

# A Career in Shipbuilding and Shiprepair.



## **Your career in shipbuilding**

Three-quarters of the world's surface is covered by sea. So it is not surprising that shipbuilding is one of the oldest industries in the world. Indeed the history of seagoing sailing ships can be traced back for at least 5000 years.

All through the ages the sea has challenged man's skill, testing ships to the utmost, and the tradition has grown up in our country that only the best is good enough.

This industry has played a vital part in the development of the British Isles. An island people. we depend on our shipping links with trading countries everywhere. And so we have learned to build ships equal to the best in the world.

## **Using your skill**

Modern shipbuilding offers you a career more varied and satisfying than most, with promotion prospects equal to any. A wide variety of skills is demanded in the design, construction, fitting-out, maintenance and repair of a ship.

Each ship is the identifiable product of teams of craftsmen, who have the satisfaction of seeing their work take shape and become a proud contribution to commerce and the defence of the nation. Consequently there is much less of that kind of boredom associated with a factory production-line.

Although the industry is advanced in automation, large numbers of skilled craftsmen are still needed. Their work calls for fitness of body and alertness of mind, since the work can be heavy and challenging.

## **Good Working conditions**

Today however much of the construction is done beneath cover with labour-saving equipment— a considerable improvement on the past when most men worked in the open in all weathers under physically exacting conditions.

If you are good at mathematics and draughtsmanship, you might aim to work in the drawing office. Again, if you possess any of the newer skills, such as data processing and computer programming, you might well benefit from the increasing use of the computer in shipbuilding.

Clearly there are advantages in terms of pay and security for those with a craft or other technical qualification but it is by no means essential to be qualified. There is also a demand for people who do not need the same lengthy training.

## **A wide choice**

British shipbuilding offers many lines for advancement, in a variety of locations, and in the widest range of jobs: scientists and engineers; technicians; draughtsmen; craftsmen and non-craft manual workers together with administrative and commercial staff; clerical; secretarial and other office staff; and staff for everything from the stores to the canteen.

The rest of this book gives further detail about many of these jobs, tells you how to find out more, indicates where and how to join the industry, and explains how you would be trained.

## How a ship is built

It will be easier to discover whether you might find a career in shipbuilding if you first understand broadly how a ship is built.

There are six principal stages: design, pre-fabrication of sections, assembly of the hull, installation of main engines, launching and fitting-out.

The design will be the outcome of discussion between the prospective owner and the shipyard, involving calculations and costings. When a design is agreed and the contract signed, the process begins of translating the design and calculations into drawings and orders for the required materials.

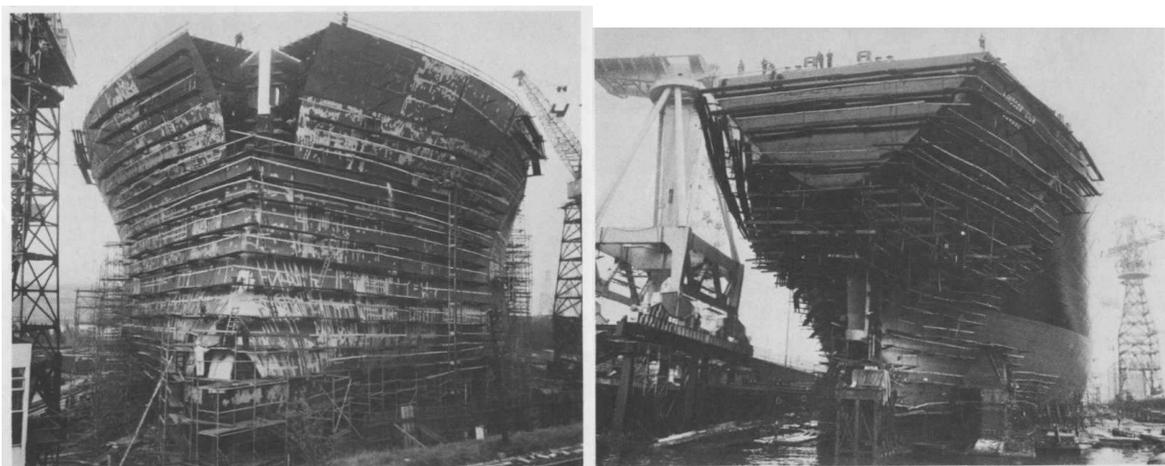
These days this is a faster, surer stage than in the past, thanks to the computer. All the requirements for the new ship such as speed, cargo capacity, draught and weight are fed into a computer along with information about experience gained with previous ships. There emerges a specification of what the new ship's lines should be. Sometimes the shipowner or designer requires the design to be tank-tested, in which case a scale model is constructed and tested in a tank built specially for such experiments. Any minor modifications as a result of the tests can be calculated by the computer.

Next comes the task of converting into full-scale all the dimensions from the scale model. Here again the computer can be harnessed to assist with everything from calculating the size and shape of each part to guiding a flame-cutter in burning out the exact shape of a steel plate.

Time was when a ship was built from the keel up, with a row of towering cranes on either side while scaffolding rose in step with the growing hull. Nowadays enormous cranes can usually be seen moving large sections of ships into position and sometimes a gantry crane straddling the full width of the ship and able to travel its entire length.

## How a ship is built

The bow of a 250,000-tonne tanker nearing completion. Priming paint over the welding makes the white patterning.



The stern of the same vessel before rudder and propeller have been fitted.

This is fundamentally an assembly industry with the shipbuilder bringing together in his ship a cross-section of the products of the nation. To illustrate this point, over 300 suppliers throughout the country can be involved in the building of a 250,000 tonne\* tanker. The materials used include 35,000 tonnes of steel, 15,000 litres of paint, 40 kilometres of piping and 100 kilometres of electric cable.

For every one person directly employed in building a ship there are another four in the supplying industries.

A numerically-controlled 8-head burning machine for cutting plates to shape.

A steel stockyard where plates are stored before moving to the panel line.

On the panel line plates can be rotated and turned over as required during the processes of cutting to size and welding of stiffeners.

The final process on the panel me where stiffening bars are automatically welded to plates.



Prefabricated sections arrive at the building berth, in some cases complete with services such as pipes already installed. The sections are then welded exactly into position. The assembly starts with the stern nearest the water and works towards the bow, except in cases where the ship is built in a dry dock.

