TRAWLER ENGINEERING

BY

COMMANDER K. B. CLARKE, R.N.

Fishing vessels of the United Kingdom and their crews have, in past wars, contributed in no small measure to the naval effort. Some vessels have been taken up and converted into A/S and M/S units and others have performed a wide variety of functions for the Royal Navy. Their personnel, in the form of the Royal Naval Reserve Patrol Service has been a valuable and experienced 2nd XI. Most of us are familiar with the Brixham drifter and the old coal burning trawler, but since the war there has been a revolution in trawler construction which has been going ahead on an extensive scale. The new ships bear little resemblance to their predecessors.

TYPE OF FISHING VESSELS

Before embarking on technical details, it is well to classify the existing vessels and indicate their functions. Fishing vessels are now built to operate from a particular port whose traditions and proximity to lucrative fishing grounds or markets determine the design. While a definite pattern of new construction is apparent, there is by no means a standard form of trawler for each class.

The broad subdivisions are :—

(*a*) *Distant water vessels:* 180 ft length, 14 knots : based on Hull, Grimsby and Fleetwood : fishing the grounds of Iceland, Barents Sea, Bear Island. Extensive building programme carried out since the war.

(*b*) *Middle water vessels :* 130 ft–140 ft length, 11 knots : based on Grimsby, Fleetwood, Aberdeen and Milford Haven : fishing grounds of Iceland, Faroes, North Sea. Active construction programme.

(*c*) *Near water vessels :* 100 ft–120 ft length, 10 knots : based on Aberdeen, Grimsby, Fleetwood, Leith, Lowestoft and Milford Haven : fishing grounds of North Sea, S. and N.W. Eire. Majority of vessels 34 years old. Limited construction programme.

(*d*) *Drifter/Trawlers :* 90 ft length, 9 knots : based on Lowestoft. Herring fishing, North Sea trawling. New design replacing steam drifter.

(*e*) *M.F.V. type :* 50 ft–80 ft length, 9 knots : based on N.E. Scottish ports. Vigorous reconstruction programme.

(*f*) *Inshore vessels :* 50 ft length : distributed round U.K. coasts. Diminishing in number particularly in England and Wales.

The types of vessels which have come into service since the war, in the distant and middle water classes, are shown in FIGS. 1 and 2. It can be seen that the middle water type is really a replica of the distant water type. This is also true of the new construction near water trawler.

Construction and General Features

The new vessels in the first four categories are all of steel riveted construction with part-welded superstructures. The extensive superstructures abaft the bridge is a new feature, designed to ensure adequate standards of accommo-

