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A Treatise on Navigation by Steam

Following distinguished service during the Napoleonic Wars, the Scottish naval officer and Arctic explorer Sir John Ross (1777–1856) embarked on an abortive expedition to discover the North-West Passage. The existence of the Croker mountains, which he claimed had blocked his path, was afterwards disputed and his reputation suffered. His 1819 account of that voyage has been reissued in the Cambridge Library Collection. Prior to setting out in a steam vessel on a second expedition, for which he would be knighted, Ross published the present work in 1828. Seeking to establish himself as an authority on steam power when the technology was still in its infancy, Ross explores the development of the steam engine, the commercial and military potential of steam navigation, and how this called for a radical change in naval tactics. Illustrated throughout, this is the work of a practical maritime mind, combining both historical and technical detail.

A Treatise on Navigation by Steam

Comprising a History of the Steam Engine

John Ross

CAMBRIDGE UNIVERSITY PRESS

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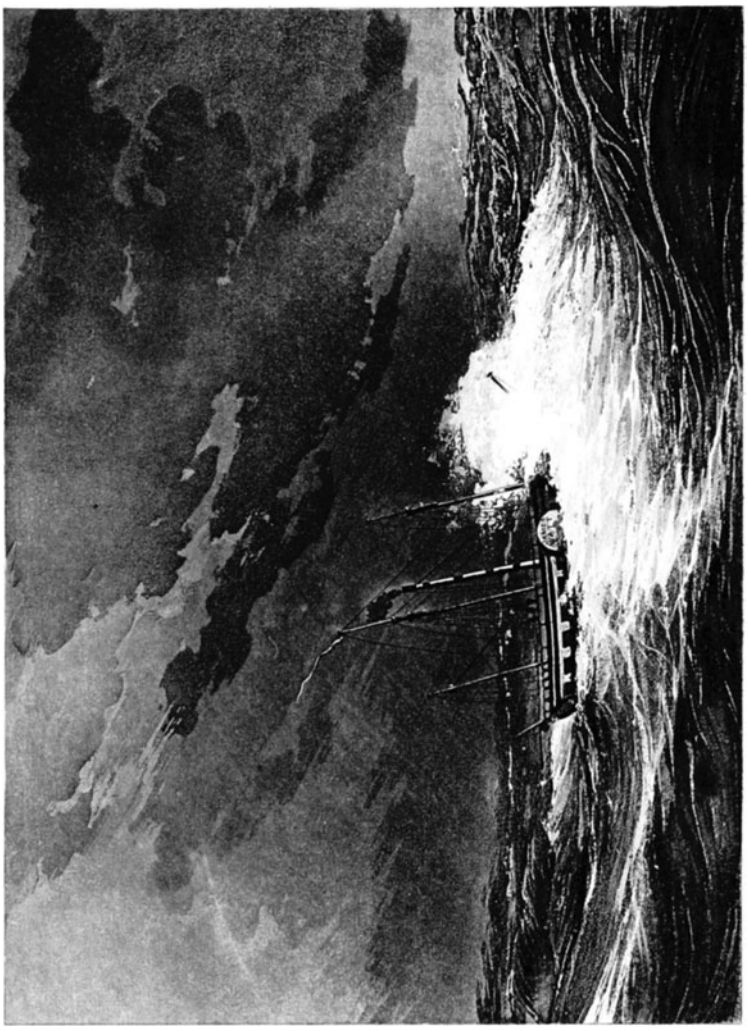

The James Watt, Steam Packet, propelling against
A STORM,
On the Night of the Twenty-third of November, 1824.

J. Ross

A

TREATISE

ON

NAVIGATION BY STEAM;

COMPRISING A

HISTORY OF THE STEAM ENGINE,

AND AN ESSAY TOWARDS A SYSTEM OF

THE NAVAL TACTICS PECULIAR TO STEAM NAVIGATION,

AS APPLICABLE BOTH TO

COMMERCE AND MARITIME WARFARE;

INCLUDING A COMPARISON OF ITS ADVANTAGES AS RELATED TO OTHER SYSTEMS IN THE CIRCUMSTANCES OF

Speed, Safety and Economy,

BUT MORE PARTICULARLY IN THAT OF

THE NATIONAL DEFENCE.

