that point. She had found very marked boundary migration in copper which was probably due to stresses during cooling. They were of a similar type to those referred to in the paper by Bowden, but she did not think they could be attributed to the cause suggested. There was a definite boundary migration which might be due to thermal expansion or to residual stresses set up by grain growth.

Professor F. C. Thompson challenged the very first statement in the paper by Sir Lawrence Bragg that "when a metal is strained beyond the elastic limit, slip takes place on glide planes and in a glide direction which can be identified with a row of most closely packed atoms in the structure." He said that in the case of single crystals there was some evidence for this statement, but in the case of polycrystalline materials the evidence was increasingly strong that that was not the direction in which atomic movement took place at all. It seemed inevitable that there was some difference in the type of atomic movement in the two cases, and he thought a movement took place which he and those associated with him in this work called the "easy glide." This did not in the least detract from the value of the general thesis which Sir Lawrence Bragg had developed, which represented, as far as he could see, completely what was happening in the single crystal, but did not represent quantitatively what was happening in polycrystalline material.

Mr. G. J. Metcalfe said that Mr. Perryman's note on the effect of cold work on the rate of precipitation in aluminium-magnesium alloys was closely connected with some work that was started whilst he was at the Royal Aircraft Establishment. In this investigation, aluminium 5 per cent magnesium alloy sheet was heated and quenched in cold water after which specimens were cold worked various amounts by cold rolling, and were then examined microscopically before and after ageing at 70 deg. Cent. for twenty-eight days. It was found that in the unaged material, whether the specimens had been cold worked or not, there was no evidence of precipitation either within the grains or at the grain boundaries. After ageing, however, it was found that in the solution heat-treated and quenched material an incomplete grain boundary network had formed, as precipitation had occurred only on one or more sides of each grain. The effect of 5, 10 and 20 per cent reduction in thickness by cold rolling, followed by ageing, was to cause a gradual increase in the grain boundary precipitation with the result that after about 20 per cent cold work, a complete grain boundary network had formed. Ageing after greater amounts of cold work caused precipitation to occur along slip planes within the grains, but this varied appreciably from grain to grain and also within each grain, apparently due to local differences in the degree of cold work. It seemed that there was a critical amount of deformation of the lattice at which precipitation started in the slip planes, and that the amount of precipitation was dependent on the degree of cold reduction, ageing treatment and composition.

Dr. J. A. Wheeler, discussing the paper by Professor Thompson, said it seemed likely from published results that the effect of applied external load on the rate of transformation of austenite to martensite was concerned not with the elastic stresses, but with the plastic strain to which the austenite was subjected. Cotterill, in a paper to the Iron and Steel Institute in 1945, had shown this to be the case. In connection with the paper by Professor Andrew and Dr. Lee, he said that although these authors regarded the rate of diffusion of hydrogen in iron at low temperature as being relatively slow, he personally would regard it as being relatively rapid, and he asked for the comments of other hydrogen workers on this point.

Sir Lawrence Bragg, in a few comments winding up the discussion, said that what was wanted was a real investigation of crystal size under exactly the same conditions, although he admitted this would be very difficult.

The third session then closed with the usual votes of thanks.

