# The INSTITUTE of MARINE ENGINEERS

Founded 1889. Incorporated by Royal Charter, 1933.

SESSION 1943. *Transactions* Vol. LV. Part 1.

Patron : His Majesty The King. President: The Rt. Hon. Lord Mottistone, P.C., C.B., C.M.G., D.S.O.


# Ships' Lifeboats and Davits


Read by ERNEST W. BLOCKSIDGE, M.Inst.N.A.


*On Tuesday, January 19th, 1943 at 5.30 p m.*

Chairman : Sir Westcott S. Abell, K.B.E. (Past-President).

## (1) THE MEN WHO OPERATE THEM.

In submitting this paper for the consideration of the members of The Institute of Marine Engineers the author desires, at the outset, to express an appreciation of our unqualified admiration of the heroism, self-sacrifice and splendid achievements of the seaman of the Merchant Navy, which have richly deserved the highest eulogies of the whole civilized world. These men have displayed a coolness and courage, when opposed to danger by night and day from enemy action in the air, on the sea and under the sea, which have evoked great public interest and appreciation. Undeterred by the brutal methods pursued by the Axis powers to prevent the supplies arriving in this and other countries—without which the freedom of the world would perish—our sailors, particularly those in tankers, maintain their constant vigil and return again and again from the far-distant places, not only facing the perils of the sea but often fighting their ships with the skill and bravery of trained warriors. Their determination and loyalty have proved to be the sheet anchor of the Allied war effort.

A tribute from the Empire was heard from the lips of Admiral of the Fleet Lord Chatfield when, addressing the vast audience which assembled at the Albert Hall in September last in honour of the Merchant Navies of the United Nations, he stated that the merchant seamen's part in final victory will be an immense part; the battle he fights is unseen, but no longer unrealized; it is an unending battle rivalling in value the most glorious victory on land, or sea, or in the air. The author does suggest, however, that the man and the woman in the street do not yet fully realize at what tremendous cost they are being fed so regularly and with such sufficiency through the willing sacrifice, constant endurance and gallantry of the men on the sea.

Let us take heed when the days of peace follow the nightmare of war that we shall never be guilty of forgetfulness of those who have lived, dared and died for the cause of freedom.

It behoves the technician, therefore, to insist that the mistakes of the past shall never be repeated, and that the best and only the best provision shall be made on our merchant ships for the comfort and safety of the men who sail in them.

## (2) THE OBJECTIVE EXPLAINED.

The author had the honour of reading a paper before the members of the Institution of Naval Architects on 17th March, 1921, on the subject of "Life-saving Appliances on Cargo and Passenger Vessels"; and another on behalf of the Institute of Marine Engineers at the Shipping and Engineering Exhibition on the 6th October, 1923, the subject then being "Life-saving Appliances on Large Passenger Vessels". Since that time, nearly twenty years ago, the subject has not been discussed by the technical societies of Great Britain, and it has been suggested that, under the prevailing conditions of a world war, it is most inexpedient and undesirable to discuss the matter now for fear that it might result in placing the Government and the Shipping Industry in a position of embarrassment. This is quite wrong.

The Administration and the industry are equally anxious to provide all reasonably possible safety devices to meet war conditions; they welcome discussion and constructive criticism designed to call forth the most effective means of preventing disasters at sea, and the supply of suitable apparatus on board ships to minimize the hardships and mitigate the risks faced by the Merchant Navy in its task of maintaining our life lines at sea. All proposals are considered carefully by the Administration in consultation with all sections of the industry before they become law. Much patient and praiseworthy work has been accomplished during the war in the field of life-saving at sea.

Great Britain has led the maritime nations of the world, both in peace and war. It was as a result of her persistent efforts that the International Convention for the Safety of Life at Sea became universal law. Thus a new order was introduced and accomplished with complete unanimity and without bloodshed, a very significant fact to remember in these days of political jugglery. The new wartime standard of safety at sea established by Great Britain is regarded by the Allied nations as exemplary and has been or is being substantially adopted by all of them.

The purpose of this paper is not to criticize the statutory regulations, which are in fact a very creditable achievement, but to bring together within small compass a general summary of the progress made during the last twenty years in respect of the equipment and construction of lifeboats and davits installed on merchant ships.

The main pleas embodied in the two papers previously referred to were, *inter alia,* contained in three aspects of the subject, *viz.* (1) that an effort should be made to arrange the boat stowage so as to bring all lifeboats under davits operated at the ship's sides, *i.e.* that more emphasis should be laid in the rules on the importance of the "ready availability" of the life-saving equipment. (2) That sufficient buoyant apparatus should be carried on foreign-going passenger ships to accommodate 25 per cent. of the ship's complement. (3) The extended use of motor lifeboats in large passenger ships to act as convoy leaders.

These proposals and others not mentioned, although long deferred, have now been included in the peace-time statutory rules and greatly extended in the emergency regulations, which confirm the author's statement that the Government Administration and the industry do not lag behind a reasonable demand for suggested alterations or improvement.

In the approach to the present subject it is essential to discriminate between the peace-time requirements of the Merchant Shipping (Life-saving Appliances) Rules of 1938 and the various Statutory Rules and Orders for additional war-time life-saving equipment, embodied in the Emergency Rules, which came into operation on the 10th of August last, in order to appreciate what is absolutely essential under normal sea-going service and that which has been considered as necessary to meet the exigencies of war conditions.

Since the introduction of the Merchant Shipping (Life-saving Appliances) Rules in November, 1938, the purview of the whole question of the safety of life at sea has changed considerably, and has been carefully reconsidered in the light of experience gained since 1939. Survivors from lost merchant ships have been cross-examined for this purpose.

Under pre-war conditions rules were framed on the assumption that when a casualty occurred at sea the radio telegraphy apparatus would immediately come into operation and contact be made with near-by ships able to render prompt help. The life-saving equipment was so designed as to make it possible for the boats to be launched safely into the water within an assumed reasonable margin of time. It was then considered that the lifeboats should remain in the vicinity of the casualty until rescue was effected. The type of lifeboat and the details of their equipment were considered on this basic assumption when the rules were framed.

War conditions altered completely the fundamental consideration of the subject, and faced all concerned with the need to provide for a new and very different set of circumstances.

When a casualty occurs at sea as a result of enemy action the radio equipment may be incapable of functioning, or may not be available for use for defence reasons, and the preservation of life may, and often does, depend entirely on the apparatus which can be launched speedily and safely into the water under difficult conditions from the deck or davits on the ship. Casualties occur hundreds of miles from the usual lanes of commerce and in weather of extreme heat or severe cold. Lifeboats cannot long remain in the vicinity of the casualty with the hope of assistance, but may be forced, as already seen in many instances, to proceed hundreds of miles by the use of oars and sails.

In the early part of the war the suffering on board these small and heavily-burdened craft, during many days and nights and even weeks of hardship and trial, until land was reached or the occupants were rescued by a passing ship, is beyond human conception. We can only leave this phase of the conditions to the imagination without reiterating the repulsive details.

It was at once evident to the Government Authorities in 1939 that the usual statutory equipment of life-saving appliances was very inadequate to meet the situation. Since the opening of hostilities every effort has been made to increase the efficiency of the means to preserve life. Government officials, with the assistance of the industry, and much expert advice from technicians and scientists, have been hard at work examining all the sources of information; the evidence of survivors, the suggestions of some responsible, and many uninformed, persons have all been investigated, with the purpose of devising and imposing regulations to bring about the improvement necessary in the means of rescuing those who are forced to abandon ship.

In reply to enquiries from certain members of the House of Commons in September last, Mr. Noel Baker, the Parliamentary Secretary to the Ministry of War Transport, assured the House that since the commencement of the war every effort had been made by the Ministry to investigate the suggestions and criticism made from time to time, with a view to the provision of the most suitable appliances on ships of the Merchant Navy to facilitate the rescue of seamen in lifeboats or on rafts. The public may rest assured, therefore, that the Government is making every effort to safeguard the interests of the sailors, and it is up to individual members of the community to play their part in support of those who go down to the sea in ships and do glorious business in great but troublesome waters.

### (3) A REVIEW OF THE PRE-WAR REQUIREMENTS.

For the purpose of the Rules for Life-saving Appliances ships are divided into various classes, ranging from I to XVIII. Reference should be made to Diagram 1 which has been prepared to simplify the explanation. These classes vary in respect of their limits of service and type, discrimination being made between passenger ships which come within the scope of the International Convention for the Safety of Life at Sea, local passenger ships and non-passenger ships. Life-saving appliances are required by law to be allocated to ships in accordance with their defined classes.

So far as this paper is concerned reference can only be made to the equipment of lifeboats and davits.

The standard types of boats are classified as follows:—

Class 1. This is an open boat with rigid sides and fitted either with (A) internal buoyancy air tanks (Fig. 1) or (B) with internal and external buoyancy apparatus (Fig. 2). Under the war-time rules all the boats must be Class 1.

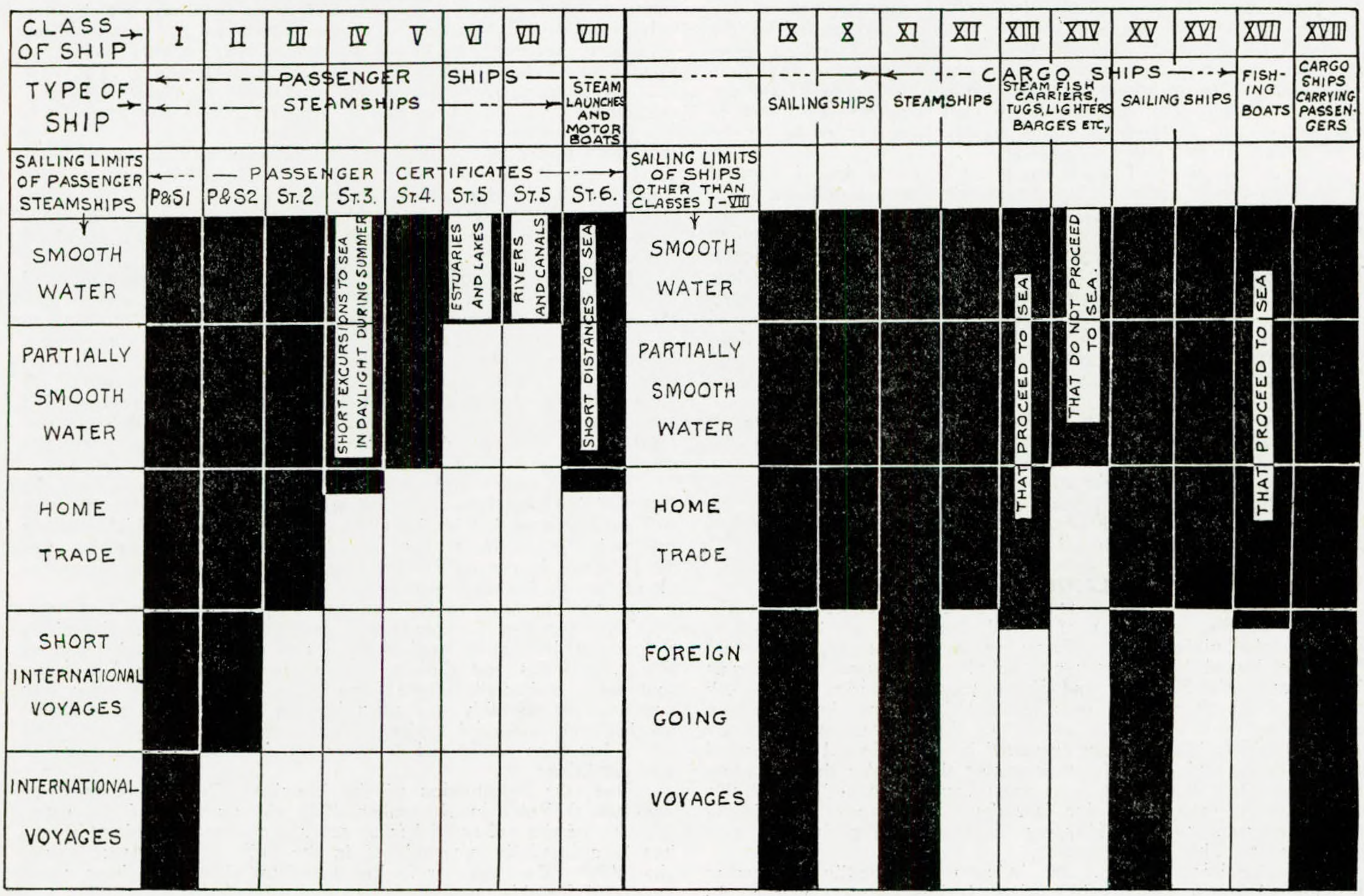



Diagram I.

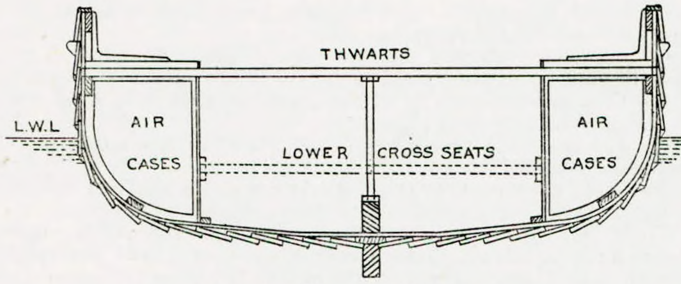



Fig. 1.—*Class 1A lifeboat.*

Class 2 (A) is an open boat fitted with internal and external buoyancy apparatus, but differing from a Class 1A boat by having the upper sides collapsible (Fig. 3). (B) Is a decked boat with fixed or collapsible watertight bulwarks (Fig. 4).

Class 3 are open boats similar in construction to Class 1, but not fitted with external or internal buoyant apparatus (Fig. 5).

For practical purposes the author intends to ignore lifeboats of Classes IB, 2A and 2B in the consideration of the present subject.

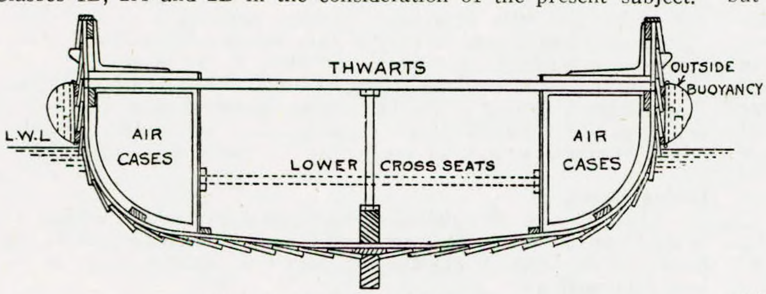



Fig. 2.—*Class 1B lifeboat.*

On all modern steamships the designer endeavours to arrange for the main life-saving equipment to consist of lifeboats of Class 1A, stowed under and attached to davits at the ship's sides.

When the urge for "boats for all", created by the loss of the *Titanic,* became a fetish, boats were stacked on decks without adequate provision being made for their transport from the stowing

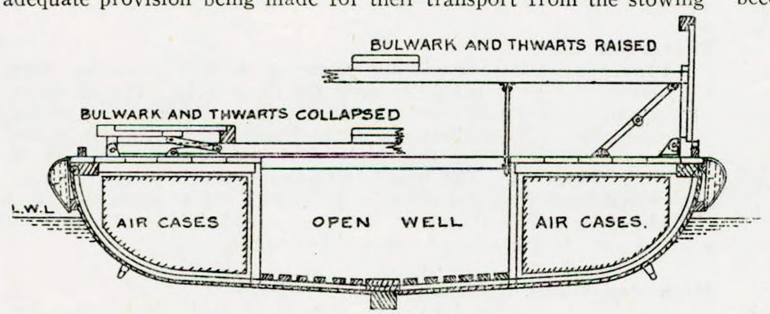



Fig. 3.—*Class 2A lifeboat.*

positions to the water in a reasonable limit of time. To enable one boat to be stowed under another, without being nested, collapsible bulwarks were necessary in the lower boats. Thus we find the peace-time statutory rules still refer to the existence of these types of boats.

Class 3 boats are only fitted in cargo ships in peace-time as a

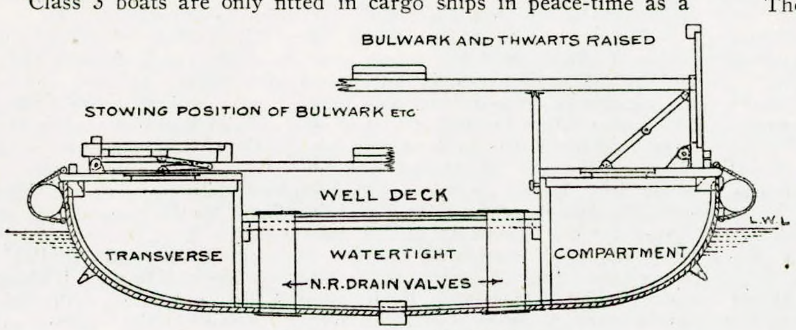



Fig. 4.—*Class 2B lifeboat.*

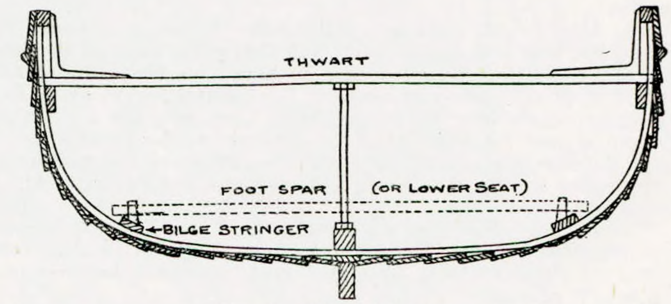



Fig. 5.—*Class 3 boat.*

part of the equipment, where provision is made for the full complement of the crew to be accommodated in boats on each side of the ship. In effect this means that on a cargo ship the boatage is doubled compared with the equipment on a foreign-going passenger ship.

This class of boat may be considered a good "working" boat, but the experience gained in the war made it necessary to fit them with internal buoyancy tanks and thus convert them to Class 1A boats.

It would thus appear that for future legislation it will be necessary to re-consider the types of boats approved for equipment on passenger and cargo ships engaged on international voyages.

The Class 1A boat has proved to be the most effective of all boats. It is capable of floating with a full load of persons in a swamped condition, it possesses good initial stability and range and preserves a righting moment until the gunwale is brought below water level. When filled with water and the statutory load these stability characteristics almost vanish, which proves the necessity to equip the boat with mechanical or other effective means of freeing the boat of water quickly.

The purpose of buoyant apparatus is to provide reserve buoyancy should the boat become flooded. The air cases are made of yellow metal or copper. It is essential that precautionary methods should be adopted with the material when clean by coating the tanks or cases with boiled linseed oil or varnish to prevent the metal becoming brittle. It is usual for these watertight air cases to be fitted along the sides of the boats under the thwarts and side seats. It has been advocated by the author for many years that the boat can be made more effective as a life-saving appliance if the tanks were fitted up to the gunwale and winged out as far from the middle line as is possible, with additional tanks in the bow. This type of boat would resemble the self-righting lifeboat. The bow tank combined with a fine form forward would have an important value in providing the boat with an easy lift on encountering waves, and the fore end being decked in would reduce the amount of watei entering the boat. A full form aft steadies the boat and prevents the bow hammering unduly on meeting waves. Continuing the breadth well aft, with comparatively fine lines below the full quarters, allows the broad stern with less surplus buoyancy to grip the water, and helps the boat to maintain headway and stability. It is essential for these characteristics to be embodied in the design, together with an efficient stern and a deep keel, to sail the boat effectively to windward with the full complement of persons on board. The foregoing statement is highly controversial and the author is fully aware the suggestions may not be accepted by some experts, but they are worth considering.