PATRONIZED BY

HIS ROYAL HIGHNESS THE LORD HIGH ADMIRAL.

ILLUSTRATED WITH PLATES AND ENGRAVINGS.

BY

CAPTAIN JOHN ROSS, K. S. R. N.

LONDON:

PUBLISHED BY LONGMAN, REES, ORME, BROWN, AND GREEN;
AND BLACKWOOD AND CO. EDINBURGH.

1828.

LONDON:

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TO HIS ROYAL HIGHNESS

THE LORD HIGH ADMIRAL

OF GREAT BRITAIN,, &c. &c. &c.

SIR,

THE era which placed your Royal Highness at the Helm of the British Navy, being that of the introduction of the Steam Engine into His Majesty's Fleet, I had the honor to lay before your Royal Highness my proposition of publishing a System of the Naval Tactics peculiar to Steam Navigation, the result of much labour and enquiry; urging the necessity of instructing the Officers of the Royal Navy, in the theory of that important part of their profession. Notwithstanding the general prejudice against innovations on a system which has for ages protected the nation, and raised our naval renown to the pinnacle of glory, Your Royal Highness patiently listened to my arguments and suggestions, and, with a laudable desire to afford every facility to improvements, was graciously pleased to sanction my humble undertaking, and to permit me to dedicate the fruits of my labours, to The Lord High Admiral. Impressed with unfeigned gratitude for this mark of condescension, as well as for the honor which has thus been conferred upon me, and with an anxious hope that my endeavours may prove worthy of them, I beg leave to subscribe myself,

Your Royal Highnesses
Most Dutiful and
Most Obedient Servant,

JOHN ROSS,
Captain of the Royal Navy.

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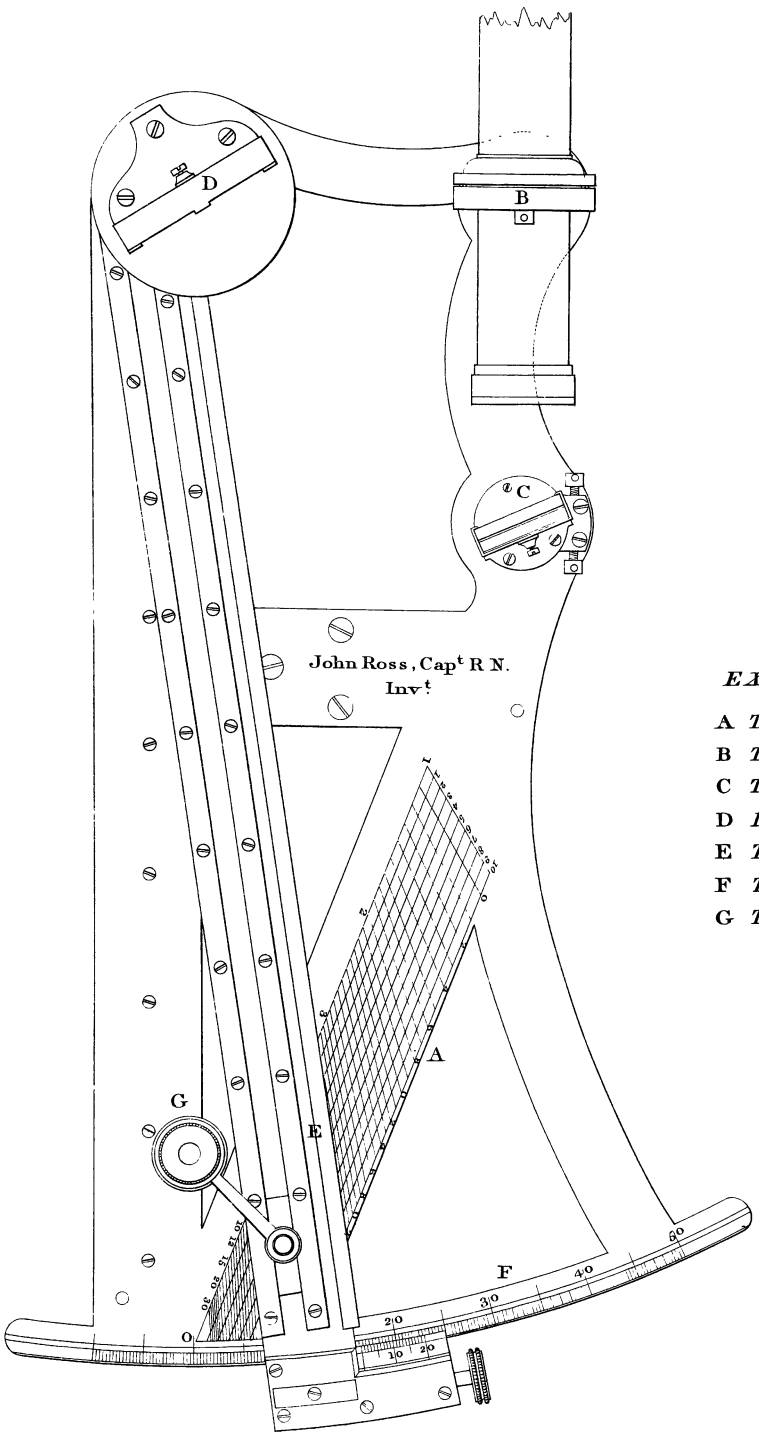

