

MARINE STEAM ENGINES

OF THE

ROYAL NAVY

This is a pamphlet written circa 1843 by Mr. Alexander Gordon to Their Lordships and concerns the competitive tendering for contracts to supply steam engines to the Royal Navy. On the cover of the pamphlet there is a note dated 18 March, 1844 and addressed to a Mr. Sked, Engineer, Dunbar, saying:

‘My dear Sir,

This pamphlet was so effective that we got an order for 3 iron boats and their

Engines from the Admiralty. It has done the good required and therefore I do not circulate it.

Yours faithfully,
Alexander Gordon.'

TO THE
LORDS COMMISSIONERS OF THE ADMIRALTY.

MY LORDS,

PERMIT me to solicit your attention to the following remarks upon the steam marine of the Admiralty. If I be honoured with your attention thereto, I am not without hope of effecting an essential good to this branch of the public service.

A long practical acquaintance with marine engines, and many years' experience in the collection and arrangement of statistical tables in one branch of my profession, enable me to submit to your Lordships the following facts and arguments, and respectfully to suggest a different arrangement, or rather an enlargement, of the statistics of the steam marine, by which extravagance may be checked, the immense drainage of public money may be reduced, good engine-makers and engineers afloat encouraged, the current economy of steamships regulated, and their efficiency for important services secured.

It is neither consistent with your Lordships' time nor with my duty to write mere compliments to, or to make complaints of, persons; and I take leave to say I should deeply regret that any expressions in these remarks (written as they are in honesty of purpose) should pain any officers of the Admiralty or any contractors under it. For not looking into the matter with the same statistical scrutiny as personal interest has led, and practice has enabled me, cannot be charged against the former, seeing it may not have been required of them as a duty or obtainable from their calling; and for not publishing it, if known to them, cannot perhaps form a charge against the more favoured of the latter, whose personal interest in this commercial country is generally considered of primary importance.

Some of the views contained in this Letter have been withheld for years, until I could meet with some public and authentic document whereon to rest a portion, at least, of my arguments and opinions; which might vouch for the truth of the main facts on which I found, and prevent my Letter being pronounced an unnecessary interference with the duties and interests of others, merely acknowledged as having been "received and laid before my Lords Commissioners of the Admiralty;" and then thrown aside as unworthy of further attention.

Such a public and authentic document has at last appeared on the subject of "Marine Engines," being parliamentary returns granted on the motion of the Hon. Capt. Gore, R.N., and ordered by the House of Commons to be printed, 16th June, 1843.

Capt. Gore having applied to me for some aid in framing his notice of motion in the House of Commons, I on the instant drew the document which forms my Appendix A. The uncertainty of that honourable member's obtaining an order for any returns, if he asked so much, induced him to alter the form considerably; and hence the curtailed appearance of the parliamentary return, which want some most important columns, and which, if complete, would have furnished the functions of valuable calculations. Had the returns been as specific as I suggested, none of the makers of engines mentioned therein could have had any, the least, reason to complain of the same. As they stand, justice to each of them, as well as to the public, requires further authentic investigation.

By these "returns," defective though they be, most important are facts

furnished. Other facts stated in this Letter may be vouched by documents under your Lordships' control. Others are fairly established from these sources; and for the rest, my word and opinion must be relied on, seeing that I know of no returns in possession of any department of the Admiralty which will give them, however essential they may be to the efficiency and economy of the steam marine.

The "returns" now founded on, shew extraordinary facts.

One favoured London house got orders for 1400 out of 2100 horse power in the year 1840, and the same returns shew at least a probability, that part, if not all, of these engines were one-fifth of their time incapable of performing their work by reason of repairs; and one pair of engines, the Alecto's, have been one-third of their time incapable of any work, whilst one pair of engines of a Scotch house were only one twenty-fourth part of their time incapable by reason of repairs.

I beg to call attention to the returns themselves: they are as follows:—

*"Return to an Order of the Honourable the House of
Commons, dated 15th March, 1843; for,*

*"Returns of the Names of Marine Engine-Makers with whom the Admiralty
"have made Contracts for Engines, from the Year 1839 to 1843 inclusive;
"with the Amount of Horse Power ordered from each of such Engine-
"Makers in each Year;—of the Original Cost of the Engines of Her Majesty's
"Steam Vessels Alecto, Devastation, Geyser, Cyclops, Prometheus, Poly-
"phemus, Vesuvius, and Stromboli, specifying any extra Charge beyond
"Contract Price, and if such Engines were fitted with an indicator;—of
"Repairs, and the Cost of such Repairs, and the Number of Days and Hours
"any of said Vessels were incapable of performing their Work, in consequence
"of such Repairs;— of the Names of the Makers of each of the Engines of
"said Vessels.*

"Ordered, by the House of Commons, to be Printed, 16th June, 1843.

*"A Return of the Names of Marine Engine-Makers with whom the Admiralty
"have made Contracts for Engines, from the Year 1839 to 1843 inclusive;
"with the Amount of Horse Power ordered from each of such Engine Makers
"in each Year.*

Name of Engine-Makers.	Amount of Horse Power in the Years				
	1839.	1840.	1841.	1842.	1843.
Mr. John Laird	265	..	..	..	..
Messrs. Maudslay, Son, and Field	200	400	420	2230	..
Messrs. Seaward and Capel	800	1400	..	1035	..
Messrs. Miller and Ravenhill .....	..	..	286	430	..
Messrs. Fawcett and Co.	300	..	..	350	..
Messrs. Fairbairn and Co. ....	..	300	20	470	..
Mr. Robert Napier .....	..	..	300	..	..
Messrs. Boulton and Watt .....	..	..	300	..	..
Messrs. G. and J. Rennie .....	..	..	..	450	..
Messrs. Scott and Sinclair .....	..	..	280	..	..
Mr. Robinson .....	..	..	..	220	..
Messrs. Acraman and Morgan .....	..	..	20	..	..
Messrs. Penn and Son .....	..	..	..	260	..

