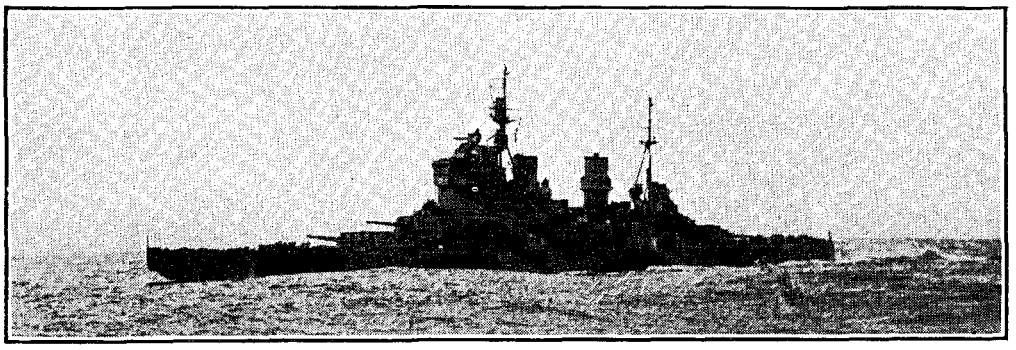

LETTERS OF MACHINERY INTEREST

(A.F.O. 1581/45)

The following are extracts from letters prepared in accordance with A.F.O. 1581/45 *by the Engineer Officers of H.M. Ships " Anson " and " Duke of York " together with the remarks by the Engineer-in-Chief's Department.*

PART I

Duke of York's letter No. 1424/200 I.E. dated 12th April, 1946, together with Engineer-in-Chief's remarks dated 15th November, 1946.

AUXILIARY MACHINERY

Evaporator brine ejectors

The RNB nozzles fitted to the brine ejectors of the evaporators lose a considerable amount of their efficiency after 2 months in use, due to erosion of the inner edge of the nozzle. Replacements have been tried made of Monel, and the renewed nozzles shew no signs of erosion after 6 months in use. It is suggested that replacements should be made in Monel and that this metal be made standard for future plants.

Remarks

The proposal to make the nozzles in Monel metal is concurred in and is also being taken up with the manufacturers.

Use of starch in evaporators

Prolonged attempts to get improved results with the use of starch have been unavailing, due to the purity of made water when using starch exceeding 0·05 grains of chlorine/gallon which is not acceptable for feed water. (Although it is realised that feed water can be used up to ·2 salinity, this practice necessitates frequent blowing down of boilers and therefore a demand for further made water.)

Conditions of operation of the evaporators (Weir's) in this ship are :—

Shell	...	17 in. vac.
Coil	...	5 in. vac. to 20 lb./ins.^{2} (when coils need descaling)
Density	...	25°

Under these conditions the output is about $5\frac{1}{2}$ tons/hr.

Evaporators are blown down daily ; and flooded with fresh water and allowed to soak whenever opportunity permits. They are usually run to about 1,500 hours before recoiling.

Remarks

The remarks are noted with interest, but the purity of water obtained in *Duke of York* is exceptionally good and approaches the design conditions for future construction.

It has been generally agreed that the starch equipment is satisfactory, provided the injection of the starch is arranged at an even rate throughout the whole of the running period. Another point in question is that the quantity of U.S. boiler compound is too high in comparison with the amount of starch used, and it has been found from experience that half the approved quantity of compound gives the best results. Furthermore, it is suggested that blowing-down once a week with the above method of operation, the coils have been used for two thousand to three thousand hours continuously, without changing.

Other methods of operation are being tried in *Implacable* and *Theseus* where it has been arranged to insert a restriction into the steam inlet to the coils. The restriction ring is placed on the coil side of the steam valve to coils, and it is expected that this, with the valve full open, will allow a constant flow of steam at all times, and improve the operating efficiency of the plant.

