

# STEAM MANUAL 1879—ENGINEERING MANUAL 1950

BY

COMMANDER (E) P. CHARIG, R.N.

The completion of a new B.R. 16—Engineering Manual 1950—and its issue in a new more modern form seems an appropriate time to look back to the first official Manual, the Steam Manual of 1879, and its successors.

The size and shape of the book has changed little over the period of years but the contents have altered considerably, and increased as new machines have been introduced.

A perusal of these Manuals is to a large extent a review of the introduction of machinery into the Navy and its progress.

## **The Contents of the Manual**

The Steam Manual of 1879 contained only 82 pages of printed matter to which was added 56 blank pages for the insertion of information now put in the Engineer Officers Note Book.

This policy continued in the 1888, 1893 and 1901 editions, though in the 1893, the blank pages were replaced by a printed questionnaire. This questionnaire included some information which later went into the Certificate of Acquaintance and is now discontinued.

By the 1917 Steam Manual, the Engineer Officers Note Book had been instituted and the Manual was similar in form to the later Engineering Manuals.

It is noticeable in the earlier Manuals that a large proportion of the space was devoted to the condition of machinery in the various states of reserve, steam trials of ships and stores. Torpedo Boat Destroyers and Torpedo Boats had a special chapter. By the 1910 edition the section on machinery in state of reserve had disappeared, that on stores was much reduced and the contents of the Manual were beginning to look more like the present day book.

## **Amendments to the Manuals**

Manuals were first amended by “Circulars” to be affixed to the blank pages at the end of the book, with a note at the appropriate place in the book.

By the 1910 issue, however, copies of all Circular Letters, Admiralty Weekly Orders, Store Memoranda had to be inserted in a Guard Book D475B and a note made in the Steam Manual of each one.

It was not until the 1923 issue that Admiralty Fleet Orders consolidated the amendments to the Manual.

## **The Duties of the Engineer Officer**

It is noticeable that Engineer Officers in the early days were required to give visible, and on occasions oral, proof of their knowledge of the machinery of ships to which they were appointed. Up to and including the 1910 Manual, “the Engineer Officer, Second Engineer Officer and such other Officers as the Admiralty may direct” were examined “touching their acquaintance with the details of the ship.” In the early days this was done by a board presided over by the Captain of the Steam Reserve, an Executive Officer, later by the Rear Admiral. A certificate had to be obtained and sketches produced.

The early Manuals show that the Engineer Officer was responsible, with the Carpenter, for the condition of the hull, for gun carriages, torpedoes and torpedo tubes. It is not until the 1910 Manual that the Gunnery Lieutenant and Torpedo Lieutenant are shown as responsible for the gunnery and torpedo equipment.

The Engineer Officer's responsibility for the personnel of his Department is mentioned in only the widest terms until the 1917 issue though it is interesting to note from the 1888 book that "one of the Engineer Officers, as the Captain may direct, will devote one or two hours in the course of each week to the instruction of all the subordinate officers of the Military Branch, and of such of the Commissioned Officers of the same Branch as may desire to avail themselves thereof, in the different parts of the Engines and Boilers, and in the practical working of the Machinery, and he will from time to time report the progress made by these officers in this important branch of knowledge to the Captain, keeping a progress book for the purpose as required by the Admiralty Instructions."

## HISTORY THROUGH THE MANUALS

We may trace through the Manual the more important stages of progress in the introduction of machinery into the Navy. Some of these will be found in the Random Regulations in this article.

### Boilers

Thus in the 1901 issue, we find for the first time regulations for the operation of water tube boilers. It will be remembered that the introduction of the water tube boiler was the subject of much controversy and that it was said (by the E.-in-C., United States Navy) that "there are as many to choose from as fleas on a dog." This is shown in the Admiralty Circular Letter No. 121 of the 12th October, 1906—Instructions for the Management of Water Tube Boilers of the Large Tube Type in which special instructions for the Belleville, Babcock & Wilcox, Niclausse, Dürr and Yarrow boilers are included.