EXPLANATION.

A *The Clarence Scale.*
B *The Eye piece.*
C *The Horizon Glass* } *forming a Right angled Triangle.*
D *Index Glass*
E *The Index.*
F *The Arc.*
G *The Microscope.*

Edmd Turrell, del et sculp.

INTRODUCTION.

In the late war which desolated Europe for twenty-three years, events took place which raised the glory and renown of the British Navy so decidedly above all other nations, that it was considered a settled point, and a generally acknowledged fact, that the "Wooden Walls of Old England," were alone a sufficient protection to her shores, from foreign invasion. Her fleets were no sooner laid up dismantled in her harbours, and those officers who had hitherto been actively employed in offensive and defensive warfare, doomed to spend the remainder of their days in contemplation of the past, than their minds were naturally turned towards the various scenes they had witnessed, and in "fighting their battles o'er again," they reviewed the peculiarities of every action, and being naturally led to reason and reflect on the importance of the subject, in the event of a renewal of hostilities, and with a most patriotic and laudable desire to improve the young and aspiring officers, who are expected to maintain the glory, and ensure the future safety of the nation, they felt it a duty incumbent on them to publish those facts and opinions which had been so fully established by talent and experience; thus affording advantages to the rising generation of officers, which would bring them at once to a knowledge of the profession, which, without those, could not have been obtained in years of practice. Among these, I may mention the works of Admiral Pender on "Seamanship," Captain Griffith's "Practical

Hints," and Admiral Ekin's "Naval Battles," &c.; the two former giving a complete system and view of seamanship, and deciding points in the profession which were even doubtful among experienced officers, and often subjects of controversy on which the sailor could not make up his mind during the course of an active life; and the latter, giving an insight into the higher branches of the profession, which would have been invaluable to most of those captains who commanded ships of the line during the war. Had no alteration taken place in naval tactics or warfare, these would have remained standard volumes in the library of every naval officer.

Navigation in general, has however undergone so complete a revolution by the introduction of the steam engine, as to render its theory and practice no longer the same, and, consequently, the able works alluded to, are no longer of that importance which were at first attached to them; the change which has taken place, is however still more applicable to naval warfare, than to commercial or mercantile purposes, and we trust that this fact has not been overlooked by those whose duty it is to watch over and defend our country.

