SESSION 1909-1910

Visit to the Works of Messrs. Capel & Co., Dalston, London

Saturday, April 17, 1909.

A VISIT was paid by the Institute of Marine Engineers on Saturday afternoon, April 17, to the works of Messrs Capel & Co., Dalston Lane, London, N.E. The visit was arranged principally in view of a paper on the question of the adaptability of the gas engine and suction plant for marine work recently read before the members by Mr. E. Shackleton which has aroused a good deal of interest, Messrs. Capel & Co. more particularly devoting their attention to the production of this type of engine.

The erecting shop was first visited, under the guidance of Mr. F. Sellers, and here were seen gas engines in various stages of construction. Particular attention was given to a 65 H.P. suction gas engine, the various parts of which were minutely examined, the very large water cooling space for the combustion chamber being noted, also the arrangement of the liner to eliminate the joint between the combustion chamber and the water space so often the cause of trouble in gas engines, and other details.

The party afterwards visited the testing shop, where a 40 h.p. suction gas engine was running, working on the Otto cycle. The piston moving forward draws in a carefully-proportioned and well-mixed charge of air and gas and compresses the mixture on its return stroke, the magneto-electrical ignition causing a regular explosion when the piston reaches its most backward position. The sudden expansion of the gases drives forward the piston on its working stroke, at the

end of which the exhaust valve opens, the products of combustion being driven out by the piston on its second return stroke. Another charge is then taken in and the complete operation again repeated every two revolutions of the crank shaft. Variable timing-gear is fitted to the magneto, and by this means the time of the explosion is adjusted to the best advantage through a wide range and while the engine is at work. Another feature of the engine is a governor of the centrifugal type, regulating the fuel consumption in proportion to the work done. This is accomplished by varying the lift on the inner valve, thus reducing the compression as the load decreases.

The suction gas-generating plant, practically a large American stove, the gas from which is utilized instead of passing up the chimney, was then examined and its construction explained by Mr. Sellers. The distinctive feature of this plant is the patent exhaust evaporator, the arrangement consisting of an exhaust silencer fitted with an internal nonpressure evaporator in which steam is raised by the waste heat from the exhaust. The plant is also fitted with a hot gas evaporator and air heater, which consists of a water jacket round the gas pipe immediately above the generator, so that the water and air are heated and steam is formed by the heat of the gas. By means of these two evaporators, therefore, practically all the waste heat is utilized. Anthracite coal is used, and in the case of the 25 b.h.p. producer in use at the works it was stated that the cost averaged 1*s.* per day in fuel for the ordinary working day. It is claimed that the usual cost of the suction gas producer is one-tenth of a penny per h.p. per hour.

The XL Otto gas engine for working on town gas was then shown, the chief features of which are the special arrangement for obtaining complete mixture of gas and air, the small amount of heat lost to cooling water, and an improved tube heater to give rapid ignition and accurate firing. The latter is obtained by means of a special type of Bunsen burner with a very small and intense flame, which impinges on the porcelain tube in one spot only, heating that particular and well-defined part of the tube to white heat. The position of this hot portion exactly determines the time of firing, thus obviating the use of a timing valve.

The Capel's XL vertical engine, to use petrol, paraffin, or gas, was then examined. If petrol is used it is not necessary

to heat the carburettor with the exhaust, but when petroleum is used a portion of the exhaust is passed through the body of the carburettor, enabling the fuel to be vaporized. The ignition is by means of coil and accumulator with the ordinary sparking plug. Splash lubrication is used in the crank case.

The party then inspected the small machine room above the erecting shop, and afterwards proceeded to the office, where, before leaving, a hearty vote of thanks was accorded to Mr. Sellers for his kindness in conducting the party, on the proposal of Mr. E. W. Ross, seconded by Mr. W. Britton.

Visit to the National Physical Laboratory

Saturday, May 15, 1909.

On Saturday, May 15, the Institute of Marine Engineers paid a visit to the National Physical Laboratory, at Bushy House, Teddington, when a large number of members and friends availed themselves of the kind permission of Dr. Glazebrook to view the various rooms.