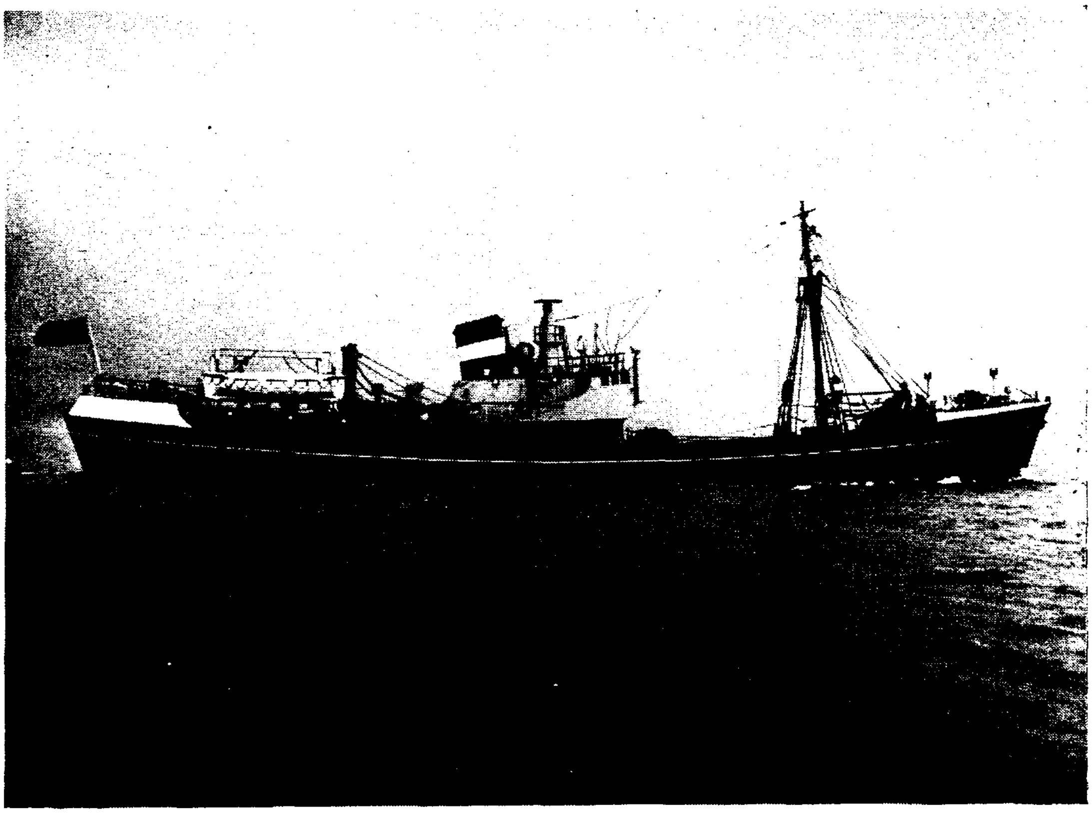

FIG. 1

dation for the crew. The distant water vessels carry a crew of 20 ; the middle water 15. The forecastle head, which in older vessels housed the crew, now accommodates stores, nets, etc., and below the well deck, forward of the bridge, is the fish hold.

Navigational equipment is fitted on an extensive scale in all the new trawlers, Decca navigator, radar, W/T, D/F, echo sounders, etc., and much of this new equipment has also been fitted to the pre-war trawlers.

Propulsion

If there is a lack of standardization in the constructional features of the new vessels, there is an even wider diversity in the methods of propulsion. Much depends on the whims of the individual owner, what firm builds his trawler and in what part of the country. However, certain trends are evident, applying to the principal classes listed above.

General Considerations

Trawlers must have good seakeeping qualities and substantial reliability even at the expense of fuel economy. The endurance must be sufficient to cover the fishing grounds for which the vessel as a whole is designed, yet have a sufficient margin in case fishing grounds further afield have to be worked in the future.

The special requirements for trawler propulsion are similar to those demanded of a tug. The vessel has to steam at its best speed to the fishing ground. There follow periods of intricate manœuvring while the trawl is being manipulated ; a series of heavy tows at low speeds and a quick return to the markets with, it is hoped, the fish room full. This demands, in particular, a well protected screw, the characteristics of which must fulfil the conditions of towing at low speeds and, at the same time, achieve a high maximum speed.

The power requirements of the trawler winch are substantial (10 per cent of the ahead propulsion power) and other auxiliary loads are large with the advent of electronics, refrigeration and improved crew conditions. These factors weigh clearly in the choice of prime-mover, although the obvious requirement for propulsion is a slow running, direct coupled, direct reversing engine which is supremely reliable. Space is not at a premium, although it is desirable for the main engine to provide the power required for auxiliary purposes.

PROPULSION

Distant Water Trawler

The established trend for this class of vessel is an oil-fired Scotch boiler supplying steam at 220 lb/sq in, through a simple superheater in the uptakes, to a triple expansion reciprocating steam engine of about 1,250 s.h.p. operating at 130 r.p.m. Steam is supplied direct to the trawl winch, auxiliary power unit refrigerating compressors, liver boilers, etc. In some cases an exhaust pressure turbine is incorporated, coupled to the propeller shaft and disconnected when manœuvring.

This method of propulsion will seem fantastic by modern naval standards. There are, however, very strong reasons, some of which are listed below, for the trawler owner's preference for this simple, reliable and robust system.

(*a*) Water-tube boilers associated with geared steam turbines or poppet-valved double-compounded engines, apart from their higher initial cost, demand a higher standard of operating personnel.

(*b*) The fishing industry is by tradition very familiar with this type of engine, with its manœuvrability, suitable propeller revolutions and ease of maintenance, bearing in mind that these vessels operate at 80-85 per cent availability throughout the year.

(*c*) The net earnings of this class of vessels can be of the order of £60,000 per year, so that fuel economy gets secondary consideration.

For these last reasons Diesels are not in favour and there are other factors which influence the choice :—

(1) The problems of the large trawl winch. It is widely held that a steam winch is more flexible and has a better feel than an electric winch.

(2) Personnel, and uncertainties of the long term maintenance cost.

(3) Supply of steam and hot water for de-icing under arctic conditions and for cod liver boiling.

(4) Lastly, but by no means least, steam keeps the ship warm.

However, it is within the bounds of possibility that the future may see a big step forward with the introduction of a free piston engine associated with a gas turbine.

Middle Water Trawler

The construction of the middle water trawler has been stimulated by a government subsidy which operates for vessels below 140 ft in length. This class, being less profitable fish catchers than the distant water class, enters the serious battle of steam versus Diesel.

