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### A Proposed Plan for Working the Heaviest Ordnance on Board Armour-Plated Ships and in Fortifications, with Complete Protection for the Men

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# EVENING MEETING.

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Monday, May 30th, 1864.

ADMIRAL SIR GEORGE R. SARTORIUS, Kt., in the Chair.

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NAMES of MEMBERS who joined the Institution between 16th and 30th May, 1864.

## ANNUAL.

Brown, Frdk., Lieut. 3rd Roy. Sur. Mil., 1l.	Macliver, D., Lieut. 2nd Som. Mil., 1l.
Griffith, J. G. T., Capt. Royal Engrs., 1l.	Gibb, P. M. N., Lieut. 13th Lt. Inf., 1l.
Parry, F. W. B. S., Lieut. 22nd Regt., 1l.	Patton, H. C., Capt. 22nd Regt.
Douglas, Sholto, Commander R.N., 1l.	Hammersley, Jas., Lieut. 22nd Regt.
Haslett, A. K., Lieut. Royal Engineers, 1l.	De-Cetto, M. H. E., Ens. 72nd Highlrs.
Kelly, J. L., Lieut. 10th Regt., 1l.	Green, Edwd., Maj.-Gen. Bom. Staff Corps.
Magrath, J. R., Capt. R.A., 1l.	Anderson, Arthur, M.D., Inspector-Gen. of Hospitals, 1l.
Trivett, J. F., Lieut. R.N.R., 1l.	Lethbridge, C., Col. H.M. Madras Army.
Brown, J. H., Lieut. R.N.R., 1l.	
Harwood, J. A. P. K., Lieut. 13th Lt. Inf., 1l.	

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## A PROPOSED PLAN FOR WORKING THE HEAVIEST ORDNANCE ON BOARD ARMOUR-PLATED SHIPS AND IN FORTIFICATIONS, WITH COMPLETE PROTECTION FOR THE MEN.

By Captain E. A. INGLEFIELD, R.N., F.R.S.

MR. CHAIRMAN, LADIES and GENTLEMEN,—To propose a revolution in the form of our ships of war and the method of fighting guns both at sea and on land batteries, may at first sight appear a presumption which could only be qualified by evidence of some plan more feasible, of some arrangement more comprehensive, and of advantages which will compensate for such material changes.

Now, Sir, though I cannot lay claim to the discovery or invention of such a plan, yet I have this evening undertaken to lay before your Institution two models, which purpose to combine certain novel ar-

rangements, by which guns of the heaviest description known, may be fought on board ships and on land fortifications, with complete protection for the gunners, and only a partial and temporary exposure of the gun. Of course it will be understood that in making this assertion, it is clearly with the provision that our armour plates are impenetrable, and that the walls of a fortress resist the impact of shot. These are elements of resistance which it is not part of my business to discuss this evening, though I may remark in passing, that it is not an unusual expression amongst naval men to speak of the "Warrior" as being practically impenetrable, though experiments again and again renewed, have gone to show that this far-famed vessel does not possess an armour-plated side capable of resisting the shot or even shell projected by the new experimental guns. I have, therefore, had this matter under consideration in the preparation of my plans for this new method of fighting heavy ordnance. I have endeavoured to combine an extra protection for the crew, with a certain degree of utility for the purposes of lifting the gun, and I shall presently explain to you the method by which I obtain these results.

But before entering into an explanation of the models before you on the table, it would perhaps be better to state for the information of those amongst my audience who may not be fully aware of the present position of our iron-clad navy, what are the accepted forms and build of our ships of the present day as regards their actual outline and their shot-resisting capabilities. I shall then be able more readily to explain the position which I have taken, the short-comings which I have proposed to meet, and the general advantages of a novel system for fighting guns of the largest calibre at sea and on shore.

First, exploding altogether from the category, ships of the old wooden class, I must commence with those of the "Warrior" description—vessels protected on their gun-deck and below the water-line by armour plates of a thickness considered practically sufficient to keep out the shell and shot of the ordinary sea service guns—at moderate ranges—and this armour-plate protection, with its necessary backing, in the "Warrior," actually amounts to 1,300 tons of dead weight on her outer sides; her tonnage being over 6,000.

