The
INSTITUTE of MARINE ENGINEERS
Founded 1889. Incorporated by Royal Charter, 1933.

SESSION 1936. Vol. XLVIII. Part 9.

President: The Hon. ALEXANDER SHAW.

PRESIDENTIAL ADDRESS.
"The Engineer as a Human Being."

READ

By THE HON. ALEXANDER SHAW

On Tuesday, October 6th, 1936, at 6 p.m.

CHAIRMAN: MR. H. S. HUMPHREYS (Chairman of Council).

IT was with great surprise that I received your kind but rash invitation to me to become President for the year 1936/37 of the Institute of Marine Engineers. The request, I thought, could hardly be seriously intended. My sole qualification for the Office is both negative and unique—for alone among all the Presidents of this Institute I am completely ignorant of all branches of engineering. It would accordingly be vain for me to attempt to deliver a technical address. Human frailty leads me rather away from the science and practice of engineering, of which I know nothing, and towards the engineer as a human being with whom I can claim some acquaintance.

Before I became actively immersed in shipping, I had the great privilege, at the English Bar, of making the acquaintance of more than one engineer as an expert witness, and was often puzzled by the conflict of their skilled testimony. One could be forgiven for doubting, after such an experience, whether engineers must not, in spite of the precision of their mathematics, be inadequately equipped with veracity. But the more generous conclusion was that drawn by a distinguished legal relative of my own, that the conflict of expert engineering testimony reveals in its full majesty the principle of "the many-sidedness of truth".

I have sometimes thought of these early experiences of mine when sitting in an office, and, with that docility of mind which is the only proper attitude for a managing director of a shipping concern, endeavouring to absorb first one and then another conflicting view of some concrete engineering problem. Suppose, for instance, that a new ship is to be laid down. Many weeks and even months of calculation and estimate are gone through on the purely business side; but in the long run the matter lies in the hands of the engineer. Mr. A, to take an instance, proves to demonstration how much more reliable and economical it would be to propel the ship by electricity. You think, "Well, that seems all right. Why does anybody ever do anything else?" Then comes along Mr. Engineer B with his convincing argument on the virtues of single reduction gearing, and after half an hour of him you wonder why electricity was ever invented. Cannot this great Institute give us poor shipowners some unbiassed and reliable guidance upon this subject? The problem is:—which of two identical hulls, one equipped with electric drive and the other with single reduction gearing, can be propelled through the water with the greater economy of fuel under conditions which call for twenty knots during say two-thirds of the voyage and sixteen knots for the remainder? I feel that the final solution of this problem is well within the scope of the Institute of Marine Engineers, and that shipowners need not be asked, as was suggested to a Company which I know, to spend over a million pounds each on two vessels, one with single reduction gearing and the other with electric drive, in order to find out which of the two would be the less economical.

Fads, Fancies and Loyalties.

Let us suppose, however, that one has come down on the side of single reduction gearing. Are one's troubles at an end? No, gentlemen, far from it. Even the engineers who favour single reduction gearing remain human beings. They have their fads, their fancies, and their loyalties. I can tell you from personal experience that the almost religious devotion of one engineer of my acquaintance to a particular type of tooth form brings to mind the monastic fervour of the Middle Ages. Others again adhere to a different although not less sincerely held creed upon this subject. But common ground is not entirely lacking: and it is some satisfaction to the perplexed layman to know that the adherents of the V.B.B. form of faith and the devotees of the A.A. persuasion now find a common object of worship in a deity called k.—an abstraction whose influence appears to a layman to be as mysterious as it is profound. When first I was told about k., I thought by the tone of respect with which he was referred to, that Kay must surely be a professor of the Glasgow University. It was a shock to my patriotism to learn that he was a mere abstraction and not altogether a benevolent fellow, since if his wants are insufficiently provided for he is prone to tear off teeth and even to smash wheels and pinions. *Credo quia impossible.* Gentlemen, I believe in k., but I confess to a feeling that he is a nasty fellow whom I do not really wish to meet. I am glad to know now that he is not a Scotsman. If he were I should do my best to have him called before the Presbytery.

Throughout life I have always felt it a great handicap to have no knowledge of mathematics. Engineering is based on mathematics. The science of Physics is becoming more and more mathematics. Mathematics is everywhere. There is no field of human endeavour which it does not invade. You can expel mathematics with a pitchfork, but nevertheless it will run back again. It has even invaded the sphere of Theology. Personally I am not in favour of mathematics, because I am not in favour of anything which I do not understand. It appears to me that if you have a simple proposition with which the whole population will immediately agree it is better to state that proposition clearly and to secure that agreement. But the mathematician will put the proposition in the shape of a formula of algebra, and thus at once deprive nine-tenths of the population of the opportunity either of understanding it or agreeing with it. A very distinguished friend of mine at the Bank of England was good enough to give me a short time ago a copy of an erudite paper which he had read before some learned society. I am sure that, since he is an honest man, the proposition he was seeking to establish was a reasonable proposition. I read the paper from beginning to end. It was a mass of algebraical formulæ, with alphas and betas and square root signs all over the place. You would find a single letter with two short lines after it (meaning "is equal to"—I am told) and then would come a neat little heap of symbols and figures piled one upon the top of another like the storeys of a tenement building. I struggled on with the thing as best I could and read it through. It was pointed out to me that the whole argument depended upon something called the "Pareto index". I asked the author whether anybody could really understand his paper, and he answered me, "Oh yes, probably about half the trained economists in the country and nearly all the statisticians". I cannot cope with this sort of thing, nor with your abstruse engineering calculations. But I can still admire them, like the man who admired the peacock which was unfolding its tail—not because he understood its beauty, but on the ground that Mr. Lloyd George could not do it.

Yet upon these abstruse calculations, as I must admit, there hinges very largely the future progress of engineering. In saying that I do not exclude the value of practical experience under operating conditions, which is the test to which all our calculations, whether in the engineering or in the merely business field, have to submit. In my humble opinion no praise can be too great for those engineers who, since the War, have effected what amounts really to a revolution in methods of ship propulsion. When I see the fuel bill for a voyage, say, to Australia and back of an elderly ship with the old-fashioned Scotch boilers and reciprocating engines, and compare the figure with the cost in fuel of propelling a much larger ship fitted with high pressure steam and modern turbines on the same round voyage, then I take off my hat to the engineers. But, gentlemen, do not imagine that your skill is all jam for the shipowner. On the contrary, these unfortunate people have sunk millions of pounds in tonnage constructed shortly after the War and fitted with systems of propulsion which, although then modern, are now out of date. The resources to replace that elderly tonnage at once by modern ships simply do not exist. They have to be slowly and laboriously acquired by shipping concerns—and acquired largely by the operation of ships not now past their middle life, which must compete with vessels of the most modern kind supported in the case of many foreign countries by lavish subsidies from governments. So in a sense the engineer has sold the shipowner a pup; for the very improvements which make a new ship less costly to run have the effect of rendering expensive in comparison the operation of ships which are not yet middle aged.

Science and Shipping Finance.

Well, nothing will stop the progress of marine engineering, and the shipowner must adjust his difficulties as best he can. In the long run the public interest is the predominant factor, and that interest is best served by the most efficient means of propulsion. Yet the poor shipowner may be excused a sigh when he contemplates the possibility that vessels laid down to-day will in their turn be rendered obsolete by engineering advances perhaps only a few years ahead. The pace of science in these times is fast indeed, and shipping finance struggles after it with difficulty. It was not always so. The whole stretch of the centuries from the Roman times to the days of Queen Elizabeth produced no really radical change in the construction of ships. Indeed, I doubt whether the change in ship construction during all these ages was so great as the change which has taken place in the comparatively short period since the middle of last century. When I look on the walls of the P. & O. Office in Leadenhall Street and see hanging there pictures of the ships which carried the P. & O. flag early in the history of the Company—great leviathans of their time, such as the "William Fawcett", 206 tons, 60 horse power, and compare them with the ordinary bread and butter ships of to-day, such as the "Strathmore", or with Western Ocean luxury vessels like the "Queen Mary", I am humbled by the thought that history may repeat itself, and that the vessels of which we are so proud to-day may be considered puny back-numbers in times to come. Still, there are some factors of a general character which must for a time impose a limit. Among these are the size of ports, the depth of water which can reasonably be made available up to the quayside, and the vast expense of providing dry docks to hold the largest liners. Another, and quite different, consideration is indicated by the remark of a gentleman on board one of the latest giant Atlantic liners, who returned on deck breathing heavily—"I left my tobacco pouch in my cabin, and it took me a quarter of an hour to get there to fetch it and get back on deck again". Further, there are few trades indeed in the world which are likely to provide a load factor for a single sailing capable of giving the mammoth ship any chance of financial success. I have long since ceased to suppose that there is anything that marine engineers and naval architects cannot do, but I have a shrewd idea that the pace must to a great extent be set by effective public demand and by the old-fashioned problem of making ends meet.

A Menace to the Empire.

One of the most deplorable facts in the present shipping situation, and in its effect on our marine engineering and engineers, is that vessels have been built by certain foreign Powers of a size, speed, cost, and standard of luxury which the trade on which they are engaged will not stand. A gap is therefore created at once between expenditure and receipts, and that gap is filled by the foreign tax-payer. One of the results is that the British ships engaged in the same trades are at once outclassed by uneconomic competition. Where the British Empire is faced by this form of menace an answer must be found; and that answer to my mind is not given by a policy of drift. An Empire whose life depends upon its sea communications cannot consent to stand idly by while one British Line after another is swept off the seas by uneconomic competition. I submit to you that the only effective answer is to demonstrate to countries which follow that course that such aggressive action does not pay and cannot be made effective against the British race. Once the Governments of Great Britain and of the British Dominions beyond the seas adopt the policy of active support to their shipping, other countries will begin to realise how vain is their attempt at uneconomic competition; and all our fellow citizens whose livelihood depends upon British ships and on sea-borne commerce will feel a new sense of confidence in the future of the Empire.

We must note, I think, that it is not any inefficiency of British ships which has produced the present situation. The trouble has been caused by the fact that British shipping is so efficient. British marine engineers and naval architects, British shipbuilders and ship managers, and British ships' officers and personnel, have set a standard at sea too high for the ordinary competition of some other countries to meet it. Those countries, in their endeavour to find an artificial reply have far overstepped the bounds of mere equalisation of opportunity, and, by lavish subsidies to their own ships and restrictions upon those of other nations, are gradually rendering the "freedom of the seas" a freedom available only to those who are inferior in natural aptitude.

It may not at first appear that the threat to British shipping is having any very serious effect upon marine engineers as individuals or as a body.

But when we realise that before the War Great Britain owned not far off half the total tonnage of the world's shipping, and that now she owns not much more than a quarter of that tonnage, we must realise how greatly the relative importance of British marine engineering has sunk in the world's scale. But the decline is not merely relative, for there has been an actual and quite serious diminution in the figure of British sea-going tonnage, and therefore a restriction in the scope open to marine engineers. One of the most serious facts in the decay of British shipping has been the decline in the numbers of skilled men employed in the shipyards, and the Government are now finding how awkward this decline has been. In spite of the ups and downs which take place in the fortunes of British merchant shipping, the general tendency clearly visible over a term of years is a downward tendency, and this means a growing restriction of employment in the technical branches of the profession. The Government of this country cannot have it both ways. They cannot expect to experience the luxury of doing nothing for British liner tonnage, except looking on while it fights its lonely battle against the growing resources of foreign lines, and at the same time expect, if a great emergency should occur, to find at their command the same abundance of technical men and the same multitude of ships to carry food and munitions as was at our disposal in 1914. Fortunately there is more than one indication that our rulers are now taking a more active interest in the problem. One of the most hopeful features in recent difficult years has been that although the opportunities open to marine engineers have been somewhat restricted, their skill and technical efficiency have not been impaired. On the contrary, they have been greater than ever. May I be allowed also to say, from my own grateful personal experience, that their reliability and loyalty in time of stress and emergency have never been higher than they are to-day. In these qualities, indeed, they lead the world. No economic stress can break them down, for they are deeply rooted in the character of our race.

I often wonder how far this rapid progress of engineering tends to stifle individuality and to crush initiative. The specialisation and subdivision which you see in the large factory often results in one man performing hour after hour one single simple process which has become second nature to him, but which allows no room for the old-time individuality of the skilled artificer. On board a ship there is, of course, more scope, and I must say that I have not been able to observe any lack of individuality, sometimes strongly marked, among marine engineers; especially, if I may be allowed to say so, among those of them who hail like myself from North of the Tweed. Their individualities, like their accents, are happily unimpaired either by the heat of engine rooms or the linguistic rigours of London and other foreign ports.

Grasping the Greater Realities.

Imagination, no doubt, is to them, as to all of us, a great help amid the routine of life, although in the career of the marine engineer it might, at first sight, seem to play but a small part. But I think that the best engineers, like the best men in any other profession, are gifted with imagination, and that it makes their work vivid; for imagination, rightly understood, is not the fancying of fictions but the faculty of grasping the greater realities. There is no end to your labours in the advancement of engineering, just as there is no end to the labours of science generally. The area of research grows ever vaster and the goal ever recedes. This is not strange when we remember that the quest of science lies among the unfathomable riches of Creation. That quest is no task whose complete results can, in a few decades, as some used to suppose, be compacted in neat and conclusive formulæ. The search of science is eternal, because man is finite and God is infinite: and the best minds among us are realising more and more fully, as one of the greatest of living scientists has had the courage to proclaim, that the soul of man most correctly responds to the message of the Universe when it returns from groping into its secrets with no air of self-sufficiency but humbled and yet exalted by "wonder, love and praise". If those who go down to the sea in ships "behold the works of the Lord and His wonders in the deep", do not these ancient words now apply in double measure to the modern marine engineer? For the power which his skill harnesses for the use of man had its remote origin, before the sun was made, among the profound mysteries of time and space. He is the steward and minister for a day of timeless forces; and his own grasp of this fact cannot fail to increase respect for his calling and for the great profession to which he belongs.

Gentlemen, it is a great profession, and those who devote their lives to it deserve well of their fellow countrymen. Without modern sea transport the vast population of this small island would be starved out in a few weeks. How dependent we are upon the marine engineer! There is no breakfast table in the land where he is not represented by the fruit of his labours; and I hope that in every British home he will be more and more regarded as a friendly although unseen guest—admired for his skill which so greatly ministers to the public weal; and above all respected for his qualities as a man.

The foregoing Address was listened to by a large and appreciative audience who accorded the President, on his introduction by the Chairman, an enthusiastic welcome.

Following the reading of the Address, the **Chairman of Council** (Mr. H. S. Humphreys), said: "It gives me the greatest pleasure to move a

The late Mr. Charles Walter Murray.

Portrait by] [Photomaton

OBITUARY.

Mr. Charles Walter Murray.

It is with deepest regret that we record the death of Mr. Charles Walter Murray, who passed away on Wednesday, August 19th, at his residence, Stepney Tower, Southsea.

Born at Southampton in 1857, Mr. Murray commenced his apprenticeship in 1872 at the Northam Iron Works of Messrs. Day, Summers & Co., Southampton. On its completion he remained in their employ as a draughtsman until 1884, when he proceeded to sea as 5th engineer in one of the P. & O. Company's vessels. In 1885, when serving as 3rd engineer with this Company, he was appointed engineer-in-charge of their floating docks at Hog Island, Bombay. This appointment lasted for four years, and subsequently the building of the Company's vessels "Formosa" and "Malacca" was carried out under his supervision at Barrow-in-Furness.

In March, 1891, he was promoted to chief engineer and served as such until 1893 when, to obtain wider scope for his abilities, he voluntarily severed his connection with the P. & O. Company and established himself in the shipping centre at Southampton as a consulting engineer, naval architect and marine surveyor. At this time he also acted as the representative of the British Corporation Registry of Ships at Southampton. During the seven years in which he was engaged as a consultant in Southampton his designs and contracts covered a wide range of large and small vessels, including the fast pleasure steamers "Balmoral" and "Lorna Doone", which saw distinguished service during the War and were still in commission at a very recent date. In addition to marine work, Mr. Murray had a large practice in connection with land installations.

Early in 1900 he was invited to join the staff of Messrs. Babcock & Wilcox, Ltd., and accepted the appointment of marine manager and superintendent engineer. At this time the Babcock & Wilcox boiler was in its infancy so far as marine work was concerned, and due largely to his abilities big improvements were effected in the marine design. In 1904 the finding of the Naval Commission of Inquiry on Boilers, which marked the advent of the B. & W. boiler in H.M. Navy, afforded him much satisfaction. During the tenure of his service with this firm, which terminated on his retirement in 1930, the water-tube boiler came into increasing use in the Mercantile Marine, and of recent years superheaters were more generally adopted. The marine type boiler was also developed for land service under his supervision, and very large numbers were constructed.

Mr. Murray, who was a Freemason and a Member of The Institution of Naval Architects and The Institute of Metals, joined The Institute in 1890. He rendered invaluable service as a Member of Council in the years 1903, 1904 and 1906, and he is remembered by his few surviving contemporaries of that time as a man of great personal charm and character. He was interred at Southampton on 22nd August.

vote of thanks to the President for the excellent Address which he has just delivered.

I should like to assure Mr. Shaw that although the invitation to become our President may have surprised him, it was no rash one. The Institute has always been fortunate in its choice of Presidents. It is the custom to have a prominent shipowner, a shipbuilder and a marine engineer in rotation for our President, and this year we have not only a most prominent shipowner, but a man of marked ability in other directions.

Although the President modestly disclaims all technical knowledge of marine engineering, one has the impression that he has absorbed more than he cares to admit. I have no doubt that his technical advisers require to know all about "k" before approaching his presence.

Our President referred to initiative—may I suggest that this is not altogether lacking among the "foreigners" south of the Tweed either, as witness the marine steam turbine. May we hope to see some day an internal combustion turbine or other equally revolutionary development produced by our friends north of the Tweed. However, I trust that the vote of thanks will not be thought to lose any of its value in having been proposed by one hailing not only from south of the Tweed but from south of the Thames. Fortunately we have as Vice-Chairman, Mr. Rainie, whose accent and individuality both will, no doubt, make good my deficiencies, and I now have great pleasure in calling upon him to second the vote of thanks".

The Vice-Chairman of Council (Mr. R. Rainie, M.C.), said: "Our Chairman has called upon me to second his motion that a vote of thanks be given to the Hon. Alexander Shaw for the Presidental Address to which we have listened.

Before formally doing so, I would like to say that I have listened to many Presidential Addresses in this Hall, cleverly worded and ably delivered, which features I am fortunately able to recognise, and never have these features been more prominent than on this occasion. But in many cases I found myself somewhat of a 'skeleton at the feast', in that I am in much the same blissful position that our President says he is in—that is, I share with him his alleged ignorance of mathematics and the science of engineering. When I found, therefore, that the title of the Address was 'The Engineer as a Human Being', I came here this evening prepared to listen with pleasure to something which I could understand.

Perhaps when our President emphasised his complete ignorance of mathematics and the science of engineering, he was giving us just one more example of 'the many sidedness of truth'. It may even be that he was confirming—to a certain degree—that other verity, 'the meek shall inherit the earth'. Be that as it may, I believe it must be quite a unique experience for marine engineers to be considered as 'human beings', and especially to receive that consideration from the chairman and managing director of a firm of shipowners—not only unique, gentlemen, but very comforting, and if one in such a comparatively lowly position as myself dare make a submission to our President, it would be that managing directorial functions could be exercised in no better way than understanding as human beings, not only the engineer, but those others who, in various capacities, are engaged in devising and operating units of our mercantile marine.

I feel sure you will agree with me that our President's Address indicated that, insofar as the engineer is concerned, he has that understanding in full measure, and I submit that if he can understand the engineer as a human being, he will have no difficulty in understanding any 'lesser breed'.

It is good, therefore, for our Institute to have such a man as its President, who, while he states that he does not know what we do, at least knows us, and I would suggest to you that, while he may consider that in a certain sense the engineer has sold the shipowner a 'pup', that 'pup' properly reared will turn out to be a 'retriever'.

It is with great pleasure, therefore, gentlemen, that I second the motion of a vote of thanks to our President made to you by the Chairman of Council".

The vote of thanks was accorded unanimously, amid loud and prolonged applause.

The President in reply thanked the Members present for their appreciation of his Address and the warmth of their welcome. On his proposal a hearty vote of thanks was accorded to the Chairman for his able handling of the proceedings, and the meeting then terminated.

INSTITUTE NOTES.

INTERNATIONAL MEETING OF NAVAL ARCHITECTS AND MARINE ENGINEERS, NEW YORK.

The first international meeting of naval architects and marine engineers to be convened in the United States was held in New York by invitation of The Society of Naval Architects and Marine Engineers during the week September 14th-19th, 1936.

The British delegation was the largest foreign delegation attending the meetings, and consisted of nearly one hundred delegates representing The Institution of Naval Architects, The Institute of Marine Engineers, The North East Coast Institution of Engineers and Shipbuilders, and The Institution of Engineers and Shipbuilders in Scotland. The following Members of our Institute and ladies took part in the proceedings:—

Mr. and Mrs. H. F. Carmichael, Mr. and Mrs.

D. B. Carswell, Mr. B. C. Curling, Mr. and Mrs. John Elliott and Miss R. Elliott, Mr. R. H. Gummer, Mr. and Mrs. A. C. Hardy, Mr. and Mrs. W. Hamilton, Eng. Rear-Admiral J. Hope Harrison and Miss J. Harrison, Mr. and Mrs. P. Inglis, Mr. J. Foster King, O.B.E., and Mrs. J. M. Brown, Mr. G. H. Lake, Mr. and Mrs. T. S. Morrison, Mr. Walter Pollock, Mr. M. B. Pollock, Mr. and Mrs. F. W. Porter, Mr. J. A. Reader, Mr. W. L. Roxburgh, Mr. and Mrs. J. Russell, Mr. and Mrs. W. T. Townend, Mr. H. D. Wight, Mr. R. B. Wight, Mr. W. G. Winterburn, and Mr. and Mrs. W. A. Woodeson.

The British party was under the leadership of The Right Hon. Lord Stonehaven, President of The Institution of Naval Architects, The Institute of Marine Engineers' section being headed by Eng. Rear-Admiral J. Hope Harrison.

The majority left Southampton for New York on Saturday, September 5th, in the Cunard White Star M.V. "Britannic", arriving on Sunday, September 13th, and returned in the same Company's R.M.S. "Queen Mary", leaving New York on Wednesday, September 23rd and arriving at Southampton on Monday, September 28th.

During the crossings a number of the delegates inspected the engine rooms of the "Britannic" by courtesy of the Chief Engineer and the Second Engineer, Mr. H. Wright (Member), and the engine and boiler rooms of the "Queen Mary" through the kindness of the Chief Engineer, Mr. Llewelyn Roberts (Member), and several of his Assistants, including Mr. T. W. Benson (Member).

