION 1889-90.

Robert Sadler (Member), lost in the "Glencoe."

George Cleghorn (Member), lost in the "Duke
of Beccleuch."

"Aqua involvens navemque virosque."

William Waddell (Member), died at Wellington,
N.Z.

Joseph Stewart (Member), died in London.

William Stevenson (Member), died in Greenock.

"Stat sua cuique dies: breve et irreparabile tempus
Omnibus est vitae; sed famam extendere factis,
Hoc virtutis opus."



SESSION 1890-91.

Andrew McDurphy (Member), lost in the
"Quetta."

John Simpson (Member), lost in the "Erin."
"Aqua involvens navemque virosque."

Mathew Prior (Member), died at St. Helier,
Jersey.

Alexander Young (Member), died at Victoria
Park, London.

R. L. Gaudie (Member), died at Arbroath, A.B.

Charles Elms (Member), died at Cardiff.

"Stat sua cuique dies; breve et irreparabile tempus
Omnibus est vitae; sed famam extendere factis,
Hoc virtutis opus."

Gilbert Pearson (Member), drowned in Albert
Dock, London.

W. F. Brown (Member), drowned in Montreal
Harbour.

"Omnes eodem cogimur omnium
Versatur urna serius ocuis
Sors excitura et nos in aeternum
Exilium impositura cymbae."



SESSION 1891—92.

R. P. Brown (Member), died at Sea.

R. Ferguson (Member), died at Alexandria,
Dumbartonshire.

D. G. Hoey (Honorary Member), died at
Chicago, America.

A. Sommerville (Member), died at Sea.

M. C. Storrar (Member), died at Sea.

R. Kelly (Member), died at Poplar.

*"Stat sua cuique dies, breve et irreparabile tempus
Omnibus est vitæ; sed famam extendere factis,
Hoc virtutis opus."*

A. Cathcart (Member), drowned at New
Orleans.

*"Omnes eodem cogimur omnium
Versatur urna serius ocios
Sors excitura et nos in aeternum
Exilium impositura cymbæ."*



SESSION 1892-93.

W. C. Buchanan (Member), died at Greenock.

—
Peter G. Skelton (Member), died at Antwerp.

—
D. McMillan (Member), died at Forest Gate.

—
Geo. Fownes (Member), died at Cardiff.

—
E. H. Minns (Honorary Member), died at
London.

—
John Varley (Honorary Member), died at
Liverpool.

—
L. Mackenzie (Member), died at Forest Gate.

—
J. Wilkinson (Member), died at Sea.

“Stat sua cuique dies; breve et irreparabile tempus
Omnibus est vitæ; sed famam extendere factis,
Hoc virtutis opus.”



SESSION 1893—94.

R. J. Lucock (Member), lost in the "Haronic."

"Aqua involvens navemque virosque."

J. Hardy (Member), died at Cardiff.

J. Williams (Member), died at Rothesay, N.B.

S. Carrick (Member), died at London.

G. W. Ough (Member), died at Bombay.

Henry Prior (Vice-President), died at Chingford.

A. Stenhouse (Member), died at Port Said.

D. McCullum (Member), died at Sea.

John Tait (Vice-President), died at Custom
House, Victoria Docks, E.

John Ferguson (Member), died at Forest
Gate, E.

Frank Pool (Member), died at Sea.

"Stat sua cuique dies; breve et irreparabile tempus
Omnibus est vitæ; sed famam extendere factis,
Hoc virtutis opus."



SESSION 1894—95.

A. B. Cater (Associate), lost in the "Haronic."

"Aqua involvens navemque virosque."

F. J. Arford (Member), died at Catford.

Edwin Beer (Associate), died at Torquay.

Thos. Campbell (Member), died at London.

W. H. Eastwood (Member), died at Cardiff.

John Law (Member), died at Bombay.

David Phillips (Vice-President), died at
Chipping Sodbury.

William Simpson (Member), died at Sea.

G. Timmis (Associate Member), died at Sea.

F. B. Trew (Member), died at Hong Kong.

"Stat sua cuique dies; breve et irreparabile tempus
Omnibus est vitæ; sed famam extendere factis,
Hoc virtutis opus."



SESSION 1895-6.

George Angus (Member), died July, 1895.

W. Hoaz (Member), died July, 1895.

Thos. Davies (Member), died May, 1895.

Peter Denny (Past President), died Aug., 1895.

Andrew Dinning (Member), died June, 1895.

T. G. Martin (Member), died January, 1896.

J. W. Pratten (Member), died November, 1895.

J. H. Price (Member), died March, 1895.

H. J. Seabrook (Member), died May, 1895.

Thos. Scott (Member), died February, 1895.

J. C. Soulsby (Member), died January, 1896.

W. Tapley Evans (Member), died Jan., 1896.

E. J. Wailes (Member), died December, 1895.

Robert White (Member), died February, 1896.

*"Stat sua cuique dies : breve et irreparabile tempus
Omnibus est vitæ ; sed famam extendere factis,
Hoc virtutis opus."*

Philip Devlin (Member), wrecked in the
"Ealing," January, 1896.

"Aqua involvens navemque virosque."



SESSION 1896-7.

- Archie Black (Member), died at Antwerp.
Archie Campbell (Companion), died at Highgate.
Captain Chapman (Companion), died at
Southampton.
Lewis P. Coubro (Member), died in Australia.
Zvie Douglas (Member), died at Forest Gate, E.
Thos. Henderson (Member), died at Liverpool.
J. T. Howieson (Member), died at Kirkaldy.
E. John (Member), died at Cardiff.
J. Milne (Member), died in Queensland.
J. Stephen (Member), died at Singapore.
J. Steven (Member), died in India.
A. Watson (Member), died at Manor Park.
“Stat sua cuique dies; breve et irreparabile tempus
Omnibus est vitæ; sed famam extendere factis,
Hoc virtutis opus.”
J. J. Grabam (Member), killed by accident at
Bombay.
A. Inglis (Member), drowned by accident at
Shanghai.

“Omnes eodem cogimur omnium
Versatur urna serius ocius
Sors excitura et nos in aeternum
Exilium impositura cymbæ.”