The thickness of these plates varies in different vessels from  $4\frac{1}{2}$  to  $5\frac{1}{2}$  inches, and in the case of the "Black Prince," extends  $5\frac{1}{2}$  feet below the water line. Now, vessels of these huge dimensions are only constructed to carry from 30 to 40 guns, and these guns are mounted at broadside ports, reduced now to the smallest dimensions consistent with the proper working of the gun at extreme training.

In the model before you is a port made to the scale of  $\frac{2}{3}$  of an inch to a foot, and indicates the exact size and proper proportions of the ports of the iron-plated ram frigate "Agincourt," now building at Messrs. Laird's yard at Birkenhead. By actual measurement and tracings obtained on the premises, these ports are 3 feet  $7\frac{1}{4}$  inches in depth by 2 feet breadth on the outer side, but 3 feet 9 inches on the inner side, and they are placed 11 feet 8 apart. I am exact in stating this, as I wish to point out very particularly the area equivalent to a space 10 feet square (in a vessel having only 15 ports on a broadside),

exposed to the unobstructed intrusion of shot and shell from an enemy's ship. And when we remember the lamentable destruction of life lately recorded in the sea fight between the German and Danish ships off Heligoland, when 14 men were killed and wounded at one gun, by a single projectile, he, then, who can say that any invention which shall go towards reducing these apertures in armour-plated ships, or, still better, shut them up altogether, is not a step in the right direction, can hardly realize the frightful carnage which must be the result of a sea fight in modern days though hardly lasting half the time occupied by our ships at Camperdown, the Nile, and Trafalgar; out of which fights they escaped comparatively scathless.

Naval men have not two opinions on this subject, and hence the eager anxiety expressed amongst them as to the success of this or that gun and its projectile.

I have spoken now of what may be called the first Government form of armour-plated frigate. There are other varieties, and these are usually alluded to as vessels of the "Defence" class, or the "Hector" class, &c. It will be sufficient to add that in this latter-named vessel of 4,089 tons, the weight of armour-plates is limited to 873 tons against 1,300 tons in the "Warrior," and these tapering round the stem and stern, are  $4\frac{1}{2}$  inches in thickness at the broadsides.

There is still another class of iron-plated frigates to which I must make some allusion, as they appear to be gaining golden opinions for themselves from the result of their first experiments—I speak of Mr. Reed's vessels. Until that gentleman became chief-constructor of the Navy, it was deemed an impossibility to combine great speed, heavy armaments, and impenetrable armour-plated sides with a moderate tonnage; but, by the experimental vessels "Research" and "Enterprise," Mr. Reed has proved the fallacy of this supposition, for he has combined all these requirements in vessels that are termed sloops. The "Enterprise" being only 933 tons burden.

Whether these vessels, with their central iron-cased batteries, will not cause a revolution in the opinions of our shipbuilders and ship fighters, seems to be no longer a question, and much credit is undoubtedly due, not only to Mr. Reed as the chief constructor of the navy, but also to the Admiralty, who, against much opposition, singled out this talented gentleman for so eminent a position.

I have now done with iron-cased port-holed frigates, and I come to the first innovation upon the orthodox form of a vessel of war, and the method of fighting her guns; but I can hardly pass at once to a brief description of the clever invention of my friend and old messmate, Captain Coles, without some allusion to the angulated sides for ships of war, proposed by Mr. Josiah Jones, of the firm of Jones & Quiggin, iron shipbuilders, Liverpool. With an amount of patriotism and zeal seldom equalled, this gentleman has expended from his private purse a sum expressed by thousands of pounds, merely to exhibit to the world the soundness of his theory, and it is but fair to say, that the experiments carried out by the Government upon the shot-resisting targets constructed by Mr. Jones were successful as regarded the object that gentleman had in view. In what other requirements they failed for

their application to ships of war I am not in a position to state; but, together with other naval officers, I am so strongly of opinion that this form of angulated side might prove of great value for our fleet of the future, that I have constructed one side of my model to represent a vessel with angulated sides, and I believe that the day is not far distant when such a form will attract for itself the attention it deserves, and which did not elude the careful consideration of our ancestors in olden times, when they donned the pigeon-breasted steel cuirass, from which a bullet or spear would glance off, and the force of a sword blow be destroyed.