The sections will have been fabricated under cover within the yard, and may be large enough to span the full width of the ship and from upper deck to keel. In larger ships it may take a number of units to complete a full width section.

A complex system will have organised the arrival of plates, ready cut, cleaned by shot- blasting and prime-painted from nearby workshops, to coincide with the arrival of other materials.

Sometimes several units are joined into one large section before being moved to the building berth.

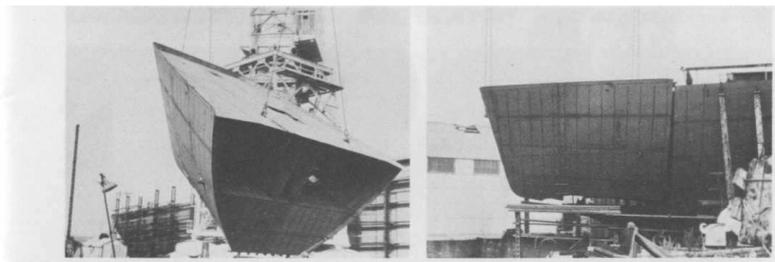
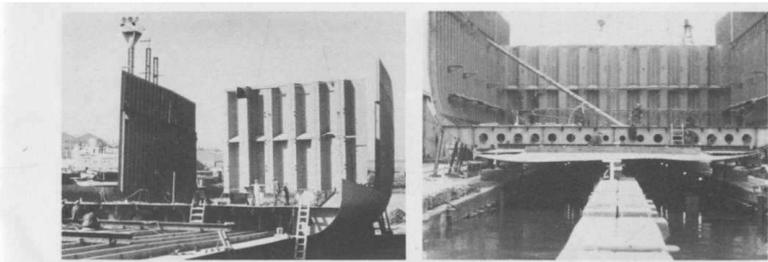
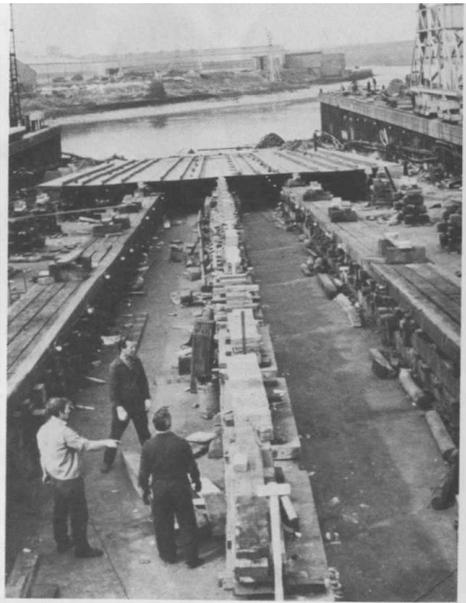
Welding has taken over completely from riveting as the method of joining metal, with these attendant advantages: reduction of weight, better watertightness, improved finish and no overlapping edges.

First bottom shell plates are in position and keel blocks are being prepared for more. Prefabricated stern section being moved into position.

Part of a bulkhead being lowered into place

An early stage of construction showing the double bottom and ship's side.

The same section being lowered into place.



When the hull is completed, it is painted as a protection against corrosion and prepared for launching. Sliding the vessel down a slipway into a river is still the commonest way of launching a ship. Careful calculations must be made to control the speed of entry: the ship must have enough momentum to carry it clear of the slipway, and the braking force of enough heavy chains to prevent it careering into the far bank.

On the great day the ship, resplendent in its own colours and looking almost complete externally, will be launched usually by a lady connected with the owners or the builders.

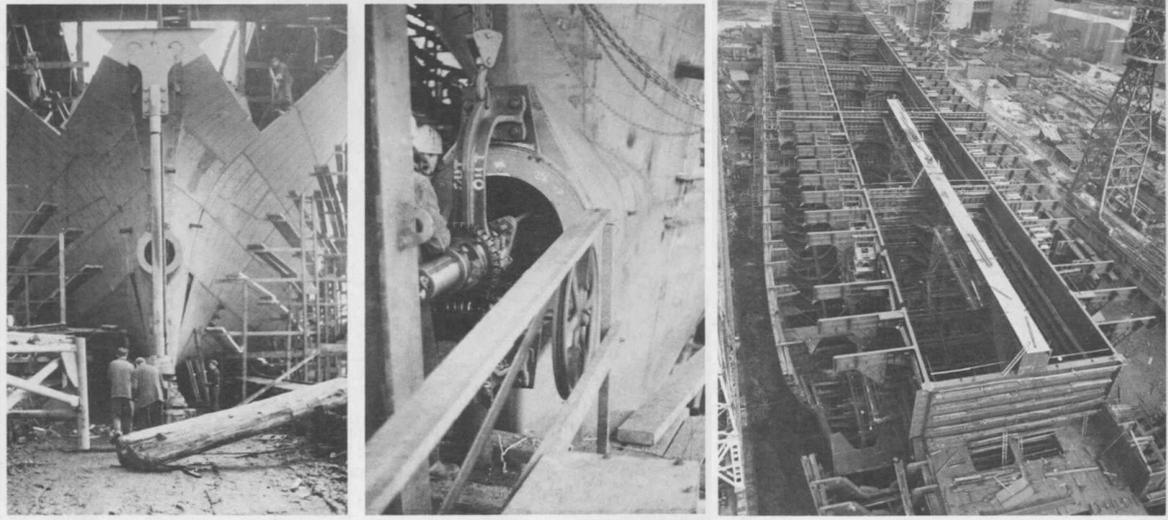
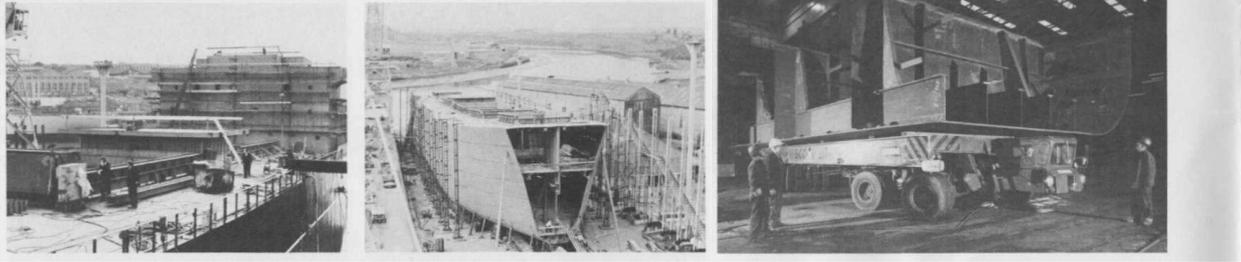
A transporter moving a prefabricated section from workshop to building berth.

