'A SONG OF STEAM'

BY

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AND

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In the years shortly after the Second World War, the machinery of British warships was to undergo the first major change in design philosophy for about thirty years. The long era of the Parsons impulse-reaction turbine, powered from Admiralty three-drum boilers, was to come to an end and be replaced by controlled-superheat boilers and various new designs of turbines for the DARING Class destroyers and WHITBY Class frigates. The professional training at the R.N.E. College, Manadon, after consolidating our knowledge of the conventional marine machinery was concluded by a study of the machinery of these latest designs that were to enter the Fleet. It was with considerable apprehension therefore when, at the end of their course in 1952, the authors discovered that they were not taking up their appointments to ships in the Far East until after a passage as steaming crew in H.M.S. *Ranpura* from Rosyth to Malta.

H.M.S. *Ranpura* must have been one of the older ships still wearing the white ensign. She was fitted with steam reciprocating machinery that first went on trial in April 1925. It had long since been superseded in current warships and had therefore not been considered worthy of inclusion in our course syllabus. This article is written to record our experiences in preparing ourselves for this unusual assignment in what was to be one of the last sorties ever made by that ship.

H.M.S. *Ranpura* was a converted P. & O. passenger liner. She was one of a class of four ships: S.S. *Ranpura*, S.S. *Rawalpindi*, S.S. *Ranchi*, and S.S. *Rajputana*, built for the Bombay Mail Service. Of these ships, only *Ranchi* remained entirely in the P. & O. Service. S.S. *Rawalpindi* achieved fame as an armed merchant cruiser when she was sunk by gunfire in battle with the *Scharnhorst* in the North Atlantic on 23rd November 1939. S.S. *Rajputana* was also requisitioned in Vancouver in 1939 and undertook a similar conversion before being torpedoed off Iceland in April 1940, and S.S. *Ranpura* was converted to an armed merchant cruiser in Calcutta in September 1939 and began her war service as such in the eastern Mediterranean. In 1944 she was purchased outright by the Admiralty and converted into a fleet repair ship and depot ship and it was back to the Mediterranean that we were to take her in 1953 to relieve H.M.S. *Tyne* in Malta so that the latter could take up her new task as headquarters ship in Sasebo, Japan, from the aging Yangste River gunboat H.M.S. *Ladybird.*

Since the machinery in *Ranpura* was totally different from any on which we had been trained, advantage was taken of the fact that her one remaining sister ship *Ranchi* was about to make her last voyage, from Tilbury to Newport, Monmouthshire, where she was to be broken up; two of us, future watchkeepers in *Ranpura*, were signed on in *Ranchi* as supernumeries (R.N.) at one shilling a week! We were to learn on that voyage as much as we could about the operation of the largest reciprocating engines at sea at that time. These were two quadruple-expansion engines which between them developed 15 000 shaft horse power using saturated steam from six double-ended Scotch boilers at 215 pounds per square inch. This horse-power was transmitted to two 19 ft 6 in diameter propellers which, at about 90 rev/min, drove the 16 000-ton ship at 18 knots on her builders trials. The performance, however, had fallen off in both the *Ranpura* and the