*"Admiralty,
"26th May, 1843.*

*"WM. EDWARD PARRY,
"Comptroller of Steam Machinery.*

“A Return of the original Cost of the Engines of the following Steam Vessels, specifying any extra Charge beyond Contract Price, and if such Vessels were fitted with an indicator; of Repairs, and the Cost of such Repairs, and the Number of Days and Hours any of said Vessels were incapable of performing their Work, in consequence of such Repairs; and of the Names of the Makers of each of the Engines of said vessels

Names of Vessels.	Original Cost of Engines.	Extra Charge beyond Contract Price.	Indicator.	REPAIRS:			Cost of Repairs.	Number of Days and Hours the Vessels were incapable of performing their Work in consequence of such Repairs.	Names of the Makers of the Engines.
				Nature.	Period over which they extend.				
					From	To			
	£.	£.					£. s. d.		
Alecto.....	10,700	297	not fitted	... to engines, boilers, and paddle-wheels.	13 Jan. 1843	31 Mar. 1843	1158 4 4½	393	Messrs. Seaward & Capel.
Devastation	18,650	681	ditto	ditto	Dec. 1841	ditto	249 10 8½	92	Messrs. Maudslay, Son, & Field.
Geyser	13,933	410	ditto	ditto	July 1842	ditto	89 7 3½	50	Messrs. Seaward & Capel.
Cyclops	22,103	906	ditto	ditto	Oct. 1840	ditto	800 7 10	164	ditto.
Prometheus	10,700	315	ditto	ditto	March 1840	ditto	1012 1 5½	353	ditto.
Polyphemus	10,700	214	ditto	ditto	June 1841	ditto	240 7 11½	162	ditto.
Vesuvius*	13,480	400	ditto	ditto	Oct. 1840	ditto	37 19 0½	38	Mr. Robert Napier.
Stromboli†.....	13,480	nil.	ditto	ditto	Sept. 1840	ditto	68 6 3½	51	ditto.

“Admiralty,

“26th May, 1843.”

* This ship has steamed as much, if not more, than any steamer in this return, and with the smallest possible consumption of fuel.

† The Stromboli's engines might also be quoted as favourably as Vesuvius; but that, by “quarter-deck” authority, a hot cast-iron plumber-block was cooled with cold water, and, of course, she required repair, after teaching seamen the lesson that cast-iron in a steam-engine is like cast-iron in a ship's gun, which is never now so cooled.

“WM. EDWARD PARRY,
“Comptroller of Steam Machinery.”

By taking the names of each steamer specified in these Returns, and dividing the days of their respective times of duty by the time that each is therein stated to have been incapable of duty, in consequence of repairs, we find the fraction of incapacity of each to be as follows:—

Alecto	incapable more than $\frac{1}{3}$ of her time.				
Devastation	} each incapable about $\frac{1}{5}$ of her time.				
Geyser					
Cyclops					
Prometheus					
Polyphemus		ditto	ditto	$\frac{1}{4}$	ditto.
Vesuvius		ditto	ditto	$\frac{1}{24}$	ditto
Stromboli		ditto	ditto	$\frac{1}{18}$	ditto.

It will be seen from the returns quoted, what engine-makers are most esteemed at the Admiralty; which of these makers have supplied the cheapest and most efficient engines; and which the most extravagant and least capable of duty.

The following may be looked upon as a concise view of the cost and worth of a pair of engines furnished by each of the makers referred to:—

	Alecto 200 H. P.	Devastation, 400 H. P.	Vesuvius, 280 H. P.
Price per horses' power, including cost of repairs for equal times, but not calculating loss to the service for non-efficiency	£ 59 s. 10	£ 49 s. 10	£ 49 s. 14
Efficient as steamers.....	$\frac{2}{3}$ of her time.	$\frac{4}{5}$ of her time.	$\frac{33}{40}$ of her time.
Incapable of steaming owing to repairs	$\frac{1}{3}$ ditto.	$\frac{1}{5}$ ditto	$\frac{1}{24}$ ditto.

I own that in constructing this table I have taken the best and the worst engines on the list; and that I have, unfortunately, but one pair of Messrs. Maudslay's to refer to.

Therefore let me make another table, including all the ships specified in the "Returns."

	Mean per Centage of Efficiency.	Orders given to each of the Makers out of 10,736 H. P. in $4\frac{1}{2}$ years.	Comparison of Price per Horse Power.	
			Price Paid.	Real Value per H. P. exclusive of any Charge for Loss of Service.
Alecto, Geyser, Cyclops, Prometheus, and Polyphemus	Per Cent. 76	Per Cent. 33	£. 56 s. 12	£. 40 s. 0
Devastation	80	33	49 10	42 0
Vesuvius and Stromboli}	95	3	48 18	48 18

In any way that such tables be constructed from the materials furnished by these Parliamentary returns, the enormous disparity in the horse power paid for, and the efficiency derived from it, will be apparent; as well as the extraordinary preference shewn to makers of the least efficient engines. And were proper returns furnished from all the steamers in Her Majesty's service, similar incongruities would stagger your Lordships.

How is this? and why is this? A look into the manner of making the contracts, and into the blanks in the statistical department of Her Majesty's Steam Marine, will supply the answers.

On neither of these matters am I fully informed. Had I access to the log-books, reports, and documents, this Letter should not be so feeble.

From the largest number of steamers in the world, under your control, with your Lordships' power, and the nation's pocket, perfect statistical tables might be submitted before another order be given for engines.