Half-way stage on a large tanker showing the intricate assembly of hundreds of prefabricated sections.

Stern section showing rudder post and opening for the propeller shaft.

The stern tube must be accurately bored to take the propeller shaft.

The bridge structure and cargo hold. Nearly ready to take its bow.

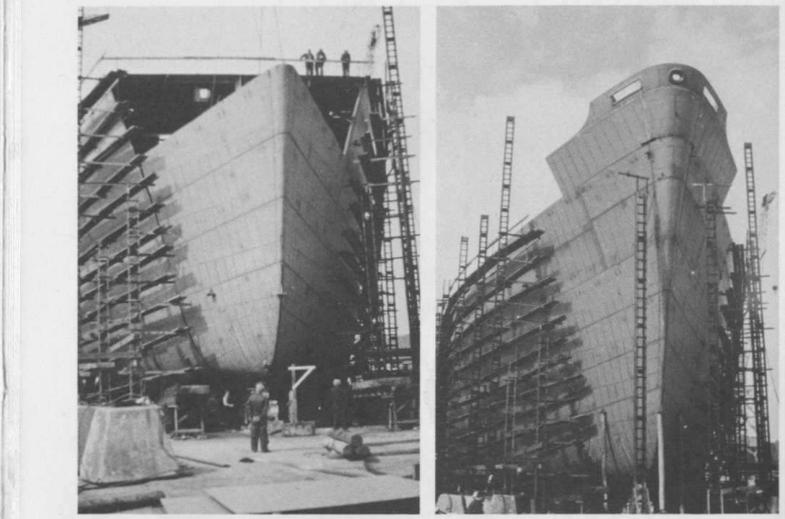


A bow section being positioned. The completed bow rising proudly.

The crankshaft of a large diesel engine being moved to the berth.

The stern section of a 264,000 tonne tanker straddled by a 225-tonne gantry crane. This ship was built in two halves.

The completed hull prior to launching.





After launching there is still work to be done, mainly on the interior. This is called fitting-out. It consists of the installation of machinery and of electrical, plumbing and navigational equipment the fixing and finishing of joinery in living and working quarters; and the painting of the interior throughout.

The modern method of assembly takes care of much of the fitting-out during the time that the hull is being built—even engines are often installed before the launch. This all means that machinery and equipment tests can begin much sooner, so speeding the completion of the ship.

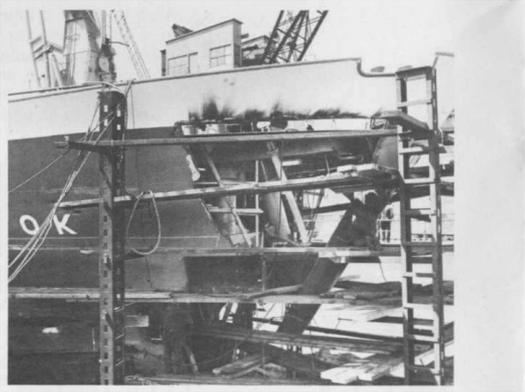
Trials at sea follow during which representatives from the shipbuilders and from the owners will be checking the performance of the ship and of all the equipment. When all concerned are satisfied, the ship is handed over to the owners.

## Shiprepair

Repair work may mean anything from the replacement of a few damaged plates to stripping and completely refitting the whole vessel, or a surgical job of inserting a mid-section and rebuilding the ship with its old fore and aft ends. Even in normal usage, the everyday wear and tear and the corrosive action of the sea or of cargoes carried mean that ships must be dry-docked and thoroughly overhauled at intervals. This major overhaul is interspersed with general maintenance after each voyage and, of course, the repair of any damage sustained.

All the crafts described in the next chapter apply equally to shiprepair as to shipbuilding. Repairing is sometimes the more difficult of the two because of the problem of reaching the damaged areas of a ship. Many men welcome the challenge that this presents.

Another advantage in the eyes of some craftsmen lies in the fact that each job is different. This may be why those who have been trained in repair work tend to remain in that side of the industry.



Repairing the damaged bow of a trawler.

### **The main manual occupations**

You may already have some idea of the particular job which would match your ability and interests. The brief descriptions of occupations which follow will give you a picture of how each man contributes towards the building of a ship.

The broad groups of manual occupations are steel workers, outfitting tradesmen and non-craft workers.

This craftsman's work is complementary to that of the plater/shipwright. In fact he may have had the same training. He is really the link between Drawing Office and Fabrication Shops.

His job was originally that of making full-size patterns of the more complex parts of the ship so that steel might be shaped and cut from them. The craft name derives from the practice of making these patterns on the floor of a mould loft.

A method which saves both time and space has largely replaced the traditional one: an electronically controlled flame-cutter is used working either directly from tenth-scale drawings or from punched tape translated from the drawings.

### **Steel Workers Loftsmen**

'Scrieving' or scoring lines on a mould loft floor.



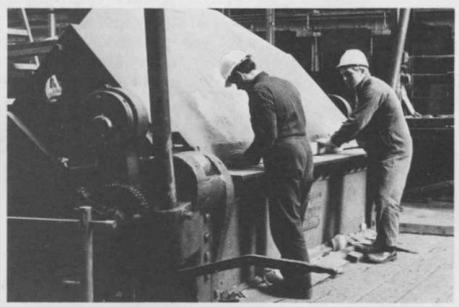
### **Plater/Shipwright**

You will have gathered that this work is well suited to someone good at mathematics who can draw neatly in geometrical shapes and who can read plans.

The loftsmen often has a hand in marking the positions for paint lines, plimsoll marks and draught marks and in some cases checking the prefabricated units for accuracy.

When ships were built of wood, shipwrights built most of the ship themselves. The change from wood to iron and later to steel led to the emergence of the plater as a separate craft but the two trades are now largely combined.