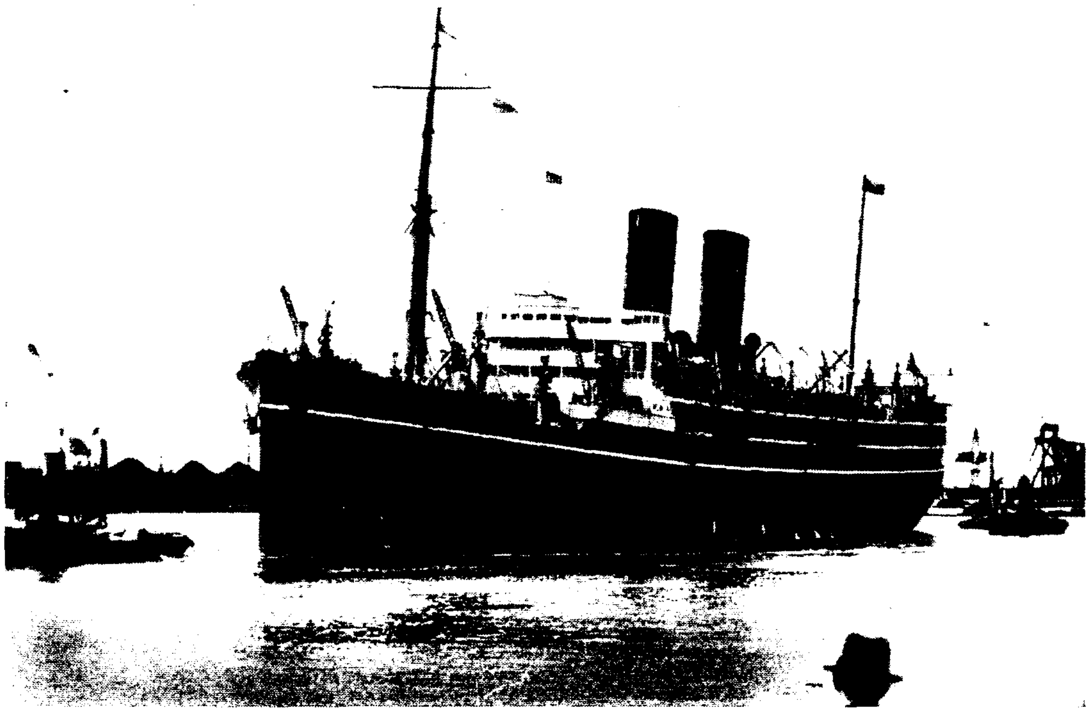

FIG. 1—S.S. 'RANCHI'
Photograph by courtesy of P. & O. Group

Ranchi in their later years but *Ranchi*, on her last voyage to Tilbury from Australia, still managed a steady 80 rev/min developing 14 knots.

The machinery layout in *Ranchi* was very simple. There were three main machinery compartments—the forward and after stokeholds with three boilers in each and an engine room which, in addition to the main engines, contained most of the auxiliaries. At the after end of the engine room, there were two shaft tunnels that emerged in the tiller flat where the space was dominated by the Browns steam steering gear. This was a steam reciprocating engine mounted directly on to the tiller arm and driving a toothed pinion engaging a racked quadrant fixed athwartships to the ships structure. Steam and exhaust was connected to the engine through glanded banjo-pieces on an extension of the rudder post. There was direct access from one compartment to the next through sluice-type watertight doors at the engine-room deck-plate level making it possible to walk straight through from the forward stokehold to the tiller flat without climbing a single ladder. A lift conveyed the engineer officers from the watchkeepers' mess on the boat deck to the grating immediately above the starting platform—a boon after a tiring watch, but not without hazard as at least one officer had been trapped 'between floors' when the lift broke down. Neither was too much trust placed in the hydraulic system that kept the doors open, so this was backed up by wooden props under the doors which could be kicked away in an emergency.

The six boilers were double-ended Scotch marine type that had been converted to burn oil fuel. Each boiler had eight furnaces (four at either end with one sprayer per furnace) which were corrugated to allow for differences in expansion between themselves and the boiler shell. The overall length was 20 feet. The flue gas left the furnace at the centre and passed back through fire tubes to smoke boxes at the furnace front whence it was re-directed to a central uptake. Soot blowing on these boilers was a fearsome process as the smoke box doors were opened and a steam lance was passed down each fire tube in turn. Soot, steam, and funnel gas invaded the stokehold creating an impression of 'Hell's Kitchen'. It was noted that in *Ranchi* the Fourth Engineer, who had charge of the stokehold, usually retreated to the engine room while this operation was in progress.

The two main engines each had four cylinders whose diameters were 32½ inches, 46½ inches, 67 inches, and 96 inches respectively. The HP and the smaller IP cylinder were placed at the end of the engine so as to accommodate poppet valves which, with the slide valves of the other IP and the LP cylinder, were operated by rods driven off the eccentric straps. The stroke of the piston was 5 feet and the sight of the 30-inch diameter crank rotating in an open crank pit at 80 rev/min was indeed awe inspiring. It was even more nerve racking to watch the Third Engineer checking the big-end bearing temperatures by touching the crank web as it came up to top dead centre and then, having judged the timing, bending the tops of his fingers down over the webs until they touched the crankpin bearing brass to pick up a trace of oil from the journal. This oil was important because the presence of grit or metal particles in it was the only indication the engineer would get of impending failure. It was very noticeable that the regular watchkeepers wore short-sleeved overalls and no rings on their fingers.

In contrast, when feeling the slipper guides and small-end pin face, he kept his fingers well tucked in, to avoid the sharp edge of the oil feeder box on the crosshead, and touched the metal with the back of his fist. It was with trepidation that we copied him, but were pleasantly surprised how soon the knack of it came though the crank pin gave us some nasty bruises until we got the timing right.

