CORRESPONDENCE

SIR,

Dockyard Machinery—Forty Years in Retrospect

The article in Vol. 7, No. 4, will undoubtedly be of great interest to all engineer officers whether they have had dockyard experience or not, and Mr. Spencer has shown that dockyard officers are alive to the need to keep their plant up to date and in line with the ever-changing requirements of H.M. Ships.

There are two items, however, about which I feel sure all engineer officers would have been glad to see more information.

These are the supply to ships alongside of :—

(*a*) Electric power
(*b*) Steam.

In all the Royal Dockyards such supplies are generally quite inadequate. Sufficient electric power is not available because of the greatly increased power requirements in modern ships and because the dockyard power stations have not expanded in line with this increase. Sufficient steam is not available because we still cling to the antiquated ' donkey boiler ' which is coal-fired, and makes an infernal mess, partly perhaps because the present day engine room personnel have no experience of burning coal. Anyone who has seen H.M.S. *Vanguard* alongside the South Railway Jetty at Portsmouth, with two ' donkey boilers ' connected, is familiar with the clouds of soot and black smoke which result.

I know that the responsible officers are aware of both these deficiencies but, in view of the ever-increasing need to shut down completely for machinery maintenance, I feel sure that engineer officers and ratings alike would be glad of an assurance that something is being done to provide an adequate supply of electricity and steam to all dockyard berths in the near future. Such facilities would improve maintenance and also serve to eliminate harbour watchkeeping for P.O.M.s.(E), a not unimportant point.

Mr, Spencer states on page 452 that he is concerned with the Engineering Department and that his list is not complete. A further item of purely historical interest may be that in H.M. Dockyard, Sheerness, the water supplies come from two wells, both of considerable antiquity and of great depth (of the order 500-600 feet). These were cleared out and an electrical pump installed in one of them about 1938, while the writer was Assistant to the Chief Engineer, and I believe a short note on these wells would be of considerable interest.

I cannot trust my memory after 16 years to give all the details ; perhaps the present Chief Engineer could spare time to record a brief history of these wells for the archives.

(*Sgd.*) L. F. INGRAM,
Captain, R.N.

SIR,

Automatic Control by Pneumatic Devices

To those who were interested in Lt.-Cdr. Edwards' article on this subject (Vol. 7, No. 4) but were, like me, deterred by the mathematical analysis from fully grasping his argument, I offer an analogy which I believe to be a fairly strict one.

Imagine the automatic controller as a driver in a car attempting to follow a white line along a road, and assume that, because of fog, he can only see the line just in front of the car.

The position of the line is the ' desired value ' and the position of the car the ' process variable '.

If he deviates from the line, the driver senses his error and applies with the steering wheel a correction intended to reduce the error to zero. It is reasonable to suppose that at first the further he is from the line, the greater the correction he will apply : (proportional control).

Now suppose that he puts on full lock for a deviation of, say, a foot (narrow proportional band), he is liable continuously to overshoot and zig-zag down the line : (with proportional control, a narrow proportional band tends to cause oscillation). As he becomes more practised, he applies less correction for a given deviation, (he widens the proportional band), and oscillation disappears.

Imagine now that he is accurately on a straight part of the line and comes to a bend. He will deviate to the outside of the bend, applying a correction as he deviates, until he has enough wheel on to take him steadily round. He will now, of course, be outside the line by an amount dependent on his proportional band width : (offset increases with proportional band width).

The next time he meets a curve, he notes this offset and applies an additional correction whose magnitude he makes dependent on the error and its duration, so that, if he continues round the curve long enough, he gets back on to the line. In fact, he integrates his error and applies a correction accordingly : (proportional plus integral control reduces offset).

If he comes to a sharp bend, he sees that his deviation is increasing rapidly and will apply another additional correction ; in other words, he estimates his rate of change, or derivative, of error and corrects accordingly : (derivative term introduced).

On the other hand, if he finds himself off line but approaching it, his proportional control term will tell him to turn towards the line, whereas his derivative control term will tell him that his error is decreasing (derivative of error is negative) and that he should steer away from the line. These act in opposition and the driver will allow the car to approach the line with only a small amount of wheel on to straighten himself out.

By the same analogy, the response to a step function can be followed by imagining the white line to be painted with a sudden displacement to one side and the effects of time lag, inertia and capacity can also be considered.

(*Sgd.*) J. SIDGWICK,
Commander R.N.