The structional strength of all boats must be to the satisfaction of the Ministry of War Transport. For the guidance of boat builders, shipowners, and their surveyors, the Ministry have issued instructions in respect of the details of constructions of all types of boats. The scantlings of wooden boats appear to be heavy compared with normal practice and boats constructed for the Admiralty service, but it must be kept in mind that with certain exceptions the strength of the boats on all vessels engaged on international voyages must be sufficient to permit them being safely lowered into the water when loaded with a full complement of persons and equipment.

Since the introduction of these instructions reputable boat builders have been encouraged to build boats for the Merchant Navy, whereas they could not compete at one time in a market where the scantlings, form, and quality of workmanship were not controlled.

**Capacity.**

The actual cubic capacity of the Class 1 boat is obtained by dividing the length into four parts, calculating the area of the sections, and completing the procedure by Simpson's Rule, due regard being paid to any excess of sheer at the quarter length above the standard of 1 per cent. of the length of boat, also for any excess of depth beyond the standard of 45 per cent. of the breadth.

In the case of a motor boat of this class the actual space occupied by the engine and its accessories, and the radio installation, if fitted, must be measured.

The number of persons allocated to the Class IA boat depends upon this cubic capacity divided by a standard unit of 10 cubic feet. A boat of 504 cubic feet capacity would, therefore, be permitted to carry 50 persons.

There is a proviso in the rules that the number shall not exceed the number of adult persons wearing life jackets for which there is proper *seating accommodation*, arranged in such a way that the persons, with their lifejackets, when seated, do not interfere in any way with the use of the oars.

An illustration will be shown by lantern slide of a lifeboat under test with the full complement of persons on board. If this boat had been afloat in the Atlantic the condition of the occupants, after many hours of exposure, is left to the imagination.

The foregoing explanatory remarks apply to the statutory rules issued in 1938. It should be mentioned, however, that for some time, as a war measure, 10 per cent. additional capacity has been provided in lifeboats on new ships.

When lifeboats are constructed with a single skin of larch or other similar timber and they form the equipment on ships employed on international voyages passing through the tropical zone, it is considered their days are numbered, and they should be replaced with boats having a double skin of mahogany or teak, or be constructed of metal.

It is the author's opinion that there is a great field for investigation into the merits of plywood for use in the construction of lifeboats.

**Motor-boats.**

It was a progressive step when motor boats were included in the statutory rules, but this provision only applies in peace-time in the cases of ships of Classes 1 and 2, *i.e.* steamships carrying more than 12 passengers on international voyages and steamships carrying more than 12 passengers on short international voyages. Other classes of ships, including cargo vessels, were not affected.

When the number of lifeboats carried in accordance with the rules is more than 13, one of such lifeboats shall be a motor-boat fitted with an approved wireless telegraphy installation and searchlight; and where the number is more than 19 two of such lifeboats shall be motor-boats.

Any of the *other* lifeboats, except those which the Ministry may require to be carried as "emergency boats", may be motor-boats, but they need not be fitted with a wireless telegraphy installation or a searchlight.

The purpose of the motor-boats was to pick up persons in the water quickly and act as mother ships to the remaining boats, to keep them together and, if necessary, take them in tow until relief came from nearby ships.

The number of persons which can be accommodated in a motor-boat is less than the ordinary open Class 1 boat, due to the increased amount of buoyancy needed and the space occupied by the motor and fuel.

The motor-boat must be adequately supplied with fuel, and *kept so as to be at all times ready for use.*

The motor and its accessories must be suitably enclosed to ensure operation under adverse weather conditions, and provision made for going astern.. The speed is to be at least six knots when fully loaded in *smooth water.*

Where boats are capable of carrying 100 or more persons they must be fitted with a motor and comply with all the conditions relating thereto.

The instructions relating to the type of wireless telegraphy installation and searchlight to be carried are laid down in the regulations. The source of power for the former is to be capable of maintaining the installation, allowing for intermittent use, or a period of six running hours, and the latter for a total period of six hours, or three hours continuously.

Instructions relating to the mechanism of the motor are clearly defined, but particulars must be submitted to the Ministry for approval. The main considerations are as follows:—

(1) The engine may be driven by heavy oil or paraffin, but not by petrol. Where necessary for starting a small quantity of petrol may be carried.

(2) Reversing gear for going astern must be provided if the engines are not of the reversible type.

(3) Adequate protection must be given to the engine and all its accessories and to the fuel tanks under conditions of heavy weather.

(4) They must be capable of being readily started by hand and kept running reliably in cold weather.

(5) The motor casings to be of steel, but if of wood they must be suitably insulated.

(6) Protective measures must be taken with the shafting and all moving parts to prevent damage to the occupants of the boat.

(7) It is very essential that the quality and size of the shaft be considered in relation to the power of the motor, and particular attention paid to the seatings of the engine and its accessories.

(8) The most important item is that which requires the whole installation to be maintained in efficient condition and ready for immediate operation at all times.

A motor-boat need not carry a mast or sails.

**Sails.**

All boats, other than motor-boats, must carry a mast and sails with proper gear for each. In the case of ships carrying passengers in the North Atlantic on a voyage not proceeding south of 35° North Latitude, only a proportion of the boats need be equipped with masts and sails, as approved by the Ministry.

All boats must now be fitted with a standing lug sail and a jib, the latter permitting the boat to sail close to the wind.

It is suggested that the sailing qualities of the boats would be considerably improved if the keels were increased in depth beyond that generally adopted. Suitable area plans are included in the official regulations, and the quality of the material is stipulated.

**Lifting Hooks.**

There is now less difficulty experienced with the lowering of boats from the davits, because more attention has been paid to the details of the lifting hooks and the method of securing them to the keel combinations.

All open boats of Class 1 are fitted with fixed hooks, the hooks facing amidships. Standard sizes are based on the result of actual tests, and there is an ample margin of safety.

It is not always practicable to fit fixed lifting hooks, as in motor-boats, and a suitable arrangement of chain slings is substituted, which, in the opinion of the author, provides a safer and steadier action when lowering a boat from the davit than that given by the fitting of the usual lifting hooks.

**Disengaging Gear.**

Provision must be made for releasing the falls speedily from the lifting hooks, but not necessarily simultaneously. The efficiency of the operation depends on a trained crew. When an *approved* releasing gear is fitted there should be less difficulty in getting the boats away quickly from the ship's sides, provided the method of release is foolproof. The type of apparatus which permits release before the boat is waterborne is dangerous unless operated by a skilled person and is, therefore, not recommended for ordinary lifeboats, except in the case of the accident boats.

**Mechanical Means of Propulsion.**

When it is proposed to fit a system of mechanical propulsion in a lifeboat it is necessary, in the first instance, to submit the design to the Ministry, when tests for strength, stability and seaworthiness are carried out for approval. Additional internal buoyancy apparatus is fitted to compensate for the extra weight of the apparatus beyond that which is fitted in the ordinary type of lifeboat.

Messrs. I. R. Fleming & Co. of Liverpool have developed this type of gear and design their own lifeboats to suit. The mechanism is so well-known that a detailed description is unnecessary.

The great advantage derived from this method of propulsion is that it allows the boats to get away from the ship's sides quickly, and its radius of action is not limited by a supply of fuel. From the experience gained from this type of gear and boat the author has no hesitation in stating that it is a definite improvement in the open boat which has to depend mainly on the use of oars, requiring more expenditure of energy, and on sails, as the only means of propulsion. Under the present conditions prevailing at sea, one must consider, however, the question as it relates to the expenditure of energy by the occupants of the boat when a long journey seems likely and which cannot be replaced by such foods as are available in the boat. Fig. 23 illustrates the latest design of Class 1A lifeboat constructed by Messrs. I. R. Fleming & Co. and fitted with their hand-propelled gear, shock absorbing lifting hooks, permanent skates, hand bilge pump, portable floor and sleeping boards, protective hood, and a neat arrangement of food lockers and water containers.

**Equipment.**

It is necessary for the purpose of this paper, before giving a description of what is being done at the present time for the comfort and safety of the men of the Merchant Navy, to refer briefly to the statutory equipment required to be carried in lifeboats under the pre-war rules.

Every boat carried on any ship must be equipped as follows:—A full single-banked complement of oars, two spare, and one steering oar. Plugs for the plug holes, or automatic valves in lieu. A sea-anchor, bailer, iron bucket, tiller or yoke, painter and boat hook. Fresh water to be supplied and contained in two galvanised iron tanks or wooden beakers, sufficient for one quart for each person the boat is authorized to carry. Two hatchets. Lifelines fitted around the outside of the boat, in addition to bilge rails for use should the boat capsize. An efficient lantern trimmed with oil which will enable it to burn for eight hours. Matches in a watertight case. Mast and sails, with certain exceptions already referred to. An efficient compass. One dozen self-igniting red lights in a watertight case. One pound of condensed milk for each person, and a locker for carrying small items of equipment. The foregoing does not include the additional equipment required by the emergency regulations, to which reference is made latter.

**Metal Boats.**

It is a significant feature in the equipment on vessels in the United States of America, where there is an ample supply of suitable timber, to find that the bulk of the lifeboats are constructed of metal, and this type of installation is still maintained after many years of experience.

In this country we have been biased against the use of metal

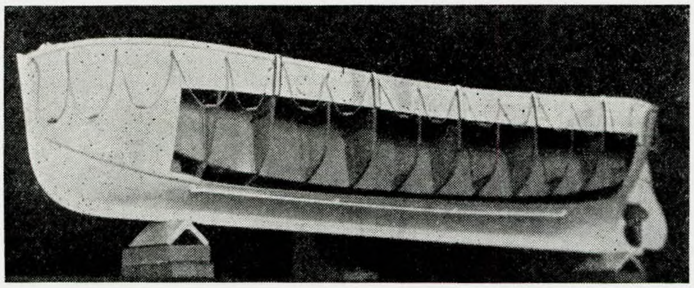


Fig. 6.—*Fleming's "Birmabright" lifeboat showing built-in buoyancy compartments.*

for boats, and the bugbear of corrosion has no doubt prevented its adoption to the extent it has been used in other countries. The conditions prevailing at sea at the present time have drawn attention to the necessity for immediate action to supply metal boats for certain types of ships, *e.g.* oil tankers.

A very complete specification is given in the instructions issued by the Ministry for the guidance of the builders and no useful purpose will be served by referring in detail to the items. The material may be of mild steel, aluminium alloy or other approved metal. Some of the important features are as follows:—The thickness of the shell plating depends on the system of metal framing adopted, and whether the method of galvanising is carried out by the electric-deposit system or the hot process, and varies between 12 s.w.g. (1/10 inch) and 16 s.w.g. (1/16 inch).

It is recommended that the riveting of the shell plating be reduced to a minimum, in order to avoid the use of oiled or painted fabric to ensure watertightness, and the connections of seams and butts be secured by an approved system of welding before the material is galvanised. Faying surfaces to be suitably coated with a protective material. Rivets are of charcoal iron and hammered cold. All structural steel is to be galvanised when the thickness is ⅛in. or less. In addition the whole of the interior is to be coated with an approved composition, particular attention being paid to the plating in the vicinity of the keel connections. The exterior is painted with at least three coats of best lead paint.

Internal buoyancy is provided by yellow metal or copper air cases, suitably insulated from the hull by wood packing. Additional airtight compartments are provided in the metal boat so as to preserve the same amount of reserve buoyancy as in a wooden boat. As previously stated, when the boat is certified to carry 100 or more persons the volume of air-cases is increased in accordance with the rules.

A sample boat of a particular design is subject to strength and flotation tests.

Messrs. I. R. Fleming & Co. have developed the "Birmabright" lifeboat constructed of a salt-water resisting aluminium alloy, which has found favour with many shipowners for its durability, lightness, and seaworthy qualities. A feature which also commends itself to the author is the system adopted of "built in" buoyancy spaces, illustrated in Fig. 6. The Holland-Amerika liner *Nieuw Amsterdam* has a complete installation of 22 Fleming lifeboats, 16 of which are fitted with their patent hand-propelled gear and 6 are motor lifeboats also constructed on the "Birmabright" principle.

**Availability of Lifeboats.**

We have now arrived at the most important aspect of the subject as applied to pre-war conditions. There is a false sense of security created by piling up stacks of boats, buoyant rafts, etc. on a deck or decks of a ship, unless there are special facilities provided for launching them overboard immediately and with safety.

The keynote of the statutory regulations is the "ready availability" of the life-saving equipment. In this respect there are three conditions of importance to observe, *viz.*:—

(1) They must be capable of being put into the water safely and rapidly under unfavourable conditions of list and trim.

(2) The launching of one set of boats should not impede or interfere with the operation of launching other boats, the rafts or buoyant apparatus.

(3) Efficient arrangements must be made to embark the passengers in boats rapidly and without confusion and interference with the launching of the boats and other life-saving apparatus.

Plans for the boat stowage on all new ships must now be submitted for the consideration and approval of the Ministry.

The ideal arrangement which conforms to the instructions is that where the whole of the lifeboats are of the Class 1A type, stowed under and attached to gravity davits. In the event of a

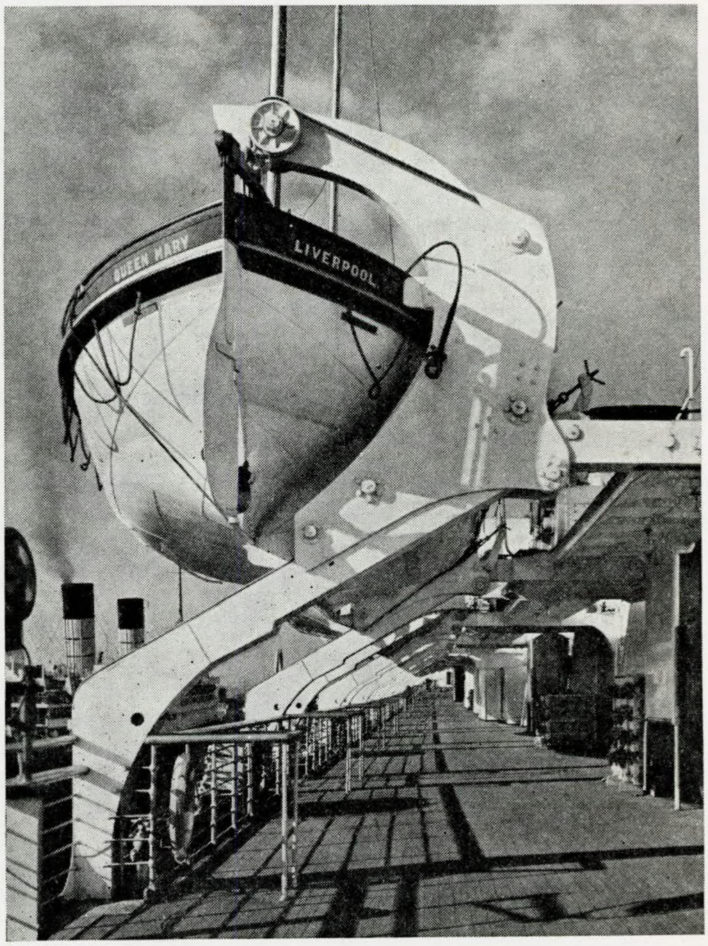



Fig. 7.—*The Taylor gravity davit fitted on the q.s.t.s "Queen Mary".*

casualty the boats can be lowered immediately to the embarkation deck, ready for the marshalling of the passengers to their respective places in the boats. Such an arrangement is to be seen in the *Queen Mary* and *Queen Elizabeth,* which is illustrated in Figs. 8 and 9. The *Normandie* was also equipped with all the boats stowed at the ship's sides under gravity davits, but they were nested, which necessitated the launching of one boat and getting her clear of the ship's side before the second boat could be lowered.

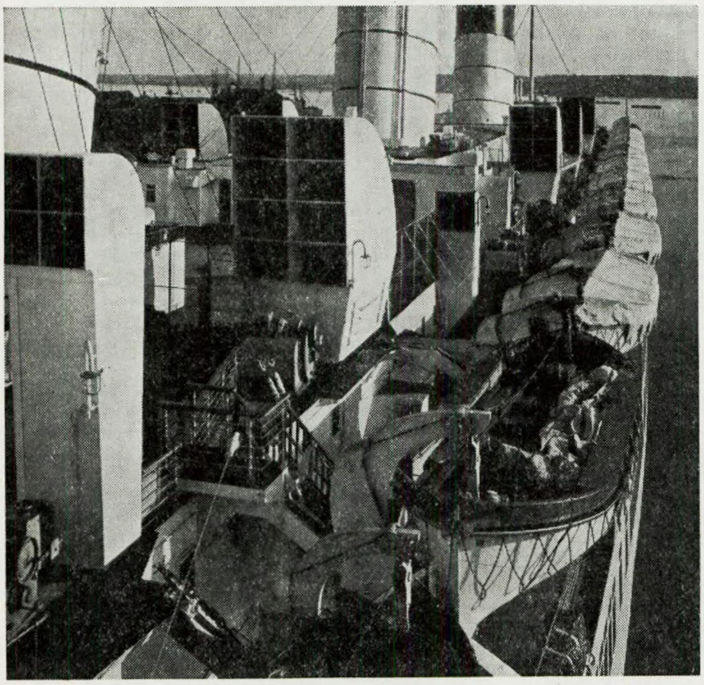


FIG. 8.—*The Taylor gravity davit fitted on the q.s.t.s. "Queen Mary".*

FIG. 9.—*The Welin-Maclachlan gravity davit fitted on the Union S.S. Co. of New Zealand's s.s. "Awatea".*

The rules still retain the "skeleton" of the pre-convention regulations, which permitted lifeboats to be nested, or stowed one above the other, or even stowed across a deck, bridge or poop, with mechanical appliances for transporting them overboard. It is suggested that the history of the past proves conclusively that the time factor prevents such an equipment being of effective value in an emergency and, as far as this paper is concerned, no further reference will be made to such a recognized provision.

**Davits.**

These must be of approved form, suitably placed, and together with the falls, blocks and other gear, be of sufficient strength to the satisfaction of the Ministry.

In the cases of ships of Classes 1, 2, and 3 (see Diagram 1), with certain approved exceptions, the *strength* of the davits and attachments must be such that the boats, with the *full complement of persons and equipment* on board, can be lowered safely into the water, with the ship listed to 15 degrees either way; and the davits must be fitted with gear of sufficient power to enable the boat, fully equipped, with sufficient number of men on board to control the launching operation, to be *turned out* against the maximum list at which the lowering of the boat is possible.

The principle of the "gravity davit" is such that turning out gear is unnecessary, and this type of davit is now fitted on most modern passenger ships. A number of illustrations is given and each type of davit embodies the same basic principle, but differs in details. Figs. 7 and 8 show the lifeboat equipment of the Cunard White Star r.m.s. *Queen Mary,* which consists of 24 motor lifeboats of Class 1A, two of which are fitted with wireless telegraphy, but, in addition, each lifeboat has a small radio-telephony set. They were constructed of steel by Messrs. Hugh McLean & Sons, Ltd., of Glasgow. The dimensions of the large boats are 36ft. × 12ft. × 5ft., each certified to accommodate 145 persons. Each boat is equipped with an 18-b.h.p. two-cylinder Diesel engine, with reduction reversing gear, and manufactured by Messrs. John I. Thornycroft & Co., Ltd. They conform to the regulations previously referred to in this paper. From the illustrations it will seem that the seating arrangements are such that protection is given to the occupants from the sides of the boats.