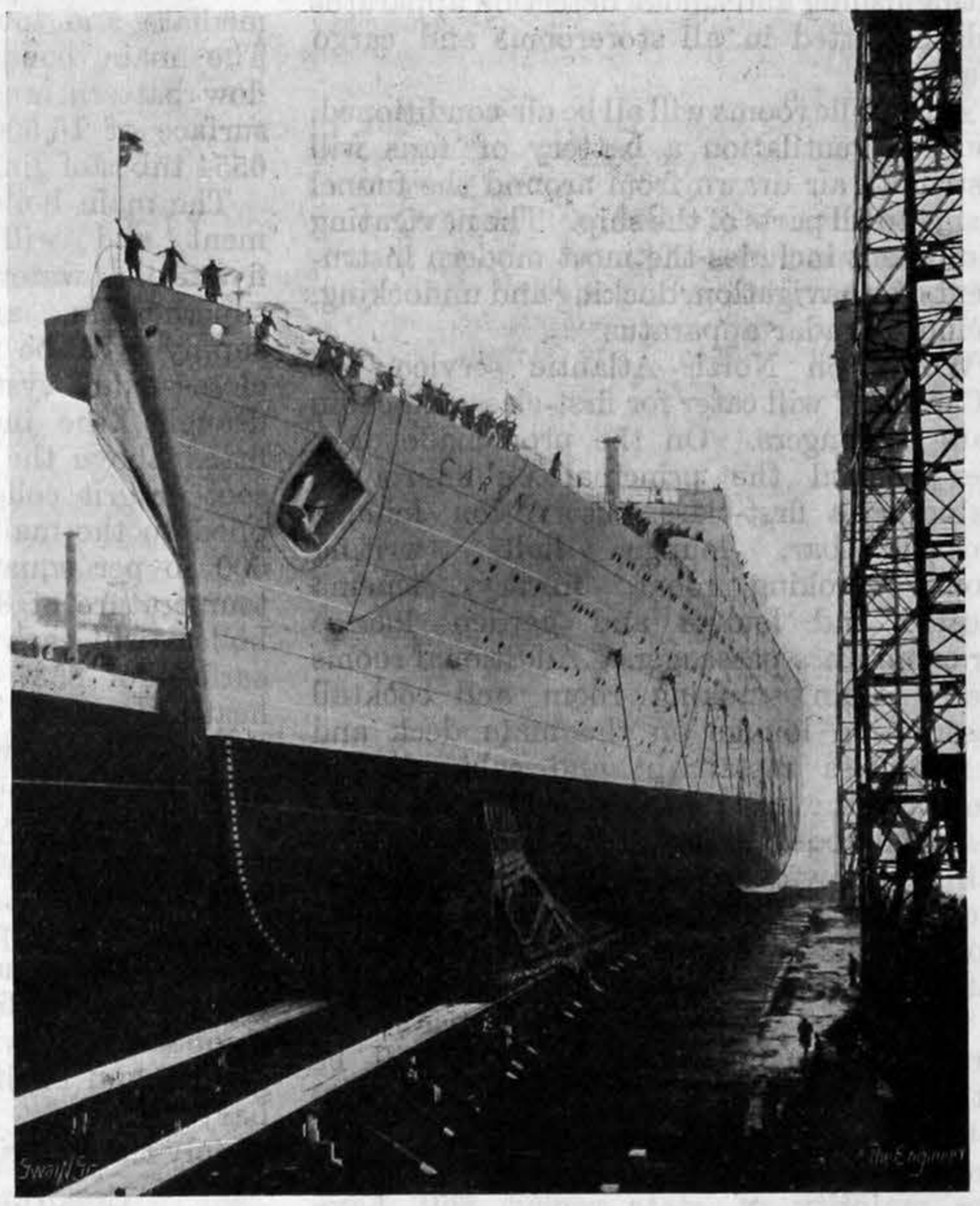
(To be continued)

Launching of the Cunard White Star Liner "Caronia"

THE launching of the Cunard White Star liner, "Caronia," from the Clydebank yard of John Brown and Co., Ltd., on Thursday, October 30th, marked a further stage in the completion of the largest passenger liner now building in the world. The ship is of especial interest as she has been designed not only to take an important place in the company's North Atlantic service, but to be available also for cruising in tropical waters. Many model experiments were made in the Clydebank experimental tank, and the size and draught of the vessel were carefully calculated in order to allow the ship to enter all the ports which are likely to be included in a world cruise itinerary.

The "Caronia" is the second ship of the same name to be built by John Brown for Cunard ownership. On July 13, 1904, the first "Caronia," a ship of 20,000 tons, was launched from the same building berth at Clydebank.