At the after end of the engine, a small exhaust-driven steam turbine was coupled to the main engine crank shaft through a hydraulic coupling and double-reduction gearing. This was known as the Bauer-Wach system. Steam was exhausted from the LP cylinder at a higher pressure than usual, through a water eliminator, and expanded in the steam turbine down to 0·75psia. This lowered the output of the reciprocating engine but made available a correspondingly greater pressure drop in the turbine. Furthermore, this auxiliary drive had a soothing effect on the reciprocating forces and so reduced the vibration considerably. The turbine was engaged by a control valve which directed oil to the hydraulic coupling which, when full, allowed oil to overflow to the control valve piston that operated the change-over valve in the exhaust steam line. Steam was then directed to the turbine. A push rod operated by a way-shaft prevented the control valve from being operated when the engine was stopped or going astern. A high-speed 150 kW electric generator was coupled to the first reduction pinion of the Bauer-Wach turbine with an independent auxiliary turbine in series with the Bauer-Wach turbine connected to the first reduction pinion by a hydraulic clutch. This clutch was kept filled when the exhaust turbine was driving the generator and emptied when the auxiliary turbine drive was required either when in port or when the exhaust turbine was for any reason cut out. Steam to the auxiliary turbine was off or on according to the state of the hydraulic clutch. In *Ranchi* the control valve to the exhaust turbine proved unreliable and had a tendency to come out on its own; in consequence, the hand lever was lashed 'in' and a knife was hung near the lashing to disconnect the turbine in an emergency!

In addition to the direct drive generators, *Ranchi* was fitted with a 100 kW Shanks reciprocating generator and a 250 kW Allens turbo-generator. The Allens turbo-generator had a temperamental generator tail-end bearing which tended to overheat. This was overcome by fitting a copper coil in the bearing sump and running a rubber hose from this to the engine-room tap. A close watch had to be kept as the vibration of the machine caused the hose to chafe and fail.

Many other parts of the main engine were water cooled. The eccentric straps were cooled by dipping into water-filled boxes which, of course, had to be replenished as the water splashed out into the bilges on every revolution of the crankshaft. This was the task of one of the paniwallas, as the Patan engine-room hands were called. 'Paniwalla' is a native word for 'water carrier' and this was literally his task. For four hours he went round the eight eccentric boxes topping them up from two two-gallon buckets which he filled from a tap. Practically every Third Engineer at some time had compassion on the paniwalla and suggested that he put a hose on the tap for the purpose. However, it was not long before the paniwalla had wrapped his hose around the eccentric rods and the engine had to be stopped to unravel it all—so back to the buckets. He did, however, use a hose to spray the slipper guides to keep them cool.

The crew except for the officers were nearly all Asian. The seamen were Lascars, the stewards Goanese, the engine-room hands Patans, and the firemen silent turbaned fellows from the Punjab. These firemen were called 'agwallas' and there were three in each watch under a leading hand or 'tindal'. In one stokehold, the tindal was the water tender and in the other the senior agwalla carried out the task. The two stokeholds were in the charge of the Fourth Engineer.

The engine-room watch consisted of the Third Engineer in overall charge with a junior who double-banked him and, in addition, carried out most of the maintenance and running repairs. There were also the two paniwallas under their tindal, one looking after the eccentric boxes and the other looking after the two evaporator shells and doing routing greasing.

Since salt water was used for all bathing and washing facilities, the only domestic requirement for fresh water was for drinking and this was catered for by storage tanks refilled each time the ship bunkered. The evaporators therefore were solely for use on make-up feed but, as the distilling capacity was small, great attention was given to rectifying steam leaks as soon as possible after they arose.

The deck and engine-room sections of the Indian crew were each under the charge of a boss man or 'serang'. Such a section would often come from one village where the 'serang' would be held in high esteem and from him the crew would buy their jobs at the start of the voyage. They were paid by the Shipping Company but it was the serang who recruited them, brought them to Bombay to join the ship, arranged their watches, and took care of the discipline usually by way of a sharp cuff or kick. He rarely appeared down below but when he did he was treated with the utmost respect.