The davits were manufactured by Messrs. Samuel Taylor & Sons (Brierley Hill) Ltd., and are controlled by electrically-driven winches. The mechanism of this and other similar davits is so well known that a detailed description does not appear necessary.

Thus we see the ideal arrangement of boat stowage in one of the foremost British passenger ships. The whole of the passengers and crew, numbering 3,266, are accommodated in lifeboats attached to davits at the ship's sides, and the launching equipment is automatically controlled against any list the vessel is likely to sustain.

There are other types of davits manufactured by British firms, but space will not permit more than a selection being mentioned and illustrated.

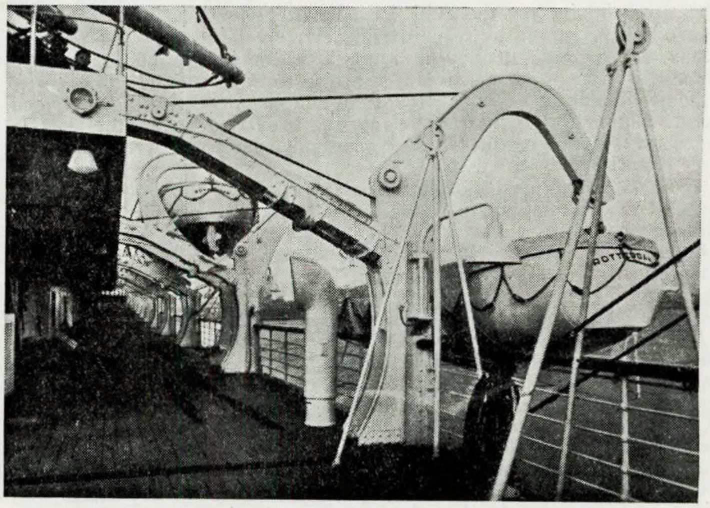


FIG. 10.—*The Barclay gravity davit fitted on the Holland-Amerika s.s. "Nieuw Amsterdam".*

Fig. 9 shows Welin-Maclachlan gravity davits fitted on the Union S.S. Co. of New Zealand's s.s. *Awatea*. The cradles are of welded box section; the rollers are now inside the trackways and the davits are controlled by a two-part arrangement of wire falls. The arrangement shows how easily the boats can be controlled and lowered without interfering with deck passage and the marshalling of passengers. The 12 lifeboats are of aluminium alloy supplied and constructed by Messrs. I. R. Fleming & Co., Ltd.

Figs. 10 and 11 illustrate the Barclay gravity davit as fitted on the s.s. *Nieuw Amsterdam* and the m.v. *Dunvegan Castle* respectively.

These types of davits form the equipment of most passenger ships and experience has proved they are going to stay, for the inherent principle embodied in the design is good.

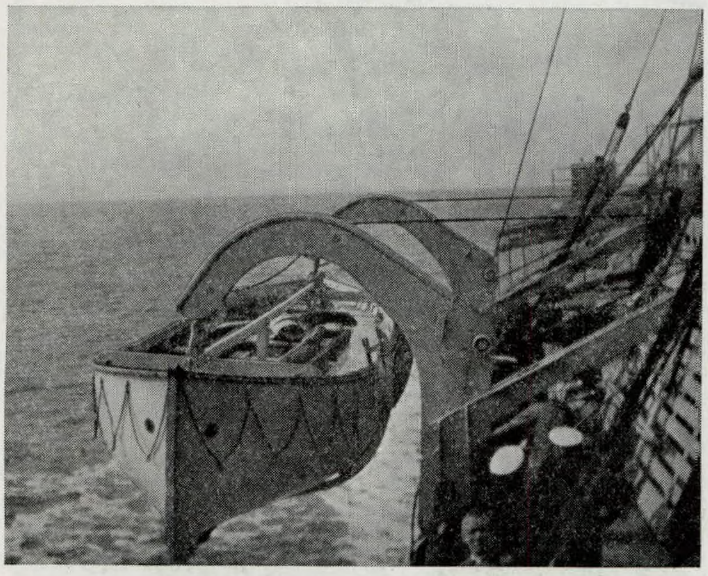


FIG. 11.—*The Barclay gravity davit fitted on the m.v. "Dunvegan Castle".*

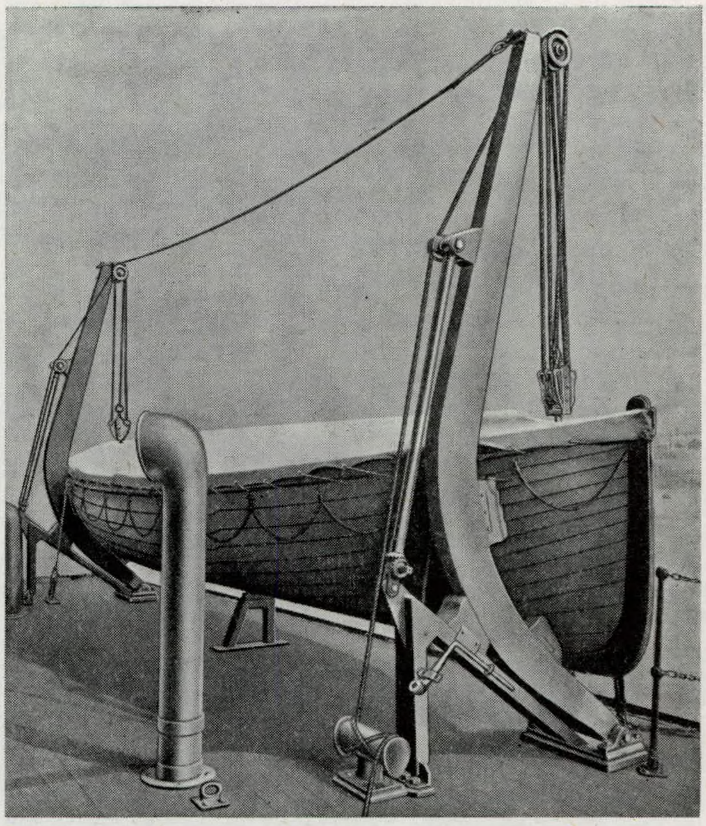


FIG. 13.—*Welin-Maclachlan welded box section "Crescent" davit.*

It must be pointed out before proceeding that in a passenger steamship accommodation is provided for all persons on board in boats stowed on both sides of the ship, but the boatage is not duplicated; hence the necessity to stipulate that means must be fitted to launch the boats when the ship has a heavy list. In the case of cargo ships the situation is somewhat different; more space is available and a smaller number of persons are on board compared with a passenger ship of the same size. The boat provision in a cargo ship is, therefore, duplicated, *i.e.* full accommodation is provided in boats on each side of the ship, so that if the ship is listed the most convenient side can be used from which to launch the boats. In this connection, however, the strength of the davits has, until recently, always been estimated on the basic assumption that the boats will be lowered into the water fully equipped, but only with a sufficient number of men on board to adjust the falls.

The peace-time regulations do not require power-operated davits on non-passenger ships, because of the duplication of boats. It was quite within the law, therefore, for owners to fit the ordinary antiquated goose-neck type of radial davit and many are so fitted. Under normal conditions of service the boat is carried inboard and before it can be launched overboard it must be lifted from

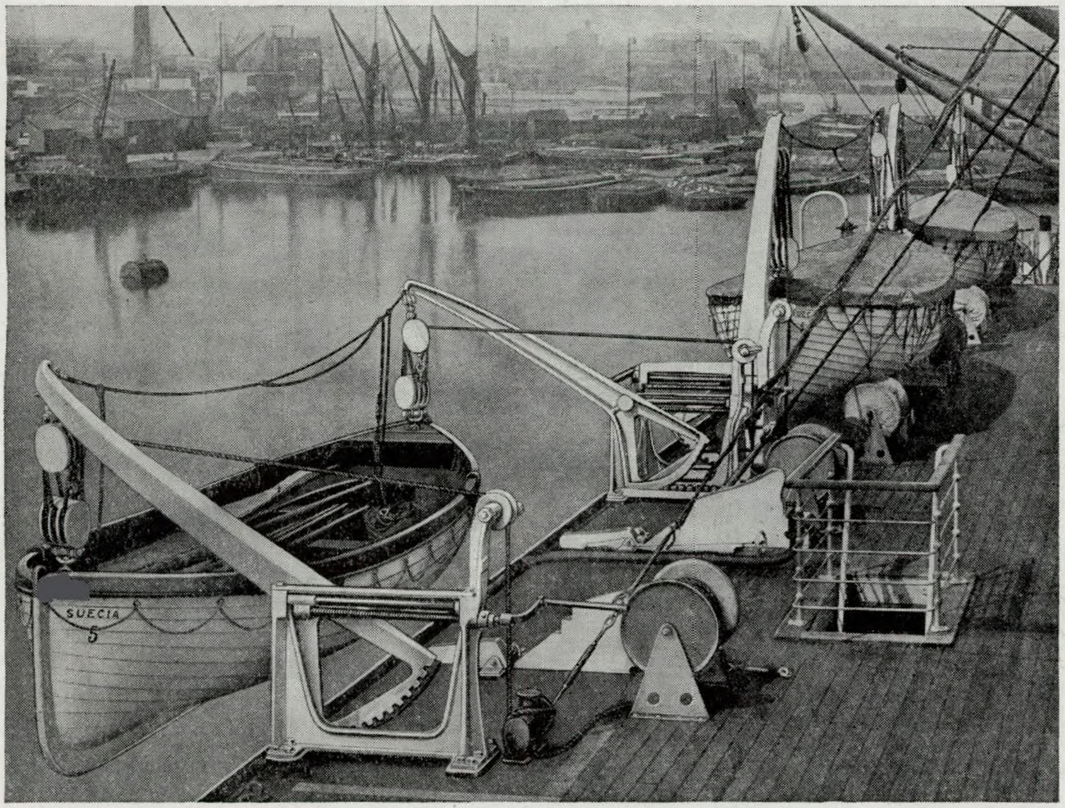



FIG. 12.—*Welin-Maclachlan standard quadrant davit.*

the chocks and swung outboard by hand, a tedious and unsatisfactory process in an emergency.

Mechanical davits do, however, obviate the drawbacks associated with the radial davit and are required in all new ships as a wartime measure. These are the product of various patentees; a limited

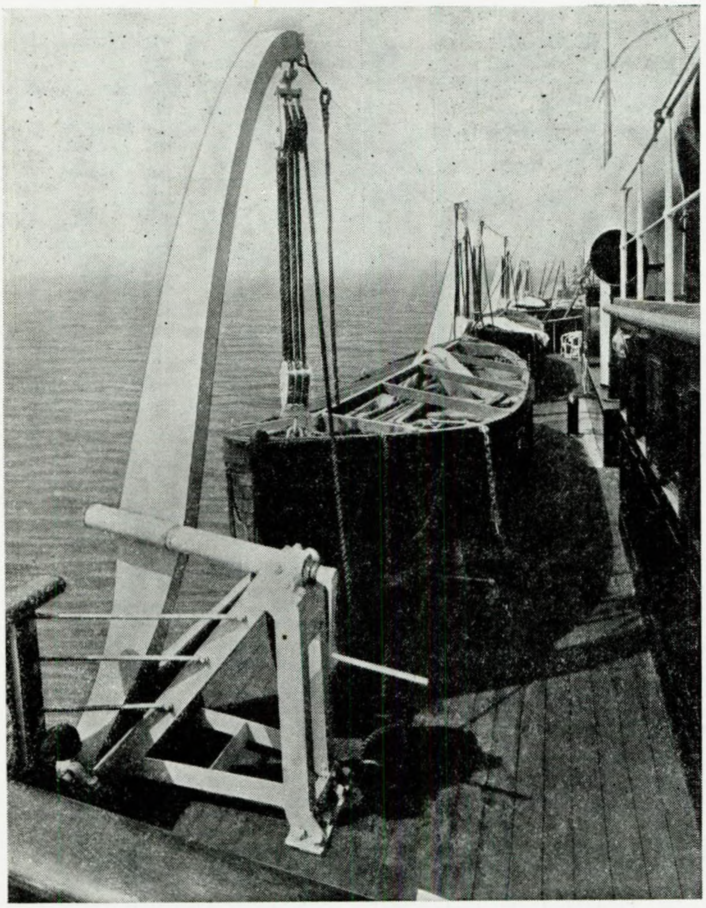
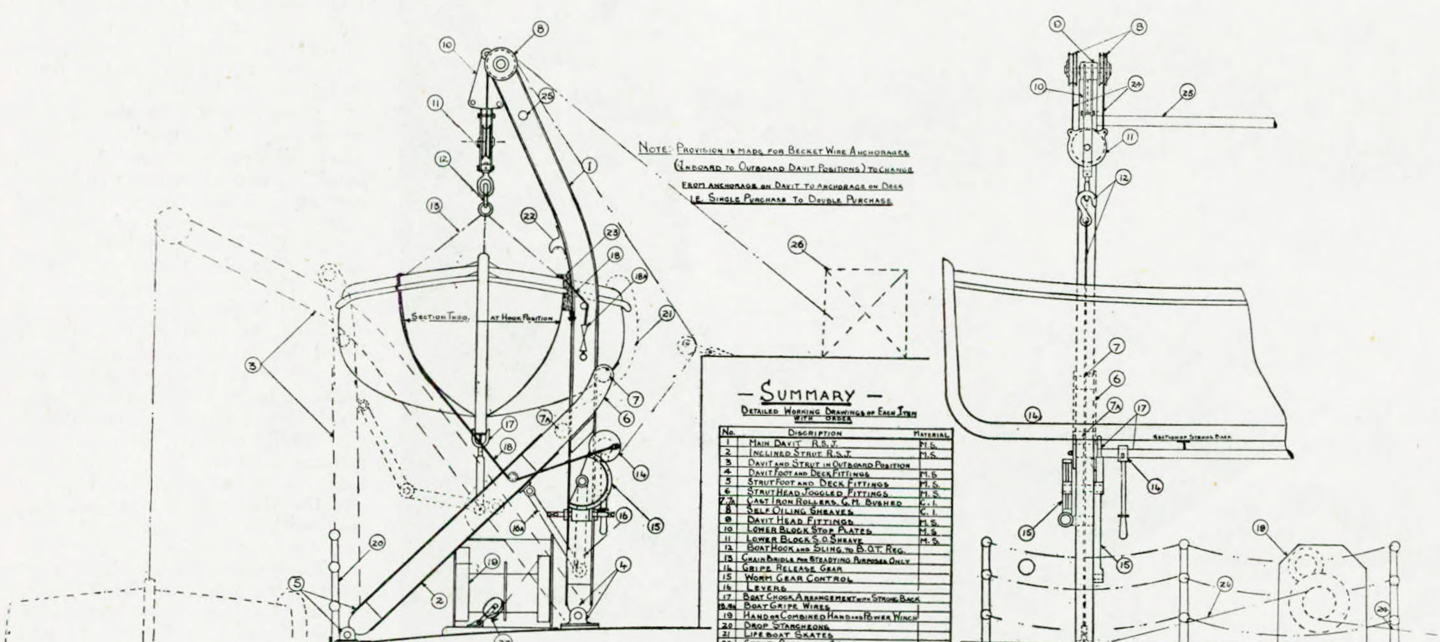


FIG. 14.—*The "Columbus" mechanical davit, "Lum" type.*


FIG. 15.—*The "Optimum" extending balance davit.*




APPROVED BY BRITISH BOARD OF TRADE
AND LLOYD'S CLASSIFICATION

FIG. 16.—*The "Hunt" mechanical gravity-aided davit.*

selection has been made for the purpose of illustrating this paper as representatives of types.

Fig. 12 shows the standard type of the Welin quadrant davit for single boats, operated mechanically by hand.

Fig. 13 indicates the same maker's welded box section "Crescent" davit, a very popular type in the present demand for mechanical davits.

Fig. 14 is a typical example of the "Columbus" davit manufactured by the same firm who produce the "Taylor" gravity davit.

Fig. 15 gives some idea of the principle of the "Optimum" extending balance davit, manufactured at Wallsend-on-Tyne; the screw gear operating the swinging out of the boat is controlled by hand.

Fig. 16 is the last of the illustrations which it is possible to include in this paper, and refers to Hunt's patent mechanical gravity-aided davit.

The "Schat" davit is fitted on a number of British ships and is one of the most popular davits in the United States of America.

The foregoing should be sufficient to indicate the trend of design in modern types of davits.

**Embarkation of Passengers and Boat Drills.**

The regulations governing the scheme for an effective marshalling of the passengers, and the training of the crew in the management of boats, are very comprehensive and clear in detail. Provision is made in large passenger ships for an installation of electrically-controlled signals from the bridge, for summoning passengers, with properly directed arrangements made for the persons on board to move from the different compartments and decks quickly and without panic to their respective muster stations, ready for their appointed positions on the embarkation deck.

The Ministry give every encouragement to members of the crew to become efficient in the method of launching the lifeboats, and issue to them, after qualification, a special certificate.

Although the regulations are very complete with respect to the methods of embarking passengers, the efficiency of the scheme can only be maintained by the exercise of discipline by the ship's officers and the constant repetition of boat drills.

Standard regulations in respect of musters and drills on cargo ships were issued by the Board of Trade in 1934, which are similar in principle to those in operation on passenger ships, but the responsibility must rest with the master and his fellow officers to train the crew in the operation of launching the boats if the scheme is to be effective in an emergency.

Loss of life has occurred through mismanagement during the process of launching the boats, through the excitement of the moment, or owing to the slippery condition of the falls produced by oil thrown up by an explosion, or by the premature release of the boat. It is, therefore, now a statutory law for drills to be held at intervals of not more than a week to train the crew in the use of life-saving appliances and the procedure for abandoning ship. A record of such drills must be kept in the official log book. It is of special interest to note that schools have been established by the Ministry in certain ports for the training of seamen in lifeboat work.

## (4) WHAT HAS BEEN DONE TO MEET THE CONDITIONS CREATED BY WAR.

The foregoing descriptive matter is devoted mainly to a résumé of the statutory requirements relating to the provision of boats and davits *under normal conditions of service.* The somewhat lengthy details were considered necessary in order that the reader may fully appreciate what has been done to meet the war conditions. It soon became evident when the present emergency developed, and ships were subjected to enemy attack from the air and beneath the sea, that additional life-saving equipment was necessary, and the conditions have been kept under constant review, with the result that there has been an increasing flow, during the war, of new devices and measures for the safety of life at sea.

It will not be possible in this paper to refer in full detail to all the modifications which have been effected to the life-saving equipment on all ships, but the important items as affecting lifeboats and davits are as follows:—

(1) One of the first actions by the Ministry was to arrange for cargo ships to be equipped with rafts or buoyant apparatus. Sea-going passenger ships were already provided with buoyant apparatus in accordance with the life-saving appliances rules. The number of rafts, etc., is to be sufficient for supporting all persons on board and must be equipped with self-igniting buoyant lights or other form of self-acting illumination, to guide the crew or the rescuers to them. The rafts have been greatly improved in the light of experience, are well equipped, and are stowed forward and aft, and where possible, on launching ways. Men have survived on them for weeks.

The author has digressed slightly from the limit of the subject under review, but considers the matter of such importance as forecasting the necessity of providing such apparatus in addition to lifeboats on all cargo ships under peace-time conditions; they will result in fewer ships being lost with all hands.

(2) Provision was originally made for all lifeboats *other than those under gravity davits* to be gripped in the *outboard* position, and in such a manner that the boat was not liable to be unhooked by a heavy sea, but could be lowered quickly into the water in an emergency.