On the 5th May, 1837, I had the honour to urge on the attention of the Admiralty the expediency and necessity of having most minute returns from each steamer. I could not then recommend these with the urgency I am now called on to do. But I do assert, confidently, that such returns, collected into succinct and distinct tables, would benefit the service. Those able engineers, Mr. Lloyd, Mr. Murray, Mr. Dinnen, and Mr. Kingston, would each and all of them find the advantages of such statistical information, and your Lordships would be able to form your own opinions on the worth or worthlessness of what you have submitted to your decision.

My Lords, I could lead you over a variety of fancies with which the service has been troubled. To mention only a few.

Formerly a great house near Birmingham were the favourite makers of marine engines; and because they recommended no larger engines than a pair of 240 for any ship, the service ran some risk of having none more powerful: but that a party, trying to throw the contracts more open, discovered that that house had recommended just such engines as could be passed in pieces through the small canal locks of their line of transport. A pair of engines so ordered of the thus recommended size are, I believe, now in a smaller ship, the *Hydra*; and, perhaps, it is to that cause that the *Cyclops*, which was to have had them, cannot carry guns on her main deck,—a defect, by the bye, observable in her sister-ship, the *Gorgon*.

In days of yore the Admiralty had at least a wholesome fear of suffering from new inventions: an honest care that the public money should not be squandered in untried schemes. It is true their fears were often unfounded, but their care of the public money was at all times praiseworthy. The Admiralty being the highest mark for a mechanical schemer, has always been, and always will be, aimed at. Hence the necessity for adopting the old rule of caution, and a practice of allowing private owners or public companies to be the first introducers of novelties.

Now, however, see the change which has come over our Admiralty. Novelty is sought for, and how has efficiency been sacrificed to obtain it?

The value of a pair of engines which your Lordships pay for, consists in their efficiency, readiness for service, and current economy. The puff of novelty, and all the dust the puffers may throw in the eyes of the executive officers, such as a small engine-room, light engines, pretended small consumption of fuel, and all the fallacies about short-stroke engines and short connecting rods, though bolstered up by the name of a distinguished *astronomer*! must soon come to nothing, though ignorance or private and hidden interest may still for a short time prevail.

Where are there to be found any steamers doing their work with the regularity, or in any other attribute to compare with the line of steam packets from Liverpool to Boston *via* Halifax? Which of Her Majesty's steamers will surpass in the essential attributes above referred to, Her Majesty's steamer *Vesuvius*?

Your Lordships have the means of proving the last ship; and I have annexed Appendixes B and C to prove the others just referred to. As their work and slight consumption of fuel have not been equalled, the documents require no further note or comment from me.

All of these have engines made on well-known and long-tried principles of construction, and it is a remarkable fact, that few, if any, private owners or public companies have yet ventured to follow the lead of the Admiralty in the adoptions of questionable novelties¹.

Some months ago a move was made to puff the expansive action of steam just as if it had not been known and practised years before, and as if steam ships in commission had not been fitted with the gear necessary for using it. The *Vesuvius* and *Stromboli* were perfectly fitted with the same; and when I was told at the Admiralty, about two years ago, that the latter had been short of coals on one of her passages, I was not informed that her expansion gear was never used². Lieut. Hoseason, R.N. has, however, opened the eyes of the public, by a pamphlet, in which he founds all his computations on the *Berenice's* voyage to India; and there can be no doubt that had the expansion gear been used in those of Her Majesty's ships properly fitted with the same, when not in haste, they might have saved *many thousands per annum of the public money* by only dropping their speed about $\frac{1}{8}$ th or $\frac{1}{9}$ th.³ I shall revert to this below.

The thirst for novelty which sprung up at the Admiralty appears to have induced a distinguished London house to attempt its gratification. Hence the service is now in possession of *four* cylinders in some of their engine-rooms, whilst with less space, less weight, less expense, less chance of breakage, and less fancy, all the advantages of the expansive action of steam and equal power, could have been had by two cylinders.

The manner in which Tenders are called for, opened, and treated, is worthy of some notice.

The contracts for marine engines are made in a manner quite peculiar, unlike all other contracts for the public service. They are made at that office in the Admiralty where no other contracts are made for any of the many supplies and stores for the navy.

The tenders are, or have often been, opened not in one day and hour, but without regard to the strict rules of tender and contract known and practised in other departments of Government.

The clause sometimes thought necessary for protecting the public, viz. that the Board does not bind itself to take the lowest tender, has not been inserted in the application, and the lowest tenderers have been disappointed.

After tenders have been given in, and after some of the contracts have been made, favoured ones of these very contractors have been allowed to tender for more engines, as in the year 1840, when a London house, having obtained an order for two or three pairs of engines, obtained a further order for two more pairs of engines in the following October by reducing their tender, making orders for five pairs of engines, &c. at one time; no other engineers having had any chance of amending their tenders, or of offering for these other engines.

Contracts have been made in the latter half of the year 1842 for nearly 120,000*l.* worth (I question the last word) of engines without the chance of competition being given to other engineers, not even to those to whom the Government are solely indebted for a great reduction in the price of marine engines; and to the agent of one of whom your secretary officially wrote, "2 July, 1842, that in the event of engines being required, invitations for tenders will be sent to him."

¹Her Majesty's ship *Thunderbolt* has been, by order of the Admiralty, furnished with direct action engines, by the maker of *Vesuvius'* and *Stromboli's* beam engines. The result in this case of equal *workmanship* will try the value of the *principle*.

²Robert Napier made the Honourable Company's steamer *Berenice* with expansive gear in 1836.

³Strange to say many of the largest steam-ship owners do not know the difference between mere throttling of the steam and *working expansively*. Mr. Watt's views of the latter may be seen in Sir David Brewster's edition of Robinson's *Mechanical Philosophy*, vol. iii. p. 129, published 1822.