The gathering of representatives of the various maritime countries was opened most happily with a reception and official welcome on the afternoon of September 14th at the Webb Institute of Naval Architecture, the present home of Rear-Admiral George H. Rock, formerly Chief Constructor of the United States Navy, now retired, who is President of the Society of Naval Architects and Marine Engineers. Admiral and Mrs. Rock, assisted by other members of the Society and their wives, made the occasion a very enjoyable one for the delegates and their ladies, the weather contributing much to the brightness of the occasion.

Delegates assembled at a session of the International Meeting on September 16th.

The Webb Institute of Naval Architecture has a historical background. It was founded by William Henry Webb, who enjoyed for many years a world-wide reputation as a builder of merchant and naval vessels of various types and sizes. The situation of the Institute, in spacious grounds overlooking the Harlem River, where that stream joins the Hudson River, afforded an especially appropriate place for a social gathering of international representatives immediately interested in the associated arts of shipbuilding and marine engineering.

The technical sessions of the meeting were opened at 9.30 a.m. on Tuesday, September 15th, in the Sert Room of the Waldorf-Astoria Hotel. Rear-Admiral Rock presided, and was assisted by Mr. H. Gerrish-Smith, secretary-treasurer of the Society and formerly of the Construction Corps of the United States Navy. In opening the first session, Admiral Rock said that he recognised that no formal address was called for on his part. The importance of the meeting was sufficient in itself to explain the reason of the occasion. The members of the Society of Naval Architects and Marine Engineers had previously participated in international meetings held abroad, and those fortunate members were keenly alive to the value and the significance of such interchanges of professional knowledge. Therefore, the Society was desirous of holding such a meeting in the United States. Steps to that end were initiated not without some doubts as to the wisdom of the course, but the prompt and even enthusiastic response of the foreign brethren proved most gratifying.

Before concluding his remarks, Admiral Rock spoke feelingly of the passing of Sir Archibald Denny, and what his death would mean to all who had had the privilege of knowing him, and of the great loss to the shipbuilding world. As a silent tribute to Sir Archibald everyone present stood with bowed head for a few moments.

The attendance at the long first day's session of the meeting number 225, and there were delegates present from France, Germany, Great Britain, Italy, Japan, Spain, Sweden, and the Society of Naval Architects and Marine Engineers. In addition, there were representatives of many American and foreign shipyards, engine-building firms, and other maritime interests.

This particular international meeting of naval architects and marine engineers might well be described as a symposium devoted to safety of life at sea, because the greater number of papers read and discussed had to do primarily or partly with that subject. Five such papers were read in abridged forms at the first morning session, and immediately thereafter discussion on them was opened. The five papers in question were as follows:—

"Safety at Sea", by Dr. James Montgomerie.

"Fire in Passenger Spaces", by Mr. E. Leslie Champness.

"Safety of Life at Sea", by Monsieur Abel de Berlhe and Rear-Admiral Rolland Boris (DD), French Navy.

"Some Observations on the Actual Application of the Safety and Load-line Convention Rules", by Mr. Sozo Ikushima.

"Safety at Sea", by Rear-Admiral J. G. Tawresey (CC), U.S.N.(ret.).

At the close of the morning session luncheon was served in the Norse Grill on the first floor of the Waldorf-Astoria.

The afternoon was devoted to the reading in abstract and discussion of the following papers:—

"Some Particulars Concerning the Design of the 'Normandie' and the Elimination of

The Banquet at the Waldorf Astoria on September 15th.

Vibration", by F. Coqueret and P. Romano.

"Modern Atlantic Liners", by Ernest H. Rigg.

During the day the ladies participated in an interesting trip through the Bronx River Parkway to Bear Mountain Bridge, across the bridge, and through Beer Mountain Park. Luncheon was served at Bear Mountain Inn, and the party returned via the Jersey Shore, George Washington Bridge and Riverside Drive.

In the evening a Banquet was held in the Grand Ballroom of the Waldorf Astoria for the delegates, the members of the American Society, and their ladies, followed by dancing in the East Foyer. Mr. Homer L. Ferguson, president of the Newport News Shipbuilding and Dry Dock Company was the principal speaker, followed by Lord Stonehaven, Dr. John T. Batey, Capt. Maurice Bredeaut, of the French Navy, and Dr. E. Foerster, of the Friends of the Hamburg Model Tank of Germany. Rear-Admiral Rock presided, and read the following telegram received from the Secretary of State, The Honorable Cordell Hull :—

"May I take this occasion to extend a warm welcome to this country to those delegates who have come from abroad to attend this International Meeting of Naval Architects and Marine Engineers. I wish the Meeting every success".

The following reply was sent to the Secretary of State on September 17th :—

"Foreign delegates of all nationalities to International Meeting of Naval Architects and Marine Engineers deeply appreciate your courteous greeting and request me to offer you their warmest thanks. Rock".

On Wednesday, September 16th, the morning session was opened at 9.30 a.m. in the Sert Room and the following papers were presented and discussed :—

"The Rolling of the s.s. 'Conte di Savoia' in Tank Experiments and Sea Courses", by Doctors Ing. R. de Santis and M. Russo.

"A Study of Ship Performance in Smooth and Rough Water", by Dr. Gunther Kempf.

"Power, Speed, Economy and Seaworthiness of Medium-sized Fast Liners", by Dr. E. Foerster.

During the morning the ladies made a trip to, and inspection of, Radio City, including the performance at Radio City Music Hall and luncheon in the Rainbow Room.

In the afternoon a large number of the visitors made a trip by boat around New York Harbour to view the shipyards and other points of interest. Others of the delegates made an alternative trip to Stevens Institute of Technology, Hoboken, N.J., to inspect the Stevens Model Tank.

On Thursday, September 17th, the delegates made a trip on the Hudson River Day Line Steamer "Alexander Hamilton", leaving at 10.30 a.m. for the U.S. Military Academy, West Point, N.Y. Luncheon and dinner were served on board the steamer. On arrival at West Point, at about 1 p.m. an organ recital was heard in the Chapel. At 3 p.m. the party witnessed drills, athletic and riding formations, and at 4.35 p.m. a battalion parade. In addition, various buildings were opened for inspection, officers being assigned to guide the visitors around the Post. On the return of the steamer to New York, buses took the party back to the Waldorf-Astoria.

On the fifth day, Friday, September 18th, the delegates, members and their ladies left the Waldorf-Astoria at 10 a.m. on Baltimore and Ohio buses for Jersey City to make connection with the modern streamlined train "The Royal Blue". Luncheon was served in the dining car, and the party arrived in Baltimore at 1.18 p.m. The party proceeded by bus to the U.S. Naval Academy, Annapolis, Md., where they were met by Officers and given an opportunity to see the buildings and grounds. The journey was continued by the same buses to the Hotel Mayflower, Washington, D.C., arriving in time for dinner. The Mayflower was the Headquarters of the party while in Washington.

The program for Saturday, September 19th in Washington was in charge of a Special Committee, and included, for those who desired, a visit to the Model Basin, to the principal buildings, and to Arlington and Mount Vernon. In view of the fact that the Navy Yard in Washington is not open on Saturday and because special arrangements had been made to open the Model Basin, those wishing to visit the Basin did so in the morning. The times of the other visits in Washington were optional. A special train conveyed the party back to New York at 5 p.m. The delegates and their ladies were the guests of the American Society from the time of leaving the hotel in New York on the Friday morning until their return on the Saturday evening.

Following the conclusion of the Conference, on Monday, September 21st, the British delegates gave a dinner to their hosts at the Waldorf-Astoria. Lord Stonehaven presided, and, on behalf of the four British societies participating in the Conference, presented to the American Society a silver bowl bearing the following inscription :—

"Presented to the Society of Naval Architects and Marine Engineers by The Institution of Naval Architects, The Institute of Marine Engineers, The Institution of Engineers and Shipbuilders in Scotland, and The North East Coast Institution of Engineers and Shipbuilders, as a token of appreciation of the hospitality extended to the British delegates to the International Meeting of Naval Architects and Marine Engineers, New York, September 14th to 19th, 1936".

Rear-Admiral Rock responded on behalf of the Society, and the proceedings closed with a speech by Eng. Rear-Admiral J. Hope Harrison proposing the toast of the Chairman, Lord Stonehaven. In the course of his remarks Admiral

The British delegates' dinner to the President and Council of the Society of Naval Architects and Marine Engineers at the Waldorf Astoria on September 21st.

Harrison mentioned that The Institute of Marine Engineers was numerically the largest of the participating institutions and that an account of the Conference proceedings would reach The Institute's world-wide membership through the next monthly issue of the Transactions.

The silver bowl presented to the American Society of Naval Architects and Marine Engineers by the four British institutions.

The following letter was received from Admiral Rock the next day :—

"Dear Lord Stonehaven,

We all are much touched by the receipt of the silver punch bowl, presented to our Society last night by you on behalf of the four British Societies :—

The Institution of Naval Architects.
The Institute of Marine Engineers.
The North East Coast Institution of Engineers and Shipbuilders, and
The Institution of Engineers and Shipbuilders in Scotland.

The time and manner of presentation was so appropriate, and the affection for us so plainly evident in the act, that this gift is a treasure which we shall always cherish and hand down to our successors for all time.

Yours sincerely,
(Sd.) Geo. H. Rock.
Rear Admiral (CC) USN Ret.—
President".

In conclusion it may be recorded as the unanimous opinion of the British delegates that the efforts of our American hosts to make, by this Conference, a lasting contribution to the comity and technical advancement of the maritime nations have been completely successful.

[*Part of the above report is reprinted from "The Engineer" of October 9th, with acknowledgments.—Ed.*].

AUTUMN GOLF MEETING.

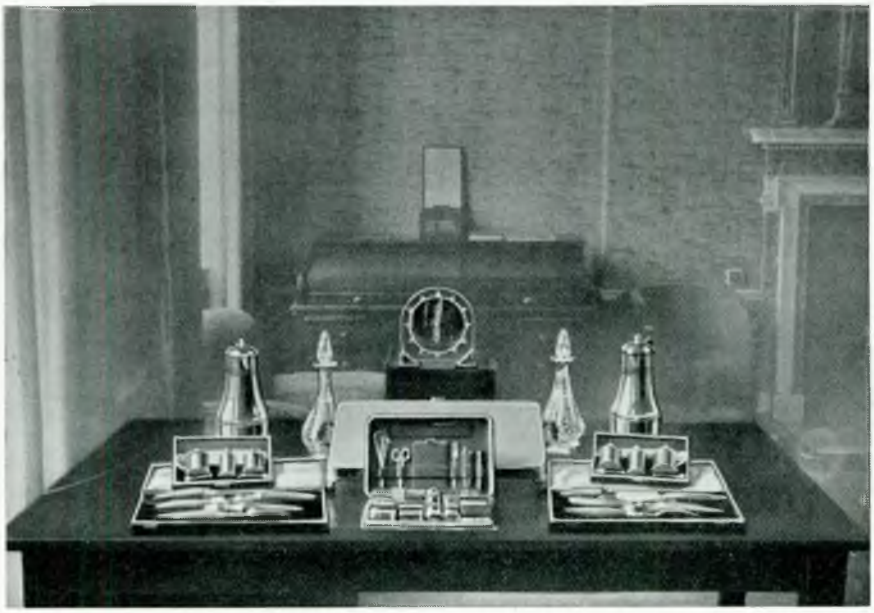
An Autumn Golf Meeting was held at Addington Park on Friday, September 25th, 1936, by kind permission of the Addington Palace Golf Club.

Although dull, fine weather prevailed throughout the day. Twenty-nine members took part in the medal competition held in the morning. First prize, presented by Mr. R. T. Clarke, was won by Mr. D. M. Denholm with a net score of 70. The second prize, presented by Mr. F. P. Bell, was won by Mr. W. C. Jones, whose net score was 72, and Mr. O. H. Moseley won the third prize, presented by Mr. J. Robinson, with a net score of 76.

With an aggregate score of 150 net Mr. D. M. Denholm also won the prize presented by Mr. R. Rainie for the best aggregate net score in the morning competitions at this year's Summer and Autumn Meetings.

A four-ball bogey greensome, in which 28 members participated, was held in the afternoon. The two first prizes, presented by Messrs. T. A. Crompton and A. Robertson, were won by Messrs. H. S. Humphreys and L. J. Le Mesurier, who finished 2 up; the second prizes, presented by Mr. E. B. Irwin, were won by Mr. O. H. Moseley and G. F. O'Riordan who finished 2 down; and the third prizes, presented by Mr. S. Pearson, were won by Eng. Capt. R. D. Cox and Mr. R. M. Gillies with a score of 4 down.

At the prize distribution Mr. A. Robertson (Convener of the Social Events Committee) observed that it was the first occasion that a Chairman of Council had found it possible to be present at one of these events, and he accordingly invited Mr. H. S. Humphreys to present the prizes. Mr. Humphreys congratulated the winners on their play and expressed the thanks of the Council to the donors of the handsome prizes and to the Committee and Secretary of the Addington Palace Golf Club for the excellent accommodation which had been provided. He also voiced the thanks of those who participated to the Social Events Committee and particularly to the Convener (Mr. A. Robertson) to whose arrangements the success of the meeting was directly attributable. Mr. Robertson suitably replied on behalf of the Committee.



The Prizes.

The following members participated in the day's events: Eng. Capt. R. D. Cox, Messrs. I. Davies, D. M. Denholm, R. M. Gillies, J. A. Goddard, S. G. Gordon, H. Gordon-Luhrs, D. J. Harris, E. C. Hatcher, S. Hogg, L. G. Hughes, H. S. Humphreys, E. B. Irwin, W. C. Jones, A. R. Langton, L. J. Le Mesurier, F. R. Lindley, W. E. Loveridge, O. H. Moseley, G. F. O'Riordan, S. Pearson, R. B. Pinkney, R. Rainie, A. Robertson, J. Robinson, H. J. Savage, W. Tennant, J. B. Wilkie and J. H. Williams.

CORRESPONDENCE.

To the Editor of the Transactions.

Phosphate Treatment for Marine Boilers.

Dear Sir,—I read with much interest Mr. J. S. Gander's article on the above subject reproduced in your August issue.

It is, as Mr. Gander indicates, absolutely essential to treat as two entirely different subjects high pressure and low pressure boilers, and whether the line between the two should be drawn at 160lb. or 250lb. pressure or somewhere in between the two does not yet seem to have been authoritatively defined. My own inclination is more towards the 250lb. mark than otherwise.

Having been actively occupied with the practical side of this subject for many years I have been particularly impressed with the desirability of any treatment being of the utmost simplicity, particularly as far as the low pressure boilers are concerned. To regulate phosphate by alkalinity tests only does not seem altogether safe, while to test for phosphate is not so simple as one might desire on board ship.

Mr. Gander states, "It is usually considered sufficient to regulate density by the blow-down and alkalinity by the phenolphthalein reaction; and, when all is said, this seems to work very well, except that the formation of scale is not prevented". I would add that under exactly such conditions scale can be completely prevented in low pressure boilers by the addition of a suitable colloid which should be fed into the boilers with the soda and in exact proportion to the quantity of soda necessary to maintain a constant low alkalinity to phenolphthalein in the boilers.

Under such working conditions I have had a number of samples of marine boiler water examined for sulphate-alkalinity ratio and have invariably found this satisfactory.

On one point I must definitely disagree with Mr. Gander, and, according to his statement, with all marine engineers, and that is when he says the use of water from fresh water tanks is the chief cause of scale. My experience does not confirm this and has convinced me that by far the greatest evil is condenser and other seepage, even despite the enormous progress made in this particular field during recent years. If my experience is correct outside softening of the make-up would only touch the fringe of the scale problem and might lead to complications.—Yours, etc.

H. Lauritzen.

ELECTION OF MEMBERS.

List of those elected at Council Meeting held on Monday, 5th October, 1936.

Members.

Alfred Cartwright, 19, Greendale Road, Nottingham.

Thomas Amner Colvill, Darnley House, 30, Mayfield Avenue, Orpington, Kent.

Frederick William Cross-Rudkin, 1, Harewood Road, Wallasey, Cheshire.

Arthur William Hansom, Dawn Hill, Civil Lines, Mandalay, Burma.

William Harding, 20, Ash Road, Parkhall, Clydebank, N.B.

Alfred Ernest Hazlewood, 20, Tullimore Road, Mossley Hill, Liverpool.

James Cathcart Richmond Hyslop, 274, Glasgow Road, Clydebank, Glasgow.

Albert Jones, 13, Ranfurly Road, Cressington, Liverpool, 19.

John Ivor Jones, Tydvil, Ashgrove, Whitchurch, Cardiff.

George Matheson Kennedy, Rocklands, Knaphill, Woking, Surrey.

Henry Russell, 35, Abbots Road, Grangemouth.

Thomas Ernest Suddes, 51, Alwinton Terrace, Gosforth, Newcastle-on-Tyne.

John Smith Thompson, 8, Langside Drive, Newlands, Glasgow, S.3.

Mark Vickers, 270, Barking Road, East Ham, E.6.

Walter Leonard Whiting, 43, West Park Road, South Shields.

Associates.

Mohammed Abdel Halim Abed, 8, Culver Road, Reading, Berks.

Clifford Cox Frayn, 11, Windsor Street, Barrow.

Frederick William Harper, 15, Cove Street, Watson's Bay, Sydney, N.S.W.

Herbert Frederick Mansfield, 10, Harlescott Road, Nunhead, S.E.15.

Allen Adamson Scaife, 19, Bideford Gardens, Lowfell, Gateshead.

George Ferguson Smith, 1, Hawkhead Crescent, Liberton, Edinburgh.

Stanley Settree Williams, 39, St. Georges Crescent, Drummoyne, Sydney, N.S.W.

Probationer Students.

Cyril Lloyd Rees, Floradale, Flushing, Falmouth.

William Bertram Rees, Floradale, Flushing, Falmouth.

Transfer from Student to Associate.

Mohammed Ibrahim Kidwai, 32, Northern Parade, Portsmouth, Hants.

ADDITIONS TO THE LIBRARY.

Purchased.

"Steam Turbines", by E. F. Church, S.B., S.M. McGraw-Hill Publishing Co., 2nd edn. 18s. net.

"Very Low Temperatures—Their Attainment and Uses", by T. C. Crawhall, M.Sc. H.M. Stationery Office, 6d. net.

Presented by the Publishers.

"Diesel Engine Combustion Research", by A. F. Sanders. Diesel Engine Users Association.

The American Society of Naval Architects and Marine Engineers. Index to Transactions, Vols. 1 to 38, years 1893 to 1930.

British Engine Boiler and Electrical Insurance Co., Ltd.'s Technical Report for 1935.

The following British Standard Specifications:

No. 394-1936. Short Link Wrought Iron Crane Chain.
No. 684-1936. Analysis of Fats.
No. 686-1936. Analysis of Coal Ash and Coke Ash.
No. 687-1936. Ultimate Analysis of Coal and Coke.
No. 693-1936. Oxy-Acetylene Welding as applied to Steel Structures.
No. 698-1936. Papers (Unvarnished) for Electrical Purposes.
No. 702-1936. Silicon Aluminium Alloy Castings for General Engineering Purposes.
No. 703-1936. Y-Alloy Castings (as cast) for General Engineering Purposes.
No. 704-1936. Y-Alloy Castings (Heat Treated) for General Engineering Purposes.

Transactions of the North-East Coast Institution of Engineers and Shipbuilders, Vol. LII, containing the following papers:

"By Air and Sea to the Antarctic Whaling Grounds", by Christensen.

"The Development of the Heavy-Oil Engine for Ship Propulsion", by Hawkes.

"Shipbuilding by Welding", by Hunter and Townshend.

"The Theory of the Bulbous Bow and its Practical Application", by Wigley.

"Notes on the Development of Tug-boat Machinery during the Past Forty-six Years", by Baird.

"The Relation of Laboratory Research to Engine Design", by Hauttmann.

"The Protection of Ships' Hulls against Marine Corrosion", by Lewis.

"Friction of Piston Rings", by Hawkes and Hardy.

"The Wake and Thrust Deduction of Single-Screw Ships", by Telfer.

"New Cargo Steamers: Efficiency Problems", by Batey.

"The Modern Locomotive", by Irving.

"Modernizing the Motorships 'Silverpine' and 'Silverlarch' and Increasing Their Service Speed", by Thompson.

"Examples in Practical Mathematics", by Leonard Turner, F.S.S. Edward Arnold & Co., 96 pp., illus., 1s. 6d. net.

This small book contains 600 examples grouped in 30 sections suitable for second year (senior) students who are preparing for a National Certificate at a technical school. The author attains the object he has in view, and we can recommend the book as suitable either for students to supplement the examples set in class or as a supply of useful exercises for teachers to set.

"An Introduction to Engineering Mathematics", by D. McMullin, B.A., and A. C. Parkinson, A.C.P. (Hons.), F.Coll.H. Cambridge University Press, 266 pp., illus., 4s. net.

This book is intended primarily for the use of students of practical mathematics in so far as it comprises a subject taken in the first year of the senior technical courses, established in technical colleges and institutes.

It would be very difficult to justify the necessity of another book on this subject with so many already available, but the authors have succeeded, with one exception, in laying out the work in a simple yet concise manner. We must, however, take exception to Chapter XVII, which falls below the excellence of the remainder of the book. The inclusion of trigonometrical identity on page 190 before a student can have fully grasped the meaning of a trigonometrical ratio is out of place. The method of using the trigonometrical tables is not explained, although exercises are set requiring their use. We find that the use of the cypher before the decimal point makes for clearness, but throughout the book the authors are very inconsistent in its use. With these exceptions the book is highly satisfactory, containing many very useful illustrations and we can recommend its use.

"Practical Mathematics for Marine Engineers", 2nd edition, by H. H. R. Daish, J. H. Sword and W. Embleton. T. Reed & Co., Ltd., 184, High Street West, Sunderland, 788 pp., illus., 18s. 6d. net.

This is a book written for students preparing for First and Second Class B.O.T. Certificates. The second edition is a reprint of the first, with new matter added to meet the present standard of these examinations. The chapter on strength of materials has been enlarged and problems relating to stresses induced in compound bars and oblique sections are dealt with. Electricity and the combustion of fuel provide the subject matter of two new chapters. The principles involved are explained very clearly, but these chapters could have been extended; they meet the requirements of the examinations but no more. "Atomic Weight" should have been defined, several values are given and examples involving the use of the term are solved to show their application, but the student is left to infer the meaning of the term.

Test papers are set at the end of each chapter, also specimen examination papers for each grade of certificate. Solutions are given for all of these problems. This appears not only unnecessary but harmful. The text matter has been prepared very carefully and the principles involved explained so clearly and simply, that students of average ability should experience no difficulty in understanding them. When the solutions to problems are given the tendency is for students to pay more attention to them than to the text matter.

