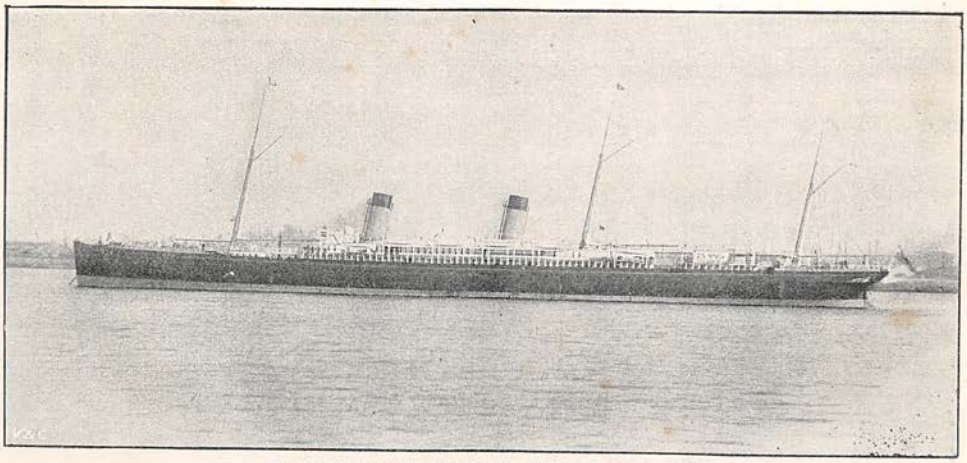


THE MERCANTILE ARMED CRUISER "MAJESTIC."

WORKERS AND THEIR WORK.

BUILDING AN ATLANTIC LINER.

By John Foster Fraser.

IT was in accordance with the eternal fitness of things that I should find the Queen's Island, Belfast, no island at all, save in the Irish sense; that it is just the opposite. Still, one hardly expected to encounter a Hibernian bull so far north as Belfast, where the inhabitants are more Scotch than the Aberdonians themselves. My object was to visit the largest shipbuilding yard in the world—that of Messrs. Harland & Wolff—and my curiosity prompted me to inquire the nationality of those who had the directing of this great concern, and I learnt that Sir Edward Harland, who died since my visit, was an Englishman, Mr. Wolff a German, and Mr. Pirrie and Mr. Wilson Irishmen, though of Scotch descent. Perhaps it was this joining of the nations on the banks of the Lagan that has made the firm the tremendous affair it is to-day.

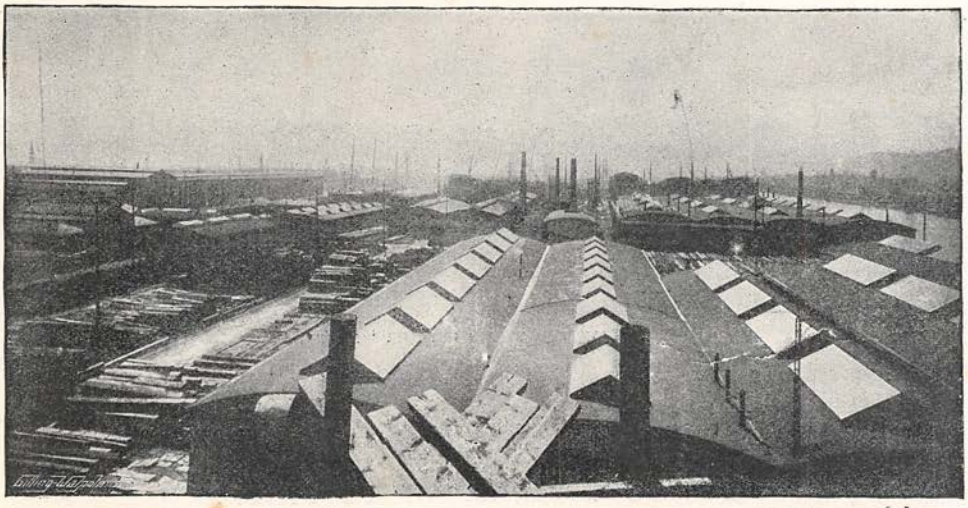
To judge from his brogue, it was a real Irishman who induced me to mount his jaunting-car and be driven down to the shipyard. We proceeded safely enough, though I had to hold on to the uncomfortable vehicle, and to pretend I liked it, while all the time I was in mortal dread of being pitched head first on to the cobblestones, which were so useful when Belfast gave itself up to popular diversion—a riot. But the horse, so the driver told me, had a hatred of steam-rollers, and when we encountered one snorting along the quayside I was told I could not be taken any further, for the only progress I would make would be into the docks. I had no desire for a douche with my clothes on; so, with a grumble, I dismounted and pursued the rest of the journey on foot. It was to my advantage after all, for I was able to inspect the shipping, to listen to the not unpleasant rattle of the cranes as the loading and unloading went on and see everybody in a state of bustling activity, until I began to wonder whether I was in Ireland after all, for the scene and the people were so different from what one generally expects to find.