An important part of the work of the Laboratory deals with the standardization of measures, and the Metrology building, which was first visited, is designed to provide all the necessary conditions conceivable for the utmost accuracy, the rooms being of the double shell type, provided with thermal regulation so as to ensure an equable temperature; while each machine has a separate foundation to nullify the effects of vibration. Engineers to-day turn out work true to $\frac{1}{10000}$th part of an inch, and it is perhaps necessary that the gauges which make possible such accuracy in practice should be tested by machines capable—as it was stated several in this section were—of determining the almost unthinkable measurement of one-millionth part of an inch. Here were seen the screw-threads and gauges standardized by the British Engineering Standards Committee, comparators for the comparison of line standards of length and gauges (1 metre and 4 metres) a 50 metre comparator for the standardization of surveying tapes. The standard yard, the British unit of length, was also shown, also an instrument referred to as the " balance upon

which the earth was weighed," used to calculate the weight of the earth by determining its density.

The testing of taximeters is, of course, a modern feature, and arrangements are made whereby forty of these instruments may be tested at one time at speeds of from five to fifty miles per hour.

The Electrotechnics division, rooms arranged for tests of machines, transformers, etc., was then visited, the transformer house containing a 100,000 volt, 20 kw transformer, with voltmeter, resistance and switch for measuring up to 100,000 volts. Apparatus for measuring electrical capacity at various frequencies was shown and explained, including a rotating mirror and camera for photographing high frequency sparks up to two million per second. Among other remarkable instruments was the British Association Ayrton Jones Current Weigher, recently installed for the accurate determination of current in terms of weight.

The apparatus which perhaps strikes the imagination as being the most notable is the elaborate tide-predicting machine chiefly used for the compilation of nautical tables. By this means the height of the tide in any part of the world, at any time up to a period of six years ahead, can be determined, the machine making in two hours a calculation which it would take the scientist from four to five months to perform.

The Metallurgical department is equipped for tests involving the application of the microscope and pyrometer to the study and the chemical analysis of metals, chiefly for dealing with cases of failure in practice, the analysis of material for special work and for research work. The polished and fractured surfaces of a piece of metal were examined by the visitors through the Rosenhain metallurgical microscopes, and a demonstration was given with the Zeiss apparatus for the photo-micrography of metals by the aid of ultra violet. Another useful apparatus in the large equipment in this section is the Rosenhain quenching apparatus, in which small specimens are heated in vacuo and quenched without being removed from the furnace or exposed to air or other gases.

After making the tour of the buildings, the party, which included a number of New Zealand engineers, assembled to witness a very pleasant ceremony, when the High Commissioner for New Zealand, the Hon. Wm. Hall-Jones, on behalf of the New Zealand section of the Australasian Institute of Marine

Engineers, decorated the Honorary Secretary of the Institute with the Gold Emblem of New Zealand, and declaring him elected a life Honorary Associate of the Australasian Institute " in recognition of the magnificent work performed by him on behalf of the engineers of the Empire." In making the presentation the High Commissioner referred to Mr. Adamson's career as an engineer, and said that from all quarters he had heard of his good qualities and natural qualifications. On glancing through the proceedings of the Institute he had noticed lectures given by Mr. Adamson, which indicated him to be a man of comprehensive mind, who had ideas above the mere mechanical part of his work. He was also one of the best hearted of men, and he had heard of many young engineers coming from New Zealand to the home country whom Mr. Adamson had always been ready to hospitably welcome and assist. He hoped he might live long to continue the good work he had carried on so well and that in years to come he might reap some of the distinction he had won by his merits. He called for cheers for Mr. Adamson, a call which was responded to with great heartiness.