On Thursday last, the naming ceremony was gracefully performed by Her Royal Highness, Princess Elizabeth, who was accompanied by her fiancé, Lieutenant Philip Mountbatten, R.N. Before launching the ship the Princess spoke of her previous visits to Clydebank and, after referring to the present economic difficulties with which the nation was faced, and the help proferred by the Dominions and Colonies, said that while we could call upon such qualities and such craftsmanship as this great ship represented, we could be sure of our ability to solve the problems before us, and to weather the present storm. After the bottle of Empire wine had broken on the bow of the "Caronia," there was a short pause before the liner began to move down the launching ways. In a little over half a minute her bows touched the water and shortly after the pull of the drag chains brought her to rest.



LAUNCHING OF THE "CARONIA"

At the luncheon which followed the launching, Lord Aberconway, the chairman of John Brown and Co., Ltd., congratulated the Princess on her speech and presented a gift of antique plate, as a combined launching and wedding gift. In proposing the toast of the ship and her owners, he referred to the dual capacity of the ship and the fact that she would carry nearly 1000 passengers in every modern comfort which could be applied to a ship at sea. Mr. F. A. Bates, the chairman of the Cunard White Star Ltd., responded and said that the Cunard company was proud of the fact that its association with John Brown and Co., Ltd., and the firm which preceded it, went back as far as 1853. He then proposed the toast of the builders. In his reply, Sir Stephen Pigott, the managing director of Clydebank shipyard and engine works, made reference to the Cunard White Star company as the firm's chief customer. His firm and its predecessors had built for Cunard, he said, a total of about fifty ships, representing a gross tonnage of more than 500,000, with machinery of 750,000 h.p.

Hull Design and Construction

From a gracefully curved well raked stem, the main deck will sweep back to a terraced bridge structure, the single tripod mast being set abaft the bridge. There will be a single large oval funnel amidships, without external guy ropes, and cowl ventilators will be done away with, giving clear upper

deck spaces. The principal hull dimensions and particulars are as follows :—

Length overall	715ft
Length between perpendiculars ...	665ft
Length of promenade deck	495ft
Moulded breadth	91ft
Number of decks	9
Approximate gross tonnage	34,000

The ship is built with a cellular double bottom, which gives a continuous watertight inner skin, from fore to after peak, with forty watertight compartments between the inner and outer bottoms. Ten watertight bulkheads form the main watertight compartments of the ship above the double bottom. Special attention has been paid to lifeboat equipment, and all boats will be carried in gravity davits and will be power driven. In addition to eight orthodox pattern lifeboats, each designed to carry 145 persons, there will be six single-screw launches, designed to carry sixty persons, fitted with deck shelters and driven by 130 h.p. diesel engines, at a speed of nine knots. Besides serving as lifeboats, these launches will enable passengers to land comfortably and speedily on shore excursions, when the ship is at anchor off cruising ports.

For fire protection automatic sprinklers will be installed in public rooms, cabins and working spaces, while combined CO_2 fire-extinguishing and smoke detection apparatus will be fitted in all storerooms and cargo spaces.

The public rooms will all be air-conditioned, and for ventilation a battery of fans will distribute air drawn from around the funnel casing to all parts of the ship. The navigating equipment includes the most modern instruments for navigation, docking and undocking, including radar apparatus.

Whilst on North Atlantic service, the "Caronia" will cater for first-class and cabin class passengers. On the promenade deck are grouped the principal public rooms, including a first-class observation lounge, cocktail bar, lounge hall, writing room, smoking room, library, cinema theatre and lounge and garden lounge for cabin class passengers. Additional rooms are a cabin smoking room and cocktail observation lounge on the main deck and a first-class restaurant and cabin dining-room on the restaurant deck.

Accommodation for first-class passengers will be provided on the sun deck, main deck, "A" deck, and restaurant deck. Most of the cabins will be outboard, with natural lighting and ventilation, in addition to mechanical ventilation and electric radiators. The main deck amidships will be set apart for suites of accommodation consisting of sitting room, bedroom, servants room, box room and private bath room. The majority of state rooms will have private bath rooms and in addition to the usual hot and cold water services, iced water will be available at each wash basin. The cabin class passengers will be accommodated in state rooms on the main deck, the restaurant deck and "B" and "C" decks. Single and two-berth cabins will be provided, provision being made for an extra Pullman berth. Each state room will have its private toilet.