The compulsory rule has been revoked in view of the serious loss of or damage to lifeboats carried in such positions due to heavy weather. With the ordinary radial davit there appears to be no alternative but to carry them outboard. In the case of mechanically-operated davits, apart from the gravity davit, the necessity does not seem so imperative, and the matter is now left to the discretion of the master.

(3) All lifeboats on all classes of ships, except those on restricted waters, are now to be Class IA lifeboats. Where cargo ships are equipped with boats of Class III in accordance with the rules, they are now to be converted to Class IA, *i.e.* they are now fitted with internal buoyant apparatus.

(4) Every ship must carry *on each side of the ship* lifeboats attached to davits sufficient to accommodate every member of the crew. In addition, every ship carrying passengers must carry sufficient lifeboats to accommodate the total number of passengers the ship is certified to carry, *they must be attached to davits,* where practicable, otherwise they must be stowed under hand-operated launching apparatus such as a topped up derrick, so placed as to float clear of the ship, and fitted externally with a buoyant self-igniting light for a ready means of identification when the boats are waterborne. One or two additional lifeboats, similarly equipped and carried in approved positions free to float clear of the ship, must be carried in all ships of Classes I and II.

(5) All lifeboats carried in ships of Classes I, II, III, XI, XII and XVIII, which include cargo ships, *viz.* Classes XI and XII, must be fitted with approved means of launching the boats against an adverse list. The fitting of skates satisfies this requirement where mechanical turning out gear is not provided.

(6) Another important provision is that in respect of the equipment of power-propelled lifeboats on certain classes of passenger ships and cargo ships over 2,000-tons gross tonnage. At least one of the lifeboats attached to davits and carried in accordance with the rules must be a motor lifeboat with approved means of propulsion, and provided with sufficient fuel to enable the boat to make a voyage of 160 miles.

The Austin and Morris Motor Companies have done remarkably well in producing for the Ministry, at the moment of writing this paper, some 1,200 sets of motor engines, with petrol as the fuel, for the purpose of installation in lifeboats as quickly as possible. The layout of the installation is shown in Fig. 22.

The engine is a four-cylinder model rated at 10 b.h.p., which it attains at about 1,450 r.p.m., but is capable of developing up to about 17 b.h.p. at 2,500 r.p.m. It is fitted with reduction gear and allows the lifeboat to get away from the ship's sides quickly. With a direct drive to the propeller there is always the danger of the engine stalling at the critical moment. Magneto ignition is employed and oil circulation is effected by gear-driven pump.

In passenger ships engaged on international or short international voyages and in oil tankers two of the lifeboats are to be motor boats.

(7) All new ships of Class XI, *i.e.* foreign-going cargo ships, in addition to all passenger ships engaged on international and short international voyages, are to be fitted with davits having gear of sufficient power to enable the boat, fully equipped and manned, to be turned out against a maximum list.

(8) Four lifelines of suitable length, with tricing lines, are to be fitted to all davit spans.

(9) With the exception of fishing boats which proceed to sea (Class XVII), *all ships* are to be provided with rope side ladders and rope side nets, to facilitate the means of getting down the ships' sides when the boats are waterborne.

(10) It has also been suggested that the keels should be increased in depth, to enable the lifeboat to sail more effectively to windward.

(11) The air cases (buoyancy apparatus) of all lifeboats are to be filled with an approved buoyant material to safeguard buoyancy should the cases become perforated by accident or enemy action.

(12) An approved portable transmitting apparatus and portable wireless receiving apparatus, with means for changing their batteries, are to be kept on board, ready to be placed in two of the lifeboats, when the emergency arises, one on the port and one on the starboard side; such boats being fitted with aerial masts for the purpose. This

requirement is applicable to all passenger steamships which proceed on international and short international voyages and foreign-going cargo steamships, but does not apply to those ships which are already supplied with two motor lifeboats fitted with a wireless installation in accordance with the rules of 1938.

The provision of the portable transmitting and receiving wireless sets causes misapprehension in the minds of some mariners, from the point of view that when wanted they may not be available. It is considered that if a more powerful set were supplied and permanently installed in the lifeboats, there would not be the necessity to carry the large volume of equipment, or at least some items of the equipment could be dispensed with.

(13) In order to provide shelter to the occupants, all lifeboats are to be fitted with a canvas hood for at least half the length of the boat, with side screens, and coloured yellow or bright orange for identification purposes.

Power-operated lifeboats were closed in by a steel cover, fitted with side ports for light and use of oars if necessary, in the United States of America some thirty years ago to the author's knowledge.

(14) The davits on all new foreign-going cargo ships are to be of such strength as to permit the boats being lowered into the water with their full equipment and number of persons on board, thus bringing them into line with foreign-going passenger ships.

**Special Provisions Made for Lifeboats in Tankers.**

Under the present war conditions prevailing at sea it is almost useless to carry lifeboats constructed of wood on oil-carrying vessels. The subject has been of some concern to the Ministry officials because of the serious danger from fire on board tankers and the effect of oil burning on the sea after a casualty. All tankers are now to be equipped with steel lifeboats and if a vessel carries four lifeboats two of them should, where practicable, be carried amidships. Two of the boats are to be motor-boats fitted with an approved means of propulsion, but one of these should, if possible, be carried amidships.

There are special precautions to be observed in respect of the provision of fire hose in lifeboats and asbestos blankets and flame-resisting garments for the crew. A very simple and effective cover has been designed which gives protection to the crew operating lifeboat falls to enable the boats to get away from the ship's sides as quickly as possible. It is easily and quickly slipped over the body and protects the head, arms and hands, and at the same time enables the operator to preserve as unobstructed view.

Life-saving equipment on tankers requires special consideration in view of the inflammable nature of the cargoes carried. After carefuly reviewing all possible means of saving the lives of the crews of casualty tankers, and sifting the information furnished by their technical experts and the evidence given by the masters, who have had first-hand experience in getting their crews away from torpedoed and other casualty tankers, a new type of steel lifeboat and improved quick-handling equipment has been designed by the Petroleum Industry and developed in association with the Ministry of War Transport with a view to overcoming many of the difficulties in tanker lifeboat operation and to provide a reasonable chance of survival for the occupants of boats under the most severe and hazardous conditions they are likely to encounter.

The most interesting features of the new-type steel lifeboat are as follows :—

| | |
|---|---|
| Length overall ... ... | 28ft. 0in. |
| Moulded breadth... ... | 9ft. 6in. (increased from 9ft. 0in. as a result of tank tests). |
| Moulded depth ... ... | 3ft. 9in. |
| Maximum draught to bottom of keel when loaded ... ... ... | 2ft. 6in. |
| Sheer forward and aft ... | 15in. |

The ends of the boat are fitted with turtle decks, *i.e.* they are decked over to improve seaworthiness and to prevent swamping in the event of mishandling during launching operations. Protection

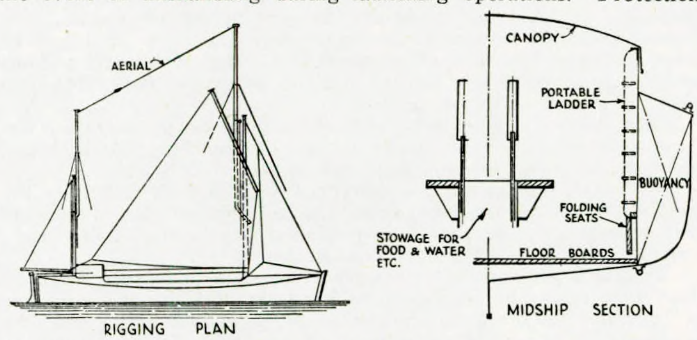



FIG. 17.—*Rigging plan and midship section of new type of metal lifeboat for oil tankers.*

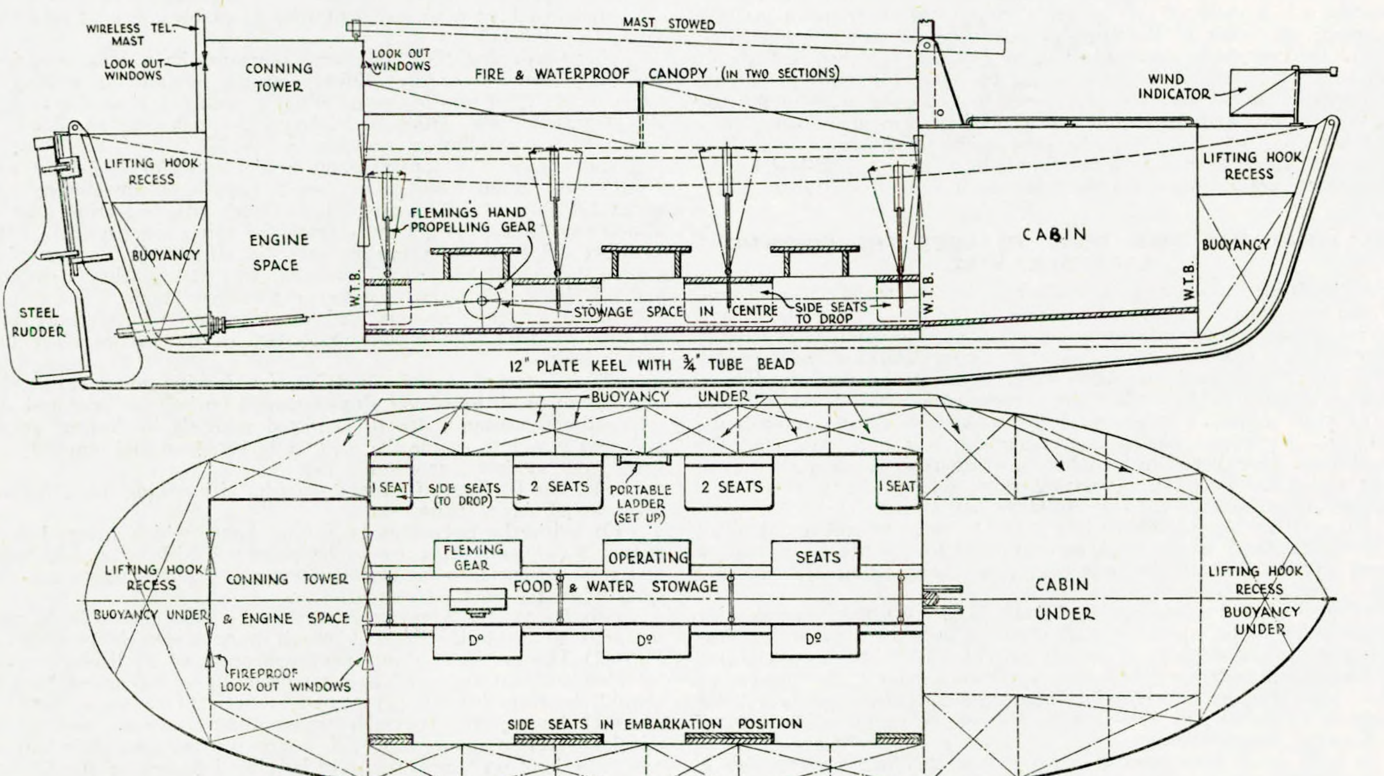



FIG. 18.—*Profile and plan of details of new type of metal lifeboat for oil tankers.*

is provided for the occupants of the cockpit by means of a canopy of waterproof and fireproof material, coloured yellow for identification purposes; it is anticipated that this will be of telescopic design in two sections, capable of being opened or closed instantaneously. Flame-proof port lights are fitted in the cockpit coaming to secure adequate vision when the cockpit is closed.

Seats are arranged in the cockpit for 27 persons. The cabin forward under the turtle deck provides a clear space for the treatment of injured or sick or for sleeping purposes. The after cabin may be arranged for the installation of a Diesel engine and/or stowage of equipment and stores, and is designed to give the steersman an unobstructed view forward and aft. Ample reserve buoyancy is provided by watertight compartments built into the ends and sides of the boat; this forms a protective belt from stem to stern which insulates the occupants of the boat from the heat and flames of any oil burning on the sea.

A deep bar keel 10in. in depth is fitted from stem to stern, to improve sailing qualities and to minimize drift and yaw and to keep the boat on a steady course.

The bronze propeller is guarded to prevent damage from debris and fouling by ropes.

Fire and bilge pumps are fitted for the dual purpose of pumping water overboard and for sucking the water from the sea for delivery through fan-spray nozzles to enable the decks and canopy to be protected by spray from the effects of fire. Additional discharges are also provided inside the boat for fire-fighting purposes.

Oxygen in bottles is provided for reconditioning air when the cockpit is enclosed and for reviving temporarily unconscious members of the crew.

Arrangements will be made to enable the maximum number of persons to sleep in a fully extended position in comparative comfort.

The painters used for controlling the boat whilst floating alongside the casualty tanker will be of flexible steel wire rope to resist failure by burning.

The boat is to be fitted with an approved mast, also jib and lug sail. A mizzen mast will also be provided for supporting the wireless aerial which will extend between the tops of the mizzen and main masts, thereby facilitating the sending and receiving of messages with all sails set. A mizzen sail will also be provided to assist the boat in lying to her sea anchor.

Two steering oars are to be provided in addition to the rudder. Each boat will be fitted with skids to facilitate the lowering operation and to protect the sides of the boat from damage whilst lying afloat alongside. Arrangements will be made to enable skids to be released simultaneously.

The dimensions and geometrical form of the boat has been carefully considered in relation to the amount of additional equipment carried and the provision of ample buoyancy and stability in the event of the cockpit being completely flooded.

In addition to Fleming's hand-operated propelling equipment it is intended to provide all boats of the new type with Diesel engines as and when the supply becomes available. Reference has previously been made in this paper to the Fleming Hand Gear which enables the boats to get away from the ship's sides quickly. In view of the paramount importance attaching to this feature the Petroleum Industry have also arranged for models of the new type lifeboat to be tank tested at the National Physical Laboratory with a view to securing the maximum possible speed of propulsion.

The davits on tankers are to be of the gravity self-lowering type with wire falls operated in conjunction with a lowering winch to ensure that this operation will be carried out as quickly as possible under all conditions of list, etc.

The Petroleum Industry have also arranged, in collaboration with the Ministry of War Transport, for two existing-type wood and steel lifeboats to be converted to embody as far as possible the special features incorporated in the design of the new-type boat. These boats, when completed, will be tested to the requirements of the Ministry of War Transport, after which it is the intention to convert existing lifeboats on tankers on similar lines as a temporary expedient until sufficient new-type lifeboats are available.

The first of the lifeboats is being constructed by Messrs. Mechans of Glasgow, and the Diesel engine by Messrs. Oil Engines (Coventry) Ltd., will be capable of generating 10 b.h.p. at 1,250 r.p.m. The radius of action of the lifeboat cannot yet be stated, until the amount of fuel to be carried and other details are finally settled.

Plans of the proposed new type lifeboat are shown in Figs. 17 and 18 and should be accepted as an approximate indication of the design.

**Skates.**

The author has received a number of letters from masters and

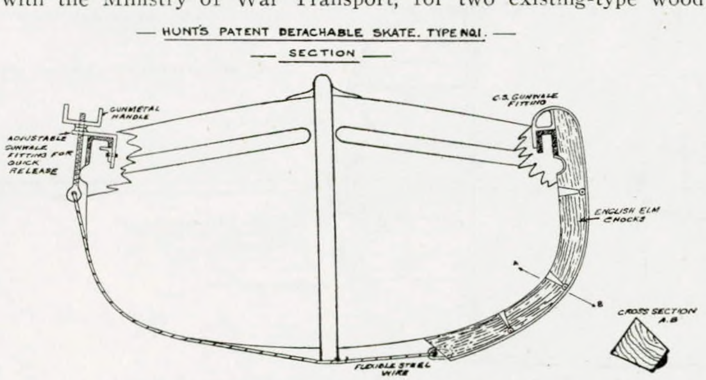



FIG. 19.—*The "Hunt" patent skates.*

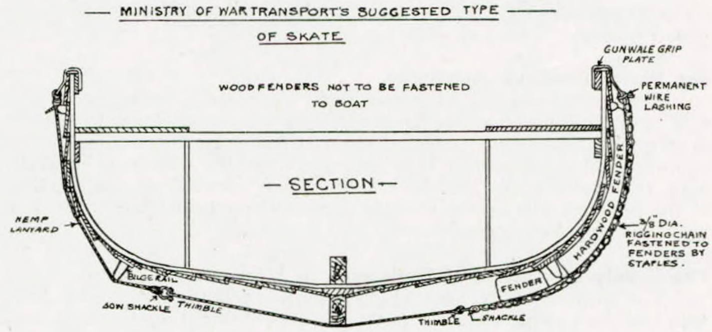



FIG. 20.

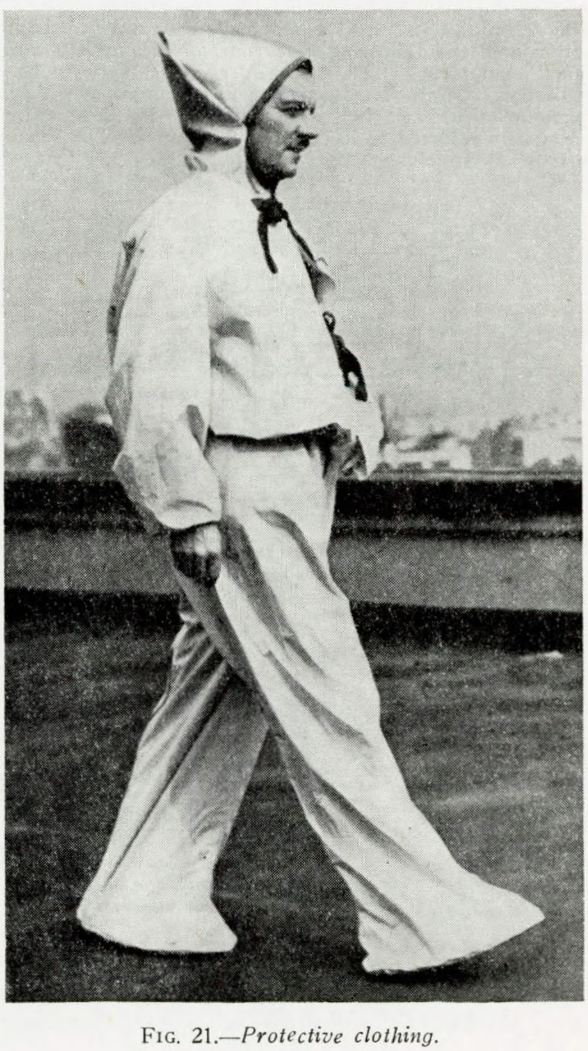


FIG. 21.—*Protective clothing.*

superintendents of ships which confirm the opinion that the fitting of skates to all lifeboats is a distinct advantage in aiding the successful launching of the boat in an emergency, thus preventing damage to the planking or sides.

Whichever type is adopted it is important that the method of release when the boat is waterborne should be simple and effected quickly.

The "Schat" design has been a standard fitting on a large number of ships, particularly those constructed in Continental ports. This type was fitted to all the boats on the q.s.s. *Normandie,* and has recently again become available in this country.

The Ministry of War Transport originally gave instructions for all new merchant ships building for the Government to be equipped with the "Hunt" type of skate, an illustration of which appears in Fig. 19, until other types were produced, when managers were left free to provide any type which was available.

The Ministry have prepared a sketch which shows a method of constructing skates from material which is usually available on board a ship. (See Fig. 20).

**Sea Water Distilling Apparatus.**

The equipment of lifeboats with a portable apparatus which will convert salt water to fresh drinking water has been the desire of mariners for many years. Research has been developing in this country, and a convenient type or types of outfit will soon be available for installation, the details of which cannot be made public at the moment, but by the time this paper is published the production will probably have commenced.