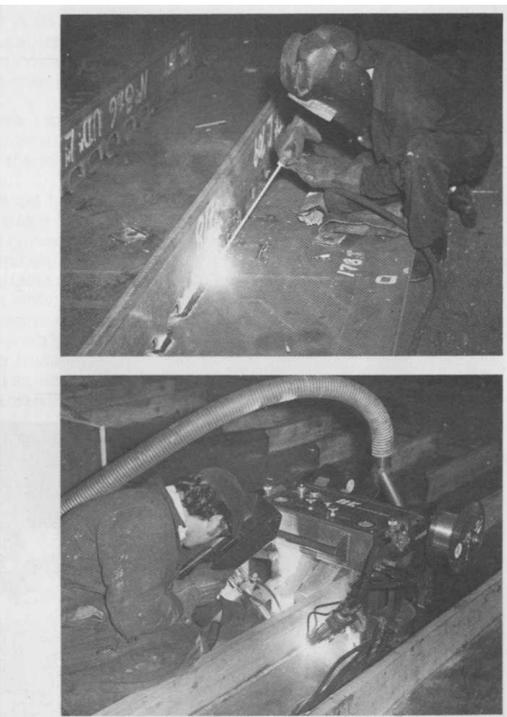
Basically these highly skilled men are responsible for the building of the hull and ensure that the steel construction is true and free from distortion. Some will be responsible for the assembly of the sub-units and units away from the building berth. Others must see that the prefabricated units – some weighing hundreds of tons – are fitted accurately to the growing ship and that the shape throughout is 'faired', that is, follows a true line.



Putting a flange on a steel plate so that it may be fixed to another at an angle.

## Welder

Welding is the process of melting metal so as to join two edges together, normally by using an electric arc. The welding equipment ranges from the small hand tool to the large multi-headed automatic machine. A welder must be adept with any of them. He must have a practical knowledge of metals together with an understanding of related trades.



Welding a stiffening bar to a plate.

Doing a similar job with an automatic welding machine.

## Caulker/Burner/Driller/Riveter

Apprentices learn all these trades but when fully trained they tend to specialise in one.

*Caulking* is the process of making a joint tight. In the days of riveted ships it meant using a mechanical hammer (which works like a road drill) to close metal edges together so that they might withstand water- or oil-pressure.

Today, a caulker's job is to clean welds and to remove temporary supports, lifting brackets, lugs and similar devices which will not be needed on the finished ship. He uses an electric gouger for cleaning welds.

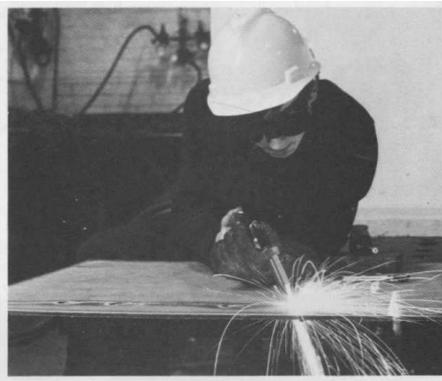
The work extends to fixing steel doors, portholes, window frames and drainplugs and to checking any compartment or container for tightness.

*Burning*. It is not a big step from caulking to cutting and preparing metal for the jobs which follow, so this craftsman is also skilled at cutting with gas burning equipment— hence the title 'burner'. He prepares steel plates, bars and brackets; cleans, chamfers and burns true edges. He also burns off unwanted bits of metal.

*Drilling* and *riveting* declined with the advent of welding. What remains of riveting is confined to the repair of older ships but some drilling is still required in new construction.

A caulker removing unwanted projections from a plate.

A powerful drilling machine with an adjustable arm.



cutting a line through a plate with a burning torch.

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A powerful drilling machine with an adjustable arm.

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## Blacksmith

The day is past when a blacksmith could be found in a shipyard at a bellows-blown forge beating out shapes with a hand-held hammer. There is nevertheless a demand for forged components — mountings, guard-rails, cleats, hooks, hangers, davits and so on.

Mechanical hammer power happily replaces some of the muscle-power formerly required and gas-fired furnaces have largely replaced coke forges. Added to that the newer techniques of stamping, welding and profile burning make many shapes easier to construct.

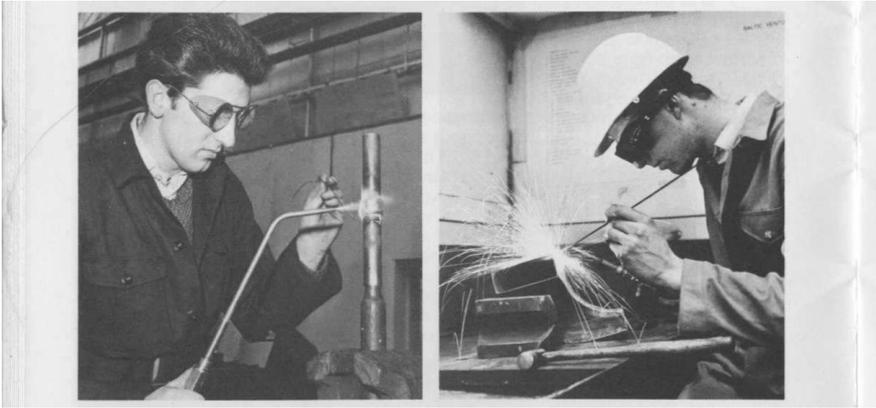


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Heating a bar in a gas forge so that it may be fashioned into shape.

## Outfitting Tradesmen

Pipeworker  
(Plumber and Coppersmith)



Joining pipes by brazing. Ventilation ducting, being made by a sheetmetal worker,

This craftsman is responsible for the pipes to and from every corner of the ship, which carry hot water and cold, fresh water and salt as well as fuel oils, lubricating oils and hydraulic fluids. He is also responsible for the installation of all valves and fittings to the pipelines.

The materials he works with can be copper, brass, bronze, steel, aluminium or plastics. Burning and welding are among the necessary skills.

### **Sheetmetal Worker**

He will construct such things as ventilation ducts, metal furniture and fittings, working in lighter gauge steel, brass, copper and aluminium.

This craftsman must be able to use hand or power tools to cut, saw, press or stamp out work. In the course of his work he may have to turn his hand to soldering, brazing, burning, welding or riveting as the task demands,

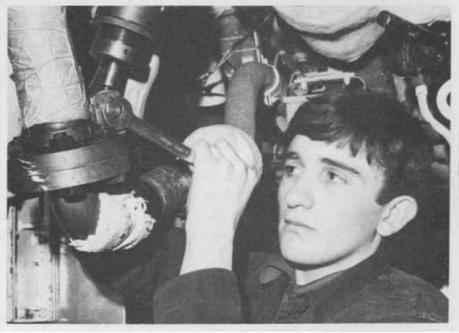
A pipebending machine makes light of a difficult manual job.