As well as the watchkeeping officers already mentioned, the engine-room complement consisted of the Chief Engineer, the Second Engineer, and three more junior engineers who did daywork. In addition there was a refrigeration engineer and two electricians who also did daywork. The engineer officers messed in the main saloon at their own table but provision was made for the watchkeepers to have their meals separately in a watchkeepers' mess near their cabins on the boat deck. The watch bill was made out in three watches in fixed sequence and the choice of watch was given in strict order of seniority. In *Ranchi*, a supernumerary Second Engineer was filling one of the Third's billets and he therefore had the first choice of watches. In a passenger liner, it was clear that preference was given to being able to participate in the social programme of the ship rather than the requirement for sleep. Thus the senior watchkeeper would keep the morning and dog watches, the next chose the middle and afternoon watches leaving the junior Third Engineer with the unsocial first and forenoon watches.

Working as they did in an old ship in very adverse conditions, the task of keeping her running with the minimum delays to her passage schedule engendered in the watchkeepers an intense pride of achievement. It led to remarkable examples of ingenuity and improvisation, and resulted in a grand old ship still maintaining a steady 80 rev/min on her last voyage to the breakers yard after twenty-five years in service. They had a saying in the P. & O. at that time, 'hardworking ships are happy ships'. This was certainly true of the *Ranchi* right to the end when she settled high and dry on the mud banks of the River Usk.

The first impressions on joining *Ranpura* at Rosyth were the lack of freedom of movement between machinery spaces. The watertight doors that allowed access from the forward stokehold to the tiller flat had all been welded to preserve watertight integrity; access to the machinery spaces was therefore only possible from the main deck. For the boiler rooms, this meant a breathless exercise through a sulphurous atmosphere in the uptake spaces caused by the many leaks in the boiler air casings, and elsewhere an exhausting marathon up and down vertical ladders.

Flashing up from cold was a novel experience. The operation started forty-eight hours before going to sea with a pile of firewood, a bundle of rags, and a box of matches. As only the centre boiler in the forward stokehold was fitted with an auxiliary stop, the first operation was to raise steam in this boiler by lighting the wood fire in the furnace and waiting until sufficient steam pressure had been raised to warm through the oil-fuel heaters and to run the fuel pump. It was a relatively straightforward operation then to warm through the steam ranges and flash up and bank the other boilers. For this reason in *Ranpura* the steam plant was rarely shut down, one boiler being kept flashed or banked.

Thus, it was usually from this condition that the flashing-up watch started. Some twenty-four hours previously, the main-steam bulkhead valves had been opened to admit steam slowly to the main-engine valve chests and the IP and LP jackets. All drains were opened and the engines warmed through.

The flashing-up watch started the main circulators and air pumps to raise 5 inches of vacuum. The reversing engines were warmed through and started. These engines were used to operate the cumbersome link gear by which the ahead or the astern main-engine eccentrics were lined up with the valve gear. This was achieved by means of a massive way-shaft which ran the full length of the engine. The operation of this gear was preceded by a bellowed warning 'mind the links' to warn any watchkeepers who might be in the way on the upper gratings. Needless to say, reversing the engines was not a very rapid process. This was further delayed if the engine stopped (as it frequently did) with the HP piston at top dead centre. The engine had to be moved over this position by admitting starting steam to one of the other cylinders. To do this, one of a series of valve levers, hung at the forward end of the engine, had to be pulled in sequence until the engine obliged and turned over.

In the warming through routine, the engines were first rocked—that is turned up towards the top of the stroke but not allowed to move over top dead centre on any cylinder until it was certain that there was no water on the top of any piston. After this, they were turned frequently and vacuum raised to 20 inches to prepare the engines for trial.

It was the practice in the Navy at this time to use Admiralty compound oil OC160 to lubricate the crossheads, connecting rods, crankshaft, and eccentric boxes. This oil emulsifies readily with water and so provides adequate lubrication even when contaminated with water and steam from the drains and glands of the engine. The eccentric straps also were lubricated from semi-circular baths secured across the engine bed plate under each pair of eccentrics. These baths contained a mixture of the same oil and water. However, we failed to get this mixture right and during the basin trials the eccentric straps overheated; it was found that the emulsion had churned like butter, and this had to be hosed out of the eccentrics before the trial could continue. From then on, only water was used in the eccentric baths.