The book can be recommended to junior engineers. It fulfils its object admirably. If used in the correct manner a knowledge of the groundwork of the various subjects dealt with will be acquired that will prove very beneficial to those who wish to continue their studies for the higher qualifications.

"A Textbook of Physical Chemistry", by S. J. Smith, M.A. Macmillan & Co., 342 pp., 164 illus., 5s. 6d. net.

The increasing importance of physical chemistry is significantly illustrated by the book before us, which, while written with the requirements of the Higher Schools and University scholarships in view, may be regarded as a valuable introduction to a vast subject which has developed profoundly since the appearance of Nernst's classical treatise. We are not, we think, wronging the majority of students when we assert that they regard physical chemistry as a formidable rock of offence, possibly because they have been confronted by the monograph or the larger treatises at too early a stage. The author's style and wise discrimination make the subject fascinating, and will cause the student to extend his reading, having realised that this study is warp and woof of all systematic chemistry.

In nineteen chapters, covering 342 pages, the book deals, *inter alia*, with molecular and atomic weights, elementary kinetic theory, solutions, chemical reaction, osmosis, colloidal state, electro-chemistry, thermochemistry, indicators and catalysis, the balance between theory and practice being well maintained, while a judicious selection is made of the technical application of catalysis in Chapter XVII.

The recent changes of view on such subjects as valency and ionisation make the textbook treatment of these matters difficult, but the author has presented alternative points of view with lucidity. The mathematical investigations, which are very clearly set out, require no more from the reader than an elementary knowledge of the calculus. The publishers are to be congratulated on the production of the volume. In our opinion the book fills a gap and supplies a need in chemical literature.

"Freak Ships", by Stanley Rogers. John Lane, The Bodley Head, 244 pp., 110 illus., 8s. 6d. net.

"Freak Ships" is a most interesting book, covering as it does a field of research for which the ordinary man has too little time, i.e. investigation of the genesis and practical outcome of a large number of curious basic ideas, upon which enterprising ship designers have concentrated attention from time to time.

Some of the ideas were born of necessity; some were inspired by false ideas upon subjects of which the science of the time had not provided sufficient information, while others might reasonably be termed absolute freaks.

Study of the various designs outlined in the book provides opportunity for reflection, and is instructive even to those who may be regarded as experts in marine engineering and shipbuilding.

The late Mr. James S. Milne.

Portrait by] *[Blank & Stoller.*

OBITUARY.

Mr. James S. Milne.

It is with deepest regret that we record the death of Mr. James S. Milne who, at the age of 69, passed away after a prolonged illness on Monday, September 7th, at his residence at Brooklyn, New York.

A native of Scotland, Mr. Milne served his apprenticeship with Messrs. Alexander Shanks & Son, of Arbroath, and subsequently went to sea in the service of the Red Star Line. He quickly obtained his Board of Trade certificates and in nine years had risen to the position of chief engineer with this Company. Amongst the vessels in which he served later was the celebrated American Line flagship "St. Louis". Retiring from active service at sea in 1897, he joined the Newport News Shipbuilding and Dry Dock Company as guarantee engineer and assistant superintendent, in which post he was connected with the construction and operation of many well-known steamships. In 1899 he was appointed general superintendent of the old Neafie and Levy Company of Philadelphia, where he was in charge of the construction of the U.S.S. "St. Louis", the cruiser "Denver" and the original destroyers "Bainbridge", "Barry" and "Chauncey". With the dissolution of this firm in 1906, he became marine superintendent, under the late J. J. Tynan, of the old Union Iron Works of the Bethlehem Shipbuilding Corporation, where he remained until 1916, when his services were in great demand during the wartime shipbuilding activity. In 1917 he became associated with the late William H. Todd as an executive with the Todd Shipyards Corporation, a post he filled with distinction until 1926, when he entered business for himself in New York as a consulting marine engineer.

Mr. Milne made a host of close friends and business associates in New York, by whom he was held in the highest esteem for his dependable personal qualities and professional ability. Amongst those who are familiar with his work it is felt that the industry has suffered a distinct loss.

In 1929 he was appointed Vice-President for New York, and he continued to represent The Institute in this capacity without interruption until the time of his death. With unflagging keenness and energy he did much to further the interests of The Institute in the New York area, and his death leaves vacant a place which will be difficult to fill.

Mr. Milne, who was also a Member of the American Society of Naval Architects and Marine Engineers, is survived by his widow, five daughters and two sons.

This book, which is moderately priced, is well worth reading, although one would not regard it as of permanent textbook value.

" Mechanical Tests for Engineering Materials". by A. M. Roberts, B.Sc. Draughtsman Publishing Co., 89 pp., illus., 4s. net.

This publication is a useful addition to the literature on the testing of materials, and should be of special use to engineers and designers who have had little or no opportunity of gaining first-hand experience in testing methods and apparatus. A concise description of the various methods of testing commonly used in commercial practice is given, together with explanations of the principles of the testing machines used.

An indication of the scope of this pamphlet is obtained from the fact that the following tests are dealt with:—tensile, bend, hardness, impact, transverse tests on cast-iron, fatigue, creep, tests on welds, and tests on sand and cement. A valuable chapter is included which deals with testing procedure in connection with the requirements usually found in specifications for various typical forgings and castings of carbon and alloy steels. The pamphlet is not merely descriptive, and the author has some interesting comments to make on the various tests described. He also discusses the significance of the test results obtained.

It is evident that the author is well equipped to deal with the subject of mechanical testing, and it may be said that the pamphlet which he has produced comprises a very useful compilation of facts and figures concerning the commercial testing of engineering materials.

"An Elementary Survey of Modern Physics", by Gordon Ferris Hull, Professor of Physics, Dartmouth College. The Macmillan Company, New York, 457 pp. illus., 20s. net.

In these exacting days the marine engineer is so busily occupied with the many urgent problems that beset him within his own sphere of work that he has little opportunity to keep abreast of the rapid and ever widening march of discovery in the realm of pure physics. Much as he would like to acquaint himself with this new mysterious world within the atom—that infinitely hard and indivisible pellet of his schooldays—he knows by hard experience that there is no short road to real knowledge, and time forbids.

The author of this alluring book has done much to shorten that road and beguile the way. The very title of the opening chapter, "Molecules—in Swarms", is full of rich promise and at once excites a desire to read; and that promise is well fulfilled. Here we may read easily of electrons and protons and photons, quantums and neutrons, of X and gamma and cosmic rays, of disintegrating collisions and catastrophes upon atomic battlefields. There are chapters on X-rays, electrical phenomena in gases and solids, radio-activity and the transmutation of the elements, relativity, and others of equal interest. The final chapter deals with some "Modern Applications of Physics". The book covers an immense field and, to quote from its title, nothing more than an "elementary survey" is possible. The reader is never involved in abstruse theory: results are stated and the author indicates the manner in which they have been obtained by experiment and the mathematical application of fundamental physical laws.

The work, which throughout is profusely illustrated by line drawings and photographs, should ably serve a dual purpose—that of enabling the educated general reader to acquaint himself with the results of modern physics, and that of providing an introductory course for those who intend to proceed to a deeper and more specialised study of the subject in one or more of its many branches.

"Thermodynamics", by Lester C. Lichty, McGraw-Hill Publishing Co., 281pp., illus., 18s. net.

The author has aimed at a book to simplify the treatment of a subject which, hitherto, has been rather over-treated by many mathematical manipulations, which so often led the student away from fundamental thinking.

The work is produced on a sound, logical basis, and an attempt is made to establish a better balance between vapour and combustion processes.

The internal combustion engine process is treated as a combustion process, and the liberation of chemical energy in a mixture of fuel, air and clearance products is dealt with. The range of the subject matter is as found generally in a good thermodynamics book of the degree standard, but there is a feature throughout, of diagrammatic explanations of heat flow, which gives a freshness greatly enhancing its value. The total energy tables are at a slight variance with the up-to-date Callender steam tables, which produces a slight zero error, by neglecting the energy of injection of the water. The treatment of entropy is excellent, and should be helpful to many who have found this matter difficult when starting.

A number of worked questions appear throughout the book, together with a graded collection of examples at the end of each chapter, but the answers to these are not supplied. A series of useful charts, viz., Mollier diagrams for ammonia and water and $T-\theta$ diagram for CO_2, together with combustion charts for octane and kerosene, are to be found at the end of the book. The work has a bias on the pure thermodynamics side rather than on heat engines, although there are some good applications of this subject to engineering processes. The book is of American origin, but there is little to distinguish it from the work of a good English author, and any student who grasps the contents of this volume will possess a sound knowledge of thermodynamics.

ABSTRACTS.

The Council are indebted to the respective Journals for permission to reprint the following abstracts and for the loan of the various blocks.

Steam and Motor Endorsements.

BOARD OF TRADE NOTICE M. 151.

The Board of Trade have decided as from the 31st August, 1936, to reduce by three months the periods of service at present required for endorsements of Engineers' Certificates of Competency. Section 40 of the Regulations relating to the Examination of Engineers in the Mercantile Marine will now read as follows:—

The holder of an Ordinary Certificate may have it endorsed to the effect that he is competent for service in the appropriate capacity in motor ships, provided that he proves at least six months' service in foreign trade or equivalent service (in the ratio indicated in Sections 33 (*b*) and 37 (*b*) in a qualifying capacity in motor ships of horse-power not less than that required by these Regulations, and passes the appropriate examination. The holder of a Motor Certificate may have it endorsed for service in steamships provided that he proves at least nine months' service in foreign trade or equivalent service (in the ratio indicated in Sections 33 (*b*) and 37 (*b*) in a qualifying capacity in steamships of horse-power not less than that required by these Regulations and passes the appropriate examination.

Sea service performed in charge of a watch in vessels of the required horse-power by the holder of a Second Class Certificate, either Ordinary or Motor, will be accepted as qualifying for First Class Endorsement of either denomination, provided that in the case of an Ordinary endorsement the necessary experience has been gained on both main engines and boilers of a steamship.

The "Queen Mary's" Record Crossing.

"The Engineer", 4th September, 1936.

In our last issue we recorded the fine performance of the Cunard White Star liner "Queen Mary", which, on her westward voyage, made the crossing between the Bishop Rock and the Ambrose Lightship, a steaming distance of 2,907 miles, at an average speed of 30·31 knots, the time being 4 days 0 hr. 27 min. Within a week of making that record passage the "Queen Mary" has, on her eastward return voyage, made the shortest time taken by any ship between the same two points. On Sunday evening, August 30th, she passed the Bishop Rock at 8.12 British summer time, having taken only 3 days 23 hr. 57 min. for the passage. The "Queen Mary's" average speed for the voyage of 2,939 miles was 30·63 knots, compared with 30·31 knots for the previous record passage of 3,015 miles which won for the "Normandie" in June last year the Blue Riband of the North Atlantic. The "Queen Mary" won the laurels in spite of fog over the Scilly Islands and the Channel. In the course of interviews granted at Southampton, on the arrival of the ship on Monday, Sir Edgar Britten, her commander, said there was no vibration, even when the ship averaged 31 knots for the twenty-four hours; while the chief engineer, Mr. M. L. Roberts, conveyed the impression that even though high record speeds were attained, the full horse-power of the propelling machinery was not utilised. Speaking in Liverpool on Monday, August 31st, Sir Percy Bates, the chairman of the Cunard White Star Company, said that the data acquired during the record round voyage of the "Queen Mary" would be of great research value in connection with the design and construction of "No. 552", her sister ship.

Shortage of Engineer Officers.

"The Engineer", 18th September, 1936.

In the newly issued report of the Officers (Merchant Navy) Federation, Ltd., reference is made to the shortage of engineer officers. It is stated that owing to increased activity in the engineering industry ashore, combined with the general unsatisfactory conditions obtaining at sea, there are indications of an approaching shortage of sea-going engineer officers. There are also indications that an attempt will be made to persuade the Board of Trade to lower the standard of competency in the examinations for certificated engineers in order to increase supply. The Federation is watching the matter vigilantly, and it is hoped that the collaboration of the Marine Engineers' Association may be forthcoming if a concerted endeavour is found necessary to counter such proposals. The Council expresses the opinion that, provided pay and conditions at sea are improved, there is an adequate number of engineer officers available for employment in the shipping industry. Any suggestion that the standard of competency be lowered, to the financial benefit of shipowners, is, in the opinion of the Council, in effect, simply a suggestion to invite increased claims on underwriters, and possibly to lower the standard of safety at sea. With regard to the merchant navy in relation to defence, it is suggested by the Federation that arrangements should be made for every merchant officer to go through a thorough course in the self-defence of merchant ships. Such a course should embrace gunnery (including anti-aircraft), depth charges, smoke screening, and specially station keeping and convoy organisation, and anti-gas precautions. Every British merchant vessel likely to form part of a convoy should be fitted with a bridge and engine room telephone and with a revolution indicator on the bridge. Experience in the last war proved the value of range-finders on merchant ships, and it is suggested by the Council that the fitting of this valuable navigational instrument should be encouraged for national reasons.

Geared Diesel-engined Coasters.

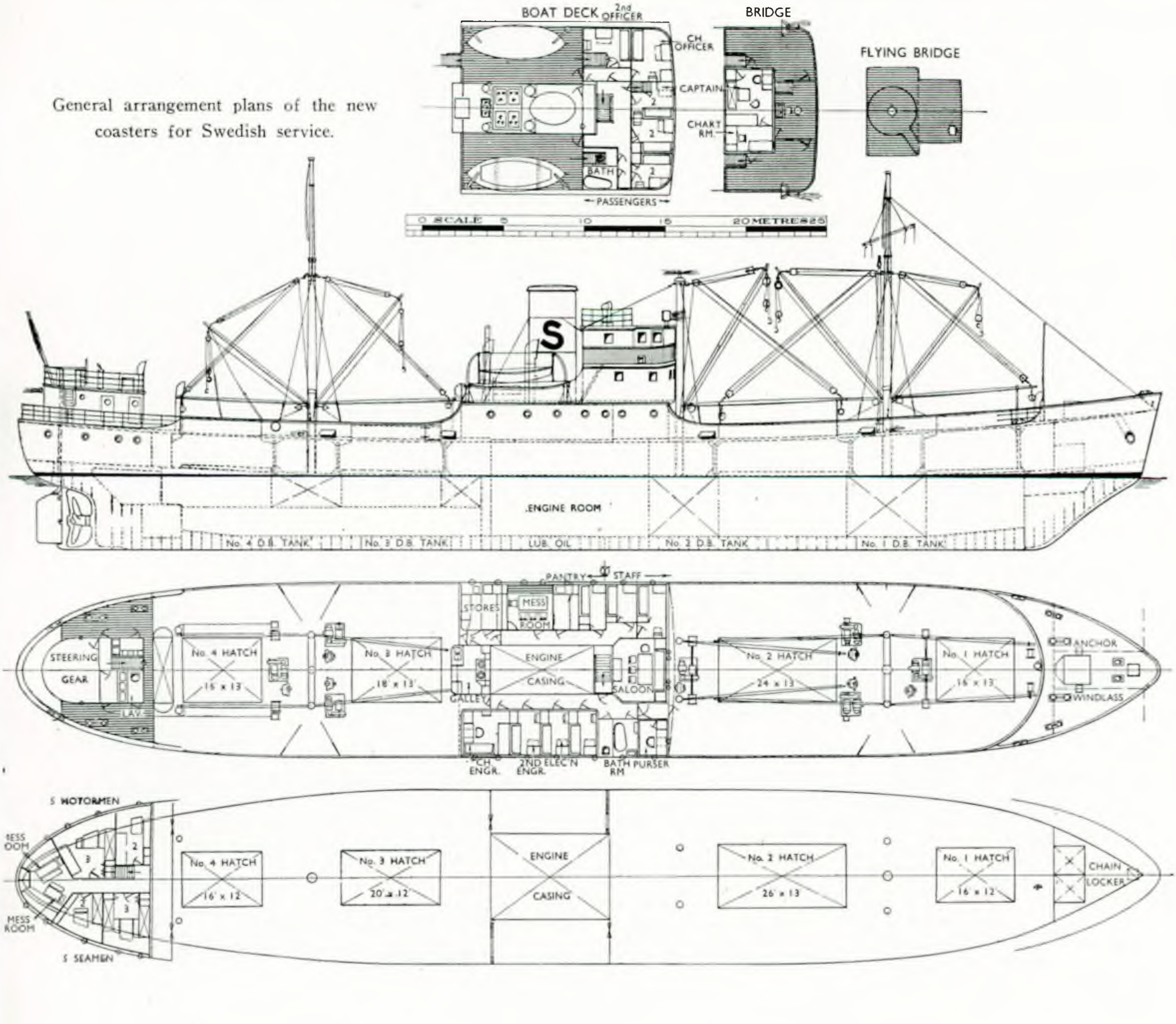
"The Motor Ship", October, 1936.

The interest which Swedish and other shipowners have lately taken in the application of gearing to motor ships in conjunction with the magnetic *type of slip* coupling recently developed by A.S.E.A. is well known to readers of this journal. There are eight or nine such ships now building, most of them fairly large cargo vessels, but two of the most interesting are for the Stockholms Rederi Aktiebolaget Svea's coastal service, under construction at Oresundsvarvet, Landskrona, Sweden.

The leading characteristics of the new ships, of which plans are published, are given in the table :—

Length b.p.	218ft.
Breadth moulded	35ft. 6in.
Draught	15ft. 1in.
Corresponding deadweight capacity ...	1,250 tons.
Machinery power	1,360 b.h.p.
Speed when loaded	13 knots.

With a view to navigating in ice, the stem is 15 per cent. over normal dimensions and the rudder



General arrangement plans of the new coasters for Swedish service.

head approximately 20 per cent. The stem is of cast steel. The ships are of the open shelter deck type built to Lloyd's highest class.

In order to provide maximum deck space, the deckhouse amidships is shortened as much as possible. The accommodation provides for six passengers on the boat deck, consisting of three-two-berth staterooms.

There are two holds and four hatches in the shelter deck, having a width of 13ft., the respective lengths, from forward, being 16ft., 24ft., 18ft., and 16ft.

Two standard Polar Diesel engines are installed, both being directly reversible and each designed to develop 700 b.h.p. at 300 r.p.m. They have four cylinders with a diameter of 340 mm. and a piston stroke of 570 mm. They drive a single propeller at 130 r.p.m., the slip couplings between the engines and the gear being of the A.S.E.A. magnetic type, as we have indicated. The power at the propeller shaft is 1,360 b.h.p., the loss in the coupling and gearing being thus 40 b.h.p.

Two three-cylinder two-stroke Polar engines of 120 b.h.p. are installed, each driving an 80-kW. 230-volt generator at 500 r.p.m. For the purification of the fuel oil, a De Laval separator is provided, also one for the lubricating oil. The two settling tanks have a capacity of $3\frac{1}{2}$ tons. The air compressor is rated at 1,200 litres per minute. A 75-ton piston-type ballast pump, a 30-ton bilge pump and a spare water-circulating pump for the main engines are electrically driven. An oil-fired donkey boiler with a heating surface of 57 sq. ft. and a working pressure of 80lb. per sq. in. is fitted for heating the accommodation.

The ship is provided with 10 3-ton derricks and one designed to lift 10 tons.

Piston Rings in Service.

Reducing Wear and Breakage.

"The Motor Ship", October, 1936.

The problems associated with cylinder-liner and piston-ring wear still remain the subject of much controversy and speculation, despite the amount of research undertaken in this direction. For this reason, an account of the experiences in service with a set of pistons over a period of eight years should prove of interest. For the sake of clearness in following the troubles encountered with the rings, and the steps taken to overcome them, the facts are set out briefly in chronological order.

The pistons in question were 3ft. in diameter, with a speed of approximately 915ft./min., and were fitted in two-stroke single-acting engines. Lubrication was by means of a ring of six individually fed points.

Originally eight plain, or Ramsbottom, rings were fitted in each piston, each ring being $\frac{5}{8}$in. in width (rubbing surface) and $1\frac{3}{32}$in. deep. During the first 18 months in service the rings gave trouble through wear and breakage with the top four. Breakage of the top ring became increasingly frequent towards the end of this period, and wear was evident in the groove lower landing. A consequent loss of compression pressure caused no little inconvenience. The liner wear was moderate and of the order of 0·001in. per 1,000 miles.

A number of the pistons were now fitted with a double-seal type of ring in the top groove. These rings were made slightly oversize to $\frac{5}{8}$in., on account of the wear in this groove. They proved unsuccessful, however, breakages increasing rapidly, leading to the conclusion that the ring in itself was too light for the duty imposed upon it. At the same time the top ring grooves became damaged, in some cases to a considerable extent. The period during which these rings were fitted was of too short a duration to obtain reliable liner-wear data.

Owing to the damaged condition of the top ring grooves it was decided to dress them out. This operation was accordingly carried out, and a double-seal ring of $1\frac{1}{8}$in. width, or rubbing surface, fitted to each piston so treated. These continued in service, for a period of about three years. At first breakage of the top ring was considerably reduced, but continued to cause a certain amount of trouble. In common with the plain rings, this defect became very much more pronounced as time went on. At the same time the damage caused to the groove was intensified, owing to the heavier section ring. During this period, too, the liner wear increased abnormally in most cases. It was the latter point, in common with the breakages, which led to the introduction of a further idea.

Plain Rings Over Double-seal Rings.

A groove was machined in the piston immediately above the double-seal ring. This groove was fitted with a plain ring $\frac{3}{8}$in. in width, or rubbing surface, and $1\frac{3}{32}$in. deep. A number of pistons being so treated, it was observed that the plain ring undoubtedly proved of value in protecting the double-seal ring, and so prolonging the life of the latter. However, very little difference was observable in the liner wear, and it was soon noticeable that the top plain ring became either carboned up and stuck fast in the groove or fractured.

The four top grooves in a number of pistons were welded up and new grooves machined $\frac{3}{8}$in. wide. The pistons so treated now contained four top rings $\frac{3}{8}$in. wide by $1\frac{3}{32}$in. deep, the five below being of the original standard dimensions, $\frac{5}{8}$in. by $1\frac{3}{32}$in. The first consequence noted with this new arrangement was a definite improvement in the rate of liner wear. In one case the liner wear was $\frac{1}{10}$in., and remained at exactly this figure after about six months' service with a piston so fitted. However, breakages still occurred, although with less frequency, but accompanied by a very considerable loss of compression pressure.

To obviate the latter defect a $\frac{5}{8}$in. wide double-seal ring was fitted in the bottom, or ninth groove. This proving of use in preventing such a heavy drop in compression, one or two more of these rings were substituted for the plain $\frac{3}{8}$in. rings in the lower grooves.

False Rings for the Top Grooves.