The turret or shield ship of Captain Cowper Coles must now occupy for a few moments our attention.

It so happened that I was one of a committee selected by the late Lord Lyons, when he was commander-in-chief of the Black Sea fleet, to examine and report upon the first proposals of Captain Coles for a gun-raft. It is almost needless to add that we were unanimous in the opinion that the invention (even in its immature form) was valuable; and we accordingly recommended that the Captain should be permitted to proceed to England for the purpose of bringing his proposals before the Admiralty. This was in the year of grace 1855, and now in 1864 the first turret-ship has not long been launched by the Government, and naval men are looking forward anxiously to the report of her abilities as a shot-resisting vessel, and what appears to be equally important, as a sea-going trustworthy ship.

Captain Coles' matured form of turret or shield-ship consists mainly in having iron shot-proof towers, which are placed amidships, and from 20 to 25 feet diameter, and which work centrally on turn-tables below the water line.

The turrets or cupolas (as they are indifferently termed) have one or more ports of a size sufficient to ensure the proper amount of elevation and depression as regards depth, and of width with reference to the size of the gun mounted. The guns are directed upon the object to be aimed at, by moving the whole turret (which has a ratchet work and pinions below) to the proper angle, the captain of the gun looking out through an aperture in the roof of the turret to determine this angle, and give the necessary orders to the crew working the levers. When the gun or guns are pointed, they are fired in the ordinary manner, and the turret is turned away, so as to carry the ports out of the line of fire whilst the gun or guns are being reloaded. This also is accomplished in the usual manner, whether the piece be a breech or muzzle loader.

The object of the shield ship is to reduce the danger to the gun and gunners by a reduction in the size of the port and otherwise, by moving these openings out of the line of fire. And here I am bound to say, that I believe the advantage gained is great, but next, it becomes my duty to examine *at what cost* it is obtained.

First, a cupola-ship must be almost rebuilt, if it is intended to convert a ship of ordinary construction into this class of vessel. Apertures must be cut through two decks of a diameter varying from 20 to 25 feet, and this is a very serious consideration in a vessel which has

Fig. 1.  
Section of a Ship of 1800 Tons.