There is, in fact, a definite leaning towards the Diesel, although one major fishing port has kept to steam of the familiar pattern in a new construction vessel and high net profits are claimed. It is thought that this trend will be the exception rather than the rule, and is prejudiced by a long standing tradition

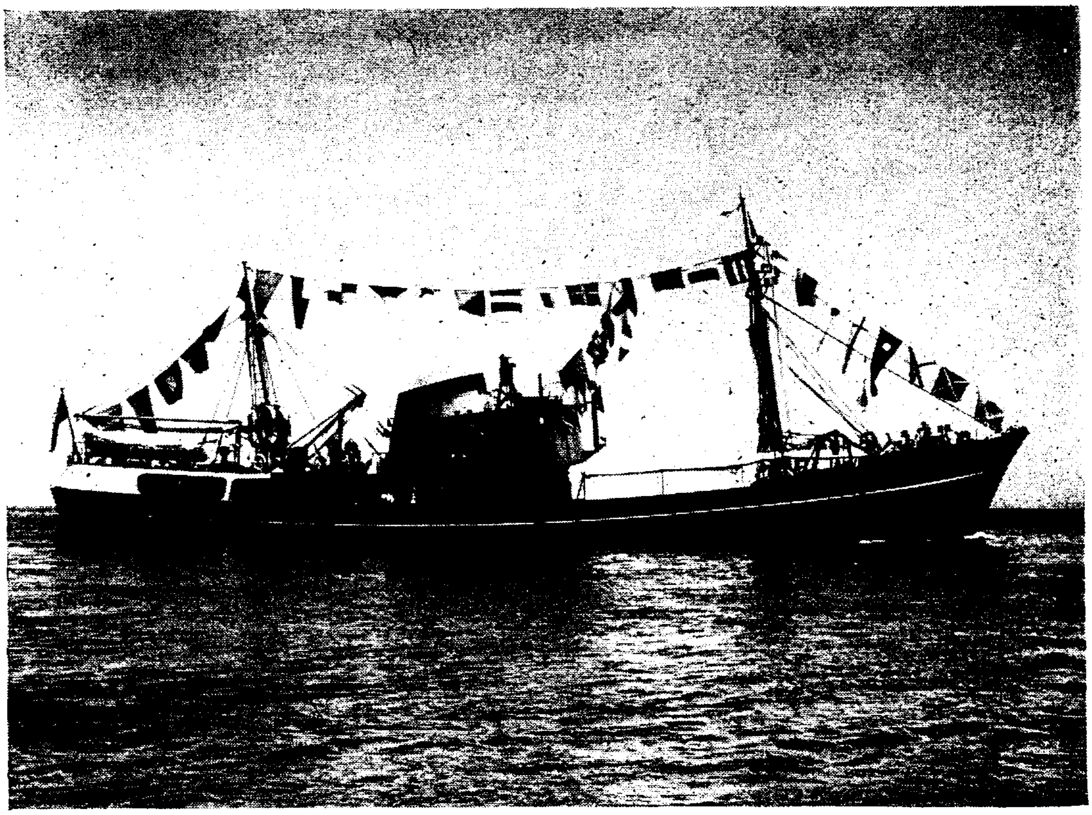

FIG. 2

of steam at the port concerned. There is also an uncertainty of availability o Diesel trained engineers in this particular area. Time will be necessary tc assess the overall economics of this particular vessel. The cost of Diesel pro pulsive and auxiliary systems causes a 10 per cent increase in the initial cos of the vessel (£100,000). The unknown is the long term maintenance anc replacement cost : much depends, here, on the intake of adequately trainec Diesel engineers into the industry.

Having decided to embark on Diesel powering, a multiplicity of methods oi applying the prime-mover to the shaft is available and trawler owners have the greatest difficulty in making up their minds. Taking into consideration the large demands for auxiliary power and the requirement for low shaft revolutions, the ultimate and most satisfactory method is to employ a Diesel-electric drive. This has been tried out by German trawler builders, and, although approached with trepidation by British trawler owners because of the high initial cost, has been fitted in a British fishery research middle water vessel.

This installation consists of four 200 h.p. high speed Diesel D.C. generators for the main propulsion motor, separately excited by motor generators. A further two 200 h.p. Diesel generator sets supply auxiliary power. These cannot be used to augment the propulsive power, but two of the propulsion generators can assist with the auxiliary load. Bridge controls are normally used for manœuvring and accurate speed regulation is attained. Certain difficulties have, however, arisen with noise and ventilation of the engine room.

Perhaps the simplest approach to a Diesel drive for trawlers is a direct coupled, direct reversing slow turning oil engine of the opposed two-cycle type. This has difficulties in application for the limited size of vessel, owing to the headroom required. Many Diesel engines on the market turn too fast to suit the propeller requirements and the following familiar choices have to be made.

(1) Direct reversing type engine with reduction gearing
(2) Non-reversing engine with reduction gearing and reverse clutch
(3) Controllable pitch propeller.