It appears from the Returns that the favoured house of the year 1840 received orders for 1400 horse power: 700 horse power being all the engine power ordered from (two) other houses that year. More houses were certainly called upon for tenders; but a reference to documents under your Lordships' control will make apparent whether partiality was or was not shewn to that house. They will shew that Robert Napier tendered for engines with 67-inch cylinders, fitted either in the Clyde, or *at Woolwich, or other suitable yard*, at the price of 13,500/. He got no orders, though the favoured house got orders for two pairs with 65-inch cylinders at the price of about 13,983/. each pair, or 27,966/. for the two pair—smaller engines at a higher price! This was in June 1840. It will also be seen whether shortly thereafter,—time having elapsed during which they may have known the prices tendered by other houses,—they were or were not allowed to amend their tender for a third pair and strike off $2\frac{1}{2}$ per cent, making the price for such third pair 13,700/.; and whether it is true that Robert Napier had no opportunity of offering at a reduced price, and that the third pair were ordered from them. If so it will be seen that Robert Napier was asked and tendered for 67-inch cylinders, but that the favoured house of 1840 (power being taken into consideration) got 4000/. more of the public money on this transaction alone, contrary to the known principles of fair tender and contract. Why? Was it because they made better engines? The Parliamentary Returns shew that the engines of the more favoured house have been $\frac{1}{3}$ th and $\frac{1}{4}$ th, nay, one pair referred to were fully $\frac{1}{3}$ d of their time incapable of performing their work in consequence of repairs; whilst of the two pair of engines made previously by the more neglected house, one pair have only been incapable in consequence of repairs $\frac{1}{18}$ th and the other pair $\frac{1}{24}$ th part of their time!

It may reasonably be presumed that orders for the other engines that year were given, either because of secret amendment of tender, or relying on the alleged value of the principle of construction, or for some other such cause.

It must be borne in mind that both Stromboli and Vesuvius had at this time been tried; and I may say, that although I did not see Stromboli's speed ascertained, I did see that of Vesuvius observed by the late chief engineer, Mr. Ewart, when she was loaded with the weight of her guns, six months' shot, shells, stores, &c. She was the fastest steamer then in the navy: 10·999 miles per hour, or within a mere thousandth part of 11 miles per hour, deeply loaded.

Let it not be said, my Lords, that Robert Napier's work was at that time little known at the Admiralty. Abundance of statistical facts were obtainable from the commercial marine had they been looked for.

Let it not be said that the more favoured house of that year had invented, and were the only makers of, an improvement in the principles or construction of ship's engines. Engines of an uncommon construction were certainly under the title of the "Gorgon" principle re-introduced by the favoured London makers (but this principle was long before known and practised, and long before abandoned, in Scotland);⁴ and, besides all this, Robert Napier was ready, and offered to construct engines on this or on any other plan the Admiralty preferred.

Was it that "Gorgon" engines, or even London made engines were alleged to consume less coal? No; for the Admiralty appear to have had no statistical returns from which either to refute or verify the allegation. I have seen an official return of fifty-eight steamers of the aggregate power of 10,295 horses afloat, wherein the engineer officers, 24th August, 1842, intimated as to fuel, that "this depends materially upon the kind and quality of the coals used," and stated, "as far as they were able, the quantity of fuel expended by each per horse

See the credit given to the late Mr. Gutzmor, of Leith, by the president of the Institution of Civil Engineers, at the first annual meeting of that Institution, in January 1843.

power." Every steamer in that return, whether old or new, in good or bad condition, large or small, fast or slow (and the speed is as essential a function in the calculation as the coals), is said to consume "eight pounds per horse power per hour." It could not, therefore, reasonably be on the score of fuel.

Certain reports prejudicial to Scotch engines have been industriously, and with desperate dishonesty, circulated as to their consumption of fuel, by London makers whom I could name; and, if both theory and facts have been overlooked, such reports may possibly have influenced the Admiralty in withholding orders from Scotland, especially as your Lordships do not appear to have either the theory or such important statistical information collected and submitted to you. I therefore take leave to point to Appendix B, and state that by that document the consumption of Welsh coals, outward across the Atlantic, by Robert Napier's engines, has been, when going at full speed, not availing of expansive gear, $5\frac{3}{100}$ lbs. per horse power per hour; and the consumption, returning home, with inferior (principally Nova Scotia) coals, $7\frac{6}{10}$ lb.; and had it not been that all the steamers of that line "carry on" at their utmost speed, to make quick passages, the expansive gear could have been used, and the consumption reduced below 4 lbs., merely dropping the ship's velocity by perhaps $\frac{1}{8}$ th or $\frac{1}{9}$ th. Let me repeat, Robert Napier's tenders for engines could not reasonably have been rejected on the score of consumption of fuel.

Objection was certainly more than once made to the sending of Her Majesty's ships round to the Clyde to be fitted with their engines.

It was verbally and industriously reported, that the ships were injured in the Clyde. Your Lordships will find no *official* report of defects occasioned, or of repairs necessary, to either Vesuvius, Stromboli, or Thunderbolt, when docked in Her Majesty's yards, before being commissioned: and it does appear more than strange that such things should be talked of to the prejudice of the makers of superior engines, without a document whereon to found.

It has been alleged that the expense of sending Her Majesty's ships to the Clyde has been too great. If your Lordships will call for a full statement of the expenses which you have actually paid for ship-keeping in the Thames, and of the favours conferred on London makers,—such, for instance, as sending them an old ship-of-war as a hulk and the like,—and for the cost and *gain* of sending Vesuvius, Stromboli, and Thunderbolt to the Clyde; and, then, permit me to suggest an audit on the statement, I entertain no doubt of being able to shew how unfounded the allegation is,—and that the now reported proposal to deduct 1*l.* per horse power from the price of engines fitted in future on the Clyde would be worse than unwise.

But this allegation of extra expense, even if it had been just, could not (may I say ought not?) to have prevented the acceptance of the Scotch tenders referred to, to fit the engines on board in the Clyde, or at *Woolwich, or any other suitable place* the Admiralty might prefer.