There is, indeed, abundant reason to believe, that it is fully felt, not only by the government itself, but by every naval officer who has bestowed the slightest attention on the subject; while, if it be true, as is generally understood, that our rivals and enemies are turning their attention very particularly to this object, it is the more incumbent on us to see that no time is lost by ourselves, in taking such steps as may insure us that continued superiority at sea on which our very existence depends.

It is for the purpose of hastening the general attention to this most vital subject, that the present work has been undertaken; imperfect as it needs must be, where every thing is entirely new, and we have as yet no experience to guide us. Such as it is, pretending to no more than a bare sketch of what time and practice must hereafter fill up, it will at least

serve to call the thoughts and labours of other officers to the same subject, while I may occupy a few pages of introduction on some general remarks on the most leading points connected with a system of offensive and defensive Steam Navigation.

The first remark is, that such a system will require a great numerical increase of officers, in the event of a future war, proportioned to that of the men; whether the object be merely the protection of our commerce, or a national defence against invasion and active offensive warfare. Such officers, must also be educated with the knowledge, not only of Steam Navigation, and of the construction and management of Steam Vessels, but of the very machinery and principles of the engine itself, without which they will rarely be efficient for their duties; much as the adequate management of a ship of this nature depends on an intimate knowledge of its moving power, and highly necessary as it is that they who command should be able to direct and controul every thing. It is indeed plain, that if it is necessary that a good officer should be intimate with every thing that appertains to the construction and guidance of a ship on the present system, so that he may direct every thing and depend on no one, not less is it indispensible that he should equally know every thing which relates to the new force which will thus be placed in his hands.

It is moreover plain to a very slight reflection, that the adoption of this mode of motion, and these new inventions, will produce an entire revolution in the present system of attack and defence, and that an entire new method of tactics must be a necessary consequence; great differences in the management and conduct of vessels, whether separately or in bodies, must follow from substituting the present mechanical powers, utterly independent as they are of the wind, for those which depend solely on that force: and hence, an entire new course of study becomes opened to naval officers, no less indispensible, than it is new. Thus, for example, must the ancient rule of forming the line of battle, be utterly changed;

since the nature and direction of the wind will no longer form the same elements of calculation: and similar changes will become necessary, in the modes of attacking and defending, and even in the usual and simpler cases of chasing, and of other operations between single ships. Some of these will be demonstrated hereafter; but I may also here remark, that another essential variation in the conduct of ships of war, in action, or intending it, will occur in the present system, from the power which is possessed of rendering vessels of this nature partially invulnerable, and of making them shot proof, within at least, certain limits. Thus, for example, it will become possible, for a ship rendered shot-proof, within six hundred yards, or more or less, should it so happen, to approach within that distance of a ship of the line, and, even with one gun, to maintain an action, perhaps to disable and destroy her much more weighty opponent; while the difference in favour of the steam vessel is obvious, because the machine can be secured, both by being fortified and placed beneath the water, so as to keep the hull and all the moving power secure from injury, when the sails and rigging of her antagonist, or her moving powers, are as well as her hull, completely exposed; constituting a difference, the great influence of which can be immediately appreciated.

Another advantage appertaining to steam vessels thus fortified, which is also of immense importance and effect in its general results, as to naval warfare, is this, that a vessel of this nature cannot be boarded by boats; while the general system of attack and defence on boarding at close quarters, must also undergo an entire change, as the least consideration will render apparent. In reality, a steam vessel, fortified in the manner above alluded to, is incapable of being boarded at all, and cannot be taken in this manner; while it is plain also, that this mere fact will lead to considerable changes of plan and conduct in the case of close actions.