And when I was in the shipyard, where great steel vessels destined to plough the oceans were in course of erection, and saw the thousands of men all busy, like a hive of bees, my wonder was still greater. There are few places so interesting as a yard where boats are built. I can understand, however, that lack of keen personal interest there must have been in the old days when the shipbuilder built his vessels of wood, when every man acted more or less in accordance to rule of thumb, and never bothered his head about the laws of

resistance and the like, but every boat had an individuality of its own. With the introduction of steam, wood gave way to the more serviceable iron, and in later years iron has made room for steel. So it is that whereas in former times it was the shipwright who designed and built the boats, now the labour is divided between the draughtsman, the riveter and the boiler-maker, and along the banks of the Tyne, the Clyde, the Mersey and the Lagan now resound the harsh clang of heavy hammers beating on stubborn rivets. The making of vessels has largely become stereotyped, but with this stereotyping has come the display of great enterprise and the launching of gigantic undertakings.

Formerly the speed of sea-going ships was largely a question of the spread of canvas, without "heeling" too much; but science now plays a considerable part in shipbuilding. A great change has taken place in the method of construction. Iron ships have generally less than half their bulk out of the water, and they will float even when almost filled with water. Everything which goes to the making of an iron ship is decided by mathematical calculation; the thickness of all the parts are detailed in the specifications, and, as the weight of each part is known, it is possible to arrive at the approximate weight of the vessel when completed. Much judgment, foresight and clear-headedness is required in the conducting of a shipyard, and Mr. Carlisle, the manager at Messrs. Harland & Wolff's, though still a comparatively young man, is beginning to grow gray in the service of the firm.

And to what wonderful dimensions this firm has extended its works since the nucleus was laid nearly half a century ago! The yard is on ground which has been reclaimed from the river Lagan, and covers 80 acres. Not only is there shipbuilding to be seen, but also engineering, for, as I will show, Messrs. Harland & Wolff not only build, but equip a vessel throughout. I will give a few figures to indicate the sort of industry of which the North of Ireland can boast. Here are the number of vessels, with their aggregate tonnage, launched from this one yard during the last four periods of five years on to 1894:—



From a photo by] [*Reid Bros., Belfast.*

VIEW OF THE YARD FROM THE TOP OF A VESSEL.

	Vessels.	Tons.
Five years ending 1879 . .	44	57,068
" " 1884 . .	42	125,626
" " 1889 . .	57	156,091
" " 1894 . .	68	313,225

These figures go to demonstrate the great increase in the size and weight of vessels during the past decade. I do not wish to flatter Messrs. Harland & Wolff, for my object is rather to give an idea of the industries which have placed Great Britain in the forefront of the nations than give credit to any particular firm. Still it is interesting to remark that for four years in succession their tonnage output has exceeded that of any other firm. While other firms produce more vessels, Harland & Wolff make up for

it by the size and weight of theirs. For instance :—

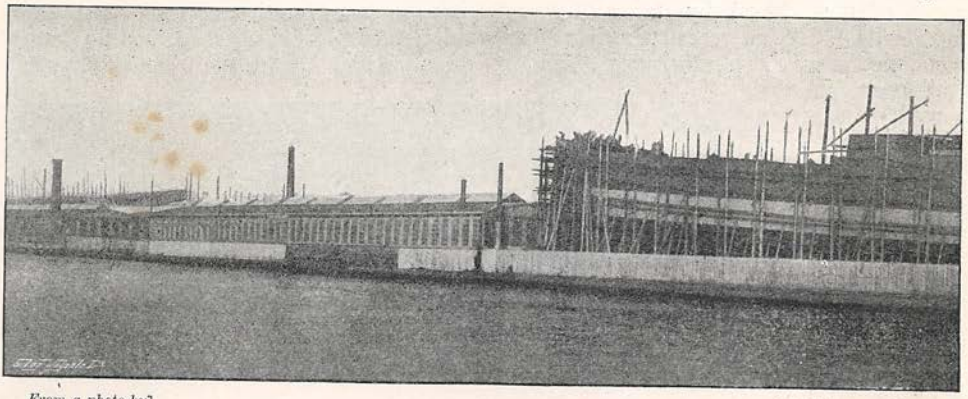
Harland & Wolff.	Vessels.	Tons.	The next best record.	Vessels.	Tons.
1891 .	13	64,962	1891 .	26	59,033
1892 .	14	68,612	1892 .	21	59,810
1893 .	15	65,660	1893 .	18	50,349
1894 .	13	65,448	1894 .	25	56,946