The tendency now is to encourage operators to reduce the density of the brine to 20° and even to 17°, using the maximum vacuum, say, 15 in., in the shell. Throughout these trials starch is not being used, and *Theseus* has reported that the distilling plant has operated for two thousand hours without changing the coils, and the output is 4·5 tons per hour for the two shells working in single effect, which is approximately 80% of the normal specified output.

If operating the distilling plant under the conditions mentioned, *i.e.*, with high vacuum, low density, and it is hoped with little or no scale, it is most important to keep the working parts of the brine pump in good condition.

Space for extra evaporators

It is generally recognised that extra evaporating capacity is required in this class of ship. Space available for its installation is not easy to find.

Evaporators can however be arranged in the following spaces :—

(i) Each Diesel room—a destroyer set of capacity $1\frac{1}{4}$ tons/hr. Headroom is considerable here.

(ii) If a suitable horizontal type were designed, space exists lower deck workshops, or in the spare armature stores port and starboard (162-184), stowage being found elsewhere for spare armatures.

Headroom here is very limited, being about 6 ft. only. A vapour compression type either steam or Diesel driven (by the well tried Gardner) would be economical. Difficulty might be experienced in finding an alternative site for the lower workshops. Lagging and ventilation would have to receive careful consideration.

(iii) The ship has 3 (originally 4) in No. H.P. air compressors, and now that aircraft are not carried, these appear to be sufficient for all purposes even when one is out of action. The space left is enough for one extra evaporator as (ii) above. Extra evaporators of combined capacity of about 5-6 tons/hr. would go far to alleviate the existing inadequacy of evaporators and it should be found practicable to find suitable positions for such plant. Additional watch-keepers would in most cases be required.

Remarks

It has already been proposed to fit two additional distilling plants in each ship of the Class when modernised, one plant to be fitted in each oil-driven generator compartment, but the capacity of the two sets would not exceed four to five tons per hour/total.

To compensate for a part of the extra weight, it is proposed to remove the four emergency distilling sets which are situated one in each engine room.

DAMAGE CONTROL

Telescopic shores

It was observed recently that a ship in dock in Hong Kong (Taikoo) was supported by telescopic shores.

The use of these shores for certain damage control purposes would have the following advantages :—

(1) Fireproof.
(2) Much quicker to fit—no cutting required.
(3) No heavier than wooden shores.
(4) Reduces the amount of wood carried on board.
(5) No special cut shores required.

It may be that the ratchet type of fastening as shown in the sketch would not be strong enough, in which case the tubes could be secured by steel pins through suitably drilled holes. The final adjustment of these shores when in place would, of course, be performed by means of wooden wedges.

It is suggested that some trials be carried out with shores of this type although it is doubtful if they would be found satisfactory for all purposes to which wood shores are liable to be put.

Remarks

Suggestions of this nature have frequently been submitted from ships, in an effort to dispense with wooden shores, and it is agreed that the fire risk involved in having quantities of timber around the ship has been a major consideration. Added to this is the feeling that the use of wooden shores takes us back to the days of " the Ark," which is strongly resented in the present-day Navy.

The steel telescopic shores suggested in this submission are certainly an improvement on the majority of previous suggestions. However, it is pointed out that the supporting of a ship in dock is concerned only with a steady strain in one direction, whereas the supporting of a bulkhead, etc., in a ship at sea in a damaged condition involves new and growing strains as the ship is steamed or towed.

The advantages held for the telescopic shores are commented upon as follows :—

(i) *Fireproof.* Agreed, but the great advances which have recently been made in the fireproofing of wood, enormously reduce the advantage steel shores would once have held.

(ii) *Much quicker to fit—no cutting required.* Agreed where shores are fitted direct from A—B, and where the surfaces being shored are normal to the axis of the shores, but experience has shown that this is very seldom. Otherwise, shaped wooden heel and toe pieces would have to be cut to back up the shores, and if this has to be done it is considered much easier to cut the wooden shores themselves.