### **Fitter**

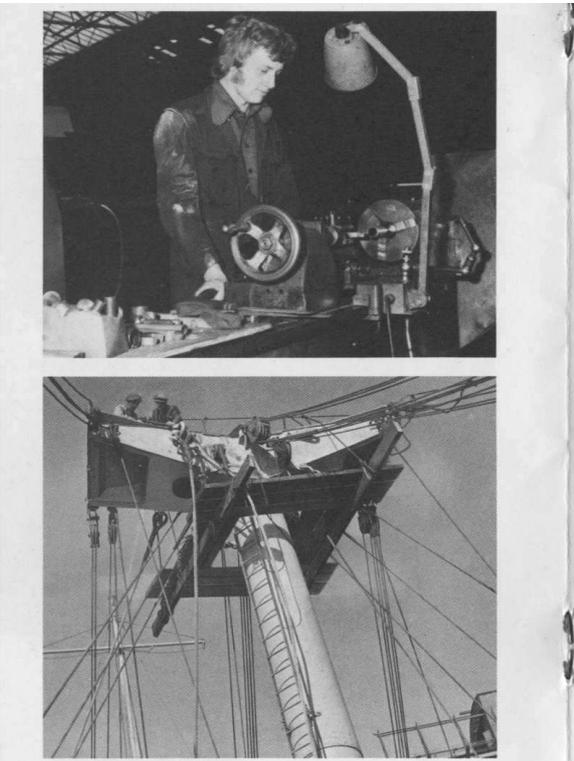
Now we come to an entirely different aspect of fitting-out: the engines and all their ancillary equipment including associated pipework, stern tubes, propellers and shafting. The installation of this equipment is a massive task.

The fitter, a key man in this phase, having completed the installation, will run and test all the equipment. His domain is not restricted to the engine room for he must deal with steering gear, winches, valves and the like,



Connecting up pipework in an engineroom

In the fitters shop he can be found making such things as tools and jigs. The scope of his work is determined by the size of the yard and may include engine fitting, maintenance fitting and turning.



Fitters are sometimes engaged on turning work.

Riggers at work supporting a mast.

## Rigger

Mention of rigging can conjure up a picture of midshipmen swarming up the ropework of a sailing ship to form a spectacular display. More usually our rigger will be concerned with heavy steel wire. But these perform the same job as ropes, that of supporting the masts.

Riggers are responsible for splicing and fitting all ropes (of whatever material) and for rigging block and tackle. It may be for a large derrick capable of lifting over a hundred tons, or for lowering lifeboats over the side of a ship.

## Joiner

This craftsman's job is to clothe much of the interior metal framework with wood, laminates and other furnishing materials. A skilled man can transform a steel shell into a finished cabin with all its built-in furniture.

He works from drawings and must obviously know a great deal about timber, veneers and finishes. In some cases he may have the assistance of a Woodworking Machinist in the preparation of wood.



Fitting the panelling of a cabin is a job for expert joiners.

## Painter

Painting may seem to be the straightforward job that any do-it-yourself enthusiast could tackle but the exacting conditions at sea – salt, wet, and extremes of temperature – call for a much higher standard of protection than is usual on land.

In addition to all the usual knowledge of materials and techniques, painters must be adept at spray-painting and sign-writing.

The painting of the hull is normally done by non-craft manual workers known as 'red-leaders'.

## Electrician

The work aboard ship is much as you might expect an electrician to carry out anywhere. However, he has in addition to install such things as generating equipment and telephone and control circuits for navigation and for the engine room. He also has the challenge of wiring some difficult runs, not forgetting the need to protect wiring and equipment from water.

A specialist branch of this trade would take care of the installation of radar and other electronic equipment.



Fitting electrical equipment in the wheelhouse.

### Non Craft Manual Workers

There are many jobs to be done which do not call for the same degree of skill or the lengthy training appropriate for the craftsman. The following job titles give some indication of what such workers do: Plater's Helper, Blacksmith's Striker, Plumber's Mate, Shot-blaster, Red Leader, Stager, Crane Driver, Slinger, Lagger— to name but a few.

Among others not directly connected with building a ship are found: Storeman, Transport Driver, Power and Boiler House Attendant, and Patrolman.

Wherever heat needs to be retained (as with steam) or cold excluded (as with oil), pipes must be lagged.

Spraying a priming coat of paint on stiffened plates.

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Spraying a priming coat of paint on stiffened plates.



### The drawing office

Long before the drawing office can start applying their expertise to the creation of a ship, there will have been many discussions and much research at a high level.

The first stage will have been talks between the future shipowner and a ship designer. The designer will be a qualified naval architect and his research will have covered the questions of what the ship will carry, the distances to be covered and the desirable speed, the sort of harbours and dock facilities she will encounter (so that length, width and depth may be correct), the ship's tonnage and the size of engines to move it all through the water.

Designs will be drawn and redrawn until all parties are satisfied that the ship is exactly right for its purpose. Eventually the designs reach the drawing office where substance is given to the architect's outline sketches, and plans are drawn showing measurements and detail.

### **Ship Draughtsman**

A qualified Ship Draughtsman has a wide knowledge of ship forms and he thinks in three-dimensional terms. On occasions a three-dimensional model is made for the engine room space, so that the draughtsman can consider the best arrangement for the installation of the machinery, electric cable and pipe runs,

Draughtsmen for design work are selected from the drawing office.

### **Engineering Draughtsman**

This man is concerned with drawings for the assembly of the main engines and for the machinery drawings of auxiliary equipment such as generators and bilge pumps.

Only the largest yards employ their own engineering draughtsmen and marine engine-builders employ the majority of the others

### **Electrical Draughtsman**

He prepares all drawings for a ship's power supply and for equipment and lighting circuits. Wherever wiring is to be installed alongside other equipment the draughtsman must show a wiring diagram on the drawing for that equipment.

### **Tracer**

A few women are sometimes employed as tracers, mainly in the drawing offices of the warship builders, and there is a three year apprenticeship scheme for them. They are employed on tracing drawings but their numbers have decreased since the introduction of photographic reproduction.



Where the working drawings for the shipyard are produced.

### **Supporting Services**

Any organisation would come to a halt if it did not include people to look after everything from finance to filing, from personnel to postage, from welfare to wages – and so on.