The fame of the yard chiefly rests on the magnificient Atlantic liners that have been built in it. For nearly a quarter of a century the fleet of the White Star Line has been launched here. Everybody has heard of those floating palaces, the *Majestic* and the *Teutonic*, which first touched water in the Lagan. Amongst the other noteworthy steamers built by Harland & Wolff within the last few years are eight mail and cargo ships for the Pacific Steam Navigation Co., four passenger steamers for the Union Steamship Co., familiarly known as the four G's — *Gaul*, *Goth*, *Greek*, and *Guelph* — specially designed and constructed to cross the bars at certain ports in South Africa—a course hitherto found impracticable by large vessels. For the same company they have built the magnificent mail steamer *Norman*. I could go on quoting a string of boats built on the Queen's Island slips, but those I have mentioned are sufficient to show what an immense place it is.

Between eight and nine thousand men are employed, and one of the most remarkable sights I have ever witnessed was one night, shortly after 5.30 o'clock, when they were all released. The crowd rushed along the roadway like the swell of a wave. All the men do not care to cross the river by the bridge, so some make use of the ferry. The crowds on the steps waiting their turn to get on the boat was really very like a great throng I once saw on a railway platform awaiting the arrival of Mr. Gladstone. There was a sea of eager upturned faces, but in the case of the crowd on the steps their countenances were toil-stained and their coats covered with iron dust, while in their hard hands were tin flasks which had been filled with cold tea, or maybe something stronger, to appease their thirst in the heat of the day.

And now having roughly sketched in outline the magnitude of the shipyard, I may proceed to give my impressions and the facts I gleaned as I trod my way between the iron-ribbed monsters which were reared on all sides. I had a long chat with the manager in his office, and he showed me how he was in communication with the chief of every department all over the works. He had merely to ring a bell by his side and instantly there was an answering ring and the telephone was in use. Or a certain signal might be given to indicate that a chief of a department was wanted at once, and another signal that a boy was to be sent. There was no waste of time ; and although in the shipyard there seemed much confusion there was really no more than in a newspaper office, where, despite all the rushing about, everything proceeds with regularity and precision. So I was interested to find that while Mr. Carlisle was chatting with me he at the same time was sending instructions into thirty offices in different parts of the works.

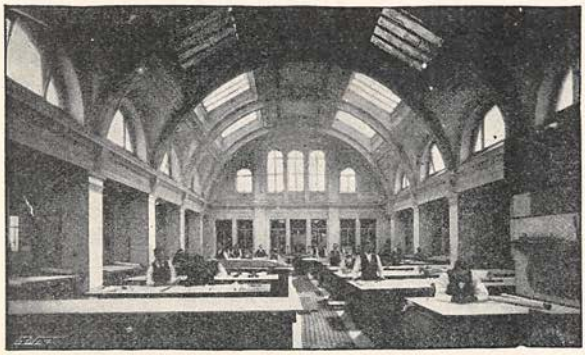
Mr. Carlisle showed me over the yards, and in the course of further conversation with him the thought that had often occurred to me when hearing of Messrs. Harland & Wolff's success came back with more force than ever, viz., that the characteristic feature



From a photo by] [*Reid Bros., Belfast.*

VIEW OF THE YARD FROM THE RIVER LAGAN.

of their relations with the shipowners for whom they build, is the friendliness and unanimity that seems to exist (and, as Mr. Carlisle assured me, *does* exist) between them. All the partners are on friendly and social terms with those with whom they do business, and in some instances such implicit confidence is placed in them that an owner actually gives an order for one of the magnificent Atlantic steamers that Messrs. Harland & Wolff know so well how to construct without any formal agreement being drawn up and signed by the contracting parties.



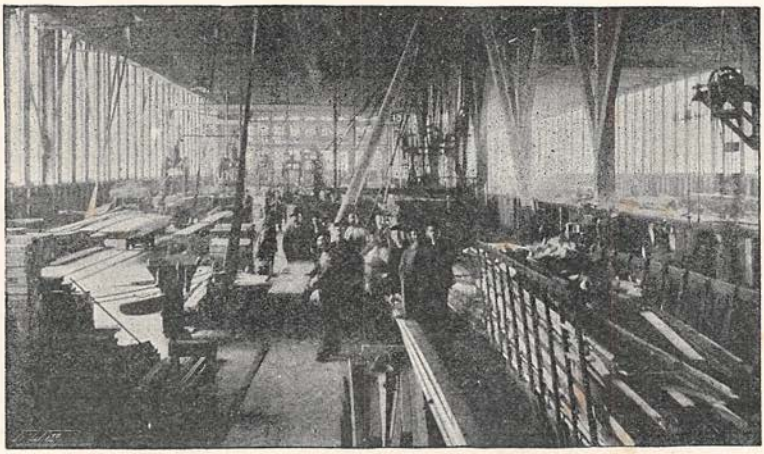
From a photo by] [*Reid Bros., Belfast.*

IN THE DRAWING OFFICE.