Some stress has been laid on the alleged lightness of engines constructed on these new principles without sway beams. The fact is, that what the favoured engineers of 1840 saved in weight of their engines,—and, it is said, *even more weight*—was added in ballast or kentledge, to keep the ship up, when out of coals and under canvas. Were Appendix A filled up, this would appear. To rest on such a quality in engines, when the ship must still have ballast, seems worse than foolish and unmeaning.

It does appear, my Lords, that those who have (nominally) invented most, and puffed their inventions industriously, have been most successful of late years in obtaining orders from the Admiralty.

In the year 1842, there were two houses more highly favoured than others. One of them received orders for 1035 horses' power, and the other 2230 horses' power. The maker of the best engines on the "Return" got no orders that year,

although he tendered *to put the engines in the limited engine-room appointed for them by the Surveyor of the Navy.*

The size of engine-room is here noticed because the opinion is entertained by the surveyor that short engine-rooms and short ships are the only ones for the naval service.

My disputing the accuracy of opinion entertained by so distinguished a ship-builder, would be of no use in this Letter. Robert Napier complied with his limits, and that is enough for my present purpose. I will only say, that, so long as there is such a disparity between the locomotive duty and efficiency of such of Her Majesty's steamers and that of the commercial marine, the limitation is questionable; and, in my humble opinion, the public cannot expect to have the short passages for troops, the short chases, and the short wars, which they might otherwise reasonably look for.

How far the inefficiency of certain ships in the Returns is due to the principle of construction of the engines, thus necessarily accommodated to such reduced limits of space, may be ascertained when the repairs are stated more in detail than they are in the Returns, as *generally* "to engines, boilers, and paddle wheels," but not until then.

Care should be taken in every steamer to have always the most efficient arrangement of engines, and space left to get well round, and to all parts; leaving also a comfortable engine-room for the important duty to be done there.

The price paid, or to be paid, for the engines ordered in 1842 (and which ought from their arrangements to be *cheaper* than sway-beam engines) is as follows:—

The 5445 horses' power (all I believe of some new construction for saving space) must amount together to the sum of about 272,000*l.*; and if the repairs of engines of merely the two favoured houses is allowed, as in page 8 hereof, to form part of the price, as it ought, the 3265 horses' power ordered from them will cost much more than 165,000*l.*; and, above all, there is no certainty that repairs may not keep them unfit for service from one-third to one-fifth or one-sixth of their time.

What I have said of the facts regarding Vesuvius and Stromboli within the knowledge of the Admiralty, in 1840, applies equally to the year 1842. They had many more favourable facts within their reach when, on the 24th August of that year, tenders were called for. The monthly returns from all of Her Majesty's steamers were there. The contractor for the making of the steamers between Liverpool, Halifax, and Boston, which have done their work so well, was known to be the contractor who made the Vesuvius and Stromboli's engines;⁵ and the *Nautical Magazine* for August 1842 contains a statement of the duty of these ships from July 1, 1840, to June 4, 1842. The table of passages referred to in that article I have copied, added thereto the duty of these ships down to the 14th December last, and printed in Appendix C.

Of the engines ordered this year, 1842, it will be found that about 120,000*l.* worth (I question the last word) was ordered from two houses, without even the *chance* of competition being afforded to other approved contractors.

The principles of construction, the practical action and mutual relation of the engines ordered in 1840 and 1842, are well worthy of investigation. One favoured house published largely, and quoted confidently, the opinion before referred to, of an eminent *astronomer!* with about as much judgment as if a master had quoted Sir Isaac Newton upon stowing the hold, or a seaman had adduced the opinion of Commissioner Linn upon the proper time to take in sail.

The alarming inefficiency of *so many new steamers* as appears on the Parliamentary returns is due to one of six causes.

⁵As well as Her Majesty's ship Thunderbolt's engines, on the direct action called the "Gorgon principle."

1st. The novel principle of construction of engines thought necessary for accommodating them to the limited engine-room.

2d. The attempt to have light engines in ships which must afterwards have ballast to keep them upright.

3d. Defects in the material and workmanship.

4th. Incompetency of ship's engineers appointed by the Admiralty.

5th. "Quarter-deck" interference.

6th. Some unavoidable disaster.

I believe that all of these may be causes of mischief, but the sixth cause suggested does not seem to have effected the evils so glaringly apparent on the Parliamentary returns.

The first two suggested causes are discussed above. The third appears also to have some application. But for any one to attempt to account for such heavy repairs and loss of service by the fourth and fifth, and to lay the blame on engineers afloat and officers in command, would only shew a bad selection of the one, and an inexcusable interference of the other.

Permit me here to make a few remarks upon the engineers afloat, an indispensable class of men, upon whose judgment, foresight, coolness, and skill the ship and all on board so often and so entirely depend for safety. A knowledge of the duty required, and acquaintance with the mainspring of valuable men's actions and exertions, would suggest a different treatment of the engineers in war steamers, even to those who know little of these workmen. And the intimate acquaintance I have with the habits, studies, associations, feelings, motives, principles, attainments, industry, and ultimate prospects of many men I have known in the workshop and met at table, even with commissioned officers of the navy, enables me to assert that if the chief engineer's rank were raised, so as to place him in the position of a gentleman (not rated below an inferior mechanic, the carpenter), and his assistants encouraged with hope of such a step in course of faithful and useful service, without any additional pay, the Admiralty would soon have a change in the present men, and obtain in future a better and more respectable class of engineers.

It must be little known at the Admiralty how many respectable gentlemen's sons, having found professions overstocked, or commercial enterprise doubtful; and how many of nature's gentlemen, with master minds, are within the mole-skin jackets, which are seen in the best of our engine factories.