**The Supply of Additional Equipment in Lifeboats.**

The author appreciates the kindness of shipowners who have supplied him with copies of the reports from their officers and seamen who passed through the ordeal of long voyages in open lifeboats, and whose suggestions must always be considered seriously if the difficulties are to be obviated in the future.

The Admiralty and the Ministry have been alive to the necessity for action, and the following gives one an idea of the amount of additional equipment which is considered necessary to be carried in the lifeboats on all vessels engaged in ocean voyages, beyond the large amount already carried in accordance with the statutory law, and previously referred to in detail in this paper. The requirements are, briefly, as follows :—

(1) Means to be fitted to enable persons to cling to the boat should it be upturned, in the form of bilge rails and grab lines, attached to which should be suitable containers filled with fresh water.

(2) The sails to be coloured red for identification purposes.

(3) The provision of a *binnacle* compass with a luminous face.

(4) The sea-anchor to be of an approved size, and a fairlead fitted forward in the boat for controlling the painter attached to the sea-anchor.

(5) Provision of a canvas hood, with side screens, and coloured yellow or bright orange.

(6) At least six woollen blankets to be carried in a waterproof covering.

(7) An electric torch for Morse signalling to be supplied.

(8) A whistle to be attached to the boat by lanyard, which is additional to those supplied to the crew.

(9) A manual pump to be fitted for clearing water from the bilges.

(10) Four buoyant smoke signals.

(11) Outfits comprising palm needle and twine, and suitable tools for repairs.

(12) A supply of oil for massage purposes, a necessary precaution against "trench feet", and an approved first-aid outfit.

(13) A large bunting flag coloured yellow or bright orange, and attached to one end of light spar.

(14) A set of charts, covering the globe, in a watertight case.

(15) Hand rockets in addition to the peace-time red flares.

(16) Emergency rations, which are, briefly as follows :—

Treble the peace-time amount of fresh water, biscuits, a special chocolate which does not induce thirst, milk tablets, and pemmican, which is an approved meat extract, slightly salt due to actual meat salts, and can be dissolved in water.

All the emergency rations are to be kept in watertight containers. The provision of boiled sweets, lime juice and chewing gum have been advised by the Ministry. It has been suggested that raisins and prunes have been very effective, and owners often provide them when obtainable.

It should be remembered that in addition to the many items of equipment referred to, each person in the boat is supplied with a life-saving waistcoat or jacket, to which is attached an electric light having a globe tinted red, complete with battery, also a special suit as a protection against the heat of the sun or inclement weather,

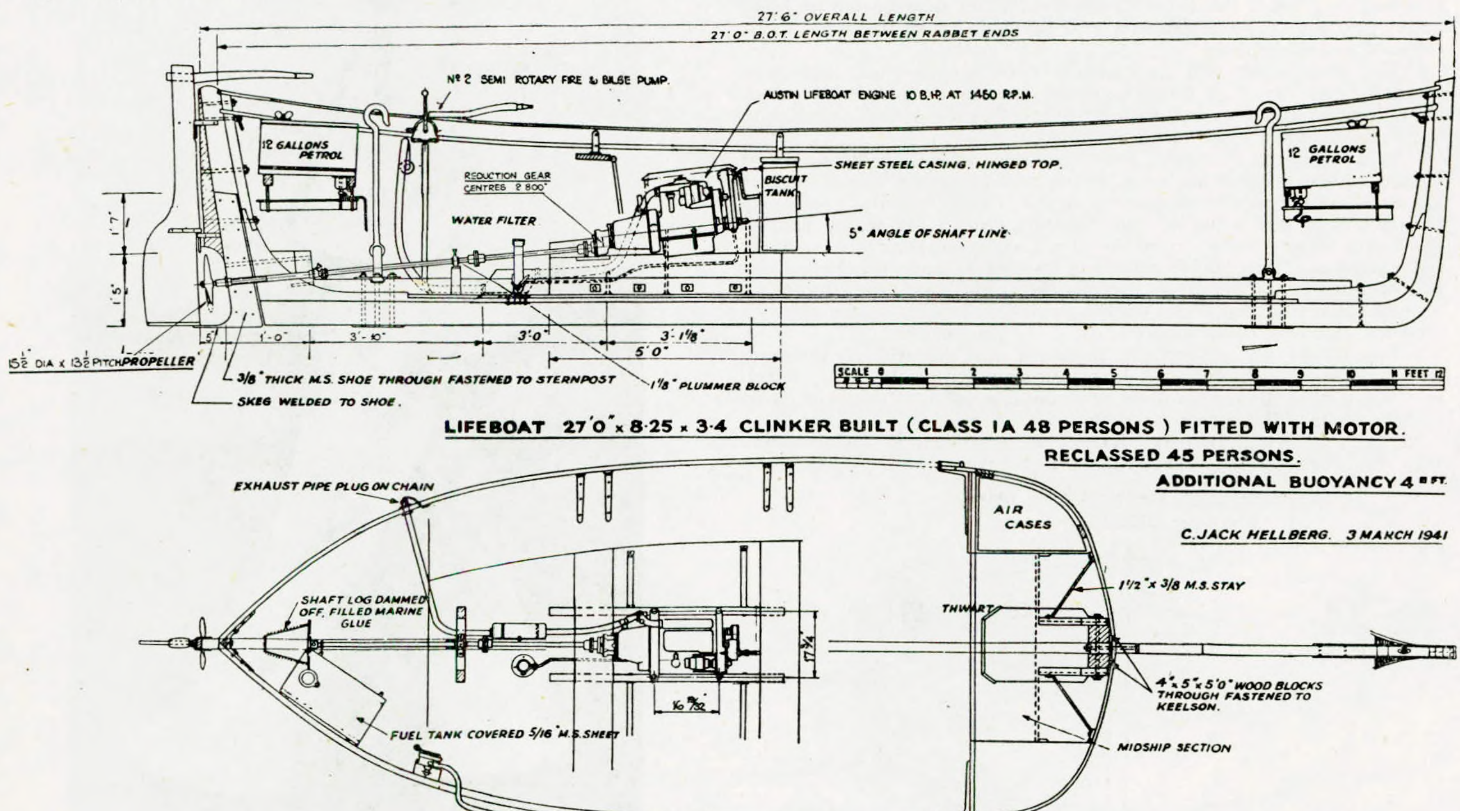



FIG. 22.—*Lifeboat with petrol motor installed (power unit has forward and reverse gear with reduction gear of 1·80 to 1).*

coloured yellow so as to be easily seen by aeroplanes or ships. The value of these items has been proved by the evidence of survivors and officers of rescue ships and aircraft, and by occupants of boats and persons in the water having been readily identified. The author has worn one of the protective suits designed by Mr. T. E. Metcalfe, O.B.E., of the Ministry of War Transport, in consultation with Sir Leonard Hill; this is an ingenious, simple and effective dress of light weight, and is illustrated in Fig. 21.

This equipment encroaches considerably on the space available in the boat, and the Ministry recognize that the number of persons who can be allocated to a boat must necessarily be reduced, which will mean an increase in the sizes or number of boats to be carried. It is suggested that an inventory of all the equipment should be supplied to each lifeboat indicating where it is stowed.

The Ministry provide some of this equipment, but responsibility for making arrangements for the supply of the remainder rests with the owners, and at the time of writing this paper the demand exceeds the supply, but the items which are of immediate necessity are being produced as quickly as possible.

The owners must provide and maintain in every ship a "record" showing the extent to which the principle requirements of the rules are complied with.

## (5) CONCLUSION.

In order that members of the Institute may realize fully the extent to which the war has influenced the equipment of ships, in respect of life-saving appliances, it has been necessary to divide the subject into two sections, the first dealing with the actual requirements by statutory law when ships were engaged on their normal peace-time service, and the second giving a general word picture of the amendments and additions which have arisen from the experience gained during the present war.

The treatment of the subject has involved a longer description than was at first anticipated. There is no finality to the subject of the safety of life at sea; much progress has been made, but it will be necessary to review the whole matter after the war in the light of experience gained, and meanwhile the Government authorities, in conjunction with the Shipping Industry, will undoubtedly face up to any further requirements for the maintenance of the morale of the Merchant Navy whose sterling qualities have placed all of us in their debt.

When ships return to normal service, and post-war regulations are prepared, it is to be hoped that the framing of rules will not be influenced unduly by the academic mind and a public unacquainted with the conditions at sea, which was so much in evidence after the loss of the *Titanic*.

The author wishes to record his appreciation of the assistance so freely given by many friends in the Shipping Industry in the preparation of this paper, and in particular for the help rendered by his old colleagues at the Ministry of War Transport.

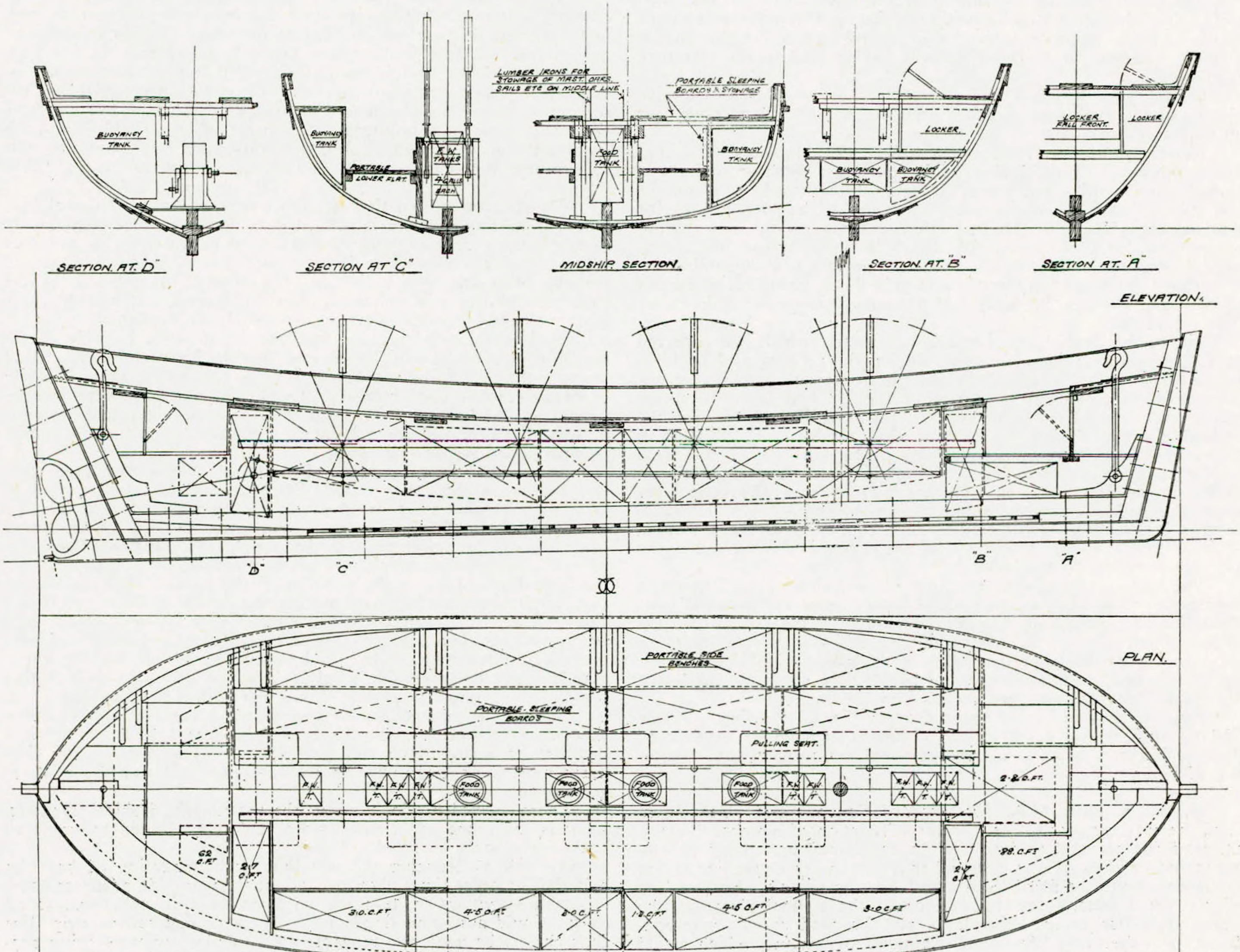



FIG. 23.—*Design of Fleming's Class IA lifeboat with hand-propelled gear.*

## Discussion.

At the invitation of **Mr. H. J. Wheadon** (Chairman of Council) **Sir Westcott Abell, K.B.E.** (Past President), who was present at the meeting, occupied the Chair.

Sir Westcott, opening the proceedings, referred to his past association with the author, and particularly to their work together in connection with the problems of safety at sea at the time of the conference on this subject in 1929.

Since then experience at sea had been much more strenuous than was anticipated. He was not competent to say whether or not the provisions which had been made for the safety of life at sea under the terrible conditions now existing were good or bad, but he knew that everybody concerned had done their best to make the lot of those who had to suffer from the actions of these pirates as good as possible. The author was here to give an account of what had been done, and would welcome their views as to the sufficiency of insufficiency of the provisions made.

Sir Westcott thereupon invited the author to deliver his paper.

**Mr. H. J. Wheadon** (Chairman of Council), opening the discussion, said: It was generally regarded nowadays that a man could justly claim to know his subject if he had written a book upon it, and in this connection most of those present had heard of Mr. Blocksidge's excellent book on "Ships Boats". He was author of papers on the subject of ship's life-saving appliances read before this and other technical institutions a few years after the last war, and it was interesting to note that a number of the recommendations which he made in those papers twenty years ago, although opposed in many quarters at the time, were now included in the statutory regulations.

In the present paper the author had given a comprehensive history of the evolution of ships' lifeboats and their launching gear up to the present date.

Referring to the cubic capacity he (the speaker) was very much impressed by the lantern slide showing a lifeboat under test loaded with a full complement of persons on board. The author had stated that the capacity had been increased by 10 per cent. for new vessels. Was this done to relieve overcrowding or was it to compensate for loss of capacity due to additional war-time equipment? Was the author satisfied that the present rules including the 10 per cent. allowance were satisfactory in this respect, having regard to the long voyages lifeboats had frequently to make under war-time conditions.

The author had referred to the loss of life which had occurred by the premature release of boats during the process of launching. In this connection it would be instructive to know how far the reliance upon a bollard as shown in Fig. 15 had been the direct cause of loss of life. The speaker for long had considered the bollard a crude device for such a vital service, and although it might have been in keeping with ships of Nelson's day, it did seem to him as an engineer to be something in the nature of a relic in 1943. Some simple means whereby both ends of the boat were lowered together from the same station appeared to be desirable, so that it would be impossible to lose control over the lowering, such as could easily happen with the bollard. What were the author's views upon that point?

The speaker was glad to note that the propeller of the Petroleum Industry's motor lifeboat for tankers would be of the guarded type. That provision was long overdue, not only for the risk of fouling by debris but also on account of the possibility of severe injury to survivors, particularly in the hours of darkness. Could the author say if this type of propeller would be fitted to all motor lifeboats, for its advantages were not confined to the tanker?

Finally, he would refer the author to Fig. 22 showing a motor lifeboat fitted with a petrol engine, although on page 4 it was stated that the Ministry of War Transport would not accept petrol engines for lifeboats.

**Mr. W. S. Burn, M.Sc.** (Member of Council) said: Bearing in mind the extreme sensitiveness to torpedo action of merchant vessels designed for peaceful trading—only a very small percentage surviving torpedo action—it was essential that very much better life-saving appliances should be fitted to new and existing vessels. From a loss of one per thousand per annum due to the normal elements, the figure must rise to some hundreds per thousand due to war conditions, and therefore life-saving equipment of a nature which would be considered hopelessly extravagant in peace time must be considered.

The author had done a great service in opening up this vital subject and putting the alternatives before us.

Looking at the excellent lifeboats and davits provided for the peace-time "Queen Mary", the speaker was tempted to suggest that boats at least as good and no less in size should be provided for merchant vessels in war-time, and he was satisfied that there were firms in the country which could mass produce such boats and so bring the production cost in man-hours down to a moderate figure. Such firms need not be boat building firms, but firms skilled in the art and craft of sheet-metal working and welding.

Nine months ago the speaker introduced a first-class manufacturer with experience of building fabricated steel boats for special purposes, to the Admiralty and the Ministry of War Transport. Becoming interested he was prepared to produce 30 first-class steel lifeboats per week, only technical assistance and instructions being wanted. Meetings were held, drawings and models produced, but in the end the speaker's friend and his firm were discouraged and no lifeboats were produced.

The urgency of the need for the best life-saving appliances possible did not appear to be appreciated by those in technical control at the Ministry of War Transport. A fortnight's sojourn in mid-Atlantic in the present normal lifeboat built to Ministry of War Transport requirements was suggested as a cure for such ineffectiveness, to be continued in three-monthly doses until suitable boats were produced. This would remove obstructions.

The new lifeboat in Fig. 18 was a vast improvement on the old type of boat, but when were these going to be delivered in quantity? It was many months since this new type was first mooted. Was this new lifeboat for this war or the next? Whilst the speaker agreed that the new lifeboat was better than nothing, he felt sure that every member of this Institute hoped that the matter would be treated as being *extremely urgent*. To make sure, he hoped the new designs would be sent to America at the first opportunity, as they were now mass-producing steel lifeboats in suitable quantities but hardly good enough in design quality, and they might be able to produce for both countries. The same observation applied to davits.

The speaker trusted that the peace-time objections to steel lifeboats of marine superintendents, that is, localized corrosion due to resting on stools, would not be maintained in war-time, as not only was a steel lifeboat safer in fire, but it was more resistant to torpedo blast and was easier to plug if machine gunned, as the hole was clearer and relatively free of tearing. It was no easy matter to plug wooden boats under actual sea conditions.

Steel pressings should be used to the greatest possible extent and joints, which should be kept to the absolute minimum, should be by welding. Some months ago there was ample press capacity in the automobile body industry. Coming to the davits, the practice of slinging the boats outboard was to be seriously deprecated in view of torpedo blast, and some form of first-class gravity davit should be fitted operable by one man.

A considerable proportion of boats of the normal type were lost before reaching the water. Most torpedo action occurred at night or dusk, and therefore the boat lowering *control gear* must be of elemental simplicity. There was, however, no need for the actual operating or *lowering gear* to be simple; it must be absolutely *efficient* and *reliable,* which was another matter.

This brought us to the position of the boats. Had the author considered the possibility of placing the boats in safer positions? The U-boat usually aimed at the engine-room, around which were accommodation and lifeboats, and a considerable percentage of lifeboats were rendered unseaworthy by blast before reaching the water. Would it not be preferable to place boats on the main deck during war-time? First-class gravity davits could then be provided.

One of the advantages of steel hatch covers in war-time was that it was often possible to give the affected hold or holds a measure of airtightness, and thus by increasing the sinking time much more time was available for the crew to lower the boats in good order.

There seemed no doubt about the usefulness of skids or skates, such as the Hunt and similar types, and it was good to know all boats were being so fitted.

As well as reducing the war-time accommodation of boats to half that of peace-time, it seemed essential to provide adequate room to enable survivors to lie down, so as to have an occasional sound sleep. Could not some simple form of suspended canvas strip (like deck chairs) be used, the movable steel tubular supports being supported in suitable sockets on the sides of the boat?

The author mentioned the need for a good water supply. A first-class distiller on the engine is the proper solution with alternative oil firing. This sounded elaborate, but need not be.