Many years ago, when Sir Edward Harland took an active interest in the firm, the White Star Company, as a recognition of the time he devoted to, and the personal interest he took in, their work, and as an expression of their good feelings towards him, presented a portrait of Sir Edward, by Frank Holl, to Lady Harland. A few years later, just after the completion of the *Teutonic* and *Majestic*, a similar compliment was paid by the same friends to Mr. W. J. Pirrie when his portrait, by Professor Herkomer, was presented to Mrs. Pirrie as a mark of their appreciation of her husband's efforts to maintain their line in the position it has always held in the Atlantic service.

I also gathered from Mr. Carlisle's remarks that these friendly relations to some extent explained why Messrs. Harland & Wolff, as far as fast Atlantic liners are concerned, never build for any other than the White Star Line. There being such perfect understanding between these owners and builders when an order is given, everything is left to the latter as to the construction and equipment of the vessel, and naturally they build the best vessel they can produce at the time, within certain limits, and it would be manifestly unfair to build for rival lines under such conditions.

I spent some time in the drawing office where the various plans were being prepared. The paper was stretched on high solid tables, and then the draughtsmen, in their shirt sleeves, worked out according to scale particular sections of the vessels. This requires great delicacy, and errors are things which simply must not be. The drawing office is one of the most carefully guarded places on the works, for Messrs. Harland & Wolff have their own particular designs as to the way vessels should be built, and they do not care for other people to learn the details; indeed it is necessary to be very careful who is admitted to the yard at all. It would not do to allow every stranger to enter, for he might be a representative from a rival firm on the outlook for "wrinkles." Although I went into the drawing office and through all the machinery departments, it was in accordance with special provisions made that I should wander where I wanted, the firm knowing that however great was my interest in marine engines, I had no desire to detail what I saw for the benefit of any other



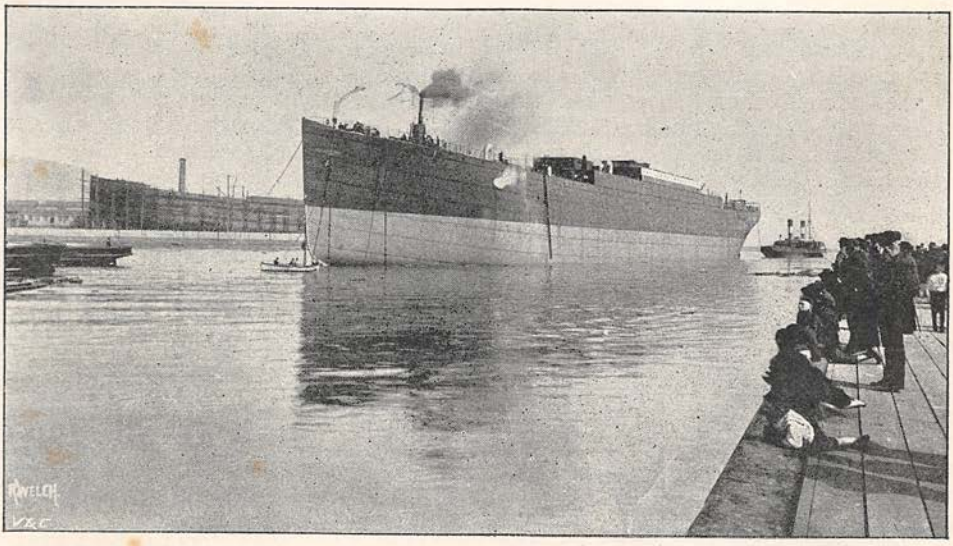
From a photo by] [*Reid Bros., Belfast.*

IN THE SAW MILL.

makers, but rather to give a general idea of what is to be seen in a great shipyard whose doors are closed to the public gaze.

After the plans have been worked out on paper, there takes place what is called the "laying off"; that is, on the floor of an immense loft, called the mould floor, the plan is transferred on the exact dimensions they are to be in the ship. The floor is covered with curved lines, and although confusing enough to the lay eye, every line indicates a part of the ship, and altogether they may be reckoned as the skeleton from which the shipbuilders work.

Before turning into the yard I entered the joiners' shop and saw mills—for even in an iron-bound vessel there is a good deal more



From a photo by] *[R. Welch, Belfast*

S.S. "GEORGIC" LAUNCHED.
(The largest cargo steamer in the world.)