In acknowledging the honour conferred upon him, Mr. Adamson said he appreciated very highly indeed the spirit which animated the engineers in the Colonies to waft across the seas the message and sentiments conveyed to him by letter, the outward and visible sign of which had now been handed to him. The token he had received would be treasured as befitted the manifestation of the beautiful spirit which conceived it, and he would like the High Commissioner to convey to the engineers of New Zealand how deeply he felt their friendly thoughts towards him and the Institute he was associated with, and how keenly he appreciated their action.

In proposing a vote of thanks to the Hon. Wm. Hall-Jones, Mr. Wm. Earnshaw, speaking as a member of both Institutes, said that the words spoken by the High Commissioner were a true indication of the estimation in which Mr. Adamson was held in the Dominion, and Mr. A. E. Battle, in seconding the vote of thanks said, as a New Zealander, he felt very grateful to the Institute in the Dominion for conferring the honour upon Mr. Adamson, and also that the Institute in London was honoured in having one so well versed in marine engineering as the Hon. Wm. Hall-Jones to make the presentation.

Before leaving, a hearty vote of thanks was accorded, on the proposal of Mr. J. T. Milton, to Dr. Glazebrook, for his courtesy in permitting the visit and to his assistants for the interesting manner in which they had explained the matters of interest to the visitors.

Visit to Trinity House, Tower Hill, E.C.

Saturday, June 19, 1909.

On Saturday, June 19, the members of the Institute of Marine Engineers paid a visit to Trinity House, Tower Hill, the centre from which the Brethren of Trinity direct their valuable operations for the safeguarding of shipping around these islands. The building was erected in the year 1794; the constitution of Trinity House however dates from the year 1514, in which year a charter was granted by Henry VIII, giving considerable powers, including maritime legislation, shipbuilding, the provision of storehouses for arms, ammunition, etc., but in later years its work has been chiefly confined to the control of pilotage and the upkeep of lighthouses, lightships, buoys, etc. Some time ago it was made a department of the Board of Trade, but it occupies the somewhat anomalous position of being at once a Government department while retaining the privileges of a private Corporation, and its connexion with the prosaic legislative body has not altered its customs or constitution, which are still reminiscent of the days when England first took its place as mistress of the seas. The present Master of Trinity, a position generally occupied by a Prince of the Royal Family, is H.R.H. the Prince of Wales. There are twenty-four Elder Brethren, of whom eleven are Honorary, and thirteen acting members, and an unlimited number of Younger Brethren. The acting Elder Brethren must be officers who have attained the rank of commander, and have had command of a ship of war at sea for at least three years if in the Royal Navy, or must have served in command at sea on foreign service for four years if in the mercantile marine. No special qualification is necessary for the Younger Brethren, a position entirely honorary and

involving no duties, but in practice only persons connected with the Royal Navy or the merchant service are ever chosen.

The subjects which excited the greatest amount of interest among the visitors were the very fine models of lighthouses and lightships. The splendid collection included models of the Eddystone, Smalls, Wolf Rock, Needles, Maplin and other well-known lighthouses, also a model of the Roman " pharos " in the grounds of Dover Castle, one of the earliest lighthouses known. The collection of buoys in the entrance hall includes many types of buoys now obsolete, and other elaborate buoys used at the present time, bell buoys, arranged so that a bell is sounded in rough weather, whistling buoys—the up and down motion of the waves providing an automatic blast for the whistle—others with devices by which a light is shown from the head of the buoy, and other ingenious attachments and designs. In this room also is a model of the most recent light-ship, which is loaded with oil and performs its duties un-attended for a period of six months at a time. Some handsome models of the pilot ships belonging to the Corporation also claimed a fair share of attention.