The need for increased range suggested the use of a Diesel engine, as thereby half the weight of fuel would be used, but it seemed apparent that a very good hand-starting design was needed and this suggested an opposed-piston type which had fundamental advantages in this respect.

On the question of pemmican, the speaker suggested that a supply of the American fruity pemmican as well as the British meaty pemmican should be provided. A more balanced diet was thereby obtained.

Finally, it was noted that a "ring" type propeller was proposed for the new boat. Surely the best solution was to use the Kort nozzle which would give greater efficiency and reduce racing and pitching?

**Mr. C. J. Hellberg** (Associate) said: There must be approximately 1,800 lifeboats afloat for the motive power of which he felt in some measure responsible. During 1939 and 1940 he had spent a considerable time persuading the Ministry of War Transport (then the Ministry of Shipping) to place large orders to make possible the production of suitable lifeboat engines. A contract was placed in January, 1941, for 500 engines with the Morris Company, also 600 and 900 in July and December, 1941, respectively with Austins.

The speaker drew up an installation plan for guidance with the hope that installations would be standardized (this layout was shown in Fig. 22 of the author's enlightening paper).

To cover all requirements for conversion a very comprehensive set of installation equipment was sent out with each engine. The first conversion jobs were somewhat a "jury-rig" and lifeboats were converted as well as could be done in the circumstances. The engines were made as well as possible and they were driven by petrol fuel. The conversion of rowing and sailing lifeboats to motor power was not very difficult, but the work was carried out in a hurry. Some were a sound job and others were not. There must be many of these lifeboats on ships afloat to-day, and if they were called upon to save life, not all of them, he submitted, might serve that purpose. He had advocated that existing boats fitted with motors should all be reviewed and more care taken to make them waterproof, because he had had many cases reported where the lifeboat had been launched successfully only to find that the engine would not function. Every care was taken to produce and test the engines to see that they were in good working order on leaving the works, but they were then installed in a lifeboat and no real efforts had been made to provide protection from the elements or from partial or total submersion. He submitted that all lifeboats fitted with petrol or Diesel engines should have a watertight box brought well up to the top of the gunwale line and then the airtakes provided with some form of "top hat" cover to prevent high-flying spray from entering.

He had misgivings regarding the percentage of these engines which had started and thus saved life. The whole idea was to produce a solution quickly, and he suggested that boats should now be surveyed and brought up-to-date.

When ships were operating in Arctic or low-temperature conditions, there should be some form of electric heater connected to the ship's mains (about 200 Watts would suffice) and this would always keep the lifeboat-engine temperature above freezing point. It would also save condensation which was one of the bugbears of the internal-combustion engine afloat. A simple heater would give the engine a reasonable chance of starting, also the special exhaust pipe plug should be used, as a following wind could drive a considerable amount of salt-laden atmosphere up into the combustion space, rusting valves and springs and putting out of action the sparking plugs. The cold starting of a Diesel or oil engine, for instance, did present difficulty, and as every ship was fitted with power for electric lighting, etc., why not use this to keep the lifeboat engine efficient for service? One shipping company was to try this out soon, but this trying-out was a lengthy business and he submitted that it should be adopted generally and immediately. This was the fourth year of the war and no time for lengthy tests of articles of proved technical value, if we were going to improve the lot of our seamen.

The speaker was concerned with production, and he had, in conjunction with Mr. Burn and others, investigated the possibility of the Diesel engine in lifeboats. He feared that as far as his Company's output was concerned, it would be a somewhat lengthy time before sufficient orders were obtained to warrant production. There did not seem to be any link-up between getting a proposition through and getting a practical application.

With regard to the new proposed lifeboats for tankers, while all appreciated that tankers should take first place, he submitted that cargo ships should be of the same priority and that there should be only one type of lifeboat for all ships. By so doing, production could be concentrated on one type, the oil tankers naturally taking the first off. First orders for this type of lifeboat and oil engine should be of the nature of at least 1,000, and this would justify a firm getting its production going for deliveries of say 20 to 30 per week. Only by this means was it possible to get large quantities produced in time.

Again referring to the model lifeboat for oil tankers, it seemed that the intention was to provide Fleming hand gear, and this gear was to be in some way connected to the same propeller shafting as the propulsion motor. It seemed advisable to have two propellers, an independent one for the hand gear and one for the engine. The present suggested arrangement would require a clutch of some sort which might be thrown in at the wrong moment and damage many people at the handles of the hand-gear. The drives should be independent, but why, in 1943, should it not be possible to rely more on a product of engineering? Engines for lifeboats should be classed as high or higher than any other engine of war, and they could be made if sufficient official support were propelled behind. One governing body of technical experts, who could direct this policy, would solve many of the problems of overlapping administration. If our seamen had to *"Abandon Ship"—let it be in the finest lifeboats we could build them.*

**Mr. H. B. H. Maundrell** (Associate) said: The speaker had recently sailed on a ship which was fitted with radial davits, and he had seen three lifeboats smashed by the elements and one by the blast of a torpedo explosion.

There possibly had been other such instances, and in view of such occurrences the inadequacy of the radial davit seemed proven and it should be condemned.

There were three fundamental considerations which governed the installation of life-saving equipment aboard ship; firstly the efficiency of the gear, secondly the superstructure of the vessel, and thirdly the initial outlay to the owner. Shipping personnel would appreciate if the government department concerned would recognize some standard installation which would form a compromise of these three requirements.

**Mr. A. F. C. Timpson, M.B.E.** (Member of Council) said: On the question of handling falls when lowering lifeboats, he agreed with Mr. Wheadon's remarks on utilizing bollards, and suggested that even if the fitting of modern boat winches presented difficulties, it should be possible to provide drums of sufficient size to accommodate the total length of fall, these drums being connected together and provided with a suitable brake of the screw band type, for lowering by gravity. An arrangement of this nature could be operated by less skilled personnel without the risk of upsetting the boat in the process.

The speaker raised another point, regarding the danger to the occupants of lifeboats from the fall blocks, particularly when there was still way on the vessel. There was the possibility of the fall blocks sweeping along the boat at very little height above the gunwale with consequent risk to the occupants, and some means might be devised of ensuring a greater clearance when the boat was released.

On the question of the special tanker lifeboat, he was aware that experiments were being made with asbestos cloth and a type of glass cloth to provide a suitable fireproof canopy, but drew attention to an announcement which recently appeared in the press on research for a flame-proof cloth, instituted by Sir Hector MacNeal. This research had been undertaken by a Mr. Petzoldt and his son, the primary object being fireproof clothing for airmen. It would appear, however, from published reports, that the process might well be applied to this canopy service also.

The author had touched on the question of disengaging gear. Fig. 24 (overleaf) showed what the speaker thought might be a suitable design. It incorporated the features that the author stated as desirable, *i.e.* it would not release until the boat was actually waterborne. The invention had Board of Trade approval, but had never been developed commercially, and might possibly be of interest under present-day conditions.

**Eng. Lt.-Com'r. W. E. Forster, R.D., R.N.R.** (Member) said: Was it humanly possible to design boats or davits to withstand war conditions? Everyone associated with shipbuilding during the past 50 years knew that there had been considerable improvement in every direction, but everything should be done to make the men as comfortable as possible.

The more one examined these mechanical davits the more it

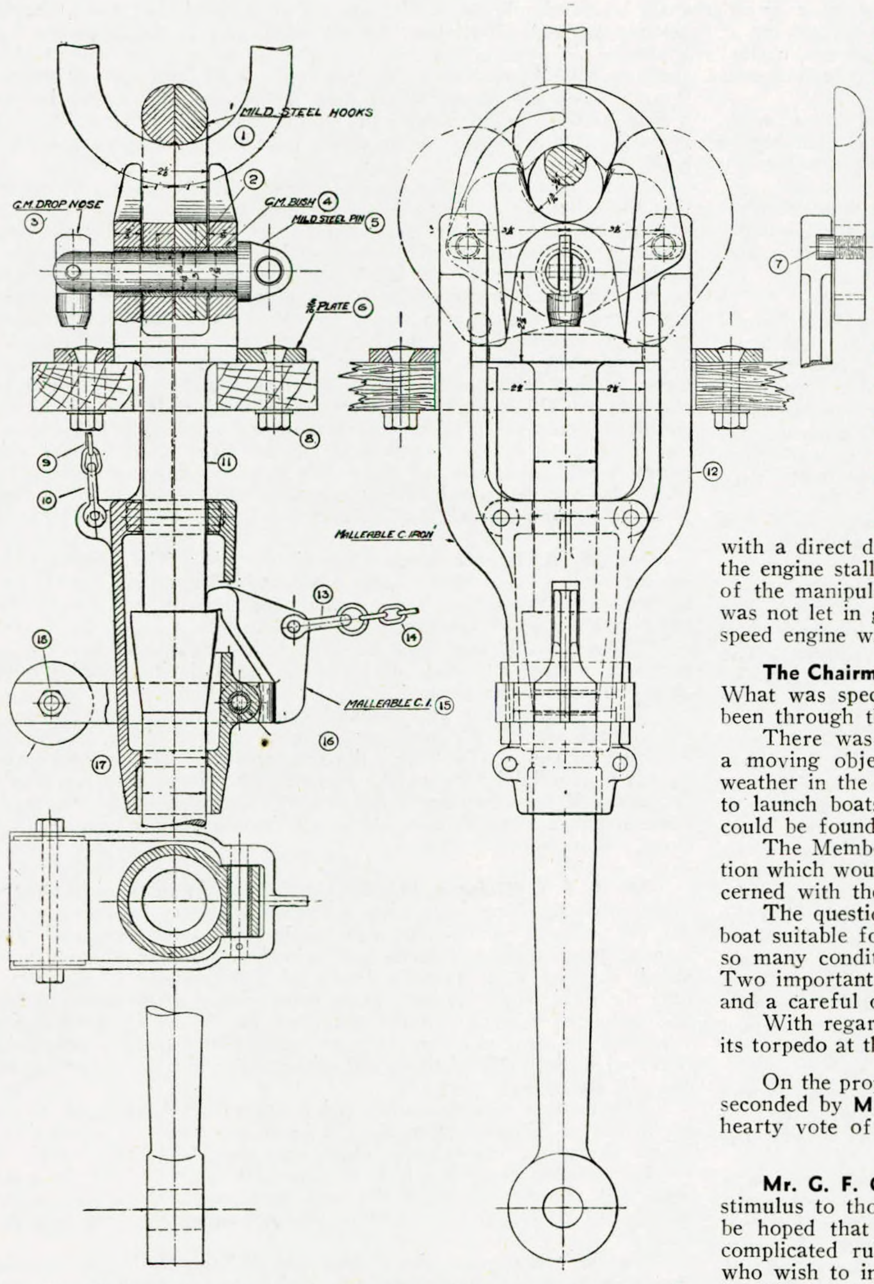



FIG. 24.—*Hodge patent boat releasing gear. (The gear at both ends of the boat releases simultaneously by pulling the releasing handle, which is placed at the starboard side of casings at after end of boat. Independent release of either gear can be accomplished by lifting the balance weights behind end casings. The gear is engaged by placing the link on the lower fall block in the forked end of the lifting rod, and pulling the operating weight to its top position by the handle attached to chain 9 and 10, where it is automatically retained. The gear passes through gangboard and is held in position by a solid plate rigidly bolted with countersunk bolts. The connecting rod and chains are carried along the starboard side in front of the side seat casing and protected by a galvanised pressed steel housing. A drop-nose pin is provided by which the hooks can be detached if required once the weight is off the falls).*

became apparent that they were liable to dislocation by the explosion of torpedoes, and he could not see how elaborate systems could possibly operate under wartime conditions.

**Mr. G. A. Day** (Member) said: In addition to the provision now being made to distil water at sea when in lifeboats, and in view of the fact that people sometimes spent weeks in these boats, he would suggest that fishing gear and some form of gear for trapping birds should be provided to augment the supply of food. It might even be possible to carry out some form of cooking using the heat from the distiller for this purpose.

**Mr. E. G. Warne** (Member) said: The author had emphasized the provision of bronze propellers for lifeboats, and he (the speaker) would suggest that in these times that provision was unnecessary. Much the same object could be achieved with cast-iron propellers, which in the present abnormal circumstances could be turned out more readily and cheaply. Bronze propellers seemed an unnecessary luxury.

The author had given a clear indication of the unsatisfactory nature of the construction of wooden lifeboats, as shown in the lantern slide of a new boat in which the planking was completely broken away from the stem. It was an unsatisfactory feature of wooden lifeboats, and it was time designers avoided any possibility of planking breaking away in this manner.

With regard to high-speed engines and reduction gears, on page 9 the author mentioned that with a direct drive to the propeller there was always the danger of the engine stalling at the critical moment. Was not that a question of the manipulation of a clutch? If the clutch fitted to the engine was not let in gently, the engine would stall whether it was a high-speed engine with reduction gear or not.

**The Chairman** (Sir Westcott Abell, K.B.E., Past President) said: What was specially wanted were the comments of those who had been through the experience of abandoning ship at sea.

There was no real solution to this problem, which concerned a moving object on a moving surface, such as a ship in heavy weather in the North Atlantic. One started from a moving surface to launch boats on to another moving surface, and no rigid way could be found of doing it.

The Members of The Institute could no doubt provide information which would be of service to the Government Departments concerned with the safety of life at sea in war-time.

The question had been asked, "Why could we not make a lifeboat suitable for war conditions?" He (the speaker) could mention so many conditions that it was evident we would fail somewhere. Two important things were to have a margin of numbers of boats and a careful distribution of the boats on the ship.

With regard to an earlier speaker's remark, a submarine aimed its torpedo at the bow in the hope that it would hit the engine room.

On the proposal of **Mr. W. S. Burn, M.Sc.** (Member of Council), seconded by **Mr. A. F. C. Timpson, M.B.E.** (Member of Council), a hearty vote of thanks was accorded to the author.

## BY CORRESPONDENCE.

**Mr. G. F. Campbell** wrote: The paper provides a much needed stimulus to thought in the realm of life saving at sea and it is to be hoped that the author's concise and clear explanation of the complicated rules and requirements will be a valuable guide to all who wish to interest themselves and experiment in this direction.

That so little official progress or legislation on such an important subject has been made over so long a period seems incredible and the author will indeed have provided a valuable contribution to our war effort if new ideas coming from new minds convince those responsible powers that be, of the general concern and desire for improvement in the safety of our seamen.

A glance through a list of catalogues concerning lifeboats and davits, reveals a number of good ideas, some of them invented many years ago, but which one never sees in practice. Very often an inventor, in his desire to be original and avoid treading on someone's "patent" leather clad toes, uses his new feature on some almost impracticable arrangement, thereby killing the whole idea, whereas if all the good points were combined, something really sensible would result.

We have such anomalies as a well-oiled and bushed block at the end of a davit, of such a diameter for a given size of rope as will give the least friction on the rope, and the same rope being run out from a few turns around a cruciform bollard.

Is it beyond the wits of inventive minds to standardize a type of hand- or power-operated boat falls winch, so that both falls run on a common divided drum which is well controlled by brakes? Or are the known winches of this type of prohibitive cost because of the patent rights, etc.?

When human life is at stake, the patent rights of an entire invention should never be allowed to prevent a useful portion of that invention being embodied in a more useful whole.

In all arrangements of davits it would appear that too much thought has been directed along lines starting from "what has been done before"; for instance, why should a lifeboat be launched parallel to its parent ship at all, with the consequent swinging, broadside, against the shell and juggling with oars on the inboard side? A crane arrangement of tubular construction swinging the boat out bodily from one axis until the lifeboat was at 90° to the parent ship, would give more freedom for swinging, less chance of crushing either persons or gunwale, and entire freedom for both banks of oars.

The "all in one" lifesaving suit, illustrated in the paper, which apparently has only comparatively recently been adopted for the Merchant Navy, was in use on certain lifeboats of the Royal National Lifeboat Institution five or six years ago to the writer's knowledge, and was known then as the "Don Alfonso". It is a pity that its advantages were not realized sooner for more general purposes.

The shielded propeller mentioned in connection with tankers' lifeboats brings to mind a patent brought out by a Liverpool firm many years ago, called the Kitchen rudder, an arrangement similar in appearance to the Kort nozzle, but in which both sides of the flat ring could move independently and act as a rudder as well as a shield. The closing of the two halves, either behind or before the propeller, formed almost a semi-spherical shape, which was also an effective brake to the craft's motion.

An adaptation of this nature would be of great advantage as it also eliminates the usual form of rudder so liable to become unshipped.

As regards the boat itself, improvements are long overdue. The necessity of life rafts to-day raises the question as to whether a lifeboat should be built for good sailing qualities or primarily floating qualities and capacity. Obviously both boats and rafts cannot cover distance in *company* and one wonders at the feelings of a shipwrecked crew when forced to part company for this reason. Therefore, the writer suggests that a large full-formed boat with "Dutch Boier" lines would be a sensible compromise. The rafts would still be very necessary, of course, owing to their rapid launching qualities and resistance to damage, but the fuller boat would have increased capacity for more persons and, especially, equipment.

A full formed, almost apple-bowered boat would lend itself to many improvements in construction and comfort. For instance, hood ends of planking—the weak point in the present construction—would be eliminated a great deal by planking which was continuous around the bow in a wide sweep with a good high sheer for shelter, and a flat bottom and beam carried well fore and aft would be more convenient for injured persons. Such a primitive idea as the outrigger could, perhaps, be adapted in a portable form, using oars to resist capsizing and to assist persons climbing aboard from the water.

Those concerned primarily with the sailing qualities of a boat would object to such a "tub" no doubt, but this form has proved very seaworthy on the Zuyder Zee where sharp broken waves are frequent; and then, as has been pointed out before, is not the capacity and comfort of first importance?

Another point worthy of consideration in the light of war-time experience is that of the point of suspension of lifeboats. Many boats to-day, having to be hung clear of the chocks, are developing a considerable sag and this seems to indicate a better position is required of the lifting hooks—closer together. The rules for this seem to have been designed for the old radial type of davit and to the clearance necessary at stem and stern when swinging out. Perhaps the author can tell us whether this is so or whether other considerations make their position necessary as at present.

It is to be hoped that ideas will be prolific and progress made possible with them against the seeming complacency, and consequently we look forward ardently to further developments.

**Mr. S. Eady Laxton** (Associate) wrote: One relatively small point of detail in connection with motor-driven lifeboats employing petrol engines arises largely out of war-time operation and the consequent scarcity of tin-plate for making containers, transport facilities and labour. The writer refers to the undesirability of providing a special lubricating oil in a special container for use in the lifeboat engine.

The writer thinks that builders of petrol engines for use in ships' lifeboats should be encouraged to make their engines non-selective to lubricants to the extent that they can use satisfactorily any of the first-quality oils normally found in all ships, such as the following:—

In reciprocating steam-engined vessels—
The dynamo engine crankcase oil.
In turbine-engined vessels—
The main turbine oil.
In Diesel-engined vessels—
The main engine or auxiliary Diesel engine crankcase oil, whichever has the lower viscosity.

Technically, this would mean that the engine should start at low temperatures and also run under conditions of the highest sea-water temperature, on any first-quality oil having a viscosity between 100 and 220 seconds Redwood I at 140° F.

The principal considerations would be to ensure that the engines would start easily by hand at low temperatures on the highest viscosity oils within that range, and be safeguarded from oiling up their sparking plugs when running at the higher temperatures on oils at the lower end of the viscosity range.

The problem is less easy of solution with Diesel lifeboat engines, especially in connection with hand-starting, but the writer feels that it is worthy of consideration by superintendent engineers and engine designers.