Too often is it supposed that naval officers may attain, by six month's observation in a factory, the same information which a workman, by years of apprenticeship and subsequent servitude, has grown up with. The supposition is about as erroneous as would be a landsman's fancy that mere observation would qualify him to pass an examination for seamanship, and to prove on board that he could "hand, reef, and steer."

The commander of a steamer can, in truth, no more reasonably be expected to supersede or direct the engineer, than he could be expected to supersede or direct the surgeon in his operations.

Many of the engineers, even now in the navy, with talents and attainments at least equal to, if not surpassing, those of their commanding officers, feel their low rating, and suffer from the treatment it necessarily subjects them to. With duties unquestionably more difficult and onerous than most of the commissioned officers on the quarter deck, their influence is small and their encouragement still smaller. Would not the light of a Watt, a Woolf, a Maudsley, in such circumstances under a pennant, have been liable to extinction by some quarter-deck "lack beard?"

All that has been done in the navy for this indispensable class of men is to pay them, stamp an engine on their uniform buttons, and allow them to mess together.

Many engineers afloat in the commercial marine are, or may soon be, capable of all the duties of their commanding officers in navigation, astronomy, marine and land surveying. Such men would gladly enter the service if they saw a prospect of rising, by ever so slow degrees, to rank with a lieutenant, master, or purser. That hope is denied them, and numbers are working in factories at lower wages, rather than lose caste among their connexions, by taking a rating so humble, and a position so obnoxious to irresponsible treatment, as engineer on board a war steamer. Neither would they risk the *mind and soul-saving principle of HOPE*.

The Parliamentary returns so much founded on are defective in many particulars. Among the wants, there is no statement as to consumption of coals. That such statistical information should be had more fully and more accurately than is afforded by the general statement of "8 lbs. per horse power per hour" (24th August, 1842) will appear evident to your Lordships, when I say that supposing only the 10,295 horses' power there specified be under steam one fourth its time, one pound more or one pound less consumption of fuel per horse power will vary the annual cost to the country 10,000/. in coal money alone. Your Lordships can easily have that matter worked out.

The consumption of coals in the steam marine (exclusive altogether of coals sent to China and the East Indies) must have exceeded 50,000 tons⁶ last year, and cost above 50,000/. in money.

Now, except perhaps those of Her Majesty's steamers doing Post Office packet service, almost the whole of the steamers in commission might be fitted to avail of the expansive action of steam. Then they would be able to accomplish long voyages when required, not only with reduced expenditure of fuel, but with the certainty of not having to turn back for coals, as they have been in the Mediterranean when they actually have had the means on board to prevent such a calamity. They might also, when not in haste, economise their fuel by the same provision, and yet always have full steam power at command for any sudden or lengthened emergency of service. They, moreover, would be kept in more efficient trim, the water-line would be less varied, and the engines not subjected to the same consequent irregularity of speed.

It must be remembered that the demands for steam power will probably increase annually; and that any question relative to a reduction in consumption and cost of fuel is of the utmost consequence both as regards economy and efficiency. The question of fuel at full speed, and when working expansively, involves not only the saving of *many thousands* of pounds during peace, but the greater saving and greater efficiency in times to come.

But, my Lords, the question of fuel, important as it is, is of less consequence as regards steamers in the Royal Navy, than a searching inquiry into their efficiency or non-efficiency, and the causes and probable consequences of the same.

In the foregoing lines I have suggested six causes for the *alarming inefficiency of so many NEW steamers*, and I respectfully urge the matter on your Lordships' serious attention.

Let me not be blamed, my Lords, for writing the present Letter, and for the share I individually have taken in furthering the purpose of the Honourable Captain Gore when he proposed calling for the Returns now founded upon. But for these, your Lordships might never have known the inefficiency, irregularity, and extravagance which have thus been brought to light. You might never have known how unnecessarily coals are wasted, or been induced to inquire into

⁶Mediterranean 20,000 tons.
Home Stations 20,000 —
Other Stations not in India .. 10,000 —
China and India, *not known to me*,

the whole subject of original cost, annual maintenance, and current economy as regards coals and speed. You might never have known that of two new steamers, one, the Polyphemus, has been, out of only 1 year and 293 days, so much as 162 days, or about $\frac{1}{4}$ th of her time, incapable of performing her work, in consequence of repairs; and the other, the Alecto, out of only 3 years and 78 days, so much as 1 year and 28 days, or more than $\frac{1}{3}$ d of her time incapable of performing her work from the same cause. Nor would you have been sensible of the expense of such repairs, and how they enhance the actual cost of the engines; and of the fact that the Admiralty has been paying the dearest price for the most inefficient machinery. Such, indeed, as was scarcely able to go to, or keep at, sea under steam. The national exchequer has paid for a course of procedure, which, by its condensed extravagance and inefficiency, must have brought any private owners or company to bankruptcy.

But lest I be charged with making an invidious distinction, in pointing particularly to these two vessels, do, my Lords, but cast your eyes again over the Parliamentary Returns, and there,—whether from defects of principle, or workmanship, or favouritism, or ignorance, or gross mismanagement,—six of only eight of Her Majesty's new steam ships, specified in the Returns, go far to rival each other in the field of incompetency.

Misplaced confidence in a steamer's efficiency might defeat the most important *political or naval evolution*. The cost of engines, were it even doubled by payments for repairs, may be in many cases of little moment when compared with the urgencies of the service; for when steamers arrive out on distant foreign stations, their fitness for duty is the main point. What I may ask, would the high interests of the empires have suffered had steamers, $\frac{1}{3}$ d, $\frac{1}{4}$ th, or even $\frac{1}{5}$ th of their time, totally unfit for steam locomotion, formed part of the squadron under Sir William Parker in China; and had he, confiding in such vessels, trusted himself on board one of them to perform a distant voyage, (such as Commodore Bremer took to Penang, after having been at Calcutta to arrange with the Governor-General the plan of that momentous campaign), found himself in the ocean with his engines out of effective condition, and requiring 18 days to perform the work which ought to have been done in $\frac{1}{3}$ d of that time?