These are the many and varied supporting services in the shipbuilding industry, much as are found in all walks of industry and commerce. In shipbuilding there are plenty of opportunities both for variety and for advancement, plus the satisfaction of being part of a team producing something of which to be proud.

The supporting services include:

### **Estimating**

This department is first involved at the customer enquiry stage. It works with the design or drawing office to cost designs, and later with the production department in costing alterations to the original estimate. It will have to take into account the additional cost of such setbacks as delays in production and rejected materials.

### **Planning and Production Control**

The building programme is prepared by planning staff and monitored by production control staff, both of whom provide information for production management. Standard production systems are developed as a result of a detailed practical study of all the possible methods of construction and the whole building programme is timed.

Schedules have to be worked out for the supply of steel, for the cutting of steel plates and welding of stiffeners, and for the fabrication, storing and, finally, lifting of sections into place on the berth. In addition to this there must be a further plan for getting all the equipment to the berth at the correct time for it to be installed. While a ship is being built or a major repair carried out, the programme is constantly reviewed.

### **Marketing and Sales**

Marketing and sales are different though closely related functions.

Marketing concerns the study and forecasting of supply and demand so that a type of product may be defined for manufacture. This leads to the development of designs best suited to the market requirements. On occasions, shipbuilding companies will arrange for presentation of designs to shipowners who are potential purchasers.

### **The technique of selling**

Sales deals with the advertising and selling of the product as defined and designed, and involves consideration of customer relations, product costs and financial aspects of buying and selling. Speed is of the essence in this activity, and sales staff must be conversant with the technical capabilities of ships.

It is not uncommon for approaches to be made both at home and abroad to shipping companies, to producers, and to government departments at high level, so as to ascertain future needs with a view to presenting new designs. This work is often undertaken by the Managing Director himself, who will also take a leading part in subsequent negotiations, supported by the marketing staff. Marketing demands a thorough knowledge of the technical capabilities of a wide range of ships.

### **Purchasing**

Purchasing staff are responsible for maintaining the supply of all the company's requirements for both materials and services, on the most advantageous terms. Their duties include the provision of advice on sources of supply, ordering, expediting, the avoidance of excess stocks, and relationships

with sub-contractors. It is therefore necessary for purchasing officers to have sound commercial training and background, and there is scope for obtaining professional qualifications in this field. The buying activities of the Purchasing Department cover not only steel and the other materials needed to build ships but also the whole range of machinery, equipment and tools necessary for the operation of the yard as a whole.

## **Finance**

This department is responsible for controlling the day-to-day cost of running the shipyard which includes the provision of equipment in the yard, its maintenance and the cost of building a ship until payment is received at the stages agreed in the contract.

Various methods of financial and management accounting are used to control income and expenditure, and to make the best use of the company's monetary resources. They entail the preparation of budgets, stock and credit control, payment of wages and salaries, investment of money and the provision of up-to-date information to management.

## **Personnel and Industrial Relations**

The Personnel function covers a wide range of activities, the most important of which may include assistance with recruitment, selection, training and promotion, maintenance of employment records, wage and salary administration, welfare and the provision of information and support for production management.

From the point of view of the Industry's future, training activities play a vital role. Training staff organise and conduct craft and technician training both in special training centres and during periods of planned practical experience in the shipyard or shiprepair yard. They may also be involved in courses to meet training needs which arise through changes in techniques or working practices, or in devising systems for reviewing and assessing performance.

Industrial relations staff are responsible for negotiating agreements with trade union representatives on wages and conditions of employment, for organising joint consultative arrangements, for dealing with disputes and individual grievances, and for advising production management on any employment problems which arise.

## **Safety and Health**

The safety and health of employees is receiving increasing attention on all sides. Staff concerned with these matters bear the responsibility, in conjunction with production management, for promoting safe working practices in all aspects of shipbuilding and shiprepair operations and for minimising health risks. They must be familiar with all the relevant legal requirements and must ensure that these statutory provisions are observed. Their duties include the operation of ambulance rooms and first-aid facilities, maintenance of accident records, investigation of the causes of accidents and health hazards, inspections and co-operation with the Factory Inspectorate.

## **Administration and Office Management**

It is the responsibility of Administration to provide the variety of services which every department needs at some time or other: such matters as insurance, pensions, catering, publicity, public relations, printing, post, telephone, transport, decoration and maintenance of the buildings.

Office Management normally provides the secretarial and clerical services but the responsibilities vary from firm to firm. The Company Secretary's department deals with the statutory returns required by law, share registrations, payment of dividends, and other legal matters.

There is scope for obtaining an appropriate professional qualification in one or more aspects of this work.

## **Management and supervision**

### **Management**

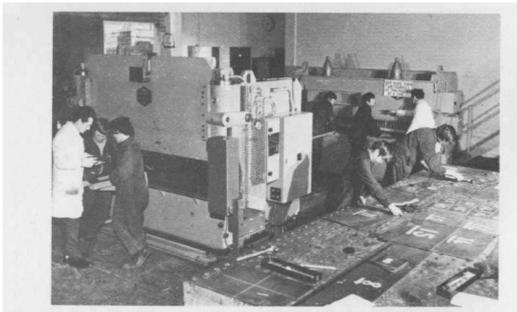
The number of senior posts to be filled will naturally depend on the size of the particular shipyard. In the smaller yards one person may be responsible for a number of functions: in the larger ones certain functions may be subdivided.

All the functions set out in the previous chapter will require one or more managers. Among the most senior posts will be the Managing Director and the Heads of Marketing, Production, Personnel, Purchasing, Design and Finance.

Except in the production department, managers are not necessarily drawn exclusively from within the industry because they are expected to have had wide and varied experience, together with specialist training in one or more fields. There is a steady demand for graduates to fill these posts.

### **Supervision**

In this category are Head Foremen (in some yards called Managers), Yard and Workshop Supervisors, and Section Leaders in the Drawing Office. Unlike managers, supervisors invariably come from within the industry. They have an important role for they are in direct control of all the men involved in the building of the ship.



### **How to make a start**

The Shipbuilding and Shiprepair Industry employs some 90,000 people excluding those under the Ministry of Defence (Navy) and has an annual intake of over 2000 apprentice craftsmen and technicians. The map at the end of the book shows where the shipyards are located.