By the 1910 issue, the boiler instructions are in the text and no special types of water tube boilers are mentioned though they are still in use.

The 1917 issue revives the 1906 instructions as an appendix. Feed water treatment is first dealt with at some length in this edition and tests instituted which take us up to the introduction of salinometers and the present system.

Steam soot blowers are mentioned now but are only to be used in emergency and during war-time.

### Oil Fuel Burning

Instructions for Guidance in Working Oil Fuel Installations were first issued as an amendment to the 1906 Manual in a Confidential Store Memorandum N.S. Coal 35/1892 of 1908. This includes special orders for ships burning oil only and for those fitted to burn both. It was reproduced the next year as form S.359.

A further N.S. Coal Memorandum issued in 1910 provided a later guide for instruction in the burning of Oil Fuel. This was an amendment to the 1910 edition.

These instructions were revised in 1917 and inserted as an appendix to the Manual of that date.

An interesting article (No. 588) in this edition describes a method for supplying Oil Fuel to burners through the filling system when the tanks

originally in use became contaminated through leakage of sea water through the hull. The acceptance of the risk of using 80 lb pressure in a system of a working pressure of 40 lb in an emergency is made.

By the 1923 edition, instructions for working oil fuel installations are in the text and for the first time space is devoted to the fuel itself.

### **Turbine Machinery**

The story of the *Turbinia* and the ordering by the Admiralty in 1899 of H.M.S. *Viper* with turbine engines will be well known to many readers.

It was in an Admiralty Circular Letter of 4th March, 1907, that the Memorandum of Instructions for Turbine Machinery was issued. These instructions with diagrams in colour give comprehensive guidance for the operation and adjustment of the turbine machinery fitted.

In the 1910 edition, these instructions were incorporated in the text though there were a number of amendments before the 1917 book. In this latter issue, we find the instructions as an appendix in the same way as for boilers. We now find Brown-Curtis turbines mentioned, and the Michell type thrust block is starting to replace the multi-collar type. A short section is devoted to gearing.

It is interesting to read in the 1923 issue that attention is drawn to *Paper on Engineering Subjects* No. 1 for a description of how an oil film is created in a Michell Thrust Block. This arose from a failure, the circumstances of which are explained in this Manual.

The examination of machinery, including turbines, has to be carried out after 20,000 miles steaming and the details are laid down. This was started in 1901.

### **Auxiliary Machinery**

Distilling Apparatus is mentioned in the 1879 issue of the Steam Manual but it is not until the 1906 edition that we read of refrigerating machinery and the internal combustion engine.

Refrigerating machines were either  $\text{NH}_3$  or  $\text{CO}_2$  with brine as the cooling medium and the instructions in 1906 appear to vary little from those in force many years later. In fact, the main difference in the machines over a long period appears to be the substitution of the electric motor for the steam engine as a prime mover.

Internal combustion engines have only small mention in the 1906 and 1910 editions though the latter contains the first mention of the Diesel or Oil engine. In the 1917 issue, however, they are dealt with at more length and divided into three classes, the Diesel type, the Semi-Diesel type and the Motor type.

Electric Light engines are first mentioned in the 1888 edition and in those days the Engineer Officer was responsible for the dynamo.

The 1917 issue mentions several novelties such as submersible pumps (familiar to the writer at General Drills), Oxy-acetylene cutting and welding, the main drain or suction pipe.

In 1923 we read of catapults, C.S.A. Smoke Making apparatus and turbine driven auxiliary machinery, oxygen and E.A. plants, laundry machinery, aircraft carriers, aircraft cranes, central storekeeping. The Carpenter has become the Shipwright Officer. Flooding boards are mentioned. The machinery has begun to get varied and more complicated.

### **Torpedo Boats and Torpedo Boat Destroyers**

It is something of a shock to read in the 1879 edition that the hulls of torpedo boats were only  $\frac{1}{16}$  inch thick.