To sum up, several useful conclusions may perhaps be drawn from the foregoing account. Throughout, the greatest source of trouble consists of the constant breakages. It would appear that these are in some measure dependent upon (1) wear in the groove, and (2) the section of the ring itself. As the dressing out of the grooves in a piston of this size is a costly process, an amendment to the original design is indicated. This might consist of carrying the top two or three working rings in false rings built into, and firmly secured to, the piston. These false rings could then be renewed, as their grooves became worn, at a comparatively small cost.

The very considerable reduction in liner wear, consequent on the fitting of lighter-section rings, points to one at least of the reasons for the former. It thus seems that wear in this direction can be definitely controlled by the size of the ring fitted. It is highly probable that gas pressure behind the ring plays an important part in such wear, as the double-seal ring as then fitted had a slight gap open to the ingress of gas on the power stroke. The results observed with the $\frac{3}{8}$in. wide by $1\frac{3}{32}$in. deep ring point to the conclusion that the lighter the ring section in proportion to its depth in the groove, the less is the wear occasioned on the groove landings.

Finally, some form of special sealing ring or rings in the lower grooves of the piston, to obviate a loss of compression pressure, would appear to be most desirable. L.J.H.

A New Aircraft Altitude Record.

"The Engineer", 2nd October, 1936.

A new world's high altitude record for aeroplanes was set up on Monday last, September 28th, by Squadron Leader F. R. D. Swain, a test pilot at the Royal Aircraft Establishment at Farnborough. Elsewhere in this issue a description of the machine and equipment is given. The flight lasted 3hr. 20min. and a height of 49,967ft. was reached, an improvement of 1,269ft. on the previous record. The attempt began at Farnborough aerodrome at 7.30 a.m. After climbing in circles to a height of 40,000ft., Squadron Leader Swain commenced a straight-line climb on a south-easterly course. At 45,000ft. he was about 10 miles north of Brighton. Here he encountered a strong north-westerly wind. At 46,000ft., looking downward, he found that his visibility extended along the coast from Margate to Land's End, and northward almost to the Wash. The coast of France and the Channel Islands were also visible. The pressure suit became cumbersome in its expanded condition at this height, and slight cramp in the pilot's arm developed. The machine, it is stated, reached its absolute ceiling some time later when in the vicinity of the Bristol Channel. The downward glide was then begun. After losing 5,000ft. altitude the window of the pilot's helmet began to get misted and the cockpit cover frosted over completely, making it impossible to see the ground or the instruments. Continuing his glide in a easterly course he began to feel sensations of suffocation, and concluded that the oxygen supply was failing. He attempted to open the cockpit roof, which, however, would not work. He then tried to pull the zipcord of his suit, but found it impossible to do so owing to the harness which he was wearing. Weakness was increasing, but he made a final effort and with the aid of a clasp knife slashed the window of the helmet. Revived by the fresh air, he found that his altitude was 14,000ft., and his position near Yeovil. Shortage of petrol was also revealed, and accordingly he made a landing at Netheravon, whence, after a rest, he was flown back to Farnborough.

Whitworth Society Summer Meeting.

"The Engineer", 25th September, 1936.

The Summer Meeting of the Whitworth Society was held this year on September 16th and 17th on Tyneside. It began with a dinner at the Royal Station Hotel, Newcastle, where, in the regrettable absence through indisposition of the President of the Society, Professor E. G. Coker F.R.S., the chair was taken by Mr. Charles Day, Past-President. After the dinner Mr. Day inducted the President for 1936-37, Sir Henry Japp, M.Inst.C.E., into the chair. The programme on the second day was a full one. The members embarked on the "Sir William Stephenson", kindly placed at their disposal by the Tyne Improvement Commission, and after journeying upstream to inspect the five Newcastle bridges, the vessel proceeded downstream to Wallsend, where the party landed for a visit to the works of the North-Eastern Marine Engineering Company, Ltd. There the members saw some new triple-expansion reciprocating steam engines, employing poppet valves on the H.P. and I.P. cylinders, and using highly superheated steam with heat interchanges between expansions, and also some new single-acting oil engines fitted with exhaust-turbo superchargers. Thereafter the members re-embarked and proceeded down river to North Shields, completing an inspection of some 12 miles of river front. The journey was continued from North Shields by motor coach, via Tynemouth and Cullercoats to Whitley Bay. After lunch the party returned by road to Newcastle for a visit to the works of Michell Bearings, Ltd., where the party was entertained to tea by the company.

*Choice of Career.

"The Engineer", 25th September, 1936.

A pamphlet on Engineering in the "Choice of Career" series has just been published by the

* See also a review of a book "Planning your Career" in The Institute Transactions for April, 1936, page 115.

Ministry of Labour. It is pointed out in it that new developments, which have been and still are proceeding rapidly, are bound to introduce elements of risk as to prospects, but generally speaking progress and ultimate success depend upon individual initiative and capacity. The pamphlet covers a wide field and contains special sections devoted to such diverse branches as manufacturing or production engineering and naval architecture. The qualifications required, both personal and educational, the methods of entry into the profession (by apprenticeship, after technical college training, or after university training), the nature of the day-to-day work of the various branches, the scholarships, certificates, and diplomas obtainable, and, finally, the pay and prospects in each branch, are all clearly stated. The prospects for women in engineering are also dealt with. The price of the pamphlet is 6d.

New Stork-Hesselman Two-Stroke Diesel.

A Single-acting Engine of Moderate Power is Described.
"Gas and Oil Power", August, 1936.

For a number of years the Dutch firm of Stork Brothers, Hengelo, have been well known as makers of large two-stroke cycle marine diesels—usually of the double-acting type—while latterly they have also turned out smaller engines of the four-stroke cycle type. Recently the firm has introduced a comparatively small two-stroke cycle trunk-piston engine suitable for the propulsion of small craft; the engine should also be suitable for stationary duties. Prior to commencing the construction of this new type of engine, Stork Bros. engaged extensively in the manufacture of single-acting four-stroke engines with an output up to 800 b.h.p. for driving generators and pumps for land installations as well as for the powering of small craft such as coasters and vessels for inland waterways; they are also used for generator driving on board large ships.

As the result of the very satisfactory performance obtained with Stork-A.E.G.-Hesselman double-acting engines, it was decided to design a special type of two-stroke engine for small and medium outputs in which would be incorporated some of the features of the larger type.

In the standard type here described an output of 80 b.h.p. per cylinder is developed at about 310 r.p.m. with a mean piston speed of about 960ft. per minute, which to-day is considered moderate. These engines are constructed in units of five, six, seven, and eight cylinders developing, at the speed mentioned, 400, 480, 560, and 640 b.h.p. respectively.

The results obtained with these engines have

Piston and connecting rod, scavenging blower rotors, cylinder covers and cylinder liners for the new Stork engine.

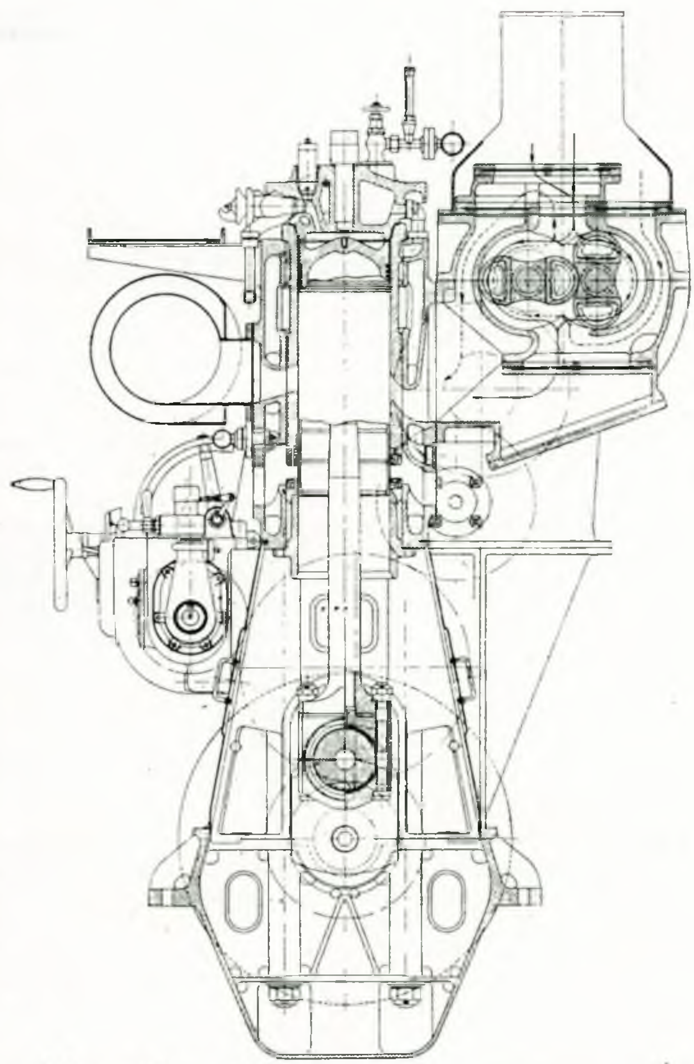
been good, their great simplicity of operation and low cost of operation being excellent features.

The accompanying sectional drawing clearly shows the special design of the combustion space and the centrally situated fuel valve. Cooling of the fuel valve is effected by means of fuel oil.

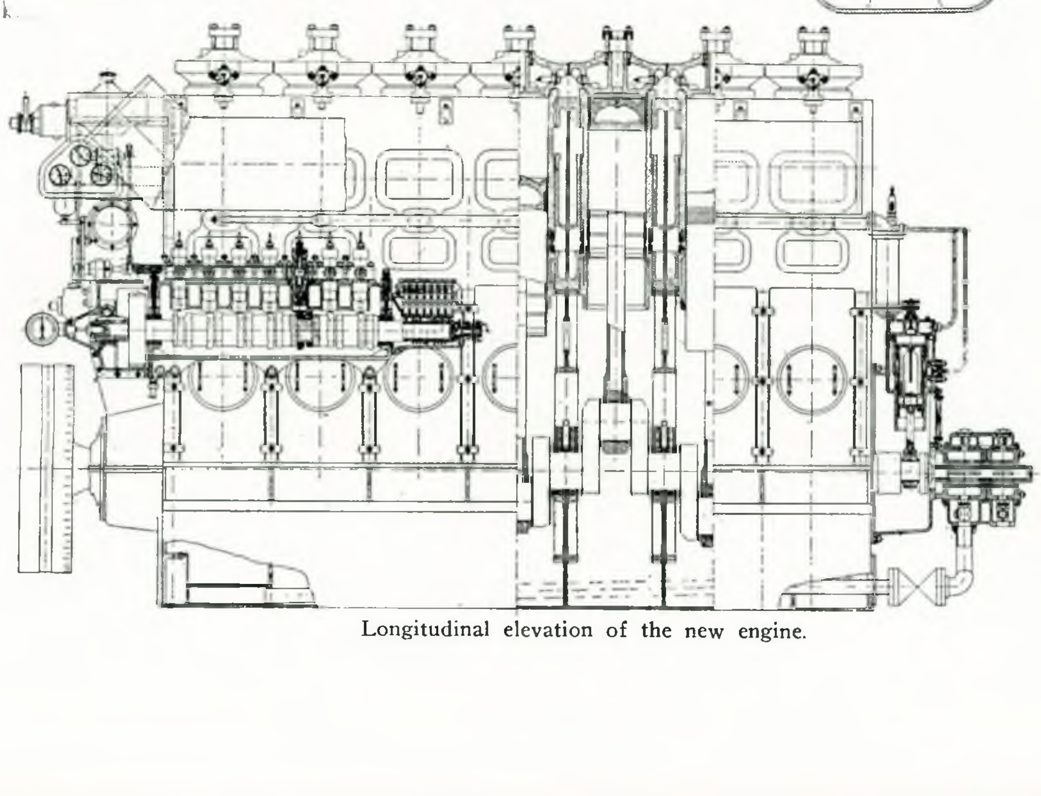
Fuel, air starting, and relief valves are situated in the cast-iron cylinder head. The cylinder liners are made of special Perlit cast-iron, these being bored and afterwards ground; the scavenge and exhaust ports are carefully milled.

The liners are held in position by the cylinder covers, whilst the bottom ends of the cylinder liners are introduced from below and are fixed in position by means of bolts in the crankcase. An opening is left between the upper portion of the cylinder liner and its lower portion in the crankcase through which the piston may be observed while running. This enables close supervision over the pistons being maintained while in operation.

Two sets of scraper rings, one in the cylinder space and one in the crankcase, ensure proper gas-tightness in both directions. An advantage claimed for this method of construction over that of the normal trunk piston two-stroke cycle engine of "low construction" is the fact that a low temperature is maintained in the crankcase due to its being entirely separated from the combustion space. This effectively prevents the formation and escape of oil vapour. Another advantage is that no combustion gases can enter the crankcase, and consequently pollution of the oil in the crankcase is avoided.



Transverse section, showing the location of the blower adjacent to the scavenge ports. The interesting liner construction will be noted.



Longitudinal elevation of the new engine.

Long Piston Used.

The long length of the piston will be observed, which gives a larger ratio between connecting rod length and crank length, resulting in much lower thrust pressures due to the larger available piston area. This is claimed materially to reduce liner wear which is said to be less than is the case with trunk-piston engines of lower construction. The ratio between connecting rod length and crank length is, in the case of the Stork single-acting two-stroke cycle engines, 5¼ to 1, as compared with the usual ratio of 4½ to 1.

The construction of the piston is such that a long bearing surface for the gudgeon pin, attached to the connecting rod, is obtained. Piston pressure is taken up by the full length of the gudgeon pin, ensuring low surface pressure, whereby lubrication by means of the engine's main system of lubrication is sufficient for this part. The gudgeon pin has been so designed that it may be easily taken apart and the small end is adjustable.

Long through bolts connect the cylinder block to the engine bedplate. The combustion loads are taken up by these through bolts, and no stresses are set up in the material of the cylinder block and the cast-iron columns. Between the columns at the front as well as at the back of the engine easily removable oil-tight sheet iron inspection covers are fitted. The removal of these covers leaves inspection spaces of such dimensions that the pistons may easily be withdrawn from underneath.

This method of construction has the undoubted advantage that the withdrawal of the pistons does not necessitate the removal of the cylinder covers with their fittings, and the breaking of pipe joints.

Roots-type Blower.

As already stated, the scavenge blower is of the rotary displacement type. As the drawing indicates, the blower housing is adjacent to the scavenge ports. When reversing of the engine takes place air for scavenging is drawn into the blower on the original pressure side and the delivery takes place on the original suction side of the blower. By means of a combination of automatic valves and air flow channels the direction of the air flow is always maintained constant. This arrangement obviates the necessity of slide valves operated by the manœuvring gear. An amply dimensioned suction chamber, which also acts as an air silencer, ensures a noiseless air intake directly from the engine room. The scavenging pressure is approximately 1,100mm., and the blower has been so arranged that it has an excess capacity of 60 per cent. For lightness the rotors are made of silumin. The rotor shafts of the blower are driven from the crankshaft by means of gearwheels and chains which also operate the camshaft. A flexible coupling is interposed between tthe driving shaft and the rotor shaft. The short camshaft, which is driven from the crankshaft, is entirely enclosed. On this shaft the fuel cams are arranged for ahead and astern running, and on the end of this shaft besides the fuel cams are placed the cams actuating the air-pilot valve plungers of the self-acting starting-air valves. All these parts are lubricated from the engine's main lubricating system. Over this housing are placed the fuel pumps, one for each cylinder and connected to the fuel valves by means of steel pipes.

Starting.

The starting of the engine and the regulation of the fuel supply are controlled by means of a single lever. Underneath this lever the main starting air valve is situated. The reversing of the engine is effected separately by means of a handwheel.

In the case of the larger units, reversing is done by means of a servomotor operated by compressed air. The throttle lever, through a regulator shaft, controls the fuel supply, the shaft being connected up with the governor.

The setting of the governor may be altered to function at any given number of revolutions by means of a geared handwheel.

For lubrication purposes, in the case of the smaller two-stroke cycle units, a spur gear-operated lubricating oil pump is arranged in the front of the engine, driven off the crankshaft, as are also the starting-air compressor, a plunger water-circulating pump and also a bilge pump.

The pump plungers and the starting-air compressor are driven from the same crank.

The fuel oil consumption is 170 gr. per b.h.p. per hour in the case of the smaller units, and 168 gr. (which is equivalent to approximately 0·37lb. per b.h.p. per hour) for the larger units.

The Diesel Engine for Navigation on the Rhine.

A Continental expert's observations on an interesting subject with which the diesel is intimately concerned.

"Gas and Oil Power" September, 1936.

The "Neue Zurcher Zeitung" recently published a special edition devoted to navigation on the Rhine; it contained several articles prepared by leading men connected with Rhine navigation companies and also by others interested in promoting development of this type of transport. Mr. Louis Groschupf, director of the Basle Rhine Navigation Company, dealt particularly with the question of extending navigation up to the Lake of Constance and to Zurich. He wrote as follows :—

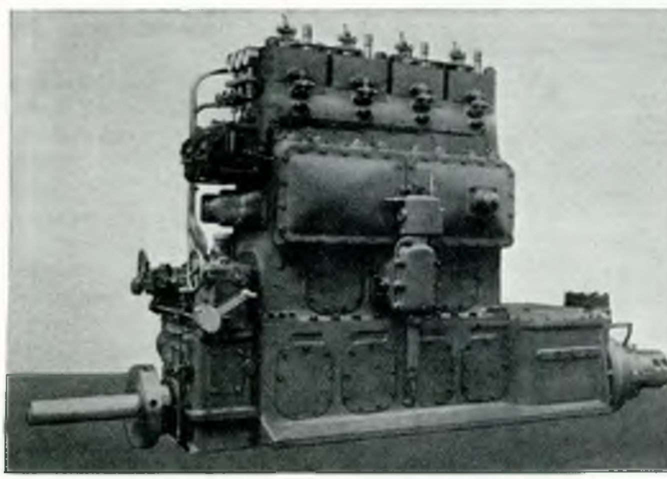
"Basle, Lake of Constance. The bulk of the traffic will not stop at Basle. The port of Basle will continue to serve North-western Switzerland. The traffic to Eastern Switzerland and to the industrial region round Zurich will be developed from Basle along the waterways.

"Navigable waterways to the Lake of Constance and—by the Aar and the Limmat—to Altstetten, the port of Zurich, will only be realised by constructing hydro-electric power works along the Rhine, with locks for passing the dams. The dimensions of such works on the rivers above Basle should be sufficient to permit direct navigation from the North Sea and the Ruhr territory up to the Lake of Constance.

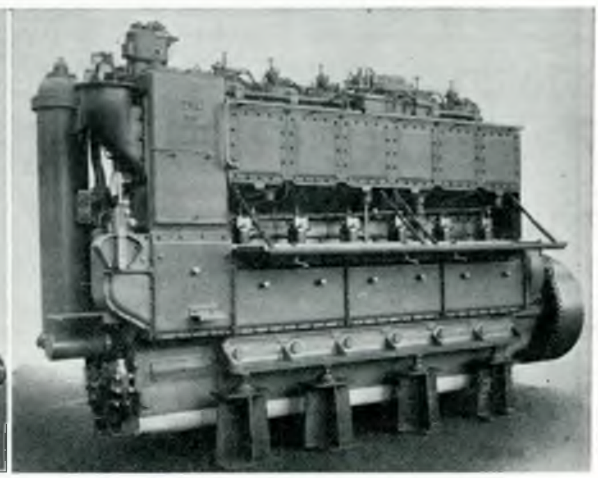
"Projects for regulating the Rhine up to the Lake of Constance are in existence. They have been prepared in connection with a competition for plans to render the Rhine navigable beyond Basle, which was kept open from 1913 to 1920 by the League for the Navigation on the Rhine at Constance, the Association of North-eastern Switzerland for the Navigation on the Rhine and the Lake of Constance at St. Gallen, and the Society of Navigation on the Upper Rhine at Basle. These projects were based on the idea of constructing locks for towed lighters, with a length of 450ft. and a width of 39ft., with the necessary mooring facilities above and below them. Between Basle and Constance 16 of these locks would be necessary. Work carried out in this manner would allow of the passage of lighters of 1,200 tons. The annual traffic should be about four million Swiss francs. The cost of construction is estimated at about 100 million Swiss francs. Until recently, the idea of rendering the Rhine navigable by means of large locks for towed lighters was considered the only possible solution. But the continuously increasing number of cargo boats on the Rhine propelled by their own Diesel engines has raised the question as to whether the use of self-propelled lighters would not allow the Rhine to be made navigable at a much lower cost and still be equally sufficient for the traffic.

"I am of the opinion that the navigation of large vessels on the Rhine up to the Lake of Constance will only be realised when the high initial expenditure for the constructional work required between Basle and the Lake of Constance—estimated, as has been said, at 100 million Swiss francs —can be reduced by designing locks, etc., of greatly reduced dimensions, bring the expenditure down to the neighbourhood of about 50-60 million francs. This would seem to be possible if the use of modern self-propelled lighters is considered, and this type of lighter should certainly suffice for a great number of years for all traffic requirements on the river.

"In every department of transport great changes have been brought about by the adoption of the Diesel engine. In marine navigation, the steamer is more and more giving way to the motorship. In inland navigation the Diesel-engined lighter has great advantages over the system hitherto used, the towed lighter.* The Diesel-engined lighter is undoubtedly the vessel of the future for navigation on the Upper Rhine. It will probably be because of it that the Rhine from Basle to the Lake of Constance can be rendered navigable at an expenditure not exceeding 50-60 million Swiss francs. Such a sum, to be divided between the two countries adjoining the river, Germany and Switzerland, should easily be found, even in such critical times as the present. The advantages given by navigation with motor vessels, extended up to the Lake of Constance, will justify the expenditure of each of these two countries from the economic point of view. The objection that the existing motor boats would not suffice to deal with the expected traffic cannot be upheld. The Upper Rhine will be rendered navigable for future requirements; and the result will determine the dimensions of the lighters. For example, the dimensions of the canal from the Rhine to Herne, opened in 1914 led to the building of the 1,350-ton lighter, which is to-day the predominant type on the Rhine. There is no doubt that when the Rhine is made navigable up to the Lake of Constance the development of the motor lighter on the Rhine, which is already well advanced, would tend to accelerate, so that when the new waterway was opened, a sufficient number of these vessels would be available for the traffic. In this connection there is the example of the canal from the Rhine to the Rhone



Sulzer two-stroke cycle crosshead-type engine of 165 b.h.p. at 500 r.p.m. with inbuilt reverse gear.