(iii) *No heavier than wooden shores.* It is considered that a number of different lengths of telescopic shores would have to be supplied, and it is questionable whether the total weights would, in fact, be approximately the same. However, the difference would not be prohibitive.

(iv) *Reduces the amount of wood on board.* This would appear to boil down to a repeat of (i)—Fireproof.

(v) *No special cut shores required.* The cutting of special shores has been practised afloat in many ships, but is a practice which is not encouraged. Estimating the length of shores for a certain purpose before damage occurs, is assuming that no distortion results from the damage. The telescopic shore, however, has distinct advantages on this point, especially in the case of boiler rooms, where the maximum length of shore which can be carried below is in the region of eight feet and is governed by the awkwardness of striking down through the air lock.

The suggestion that the ratchet type of fastening may not be strong enough, would seem to cancel the value of this type of shore. Either the tube has to be drilled for pins at intervals to allow for adjustment, in which the strength of the shore is greatly reduced ; or the holes for securing pins must be drilled when the length of the shore required is established, which does away with the main advantage of this type of shore, *i.e.*, saving of time in fitting. If the telescopic shore is to be of any use at all, it must have the ratchet type of fastening, and the latter must be stout enough to stand up to the strains to be expected.

As stated under (ii) above, the number of applications of straight shores on normal surfaces are very few. In addition to this, there is the major objection to any type of steel shore. After wedging and hardening up the shoring arrangements, every wedge, filling piece, pad and shore must be efficiently secured in place against movement, to contend with the inevitable working of the ship at sea. This is done in the case of wooden shores by nailing and dogging, but would be extremely difficult with steel shores of any sort.

Conclusion. It is considered that the limited applications of the type of telescopic shore do not merit the carrying out of trials.

PERSONNEL

Professional Instruction of Ratings

In order that the Engineer Officer's responsibilities for training of junior ratings may be properly met, it is essential that lectures should be given by Engineer Officers (E.M. Art. 12 (2)). The great difficulty encountered is a lack of suitable space to lecture in and it is strongly recommended that in New Construction, some space be allocated the Engine Room Department for Instructional purposes.

The remarks of an Admiralty Psychologist who visited the ship a year ago are perhaps apposite. " One of the points that impressed me," he wrote, " was the ubiquity and importance of instructional work in the Engine Room Branch. Ideally it seems every S.P.O. should be an expert in instructional technique. I had no idea that so much detailed instruction had to be done with Stokers, but it is obvious that a great difference to the efficiency of the ship can be made by good instruction from Senior Engine Room Ratings to the Junior Engine Room Ratings."

Professional instruction falls into three classes :—

(i) Instruction for Junior E.R.A's.
(ii) Instruction for Stoker 2nd Class.
(iii) Instruction for Stokers in A.W.K.

(i) **Junior E.R.A's.** There are nowadays more E.R.A's aspiring to Commissioned Rank. Thermodynamics is not a subject taught at the A.T.E. and these C.W. candidates rely entirely on the Ship's Officers for instruction in this subject and in mechanics and higher mathematics. The recent improvisation in this ship of a 5th Class E.R.A's Mess is considered quite invaluable.

The occupants take part in all the activities of the main E.R.A's Mess and there is a C.E.R.A. in charge of them though not living in their Mess. This small Mess, however, can be and regularly is turned into a lecture room.

Without such a place there would be little encouragement for the E.R.A's or incentive for the Officers to give lectures.

(ii) **The Stoker II's** generally coming to sea now are young, fairly keen, and quite ignorant professionally. An attempt is being made to convert a locker flat into a lecture room and instruction will be given there in elementary Damage Control, burning of Oil Fuel, etc.

(iii) **Auxiliary Watchkeeping Course.** In recent months it has been found possible to run a monthly course of 4-5 stokers besides a small number extra obtaining instruction in one or other types of outside Auxiliary Machinery.

The question of payment of instructors causes some anomalies.