Apart from this incident, the first basin trials in *Ranpura* were very successful and on completion the ship was stored and made ready for sea. Not long after

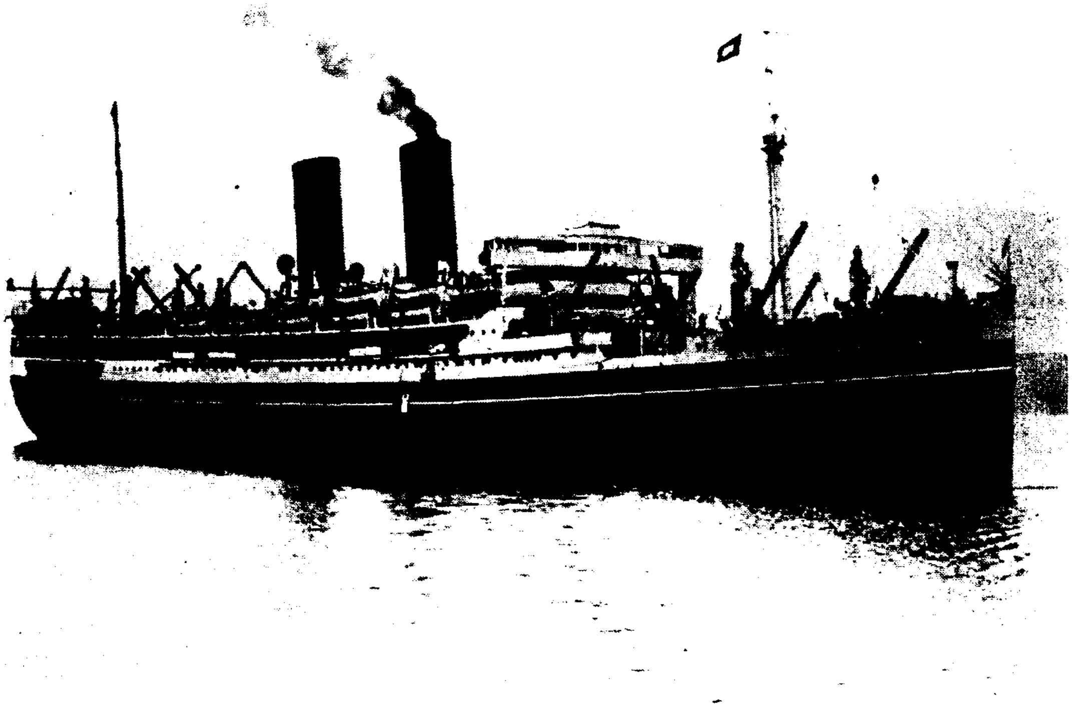

FIG. 2—S.S. 'RANPURA'

Photograph by courtesy of P. & O. Group

FIG. 3—H.M.S. 'RANPURA'

the basin trials and while embarking fuel, a seepage of oil into the sand-pit in the foundry was discovered. This sand-pit was directly over one of the double-bottom tanks, the top of which had split releasing the oil into the sand. There was a considerable delay while the sand-pit was emptied and the damaged fuel tank isolated before fuelling could recommence.

After making sure that the main machinery was operating correctly, attention was turned to the distilling plant. This was an impressive contrivance of three triple effect evaporators arranged on three sides of their compartment. On each set, the brine discharged from the first shell was the feed for the second and the brine from the second shell the feed for the third. This arrangement required a delicate balance to be achieved in the triple pump to maintain a steady level in the three shells. It was nearly impossible to measure the density of the brine from the last shell because, being so high, the brass hydrometer well-nigh stood out of the pot. The first set was commissioned without too much difficulty but the second and third sets would not feed at all. After opening up some of the pipelines, the reason for this was discovered: whoever had refitted the brine lines had failed to knock out the centres of many of the pipe joints! It took most of the night to put this right, but in the morning all three sets were operating and it was a grand sight to stand back and see the three triple pumps jogging away with the light flashing on the gleaming pump rods.

Thus with the machinery tried and proved H.M.S. *Ranpura* completed storing and sailed from the Forth into the North Sea and down the East Coast towards the Straits of Dover at a steady cruising speed of nine knots. The ship had not been under way long when the weather began to deteriorate and gales began to develop to the north of us moving steadily southwards at about our speed. We were apprehensive about our stability because the ship carried a large amount of top weight. As part of her conversion to a heavy repair ship, large rolling mills were installed in the upper-deck workshops in which were also stored many tons of steel plate and timber for shipment to Malta. Luckily this was compensated to some extent by 70 tons of torpedoes in crates stowed down in the foundry. While examining the Ship's Book during this period, an entry was discovered warning of a loss of stability if there was an accumulation of more than 6 inches of water in the machinery space bilges. As may be imagined, being an old ship that had not steamed for a long time, there were a considerable number of steam leaks which kept topping up the bilges, and so a fervent pumping routine was started. This brought to light many defects in the ship's bilge system: the valves were heavily contaminated with paint chippings, the system joints were perished, and, in one suction valve, the valve disc had been lost and replaced by an empty 'Zube' tin! The refitting of this system turned out to be an on-going event for the rest of the voyage. We plodded on down the North Sea just ahead of those gales that were to wreak such havoc along the East Coast, particularly in the Thames Estuary, and it was with considerable relief that we finally turned westwards through the Straits of Dover experiencing nothing worse than some heavy rolling. The effect of this rolling was most marked in the engine room because, in addition to the continuous movement of bilge water, the water in the open-topped feed system hot wells was continuously slopping about, resulting in considerable loss of feed water. One of the auxiliary petty officers discovered a valve which allowed feed water from the evaporator make-up feed discharge to be admitted directly to these hot wells. By surreptitiously opening this valve he not only saved himself the trouble of running down water from the reserve tanks but also made it look as though the feed losses were less when he was on watch! It was some time before this 'irregular practice' was discovered.