Still more, a steam vessel may be rendered a single offensive weapon in herself, on a system similar to that of the ancient warfare of galleys in the

time of Rome; and to use familiar language, may be employed in running down its antagonist, by the mere impulse of a fortified stem, accompanied by a superior weight and velocity; while this is a species of attack, which, by being always at command, and being independent of wind, will necessarily lead to manœuvres at once new and complicated; since the object of the assailant will be to attack the broadside, or most vulnerable part of the enemy, reversing entirely, what is now attempted. If I add to this, that vessels of this description may easily engage with red-hot shot, and with other missiles, which the present system does not appreciate, or which are now not deemed convenient, it is further easy to see that there is scarcely a limit to the changes which a system of this nature will introduce into naval warfare, and that consequently, an entire new course of study will be required in training both men and officers to this science.

It is true, however, I fear, that there are many old officers, who as yet oppose the introduction of this system, or doubt of its practicability; and if it be so, it is no great cause of surprise, while it must be also allowed, that there are objections, many of which are more obvious than admissible. Certain it is, that should such a system become general, we must bid farewell to the pride of seeing our flags flying in a three-decker, and to all the pomp and consequence of a glorious fleet, so captivating to the human fancy; and what is more, officers will no longer enjoy, particularly in the superior ranks, that comfort and accommodation which they now possess. It is true; the insignificance of an admiral's flag flying at the miserable mast of a steam boat cannot be denied; nor indeed, the generally insignificant aspect of a fleet of this character, compared to the gigantic aud noble structures of present warfare. But, whatever may be the ideal value of all this, we must recollect, in opposition to it, the enormous difference of expence in favor of a system of defence on the projected principle. The value or cost of a first rate, would build and equip forty steam vessels; either of which, singly, might be sufficient to subdue two

of the former in action. The defence afforded to a coast, by even half a dozen vessels, would be more effective than that of a large ship of ten times the cost; or, were even a convoy of a hundred merchant vessels, protected by a line of battle ship, to be attacked by four steam vessels, the probability is, that they would be all taken and destroyed.

If there are more serious objections, or objections of more apparent solidity, brought forward by that class of persons to whom I have been alluding, they are almost entirely founded on misinformation respecting the subject; on inattention, or want of reflection respecting a mode of navigation, which is of recent date, as yet applied to limited purposes, and has not excited that degree of attention which it deserves. I must hope, that this treatise will have the effect of at least leading to a more careful consideration of the subject, though it should do no more; and I have no fear, but that the results will prove what I contemplate, in the abandonment of so pernicious a line of conduct. But we dare not renounce the attempt, at least; rather I fear, we have no time to lose, in commencing our courses of experiment, instruction, and study; while I also fear that we have already been culpably backward, and that our watchful rivals, enemies to become, have been some time labouring, in somewhat of secrecy, on this subject, anxious to get the start of us, and not unlikely to succeed in so doing, unless our government should come to a decision without further loss of time.

In fact, it is notorious, that both the French and Americans have been for some time training their officers in this new art of Steam Navigation; while the former abound not only in steam engines of our manufacture, but even in English workmen and engineers; a sufficient proof of their intentions on the subject, and of the importance which they now attach to it. If we do not absolutely know, that any other naval power has turned its attention to the subject, this, at least is probable, or we may safely infer, that conscious from experience of their inferiority as to naval warfare on

the same old system, and hopeless of attaining, in an equal degree, the management of large vessels and fleets, they will gladly resort to a system more practicable, and more economical; and one, which from its requiring far less of what is called nautical knowledge, will bring their means to that equality which may render their future enmity at sea most hazardous to our superiority, if not to our existence.

This is a serious, but a true view of the subject; and without wishing to excite unnecessary alarm, not being an alarmist in disposition, it is very difficult to reflect steadily on the question, without some feeling of doubt whether the destiny of Great Britain, may not at length be involved in this very invention, whether its fate will not even be sealed, as soon as steam vessels shall supersede the present ones among the nations of Europe, and become, what the latter scarcely ever can, the general naval warfare of the world.