The Officer who spends his evenings teaching those subjects which an Instructor Officer is not qualified to teach receives 5s. an hour while the Officer who volunteers in the interest of the Service to give up his evening in teaching E.R.A's 5th Class thermodynamics expects and of course rightly receives nothing.

Remarks

Noted with interest. Extra allowances cannot be authorised for giving instruction to 5th Class E.R.A's in thermodynamics, as this work is considered to be included in the duties of Engineer Officers.

MISCELLANEOUS

Need for larger Engineer's Office for large ships

In war-time the number of Engineer Officers in this class of ship is increased from 10 up to 16 or more. The Engineer's Office, which is hardly adequate for the complement of 10 becomes very overcrowded. The number of Officers borne in peace-time may also be up to 16 as there are always several under training. Accommodation in the office is also required for the Engineer Officer's Writer and a messenger, most of the time employed on typing. A larger office is therefore a necessity. At the same time a big improvement would be effected by having a small separate " Drawing Office " adjacent to the Engineer's Office ; this Drawing Office would contain most of the drawings and Makers handbooks (some of the more important drawings being retained in the Power Control Room for dispersal) with suitable desk space for laying out drawings. At present the Engineer's Office is so crowded that it is impossible to keep desk space clear for laying out drawings, with the result that drawings inevitably get damaged and torn.

In view of the large quantity of typing required to be done in an Engineer's Office of a large ship, it would be an advantage if selected ratings could be given suitable instruction in this work and duplicating, instead of being left to " pick it up at sea."

Remarks

Noted with interest. This matter, including the necessity for specialised writers and modern office equipment, is being discussed officially and E.-in-C. remarks on this subject are as follows :—

" The Departmental Office serves as a centre of activity for the Department, and, as such, it is a necessity for proper administration, but where 'common user' service can be applied, the advantage would be welcomed."

" The qualifications for an Engineer's writer are largely technical and he cannot be replaced by an 'all purposes,' or even a 'specialised' writer rating."

" A Departmental Office for the Engine Room Department is a requirement in all Classes of ships, destroyers and above. Other Office requirements are as follows :—

(*a*) Regulating Office for the Chief Stoker in all Classes of ships, cruisers and above.

(*b*) An Office for the staff of the Fleet or Squadron Engineer Officer in ships in which these Officers are carried and where their duties are not combined with those of the Engineer Officer of the ship."

Engineer Officer's Notebook

It is believed that steps have been taken to bring up to date the present edition of the Engineer Officer's notebook which commences with ' Air Blowing Engines ' and ' Ash Expellers ' and continues through to ' Steam Turning Engines.' If not, however, it is considered that some standard form of notebook should be decided on for each class of ship. It should be preferably of the loose leaf type so that insertions can be typed instead of written, with a number of standard printed sheets for each portion of machinery. The loose leaf system would allow easy modification if required.

Remarks

Vanguard has been issued with a loose-leaf Engineer Officer's notebook and a report on this experiment is awaited before proposing that it should be distributed to the Fleet.

Dissemination of Information

In A.F.O. 1581/45 it was inferred that in addition to Quarterly Reports from Engineer Officers, there would be a flow of information in the opposite direction by means of the series " Papers on Engineering Subjects." Since this A.F.O., one issue of Papers on Engineering Subjects (No. 18 of July, 1945) has been received. (It is not known how near the next issue is to publication.) This has proved of great interest. It is felt however, that a supplementary series of less formal publications dealing with the problems of the different classes of ships would be of great interest to other ships of the class and other classes of ships, one series for Battleships, another for Cruisers, etc. (Carriers either separately or with Battleships). One of the chief features should be to get the information out without too much delay.

Remarks

Nos. 19, 20 and 21 issues of *Papers on Engineering Subjects* should have been received. The issue of No. 20 was delayed for three months owing to a printer's error, but the issue of No. 21 commenced in September. (*No. 22 has since been issued, dated December* 1946—*Ed.*)

A number of changes have been made in the Publication, with a view to improving and popularising the papers, but shortage of staff makes it impossible to consider a separate Publication for each Class of ship.