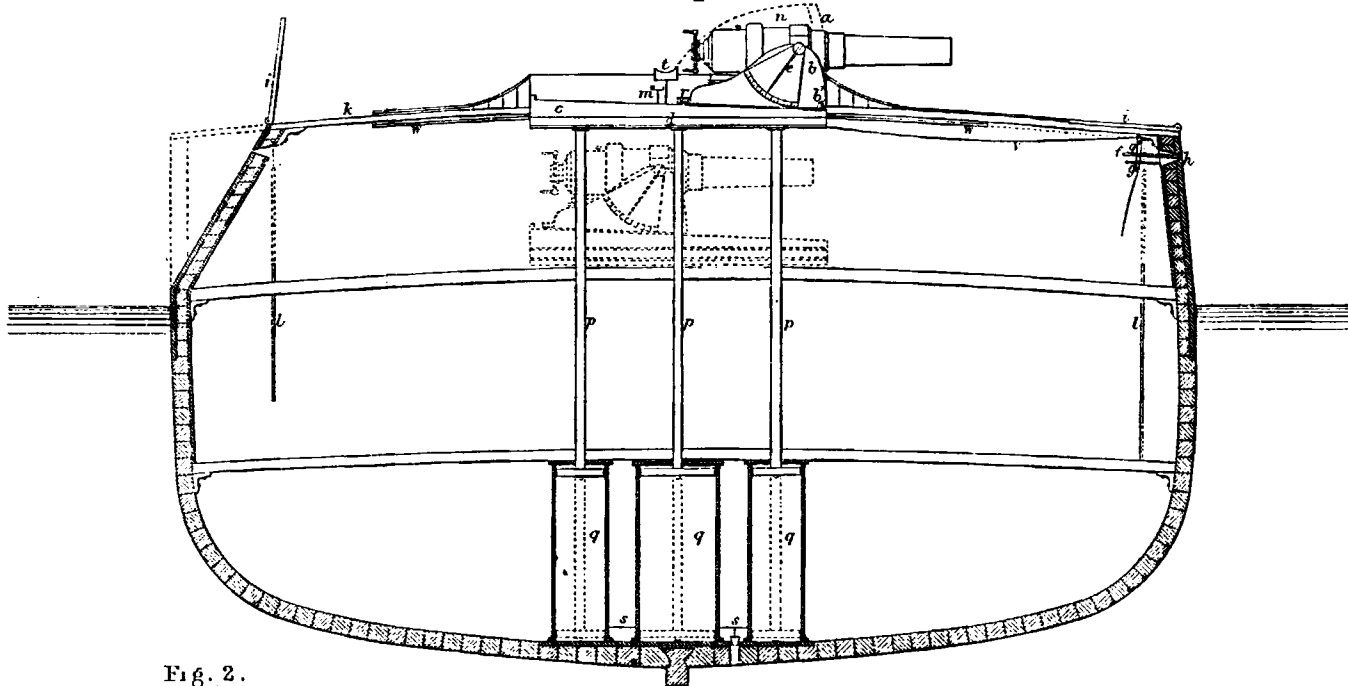


Fig. 2.

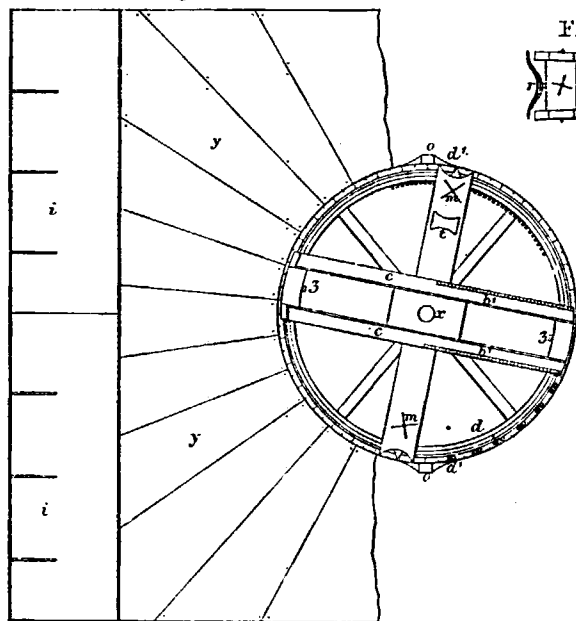


Fig. 3.

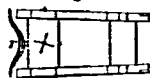


Fig. 4.



## Reference.

- a. The Gun
- b. The Carriage
- b'. The Piston
- c. The Slide
- d. The Platform
- d'. The Checks on D°
- e. The elevating Pointer
- f. The directing Tube
- g. The directing Arc
- g'. The elevating Arc
- h. The ordure in the Ships side
- i. The falling Bulwark
- k. The recess for D°
- l. The Counterpoise
- m. The directing Levers
- n. The cast iron Shield
- o. The guide Stanchion
- p. The Piston Rods
- q. The Cylinders
- r. The Spring on Gun Carriage
- s. The steam Pipe and Valve
- t. The Saddle
- v. The Trigger line
- w. The iron Shutters
- x. The Axis for the Gun slide and Platform
- y. The plated upper Deck
- z. The Rollers for the Pendant and Tackle

Scale  $\frac{1}{8}$  of an Inch to a Foot.

0 1 2 3 4 5 10 15 20 25 Feet.

to bear upon her broadsides such an amount of armour plating as I have stated is borne by the "Warrior;" but to this we must add, the great weight of the iron cupolas, which I cannot better illustrate than by stating that in the far-famed iron-clad Birkenhead rams (which have been for several months under my charge), the turrets weighed each 100 tons without the guns, and this in vessels of only 1,800 tons burden. Thus it will be seen that, to obtain the partial protection of the crew fighting a turret-gun, we must cut large holes in the decks of our ships, and add an amount of top-hamper to the vessel, this, not the least objectionable element in such an arrangement for a sea-worthy vessel. It is just this which seems to be the most doubtful part as regards the success of the cupola-ships, for it must always be borne in mind that be the armament, or the means of fighting it, what it may, England's marine supremacy can only be maintained by possessing a sea-going fleet; and admirable as the cupola-ships may prove for coast defence, I cannot bring my 30 years' experience in the navy to reconcile the notion that a cupola-ship in a gale of wind will behave very differently to the Agamemnon, when she was well nigh foundering with the Atlantic cable on board.