The decks in the "Caronia" will be exceptionally spacious. In addition to a glass-enclosed promenade deck, over 400ft in length, open promenades will be provided on the sun deck with a 70ft wide space abaft the bridge for sports and games. In addition to a terrace above, there will be a considerable amount of space surrounding the open-air swimming pool. The cinema will be designed to seat 300 persons, and will be open to both first-class and cabin class passengers. The first-class restaurant and the cabin class dining room will, together, have a capacity for 540 persons.

Main Propelling Machinery

The main propelling machinery comprises a twin-screw arrangement of Parsons geared turbines, taking steam from Yarrow water-tube boilers, constructed by the shipbuilders. The two turbine units will each consist of triple expansion impulse reaction turbines, designed to be operated independently in either the ahead or the astern direction. The high pressure, intermediate pressure and low pressure turbines are grouped around a main gear wheel, the condenser being underslung from its low pressure turbine. At full power the high pressure turbine will run at 3686 r.p.m. and the intermediate and low pressure turbines at 1990 r.p.m. The turbine revolutions will be reduced to the propeller speed of 140 r.p.m. in the case of the high pressure turbines, through double reduction, double helical gearing; for the intermediate and low pressure turbines there will be single reduction helical gearing. The primary gears of the high pressure pinion are of the all-addendum type, whereas the high pressure second reduction gears and the intermediate and low pressure gears are of the deep tooth involute design. The astern turbines are incorporated in the intermediate and low pressure turbine casings. The main condensers are of the single-flow pattern, and each will have a cooling surface of 16,500 square feet, made up of 6554 tubes of $\frac{3}{4}$in external diameter.

The main boilers will be in one compartment and will comprise six side-fired, five-drum water-tube boilers fitted with superheaters and air heaters. Air supply will be controlled by a balanced closed-trunk system of forced and induced draught, the induced draught fans being fitted above the air heaters and under the soot or grit collectors. Steam will be supplied to the main turbines at a pressure of 600 lb per square inch gauge and a total temperature of 800 deg. Fah. Four of the boilers will each have a generating heating surface of 8387 square feet, and a superheating surface of 2945 square feet, while the remaining two boilers will have each a generating surface of 5861 square feet and a superheating surface of 2224 square feet. All the auxiliary machinery serving the main machinery, except the feed pumps and the extraction pumps, will be electrically driven. Pass-out steam from the turbo-generators will, for the first time, be used on shipboard, and will supply the thermo tanks, galleys and engine-room low pressure auxiliary services. The generators will also supply the electrical power for hotel services.

Electrical Installation

The entire ship's electrical requirements will be supplied from a power station situated forward of the boiler room, with a designed output of 4400 kW.