PART II

Anson's letter 1/12B/617 of 30th April, 1946 together with Engineer-in-Chief's remarks dated 12th November, 1946.

MAIN ENGINES

Vibration in Cruising Turbines

All cruising turbines exhibit a high frequency vibration at the higher cruising powers. A high pitched noise is apparent and the forward bearing, nozzle valves and manœuvring valve are "alive." This is most apparent at the lubricating oil discharge pipe on top of the adjusting block housing which acts as a tuning fork and appears to indicate that the vibration emanates from the rotor (although vibration set up in the nozzles is still a possible source).

It is evidently a function of steam speed and not rotor speed as for the same revolutions different combinations of nozzles will reduce, and can where the turbine speed will allow of an uneconomically low nozzle box pressure, remove the vibration.

Further it does not occur at any speed when the cruising turbine is not in use but is being driven by the H.P. turbine.

In view of defects in the shrouding of the first row of impulse wheel blading which occurred in the early days of the ships of the Class (heavier gauge shrouding fitted at Devonport end 1944) it was considered likely that a steam induced vibration was being set up in either the impulse wheel or the impulse wheel blading and although no defects were apparent by examination through the impulse stage drain orifice, it was decided to ask for one turbine to be opened during the refit at Sydney in March, 1946. 'A' was chosen as having the most marked vibration. No defects were found, the new shroudings fitted at Devonport at the end of 1944 being in excellent condition, and all blades were tight in their grooves. There was therefore no justification for opening the other cruising turbines, but as this is a persistent condition with possibility of fatigue, it is considered that another cruising turbine should be opened at the next refit and that similar action should be taken in the other ships of the Class.

Remarks

It is possible that the noise and vibration arise from the nozzle control valves in a similar manner to the manoeuvring valve scream, experienced in some valves of Messrs. Cockburn's design, but before constructive comments could be made, a sound analysis should be carried out. It would be of interest to know if all ships of the Class are experiencing this vibration and noise, and if so, a sound analysis could be carried out at the first opportunity in one of the ships.

STEAM TRAPS

MacAuto versus Drayton Armstrong steam traps

All steam traps fitted originally in the ship are "MacAuto." Since building, additional steam traps have been fitted for various purposes.

These are mostly Drayton Armstrong which have proved themselves far superior to the MacAuto trap. In a period of 12 months only two failures have occurred in the Drayton Armstrong traps, one due to steam leaking between

casting and valve seat and the other a piece of foreign matter embedded in the valve seat. In the same period, cartridge collapse in the MacAuto trap has been frequent and has presented difficulties in replacement of cartridges through not being able to obtain spares in sufficient time to replace those carried on board and consumed. It is true that some of the cartridges collapsed from incorrect handling and setting, but I do not think this problem will be overcome by any amount of locking or instruction. The Drayton Armstrong trap is considered to be a much more reliable and robust job and its use is recommended for all future high pressure steam work.

Remarks

It is at present proposed that the Drayton-Armstrong displacement type steam trap should replace the MacAuto temperature-operated type, if space permits, when the ships are modernised.

It is, however, intended to investigate the " Yarway " Impulse steam trap, which is being developed by Messrs. Dewrance & Co., Ltd. Several ships had this type of steam trap fitted when in America during the war and from whom favourable reports have been received, but hitherto the manufacture of this design has been confined to the U.S.A.