In each of the splendidly appointed rooms, board room, masters' private room, museum, library and banqueting hall, etc., are many valuable paintings, old documents and relics which recall the traditions of the past. Round the well of the main staircase is a very large painting showing the Elder Brethren, in Georgian dress, of the time when the present building was erected, and in addition to portraits of various members of the Royal family and other distinguished person-ages who have filled the position of Master of Trinity, are those of Charles II, by Sir G. Kneller, and Sir Kenelm Digby by Vandyck. Models of the old three-decker ship of the line, frigates, barques and full rigged ships of a century ago, old manuscripts and books, including one " On the Dominion of the Sea," by John Selden, containing an autograph signature of Oliver Cromwell, maps and charts dating from as far back as 1634 are among the treasures shown, while the very large library, the shelves of which are lined almost exclusively with nautical literature, is perhaps the most complete of its kind. In a corner of one of the rooms, beside some specimens of the candles then used, stands a large clock which was rescued from Smeaton's ill-fated Eddystone lighthouse, and which

chimed every half hour to remind the lighthouse-keepers to snuff the candles.

Another work, of an entirely private character, undertaken by Trinity House, is the administration of various bequests and revenues from private sources for the upkeep of almshouses and the provision of pensions for deserving seamen, the most considerable of the charitable institutions under their control being the sixty-four cottages for their pensioners, situated in Mile End, which have been in the possession of the Corporation for upwards of two hundred years.

After the visit several of the party went down to the London Dock and inspected the Moravian Mission steamer *Harmony*, on board of which a farewell service was held previous to her sailing for Labrador.

Visit to Premises of Messrs. Doulton & Co., Ltd., Lambeth, E.C.

Saturday, July 10, 1909.

On Saturday, July 10, a visit was paid by the members of the Institute of Marine Engineers to the premises of Messrs. Doulton & Co., Limited, Lambeth.

The name of Messrs. Doulton is universally associated with the manufacture of decorative pottery, but it is also known in commercial circles as one of the most eminent firms of sanitary engineers in the country. Established at Lambeth in the year 1815, in Vauxhall Walk, a move was made in 1826 to High Street, Lambeth, at which time the small pottery of Messrs. Doulton and Watts worked but one kiln per week, the staff consisting of about twelve persons. The business steadily increased until the factories and studies at Lambeth now cover some seven or eight acres of ground, while the output of stoneware pipes alone, made at the various works of Messrs. Doulton in London, Staffordshire and Lancashire, amounts to about thirty miles of pipes weekly.

The marine sanitary fittings first claimed the attention of the visitors, and interest was shown in a new type of heater for supplying hot water to baths. This is intended to be used

with exhaust steam and is capable of delivering 10 gallons of water per minute raised 50 deg. in passing through the heater. Another feature was Messrs. Doulton's patent mixing valve, so constructed that either hot, cold or tepid water can be obtained with one turn of the lever, and arranged so that the cold water must always be turned on first, thus avoiding the risk of scalding. There was also shown a new type of valve which will commend itself to those who have to provide for the supply of drinking water on board ship around coasts where the supply of water for drinking purposes has to be economized. The valve is made so that only a given quantity of water can be delivered, and it is impossible to tie the handle up, or in any other way to tamper with the valve, in order to get a greater supply than the valve is regulated to give.

Specimens of the pump, single and double valve, and underline closets, baths and fittings, lavatory and sanitary fittings of all kinds recently supplied by Messrs. Doulton to some of the leading steamship companies were shown, and it may be remarked that the firm supplied the whole of the sanitary fittings to the Cunard Co.'s *Mauretania*. A demonstration was then given of the method of making a metallo keramic joint—a process for soldering a lead soil pipe to the pottery outlet. The outlet is coated with metal during the process of manufacture and the lead pipe is then soldered to this in the usual way. A very efficient joint is produced which is capable of standing a pressure of 35′0″ head.

After a visit to the brass-finishing and other workshops the visitors were conducted to the Art show-room where some of the beautiful productions which have distinguished Messrs. Doulton in the world of ceramic art, were viewed and admired. It was pointed out that the Lambeth Pottery is, in the main, a stoneware pottery, the processes, especially those relating to the firing, being greatly different to those in use in other potteries. The heat to which the stoneware kilns are fired is very intense, and the pieces only receive one firing lasting several days, only the most carefully prepared clays emerging perfect from the ordeal. The process of salt-glazing, used in this pottery, is not applicable to any other kind of ware than stoneware, as the glaze is really formed by the partial fusion of the clay itself. During the last stage of firing, when the ware is just on the point of vitrefaction, common salt is thrown into the kiln. The decomposition of the salt fills the

kiln with dense fumes of salt-vapour, producing on the wares a thin glaze of silicate of soda, exceedingly hard and thin, and revealing the least touch left by the etching or modelling tool. For " Doulton Ware " this method was the first of the decorated styles introduced by the firm.