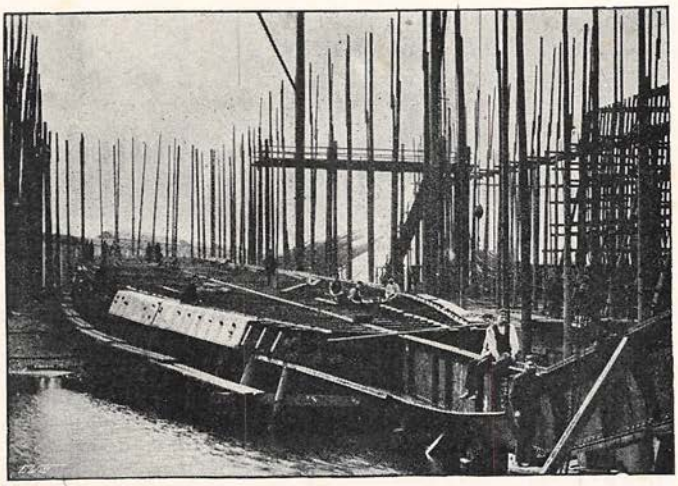
wood used in fitting up than is generally supposed by the public. All sorts of joinering was being done, from nicely turned work to rough flooring, whilst in the saw mills the teeth of the saws screeched as they cut through the middle of a huge tree. There was one saw, made of a band of steel, which was running at the rate of a mile a minute. These mills, with a joiners' shop, cover 4½ acres, while close to are the timber-drying sheds covering another couple of acres.

Then into the yard I went. There were thirteen ships being built, and all in different stages of erection. An ironclad vessel, when in the rough, is by no means artistic. Men rush about with great plates of steel on handcarts; there is the creaking of cranes as the plates are swung through the air into place, the clang of hammers reverberating again and again. Every vessel is surrounded by a network of scaffolding, and inclined wooden ways are built to the top of the ship. Chains, pieces of iron, heaps of bolts and blocks of wood litter the ground, and you shudder as the casual remark is made to keep out of the way of falling bolts, and it is added, as a piece of interesting information, that scarcely a day passes without someone being injured, and that on the average a baker's dozen of men are killed in the course of a year.

I say that all is apparent confusion; and when, for a moment, you stand in the centre of the yard or, better still, climb one of the scaffoldings and give a look round, you are seized with an abiding amazement that all this scurrying and clashing of bars and deafening noise is in the direction of making so taut and neat a thing as a steamship. Viewed from the summit of one of the scaffolds, so that a bird's-eye glance is obtained, not only of the spare-ribbed skeletons of ships, but those that are already plated, and others that have been painted and ready to float, and still others lying in the basin, having machinery fitted in them, and then allowing the gaze to wander across the river to the smoke-veiled town of Belfast or away down the Lough between the picturesque coasts of Down and Antrim, the sight presented is as varied as any I know.

Four out of the thirteen vessels I saw

being built were nearly 600 feet in length, seven were nearly 500 feet, and two were about 300 feet. Each vessel is known by a number and not by a name, and in speaking of it the number is always used. Down below me from where I stood were many bars of iron lying on blocks of wood. That was the keel of a boat for the West India and Pacific Steamship Company. At the other end of the yard was a vessel for the Johnston Line, two for Messrs. Bates, of Liverpool, and one for the Harrison Line, and others of lesser degree.

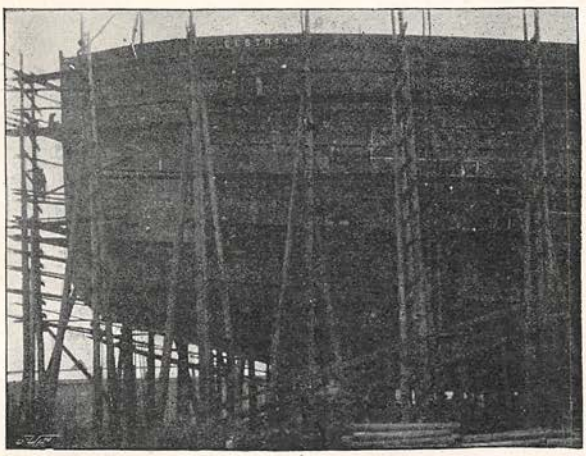


From a photo by [*Reid Bros., Belfast.*

THE KEEL OF A VESSEL.