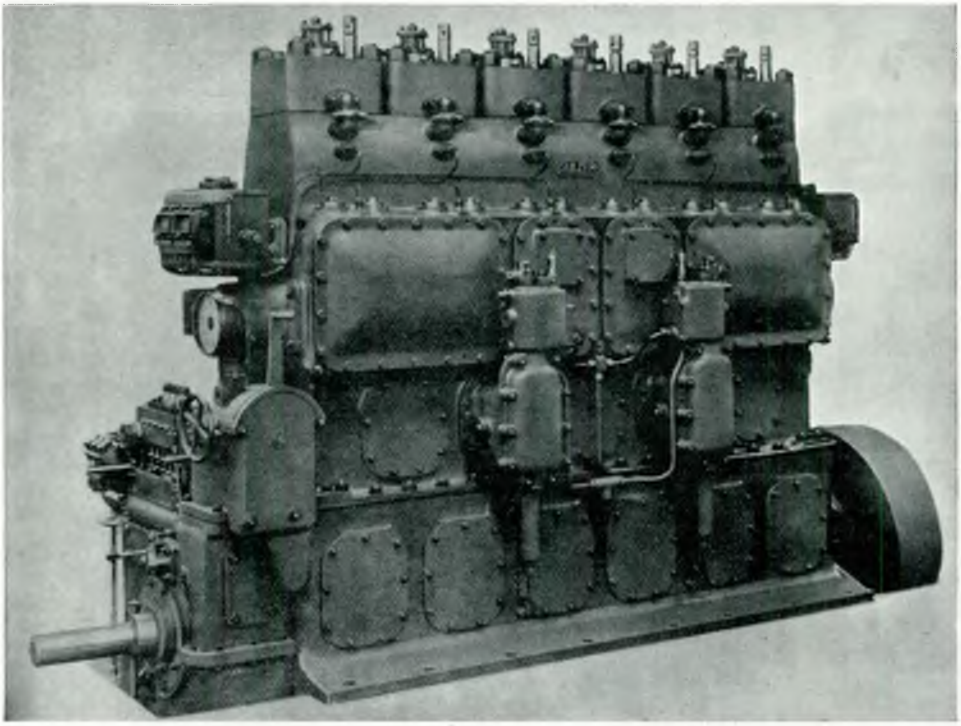


Sulzer two-stroke cycle trunk-piston directly-reversible engine of 700 b.h.p. at 340 r.p.m.

* In this connection it may be mentioned that Sulzer Brothers have up to the present supplied more than 160 Diesel engines, totalling more than 25,000 b.h.p., for navigation on the Rhine. These engines are installed in lighters, passenger boats, and tankers, and have always worked to the entire satisfaction of the owners.

between Strassburg and Basle, which with its 53 locks 126ft. long and 16ft. 6in. wide, deals with about 1,200,000 tons of goods per annum. Navigation up to Basle dates from 1924. In the short period of eight years the shipowners have created, on an economic basis, almost the entire fleet, which is composed mostly of motor vessels.

"Basle-Zurich.—Navigation up to Zurich (port of Altstetten) will depend on rendering the Rhine navigable from Basle up to the mouth of the Aar. Here, also, it is necessary to consider the possibility of direct traffic, without any trans-shipment, from the North Sea and the Ruhr up to Zurich. With regard to the section between the Rhine and Zurich, projects and definite estimates prepared at the request of the Zurich municipal council already exist for the improvement of the Limmat. It is intended to provide locks large enough for a self-propelled lighter of 500 tons, i.e., about 210ft. long and 28ft. wide. The cost is estimated at 32½ million Swiss francs. The short distance along the Aar, between the Limmat and the Rhine, would require the construction of two locks, of the same dimensions as the foregoing, near the hydraulic power stations of Döttingen-Klingnau and Beznau; the cost of carrying out this part of the work is estimated at about 4 million Swiss francs.



Crosshead-type direct-reversing two-stroke cycle engine of 275 b.h.p. at 500 r.p.m.

"Investigations have shown that navigation up to Zurich is only possible with modern motor vessels. Estimates of the traffic which would at first enter the port of Zurich vary between 300,000 and 750,000 tons per annum. In my opinion, the first of these figures appears rather low. Already in 1932 the port of Basle dispatched 526,000 tons of goods to the territory which would be served by the future port of Zurich. The transport of about 500,000 tons per annum would suffice to cover interest charges and depreciation and also the expense of maintaining the waterway. If the traffic should increase to about 700,000 tons per annum, the amount saved in freight, in comparison with the present tariff rates of the Federal Railways, could be estimated at about 3 million Swiss francs. Calculating with the present tariffs of the Federal Railways from Basle and other German-Swiss frontier stations, and with the tariff rates of the Federal Railways from the future ports of Brugg and Alstetten-Zurich, the region interested in the waterway of the Aar and the Limmat is bounded approximately by a line passing through Döttingen-Klingnau-Bülach-Winterthur - Bauma - Uznach - Weesen - Ciornico - Meiringen - Lucerne-Aarau.

"It is evident that the traffic on the Aar-Limmat waterway would reduce the traffic on the Rhine above Koblenz-Säckingen, but investigations made by experts of the city of Zurich have shown that to sail large lighters right up to Zurich would be more advantageous for the Zurich industrial region than to be served from a port on the Rhine above the mouth of the Aar.

The Railways and Navigation.

"In all projects for rendering the Rhine navigable beyond Basle, it is necessary to take account of the fact that the waterway in the interior of Switzerland will enter into competition with the Federal Railways, just as navigation on the Lake of Constance will compete with the German Railways. From the point of view of national economy, navigation on the Rhine is only justifiable if it can continuously offer, on a sound economic basis, substantial advantages in comparison with the existing national network of railways. This can only be the case if the capital invested in the waterway earns sufficient interest and can be written off, directly or indirectly, by the charges for services rendered or by economies effected in transport, and if in addition it shows further real advantages in comparison with the railways.

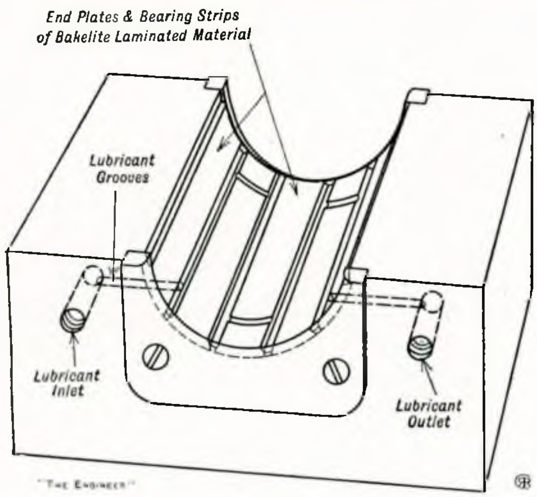
"This programme could only be realised by modern navigation on a large scale on a waterway constructed without any great capital outlay. That is one of the reasons why the existing projects for navigation will have to be revised. An objective examination of the results of the existing means of navigation up to Basle allows the conclusion to be drawn that navigation by motor vessels, up to Zurich as well as to the Lake of Constance, would be justified from the point of view of economy and would also bring further great advantages in comparison with existing means of transport."

Laminated Bakelite Bearings.

"The Engineer", 11th September, 1936.

Bearings manufactured from laminated fabric material have been successfully applied to heavy rolling mill plants for some six to eight years. The majority of these applications have been installed in the U.S.A. and Germany, and recent trials in English rolling mills have confirmed previous successes elsewhere. The conditions under which bearings in rolling mills have to operate are very arduous, and any means whereby increased life, reduced replacement charges, and decreased power consumption are obtainable would be welcomed.

To this subject Bakelite, Ltd., of London, has given considerable thought and attention. It has been found that special laminated materials manufactured from carefully selected fabric impregnated with Bakelite synthetic resin, produce a more perfect bearing material than has hitherto been known. This material possesses strength, density, smooth bearing surface, high load-carrying capacity, high impact resistance, and non-scoring properties. These features, it is claimed, produce a bearing material which is practically frictionless, and gives a much longer life than metallic bearings. Generally, one of the most successful methods of fitting bakelite laminated materials to bearings is to machine a standard metal bearing housing with deep grooves, approximately 2in. wide by ⅜in., running coaxial with the centre of the bearing. Into these grooves are introduced strips of bakelite laminated material, and the built-up bearing so formed is machined to size and end plates are fitted to prevent excessive leakage of lubricant and to take up any side thrust. This design, it is claimed, is a cheap and easy method of assembly where the introduction of a completely moulded or solid block of bakelite material would be a costly matter. Also the question of renewals is very much simplified. In a built-up bearing of this description the final machining operation ensures that a perfectly fitting bearing surface is produced, and also any moulded surfaces which remain are removed, thereby allowing the frictionless properties to become apparent immediately on installation. In smaller applications it may be more suitable to install blocks of material machined to size.



Laminated bakelite bearing.

The question of lubrication is very important, and has been solved in a comparatively simple manner. In the case of a bearing made from bakelite laminated material, the conditions are somewhat different from those in an ordinary bearing. The material, while largely frictionless, has, compared with metal, a low thermal conductivity. The frictionless features make an expensive lubricant unnecessary, but the low thermal conductivity demands that the lubricant shall be in sufficient quantities to remove the friction heat generated. The most satisfactory lubricant for all speeds and loads up to 4,000lb. per sq. in. has been found to be water mixed with a water soluble oil, free from acid and alkali. Bearings carrying loads of 2½ tons to the sq. in. have been reported to give good service and to be performing very satisfactorily. In special cases where the presence of oil is undesirable, water alone is stated to be equally satisfactory, although in this case roll necks need to be greased before shutting down, and the loads should not exceed 2,000lb. per sq. in. Lightly loaded bearings with small velocities can be kept cool by conduction through the shafts. The accompanying engraving indicates the method of assembly and shows the arrangement adopted for obtaining adequate lubrication.

The results which have been reported following the replacement of standard metal bearings by bakelite laminated material have, we are informed, been very encouraging. In all cases the power consumption has been reduced considerably, the reduction varying from 40 to 60 per cent. In many cases the life has been extended to ten times that of the previous metal bearings. Other possible applications of fabric bearings include propeller shafts and other underwater bearings, paper manufacturing machinery, and pumps handling all kinds of liquids, including most acids and mild alkalis.

Piston Heads for Large Two-stroke Diesel Engines.

A correspondent discusses various aspects of design and suggests a built-up welded steel construction.

"The Marine Engineer", October, 1936.

The design of cast-iron piston heads for two-stroke cycle engines is becoming more difficult with the increasing diameter of cylinders and the high mean effective pressures used at the present time.

Piston crowns, with increasing diameter of cylinder, must be made thicker to withstand the working load and consequently the stresses due to heat are increased. On the other hand, if the piston crown is made thin it must be supported by ribs, thereby restricting its deformation which again causes high local thermal stresses. Convex piston heads are better able to resist the working load and consequently may be made thinner, thus reducing the heat stress. At the same time they can expand more freely, which again reduces the heat stresses. Unfortunately this type of piston head does not readily lend itself to an efficient combustion space, although one or two builders of large Diesel engines have adopted this type of piston head with good results.

The concave piston head on the other hand, gives a good combustion space, but the metal on the combustion side cannot expand as freely as with the convex type, and also the crown must be made thicker to withstand the working pressure, resulting in a higher temperature of the piston crown with a consequent greater expansion. This expansion in short, stiff pistons, causes heavy loading of the piston head studs, which either break or stretch; if, on the other hand, the studs are sufficiently strong, cracks may occur in the piston heads usually through one of the ring grooves, as shown in Fig. 1. The crack commences from the water side and works out over until the circumferential wall is cracked right through for about half the circumference. The stress in the wall is then considerably relieved. When this occurs the leak of the circulating water into the cylinder causes further serious trouble as some time may elapse before it is noticed, especially if the ship is on voyage. The alternative, of course, would be to make the piston head much deeper so that the stretch of the studs is reduced and at the same time greater flexibility is allowed in the circumferential wall, as this deeper wall has the same expansion of the crown to contend with as has the short wall.

It is common practice to make the piston studs a good length so that the piston may distort without unduly straining the studs. This method does get over the difficulty to a certain extent, but there is still a fair number of broken studs and cracked piston heads. Further, due to the difference in temperature between the combustion side and the water side, the piston crown lifts in its efforts to expand and creates a bending moment between the crown and the wall, resulting frequently in a crack at the corner as shown in Fig. II. In addition, with the concave type of piston head, the metal at the corner where the crown joins the circumferential wall becomes very thick, with the result that a high temperature of metal at this point is obtained.

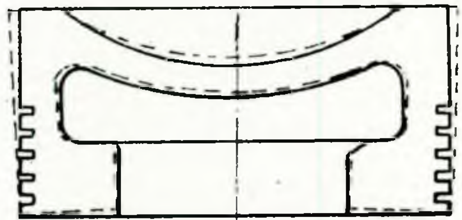


FIG. I

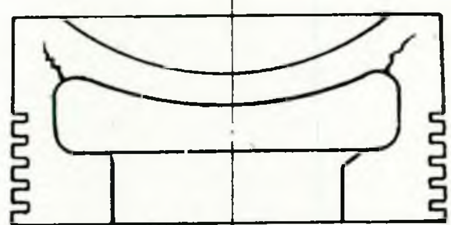


FIG. II

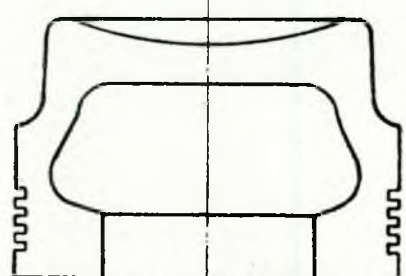


FIG III

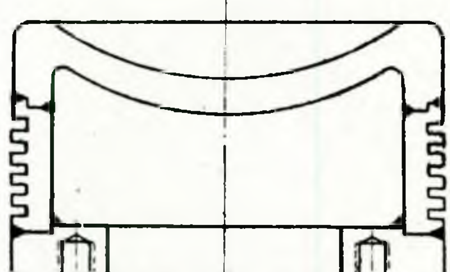


FIG. IV.

FIGS. 1-4.—Illustrating the author's remarks on piston design.

This high temperature metal, being in very close proximity to the cylinder wall, may accentuate the burning of the lubricating oil, which would have some effect on the cylinder liner wear. In the case of piston heads for two-stroke engines as shown in Fig. III, where the crown is shaped to give direction to the scavenging air stream, the thick metal is probably too great a distance away from the cylinder wall to have much effect. This thick metal becomes very hot, especially in line with the exhaust ports, and frequent cracking occurs at this point. It would appear, therefore, that there is a definite limit to the size of cast-iron piston head if a reasonable margin of safety for the material is to be allowed.

Forged or Cast Steel.

At the present time, quite a number of large Diesel engine builders have adopted forged or cast steel for piston heads, while others are experimenting with them. Cast steel, although allowing a greater latitude in design than does forged steel, has the disadvantage that good homogeneous castings are not readily procurable. Forged steel, due to its greater ductility, is even more suitable than cast steel, but it is somewhat difficult to design a piston head of this material at a reasonable cost, especially in view of the fact that something should be done to prevent excessive wear in the piston ring grooves, as it has been found that the ring grooves in mild steel pistons wear more rapidly than those in cast-iron pistons. It is also necessary to protect the internal surface of the piston against corrosion where salt water is used for cooling. One method adopted for preventing this corrosion is hot galvanizing, but it is possible that the zinc coating would be destroyed should the piston crown become excessively hot due to a stoppage in the cooling system. Another method which may be tried is the process known as Fescolising, which is an electrically-deposited coating of nickel or some other non-corrosive metal. With oil as a cooling medium, however, no protection is necessary. Regarding the wear in the piston ring grooves, a number of engine builders favour the fitting of a cast-iron ring in the bottom of each groove, the ring being secured to the piston. Fescolising the bottom of the grooves may also be worth trying, as a very hard metal can be deposited by this process.

A further advantage of steel is that it is not liable to crack due to an inflow of cold water into the piston after a temporary stoppage in the cooling system, and again, the ductility of steel offers a high resistance to fatigue.

It does not appear to be good practice to make the piston crown too thin, as a cool surface is not the best for efficient combustion; therefore it would appear that the ideal arrangement may be a hot top and a cool circumferential wall. In other words, the centre of the crown fairly thick, and the wall no thicker than is necessary to take the maximum load with a reasonable factor of safety. The steel piston head should not be allowed to come into contact with the cylinder liner, and to ensure this, a cast-iron ring should either be fitted to the head or the piston head be made a smaller diameter than the skirt.

Forged Steel Costly.

Forged steel piston heads up to the present time have been machined from the solid, which is a costly process. One prominent maker of Diesel engines recently stated that he felt quite justified in making them this way, because they were one of the most important parts of the engine. Unfortunately, however, cost is an important factor with Diesel engines, and every effort should be made to reduce it consistent, of course, with reliability. With this in view, would it not be worth while building up a piston head by welding? Welding has now reached a very high stage of excellence and has proved itself for Diesel engine framing construction. Such a composite type of steel piston would be much less costly than one machined from a solid steel forging. The circumferential wall could then be made from a flat plate or slab, rolled to the diameter required and welded at the joint, the material being of a harder nature than the crown so as to be better able to resist the wear in the piston ring grooves. The crown and the bottom flange taking the studs could be cut from a steel slab by an oxygen cutting machine, which construction is cheaper than a forging, and finished machined on the inside and rough machined on the outside. The parts could be then welded together, as shown typically in Fig. IV. The bottom inside joint would be welded before the crown was fitted, and the final machining done after assembling.

In conclusion, it would appear that cast-iron pistons, due to their lower margin of safety, are not the ideal type for Diesel engine cylinders of large diameter. Cast steel, if the castings were absolutely reliable, would be more suitable, while pistons machined from solid forgings appear to be entirely satisfactory, but costly. Steel pistons built up by welding should not be much inferior to forged steel pistons, and would cost much less to manufacture. Development along these lines may be the best solution of the problem.

Protective Rubber Covering for Propeller Shafts.

By Y. Taji, M.Eng.

"The Marine Engineer", October, 1936.

For the protection of exposed propeller shafts against corrosion and erosion various processes have hitherto been introduced, including brass sleeves, patented oil-lubricated stern tubes, cloth or rope protective wrappings, protective painting, etc. In special cases in recent years, the Fescolising process, electrolysis eliminators, and vulcanized rubber covering have been adopted. In accordance with the Japanese government regulations for ship inspection, propeller shafts protected by brass sleeves and oil-lubricated stern tubes are required to be inspected every third year, while those with cloth or rope windings or protective painting must be examined every second year. This obviously shows the official recognition of the superiority of the first two methods, but from the economic viewpoint they can only be used in the superior class of vessel.

Brass sleeves are very expensive and difficult to keep absolutely satisfactory for large diameter shafting, while the original tightness, even under perfect conditions, has often been impaired after a time. Particularly is this the case when a number of sleeves are joined together in order to attain a required length, for the sleeve frequently opens up at the joints. Furthermore, in view of the weight and the galvanic action with the hull, this form of protection cannot be considered as ideal for the purpose.

The oil-immersed gland was developed some twenty years ago, but it has not been widely adopted, probably due to the running expense in addition to a comparatively high initial cost and the possibility of oil leakage.

The cloth or rope winding idea may be sufficient to protect the shaft from corrosion, provided the wrapping is carefully done, but such materials often break down and cause some difficulty in extracting the shaft from the stern tube. Besides, re-wrapping of the shaft is necessary every alternate year in accordance with the regulations, the labour and material cost thus being considerable.

Protective paint for an exposed shaft is not wholly satisfactory under continuous running conditions, as the life of paint under such conditions is comparatively short and it is liable to be scraped off by drifting wreckage, etc. Therefore, the time allowance for the inspection is shorter in these last two cases, which makes them economically unfavourable.

The Fescolising process and electrolysis eliminators are not yet well-tried in this field, while the initial expense would be fairly high; also special arrangements are necessary for re-Fescolising or replacement in these cases.

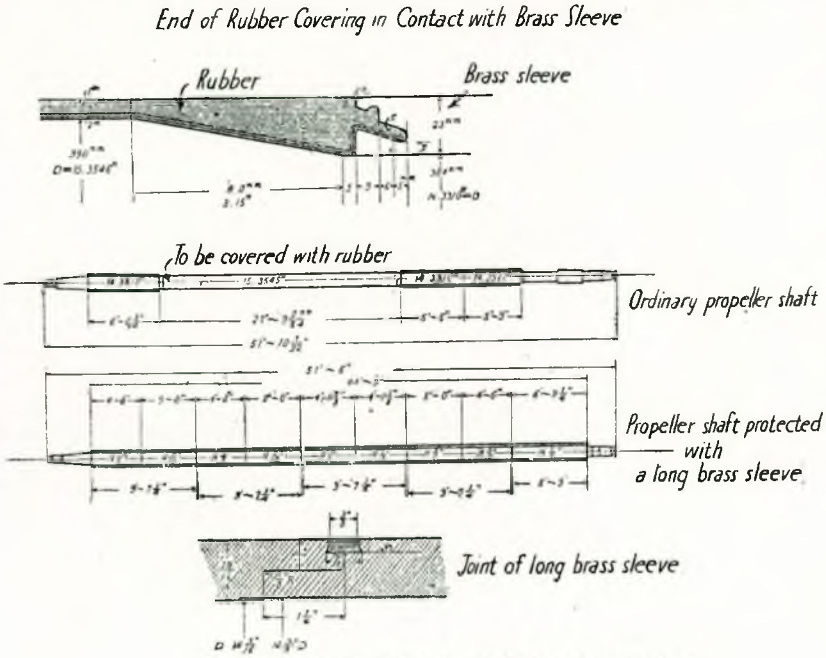
The vulcanized rubber covering process has been well devloped in Japan and has hitherto been restricted to naval vessels. Recently, however, it has been applied to commercial vessels, the first being the large propeller shafts of the ice-breaking passenger ship "Soya Maru", of the Imperial Japanese Government Railways; this vessel was built in the Yokohama Dockyard.

The history of the protective rubber covering dates back to the Russo-Japanese war period, when two Russian armoured cruisers sunk by Japanese gunfire at the outbreak of the war were later raised and it was found that their propeller shafts were covered with india-rubber, doubtless for protection

Preparing the shaft for heat-treatment in the shops. Shafts for the "Soya Maru". One is finished and ready for installation. The starboard shaft of the vessel after treatment.

against corrosion. The idea being very interesting, the Imperial Japanese Navy started an independent investigation, and the propeller shafts of the torpedo boat "Kiji" were, as a result, experimentally covered with vulcanised rubber, under a special process, in 1909. When these shafts were carefully examined after the lapse of fourteen years, it was found that the surface of the shafts had their original brilliant lustre after removing the covering, whilst the coverings themselves showed only very slight damages and defects. This excellent result has induced the Japanese Navy to adopt this process for the shafts of submarines and special service vessels.