The extension of the use of electric heaters of low output, coupled by plug to the ship's mains and installed in the engine's water circulating system, would be helpful with the higher viscosity oils, as it would for other purposes which can be better discussed by engine builders.

**Mr. E. F. Spanner, R.C.N.C.retd.** (Member) wrote: This paper will be much appreciated by all those intimately concerned with the problem of improving the chances of survival of the men of the Merchant Navy whose ships are sunk by enemy action.

It is as well to have so authoritative a stocktaking as that given by the author—enabling note to be taken of progress made, and giving opportunity for assessing the possibility of achieving still greater advance.

With so much gear *added* to lifeboats it is prudent to make certain that what is being supplied is of the proper kind.

One particular matter occurs to the writer, small in itself, but of considerable importance to men in the later stages of exhaustion. It is that no longer should use be made of harsh-fibred rope for grablines, lifelines, heaving lines, painters or any other ropes to which men may have to cling for hours to save their lives.

Ropes made of manila, hemp, sisal, fine coir and the like all get very harsh and hard in sea water, apart altogether from the fact that they twist and shrink.

It is strongly urged that, for life-saving equipment, all such ropes should be discarded in favour of cotton ropes, preferably plaited, very much kinder to the hands, equally as strong and reliable and, furthermore, obtainable in "buoyant" quality.

The importance of easing chafe to the hands of men who may have to cling to grab lines for many hours in cold, rough weather is obvious, while it requires no effort of imagination to understand that a lifeline, painter or heaving line which floats, is much more useful for throwing to a drowning man than a line which sinks before he can grasp it.

**Mr. A. M. Riddell** (Member) wrote: The author mentions that the propellers for lifeboats for tankers are "guarded". The writer does not know what type of guard is fitted, but presumes this to be a fixed single-plate shroud. Assuming a slip of, say, 25 to 30 per cent., the angle of incidence even "in open" would be such as to make a cylindrical shroud unsatisfactory, as the propeller tips would be starved. This condition would be aggravated by the after body lines and further accentuated by the wake. If a single-plate flared shroud is fitted, this would give a satisfactory propeller feed but would set up considerable eddies on the outside of the flare. In addition, any form of single-plate shroud would, the writer thinks, be vulnerable to impact and might easily distort sufficiently to jam the propeller. If a double-skinned shroud, such as the Kort nozzle were to be used, the internal stiffening and method of two-dimensional attachment to the hull would provide ample protection to the propeller. With nozzle there would also be available an increase in propeller efficiency.

In the absence of fuller particulars, the writer assesses that with the lifeboat shown in Fig. 22, the speed in fine weather would be around 6·5 knots at 10 s.h.p., which would be increased to around 7 knots with nozzle representing an increase in effective horse power of 25 per cent. An alternative but more important advantage would be that for 6·5 knots the s.h.p. could be reduced to about 7·5; thus the range of action for a given bunker capacity would be increased by about 33 per cent. The foregoing benefits, whilst not measurable except in tank trials, would nevertheless be available in the case of Fleming lifeboats and would conserve "the expenditure of energy by the occupants of the boat when a long journey seems likely". If the Fleming boat uses a larger propeller in relation to power, the efficiency of the nozzle would not be as great as in the motor-boat. These assessments of increase agree with the results obtained in actual practice and in model trials at Teddington and elsewhere.

There is a current misapprehension that nozzles are useful only for towing. The factor which controls the efficiency of nozzles is the magnitude of slip. Assuming 6·5 knots to be correct for the lifeboat shown in Fig. 22, the slip would be about 27 per cent. when free running. The same slip would be present if a very much smaller boat, fitted with the same engine and capable of, say, 10 knots free running, were to tow craft of such resistance as to reduce the speed of towing to 6½ knots. Since the slip in either case is similar, the efficacy of the nozzle would be as great in the larger boat free running at 6½ knots as in the smaller boat towing at this speed. Actual tug conversions and trials at Hamburg tank have proved that pitching is lessened and racing is almost entirely eliminated with nozzle.

A further advantage would be that a larger and therefore more efficient propeller could be fitted with nozzle, perhaps calling for a change in ratio of gear. The aprons on the foreside would ensure better immersion to the propeller, even under bad-weather conditions. The foregoing assessments of benefits due to the nozzle are compared to a normal open propeller, but as the assumed type of shroud fitted round the propeller would almost certainly detract from its efficiency, the increases should be somewhat greater than as computed.

There is one type of swivelling nozzle which takes the place of the rudder, and being pivoted a little forward of mid-length is practically balanced. This type has the advantage that full manœuvring over the stern is possible, whereas with any single-screw vessel—open propeller or nozzle—astern steering is feeble and unreliable except in still water and with no wind. In getting away from a wreck or from a patch of fire on the water where there is not sufficient sea room for ahead manœuvres, this ability to steer astern would be invaluable and would also be of great advantage in manœuvring into position to pick up survivors. One type of fixed nozzle has two small rudders on the foreside, these being directly coupled to the main rudder. This type also gives full manœuvring over the stern. In another type for small power, the propeller is worked through bevel wheels from a vertical shaft and the whole nozzle and propeller can rotate so that astern motion is possible without reversing the engine. A vessel fitted with nozzle is better at "getting off the mark" from a stationary condition and can be stopped very much more rapidly than a similar vessel with open propeller. If the propelled lifeboats have to take ordinary lifeboats in tow the efficacy of the nozzle would be enhanced. If the number of such lifeboats were such as to reduce the speed to 4 knots when developing full power, the range of action would be increased by about 50 per cent. Alternatively, the towing speed would be increased by about 12 per cent. representing an increase in effective horsepower of about 40 per cent. All the foregoing assessments assume ideal conditions; the improvements with nozzle under bad-weather conditions would be relatively greater.

The author states that model trials are to be carried out at Teddington with converted steel and wooden lifeboats. The fitting of nozzles for trials would involve no alteration to existing boats or models, apart from superimposing the nozzles on to the hulls. Trials could be carried out with normal open propellers, "guarded" propellers and Kort nozzles. Model trials at Teddington, in American, Dutch, Russian, and German tanks, as well as trials carried out by the N.P.L. staff on an actual tug, confirm benefits of the order predicted.

The claims are so easily capable of proof or disproof that an investigation appears to be more than warranted.

This is the writer's justification for "ventilating" the case for the nozzle at such length. Nothing would give greater pleasure than to co-operate with the author or any Ministry officials or with officials of the tanker industry in any trials.

If nozzles were to be adopted there would be particular satisfaction in knowing that a German invention was helping to save Allied and British lives.

## The Author's Reply to the Discussion.

The value of a paper was enhanced considerably if the subject was developed by discussion. The members had, in difficult circumstances, shown their interest by attending the meeting and submitting helpful suggestions.

It was a typical characteristic of Sir Westcott Abell, K.B.E., M.Eng., the author's old chief and associate in the effort to increase the standard of life-saving appliances on merchant ships, to travel a considerable distance in order to take the Chair. The author appreciated such a gesture and also the attitude of Mr. H. J. Wheadon, the Chairman of Council, in inviting Sir Westcott to take his place.

Mr. Wheadon, opening the discussion, referred to four items extracted from the paper upon which he desired the author to give an expression of opinion. (1) The capacity of lifeboats to accommodate a reasonable number of persons, (2) the effective value of boat lowering bollards, (3) the protection of propeller blades in motor lifeboats, and (4) the desirability of petrol engines in lifeboats.

(1) The 10 per cent. increase in capacity of new lifeboats was due to extra space required for the storage of additional equipment, in accordance with the emergency regulations, which without this extra capacity would have encroached on the space available for the accommodation of persons. One must keep in mind the fact that the war had altered completely the fundamental considerations of life-saving equipment, as explained in section 2 of the paper. There was no doubt that after the war the Government Authority, with the large amount of experience gained with lifeboats at sea under varied conditions, must and would face the problem of the number of persons which could be reasonably allocated to lifeboats.

(2) Boat-lowering bollards in the hands of unskilled persons were unsatisfactory and, in an emergency, there was always the possibility of the boat being up-ended. As Mr. Campbell pointed out, this type of fitting was responsible for a large amount of wear and tear on the falls.

(3) The propeller of the new tanker lifeboat would be protected by guards. It was obvious that there was always danger from ropes and floating debris fouling the propeller, and also to persons in the water. The author suggested, therefore, that the same provision should be made in all lifeboats fitted with motors or mechanically-operated propelling apparatus.

Mr. Riddell gave some interesting facts relating to the Kort nozzle and suggested that considerable advantage would result from its installation in all power-driven lifeboats. The results of tests appeared to justify all that was claimed for this innovation, but the author considered that such a fitting could not be considered as a statutory requirement and it must be left to the owner's discretion as to whether or not it was desirable.

(4) It was true that under the pre-war statutory regulations the Ministry did not favour the adoption of motor engines dependent entirely on petrol as a fuel. The reasons which had prevented their universal adoption for motor lifeboats were so well known that special comment appeared unnecessary. The difficulties were referred to by Mr. Hellberg in his contribution to the discussion.

The Ministry were faced with the necessity, under the conditions now prevailing at sea, of providing quickly some means of propulsion to enable crews to operate lifeboats with the minimum amount of effort. The resources of the Morris and Austin Motor Companies were applied to supply a large number of petrol motors pending the manufacture of Diesel engines.

There had been and were at present many difficulties associated with this installation, and the suggestions made by Mr. Hellberg could not be lightly discarded. The author wished to express his appreciation to Mr. Hellberg, the marine superintendent of the Austin Motor Co., Ltd., for making the journey from Birmingham to give the members the benefit of his experience.

Mr. Timpson and Mr. Campbell referred to the difficulties associated with the use of deck bollards for lowering lifeboats from the davits, and suggested the substitution of modern winches with brake attachment and proper control of both ends of the boat. Such an installation had been considered by the Ministry and adopted in certain types of ships.

The fitting of a satisfactory design of releasing gear was an undoubted advantage provided the crew was trained in the operation of release. The details of such an apparatus, as shown in Fig. 24, appeared to indicate that it was foolproof against a sudden release before the boat was waterborne. As previously stated, statutory rules could not be made to adopt a particular design of equipment, but the Government Authority was always prepared to consider any details of equipment if submitted by an owner for approval.

In reply to Mr. Warne's suggestion for the substitution of cast-iron for bronze propellers, the author was of the opinion that the authorities were well advised to adhere to the bronze propeller in the sample steel power-operated lifeboat now under construction for installation on a tanker, it being more efficient and less liable to permanent deformation. As a war emergency measure there was nothing to prevent the use of cast-iron, provided it was protected effectively by a suitable guard, but as the propeller was such an important fitting in the installation of a motor-boat the author considered that so long as bronze was available it should be used for this purpose.

The lantern slide referred to was introduced to illustrate the advantages obtained from the use of buoyancy tanks as a means of preserving sufficient reserve buoyancy should a lifeboat become damaged and flooded. Although the structure of the lifeboat forward was considerably mutilated from the effect of torpedo attack, the boat was the means of bringing a large number of survivors safely to port. The construction of modern wooden lifeboats was of the highest standard; they might be more liable to damage in the process of the launching operation as compared with a metal boat, but the present system of bracing the ends should enable the boat to meet all reasonable emergencies and hard wear and tear. If the particular boat referred to had been fitted with skates, the damage would probably have been reduced.

The author had been surprised to learn from reports by masters that it was their experience that damage to metal boats could be repaired by the ship's personnel with greater rapidity and effectiveness than was the case with wooden boats.

The design of the motor engine developed by the Austin Motor Co. for ships' lifeboats was specially considered from the point of view of permitting the boat to get away from the ship's sides quickly, and for that reason it was thought there was less liability of the engine stalling at the critical moment with reduction gear than if designed with the direct drive. Mr. Warne was quite correct in his statement in respect of a faulty manipulation of the clutch, but there were also other considerations, from the experience of the makers, which suggested that the reduction gear was to be preferred.

It was always difficult to obtain the expressed views of officers of the Merchant Navy at technical meetings due to their natural reserve in public. The experience at sea of Mr. Maundrell confirmed the author's conviction that the radial davit fitted on cargo and passenger ships employed on international voyages was an inferior apparatus. The damage to lifeboats stowed outboard under radial davits had been, to say the least, excessive and did not warrant the continuance of this emergency regulation.

The author was in agreement with the statement of Engineer Commander Forster, that complicated mechanical life-saving outfits were more liable to dislocation from the effect of enemy action under war conditions as compared with the more simple installation fitted for operating smaller boats. "Too many eggs in one basket" was not a desirable feature under the present emergency conditions.

The contribution from Mr. Campbell contained a large amount of constructive criticism; some of the difficulties he referred to had been dealt with in the author's reply to other members. The crane arrangement for launching lifeboats in the manner suggested had already been carefully considered and was fraught with considerable difficulty and danger. The time factor also came into effect, and combined with other drawbacks rendered the apparatus unsuitable.

The "Don Alfonso" suit referred to was an entirely different type of protective clothing to the one illustrated in the paper. Time and space prevented the author giving a full description of this detail of equipment, which had already proved its value at sea. The whole suit could be folded and enclosed in a case which did not exceed in size that required for a civilian gas respirator.

The remarks of Mr. Campbell regarding the "Kitchen" rudder and the form of boat rafts were interesting and helpful for the further consideration of the subject. The position of lifting hooks was dependent on the type of davit fitted. If boats were allowed in the future to be stowed inboard to prevent damage the stress would be relieved.

The writer would like to assure Mr. Campbell that since the war commenced the Government Authorities could not be accused of complacency; they have done everything that was humanly possible to provide the best methods of protection for the men of the Merchant Navy from the results of enemy action.

Mr. Eady Laxton raised an important detail relating to the necessity of builders of petrol engines being encouraged to make their engines non-selective to special lubricants. Those of the members who drove their own motor-cars did not depart, the author imagined, from the maker's instructions in respect of lubrication. The suggestions were, however, worth the consideration of firms producing motor engines for lifeboats.

Mr. Spanner drew attention to the necessity of providing suitable material for life or grab lines which were becketed around the sides of boats from the gunwales. It was usual to fit wooden hand holds in the loops of the grab lines and thus obviate the drawbacks to which he referred. This provision should be a statutory requirement of the rules.

The advantage of a buoyant type of life line or painter was obvious. The author had examined samples of the ropes now being manufactured by The Fine Cotton Spinners and Doublers Association, Ltd., for Government use on rafts, aircraft, etc., and considered their adoption would be an improvement on the present fittings.

Mr. Burn's professional interests had brought him into contact with various Government departments dealing with the provision of equipment to reduce the loss of life at sea under present conditions, and his remarks would appear to suggest that he had "fouled iron", to use an old shipwright's expression, when his smoothing plane cut into the head of a projecting screw. The author considered that his remarks relating to technical officials of the Ministry of War Transport in respect to their attitude to the needs of the moment and their alleged lack of response to an increasing demand for a revision of the regulations, were unduly bold and would not be a constructive means of assisting progress in the direction both Mr. Burn and the author desired.

The steel lifeboat had come to stay and there were firms of well-known repute, with the necessary facilities and experience, waiting to produce the equipment when the Government Authorities initiated action to commence the supply.

The position of lifeboats must be considered in relation to the facilities provided for loading and unloading cargo. In tankers the Ministry had already arranged to provide suitable davits and steel lifeboats clear of the engine room and superstructures.

The provision of facilities for persons to lie down in the horizontal position was made in modern types of lifeboats (see Fig. 23).

The suggestions made by Mr. Day in respect of increasing the equipment of lifeboats by the provision of fishing tackle and bird traps as a means of augmenting the supply of food, are worthy of consideration, provided the distilling apparatus can be utilised for the purpose of cooking the catch.

The author wished to express his appreciation to the members for the interest evinced in this paper and for the many suggestions and criticisms from those who took part in the discussion.

## *"Operation of Diesel Machinery in Cross-Channel Vessels": Discussion.

**Mr. G. R. Train** (Member): The author's figures for lubricating oil and fuel consumption do not appear at all encouraging. The lubricating oil required for 24 hours would be 55·2 gallons and that for fuel 160 gallons per hour, giving a consumption of 0·35lb. per b.h.p.-hr.

Four squills to each cylinder discharging in all 79 drops of lubricating oil per minute would appear very excessive and it is not surprising that lubricating oil is found in the exhaust manifold. The author does not mention the condition of pistons after 1,000 hours running. It is also not clear about cooling chambers requiring decarbonizing after 3,000 hours, nor the oil cooling chamber near injector nozzle.

The writer does not think there is anything to be gained by heating circulating water in jackets a matter of 20° to 30° before starting engines. Consider what takes place on starting the engines. Extreme low temperature of starting air, sudden high firing temperature, and low temperature again of scavenge air. And the author has said that the jacket temperature falls rapidly when leaving port or manœuvring.

The writer, during seven years operation with heavy Diesels, had no cracked covers or liners or pistons. This was achieved by reducing the jacket water pressure until the water was just flowing

** Abstract of a paper by J. W. Coulthard (Member) published in the December, 1942, issue of the* Transactions, *Vol. LIV, Part 11, pp. 149-151.*

through jackets, and increasing the pressure only when engines were fully under way, and on arrival in port allowing jackets to be circulated until cold.

The following was the practice of the writer with a new ship of 4,500 b.h.p., twin-screws, running at 95 r.p.m.

Year 1921. All pistons and valves overhauled after 1,000 hours.
Year 1922. Pistons removed after 1,500 hours for overhaul.
Year 1923. Pistons removed after 3,000 hours for overhaul.

Three thousand hours is about the limit a piston will run continuously; it is then necessary to renew the top rings of the piston, for however careful the fitting of rings a piston will commence to blow after 2,500 hours. The inlet, fuel and exhaust valves were overhauled after 1,500 hours. Air start valves after 1,000 hours.

To get the most life out of valves—in fact of all moving parts of a Diesel engine—a weekly check must be made of all valve clearances, and if the engines are not to be stopped these adjustments should be made when running. It was the writer's practice to sight all valve clearances every day, and in seven years of actual running of Diesels, with often five weeks between ports of call, it was not found necessary to stop the main engines at any time for any defect that could not be put right with the engines running.

The lubricating oil for piston was two squills, one back one front, two drops per minute (piston dia. approx. 29in.).

Compressor lubrication: L.p. two squills, one drop in two minutes;
H.p. one squill, one drop in 1½ to 2 minutes.

Total lub. oil for cylinders: 5 gallons per day, 24 hours.
Lubricating oil for engines: 6 to 7 gallons per 24 hours.

This gave an ample margin of oil in hand for emergency and any loss, and as the dynamo engine lubricating oil sump level was maintained from main engine oil sump, the lubricating oil for all purposes must be considered fairly good.

Lubricating oil for dynamo engines, which were approximately the same bore, stroke and revs. as the author's main engines, but four stroke, consumed by two squills (one back, one front of each cylinder) one drop per minute each. The greatest number of air starts of main engines was 97 in one hour, ordered by and given to Thames Pilot. Fuel consumption was never more than 0·25 to 0·27lb. per i.h.p.-hr.

It would seem from the author's experience that there has been no improvement since 1923 in the running and maintenance of Diesel engines.

In the writer's opinion, until such time as Diesel manufacturers and engineers-in-charge break away from the "500 to 1,000 hour complex", there will be little improvement in performance of Diesel engines.

**The author,** in reply, stated: As the article in question was an abstract of a paper which could not be published in full, owing to the demand on space in the TRANSACTIONS, many details were unavoidably omitted.