Having now generally alluded to the present construction and form of our iron-clad navy, I bring you to the arguments which presented themselves to my mind when considering the *facts* I have laid before you.

I asked myself, cannot the advantages of cupola-ships over broadside port ships be obtained by some less cumbersome arrangement than such as is set forth in the first-named vessels?

And thus I was eventually led, after much anxious thought and some experiments and calculations, to propound the plans which I now propose to explain to you, with the assistance of the models on the table.

My invention consists—

*Firstly*, in an arrangement by which I can dispense with the necessity for ports through which to fire guns in an armour-plated ship.

*Secondly*. In a peculiar method of taking the aim or laying the piece, and of loading whilst the gunners are entirely protected; that is to say, as far as the capabilities of iron armour plates will admit, and in some degree still more effectually from the effects of a bursting shell, or splinters from shot which may have penetrated the sides.

*Thirdly*. I claim to employ a process for lifting the gun from its place of security to its firing position, by a power, I believe, hitherto unemployed for any practical purposes.

The model before you (see Plate XXVIII, Fig. 1) represents the section of a vessel of about 1,800 tons on the scale of three-fourths of an inch to a foot, and the gun which was pointing through the port cut in the side of the vessel is a perfect model of a 100-pounder Armstrong gun upon the same scale. I now close up this port, and in doing so may remark that I propose with comparative facility to convert any broadside port ships into a vessel fitted as I suggest, without any material re-arrangement of structure.

The gun is now mounted on a carriage and platform, specially



arranged for the purposes I propose, and this will be better described, by displacing the piece and exhibiting the parts separately.

The circular platform or turn-table (Fig. 2), upon which the inclined slide is made to revolve centrally, has an inner ratchet-work, the outer rim of which is graduated, and the inclined slide is provided with a flat transverse bar or plank which extends to the periphery of the platform, and carries at either extremity a pointer which marks the angle upon the graduated platform which the inclined slide is made to assume by means of pinions when moved by a lever, causing the whole slide to revolve round the turn-table.

The carriage and gun are mounted on the inclined slide in the usual manner, the slide being so situated, that on the firing of the gun, it recoils *up* the inclined plane, whilst for running out the piece preparatory to firing, its slope renders this operation more easy.

It will be seen that the metal ways on the gun-slide are provided with a pall-plate, whilst the carriage itself has palls fitted on its fore part, and a coach spring on its rear (Fig. 3). The gun carries metal pointers firmly fixed on the trunnions; these work in a recess prepared in the gun-carriage, and are the indicators of the angle at which the axis of the piece is laid, by reference to a graduated arc let into the recess, and thus, when the indicator stands at 0, the gun is laid on a plane with the deck of the vessel, or perfectly horizontal when the ship is on an even keel. The breech of the gun is elevated or depressed by the ordinary breech screw.

I have now explained the mode of directing the gun, when the angle to the keel of the ship at which the object lies has been ascertained, and I must now ask your attention whilst I describe this process.

Through the side of the vessel (Fig. 4), at a convenient height from the ship's deck, a small orifice, for the admission of a tube of the diameter of an ordinary spying-glass, is made and fitted on gimbles. This tube is free to move in any direction horizontally and vertically, within a necessary radius. Immediately beneath this tube, and hinged to the ship's side is a graduated arc, whilst vertically a graduated bifurcated bar receives the telescope, and works in a slot on the horizontal arc previously described. It will thus be seen, that the angle at which the object lies to the keel of the vessel may be readily observed, and it is not difficult to understand, that if this graduated arc and bifurcated bar, correspond with the graduations on the gun platform and the carriage, the axis of the gun may be easily adjusted to correspond almost mathematically with the axis of the directing tube, and I wish it to be particularly noted, that with such an arrangement, and under these circumstances, the gun may be pointed and loaded at the same time.

I come now to the process of lifting the gun to a spot from whence it may be fired, and here I must state, that several methods suggested themselves to my mind, viz., by steam, manual power, or hydraulics.