In the building of a liner, as in the building of any other vessel, the first thing to do is to lay the keel. This is of bars of iron laid on blocks of wood, running with a gentle slant to the water's edge, and high enough to allow the man to work underneath. When the bars are fastened together then the ribs are fixed. These are of bent pieces of steel, which have been curved in the smiths' shop according to a pattern worked out on the iron-plated floor. All over the floor are holes, and plugs are stuck in these holes according to a certain arrangement, and then when the bars of iron are drawn out of the furnace they are bent to these plugs by the beat of huge hammers. You see the long bars pushed far into the furnace, and after they have been in some time, drawn out red-hot with great tongs, and the hammers descend in a rush upon them. Holes have to be pierced down the sides through which bolts are to be thrust to join the plates. The punching of the holes is all done by hydraulic machinery. At the touch of a lever down comes the punch with giant strength, nothing being able to resist it, and a piece of metal, the circumference of a shilling, is forced out. The same has to be done with the plates. These are made in ironworks in Scotland or in England, but they have to be cut according to pattern. A number of men hold the plate and guide it under a shearing machine, which cuts neatly and closely. Holes have also to be punched in the plates, and the work is done with great rapidity.

As soon as the skeleton has been fixed up and cross pieces fastened to prevent the ribs by their weight falling away, the fastening of the plates to them begins. You have only to look at an iron vessel and see the number of rivets to get some sort of an idea of the tremendous work this is. A temporary crane swings the sheet of metal into place. It is pushed backwards and forwards by the men till the position is exact. A couple of small bolts are pushed through the holes in the plate and rib, and fastened with a nut to keep it steady. On the inner side of the boat is a man with a portable furnace, in which he heats the rivets till they are red hot. Then he thrusts one through a hole, and two men on the other side immediately proceed to



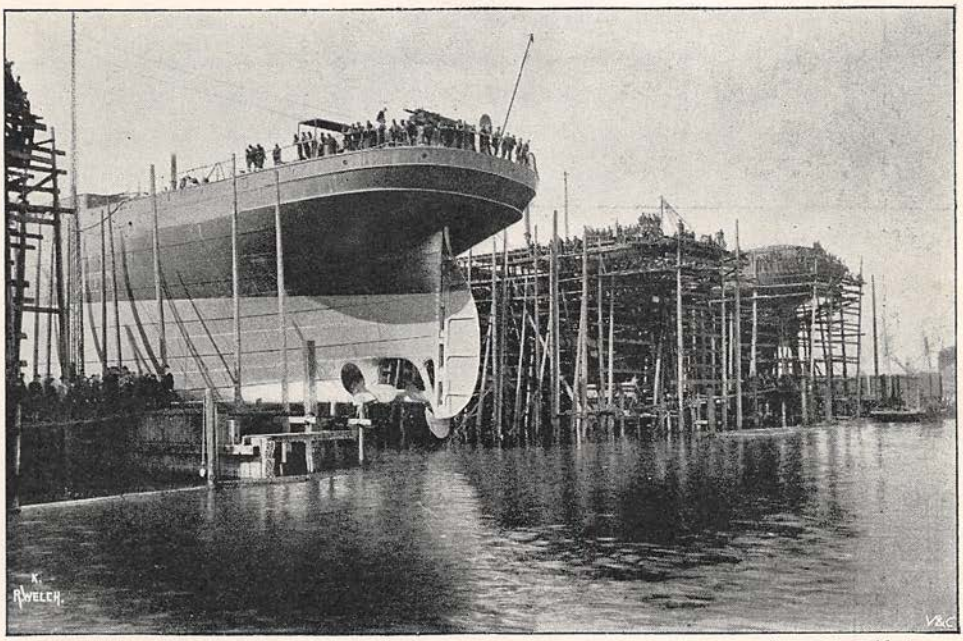
From a photo by [*Reid Bros., Belfast.*

FASTENING THE PLATES WITH RIVETS.

cut off the head of the bolt with a chisel. The moment this is done their hammers fall as quickly as they can full upon the bolt. As there is a groove slanting outwards in each hole on the plate, the bolt in its fired soft state is beaten until it fills this and is level with the plate itself. When a bolt has been properly fixed by this means nothing can wrench it out. If at any time it is found necessary to remove a bolt it has to be chiselled and drilled with no end of difficulty.

When one plate is made fast by the driving of bolt after bolt, then another plate is brought along, and it in its turn is fixed, until all along the side of the vessel a band of steel plates has been added. Another band is fixed above that, and so in the course of months, by infinite toil, the outer casing of a ship is fastened. Inside plates are fixed horizontally, some 18 inches from the bottom, and divided into air-tight compartments, which also serve an exceedingly useful purpose, namely, of being filled with water whenever necessary, to act as ballast. This is a great economy, and one that is readily appreciated by all shipowners.