Before dealing with the points raised by Mr. Train, it may not be out of place here to reiterate that the main engines under review are twin-screw 12-cylinder trunk-piston, two-cycle Sulzer Diesel engines, 360×600mm., each developing 2,250 b.h.p. at 320 r.p.m., direct drive.

The total lubricating oil consumption of 2·3 gallons per hour, *i.e.* 0·9 and 1·4 gallons for cylinder and crankcase loss, respectively, is quite reasonable for this type of engine. This, as stated, at a fuel consumption of 150 gallons per hour is 1·53 per cent. of the fuel. It has been stated (*P. H. Smith, 1935) that 2 per cent. of the fuel should be possible with two-cycle trunk-piston engines, and he proceeds to outline methods whereby oil consumption can be reduced to this level. Incidentally, the "drops", even at 79 per min., are very small, about ⅛in. in diameter.

Consideration of the factors involved shows that it is unreasonable to expect a two-cycle trunk-piston engine to run on an oil consumption like that of a four-stroke, cross-head engine. The trunk piston is working under conditions approaching boundary lubrication, whilst the other is merely a ring carrier and only requires sufficient oil to lubricate the rings.

The statement in the paper that "Traces of oil were sometimes found in the manifolds", should not be construed to suggest that large pools of oil were found there; actually it was oil smears on the edges of some of the ports.

Mr. Train also suggests that the fuel consumption is high at 0·35lb. per b.h.p.-hr.; incidentally, the figure of 160 gallons per hour was for all purposes. However, taking his figures of 0·25 to 0·27lb. per i.h.p.-hr. for engines in 1923, and assuming a mechanical efficiency of 75 per cent., the corresponding figures are 0·33 and 0·36, so there is little difference in the fuel consumption per b.h.p.-hr. It is well known that the improvement in performance of Diesel engines has not been in the direction of lower fuel consumption. But to say that no progress has been made in running or maintenance since 1923 rather astonishes the author, whose experience dates back earlier than that but was unfortunate, it would seem, inasmuch as the main engines were always of the two-cycle type. In this case it would be ludicrous to compare the modern job with those of earlier days.

In reply to the question about the condition of the pistons after 1,000 hours running, very little carbon is found (none on top); sometimes the top ring is stuck and occasionally one of the rings will have a broken lip at the tongue joint. As replacements become necessary, rings with the ordinary diagonal butt are being fitted in the two top grooves. It was stated in the original paper that the pistons would probably run longer than 1,000 or 1,200 hours. At the same time, it should not be forgotten that two-cycle pistons perform almost twice the work done by four-stroke per hour, yet the latter require overhauling after 3,000 hours.

The practice of overhauling the various parts of these engines at intervals of 1,000 to 1,200 hours originated in peace-time, when this was the annual figure for total hours run. The machinery was surveyed each year.

In reply to the suggestion made by Mr. Train that until we get rid of the "500 and 1,000 hour complex" no improvement can be expected, he will be pleased to know that the generator engines in these vessels run 4,000 hours between piston withdrawals. The original paper read . . . "The third ship had three Allen 4-cylinder S.30B Diesel generators. These are really excellent machines and are most reliable. They have run some 11,000 hours now and replacements have been confined to a few big-ends re-metalled. The air induction and exhaust valves are scheduled to run 800 to 900 hours before cleaning and grinding-in. One engine was deliberately run 1,100 hours before drawing the valves, and then they were ground-in by hand in 30 minutes against 20 minutes in the case of the shorter period".

The cooling chambers, which require decarbonizing every 3,000 hours, are the M.E. piston crown interiors; these are oil-cooled. The fuel injectors have a cooling chamber round the nozzle; oil from the piston cooling supply line is used here.

Mr. Train does not think preheating the cylinder jackets is good practice. Before dealing with this question, the article stated . . . "With a sea-water temperature of 43° to 60° F. the bottoms of the cylinders were liable to cool too rapidly whilst leaving harbour, and to overcome this trouble the two later ships were fitted with, etc. . . . " It is most essential to avoid a quick rise in temperature at the top of the jackets, particularly in engines constructed as these are. The jacket and crank-housing of monobloc construction is cast in sets of three cylinders rigidly bolted together forming a complete assembly 24ft. long×6ft. 8in. high. The circulating water inlet manifold is situated at half height; a difference of 50° F. between the inlet and outlet temperature could be very quickly reached by a reduced flow at sea temperature. The free expansion caused by such a rise in temperature would mean that the top of the cylinder block would increase in length as much as 0·085in.

It is a well-known feature of multi-cylinder engines that they require very little starting air; these are no exception. During trials one receiver of 40 cu. ft. capacity gave 33 starts from cold; three receivers are fitted to meet requirements of the classification society. The engine is often firing in half a revolution, so the cooling effect of starting air can be ignored. Incidentally, the scavenge air temperature is about 90° F.

When these vessels leave port it is quite possible for them to reach a speed of 19 knots within ten minutes of giving the first engine movement. Therefore, careful attention must be given to the circulating water practice. The following method has been most satisfactory. Preheating by generator engine discharge water for a few hours, this water being kept on after leaving port until the engines reach normal running temperature, usually about 30 minutes. At the same time the main circulating water pump is delivering a mixture of cold sea-water and warm returned water. As the inlet temperature rises the flow is gradually accelerated until full pressure is necessary when the discharge is put overboard. When the ship reaches port the generator water is circulated through the M.E., which are not cooled below 85° F., this being done to avoid temperature stresses. The vessel may leave port again in an hour or so, and the passage may last one hour or several hours depending on the particular run. Even if it lasted several days the preparation is just as simple, long journeys having been made without causing any untoward difference in the running of the engines.

In conclusion, it should be stated that whilst this type of plant is particularly suitable for vessels engaged on short voyages, the

**Philip H. Smith, "Diesel Engines: Excessive Lubricating Oil Consumption", Constable.*

possibility of using large numbers of engines like these for high powers cannot be regarded as impracticable. Providing the demand for such plant existed, there are ways and means of arranging maintenance work. The advantage of engines such as these, are light weight and extremely simple design; they are capable of being mass produced, and are quite easily kept in running order.

## ELECTION OF MEMBERS.

List of those elected by the Council at the Meeting held on Monday, 8th February, 1943.

**Members.**

John Eustace Paterson Adam.
John Picton Chittenden.
Coll Campbell Cowley.
Edward Frank Gauntlett.
William Grey.
Alexander Harvey.
John David Heppell.
Johannes Maarten Hillenius, Lieut.-Com'r. (E.), R.N.N.
Joseph Manley, Lt.-Com'r. (E.), R.N.
George Manson.
John Morgan.
John Spours Nicholson.
Thomas Edens Osborne.
Cyril David Pugh.
Fred Sands.
George Emmerson.
Henry Anderson Gardner.
Reginald John Gulliver.
Clifford Herbert Hammond.
John Richardson Hannam.
George Rowell Head.
William Dempster Johnston.
Clinton Jack Hellberg.
William Anderson Leggat.
Raymond John Lewin.
Duncan MacIntyre.
Thomas William Phillips.
William Robertson Simpson.
Francis Southern.
Gerald Valentine Sowter.
Edward Oakley Stephens.
Willem Vinke, Lieut. (E.), R.N.N.
John Charles Walker, Squadron Leader, R.A.F.
Raymond Eric Yates.

**Associate Member.**

John Milburn Emmerson.

**Associates.**

Henry James Alexander.
Frederic Irving Biggins.
David Clark Bowie.
James Templeton Carson Brown, Lieut. (E.), R.N.R.
Daniel Campbell.
Philip James Stewart Coombes.
John Ambrose Cornish-Bowden, Lieut. (E.), R.N.
Ronald Wordley Cameron Gowan Davies.
John Henry Fownes Edmiston.

**Students.**

William Bernard Richardson.
Walter James Course.

**Transfer from Associate Member to Member.**

James Muir Monro.
William John Niven.
W. A. Sycamore.
Robert James Welsh.

**Transfer from Associate to Member.**

George Nelson.

## ADDITIONS TO THE LIBRARY.

### Presented by the Author.

**"Some Types of Propelling Machinery Available to Shipowners".** The Fifteenth Thomas Lowe Gray Lecture by C. C. Pounder.

### Presented by the Publishers.

**The following British Standard Specifications:—**

No. 1,041-1943. Temperature Measurement.
No. 205: Part I: 1943. Glossary of Terms used in Electrical Engineering. Section I. General.

**Theory and Practice of Heat Engines.** By D. A. Wrangham, M.Sc., D.I.C., A.C.G.I. Cambridge University Press. 756 pp., 380 illus., 50s. net.

In the preface of this book, the author asserts that the average effective life of a technical book is about ten years, after which its proper place is the scrap heap. That, together with the altered conditions governing the award of degrees in Engineering at London University, is his reason for adding yet another to the list of books on "Heat Engines". There are, however, a number of books on this subject, of a far riper age than that, but which will continue in useful service for many years yet to come. A new book is written, or should be, for one or both of two reasons; that the author has something new to say, or that he feels able to say something better than it has been said before. In the present case the second of these two reasons does not apply, for there are already many well established books which on such matters as the laws of gases and vapours, thermodynamical principles, cycles of operation, or the steam reciprocating engine, will yield nothing in the matter of thoroughness and lucidity of expression, in comparison with the author's treatment. Indeed, in this respect some criticism might be levelled against the book under review. The author declares that books cannot teach. Be that as it may, they aim to instruct; and they aim all the surer for clearness and precision of language. For example, "the difference in temperature determines the direction in which heat flows from the hot body to the cold body, just as water flows downhill", is not greatly enlightening; nor is "the difference between the actual behaviour of gases and that predicted by the kinetic theory is due to ignoring the vibrational energy of the molecules", which occurs in a paragraph headed "Departure of actual gases from the kinetic theory", an example of the best English; and the definition of adiabatic expansion, on page 51, will leave few students with a feeling of satisfaction. The author takes to task people who speak absurdly of "intensity" of pressure; but people who live in glass houses should not throw stones. Occasionally, as on pages 50 and 75, there is an unnecessary display of algebraical prowess; and the subject of ideal cycles, dealt with in Chapter IV, deserves more than merely to "merit some consideration"!

All this may seem harsh criticism of a book which, after all, certainly deserves to live longer than that allotted span of ten years. The author's later chapters, those on the internal-combustion engine in particular, are excellent. They embody the results of the extensive researches of recent years; the author has, in fact, had something new to say.

The large number of examination examples, to many of which full solutions are provided, will be very useful to students reading for a degree. More specialized works and papers for further reading are indicated in the ample bibliography. The book is well produced—as it should be at the price—and fully illustrated by clear diagrams, many of which are in colour so that "he who runs may read".

**Boiler Plant Technology.** By R. L. Batley and E. G. Barber, B.Sc. Sir Isaac Pitman & Sons, Ltd., 284 pp., 58 illus., 15s. net.

It may not have required the actual consummation of a marriage between an engineer and a chemist to produce this work, but the simile is apt as there has obviously been a remarkably close and fruitful association between the authors. This collaboration has resulted in the production of a well-written instructional treatise on the practical science of obtaining the maximum efficiency from boiler plant and steam generating units.

The book must have a wide appeal to those of us who continue to feel that despite the rapid advancement of the internal-combustion engine, there still remains much to be said for the heat engine which employs steam as its medium. It has long been appreciated by those engineers who have the responsibility of operating steam plant, that it is in the boiler-room that there is often to be found the opportunity of effecting adjustments in operation with regard to the more correct employment of fuel, air and feed water, thereby producing a more efficient transfer of the heat units locked up in the fuel to the steam in the steam pipes. This book is a most helpful contribution to this end and the data and experience contained within its covers should be welcomed by plant-engineers generally.

Whilst laboratory experiments are dealt with, the authors have kept in mind their practical application and though this book is primarily intended to deal with land installations, the volume can confidently be recommended to those marine engineers who have at heart the whole question of efficiency in the boiler-room.

**Fuel Testing.** By G. W. Himus, Ph.D., A.R.C.S., D.I.C. Leonard Hill, Ltd. 2nd edition, 288 pp., 59 illus., 21s. net.

The author of this work deserves every praise for presenting this work at a time when every economy is of vital importance. This book contains more than its title implies, as it not only deals with testing of fuel in its solid, liquid and gaseous forms but many valuable hints are given on the utilization of the fuel in practice and to show how many losses may be avoided by the results of careful analysis of the fuel itself and deductions therefrom.

It is good to see that much more space is given to the selection of samples, as this has been a bugbear for many years. Although the analysis of fuel is a simple matter when in possession of the knowledge of how to carry this out, and providing of course the necessary instruments are available, yet how many times is this sample securing carried out by a very haphazard method (if any)?—frequently it is left to a boy or a labourer to shovel so much coal into a sack. Here we have the absurdity shown how standard tests can be made in repetition, with very close results so far as the testing is concerned, yet the basic material being tested never is a standard thing; thus how can one expect to get anything reliable for comparison unless the samples are standardized as near as possible.

The author uses the term oxidation rather freely and his manner of use of this rather leads one to the idea that oxidation only begins at 105° C. As a matter of fact oxidation occurs at all temperatures, though only slightly at the lower temperatures, the absorption of oxygen gradually accelerating the higher the scale of the heat.

A regrettable omission on the part of the author is his failure to mention the division of coal into Fusain—Clarain—Durain—Vitrain. This may have had an effect on the author's idea that all the impurities are in the small coal. Also nothing is mentioned about the blending of coals from which many advantages have accrued.

There remains one further point so far as coal for use by marine engineers is concerned. This is not just shovelled out of the stock as one may be led to believe. Many thousands of vessels have to have their bunkers ready waiting the moment they require them and the reviewer, from the experience of handling millions of tons of bunker coal, can express the assurance that if shipowners place their confidence in a firm of repute, their bunkers, whether 50 or 10,000 tons, and whether shipped in Jericho or Timbuctoo, will be there ready, together with both proximate and ultimate analyses of the particular cargo if so desired. The author summarizes the matter on page 242 when he says: "The final court of appeal must be trial under working conditions in the plant in which it is proposed to use the coal".

**Fundamentals of Vibration Study.** By R. G. Manley. Chapman & Hall, Ltd. 128 pp., 52 illus., 13s. 6d. net.

During recent years there has been published a considerable number of books relating to vibration, but in general these have either wandered rather in a sketchy manner over the whole field of vibration problems or have dealt thoroughly, though often too mathematically, with one particular type of problem. Though many of these books are excellent, none quite meets the need of the student who wishes to get a sound grasp of the first principles of this subject, from which he can tackle with confidence any type of problem that he may meet. Such a volume was needed to fill the increasing demand for engineers conversant with this subject, and Mr. Manley in the work under review has gone far towards meeting this need.

In his preface the author says that no mathematics beyond matriculation standard is required by the reader. It is true that most vibration problems can be solved without higher mathematics, but to follow this work with reasonable ease, mathematics considerably beyond matriculation standard are required. In this one respect only Mr. Manley has failed to make his book of the maximum possible value to students. He is obviously himself very well equipped with mathematics and has not fully realized that his book may be studied by many not so well equipped. In many cases where he gives only mathematical explanations he might well have added verbal explanations, so that the student could form a picture of the facts represented by the mathematics. In particular, an introductory chapter illustrating and verbally describing the principle phenomena and types of vibration would have been most helpful.

This fault will make it rather difficult for many students to follow the author's work unless his book is read in conjunction with a series of lectures. Except for this fault, Mr. Manley has treated his subject perfectly. Studies are methodically arranged, dealing first with simpler types of free vibration, then with damping and forced vibration of such simple systems, and finally with progressively more complex types of problem. Some more advanced mathematics and a method of solution by "frequency equations", which will be helpful to the student in dealing with more difficult problems, are covered in three appendices. Throughout the volume practical examples are used to illustrate the various problems, and each chapter has a number of exercises for the student. A list of symbols used is given; this is a most valuable feature often omitted from text books.

In general, this is one of the most valuable text books published recently, but its value would be greatly increased if, when the next edition is published, more verbal explanation of the various problems is given together with additional illustrative diagrams.

**The Theory and Practice of Heat Engines.** By R. H. Grundy, Ph.D., M.Eng. Longmans, Green & Co., Ltd. 723 pp., copiously illus., 18s. net.

This book is written to cover a three-years course at a university or technical college and the author states that this is very difficult to confine within the covers of one volume. There is evidence of this difficulty and as the book is in two parts, it might be more suitable for its purpose if it were in two volumes.

The proofs of some of the fundamental equations would be much easier for the student to follow if given more room, and the vertical line for division in an algebraic expression saves space only at the expense of clearness. Section II describes many practical applications but still omits or describes too briefly some principles of major importance. In particular we would mention that no reference is made to oil fuel burning, and there is only a short reference to refrigeration in Part I.

Marine engineers might object to some details in the diagrammatic arrangement of a marine reciprocating steam plant on pages 536 and 580. The dual air pump has been practically superseded by later improvements and in any case it would be an unnecessary fitting for a reciprocating engine where the vacuum should not exceed 26in. The air discharge should not be drowned in the water in the feed tank. Forced draught is more typical, and if the temperature of the water from a contact heater were only 145° F. it would not be necessary to fit the heater on the top platform.

There is much in the book to commend it. It is well written, well illustrated with many excellent diagrams, sketches and complete drawings. There is a good set of examples in the exercises at the end of each chapter in Part I and the book should prove a valuable addition to a student's library.

## NOMINATION OF MEMBERS AND STUDENTS OF PROFESSIONAL INSTITUTIONS FOR SERVICE IN THE CORPS OF ROYAL ENGINEERS.

It is still desired to obtain particulars of members and students of Professional Institutions who are not already serving and are desirous of consideration for employment in commissioned rank or otherwise in the Corps of Royal Engineers.

The following information should be sent by interested members of any grade to the Secretary for transmission to the War Office:—

(1) Date of Birth.

(2) Private Address.

(3) Occupational Classification Number (Not Industry letters).

(4) (*a*) Registration Number under the National Service (Armed Forces) Acts.
(*b*) Date and place of Registration under these Acts.
(*c*) Medical Category if examined under these Acts.

(5) If release from present employment could be obtained.

(6) Has a deferment been granted, and if so the date it ceases.

(7) Particulars of any former military or O.T.C. experience.

On completion of the necessary application forms, suitable candidates under 25 years of age are likely to be offered the opportunity of Special Enlistment (see 3 below) and those over 25 years of age would have an interview arranged for them with a War Office Selection Board in order to ascertain under which category they could most suitably be employed. Age, qualifications and experience determine whether a candidate may be recommended for one of the following:—

(1) An Immediate Emergency Commission through the Army Officers' Emergency Reserve.

(2) Direct entry into an R.E. Officer Cadet Training Unit, after Pre-O.C.T.U. training.

(3) Special Enlistment as a Pioneer Student, *i.e.* General Service Corps training followed by four months Corps training in an R.E. Training Battn., and then consideration for Pre-O.C.T.U. and O.C.T.U. training.

(4) Civilian appointment if over the military age limit or if of low medical category.

It is emphasised that every candidate receives individual consideration, and it should be noted by those appearing before a War Office Selection Board that their papers are sent to the War Office for confirmation.

At present vacancies exist in practically all R.E. Units for those possessing the necessary technical qualifications and experience, including those with experience in Transportation (Railway Construction, Locomotive Operating, Dock Operating, Marine Engineering).

Should any member or student receive a calling-up notice under the National Service (Armed Forces) Act, he should immediately inform The War Office, A.G.7(L), Hobart House, London, S.W.1, of such notice, giving National Registration No. and the date and place of reporting for duty. On receipt of such information, the question of transfer from the General Service Corps to R.E. may then be taken up with a view to subsequent consideration for commissioned rank.