In the latest practice, the protective covering is prepared from special rubber sheets prepared from pale crepe rubber or smoked rubber sheets to which are added suitable quantities of sulphur, colouring material Agelite (or other anti-ageing compound) and other chemicals which furnish the required strength, elasticity and anti-fouling properties. The hardness of rubber varies radially in the finished covering, this being mainly controlled by the percentage of sulphur and the time required for the sulphuration. The final hardness for the shaft covering is generally specified to be 80 - 90 (by a Shore's durometer) and a permanent set under a plastmeter of 0·1mm. at 0·54mm. of deformation. The finished material used for the shafts of the "Soya Maru" has a mean maximum tensile strength of 8,064·5lb. per sq. in., and a mean elongation of 2·8 per cent. for the ebonite part near the steel shaft surface, while in the outer layer of elastic rubber, 1,209·0lb. per sq. in. tensile and 181·5 per cent. were recorded, the material being tested in a Schopper's tension testing machine.



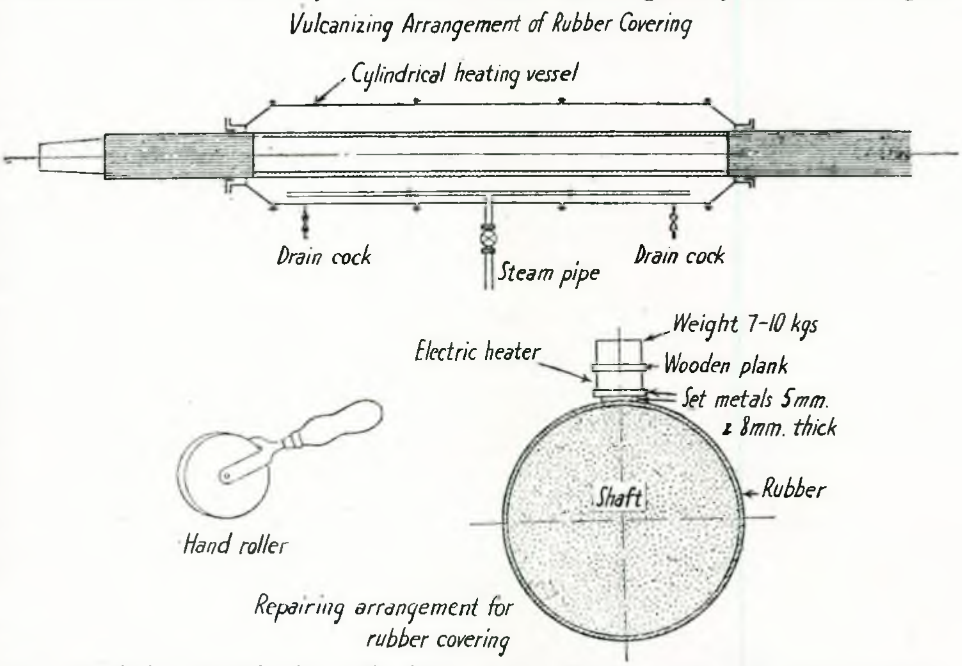
Sketches showing details of shaft and covering.

General properties specified for the protective rubber covering of shafts are: (*a*) the material and surfaces should be homogeneous and plain, without air holes or other defects, and should fit tightly against the steel surface of the shaft, and not contain any harmful element likely to cause corrosion of the steel surface; (*b*) the material should be not only suitable to protect the shaft from corrosion, but also should maintain perfect tightness with the steel surface notwithstanding the expansion and contraction of the shaft due to any abrupt change of sea water temperature; (*c*) the covering being painted with anti-fouling paint, the material should not be affected by such painting; (*d*) the covering consisting of two layers, the inner layer should be of ebonite quality which firmly connects the outer layer and the metal surface of the shaft, while the outer layer should be quite tough for the protection of the surface from damage; (*e*) the ends of the covering should be tightly fitted to the stepped grooves made in the shaft sleeves in order to prevent the penetration of sea water into the contact surfaces.

The "Soya Maru", referred to above, has a gross tonnage of 3,560 tons, and her propeller shafts are the largest in diameter ever protected by this process, the shafts having a diameter of 390 mm. (about 15in.) and a length of 15·8 metres (about 52ft.); they transmit a normal total power of 5,500 s.h.p. The vessel runs between Karaft and Hokkaido and encounters thick ice in winter time; the hull is suitably reinforced to break ice of over 10ft. thick. The rubber material for her shaft covering was supplied by the Meiji Gum Company, and the work was carried out by six workmen despatched from this company to the plant of the Yokohama Dock Company, where the ship was built and engined.

The shafts were first rough machined, shallow spiral grooves being left around the surface, and the parts of the brass sleeves in contact with the rubber covering were coated with solder in order to make a tight fit with the covering at the ends. The part of the shaft to be covered with rubber was first steam-heated in a special cylindrical vessel to a temperature of 258° F., and a pressure of 20lb. per sq. in. in order to remove all harmful materials on the surface, such as oil, grease, dirt, etc., and then the shaft was left to cool. After removing all traces of rust from the cooled shaft by means of emery cloth, it was painted with a thick solution of ebonite material in benzine, and was left for about one hour until the benzine had completely evaporated. A 1 mm. thick rubber sheet of ebonite quality with a width equal to half the circumference of the shaft, and of a length equal to that to be protected, was stretched along the shaft and firmly pressed so as to adhere to the surface, air bubbles being completely removed by means of hand rollers while the shaft was turned by shop cranes. The other half of the shaft was similarly treated.

A second layer was then placed on the first layer after having first wiped the surface of the first layer with benzine. The seams were arranged at right angles to those of the first layer and great care was taken to see that all air bubbles were expelled from between the sheets. In this way four layers of rubber sheets were placed around the shaft, giving a total thickness of about 4 mm. Before the sulphurating operation, this rubber-covered shaft was tightly bound with wet cotton tape of about 5in. width. Wet canvas tape of the same width was then applied to the surface, a final covering of tightly bound 12-gauge steel wire completing the covering. This last operation was carried out by revolving the shaft in a large lathe, the work requiring two days.



How the shaft is heated prior to the fitting of the rubber covering, and, below, how the sleeve can be repaired.

When the work described above was completed, the shaft was placed in a cylindrical heating vessel and exposed to a steam heat for about two hours under a pressure of about 20lb. per sq. in., and then for about seven hours at about 50 to 60lb. per sq. in. of steam pressure in order to attain the complete sulphuration of the rubber sheets. After the completion of this treatment the shaft was taken out from the heating vessel and the binding wires and tapes were removed and both ends of the covering material carefully adjusted to make a good fit with brass sleeves of the shaft.

Four more layers of rubber sheets of somewhat different constitution were placed on such treated rubber covering in the same manner, and the cloth tape and steel wire winding and heat treatment were carried out as explained before; thus a total thickness of 8 mm. of solid rubber covering was obtained.

The result was very satisfactory, and the surface of the covering showed a hardness of about 87 by Shore's durometer, whilst the hard ebonite layer was gradually made toward the inner surface. In this way the hardest part was near the metallic surface and the softest part at the outer surface of the covering. In the case of a smaller shaft or a hollow shaft, the bindings and heat treatments need not necessarily be carried out twice. In fact, some of the hollow shafts of naval vessels have been treated by a single heating operation, with all the layers of rubber fitted at the same time with tight bindings over them.

The shaft covering of the "Soya Maru" was carefully examined in dry dock after six months' service under the worst possible sea conditions of a severe winter, including heavy ice, and no significant damage or defect was found in the covering. On the question of effecting repairs to this rubber covering in the event of damage, the affected part should be at once bound with strong cloth tape in order to prevent further extension of such damage, and should be carefully examined when the vessel is docked. If a part of the metallic surface of the shaft is exposed, the rubber at that part should be removed and the steel surface polished with carborundum cloth. After wiping the surface with cloth soaked with benzine, specially prepared gum solution is applied. Then, rubber sheets, cut to the size of the damaged part, are firmly stuck on the surface, using hand rollers. These patches are piled up to a height somewhat greater than the original rubber covering surface, paraffined cloth or paper being placed upon this, together with a metal set. The part is then heated by steam or with an electric heater, upon which a wooden plank and a heavy weight are placed, in order to give a pressure upon the patch. The material is first heated up to about 150 to 160° C. for about 2 to 2½ hours, in order to unite the repairing material with the original covering. Such repairing materials can conveniently be stored on board ship.

The actual cost for the rubber covering of the propeller shafts of the "Soya Maru" and the estimated cost for brass sleeves for the same shafts are Yen 13,168 and Yen 16,650 respectively, the corresponding weights per shaft being 14,699 kgs. and 15,759 kgs. respectively. Thus a saving of about 21 per cent. in cost and about 6·8 per cent. in weight were attained in comparison with brass sleeves. The writer is greatly indebted to Mr. T. Morisawa, the late manager of the marine department of the Imperial Japanese Government Railways, for giving the full information on the shaft coverings of the "Soya Maru", and also to Mr. F. Tsutiya, the chief engineer in the Yokohama Dock Co., Ltd., where the fitting of the rubber covering was carried out.

The Blue Riband.

Some Observations on Recent Performances of the "Queen Mary" and "Normandie".

By V. D. Wethered, B.Sc.

"The Marine Engineer", October, 1936.

It is very satisfactory that, given the necessary weather conditions, the "Queen Mary" was able to put up the record speed for the trans-Atlantic crossing by such a good margin. Her performance was all the more convincing in that she won new laurels for the Cunard White Star line by beating all previous records on both the outward and homeward runs. On the round trip finishing on August 30th she steamed altogether 5,846 miles at an average speed of 30·38 knots. On the outward voyage the distance of 2,907 miles between Bishop Rock and Ambrose Light was covered at an average speed of 30·14 knots, while on the return journey between the same points the vessel ran 2,939 miles to give a speed of 30·63 knots, thus winning the Blue Riband of the Atlantic from the "Normandie", whose fastest run was accomplished last year in an easterly direction at 30·31 knots. Actually, the times taken by the "Queen Mary" on the westbound and eastbound passages respectively were 4 days 0 hrs. 27 min., and 3 days 23 hrs. 57 min. Thus it is that the Atlantic has been officially spanned on the sea for the first time in history, in less than four days, when the "Queen Mary" improved on the best performance of the "Normandie" to the extent of 3 hr. 31min.

An apposite observation.

Although it was only right and natural that every Briton took an enthusiastic interest in the capabilities of the "Queen Mary", and expected of her a better performance than that hitherto put up by the "Normandie", the subsequent observations of Sir Percy Bates, chairman of Cunard White Star Ltd., should suffice to prevent anything in the nature of trials of speed in the future, and useless competition between the British and French lines. He deprecated what might conceivably degenerate into racing of the motor track variety, and one is in accord with his view that it would be preferable to have no tangible prize attaching to records of this character.

Both owners and builders of the pride of the British Mercantile Marine will derive all the more satisfaction from the latest attainments of the "Queen Mary" on account of the very practical reasons which prompted them. A knowledge of the behaviour of the vessel when driven continuously with her engines producing a power approaching the maximum will naturally assist them materially in formulating the final plans for the sister ship. No. 552, which John Brown & Co., Ltd., are laying down in their Clydebank yard. It is open to speculation as to what the average steam rating was on the eastward voyage, and what further demands could have been met in terms of s.h.p. As in the case of the "Normandie", where it has been virtually admitted by her owners that they are confident she could better her present record speed, so it is equally clear that a still greater speed could be achieved by the "Queen Mary", if it was desired. It has been recorded that the "Normandie" attained a speed on trials of 32·2 knots on a displacement of 68,000 tons, (Fr.) the power being about 165,000 s.h.p. Taking the Admiralty constant 333 provided by these figures, the power required to propel a vessel of similar characteristics at 30·63 knots and with a displacement of 77,000 tons would be 156,000 s.h.p. If it can be assumed that the average displacement of the "Queen Mary" is within the region of 77,000 tons, it is possible to conclude either that the engineering department could, if they wanted, increase the power of the turbine machinery by a substantial amount, or that the propulsive efficiency of the "Normandie" is superior to that of the "Queen Mary". For the "Queen Mary" is commonly credited with a power ranging up to 200,000 s.h.p.

Comparison difficult.

Sufficient data are not at present available on which to base a reliable comparison, however, and to what extent modifications will be made to reduce hull and wind resistance in the new ship is a matter which only time will show. To marine engineers and naval architects the friendly rivalry of the "Normandie" and "Queen Mary" is all the more interesting on account of the outstanding differences between the two vessels, and the different bases of design on which they were conceived. It is reasonable to suppose that there is much that is valuable in the characteristics of both vessels that would assist in formulating the final plans of an entirely new ship.

No. 552 and the future.

If, as seems certain, No. 552 will be a larger vessel than the "Queen Mary", her extra waterline length will be of some assistance in giving her a still higher speed performance, with which she is already credited. In this connection it should not be overlooked that the "Queen Mary's" longer waterline length gives her an advantage in speed over the "Normandie" as based on the $\frac{V}{\sqrt{L}}$ of about half a knot. On the question of machinery for the 552, it is open to doubt whether any important departure will be made in the turbine machinery, which apart from initial difficulties with the high-pressure turbine blading, has proved so satisfactory in the "Queen Mary". It is more in the steam-raising arrangements where one would expect to find modifications on what has gone before. In view of recent developments in marine boiler installations utilising relatively high combustion and evaporative ratings, which are giving reliable performance under normal service conditions, it is highly probable that the number of boiler units will be reduced. Much is possible in this direction, which, while in no way sacrificing reliability, would simplify boiler-room layout, and sensibly reduce both weight and space in that part of the ship devoted to the machinery. No doubt the most careful consideration will be given concurrently to every means by which that most expensive item in express liner operation of fuel consumption can be reduced.

Dual-firing in Warships.

"The Marine Engineer", October, 1936.

The demands of war on the operation of the internal-combustion engine have reached a stage which was scarcely foreseen even five years ago. The size of air forces has reached a scale where their petrol requirements will necessitate a large and constant fuel supply; the mechanisation of the army also proceeds apace, and will similarly rely to an increasing extent on a plentiful supply of fuel, whether petrol or heavy oil. The essential necessity of avoiding a shortage, or even threatened shortage of fuel oil, which might hamper the movements of the fleet, needs no emphasis.

So far the consensus of naval opinion has been against dual-firing in warships, as it was considered that their fighting efficiency would be seriously prejudiced thereby. As far as we are aware, there has been no convincing reply to the arguments put forward in 1934 by Engineer Vice-Admiral Sir Reginald W. Skelton, K.C.B., C.B.E., D.S.O., in a paper delivered before the Royal United Service Institution, which, we believe, reflected faithfully the view of the Admiralty that oil fuel firing alone could be considered for naval purposes.

If, however, the danger of not being able to obtain adequate oil supplies to meet every conceivable eventuality should be considered meanwhile to have become more real, it would appear that a case could be made for introducing dual-firing in a few of the smaller ships of the new naval programme, which are intended for auxiliary duties apart from the fleet, such as sloops and cruisers of light displacement, which could be employed on convoy and other special service work. Recent progress with mechanical stoker arrangements and developments with steam-raising equipment should render such a policy easier of fulfilment. The experience gained with, say, two or three vessels equipped to burn either oil or coal, should not be without its value in the light of the coal-versus-oil controversy, of which the end is by no means in sight. The production of boiler oil and Diesel oil from British cannel and other coals is another aspect of the situation which is becoming increasingly interesting as progress with the various oil-from-coal plants is being made. Already the Admiralty has carried out full scale boiler trials afloat with British coal oil, and it is to be hoped that this industry will be fostered by Whitehall; it may prove invaluable to the Navy in the future.

North Atlantic Speed Records.

"The Shipbuilder and Marine Engine Builder", Oct., 1936.

Rather more than a year ago, on the occasion of the record-breaking maiden voyage of the "Normandie", when she captured from the Italian liner "Rex" the coveted Blue Riband, we expressed in a leading article the view that the "Queen Mary" (then being fitted out afloat at Clydebank), assuming her hull form to be favourable, might prove to be a successful challenger during 1936. And so it has developed. That the greatest addition to the British mercantile marine should have taken some three months to prove herself may be regarded as a tribute to the wise conservatism of her builders who, in such an undertaking, have certain exacting guarantees to fulfil—and to a proper regard for the primary consideration of safety, which her owners, in their long history, have never subordinated to mere speed as such. It is unfortunate that certain sections of the Daily Press—obviously either grossly uninformed on the major issues involved or deliberately unmindful of them—saw fit to pass comment calculated to embarrass both owners and builders as the first few voyages of the ship were completed without sensational results. The satisfaction of those charged with reponsibility for the success of this great undertaking will, in consequence, be none the less profound now that the "Queen Mary" has so amply vindicated herself as to be the first ship in history to cross the North Atlantic in less than four days.

To the layman and to the shipping expert alike, the performances of "fast" transatlantic liners have for well-nigh 100 years stimulated the liveliest interest on both sides of the Atlantic. The "fast" eastbound passage of the Cunarder "Britannia" in 1840, when the voyage took 10 days and the mean speed was 10·6 knots, can have been no less epoch-making than the latest record of the "Queen Mary". Later, Cunard, White Star, Inman and Guion liners progressively reduced this time of the crossing, but it was not until 1882 that the eastbound voyage was accomplished in under seven days. By 1897 - 1904 the challenge of the German "flyers" of the North German Lloyd and the Hamburg-American Line raised the speed to over 23·5 knots and reduced the eastbound passage to under 6 days. Propelled as they were by lofty and massive reciprocating steam engines, the ships of that period represented the upper limit of man's achievement with the type of machinery available.

In 1907 the steam turbine made still higher speeds possible, and the "Lusitania" and "Mauretania" recovered from Germany the Blue Riband. The latter ship held the honour for a period of 22 years, and in the twenty-second year of her wonderful career she averaged for the eastbound voyage the remarkable speed of 27·22 knots. In the "Bremen" and "Europa" of 1929 and 1930, both propelled by geared steam turbines, the average speed of the crossing was raised to over 28 knots and the Blue Riband reverted to Germany. The Italian liner "Rex" in 1933 raised the speed still further to 28·92 knots; and Italy's tenure of the trophy continued until 1935, when the "Normandie", with 30·35 knots, won it for France for the first time. At the end of August, the "Queen Mary" made the eastbound crossing in 3 days 23 hours 57 minutes, at an average speed of 30·63 knots, thus winning for the Cunard White Star Line and for this country the trophy which they have so often held in the past.

So much for what may be described as the popular aspects of the subject. We are here concerned more particularly with technical considerations; and having regard to the phenomenal developments which have taken place in marine engineering, and to a less extent in naval architecture, during the past 30 years, it is interesting—and possibly also surprising—to note that during this period the average speed of transatlantic record-breakers has only advanced some 4·5 knots, *i.e.*, from the 26·06 knots of the "Mauretania" in 1908 to the 30·63 knots of the "Queen Mary". To accomplish this relatively modest speed increase—ignoring for the moment the corresponding ship displacements—the power of the propelling machinery has been practically trebled, viz., from the approximately 70,000 s.h.p. of the "Mauretania" to the 200,000 s.h.p. of the "Queen Mary". When it is remembered that the vessels of 30 years ago were coal-burning and developed low-pressure, saturated steam; that the steam turbine was in its infancy and relatively inefficient in comparison with its geared prototype of to-day; that the high-pressure, oil-fired, superheated, water-tube boiler for merchant ships was unknown; and that experiment-tank technique was much less advanced then than now—the merit of performances such as those of the "Mauretania" stand out in true perspective.

The question is sometimes asked, in view of the sensational developments which have recently been taking place with super-pressure steam generators and reduced specific weight of propelling machinery generally, whether future progress will render a three-day ship crossing of the North Atlantic practicable. The problem can be best approached by comparing the speed-length ratios of the "Queen Mary" and "Normandie" with those of the fastest merchant-ship type according to this basis of assessment. The highest speed-length ratio hitherto attained was 1·435 in the Denny-built turbine-driven cross-Channel steamship "Paris" of 1913—a figure which compares with approximately 0·935 for the "Normandie" and "Queen Mary", each with round-voyage speeds in excess of 30 knots. The corresponding speed required for a speed-length ratio of 1·435 in a ship of the "Normandie's" length would be about 46 knots, and with this speed a three-day crossing could be achieved.

What are the practical difficulties in the way of the attainment of such a speed? The displacement of the "Normandie" is of the order of 65,000 tons. He would be bold indeed who would say what might be the upper limit of present progress towards high power-weight ratio in ships' propelling machinery; but if it be assumed that the necessary power and fuel could be accommodated on this same displacement of 65,000 tons, it could be shown that for a speed of 46 knots the required power would be little short of 1,000,000 s.h.p.! It is, of course, elementary that the working into a single hull of the machinery and fuel required for developing this colossal power continuously for three days represents a problem for which there is no practical solution meantime within sight.

While it may be true to say that still higher speeds than those of the "Normandie" and "Queen Mary" will undoubtedly be achieved on the North Atlantic, it is difficult to see—practical and technical considerations being what they are, and immutable—how the time of the crossing can be further reduced by more than a very few hours. From the financial standpoint, the very high cost of such ships, and the disproportionately rapid augmentations in cost called for in attaining the last extra knot of speed—coupled with the fact that air transportation in comparative safety now promises to offer possibly a two-day crossing of the Atlantic in the near future—are together factors which must inevitably tend to fix the upper economic limit of ship speed at a figure not very substantially higher than the present record.

The experience already gained with the "Queen Mary" cannot fail to prove of the highest value to the designers and builders of her succeeding sister ship, No. 552, the contract for which was recently placed with the same Clydebank builders. It does not admit of any doubt that No. 552 will be a more powerful and faster ship than her immediate predecessor, since it is only by the application of the fruits of experience that progress in this highly specialised field can be achieved. With the delivery of the second ship, her owners will be in possession of an unrivalled balanced express service, and will be able for the first time to accomplish with two ships what has hitherto required three—a weekly service across the North Atlantic. For the propulsion of the latest vessel there are several alternatives; but for the very large power involved, steam rather than internal-combustion machinery appears likely to be favoured, and with steam there becomes available the choice of turbo-electric drive—as successfully applied in the "Normandie"—or geared steam turbines. There are also a variety of types of steam generator now available other than the normal drum-type water-tube boiler; and while any forecast at the present juncture can only be in the nature of conjecture, the last-named, in view of its well-tried and wholly dependable characteristics, would seem to be in a strong position.

Whatever may be the ultimate choice, the wide experience of the owners and builders is such that the finished product may safely be relied upon to prove herself, as the "Queen Mary" has done, a credit to British shipping and shipbuilding. Ships of this character are unquestionably a national asset of the first order, and it is no small matter for satisfaction that the necessary preliminary steps should so promptly have been taken to provide the "Queen Mary" with a worthy consort.

Lubricating Oil Pressure Alarms.

"Shipbuilding and Shipping Record", October 1st, 1936.