The most common unit at the moment appears to be an 800 h.p. non-reversing engine with oil-operated reduction reverse gearing giving a maximum speed of 11 knots. Controllable pitch propellers are not in favour, because of the danger from the trawl wires. Separate Diesel generators supply power for the trawl winch, further auxiliary generators supply power for use at sea or in harbour and some are fitted with belt drive generators from the main engine. Auxiliary steam boilers complete the *mélange*.

The advantages of Diesel-electric drive in avoiding auxiliary complication are clearly seen, but further alternatives are open :—

(1) To employ a belt drive from the engine direct to the winch. This is popular but restricts ease of manœuvre.
(2) To couple a D.C. generator to the main engine through an hydraulic coupling at the forward end.
(3) To incorporate an hydraulic pump arrangement on the forward end of the engine, driving a motor at the winch.

Near Water Trawlers

The need for economic power production is much more evident in the near water trawler, whose radius of action is restricted to the less lucrative fishing grounds. It is certain that replacements to this class will be in the Diesel field, although one owner has stuck to oil-fired steam as he is convinced that atomic propulsion for trawlers is not far away ! The limited number of vessels built and under construction to replace the declining coal burners, are in general powered with 600 h.p. 4-cycle engines with the usual auxiliaries, except that a form of belt drive to the trawl winch is considered to be all that is required.

Drifter/Trawler and M.F.V.s

New vessels in these classes are entirely equipped with Diesel engines varying in size from 230 h.p. to 60 h.p., with belt drives to the various forms of winch.

PERSONNEL

The distant water trawler carries an engine room crew of 5 ; a Chief Engineer, 2nd Engineer, 3 firemen. The middle water Diesel powered ship, in general, carries a Chief Engineer, 2nd Engineer and two greasers. Down the scale one has the familiar 75 ft M.F.V. whose engine room crew consists of a deckie who is told off as a ' stopper and starter '.

In the larger vessels it is customary to keep 6-hour watches, watch and watch, throughout the 14-day trip. Bearing in mind that these ships are at sea 80–85 per cent of the year, with forty-eight hours between each trip, and with perhaps a fortnightly refit each year, it is an arduous life for the engine-room staff. Their machinery spaces would, however, grace an Admiral's inspection at any time.

There is no apprenticeship scheme or M.O.T. certificate for the Chief or 2nd Engineer ; they have to satisfy the local insurance company that they are competent to do the job, qualifying by an elementary examination. Nevertheless, the Chief, by experience is a competent individual, and carries out running repairs normally within the scope of a senior E.R.A. in the Service. One Chief

Engineer of a long distance trawler was a warrant engineer, R.N.R., serving as a W/K officer in H.M.S. *Cleopatra* at the end of the war.

The intake of trained Diesel engineers into the industry is causing concern at the moment ; there are few, if any, training schemes within the industry and only limited assistance available from the local education authorities. The usual procedure for converting a steam engineer to Diesel is to send him to the engine makers to watch the engine for his particular ship being built. In one port, an all out effort in co-operation with the engine makers was made to hold a training course.

The main factor in the lack of recruits appears to be that, by the I.L.O. convention of 1935, an article was included in the Merchant Shipping Act to the effect that a man may not serve in the engine room below the age of 18. A fisherman at the age of 17½ can gain exemption from National Service, on condition that he has been 6 months in the trade, and joins the R.N.R. Patrol Service for two periods of five years, during which he does 14 days training a year with the Royal Navy. Consequently, the engineer is a person who has either done his National Service and drifted into the industry, or who is a deckie and decides to go below.

There are further deterrents to joining as an engineman for, in addition to a flat rate of pay, the crew receive a share of the profits of the catch. The deckie receives a proportionate share of the gross takings, whereas the enginemen receive a proportionate share of the net takings, presumably to encourage him to economize on fuel. In some ports, a share of the cod liver oil money is denied the Chief, even though he supplies the steam to boil the livers. Furthermore the avenue to becoming the Skipper of a successful vessel is, perhaps, more attractive to the recruit, who may have realizable dreams of being well within the surtax class in his early thirties, as opposed to being just under in his fifties if he becomes a Chief.

The result of these factors, to the Service, is that the number of mechanics (E) in the Patrol Service is ,low some 383 out of a total number of 4,000 enginemen employed in the fishing industry. The number of seamen meets the requirements. The mechanics (E) at present do their training in the Service either in Diesel or steam—depending on what type of ship they are serving in. Diesel training is carried out at H.M.S. *Lochinvar* and steam training in H.M.S. *Teazer*.

SUMMARY

There are many interesting analogies between the problems of powering trawlers and the small ships now entering the Service. The new C.M.S. is not unlike a trawler ; similar navigational equipment ; sweep or trawl wires ; pulse generator or trawl winch generator and heavy auxiliary loads. Disparity in power ratings and weight and space requirements do not allow this analogy to be drawn too far in the case of the main engine units. The engineering personnel problem in the fishing industry is unique, and is outside the standards maintained in the Merchant Navy.