If we examine the present system of naval warfare, we perceive at once, that whatever effects may follow from the magnitude of the ships, and the force of their batteries, taking numbers also into consideration, the naval force of a nation must materially depend on its wealth. The most essential circumstance of all, however, is its nautical superiority, using that term in its widest sense, to distinguish every thing which constitutes the most perfect character of British Seamen; and this superiority, whatever other circumstances may unite to form it, is mainly connected with our extensive commerce, the real school of seamen; and however the term may be hacknied, the nursery of our navy. Now, it is in this that we possess advantages with which the continental nations, and above all, the less maritime ones, cannot easily cope, or can never come into competition at all: and thus is our naval superiority at present, or on the existing system, identified with the general causes of our prosperity, and secured to us as long as that state shall last. But the case may become far otherwise, should the system of naval warfare, which is here contemplated, ever become

generally established, should it ever supersede the system of large ships managed by thorough-bred seamen. The general political consequences are easily inferred. Warfare at sea will approach more nearly to warfare on shore, or the differences between a military and a naval system will be small, compared to what they are at present. Any nation sufficiently wealthy to levy armies and fortify towns, may then build vessels and produce seamen, if seamen they can be termed, adequate to the management of a flotilla, and as well fitted for all the purposes of naval warfare, as their soldiers are for land service. The system in fact, will become a species of military, rather than a naval one, and they which should have been sailors, will be maritime soldiers, not seamen; and then will our superiority, as far as depends on seamanship, disappear; or we also shall become what they will be, and must learn to meet them on our own channel, and on their own shores, as we met them at Vittoria and Waterloo. It is equally evident, that the least maritime nations will then become capable of undertaking naval wars, as almost every instruction and discipline which their officers, men and vessels may require, will become practicable even in their own rivers and harbours, and on their own narrow seas.

Such a system, in fact, will be a renovation of the naval warfare of the Greeks and the Romans, and of that of the gallies of the Mediterranean and Baltic in later times, if under modifications; and a mere retrospective glance at those modes of warfare, at the naval actions between Rome and Carthage, at Actium, and in more modern days at Lepanto, will perhaps carry a clearer idea, of what will then become our naval service and our naval policy, than could be given by any mode of present detail. The essential points, or the fundamental character, it is plain, will be the same; what the variations may be, it would scarcely require much reflection to perceive, nor many words to state, if I had not already sufficiently dwelt on this view of the impending revolution.

If therefore we are entitled to expect that all those nations which have felt our superiority, and know its causes, as I have stated them, are likely to turn their attention to this subject, most needful is it that we should at least lose no time in attempting to acquire the necessary knowledge; that we may at least have a fair chance of preserving that power, which it is to be feared, would otherwise, not during many more years, remain the splendid and overwhelming one that has so long distinguished us among nations. And this is not to be acquired in a day, no, nor in a year; while I need but merely say, that they who are the most early and the most ardent in this race, are dangerous rivals, or may become so; and while also it must never be forgotten, that to lose a long possessed superiority, were it but once, at the commencement of a new system, is most hazardous; operating far more injuriously on the self-confidence of a nation, than any casual loss which it might then sustain would do on its wealth or security.

I am not prepared (and if I were, this introduction is not the place for it) to point out the exact nature of the political system which would be best adapted for the purpose, and which ought to be adopted at present; but I may remark generally, that an experimental squadron of steam vessels ought to be formed with as little loss of time as possible, and that an adequate portion of naval officers, with a certain number of men, should be embarked for the purpose of instruction. It may yet be long before the larger ships will be superseded, or rather, diminished in numbers; and many think it not probable that they will ever be really done away with; but in the meantime, the course of study as to steam vessels, should be directed chiefly to their use as auxiliaries, which is admitted on all sides to be essential; while the progress of time, or rather the event of a future war, would shew what the ulterior tendency of the system was, and what more would be wanted.