This class of ship had its own section of the Manual then and until the 1923 Engineering Manual.

Officers and ratings were to be specially qualified and special regulations for the operation of machinery were made.

### **Trials**

The early Manuals laid down most comprehensive trials and elaborate records were kept.

An interesting feature of the 1888 issue is the "General Regulations for economical working under special conditions" by Admiral Ryder's method. This is set out at length and takes into account wind, current, state of bottom and gives a mathematical calculation to find the economical speed. This method is not included in the 1893 issue.

High speed trials were carried out quarterly and for 24 hours at  $3/5$  power, including four hours at full power. This must have been a good trial for machinery and personnel.

## **RANDOM REGULATIONS FROM THE OLD MANUALS**

Some of the articles, which are quoted below, from the old Manuals may cause us to smile, but it is as well to remember that they were prompted by experience at the time. The date of the Manual concerned has been put in brackets.

**Superheaters** (1879). In unarmoured ships, the superheaters, if the boilers are so fitted, are always to be disconnected before entering into action.

**Hydraulic Jacks** (1879). Fresh water is to be used in Hydraulic Jacks on ordinary occasions and when it is probable that the temperature will be sufficiently cold to freeze water, spirit (rum) in the proportion of one of spirit to two of water is to be mixed with the water in the Jacks.

**Full Power Trials** (1879). Full Power Trials of ships at the Maplin Sands should, as far as circumstances will permit, be made on the flood tide, to obviate, as much as possible, the priming, which is supposed to be caused by the muddiness of the water arising from the outflow of sewage from the Thames. On all such trials the boilers should be filled at first with clean water.

**Funnel Hoisting Gear.** When funnel hoisting gear is fitted, it is to be worked at least once a quarter and the funnel, if up, is to be lowered at least half its length and, if down, to be lifted to fully half its full length.

On no account are funnels to be left hanging on their chains.

**Propeller Feathering** (1888). In ships fitted with appliances for feathering the blades of the propeller, the gear is to be worked to the full extent of its range not less often than once a week, and mineral oil is to be used for its lubrication.

In ships fitted with a propeller lifting apparatus, this is to be frequently examined and kept in good order ready for immediate use if required.

**Special Measured Mile Trial** (1888). The steam cornet is to be carried at the main truck, or on a pole if no masts are on board, as a signal to all vessels to keep clear of the course, and every precaution is to be taken to avoid accidents.

**Distilling** (1888). He (the Engineer Officer) is at all times to pay particular attention to the distilling condensers to see that they are in proper condition, that the tubes are clean, and that the means for circulating the water are

efficient, so that the maximum of water may be produced ; he will also occasionally test the water distilled to see that it is in a pure state and free from salt.

**Indicator Diagrams** (1888). When under steam, Indicator Diagrams are to be taken at least daily, or oftener if any material variation in the power occurs ; and, at the same time, the sail set, the power of the wind, its direction relative to the ship and the state of the sea are to be registered, so that correct average results, both when under steam only, and when under steam and sail combined, may be ascertained.

**Boilers as Feedwater Tanks** (1888). Boilers are not to be used as tanks to contain fresh water for the use of the Ship's company, and they should be used as little as possible for the purpose of trimming the ship when under sail, as these practices tend to keep the Boilers in a damp state, and conduce to their decay.

**Precautions against Fire** (1893). Particular attention is to be paid to the proper clothing of boilers and its security from ignition, observing that boiler clothing, or any combustible material, must not be placed near funnels or uptakes.

### CONCLUSION

This article does not pretend to cover fully all the developments in Naval Engineering but is an attempt to illustrate some of the progress through the medium of the Steam and Engineering Manuals.

The growth of Naval Engineering has been little publicized and its history neglected. It may well be readers can correct some facts or fill in gaps. The Editor of the *Journal* would welcome such corrections or additions.