One of the striking peculiarities of the salt-glazed Doulton Ware is that its decoration is entirely completed in the plastic state, a condition and an advantage of this method, but the risk of spoiling the piece by denting or unduly moistening it is very great. The variety of the styles of ware, the beauty of form and colouring and the effective arrangement made a very pleasing picture. Almost every piece presents some different combination of work. The shapes are designed in the round ; preliminary setting out upon paper is of little use and is not encouraged. The most important method is that of incising the ornamental pattern, the artist cutting into the clay with a sharp tool which throws up a fine burr on either side to retain the colour afterwards applied.

The distinctive features and process of manufacture of the different styles of ware were pointed out, including Silicon Ware, Marqueterie Ware, Carrara Stoneware, Terracotta, Lambeth Faience, Vitreous Fresco, and Stoneware Polychrome, and a selection of terra-cotta panels by Mr. George Tinworth excited great admiration.

Before departing, refreshments were very kindly provided for the party by the firm, to whom a hearty vote of thanks was accorded on the proposal of Mr. T. F. Auckland, seconded by Mr. P. Boyd, R.N.R.

Visits to the Imperial International Exhibition, Shepherd's Bush, London, W.

July 24 *and September* 4, 1909.

On Saturday afternoon, July 24, a visit was paid to the Imperial International Exhibition, Shepherd's Bush, London, W., when a large number of members and friends, also members of the Cold Storage and Ice Association, assembled in the Congress Hall for the purpose of hearing and discussing a paper on " Refrigerating Installations, with special reference to the

arrangements necessary when narrow limits of temperature are required," by Mr. Robert Balfour (Member). The meeting was presided over by Mr. F. D. Green, Managing Director of the Orient Steam Navigation Co. Mr. Balfour's paper has already appeared in the Transactions of the Institute, and the report of the adjourned discussion, which took place in the hall of the Society of Arts on Monday, October 4, will be published in a subsequent issue.

On September 4 an Engineering Day was organized by the Exhibition authorities, under the auspices of the Lord Mayor of London, Sir George Wyatt Truscott, and it is pleasing to note that of the papers contributed on that occasion two of the most valuable were given by Members of the Institute, "The Extended Uses of Electricity on Board Ship," by Mr. John McLaren (Member of Council) and "The Treatment of Marine Boilers on Long Voyages," by Mr. H. Ruck-Keene (Member). These papers have also been issued to the members; Mr. McLaren's was discussed at a meeting held at the Institute on Monday, October 18, and Mr. Ruck-Keene's is down for discussion on Monday, January 10, 1909, an opportunity being thus given for members residing in foreign parts to send in written communications on the subject.

In the course of the day parties were conducted by members of the Committees to inspect the construction and operating mechanism of the flip-flap, the scenic railway and other amusements, and the various engineering features of the Exhibition. Special demonstrations were given in the Machinery Hall; a Reception was held by the Lord Mayor and a Banquet took place in the Garden Club Banqueting Hall at the conclusion of the lectures.

The programme of lectures was opened by Mr. Alph. Steiger, M.Inst.C.E., who gave a lecture on "Water Power and Turbines." He commented on the resources of water power in this country at present unused which might be utilized for the purpose of driving machinery, and described the means employed in the construction of turbines to effect this result. The conditions and requirements in each country had considerable influence on the design of its turbines. In Europe, where the demand for water power was in excess of the sources at disposal, it was more essential to exercise economy in utilizing those sources than in America, where the power was more abundant and more constant. The radial-flow turbine was built in several

stages in order to make it suitable to the variations in water supply ; but that type had now been abandoned in favour of the axial-flow turbine, which adapted itself better to the varying conditions, particularly to fluctuating falls. Pressure turbines with a good part-gate efficiency and continuity of flow he regarded as the most generally suitable turbines for use in the British Isles, as almost all its water powers were of the low-fall type for which such a turbine could be most economically used.