But expense, loss of time, and even impediments to the service in China, are still light in the balance when we consider that two such great nations as England and France are competing for the steam rule of the ocean.

On these grounds I humbly submit that I am fully entitled to seek your Lordships' attention.

My own individual and direct personal interest in the topics discussed here is deeply engaged—I state it without reserve; my procedure in regard to the whole subject matter of this Letter involves to me most important pecuniary interests; and although I have endeavoured to shew, fairly and honestly, what is wrong as regards the public, and how that wrong may be avoided for the future, I fear not the charge of personal advocacy; yet have I endeavoured to avoid such a charge.

The Letter I have thus written is, I flatter myself, unfair to no one. I have avoided any *ex parte* statements which tend to pervert facts and mislead your Lordships. Every engineer is inclined to eulogise his own work; and certainly, as one of the body, and agent for Robert Napier, I am inclined to compare his engines, which have been not less than $\frac{1}{18}$ or $\frac{2}{34}$ of their time quite fit for important service, with all or any others named in the Returns, which have been only $\frac{4}{5}$ ths or $\frac{2}{3}$ ds of their time equally serviceable. Your Lordships' Returns are the only true criterion, and I will stake all my claim to your notice on the same; for no panegyric of mine could by any possibility be so calculated to benefit myself or do my employer (who, I state unequivocally and distinctly, knows nothing whatever of this Letter) more ample justice than is merited by the face

of the Parliamentary Returns.

Had all the evils been known to your Lordships, justice had been accorded long ago, and I should have been hundreds, indeed thousands, richer this day, If I have jeopardised, either your Lordships' favour, or my connexion with Robert Napier, by thus writing candidly, it is because I personally and pecuniarily feel deeply. If, with the fear of putting official people out of their way, I had shut my eyes to facts and arguments, clear to me as the sun at noon day, and eclipsed to your Lordships only by the dense medium through which you could hitherto regard them, I should have, indeed, been culpably simple. Therefore I solicit your Lordships' personal serious consideration of this Letter, and Appendix A especially, in connexion therewith; and I have no doubt your Lordships will see how necessary it is that accurate statistical data, on the important topic herein discussed, be periodically and minutely collected, systematically arranged, and presented to your Board in tabular forms; and that it is no less a matter of national policy and economy than of equal individual justice, that sound views should prevail in, and economy and efficiency be encouraged by, that department of Her Majesty's service over which you preside.

"Multum futuris relictum est!"

I shall be happy to wait upon your Lordships, if desired, that you may make the truth or fallacy of this Letter apparent.

I have the honour to be, my Lords,
Your Lordships' most obedient humble servant,
ALEXANDER GORDON.

22 Fludyer Street, Westminster,
12th July, 1843.

APPENDIX A

Original Memorandum for the Honourable Captain Gore, R.N. M.P.

To move for a return of the number and names of the Marine Engine Makers to whom the Admiralty have given orders, or with whom they have made contracts, for engines during the years 1839 to 1843 inclusive, with the amount of horse power ordered from each of such Engine Makers in the respective years.

Also, for a return of Her Majesty's steamers Alecto, Devastation, Cyclops, Megæra, Prometheus, Polyphemus, Geyzer, Vesuvius, Stromboli, Gorgon, specifying the following particulars:—Original Cost—Extra Charge, if any, beyond Contract price—Whether the Engines were originally fitted with Expansive Gear, or so fitted subsequently, or at present not at all—What Houses were invited to tender—Price of Engines and Boilers, &c. per horse power ordered before Scotch makers were applied to, and the price after the competition was thrown open to the latter—Tonnage of Ship, O.M.—Power of Engines, and whether ascertained by the Indicator—Number of miles steamed during the given time in return—Rate of steaming in nautical miles in smooth water at load-water line—Proportion of Engine Power ordered, to Tonnage—Consumption of Fuel per nautical mile, and per hour—Weight of Engines and Boilers per horse power—Weight of Ballast, or of Kentledge, in hold—Repairs, specifying the number of days and hours incapable of performing their work in consequence of being under repair—Maker of Engines.

APPENDIX B.

"Abstract of Log (Engineer's and Sailing) per Steam Ship Hibernia, Liverpool to Halifax, N.S."

From Engineer's Log.					From Sailing Log.				
Date	Revolutions per min.	Coals per Hour.	Knots per Hour.	Coals per 24 Hours.	Distance per Day.	Wind.	Lat.	Long.	Remarks.
1843. April 19	Aver.	Average cwt.qrs.	Aver.	ton.cwt.	..	..	..	..	Sailed from Liverpool at 1h 30m P.M. At 2 o'clock, 21st, A.M. Cape Clear, from which take departure.
20	11½	23 0	9	26 9	..	N.N.E. ½ E.	..	..
21	11¼	22 0	9	26 8	94	..	..	..	Strong breeze, heavy swell.
22	9¼	19 0	6½	22 16	154	N.N.W.	50 41	15 38	Gales, and heavy cross sea.
23	9¼	19 0	6½	22 8	154	W. by N.	50 11	19 29	Ditto and heavy head sea.
24	9	19 0	5½	22 16	130	W. by N.	49 44	22 25	A.M. ditto; P.M. strong gales, cloudy
25	9½	19 2	6	23 12	145	N.W.	48 55	25 44	Light winds and cloudy
26	11½	22 1	7½	26 16	180	S.W.	47 53	29 57	Ditto ditto and clear.
27	11	25 2	9	30 12	212	N.N.E.	46 40	34 40	Ditto ditto and clear.
28	13½	26 2	9½	31 14	221	S.	45 32	39 42	Ditto ditto and clear.
29	15¼	30 0	10¾	36 0	258	S.	44 46	46 3	Ditto ditto and foggy.
30	15	31 0	9¾	37 4	237	N.W.	44 14	51 35	Strong winds and foggy.
May 1	14¼	30 3	10¼	36 16	247	N.N.E.	44 9	57 40	Light winds and clear.
2	16¼	34 0	11¼	40 16	282	..	..	..	Arrived at Halifax 11 A.M.