It appears to me, indeed, from what has already passed, that no large vessel would now be safe without an auxiliary protecting steam vessel, even should a war take place to-morrow; and it is a faulty feeling which *will not* see this, whether from pride, or from an undue, if in some sense excusable reliance, on a system so long the source of our strength and superiority. What the feelings of the nation may be, I am not however prepared to say; and if the government has hitherto shown any apathy or reluctance, I must hope, that under the present auspices, under Him, who now the supreme in peace, has also been supreme in war, this subject will not be long in meeting the attention, which, under the most sober views that can be taken of it, seems naturally and seriously called for.

Let me here also make one or two remarks, on that which always is and must be a primary object of anxiety, namely the coast defence. A very slight reflection will demonstrate to any one, that vessels of this description are best adapted for that purpose; and if any one has not yet made up his mind on this subject, let him reflect on the not very remote history of the Boulogne Flotilla, the alarms then entertained, and the doubts which were held as to our power of an adequate defence through large vessels. I need not repeat what was then said and thought, should that flotilla, however apparently contemptible, have attempted to make good its escape from port, and its landing in a calm which should have temporarily prevented our cruizers from acting, and above all, when a diversion in a remote part had drawn off our larger ships or the channel fleet. The case was possible then, and it is possible again; but had the threatened coast been provided with fifty or a hundred steam vessels, even of a small class, it is plain that even the most terrified might have slept in peace, and not only so, but that we should have saved the enormous expence incurred in the coast defence and fortifications, including those

Martello Towers, the price of which alone, would have constructed a powerful flotilla of steam ships.

Another remark is this; that we should without delay make such examinations of our most vulnerable coasts, as would ascertain at what points harbours could be constructed, for such vessels to take refuge in a storm, and to be ready as "*guarda costas*," or to form a floating fortification in case of a war. It is plain, that this will be indispensible under whatever view, even far short of any such event as a threatened invasion.

No trading vessel will hereafter be able to lie in the Downs, or in any open roadstead on our own exposed coast, if, as is probable, or rather, certain, the enemy shall adopt steam vessels; since any boat of this nature may run across from a French port under cover of night, even so as to plunder and destroy a shore, without the possibility of preventing it on our part, except through the adoption of such a flying and transferable defence.

But to pass from warfare, there are other reasons for extending the knowledge as well as the practice of steam navigation, more or less connected with the system of government, and with our commerce; and this extension will always be checked, until, by a far wider course of experiments, and through greater practice inspiring more confidence, the present doubts, inconveniences, or imperfections also are overcome. It is plain, for example, that this mode of navigation is especially applicable to revenue vessels, as it would always give them that superiority which is so essential to the effectual performance of their duties. Thus, also, it is peculiarly applicable to pilot vessels; while, having already been adopted for packet boats and mails of all descriptions, it is unnecessary to notice their acknowledged uses. The adoption of this system, has produced in Scotland in particular, a change in the activity, commerce, and aspect of

the country, and, in the Highlands, in the very moral character of the people, as it ultimately will in their wealth, which has exceeded in magnitude, in a few short years, all that had taken place since the rebellion of 1745, great as that change was.

If we cast our eyes over a wider range, it will be no less easy to see what advantage will arise to commerce, or even to warfare, such as that warfare is in some of our foreign colonies or settlements, from a full adoption of the same system; while, as I must not occupy too much space in these introductory remarks, it will be sufficient to allude to the navigation of the Red Sea, or to that of the innumerable narrow straits, rocky shores, rivers and so forth, of the tropical countries, and to the piratical contests of the Arabic coasts. The history of the Burmese war indeed, and the more recent Greek warfare, are examples sufficient to prove what may be done and what gained by the more extended use of steam vessels, by rendering that systematical which has hitherto been casual, and by employing the use of a power, which we can scarcely doubt is at present almost in embryo.