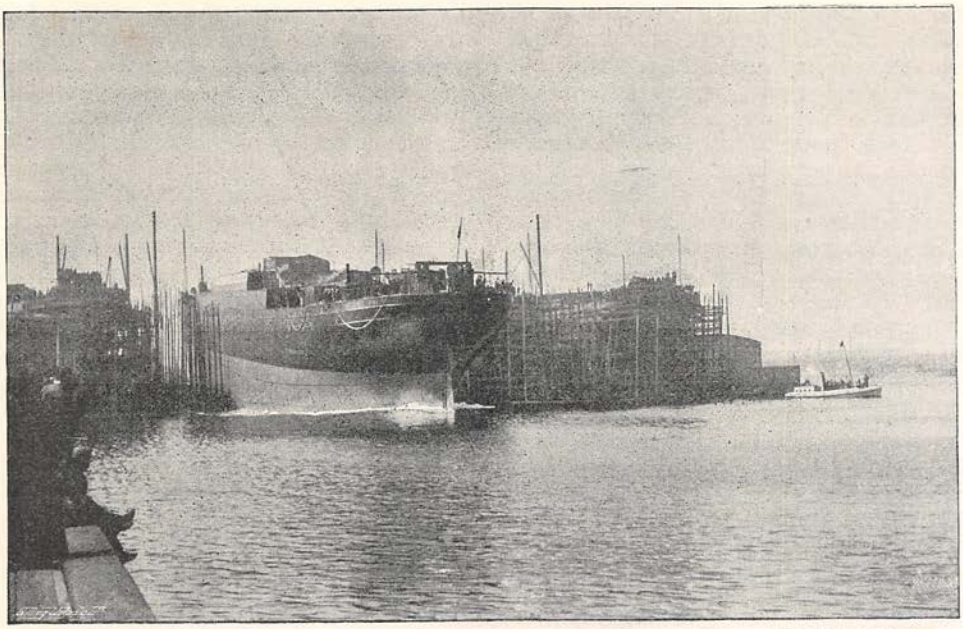
As the vessel rears higher and higher, so the immense scaffoldings rear with it, until it is literally surrounded with poles. Dangling at the end of ropes let down from the top are men who paint the outside of the vessel until the iron brown has all given place to a bright salmon tint. Yet, although the outside is complete, after the propellers have been put in, practically nothing has been done to the interior. Here, then, all activity centres, and the cutting of plates and fixing them, until compartment after compartment is made, is work that occupies a long time. About the middle of the ship an open space is left to allow the machinery to be inserted when once the vessel has been floated. There is not much variation. It is nothing else but the fixing of plates, day in and day out, until at last the top deck is reached, where the plates have a diamond-shape pattern slightly raised upon them for the purpose of affording a better foothold than the smooth-surfaced metal. Thus when the true framework of the ship is all in the vessel is ready for launching.



From a photo by] [*R. Welch, Belfast.*

THE SIGNAL FOR A LAUNCH.

The launching of a great boat six or seven hundred feet long is a pretty sight, but it is an anxious time. The keel, as I have explained, rests upon a series of wooden blocks, but at each side is a tramway, as it were, of heavy pieces of timber which run, not only in a slanting direction the whole length of the ship, but far into the water as well. This timber is well greased with tallow and black soap, and then other pieces



From a photo by] [*R. Welch, Belfast.*

VESSEL DIPPING INTO THE WATER.

of timber, all screwed together and called a cradle, are fastened above it until the sides of the vessel are jammed tight. The blocks of wood beneath are knocked away, and the vessel settles down until she rests in the cradle. The beams at the sides are removed, and, but for a dovetailed arrangement at the nose of the boat which holds the cradle, it would slip over the tallow and black soap, carrying the ship with it. This is what is intended, but first of all heavy anchors have to be buried in the ground to pull the vessel up when it reaches the water, so that it will not dash into the other side of the dock and do damage.

I was fortunate in witnessing the launch of one of these great vessels. Two anchors had been buried, each weighing 5 tons, only parts of them sticking above ground, and a humorist had written in chalk, "Don't take these away." The chain was many tons in weight, every link bearing an Admiralty stamp, and was hung along the ship's side, held up by laps of rope. There was an immense crowd of spectators to see the launch, and for a few minutes the men in the yard ceased work and clambered on the top of other vessels. Everything was ready, and then the manager gave the signal and the wedge which held the cradle to the greased timber tramway received a blow with a sledge-hammer. For a moment all held their breath. "She moves!" was the shout that went up from a hundred throats. As usual a lady gracefully christened the vessel with a bottle of champagne, and then it was seen to be gliding down the ways. Slowly at first, but immediately gathering a tremendous impetus the vessel slid towards the water. There was a rumbling of cracking timber, and men skipped briskly out of the way. With a fine sweep the stern dipped into the still water and threw up a silver-edged wave. As a cheer burst from the spectators the plunge was made, and she floated. The vessel entered the water with the speed of a greyhound, and now came the stopping. Crack, crack, went the ropes which held the anchor chains until they had run out. But still the ship was not stopped, and with a tug it drew at the anchors, tearing them several feet through the ground. It was a thrilling moment; but the anchors were too much for the ship, and, with a last strain and a groan, it pulled up within five feet of where the calculations had been made for it to stop. Many boats were out picking up the floating pieces of timber. For a quarter of an hour the ship lay idly on the water, and then she was tugged round to another part of the yard, moored and made ready for the engines to be put in, and fitted up and upholstered throughout ready for a voyage.