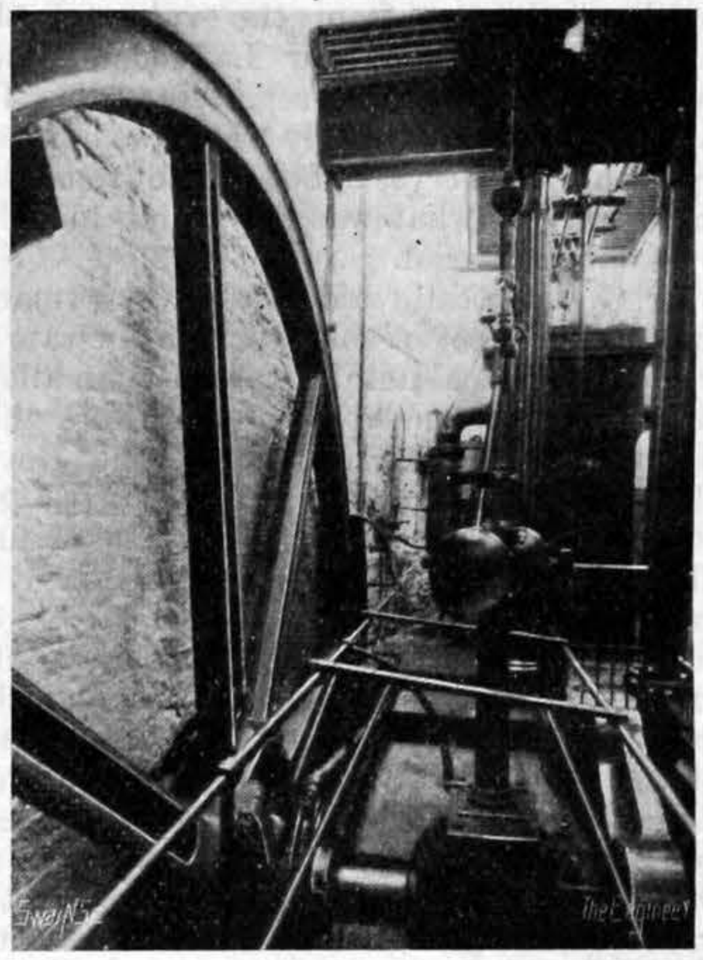
Each of the four generators will consist of an Allen 1100-kW, 220-V d.c. dynamo, driven by a steam turbine through single reduction gearing. There will be a separate condenser to each generator set.

The main switchboard will be in the turbo-generator room and will be connected by feeder cables to twenty-six auxiliary switchboards. As fluorescent lighting will figure largely in the illumination of the public rooms, about 2500 tubes being employed, two 175-kVA, three-phase, 220-V alternators are situated in the generator room, the lamps being connected across the phases.

There is a low pressure electrical system supplied by two 2-kW, 25-V motor generators, with a nickel iron battery as an emergency reserve. The emergency lighting set will consist of a 75-kW diesel-driven generator set, with electrical and compressed air quick-starting equipment. All deck machinery will be electrically operated and most of the motors for the deck and engine-room auxiliary plant will be of the Laurence Scott and Electromotors design and construction.

A Beam Engine Returns to Service

Fifteen years ago the firm of Pattrick and Thompson, Ltd., timber merchants, of King's Lynn, took an old beam engine out of service, replacing the power it had provided by a drive from a 170 h.p. electric motor. Now it is reported, the engine is to be brought back into service to save electricity. The engine has a single cylinder with a 30$\frac{1}{4}$in bore and a 63in stroke, and its flywheel is 15ft diameter, weighing about 8 tons. It develops more than 100 h.p., with steam at 32 lb per square inch, exhausting to a 26in vacuum, and will be used for driving saws, planes and other woodworking machinery in the works. Though the name of the builder of the engine is not known and some of its early history is doubtful, the machine is believed to be about 100 years old. It was, apparently, originally installed to drive a mill at Accrington, where it operated for about thirty years. In 1870 it was brought to King's Lynn and installed in its present position by Messrs. Savages of that town. We learn that one of the boilers made by the last-named firm in 1870 to supply steam to the engine is still in use and maintains its original pressure. A photograph, reproduced herewith, illustrates the engine.



OLD BEAM ENGINE

The Works of Holman Brothers, Ltd.—But few of the many users of the pneumatic tools and equipment made by Holman Brothers, Ltd., of Camborne, Cornwall, have had an opportunity to visit the company's works, owing to their distance from the industrial centres of the country. For this reason there has recently been made a particularly interesting film in which the works and production methods are described in some detail. The film is in essence a conducted tour of the works and shows the processes involved in manufacture from the earliest stages up to the final testing and despatch of the finished article. Arrangements have been made to display the film in many parts of this country and abroad, and it should do much to impress not only those familiar with the firm's products, but also potential users, with the care and attention given to every detail in the course of manufacture. At a lunch preceding the first presentation of the film, a note of interest was struck when Mr. P. Holman introduced Mr. Jim Holman as a director, one of the fifth generation of his family to serve the company in an executive capacity.