AUXILIARY MACHINERY

Accessibility of auxiliary machinery

Difficulty of maintenance, and fatigue of personnel is much increased by inaccessibility of some of the auxiliary machinery in boiler rooms. Although the positions of the auxiliaries is dictated by the space available and the need to reduce suction heads to a minimum such matters as handing oil fuel pumps, sinking floor plates down to level of base of oil fuel pumps, and arranging pipes so that the minimum have to be disturbed for access, would amply justify the additional labour and cost involved in the initial stages. Where space is very limited the desirability of having a standard machine should give way to modifications or handing to bring the important small items requiring attention such as strainers, throttle valves, emergency stop pushes, etc., to the front of the machine. In addition it is believed that the use of scale model mock-ups, including all pipes, would pay big dividends where much machinery has to be crowded into a small space or sited close up against bulkheads. A joint is now being remade in the oil fuel discharge system in one boiler room which entails breaking a total of 11 joints and cutting out filter support plate riveted to the oil fuel heater framework. All boiler rooms are similar.

Another item in this category is the condenser of self contained auxiliaries in which the various pumps are sited in front of one of the condenser end covers. Wherever possible athwartship condenser designs should be used and where this is impracticable from other considerations every effort should be made to lower the floor plates or raise the machine, so that the lowest pump is above floor plate level. The accessibility afforded by the arrangement and siting of turbo-generators and main feed pumps in Light Fleet Carriers is a very striking example of the advantages of this, and of adequate space.

Accessibility of corrosion pieces in pipe system is also worthy of close attention.

Remarks

Every endeavour is made at the design stage to ensure that access to auxiliaries is not obstructed by pipes and floor plates. Similarly, the auxiliaries are approved early in the design stage and it is not considered practicable to fit non-standard auxiliaries for particular cases from production and spare gear

considerations, but every effort will be made in future to inform the Admiralty Engineer Overseer at an early stage of the need for vigilance in this direction.

Athwartship condensers and the position of the pumps on the side of the condensers are already standard practice in the design by Messrs. W. H. Allen, Sons & Co., Ltd., and is adopted where possible.

FIRE FIGHTING

Fire in boiler furnace—use of F.P.2 portable foam making branch pipes

A fire occurred in the furnace of a boiler when lighting up due to an accumulation of oil fuel in the furnace. The amount of fuel in the furnace was such that it would have taken a very considerable time to burn itself out with possible damage to the boiler. In addition there was a quantity of fuel in the air casing beneath the boiler which had not ignited.

The fire in the furnace was extinguished by covering the fuel with a layer of foam produced by an F.B.2 portable foam making branchpipe inserted through a lower sprayer orifice after removing the sprayer. The fuel in the air casing beneath the furnace was covered similarly to prevent ignition. Both operations were carried out with ease although some hesitation was felt in using the equipment in the air casing for fear that the amount of water required to produce the foam necessary for complete coverage would raise the level of the fuel to near the underside of the hot furnace floor with added risk of ignition.

In the event this was not the case—effective coverage was obtained with no appreciable rise in surface level.

Foamites were of little use as their capacity is too small for the areas to be treated, whilst to use a continuous foam generator would have taken much longer to rig and entailed leaving open the air lock door in a boiler room in which the other boiler was steaming.

The F.B.2 branchpipe was ideal for the job and fully justified its supply.

Remarks

The remarks are noted with interest and gives another indication that the F.B.2 Branch Pipe is of great value and should be used extensively.

PERSONNEL

Proposed introduction of " Stoker Boy "

Concern is felt about the aftermath of the war years during which the entry of " Continuous Service " Stokers was negligible. In a complement of 184 Stokers in *Anson* (including those borne for training) there are only 8 C.S. Ratings. This implies a serious dearth of leading stokers now and stoker petty officers later on. Added to this is the need for a better type of man as a stoker entry.

To ensure against such a state of affairs arising in future and provide a better training in the formative years it is suggested that a " Stoker Boy " rating be introduced and a training establishment formed so that the boys may enter the service in the stoker branch at school leaving age. To make this successful the prospects must be made much more attractive for stokers. Suggestions for this are nomination as prospective mechanician candidates during the Boy training period and whilst at sea as a Stoker Boy, and the introduction of warrant rank for stoker petty officers and chief stokers. It is appreciated that the latter rank presents difficulties in suitable employment, but it is believed that it would be beneficial in shore establishments and large