This part of the building of a liner is, to the looker-on, the most interesting of all. A walk through the shops where the engines were being made was, of course, very much like a walk through the shops of any other large works. But what a mass of whizzing machinery there was! Great lathes were spinning and huge hammers beating, while not only the large sections of the machinery were being made, but also delicate little appliances, in the manufacture of which great care is requisite. Every man had his own particular article to make either in steel or in brass. At the close of the day everything is collected and put away in the store-rooms, so that the men whose particular duty it is to fit up an engine know exactly where to go for what they want. There is no carelessness. Even the men act with the precision of machinery.

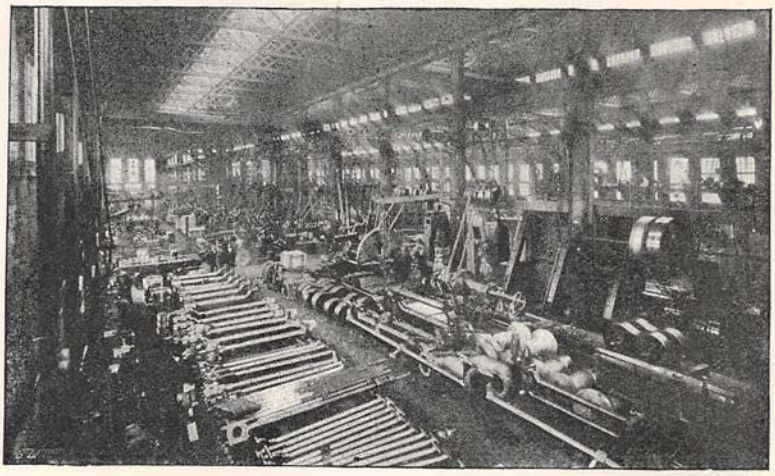
A minute or two was quite long enough to stay in the boiler shop. The din was earsplitting. It was bad enough to look on; but how the men manage to bear the noise continuously, and even to be inside a boiler while it is being riveted is a wonder. Of course their hearing is much affected. There is not a boiler-maker that is not more or less deaf; many of them are stone deaf.

Not far away was the dynamo room from whence all the electric lighting for the yard is supplied. Everything is in the store-rooms to properly equip a ship; most things you can think of, and many more of which you cannot think.

All these are fitted up in the vessel before she leaves Belfast Lough. The carpenters take her in hand as soon as she is floated and with their hammers and nails commence erecting the cabins and sleeping berths. The engines are swung into their place by shear-legs, which will lift as much as 100 tons. Then the incomplete deck is finished. An army of painters and decorators come down and many are the coats of paint put on the woodwork. The upholsterers come along and the saloons are beautified with rich ornamentation. Everything is of such magnitude that day by day you can recognise little progress. It is by allowing a month or a couple of months to elapse between your visits you get a good idea of the advancement that is made.

It is difficult to tell when a ship is really finished. Like a lady's bonnet there is always just something else to be done. But a vessel may be considered complete when she steams down the Lough to have her speed and seaworthiness tested for the first time. It is usual for most shipbuilders to test the speed, etc., of the vessels they construct, or what is generally called "the measured mile," but Messrs. Harland & Wolff are intensely practical, and I was frankly told that they consider the proper test for a vessel is a voyage from Liverpool to New York, or from London to Australia, as the case may be, and only on one occasion I understand have they tried a vessel on the measured mile. No mishaps occurring after completion, the ship is placed in the fleet ready for traffic.

On more than anything else Britain depends on shipping for her supremacy in commerce. Therefore a shipbuilding yard is naturally a place in which any Briton would delight to wander. The thought occurred to me that if I, a comparative novice, could take such a deep interest in the art of shipbuilding, how interesting the work must be to the men actually engaged in it, and what pride they must take in their work. The manager, I regret to say, did not entertain so high a regard for the motives that inspired British workmen.



From a photo by [*Reid Bros., Belfast.*

THE ERECTING SHOP.