N.B. Welsh coal used.

"Abstract of Engineer's Log per Steam Ship Hibernia, from Boston to Halifax and Liverpool."

From Engineer's Log.					From Sailing Log.				
Date.	Revolutions per min.	Coals per Hour.	Knots per Hour.	Coals per 24 Hours.	Distance per Day.	Wind.	Lat.	Long.	Remarks.
1843. May 16	Aver.	Average cwt.qrs.	Aver.	ton.cwt.	..	..	..	..	Sailed from Boston 1h 30m P.M., and running for Halifax arrived at Halifax at 4 A.M.; sailed again at 3 P.M.
17	13¼	33 0	9¼	37 19	..	..	..	..
18	14	36 0	10½	28 16	..	..	..	..
19	14¼	36 1	10¼	38 1	200	..	..	..
20	15¼	38 0	10¾	45 12	257	N.W.	45 45	52 54	Light breezes and clear.
21	15½	38 0	10¾	45 12	260	S.S.W. & S.	47 0	46 54	Ditto ditto
22	15½	39 0	11	46 16	262	S.W.	47 51	40 34	DR. ditto and cloudy.
23	16	40 0	11¼	48 0	270	W.S.W.	48 57	33 56	Ditto light breezes and thick.
24	16	40 0	11¼	48 0	274	Variable	50 17	27 11	Ditto strong breezes and ditto.
25	15¾	36 0	10	43 4	237	S.E.	51 59	21 31	Ob. ditto and clear
26	16¾	36 2	10¾	43 16	255	Easterly	51 41	14 39	Ditto light ditto and clear.
27	17¼	36 0	11¼	43 4	..	..	..	..	At 5h 20m A.M. of 27th, Cape Clear N.N.E. ½ E.
28	18	36 0	12	32 8	..	..	..	..	Arrived at Liverpool 28th 6 A.M.

Principally Nova Scotia Coal

APPENDIX C.

Passages to and from Liverpool and Halifax of the British and North American Royal Mail Steam Ships, from July 4, 1840, to June 4, 1842.

Ships' Names.	No. Voy.	Sailed from Liverpool.	Passage.		Ships' Names.	No. Voy.	Sailed from Liverpool.	Passage.	
			Out.	Home.				Out.	Home.
1840.			d h	d h	1841.			d h	d h
Britannia	1	July 4	12 10	10 0	Acadia	6	July 20	10 22	9 21
Acadia	1	August 4	11 4	11 0	Columbia	4	August 4	12 23	11 1
Britannia	2	Sept. 4	11 11	11 3	Britannia	7	Aug. 19	11 20	11 23
Caledonia	1	Sept. 19	12 9	10 22	Caledonia	6	Sept. 4	11 19	10 21
Acadia	2	Oct. 4	11 5	12 4	Acadia	7	Sept. 19	13 11	11 3
Britannia	3	Oct. 20	11 23	11 7	Columbia	5	Oct. 5	13 19	10 26
Caledonia	2	Nov. 4	11 23	11 21	Britannia	8	Oct. 21	14 4	12 6
Acadia	3	Dec. 4	14 17	10 16	Caledonia	7	Nov. 4	11 20	11 23
1841.					Acadia	8	Nov. 19	15 15	11 8
Columbia	1	Jan. 5	13 3	12 0	Columbia	6	Dec. 4	14 17	11 17
Britannia	4	Feb. 4	15 9	12 0	1842.				
Caledonia	3	March 4	14 0	10 18	Britannia	9	Jan. 4	14 12	11 3
Acadia	4	March 20	16 13	12 18	Caledonia	8	Feb. 4	put back	
Columbia	2	April 4	13 3	11 15	Acadia	9	Feb. 19	16 8	12 8
Britannia	5	April 20	13 17	11 1	Columbia	7	March 4	20 17	15 12
Caledonia	4	May 4	12 6	10 18	Britannia	10	April 5	12 22	10 14
Acadia	5	May 19	11 23	10 15	Caledonia	8	April 19	13 21	10 18
Columbia	3	June 4	10 19	10 7	Acadia	10	May 4	14 18	10 8
Britannia	6	June 19	12 5	10 2	Columbia	8	May 19	11 22	9 17
Caledonia	5	July 4	11 5	10 11	Britannia	11	June 4	11 17	10 10

Mean out 13 days 6 hours—home 11 days 5 hours.

Nautical Magazine for August 1842.

Passages to and from Liverpool and Halifax of the British and North American Royal Mail Steam Packet Company's Ships from 19th June to 4th December, 1842, inclusive.

Ships' Names.	No. of Voy.	Sailed from Liverpool.	Length of Passage.	
			Out.	Home.
		1842.	d h	d h
Caledonia	9	June 19	13 16	9 28
Acadia	11	July 5	13 6	9 20
Columbia	9	July 19	10 13	9 20
Britannia	12	Aug. 4	12 15	10 16
Caledonia	10	Aug. 19	11 14	12 11
Acadia	12	Sept. 4	12 9	11 4
Columbia	10	Sept. 20	11 22	11 8
Britannia	13	Oct. 4	13 8	12 17
Caledonia	11	Oct. 19	12 6	10 22
Acadia	13	Nov. 4	11 0	12 15
Columbia	11	Nov. 19	14 23	10 11
Britannia	14	Dec. 1	15 16	11 22