If, after reading this booklet, you want further information about a career in the industry, have a word with your Careers Teacher or the Careers Officer of the Local Education Authority, who may be able to show you a film on the industry and be able to supply more details of the work carried out in particular firms.

Should there not be a shipbuilding or repairing firm in your area which you can visit, it will be worthwhile to travel some distance to learn about career openings and see what is done in a shipyard. The Careers Officer may be able to arrange such a visit and perhaps an interview too so that you can begin your career as soon as you leave school.

The following paragraphs give an idea of the qualifications which firms are looking for when selecting applicants and the training which they will provide.

#### **Shipbuilding and Shiprepair**

Craftsmen (Steel Workers, Outfitting Tradesmen)

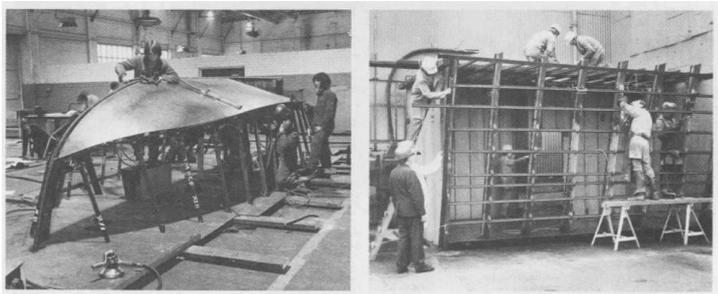
No specific academic qualifications are required but most firms look for GCE or CSE passes in English and Mathematics. A pass in a practical subject such as Woodwork or Metalwork is an advantage. In large firms interviewing starts in the Easter holidays for entry between late July and early September and the selection procedure generally includes intelligence and mechanical aptitude tests as well as interviews.

The skills of the shipyard metal-using and outfitting crafts are acquired through a training programme lasting up to four years, based upon schemes recommended by the Shipbuilding industry Training Board. These programmes vary in detail according to the needs of individual firms.

Craft apprentices generally spend their first year in a training centre. In some cases, provided that parents and employers are agreeable, this means you might be living away from home. During this year you will start off with an introduction to shipyard life and work, then going on to practical training appropriate to your chosen trade. Throughout this period you will be learning your trade and becoming proficient through a process of periodical assessment under expert supervision. At the end of it you will receive a Basic Training Certificate if you have reached the required standard.

After the first year of training, steel workers specialise in the particular metal craft for which they have been selected and all trainees proceed to a programme of planned experience training in the shipyard. This is assessed by a series of test jobs on production work for a period of up to three years. At the end of this time you should qualify for a Certificate of Craftsmanship.

During this training you will be expected to attend Technical College on either one day a week. or in several blocks each of a few weeks, up to the completion of a City and Guilds Part II Craft Studies course, or possibly a technician's course.



### **Non-craft Workers**

Recruits are drawn from among those who have practical ability but not necessarily academic qualifications. Mostly these workers enter the industry as adults rather than as school-leavers.

### **Draughtsmen**

The selection procedure is similar to that for Craftsmen and the courses that follow depend upon qualifications.

If you obtain a GCE 'O' level or CSE Grade I pass in Mathematics and in three other subjects from Physics, Physics and Chemistry. Mechanics, Mechanical Science, Engineering Science or Science (Building and Engineering), you qualify to take a four-year training course. The further education part of this leads to the award of an Ordinary and later a Higher National Certificate in Naval Architecture and Shipbuilding or of a Diploma.

In Scotland the entry qualifications are three 'O' level passes (or Scottish equivalent) from Mathematics, Physics or Applied Mechanics, and Technical Drawing. If you do less well but have good results in Mathematics, a suitable Science subject and Technical Drawing or Metalwork you could then take the four-year Shipbuilding Technician's Course.

Should you obtain an 'A' level pass (or Scottish equivalent) in Mathematics or appropriate Science subject, your training period in the drawing office would be reduced by a year.

You will spend the first year of training in a Training Centre or Drawing Office School. The arrangements for this period depend on the requirements of individual firms and vary with the different type of draughtsman. For example mechanical engineering and electrical draughtsmen generally spend more of the first year on practical work. During this time training is checked through a process of periodical assessment.



This first year is followed by a programme of planned experience training for up to three years during which further education continues. The course taken would normally be either the Ordinary and Higher National Certificates in Shipbuilding and Naval Architecture or Part II of the Shipbuilding Technicians Course.

### **Graduate Entry**

Some of the large shipbuilding groups offer Student Apprenticeships to those who have applied for admission to a University through the University Central Council for Admissions (UCCA) to take a degree in Naval Architecture, Marine, Mechanical or Electrical Engineering. Selection depends on interview and passes at 'A' level in appropriate subjects as required by the University concerned.

The programme usually consists of three years at University during which some practical training takes place in the summer vacation. This is followed by two years practical experience in shipyard practice, design and management services together with objective training related to future employment.

Some firms also offer Graduate Apprenticeships and candidates may apply for interview during their last year at University. Acceptance is on condition that a satisfactory degree is obtained and successful candidates undergo a similar type of practical training to that arranged for the Student Apprentice but depending on the previous training received.

Details of these offers can be obtained from Careers Advisory Service libraries and certain publications on career opportunities.

### **The Royal Dockyards and other Naval Technical Establishments**

The Royal Dockyards have been the centres for the construction and refitting of the ships of the Royal Navy for over 400 years. Today's advanced ship designs and complex weapon systems require an ever expanding range of technical skills.

The ships of the Royal Navy range from cruisers and Polaris submarines to harbour launches and dinghies. Within the main trades you could be working on anything from heavy plates to wood and glass fibre, from nuclear-powered engines and gas turbines to conventional outboard motors,

The Ministry of Defence (Navy) employs more than 100,000 civilians. Besides the four Royal Dockyards at Portsmouth, Devonport (Plymouth), Chatham and Rosyth, there are technical establishments concerned with research, design and testing. There are five basic methods of entry: direct entry to an unskilled post, to Junior Apprenticeships, to Craft Apprenticeships, to Technician Apprenticeships and to the Royal Corps of Naval Constructors or the Royal Naval Engineering Service.

### **Junior Apprenticeships**

Junior Apprenticeships are offered for Machinists only, normally beginning at 16-18 years of age and lasting for four years. The training consists of on and off the job training, leading to a Certificate of Competence.