On engines where a system of forced lubrication is employed, it is apparent that some form of alarm should be fitted to warn the engineer on watch should the pressure, from any cause, fall below a certain pre-determined figure. Various devices have already been adopted but the use of an audible alarm working in conjunction with the vacuum in the condenser is sufficiently novel to warrant further investigation. It has been introduced by a well-known British firm which specialises in the production of safety devices for use on board ship, and it has already been adopted on two vessels fitted with combined reciprocating engines and exhaust turbines. The alarm is controlled by a diaphragm subjected to the lubricating oil pressure on one side and balanced by a spring working in conjunction with a valve in a pipe leading to the condenser from a box fitted with two sirens. Thus, should the oil pressure fall below a pre-determined figure, the valve opens and the air rushing into the condenser operates the sirens, the connection to the condenser being fitted with a spring-loaded non-return valve which prevents communication between the atmosphere and the condenser when the engine is not working. The device is fitted with a pressure gauge and a pointer working over a vertical scale, so that the operating conditions in the lubricating oil system are visible.

Measurement of Condenser Vacuum.

"Shipbuilding and Shipping Record", October 1st, 1936.

In view of the type of condensing apparatus usually fitted on modern steamships the problem of the measurement of condenser vacuum becomes one of considerable importance. In the old days of reciprocating steam engine practice when a single cylinder air pump driven from the low-pressure crosshead of the main engine was considered sufficient, a vacuum of 26in. of mercury represented good practice. To-day, however, when twin air pumps (wet and dry) are employed or better still the wet air pump or condensate pump as it is now generally termed is used in conjunction with one or more air ejectors, a vacuum exceeding 29in. Hg. is usual. But if the height of the barometer may fluctuate during the course of a voyage between, say, 28·5 and 30·5in., it is obvious that the ordinary type of vacuum gauge will show similarly wide fluctuations which are not in any way connected with the conditions in the condenser. To overcome the effects of the variation in the atmospheric pressure, the vacuum gauge reading can be corrected to give its equivalent for a standard barometric height of 30in. or alternatively, the condenser vacuum can be expressed as a percentage of the perfect vacuum.

The Meaning of N.H.P. in Lloyd's Register.

"The Motor Ship", September, 1936.

Although in Lloyd's Register the power of all vessels listed therein, as regards ships fitted with steam or Diesel machinery, is given in terms of N.H.P., or "nominal horse power", the figures do not represent the machinery output as it is usually understood by engineers. For this reason we have taken exception to the retention of this symbol in the Register, without, however, discussing the reasons why Lloyd's find it necessary to use it. Briefly, then, N.H.P. in the Register represents a figure which is a measure of the amount of work entailed in the surveyors' inspection of the machinery of a ship. It affords a basis for computing the fees to be charged for the survey and is not the actual power of the engine; or anything like it, for that matter.

Lloyd's have fixed on the following formula:—

$$(\text{N.H.P.}) = \frac{C \times N \times D^2}{\frac{S}{D} + 50}, \text{ where}$$

N = No. of power cylinders.

D = cylinder diameter in inches,

S = piston stroke in inches (half the combined stroke for opposed-piston engines),

C = 5 for four-stroke single-acting, 10 for four-stroke double-acting, 9 for two-stroke single-acting, 18 for two-stroke double-acting, and 16 for opposed piston machinery.

The resulting figures give a "nominal" power which is quite probably not even one-quarter of the real output.

This being the case, proposals have been made by the Society of Lloyd's to include in the Register book information relating to the b.h.p. or i.h.p. of vessels—which, of course, is exactly what is wanted to enhance the utility of the statistics which have made the volume what it is to-day. It will surprise a very large number of our technical readers, we feel sure, to learn that this sensible proposition has not met with support in certain quarters.

Streamlining in Ships.

"The Motor Ship", September, 1936.

Although received with some scepticism when the idea was first mooted a couple of years ago, it is now generally accepted that streamlining of deck erections in ships, if in a moderate degree is warranted. The large majority of cargo ships and tankers being built on the Continent, and a certain proportion of those under construction in this country are so designed, and it has been possible for some shipbuilders to ascertain the exact effect of streamlining, by making comparisons between precisely similar vessels, some of which have rounded deck erections and others the more orthodox form.

The result is interesting. Fuel consumptions have been compared between similar tankers of some 12,500 tons deadweight capacity, designed for a normal speed of 12 knots when loaded. It is found that in a fairly strong head wind the tanker with the rounded deck houses shows an economy of approximately one ton of oil per day, which may be said to represent a saving of some 8 per cent. in the fuel bill. Naturally, the effect is not so marked except in a head wind, but the overall saving during the course of a year appears to be substantial. It is moreover attained practically without any higher initial capital expenditure.

The Future of the Shipbuilding Industry.

"The Motor Ship", September, 1936.

It is probably true, as Sir John Cadman remarked last month, that the black years in the shipbuilding industry are well behind, so that we may look forward to a period of activity and, probably, prosperity.

The greater part of the work which has already made British shipyards busy comprises tankers, war vessels, some passenger liners and tramp ships. There must now be a further demand for passenger ships and cargo liners of which relatively few have been laid down in the past five or six years. This will almost certainly lead to continuity of work in the yards for two to three years, more particularly as the rise in prices which has already set in will be accentuated in the near future.

The time is therefore opportune to examine the possibilities of rationalizing the shipbuilding industry in a manner which would prevent the extreme fluctuation in the amount of work in the yards, so inimical to economical production and so harmful to the industry generally. Mr. Christie, and other shipbuilders, spoke of this problem last month, referring to the endeavours, in the shipbuilding industry, to co-operate in order to prevent contracts for ships being taken at uneconomic prices—always a temptation when the yards are entirely empty. This is a legitimate aim although difficult of accomplishment, but now that the immediate future is assured some accord may be reached.

If shipping were an industry governed by logic, there would seem to be no difficulty. Every shipowner knows that, on an average, he has to renew his fleet completely in a period of 20 to 25 years. If he would spread his orders evenly over that period no matter whether conditions were good or bad, then the shipyards would be able to work economically, they would produce cheaper and possibly better ships (because of the absence of extreme stress and anxiety) and the shipowner himself would gain. Actually, what happens is that in bad times most owners forget that they have always emerged from depressions in the past. They therefore refuse to place orders. When the depression is over they contract for new ships at high prices. To-day, for instance, a new ship costs 10 per cent. to 15 per cent. more than a year ago. About twelve months ago we urged that shipowners should build new tonnage at the existing low prices, and those who did so have saved themselves many thousands of pounds. Six cargo liners recently ordered cost £200,000 more than if they had been built a year ago and a new 12,000-ton tanker now costs about £10,000 more than it did in the summer of 1935.

Figures such as these show how advantageous it would be for a shipowner to spread his contracts regularly each year and now that what has generally been termed the worst depression in the world's shipping history is passing, shipowners should realize that every depression, no matter how severe, must come to an end. The main reason for not building new ships during the bad period in the trade cycle is that that particular depression is usually considered to be something special and that it may not end at all. But it always does.

It seems, therefore, that the time is ripe for a general investigation of the possibilities of levelling up ship construction in such a manner that the average amount of shipbuilding in all the yards throughout each year should be controlled within reasonable limits so as to avoid the wide fluctuations which have hitherto been so harmful. It should not be impossible to reach this ideal if some system of co-operation between shipbuilders and shipowners can be reached and if the problem be approached from the basis, not of what has been done in the past, but what can be accomplished in the future.

Rebuilding Mercantile Fleets.

"The Motor Ship", September, 1936.

Other countries are paying marked attention to the question of rebuilding their mercantile fleets with a view to making them commensurate with the needs that will arise in the event of war. For instance, under the American Merchant Marine Act, which has just been passed, it is specifically laid down that vessels, the owners of which receive official assistance under the Act, must be so designed as to be suitable for national defence requirements.

This means, as a prominent American shipowner has pointed out, that much of the new tonnage will be constructed for a service speed of 16 knots to 18 knots, which represents another argument in favour of the general employment of faster cargo liners. It is specified that old tonnage shall be replaced by new vessels, and although there have been some sarcastic comments made regarding the probable delay in the working of the Act it would be unwise to take this view too seriously. Our own opinion is that very shortly contracts on a large scale will be placed in America for new subsidized tonnage.

In Japan again, the plan proposed by the Minister of Communications embodies new construction of 600,000 tons gross over a period of four years commencing in 1937. It is laid down in this case that the speed of the ships shall not be less than 13 knots, and there is little doubt that most of the new vessels will be designed for 16 knots.

Summarizing the position, we must inevitably arrive at the conclusion that mercantile ship construction on a big scale will be carried out abroad in the next few years, in some cases with subsidies and in others not. It seems essential, therefore, that if we are to maintain our present position—and it is much below what it was in 1914—cargo ships of 1,000,000 tons, the majority of high speed, will have to be ordered in this country within the next 12 months.

"Meccano".

"The Engineer", 25th September, 1936.

Not only boys and girls, but many engineers and inventors, heard with regret of the death on Monday last of Mr. Frank Hornby, inventor and manufacturer of "Meccano", at the age of 73 years. Whilst his name is more directly associated with clockwork trains, the production of which was added to the primary business—the making of the famous standardised, punctured steel strips and fittings—it is by the latter that he will be remembered. Mr. Hornby was a Liverpool man, and the Meccano idea is said to have sprung to his mind when travelling to the house of a relation who had children to be amused. In a wayside goods yard he noticed a small derrick crane of the familiar type, and observing the manner in which the jib was built up, it occurred to him that with the help of suitable steel strips, bolts and nuts, and some oddments of clockwork, boys could readily make models of cranes and similar structures. The idea seemed so promising that he began to punch the strips with his own hands, and his whole staff was a girl who assembled the parts for sale. That was in 1900, and as an example of the industrial importance that mechanical toy-making may acquire, we may mention that the Meccano factory now gives employment to 1,500 persons and covers 5 acres of ground, and that there is a French factory as well. The production of the strips and details is a good example of standardisation. So convenient are the parts for mechanical experimentation that they may be found in many engineering drawing offices, whilst experimental laboratories, the National Physical amongst them, make frequent use of them. In fact, something that was started as a toy for the amusement of children has become of value to the serious inventor and investigator.

The Model Engineer Exhibition.

"The Engineer", 25th September, 1936.

There is one aspect of the Model Engineer Exhibition, which is now open at the Royal Horticultural Hall, Westminster, but closes on Saturday, that has, we believe, escaped general attention, and that is its historical value. Enthusiasts will always go in for the pure modelling of contemporary machinery and plant—that is to say, its reproduction on a miniature scale—and often, as is exemplified in the present Exhibition, these models are really faithful. Such models can be retained in museums for the information of future generations quite conveniently, while the actual machines almost inevitably get scrapped with the march of progress.

This year there are some notable examples of perfect modelling, including especially a triple-expansion marine set combined with an exhaust turbine, on which Mr. Mulhorn, of Booth, Lancs., is said to have expended 5,000 hours of labour. We desired to know how he contrived the blading of the turbine, but could not find the "modeller". There are many other excellent models, including one of an engineering workshop with its engine, and many petrol engines, but what struck us most, as ever, was the preponderance of locomotives, some of them exhibited in their embryo state, in the enthusiasm of their builders. It would, however, we think, be worth while to foster an attempt to produce less orthodox designs. Some of these tiny locomotives are intended for traction purposes, and it is quite conceivable that on a small scale a vertical boiler and engine with screw gearing would be far more effective than the normal locomotive. Again, there is the Shay locomotive used in the logging camps of America. We cannot recollect ever having seen one modelled.

Another impression gained from a tour of the Exhibition was an increased interest in nautical affairs. There are some excellent models of old-fashioned historical vessels, alongside really beautiful model sailing racers. It was noteworthy that some of these racers were fitted with modern steel masts, but to an old-fashioned sailor they do not look so graceful as those of wood. An interesting exhibit is a chart showing the named rigs of many Scottish fishing boats.

Aeroplanes, naturally, provide an ever-increasing field for the modeller, and there is one of a low-wing monoplane with a wing spread of 8ft. 6in., which is intended for an attempt on the height record. There is also the usual exhibit of the Royal Air Force, including some really excellent examples of fitting work, and a number of officers are in attendance who are most courteous in answering questions about training and prospects in the Force.

The number of stands devoted to the tools and machines required by the model engineer is not, perhaps, quite so great as usual, but that is made up for by the comprehensive nature of those that are there.

We congratulate Mr. Marshall on his exhibition, and imagine that with his association with the electrical Press, his next exhibition will be even more extensive and popular.

The Blue Riband of the North Atlantic.

"The Shipbuilder and Marine Engine-Builder", Oct., 1936.

From Sail to Steam.

In 1838 there was commenced a new chapter in the history of civilisation. It was the dawn of ocean steam communication, which was to limit and regularise the duration of voyages between the continents. The best passages which the sailing ships could make at once became the longest that might be expected from the steam vessels.

Early Steamships—Paddle Vessels.

In March, 1838, the following appeared in the London Press:—

> "The experiment of a steam voyage from England to America has commenced. On Wednesday afternoon—28th March, 1838—the St. George Steam Packet Co.'s powerful steamship "Sirius" sailed from East Stairs for New York, proceeding in the first instance for Cork, whence she will start for her final destination. It is expected to complete the voyage in 15 days".

The "Great Western", a new steamship for another company, viz., the Great Western Steamship Co., was also completed and about to sail.

The "Sirius" left Cork for New York, amid great enthusiasm, at 10 a.m. on the 5th April, 1838, with 97 passengers, the "Great Western" leaving Bristol on the 8th April; and with these two departures, the navigator and engineer entered into partnership in pursuit of fame. History records that the "Sirius" was off New York late on the 22nd April, and at daybreak of the 23rd (St. George's Day) was in the harbour. The "Great Western" was signalled at 11 a.m. that morning, and at 3 p.m. came into port to find her rival already there. She had, however, the satisfaction of making the faster voyage, and equalling the fastest records of the sailing ships on her first trip.

The captains and crews were overwhelmed with hospitality. Crowds visited the ships (5,000 went aboard the "Great Western" on Ladies' Day), and much was made of "the newly discovered proximity to Europe".

Other vessels followed, viz., the second "Royal William", of 617 tons, and the "Liverpool", of 1,150 tons, in 1838, and the "British Queen" in 1839. None of these gained the honourable distinction of the fastest passage, now known as the Blue Riband, although the captain of the "British Queen" claimed that he had made the westward record from Portsmouth in 13 days 11 hours.

The Great Western Steamship Co., in their report for 1839, gave the records of their vessel as 13½ days westward and 12½ days homeward.

The Cunard Line.

The Cunard Line commenced in July, 1840, the "Britannia" making the first sailing. Outwards she did not distinguish herself, but homewards she made the passage in 10 days, the particulars of her voyage being as follows:—

> "Left Halifax 4th August, 1840, 5.30 p.m. Daily runs to noon—176, 272, 266, 280, 264, 268, 252, 244, 238 and 290 to Liverpool. Arrived late Friday night, 14th August, 1840. Average speed 10·62 knots".

The "British Queen" left New York on the 1st August, the same day that the "Britannia" left Boston, and arrived at Cowes at 6.20 a.m. on Saturday, 15th August, after a passage of 13½ days; but the "Britannia" had already arrived overnight at Liverpool. This voyage won the Blue Riband for the "Britannia"; and although in the next month (September, 1840) the "Acadia" claimed to have broken the record, it was very doubtful whether her speed quite equalled the sister vessel.

The last of the four earliest Cunarders to take up her station was the "Columbia", in 1841; and to her was appointed as Commander Captain C. H. E. Judkins, whose name will always be associated with the Blue Riband so far as the Cunard paddle steamships are concerned, as he commanded nine of them in turn.

In July, 1841, the "Columbia" came eastward in 9 days 7 hours, and in July, 1842, in 9 days ("the most rapid passage ever made"). She also made westward records to Boston in 1841 and 1842. In the latter year, however, the "Acadia" made the fastest westward crossing of 10½ days to Halifax, under Captain Ryrie.

The Cunarder "Hibernia" was launched in September, 1842, and it was announced that Captain Judkins was to command the ship. She broke the eastward record in July, 1843, with a time of 8 days 23 hours. Two years later the sister ship "Cambria" took up her station, Captain Judkins again commanding. She gained the westward record in July, 1845, crossing in 11½ days to Boston, and took the Blue Riband from the "Hibernia" in August, 1846, by an eastward passage of 8 days 16 hours. The "Great Western" had made Liverpool her port of departure since 1842, but, although she made several fine passages, could not regain precedence.

In June, 1848, the Ocean Steam Navigation Co.'s vessel "Hermann", by running from New York to Cowes in 11 days, 21 hours, claimed to have beaten a record of 12 days by the new Cunarder "America", also eastward. In October, another new Cunarder—the "Europa"—reduced the passage time to New York below 11 days. In 1849 the Blue Riband, however, fell to the "Canada" (Captain Judkins), a sister ship, whose voyage was described in the Press thus :—

> "Left Boston 18th July, 12 noon; Halifax 19th, 10 p.m.; and arrived Liverpool Saturday afternoon, 28th July—9 days 22 hours from Boston; 8 days 12 hours from Halifax. The fastest passage yet made by Cunard or any other company, and without parallel in the records of steam navigation".

Keen Rivalry with America.

In the spring of 1850, two new Collins (America) liners were ready and another new Cunarder—the "Asia" (Captain Judkins)—and these, with the previous four new Cunarders, had a strenuous time that year.

TABLE I.—RECORD VOYAGES OF ATLANTIC LINERS (PADDLE STEAMSHIPS), WESTWARD.

An Early Claim—1st June, 1840.

Lieutenant Roberts, R.N., Commander of the "British Queen", wrote :—

> "I can only state there is not a faster sea-going steam vessel in the world. . . . We have beaten 'Great Western' every voyage this year. . . . I have made the passage from Portsmouth to New York shorter than ever performed, only 13 days, 11 hours".

Year.	Month.	Ship.	Time of Passage, days, hours, minutes.		Speed, knots.
			Bristol to New York.		
1839		"Great Western"	13 12 0		9·3
			Portsmouth to New York.		
1840		"British Queen"	13 11 0		
			Liverpool to Halifax.	Boston.	
1840	7	"Britannia" ...	12 15 0		
1840	8	"Acadia" ...	11 4 0		9·5
1841	6	"Columbia" ...		12 12 0	9·6
1842	7	"Columbia" ...		11 18 0	
1842	12	"Acadia" ...	10 12 0		
1845	7	"Cambria" ...		11 12 0	10·3
1848	6	"America" ...	9 12 0		
			Liverpool to New York.		
1848	9	"Europa" ...	11 3 0		11·41
1848	10	"Europa" ...	10 23 0		
1850		"Asia"	10 11 30		
1850		"Pacific" ...	10 9 30		
1851	8	"Baltic"*.. ...	9 18 0		13·05
1857	6	"Persia" ...	9 12 10		
1860	4	"Vanderbilt" ...	9 5 0†		13·9
1863	7	"Scotia"... ...	9 2 15		
1866	7	"Scotia"* ...	8 4 34‡		14·5
1861	5	"Great Eastern"	9 19 40		

*Blue Riband Trips. †From Southampton. ‡From Queenstown.

The British Navy claimed that H.M.S. "Rhadamanthus" (800 tons) was the first vessel to steam westward from England, crossing in 1833 to Jamaica.

The "Europa" arrived at Liverpool on the 16th June after the "quickest trip ever made" from America, and now held the Blue Riband. The Collins "Atlantic" followed closely on the 26th after a very fine passage of 10½ days, with a best day of 319 knots. The "Asia", however, ran well right from her first trip, and in October came from New York direct (the first trip for a Cunarder without the call at Halifax) in 10 days 7 hours, beating the "Europa's" record by 5 hours 26 minutes. In December she made an even better passage, which was described thus :—

> "This trip left New York 18th December mid-day; lost 55 minutes repairing wheel; arrived Liverpool 28th December, 9.30 p.m. Best day's steaming 328 knots. Time 10 days 4 hours 5 minutes—2 hours 55 minutes less than her fastest summer passage; 4 hours 15 minutes less than the U.S.A. ships' best, eastward; and about 5 hours 20 minutes less than the remarkable summer run of the 'Pacific' to New York".

In 1851 the Collins liners gained the Blue Riband, however—the "Pacific" eastward in May, in 9 days 20 hours 26 minutes, and the "Baltic" westward in August, in 9 days 18 hours. Another of their vessels—the "Arctic"—claimed the speed record of 13¼ knots later, but all their four vessels were wonderfully well matched.

In 1857, the Collins Line lost the eastward record to another American vessel, viz., the "Vanderbilt", which ran from New York to Southampton, her time being 9 days 8 hours.

Iron Paddle Vessels.

In August, 1852, the Glasgow Press announced :—

> "Messrs. Burns have contracted for the building of an immense iron steamship for the Cunard Line. . . . From the great length and other proportions it will not be too much to say that this iron ship will surpass in speed any other vessel on the station, and will show the world what the Clyde can produce".

The "Persia", launched in 1855, was the ship which they built, and in August, 1856, Captain Judkins was able to claim the following record :—

> "Left Sandy Hook 6th August, 1856, 6.15 p.m.; arrived Bell Buoy, Liverpool, 15th August, 1856, 8.30 p.m. Sandy Hook to Bell Buoy 8 days 23 hours 30 minutes; delayed 2 hours 30 minutes at the bar for water. Speed 14 knots".

The "Persia" improved on this record by 2 hours in July, 1857, and in May, 1858, came from New York *via* St. John's, Newfoundland, making the run from St. John's to Bell Buoy, Liverpool, in 5 days 13 hours. The speed would be about 14·48 knots.

Table II.—Record Voyages of Atlantic Liners (Paddle Steamers), Eastward.

The First Claim—September, 1833.

Captain John McDougall, of the "Royal William", which steamed from Nova Scotia to London, where the ship arrived after 22 days' steaming, wrote :—

"She is justly entitled to be considered the first steamship that crossed the Atlantic by steam, having steamed the whole way across".

Year.	Month.	Ship.	Time of Passage, days, hours, minutes.		Speed, knots.
			New York to Bristol.		
1839		"Great Western"	12 12 0		10·0
			Halifax to Liverpool.	New York to Liverpool.	
1840	8	"Britannia"* ...	10 0 0		10·6
1840	9	"Acadia"* ...	10 0 0		
1841	7	"Columbia"* ...	9 7 0		11·0
1842	7	"Columbia"* ...	9 0 0		
1843	7	"Hibernia"* ...	8 23 0		
1846	8	"Cambria"* ...	8 16 0		12·3
1848	5	"America" ...		12 0 0	
			Boston to Liverpool.	New York to Liverpool.	
1848	6	"Niagara" ...	10 10 0		
1848	7	"Hermann" ...		11 21 0†	
1848	8	"Europa" ...	10 10 0		
1848	9	"Niagara" ...		11 12 0	
1849	5	"America" ...		11 12 0	
1849	6	"Niagara" ...		11 9 0	
1849	7	"Canada"* ...	9 22 0		12·6
		(Halifax ...	8 12 0)		
1849	10	"Canada" ...		11 0 0	
1850	6	"Europa"* ...		10 12 26	
1850	6	"Atlantic" ...		10 12 0	
1850	6	"Asia"	9 14 0		
1850	10	"Asia"*... ...		10 7 0	
1850	12	"Asia"*... ...		10 4 5	
1851	5	"Pacific"* ...		9 20 26	13·0
1853		"Arctic"* ...			13·25
1856	7	"Persia"* ...		9 4 45	
1856	8	"Persia" ...		8 23 30	14·0
1857	8	"Vanderbilt" ...		9 8 0‡	
1863	12	"Scotia"* ...		8 19 50	14·3
1863	12	"Scotia" ...		8 3 14§	
1861	6	"Great Eastern"		9 8 11	

*Blue Riband Trips. †To Cowes. ‡To Southampton. §To Queenstown.