Author's Reply : I congratulate Commander Sidgwick on the accuracy of the analogy which, in spite of mathematical deterrents, he has drawn from my article.

SIR,

An Engineer's View of Corrosion

It is with the greatest interest and approval that I have read the article by Commander J. Sidgwick, R.N., in the January issue of the *Journal*.

The correctness of his comments, at the end of his article, on the terrible cost of corrosion is undoubted, as also is his reference to the complexity of the subject, at the beginning. I like also very much the observation that while a little learning may be a dangerous thing, no learning at all is even more dangerous.

There are two important technical points to which I wish to draw attention. The first is in reference to dezincification. ' The addition of arsenic or tin almost

eliminates it in the single phase alloys '. The correct amount of arsenic (optimum 0·04 per cent) completely inhibits dezincing, but while tin has a slight discouraging effect, it does not carry complete immunity.

The second is in reference to impingement attack or corrosion-erosion· ' This occurs in parts exposed to turbulent flowing sea-water '. Certainly it does, but it should be stated that aluminium brass and 70/30 cupro-nickel are normally resistant to this form of attack, and that in practice it is not now a menace. This is the condenseritis of an earlier generation.

(*Sgd.*) H. F. SHERBORNE,
General Manager and Director.
The Yorkshire Copper Works Ltd., Leeds.

Author's Reply : In the elaborate saving clause with which I began my article, I should perhaps have included ' Directors of major tube-making companies '. I defer to Mr. Sherborne's correction on de-zincification.

I unhesitatingly agree that the menace of wholesale ' condenseritis ' is a thing of the past, thanks to the introduction of cupro-nickel and aluminium brass. The number of occasions on which isolated cases of impingement attack still occur are remarkably few, considering that a cruiser's main condensers may contain a total of thirty-three miles of condenser tube, with an area of half an acre exposed to sea-water.

SIR,

Atomic Explosions—Radiation Hazards in Machinery Spaces

The excellent article by Commander Norman in Vol. 8, No. 1 of the *Journal* will have caused much serious thought, and two questions occur to me which are at present unanswered so far as I know.

Firstly, while we are busy designing warships with maximum A.B.C.D. protection, what is being done about the merchant ships they are to escort ?

Secondly, since it is reasonable to imagine that atomic protection is being arranged on the assumption that atomic or hydrogen bombs would be used in war, what is the likelihood of these astronomically expensive weapons being used against relatively unimportant targets at sea ?

This letter is perhaps outside the scope of the *Journal* but I consider the implications, however unpalatable, are too important to ignore.

(*Sgd.*) C. G. CRILL,
Commander R.N.

Author's Reply : The problem of A.B.C.D. protection of the Merchant Fleet is receiving very active consideration, and at a very high level.

The object of the Merchant Shipping Defence Advisory Committee, on which E.-in-C. is represented, is to advise shipping owners what measures are necessary to bring their ships to a balanced state of defence.

Recommendations for the strengthening of bridges, fitting of steel in lieu of wooden superstructure doors, creation of gas citadels, trunking air to boilers and Diesels and so on are among the principal modifications which, it is hoped, will be carried out progressively and incorporated in new construc-

tion. The Merchant Fleet is very aware of the danger and is actively pursuing the problem.

As for the probability of attack by nuclear weapons, it will be appreciated that, as these become more portable, their use is more probable against an assembly of ships, such as occur in beach-head attacks, convoy assembly points, etc. Whether or not it will in fact be used, will depend entirely upon the enemy's estimate of the threat he has to counter ; and, as stated recently, probably our greatest defence in the threat of an atomic war is our willingness to engage in it.

SIR,

Welding/Cutting Plant in ' Obdurate '

Two months of possession have borne out the earlier promise of the extreme usefulness of the oxy-acetylene welding/cutting plant. Not all its jobs are orthodox. One of the most useful applications is its treatment of seized nuts, which no longer need to be laboriously chipped off, nor is there any longer danger of broken studs.

The ship's bell, guard-rails, ladders, door clips and leaking nipples have all benefited. Some twenty turns of $3\frac{1}{2}$ in wire were quietly cut from the starboard rope-guard when the ship ' rush docked ' after divers had been unable to remove the wire.

The reaction is : ' How did we manage without it ? '

(*Sgd.*) W. A. POLING,
Lieutenant-Commander, R.N.

SIR,

Pressure Testing of Refrigerant Circuits

I feel that some qualification is necessary to the comments under ' Notes From Sea ' at the top of page 68 of Vol. 8, No. 1.