Ought we not, ought not Great Britain also to take the lead? It has ever done so in every thing that belongs to the sea; it has done so in almost all that belongs to improvement in every thing; our officers have ever been the most distinguished in the world; our seamen have excelled all that ever ranged the ocean, whether in commerce or in war. But as in all else, if there is any thing to be learned, it cannot be acquired without teaching, it cannot be known without the means of instruction, and it cannot be made perfect without practice: and we do both ourselves and them injustice, when we do not afford them these means; for now shall we do them injustice if we suffer others to head them in the race; but bitterly also shall we repent it when it is too late.

At present, there is no such opportunity; not much for the men, none

at all for the officers. Casually indeed, an officer may acquire a knowledge of the steam engine through private studies; and casually, a few also, by means of passages in packet boats, may learn to understand something about their powers and management; but, for many reasons, this must be very limited. Narrow enquiries into the engine itself are not permitted, or the answers are given to mislead; and the expence of a passage renders it impossible to navigate much with this sole view. The practice, in any case, they can not acquire, since they must not interfere; while the end is, as lookers on, to sit down with the disagreeable conviction that they have much indispensible knowledge to attain, and are cut off from the means of procuring it.

But I must conclude. The purpose of this work is rather to call the attention of officers to this subject, than to lay down a complete system; for whatever the Author, who has made it his study for five years, may have attempted by his own limited exertions, it has not been in his power, more than that of others, to acquire much knowledge without the means. It is a sketch of the more essential points, with suggestions drawn from his own practice and observation, as well as from experiments; being what is found actually existent in steam packets, but extended, under the supposition of a warlike or other application of their powers and properties. That this book will teach an officer his duty, without practice, is neither expected nor pretended: it can do little more than prove to him how much he requires to study the theory and practice, while it calls his attention to the principal objects that seem at present to demand it.

With respect to the moving force, it was indispensible to convey some general idea of that, by means of a distinct chapter on the engine; since without this essential knowledge, the officers in such a command could not be adequate to their trust; but as it was not held necessary to be

very minute, the improvements of little importance to this object have either been slightly noticed, or passed over.

Here also, and on some other matters of detail, in the body of the work, the author has been restrained by the political fear, common in this country, in all matters of war, whether well founded or not, of communicating information to the enemy; and this therefore must be his apology for some omissions and obscurities: for those who wish a more full knowledge of the steam engine, the Author can refer to the three recent excellent works of Millington, Farey and Tredgold; books so complete and full, as to have rendered even an abridgement of them as impossible in a work of this nature, as it would have been superfluous.

But wherever the knowledge may be acquired, let naval officers never forget that it is indispensible; nor, by imitating the example of masters of packets, suppose that they can trust to their engineers. As well might the commander of a ship be ignorant of her construction and properties, how to make sail, work his ship, and, as has been told of former days, if tales say truth, trust all to the master and boatswain. Without the knowledge of the power in his hands, its extent, its limitations, and its dangers, he cannot tell when to moderate or push its force, or how far it should be done; he must ever be without confidence; he may, if rash or ignorant, destroy or lose his vessel; he is always at the mercy of those who are subordinate to him; and as is also possible, he may even be deceived by those in whom he must trust that which is the very heart and soul of his ship.

Enough. What the government intends to do, it is not my business to conjecture. But, it is my hope, that should this work not produce that effect which indeed I have no right to expect, it will at least serve to excite in the breasts of my brethren of His Majesty's Service, a general wish for the acquisition of the needful knowledge in the first place, and

what I deem more essential, a general desire to influence the public opinion, and that of the government, by the declaration of their own.

Should it have this effect, it may be followed by solicitations for employment: and as the public opinion has always weighed, and must weigh, in our free and liberal government, those of naval officers cannot be without their effect on the Royal and Illustrious Personage who now directs, in almost a literal sense, the Helm; nor on that Man, to name whom, would almost be disrespectful; who, once the saviour of his country in war, and now its guardian in peace, knows but too well how intimately the prosperity committed to his charge is interwoven with the success of British arms, as well by sea as land.