### **Craft Apprenticeships**

Each year about 800 apprenticeships are offered to school-leavers between 16 and 17 years of age. Candidates take a written examination of the short answer type in Mathematics and English; suitable passes in GCE. CSE or equivalent earn exemption. Examinations are held in April and June/July.

After entry each apprentice is on probation for three months before a formal contract of training is signed. Training lasts four years. the successful completion of which is marked by the award of a Certificate of Craftsmanship. Trades offered include:

Boilermaker, Electrical Fitter, Fitter and Turner, Founder, Gaugemaker, Hosemaker, Instrument maker, Joiner, Mason, Painter, Patternmaker, Plumber/Coppersmith, Iron Caulker/Riveter, Sailmaker, Shipwright, Smith and Welder.

The trade of shipwright in the Royal Dockyards comprises the crafts of plater/shipwright and boat builder. The Royal Dockyard trade of electrical fitter also embraces the electronic work associated with the sophisticated weapons, detection equipment and advanced propulsion units which are found in modern warships.

All are given an initial period of group training during which the basic skills of the craft are taught. This is followed by individual training under craftsmen. Trainees attend colleges of further education on courses which result in the award of the City and Guilds Craft and Technician's Certificates and the National Certificates.

### **Technician Apprenticeships**

Each year up to 180 places are offered to school-leavers between the ages of 16 and 21 to be trained as civilian officers. There are two methods of entry: open competition and limited competition, the latter being confined to craft apprentices who show considerable ability in their first year. Candidates for the open competition enter by a pass in at least four subjects at GCE. CSE (Grade 1), Scottish Certificate of Education or Northern Ireland GCE, and an interview; or by completing a General Engineering Course with course certificate and an interview. Academic subjects must include Mathematics, and a suitable Science subject.

There are three specializations open to candidates: Constructive, Mechanical and Electrical. The training period covers four years during which time the Ordinary National Certificate in Naval Architecture and Shipbuilding or Part II of the City and Guilds Shipbuilding Technician's Certificate must be achieved.

The first year is spent learning basic hand and machine skills, followed by eighteen months in workshops and on ships, getting a broad training and planned experience. The final eighteen months of the training period is split between drawing office work and training in management techniques.

The formal training period is followed by four years of guided development as a Technical Officer, during which you would be given jobs in both the drawing office and technical fields.

### **The Royal Corps of Naval Constructors and the Royal Naval Engineering Service**

The Royal Corps of Naval Constructors (RCNC) is a body of about 250 professional men in the Civil Service who design the ships of the Royal Navy and oversee their construction and maintenance in private shipyards and are responsible for their maintenance and repair in the Royal Dockyards.

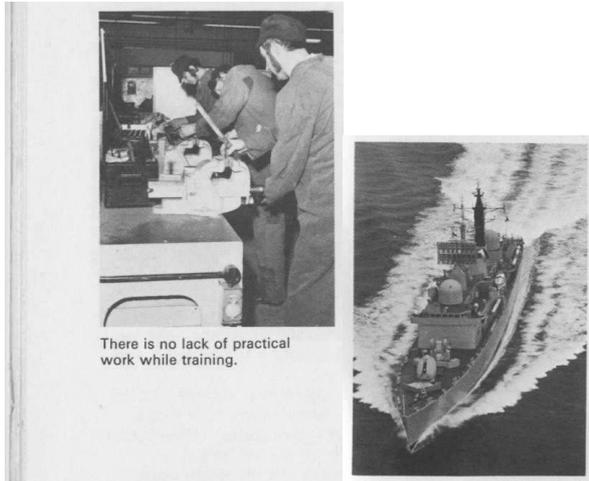
The Royal Naval Engineering Service (RNES) consists of over 300 civilian professional mechanical and electrical engineers, who design the propulsion and electrical engineering equipment of the ships of the Royal Navy, supervise the manufacture of electrical equipment and the installation of mechanical and electrical equipment in ships under construction, and supervise its repair and maintenance in the Royal Dockyards.

Entry to the RCNC or the RNES is by one of the following methods:

*Direct from school:* candidates need three good 'A' levels, in Pure Mathematics, Applied Mathematics and Physics. 'O' level English Language is also required.

*Selected apprentices:* each year the best apprentices from the Dockyards are interviewed and, if selected, follow the same course of training as direct entrants from school.

*RCNC Graduate entry candidates* require a minimum of a second class upper Honours Degree in Naval Architecture or in the Mechanical Sciences or in Mechanical or Civil Engineering.



Training consists of one year at the Constructors Training Office, Royal Naval Engineering College, Manadon, Plymouth followed by a one year MSc course at University College, London. Finally there is one year of post-MSc training which includes six months at sea.

*RCNC School-leaver entrants* ultimately follow the same training programme as graduates but take a three year BSc degree course at University College London after completing the first year at Manadon.

*RNES Graduate entry* candidates need a good Honours Degree in either Electrical or Mechanical Engineering.

Training lasting approximately eighteen months includes formal academic work and service at sea. There is an opportunity of post-graduate study leading to further qualifications at a later stage.

*RNES School-leaver entrants* receive a five year training, which includes a three year honours degree course followed by post-graduate work and service at sea.

## **Boat Building**

The line between shipbuilding and boat building is not a hard and fast one but we usually consider the latter as applying to craft up to 244 metres (80 feet) in length on the water-line.

Information about careers in this industry is given in 'A Career in the Boat Building Industry' which can be obtained from the Ship and Boat Builders National Federation or the Shipbuilding Industry Training Board, whose addresses are given at the end of this book.

## **Engine Building**

The power units for ships are usually built in specialist factories, which may be remote from the shipyard.

You should apply for employment direct to the firm of your choice. Information about such firms and a career in marine engine building can be obtained from The National Association of Marine Enginebuilders (NAME) 21 Grosvenor Place, SW1 X 7JE, telephone 01-235 5131.

Hours, wages and overtime payments, and conditions of employment generally are laid down in national and local agreements between employers and Trade Unions. The standard working week is of five days and 40 hours. There are four weeks annual holiday with pay plus seven additional paid holidays each year.

Apprentices are paid a basic wage according to age, and qualify for a man's rate at the age of twenty. They attend further education classes for which the fees are paid and they often earn merit bonuses or special prizes.

Safety and working conditions in shipyards are safeguarded by Acts of Parliament. H.M. Inspectors of Factories pay visits to places where shipbuilding and repair workers are employed to ensure that the regulations are carried out and that working conditions are up to standard.