Complete dehydration of the whole circuit under vacuum and preferably with heat is absolutely essential after hydraulic pressure testing, irrespective of whether water or oil is used. This applies equally to all types of refrigerating plant, but is of paramount importance in the case of Arcton 6 (Freon 12) and methyl chloride machines where little more than 10 parts per million of moisture will cause a breakdown, irrespective of corrosion and copper-plating difficulties (Vol. 6, No. 3, p. 312-3).

Where efficient dehydration equipment capable of reaching really high vacuum is available, there should be little difficulty in dehydrating a plant after pressure testing, though it will undoubtedly take much longer when water has been used.

However, it is clear from a recent survey that not one of H.M. dockyards has the really high vacuum dehydration equipment needed for this job, and the use of water in a plant which has been in service is therefore asking for trouble and it will certainly be extremely difficult to remove afterwards.

Clean dry lubricating oil, of the same grade as that normally used in the plant, is the best alternative to water for pressure testing. The oil we use at present is not completely free from moisture and may contain quite large quantities particularly in tropical climates, but the amount left after draining the plant will be infinitesimal compared with that left after using water.

Some moist air will be let into the plant on draining, irrespective of the testing medium employed. Oil is likely to have a cleaning action in the circuit and should carry out any sludge or dirt present. Experience in the industry, where oil is in almost universal use, has not disclosed difficulties with the heat exchangers and it has been found easy to remove any excess oil left in the circuit either from the compressor sump or from the oil separator.

The above remarks assume that pressure testing is necessary and this is by no means certain for Arcton 6 and methyl chloride plants where, internal cleanliness being essential for correct operation, corrosion is almost non-existent.

Personally, I would not test at all except by refrigerant gas to maximum working pressure (about 150 lb/sq in. gauge), but if hydraulic testing became necessary I would use oil, never water, followed by as complete and prolonged dehydration as time and available facilities permitted.

The moral is—partial or complete dehydration after any work whatever has been done which involves stripping down any part of the refrigerant circuit. Absolute cleanliness is also essential. A fully activated drier should always be fitted after any maintenance or repair work and left in the circuit for several hours or days.

It is to be hoped that money can soon be found to provide properly equipped and housed refrigerator repair shops in H.M. dockyards together with specially trained men to operate them.

(*Sgd.*) M. B. F. RANKEN,
Lieutenant-Commander, R.N.

Comment

E.-in.C.'s Department is in general agreement with the opinions expressed in Lt.-Cdr. Ranken's letter, which gives in detail the reasons for the original comments on *Cumberland's* report. It is important to appreciate that, even if the water test were to be replaced by an oil test, efficient dehydration is still essential. It is intended in due course to abolish these tests altogether.

Unfortunately adequate equipment for dehydration is not readily available, but E.-in-C. hopes to equip depot ships with suitable gear in the near future.

SIR,

Training of Engineer Officers

In view of recent articles in the *Journal*, the following quotation from the 'Evening Standard' may be of interest. It refers to a comparison made recently by the Royal Army Medical Corps between Chelsea Pensioners and Oxford Undergraduates.

> 'The pensioners were "mainly mesomorphs", that is to say, "group action was the keynote, vigour of thought, vehemence of expression, aggressiveness and energetic reaction, bold directness of manner, love of exercise, adventure, chance and combat the prominent features. Problems were met by action, not by submission or by acceptance." The undergraduates were riddled with endomorphic-ectomorphs, who have "the highest prevalence of psychiatric and psychosomatic disorders."
>
> This merely goes to show what thinking men have long realized—that our society is organized on a faulty basis. We expect striplings full of inexperience, torn with passions, beset with anxieties, to profit from higher education. They should be sent, instead, into situations of great physical

danger, and be subjected to the most testing bodily exertions. Continuing in this regiment until, say, 60, they should then proceed to the university to be educated. At 75, having shown extraordinary powers both of endurance and survival, they would emerge the whole man, ready to devote the best part of their lives to leadership of the community.'

(*Sgd.*) L. E. S. H. LE BAILLY,
Commander, R.N.

Editor's Note

Since publishing an article entitled 'Nobody Reads the *Journal*' by Rear Admiral R. W. Parker, C.B.E., it has been most gratifying to receive many laudatory letters, from a great variety of sources—naval, civilian, Dominion and foreign—upon the value of the *Journal*.