In 1862 the famous "Scotia" was placed in service; but the "Persia" had done so well that it was July, 1866, before Captain Judkins, who commanded this ship also, could say that he had gained the Blue Riband. The passage was westward, and was made in 8 days 4 hours 34 minutes; speed 14·5 knots. She had already made a record run eastward of 8 days 3 hours 14 minutes from Sandy Hook to Queenstown, and 8 days 19 hours 50 minutes to Liverpool, in December, 1863.

Tables I and II give particulars of the record passages of the North Atlantic paddle steamships.

Iron Screw Steamships.

The paddle steamship had served its purpose: the Atlantic voyage had been reduced by 3½ to 4 days during a quarter of a century. Further reduction, however, was called for, and the screw propeller appeared to give greater prospect of its attainment and of efficiency. The Cunard Line had had several years' experience with it in their slower vessels, and the Inman Line two years longer than the Cunard Co., their best passages in 1861 being the "City of New York westward in 10 days 17 hours and the "Etna" (purchased from the Cunard Line) eastward in 10 days 13 hours. There had been no intention to break records with these screw steamships; but when the Cunard Line added the "China" in 1862 for the mail service in the same year as the "Scotia", it became apparent that the future method of propulsion would be by means of the screw propeller.

Table III.—Record Passages of Atlantic Liners (Screw Steamships), Westward.

Date.	Ship.	To New York from	Time D. H. M.	Speed, knots.
1867	"City of Paris" ... (Time record only)	Queenstown	8 4 1	—
1872	"Adriatic" ...	„	7 23 17	14·52
1875	"City of Berlin"*	„	7 18 2	15·2
1875 / 1877	"Germanic" ...	„	7 11 37	15·75
1876	"Britannic" ...	„	—	15·46
1877	„	„	7 10 53	—
1879 / 1881	"Arizona"... ...	„	7 8 12	—
1882	"Alaska"*... ...	„	—	16·04
1883	„	„	6 21 40	—
1884	"Oregon"* (Guion)	„	6 10 9	—
1884	"Oregon" (Cunard)	„	6 9 42	18·16
1887	"Umbria"	„	6 4 34	18·91
1885 / 1888	"Etruria"* ...	„	6 1 44	19·57
1889	"City of Paris"*...	„	—	20·1
1892	„	„	5 14 24	20·7
1890	"Teutonic"* ...	„	—	20·17
1891	„	„	5 16 31	20·35
1891	"Majestic"* ...	„	5 18 8	20·11
1892	„	„	—	20·41
1893	"Campania" ...	„	5 9 6	—
1894	"Lucania"* ...	„	5 7 23	21·82
1898	"Kaiser Wilhelm der Grosse"*	Southampton	—	22·07
		„	5 15 20	22·29
1900 / 1901	"Deutschland" ...	„	5 11 54	23·15
1907	"Lusitania"* ...	Queenstown	—	24·00
1910	„	„	4 11 40	25·88
1908 / 1911	"Mauretania"* ...	„	4 10 41	26·06
1924	„	Cherbourg	5 2 34	—
1929	„	„	4 21 44	26·9
1929	"Bremen"*... ...	„	4 17 42	27·83
1930	"Europa"*... ...	„	4 17 6	27·91
1933	"Rex"*	Gibraltar	4 13 58	28·92
1935	"Normandie"* ...	Bishop's Rock	4 3 2	29·98
1936	"Queen Mary"* ...	„	4 0 27	30·14

*Vessels which have held the Blue Riband.

The "China" made a fast passage westward in 1864 of 8 days 16 hours, and eastward in March, 1865, of 8 days 14 hours 8 minutes, with a best day of 307 knots; and the "City of Paris" made a westward passage of 8 days 11 hours 44 minutes, with a best day's steaming of 344 knots in 1866. In 1867 the latter vessel caused a sensation, as she crossed westward again in 8 days 4 hours 1 minute, which made the first real Atlantic record for a screw steamship of the "shortest time". The news of this record was received over the new Atlantic cable—the first to successfully operate—and had much prominence on that account.

TABLE IV.—RECORD PASSAGES OF ATLANTIC LINERS (SCREW STEAMSHIPS), EASTWARD.

Date.	Ship.	New York to	Time D. H. M.	Speed. knots.
1852	"Great Britain"...	Liverpool	11 0 0	—
1869	"City of Brussels"*	Queenstown	7 22 3	14·65
1873	"Baltic"*	,,	7 20 9	15·11
1875	"City of Berlin"*...	,,	7 15 28	15·37
1876	"Germanic"* ...	,,	7 15 17	15·78
1876	"Britannic"* ...	,,	7 12 41	15·95
1879	"Arizona"* ...	,,	7 8 0	15·95
1882	"Alaska"*	,,	6 18 37	—
1883	,,	,,	—	16·88
1884	"Oregon" (Guion)	,,	6 16 57	—
1884	"America" ...	,,	6 14 8	17·8
1884	"Oregon"* (Cunard)	,,	6 10 40	18·18
1885 / 1888	"Etruria"*... ...	,,	6 4 54	19·41
1888	"Umbria"	,,	6 3 12	—
1889	"City of Paris"*...	,,	5 22 50	19·49
1891	"Teutonic" ...	,,	5 21 3	19·78
1892	"City of New York"	,,	5 19 57	20·1
1893	"Campania"* ...	,,	5 9 8	—
1894	"Lucania"* ...	,,	5 8 38	—
	,,	,,	—	22·01
1897 / 1898	"Kaiser Wilhelm der Grosse"*	Southampton	5 15 25	22·51
1900 / 1901	"Deutschland"* ...	Eddystone Lt.	5 7 38	23·51
1904	"Kaiser Wilhelm II"*	Plymouth	5 8 16	23·58
1907	"Lusitania"* ...	Queenstown	—	23·61
1910	,,	,,	4 15 50	25·57
1908 / 1911	"Mauretania"* ...	,,	4 13 41	25·89
1924	,,	Cherbourg	5 1 49	26·25
1929	,,	Plymouth	4 17 50	27·22
1929	"Bremen"*... ...	Cherbourg	4 14 30	27·91
1933	,,	,,	4 17 43	28·14
1933		,,	4 16 15	28·51
1935	"Normandie"* ...	Bishop's Rock	4 3 25	30·35
1936	"Queen Mary"* ...	,,	3 23 57	30·63

*Vessels which have held the Blue Riband.

Having tried three or four different types of propelling machinery, the Cunard Line decided on the inverted direct-acting engine for their future ships; but the Inman Line kept to the trunk type, no doubt being satisfied with the performances of the "City of Paris".

The Cunard Line built the "Russia" in 1867. and the Inman Line the "City of Brussels"; and these vessels hotly contested for the Blue Riband. The "City of Brussels" made the historic passage of 7 days 22 hours 3 minutes at 14·65 knots in December, 1869, which was the first passage under 8 days, and the first which gave a screw vessel the Blue Riband. The "Russia" brought her time down to 8 days 28 minutes, but the chief honour eluded her.

White Star and Guion Lines.
Compound Engines and Cylindrical Boilers.

At this stage another competitor entered the field, viz., the White Star Line, who, by building a completely new fleet of vessels designed on the experience of all the older companies, gained for a time a great advantage. Their "Adriatic", 3,887 tons, brought the westward passage time below 8 days in May, 1872; and in January, 1873, the "Baltic" won the Blue Riband for them with a passage eastward of 7 days 20 hours 9 minutes, this being the first passage at over 15 knots speed.

The Inman Line met the loss of prestige by building ships. The "City of Montreal" (1871) was running against the White Star vessels, but made no records. Two new ships were ordered, viz., the "City of Richmond" and "City of Chester", built in 1873, and fitted with compound inverted direct-acting engines instead of the trunk type. These, too, failed to make records. The Inman Line had already experimented with the long ship—the "City of Paris" was 8½ to 1 length to beam, the "City of Brussels" 9¾ to 1, and the "City of Richmond" over 10 to 1—but they decided to advance a step further, and in 1875 they built the "City of Berlin", which had a length to beam of 11 to 1, this being rather more than the rival "Adriatic", and with engines of greater power. The "City of Berlin" succeeded in breaking time and speed records in both directions, emphatically winning the Blue Riband with speeds of 15·2 knots westward and 15·37 eastward in September and October of that year.

The White Star Line had already built two ships which contended with the Inman vessel. These were the "Britannic" (5,004 tons) and "Germanic", which succeeded in taking the Blue Riband from the "City of Berlin". The "Germanic" was the first to capture it, with a passage of 7 days 15 hours 17 minutes eastward in February, 1876, beating the record by 11 minutes, with a best day of 383 knots and a speed of 15·78 knots.

The "Britannic" lowered the westward record in June and November, 1876, first by 1 hour and 27 minutes, and then by 3 hours and 24 minutes, to 7 days 13 hours 11 minutes, with a highest day's run of 404 knots in the earlier trip. She broke the eastward record next month (December, 1876) with a time record of 7 days 12 hours 41 minutes, and a Blue Riband speed of 15·95 knots. Both ships reduced the time record westward in 1877, i.e., the "Germanic" to 7 days 11 hours 37 minutes, and the sister ship by a further 44 minutes.

Another Line, viz., the Guion, now became vitally interested. They had tried before and failed; but with the "Arizona" (5,147 tons) they succeeded in 1879. She broke both time records straight away, and the next month (July, 1879) claimed the Blue Riband with an equal speed record to that of the "Britannic", and 4 hours 41 minutes less time, over a shorter course eastward. Her owners were so well satisfied that they built a larger but very similar ship—the "Alaska", of 6,932 tons—in 1881, which also brought them fame. Against her, the famous Cunarder "Servia" and the "City of Rome" (built for the Inman Line, but afterwards run for the Anchor Line) contested. All three proved fine steamships. The "Alaska" started well, winning the Blue Riband in April, 1882, with a passage of 7 days 6 hours 43 minutes, and a speed of 16·04 knots westward. She had the distinction of bringing the speed record above 16 knots and the time record below 7 days, both eastward and westward, although her highest speed of 16·88 knots was made over a longer passage eastward in March, 1883, and her best day eastward of 411 knots later on another. The "Servia" and "City of Rome" also made passages below 7 days, but too late to bring distinction.

The Guion Line added, late in 1883, another record-breaker—the "Oregon", of 7,375 tons—which made her presence felt by taking the speed record above 18 knots westward and breaking the previous best times by passages of 6 days 10 hours 9 minutes westward and 6 days 16 hours 57 minutes eastward in 1884. In May of that year she was disposed of to the Cunard Line, who regained the Blue Riband which they had lost 14½ years before, when she made records both eastward and westward in July and August of the same year. While the "Oregon" was changing ownership, a sensational voyage was made by the "America", 5,528 tons (National Line), which as a new ship broke the eastward record in June, 1884, by a passage of 6 days 14 hours 8 minutes.

At the close of 1884, the Cunard Line added the "Umbria", followed by the "Etruria" in 1885, The "Etruria" broke the westward record of the "Oregon" by 4 hours and 11 minutes, crossing in 6 days 5 hours 31 minutes, with a speed of 18·86 knots. In June, 1887, the "Umbria" broke this record with a passage of 6 days 4 hours 34 minutes, and a speed of 18·91 knots. The "Etruria" had, however, come eastward in March, 1887, at a speed of 19·41 knots, with a best day of 472 knots, and held the Blue Riband. In June, 1888, she completed a voyage westward in 6 days 1 hour 47 minutes, with an average speed of 19·57 knots and a best day of 503 knots.

Twin-screw 10,000-ton Vessels—Triple-Expansion Machinery.

The Inman and International Company made a great stride when the "City of New York" and "City of Paris" took up their stations. In May, 1889, the "City of Paris" gained the Blue Riband westward in 5 days 23 hours 7 minutes, speed 19·94 knots and best day, 511 knots; and eastward in 6 days and 29 minutes, speed 20·03 knots, and best day 476 knots. She subsequently crossed eastward in 5 days 22 hours 50 minutes, and westward at 20·01 knots, thus holding in 1889 the records in both directions at over 20 knots and under 6 days.

From 1890 to 1892 the White Star Line's "Teutonic" and "Majestic" held the lead, both gaining the distinction twice, the "Majestic" taking the speed record to 20·41 knots. This was eclipsed in October, 1892, by the "City of Paris", which regained the Blue Riband after a two-year interval by a passage at 20·7 knots.

The "Majestic" was fitted with propellers with three blades and the "Teutonic" four, but there was practically no difference in their speed.

The Cunarder "Campania", by passages of over 21 knots, gained the laurels in 1893; but in 1894 the "Lucania" made time records of 5 days 7 hours 23 minutes westward, and 5 days 8 hours 38 minutes eastward, and took the speed to 22 knots, thus securing the premier position.

The Channel secures the Blue Riband.

In May, 1892, the "Furst Bismarck", of the Hamburg-American Line, almost achieved fame by a magnificent passage eastward of 20·14 knots; but in 1897, the rival company, the North German Lloyd, added a fine ship, viz., the "Kaiser Wilhelm der Grosse", which made voyages of over 22 knots westward in March, 1898, at 22·29 knots, and eastward in the July following at 22·51 knots. She brought the Blue Riband to the Channel after it had been held in Liverpool since 1856.

The record passed to the famous "Deutschland" of the Hamburg-American Line in 1900. In 1901 she made her best records of 23·15 knots westward and 23·51 knots eastward, and a best day of 601 knots.

The North German Lloyd built the "Kronprinz Wilhelm" in 1901 and the "Kaiser Wilhelm II" (about 4,000 tons larger) in 1902, and with the latter improved very slightly on the "Deutschland's" record, crossing eastward in June, 1904, in 5 days 10 hours 10 minutes, with a speed of 23·58 knots. These three ships were fitted with quadruple-expansion engines.

Britain's Reply—Turbines.

The Cunard Line replied in 1907, when the "Lusitania" commenced to run, the speed records passing to her in October, 1907, with 23·61 knots eastward and 24 knots westward, and with them the Blue Riband. A few months later the "Mauretania" was looking for laurels, and made an eastward voyage in March, 1908, at 24·42 knots, which beat the highest westward run of the "Lusitania" at 24·25 knots, and gained the distinction. Owing to striking wreckage with a wing propeller, the "Mauretania" was compelled to run for a time using three propellers only, and made a record trip at 24·86 knots, with a best day of 635 knots under those conditions.

The records of these two ships before 1914 were given as follows:—

	Westward.	Eastward.	Speed.	Best Day.
"Mauretania"	4d., 10h., 41m.	4d., 13h., 41m.	26·06	676
"Lusitania"	4d., 11h., 42m.	4d., 15h., 50m.	25·88	666

Renewal of the Contest.

When the mercantile marine gathered together its shattered forces in 1919 there were many well-known vessels missing. The "Mauretania", however, had survived the war and was transferred with the Cunard mail service to the Channel, where she made new records. The best known was made in 1924 between Cherbourg and New York, and was 5 days 2 hours 34 minutes westward and 5 days 1 hour 49 minutes eastward at 26·25 knots, with a best day of 626 knots. She had no real rival, but the German-built "Majestic" made an eastward voyage at 24·76 knots in 1923.

The Ascendancy of the Continent.

In July, 1929, the "Bremen", of the North German Lloyd, made her appearance, and created a sensation by her initial performances, running from Cherbourg to New York in 4 days 17 hours 42 minutes at 27·83 knots, with a best day of 713 knots, and returning in 4 days 14 hours 30 minutes at 27·91 knots, with a best day of 667 knots. To this, the "Mauretania" responded in August by making the finest trip of her career of 22 years, viz., westward in 4 days 21 hours 44 minutes at 26·9 knots, and a best day of 687 knots, and eastward in 4 days 17 hours 50 minutes at 27·22 knots, with a best day of 636 knots. The s.h.p. developed on the westward passage by the 22-year-old Cunarder was 78,800, and on the eastward passage 80,000, which were far in excess of her designed power.

The "Bremen" was not allowed, however, to rest on her laurels, as in March, 1930, her sister ship—the "Europa"—put up a performance on the westward run which was slightly better than the "Bremen's" 27·91 knots eastward. The "Bremen" thereupon came eastward again in June, 1933, at 28·51 knots.

In August, 1933, the Blue Riband passed to the Italian "Rex", which travelled from Gibraltar to New York in 4 days 13 hours 58 minutes, at 28·92 knots, with a best day of 736 knots.

It was thought that the "Bremen" might eclipse this, but this feat was left to the great French liner "Normandie", which arrived at New York in June, 1935, from Bishop's Rock in 4 days 3 hours 2 minutes at 29·98 knots, and returned in 4 days 3 hours 25 minutes at 30·35 knots.

Tables III and IV give particulars of the speed records of notable screw steamships of the past and present on the North Atlantic.

The "Queen Mary".

For seven years the honour of possessing the fastest ocean steamship had been held otherwise than by Britain—first by Germany, then Italy, and lastly France, all nations whose achievements in maritime shipbuilding and engineering give them a place of foremost rank. Germany had held the lead before for ten years, but for Italy and France it was a new experience.

For Britain the record voyage of the "Queen Mary" is a milestone erected in the 99th year of our steamship services between this country and America; and whether she holds the Blue Riband for a lengthy or a brief period, an indelible mark has been made in the pages of the history of rapid transatlantic steaming.

The voyage westward was the first in that direction at over 30 knots average speed, and the whole trip was the first round voyage on which a speed of 30 knots was exceeded in each direction.

Particulars of the round voyage are given in Table V.

TABLE V.—PARTICULARS OF THE "QUEEN MARY'S" RECORD ROUND VOYAGE.

Cherbourg to Ambrose Light. Daily to Noon.	Distance, knots.	Speed, knots.	Ambrose Light to Cherbourg. Daily to Noon.	Distance, knots.	Speed, knots.
20/8/1936	472	29·5	27/8/1936	580	30·13
	760	30·4		703	30·57
	752	30·08		713	31·00
	753	30·12		712	30·96
	360	29·50		421	30·10
Total ...	3,097	Average 30·01	Total ...	3,129	Average 30·57

Average speed, Bishop's Rock to Ambrose Light, 30·14 knots.	Average speed, Ambrose Light to Bishop's Rock, 30·63 knots.
Times—	Times—
Cherbourg to Ambrose Light—4d., 7h., 12m.	Ambrose Light to Cherbourg :—4d., 6h., 22m.
Bishop's Rock to Ambrose Light—4d., 0h., 27m.	Ambrose Light to Bishop's Rock—3d., 23h., 57m.

The "Queen Mary", on her maiden voyage, set up a record for a highest day's steaming westward of 766 knots to noon, 30th May, 1936, at 30·64 knots.

The silver-gilt trophy to which the "Queen Mary" is now entitled, provided her record remains unbroken for three months, was presented in 1935 by Mr. H. K. Hales (who was at that time M.P. for Hanley, Stoke-on-Trent) for International competition and to be held by the liner making the fastest crossing of the North Atlantic. It was held at the outset by the Italian liner "Rex", and later handed over to the French liner "Normandie".

The order for the trophy was placed by Mr. Hales through Messrs. Henry Pidduck & Sons, Ltd., jewellers and silversmiths, of Hanley, Stoke-on-Trent, and Southport; and Messrs. Pidduck entrusted Messrs. James Dixon & Sons, Ltd., the well-known firm of silversmiths, of Sheffield, with the work of designing and producing the trophy. The firm's own designer—Mr. Charles Holliday—was responsible for the design, and the details and execution of the work were carried out in their factory.

The trophy is a substantial and ornate piece of silver, heavily gilt, and weighing 600 ounces. It stands about 3ft. 9in. high, and rests upon a very heavy onyx plinth. The idea of the designer was to symbolise the evolution of the modern liner. At the base are the figures of Neptune with trident, and Amphitrite. Rising above them and supporting the Blue Riband are two figures of Victory, standing back to back. The globe is finely enamelled in pale blue, depicting the Atlantic, and the liner route from the Fastnet to New York is shown by a red enamelled line. On the girdle encircling the globe are four enamelled panels, showing faithful representations of the "Great Western", "Mauretania", "Rex" and "Normandie".

The trophy has created keen interest in many quarters; and while it was on view in the offices of the owners of the "Normandie", H.M. King Edward (then Prince of Wales) asked that it should be conveyed to his residence so that he might have the opportunity of closely examining it.

The late Eng. Lt.-Com'r. JOHN O. MORGAN, R.N.R.

Portrait by] [Bacon & Sons

OBITUARY.

Eng. Lt.-Com'r. JOHN O. MORGAN, R.N.R.

It is with deepest regret that we record the death of Eng. Lt.-Com'r. John Osborn Morgan who passed away on Friday, October 16th, 1936, at Newcastle-on-Tyne.

Born at Bishop Auckland, Co. Durham, in 1862, Com'r. Morgan served his apprenticeship with Messrs. Blair's Engineering Co., Stockton-on-Tees and subsequently with Messrs. Wigham, Richardson & Co., Wallsend-on-Tyne. In 1883 he went to sea, serving for several years in vessels engined by Messrs. Wigham, Richardson & Co. Later he was employed for some years as chief engineer in vessels engaged in the China Coast trade.

In 1890 he became associated in London as assistant superintendent engineer with the late Mr. Joseph Blackett, and at a later date was appointed a surveyor for the Tyne district by the London Salvage Association. During the War he held the rank of Engineer Commander in the Royal Naval Reserve, and was appointed Deputy District Superintendent of Ship Repairs for the Southern District, stationed at Devonport.

After the War he returned to Newcastle and became a partner in the firm of Messrs. J. O. Morgan & Birchall, consulting engineers and marine surveyors, a capacity in which he was still engaged at the time of his death. A man of character and considerable charm, Com'r. Morgan, who was a bachelor and a founder member of the Society of Consulting Marine Engineers and Ship Surveyors, had many friends in engineering circles in the north. A keen golfer, he was a prominent member of the Northumberland Golf Club, and Gosforth Park will miss his genial presence and support.

In 1924 he was appointed as one of the Vice-Presidents for Newcastle-on-Tyne, and worthily represented The Institute in this capacity until the time of his death.