The steam-driven compressor of the CO_2 refrigerating plant at the other end of the engine room had a huge flywheel on the crankshaft. During passage, one of the gas glands on the compressor developed a leak and a cure was attempted by pulling up on the gland. Such was our inexperience that we did not know that the gland was packed with Allenite lead-foil packing and that once packed this should never be compressed further. In the event, the compressor objected strongly to this malpractice and stopped abruptly, bending the connecting rod in the process. However, skilled hands subsequently straightened the rod and we were able to run the plant again within a few hours.

As in *Ranchi*, the boilers were double-ended Scotch boilers and they operated at an exceedingly low air pressure of half an inch water gauge. This air pressure was controlled by judicious opening of a series of vent louvres in the floor of the fan flat above the boiler room; any excess movement of these flaps resulted in a complete loss of air pressure and the probable extinguishing of the oil-fuel sprayers. These sprayers were little more than steel tubes with the ends flattened and small holes drilled! If therefore one was extinguished for any length of time, an accumulation of unburnt oil would rapidly build up in the corrugations of the furnace with very serious risk of explosion and fire in the stokehold if an attempt were made to re-light it. For this reason, they were frequently examined from the remote end of their individual furnace. This was, in fact, the cause of a major fire in *Ranpura's* boiler room some years later.

In other respects the auxiliary machinery in *Ranpura* was very similar to that fitted in *Ranchi*. She had no Bauer-Wach turbine, but had additional generators fitted to provide power for her heavy workshop machinery; and right aft, there was still the massive steam steering gear.

Throughout the twelve days on passage to Malta, we were always finding something new. The watches were therefore never dull and the morale of the engine-room crew was very high. It was with considerable pride therefore that we welcomed the relieving staff who were to take over *Ranpura* in Malta for the last stage of the passage, when they arrived in a destroyer. The peculiarities of the machinery were explained, and a dramatic demonstration given why soluble oil was not used in the eccentric boxes—at full power, the visitors were showered with oily white droplets before the mixture started to churn and had once more to be hosed out with fresh water. We also, of course, pointed out to them the 96-inch complete spare LP piston securely secured to the engine-room bulkhead!

The impression left by these experiences in *Ranchi* and in *Ranpura* has remained ever since and has yet to meet its equal. How, when reminiscing with former colleagues at reunions or at gatherings of marine engineers, they bring real meaning to these lines of Rudyard Kipling from M'Andrew's Hymn written in 1893:

> 'Lord, send a man like Robbie Burns to sing the Song o' Steam!
> To match wi' Scotia's noblest speech yon orchestra sublime
> Whaurto—uplifted like the Just—the tail-rods mark the time.
> The crank-throws give the double-bass, the feed-pump sobs an' heaves,
> An' now the main eccentrics start their quarrel on the sheaves:
> Her time, her own appointed time, the rocking link-head bides,
> Till—hear that note?—the rod's return whings glimmerin' through the guides.
> They're all awa'! True beat, full power, the clangin' chorus goes
> Clear to the tunnel where they sit, my purrin' dynamoes.'

It is doubtful whether watchkeeping on steam turbines would have inspired such lines and, with diesels, the noise would have stifled them at birth.

Acknowledgement

The authors would like to acknowledge the assistance given by Mr. S. Mole, P. & O. Container Fleet Ltd. (formerly Third Engineer, S.S. *Ranchi*) and also Mr. S. Rabson, Group Librarian, P. & O. Group for loan of the photographs of S.S. *Ranchi* and S.S. *Ranpura* and for permission to reproduce them.