A very interesting paper on " Large Gas Engines " was also read by Mr. Percy R. Allen, of Runcorn. The gas engine, he said, may be considered to have become a really commercial machine when Dr. Nicholas Otto designed his first engine, using the Beau de Rochas cycle in 1875, and since then an enormous number of gas engines have been constructed upon this system, which soon became known as the Otto cycle. The Otto cycle consists of four strokes, beginning with the suction stroke to draw in the mixture of gas and air ; this is compressed on the following stroke ; at the beginning of the third stroke the mixture is fired and the pressure then rises to about double the expansion stroke ; during this stroke expansion takes place and the motion is imparted to the crank. During the fourth stroke the products of combustion are driven out by the return of the piston ; the cycle is now completed and the engine is ready to make another suction stroke. Between 1875 and 1895 there was no very striking change made in the general design of this type of engine, but in 1894 the late Mr. H. B. Thwaite demonstrated that blast furnace gas, properly cleaned and cooled, could be used in gas engines with a fairly high degree of compression ; and he thus opened up an enormous field for the profitable employment of large internal combustion engines. The two-cycle engine seems really to have been first practically worked out by Mr. Dugald Clerk, but was not apparently built on any large scale until the Oechelhauser and the Korting engin s began to be constructed. There are several possible systems of working outside the four-cycle Otto and the two-cycle Korting or Oechelhauser, but they are not at present put into practical use. The six-stroke cycle in which, after the exhaust stroke, a separate charge of pure air is drawn in and then expelled between the exhaust stroke and the suction stroke, came into a certain amount of favour. It no doubt formed a most effective scavenge, but the same result has since been obtained with

a four-stroke cycle combined with an independent air pump for supplementing the charge from the exhaust.

The internal combustion engine differs from the steam engine inasmuch as a certain amount of heat has to be deliberately wasted, that is to say, the cylinders, cylinder heads and, in large engines, the pistons and exhaust valves, have to be water cooled, otherwise the cumulative effects of the succession of explosions would raise the temperature to a very high degree. However, the heat rejected in the exhaust is now systematically made use of, the burned gases being turned through a multitubular boiler before being turned into the atmosphere. An ordinary gas engine may be roughly reckoned to consume about 70 cubic feet of producer gas having a value of 145 B.T.U.'s per cubic foot per B.H.P. hour, and this will be found to raise about 2 lb. of steam at 70 lb. pressure for each brake horse power exerted.

A lecture on " Snap-Shot Drawing " was then given by Mr. T. R. Ablett, founder and art director of the Royal Drawing Society. To facilitate the early acquirement of all kinds of drawing, he said, the Society had made their scope and relationship clearer by lay or popular definition, analysis, explanation, and also by reproductions. Drawing he defined as the process of producing, by human efforts, certain markings of a descriptive nature to serve as records and convey information in connexion with pictorial, mathematical, digrammatic and decorative work. Drawing might be analysed into pictorial drawing, representing the appearance of objects observed by means of converging rays of light ; mathematical drawing, representing the imaginary observation of objects by parallel rays of light ; and the subsidiary branches found in diagrammatic and decorative work. He had been told by an eminent engineer that when any draughtsman had a difficulty in his drawing office, he was told to draw the " look " or perspective view of the object, and this generally got over the trouble.

The last lecture, on " Geometrical and Projective Sketching," by Mr. C. Anthony Ablett, treated on perspective drawing and explained the principles on which perspective is based, and how the difficulties met with in studying the subject could be overcome. He also stated a method by which the student could accustom himself to certain rules which would enable him to obtain a complete grasp of perspective drawing.