The beautiful precision with which the steam-hammer of Mr. Nasmyth works, and the marvellous power which is so entirely under the command of the engineer, that he can alternately strike a blow of

10 or 15 tons, or crack the shell of a filbert without damaging the kernel, readily suggested a mode for raising a piece of ordnance which might be of the heaviest description, and yet must be elevated with precision and certainty. These were reasons why I first held a preference for this mode of accomplishing the object I had in view. The steam power, now always available on board our ships of war (and especially at a time when there would be, as in the case of an attack on a fortress, a quantity of this valuable element escaping to waste), was an inducement to work the guns of my new fashioned vessel by that power, but more mature consideration satisfied me that it would be imprudent to trust to this power alone, as in the event of its failure during an action, or its being all required for the purposes of locomotion, the armament of the ship would be placed *hors de combat*.

I have therefore abandoned, in some measure, this motive power, and though I am not without belief that by a judicious arrangement of counterpoises, the guns might be easily raised by manual labour, yet I would prefer considering this only as a substitute for the other method, which I must now describe.

When, in a ship drawing about 20 feet of water, the engineer desires to blow out his boilers, he finds that if the pressure of the steam is reduced to about 9 lbs. on the square inch, he must find some other way of emptying them; in other words, the pressure of the water on the bottom of the ship, is equal to about 9 lbs. on the square inch. Now, this is the power I employ for lifting my guns.

In the hold of the ship, I place five cylinders with pistons of a diameter and a length of stroke sufficient for the work required, and arranged with valves to admit water through the ship's bottom; always bearing in mind that as the upward stroke is made, the pressure decreasing, an excess of power is required in the first instance. Now, I derive from this arrangement several advantages over the use of steam; the motion is more steady, and each gun has its independent motor; moreover, the piece is supported upon five columns of water, and I conceive, is thus more easily sustained at its required altitude than if these were columns of steam. But I *do not* require a power equal to lifting the entire weight of the gun, for I have arranged counterpoises at the sides of the vessel, which by chains are so connected with the framework of the gun-platform that a great deal of the weight is transferred to them, and these counterpoises are by preference plates of iron, which form an extra protection to the crew, and are available for the detention of those death-dealing splinters and fragments of the modern-days shell, which all practical men declare, are more to be dreaded than the round shot, which blunders in at a port and carries itself with a whole skin through the other side of the vessel. This counterpoise of course rises and falls to correspond with the motion of the gun, and is kept in its position by several chains so as not to become useless should any one of them be shot away.

We must now suppose the gun to have been raised by the pressure of the water admitted into the cylinders to the level of the upper deck, guided securely and with precision by stout upright iron stanchions on

the fore and aft side of the platform, which has cheeks on its periphery to receive the same.

The deck is prepared for action by letting down the falling bulwarks into the recesses prepared for them in the iron-plated deck. The gun is run down the inclined plane by the crew below, the palls having been raised by a tripping line arranged for the purpose and acting with the running-out tackle. Should the object have altered its direction during the process of raising the gun, the gun can be re-directed by the crew from below, as the pinions and elevating screw have square heads on their under side which can be worked by keys. The piece is fired by the captain of the gun, who is thus enabled to look out when the object is on through his directing tube, should there be any rolling or other motion in the ship.

The gun upon firing recoils, and the shock of the discharge is greatly relieved by the powerful coach-spring which is affixed to the rear of the gun-carriage, and which abuts upon projections terminating the metal slides on the inclined plane. The valves are then turned to allow the water to escape into the hold of the ship, where it is used for the boiler-feed or injection, or into a convenient reservoir. The gun is thus gradually lowered into a place of security, and iron shutters which are constructed to slide under, and thus close up the circular aperture, are drawn into their places, and thereby the crew are protected from the effects of a shell bursting over the vessel.

I will now very briefly enumerate the advantages I propose for my new method of fighting guns.

1stly. I can convert any broadside vessel with comparative ease, and inexpensively, into a vessel to carry the heaviest ordnance on my plan—the ordinary hatchways in the deck of a ship being easily convertible into gun-apertures—and this will not interfere with their use as hatchways under ordinary circumstances, for they may still be fitted with skylights, as shown in the model, or hatches for battening down and with hatchway-ladders made to slant over the gun when it is secured below for sea service.

2ndly. I can carry the heaviest ordnance in greater numbers than a ship of the same tonnage encumbered with iron turrets, and I can place the weights as may be found most convenient, low or high, or in any middle position to suit the trim required.

3rdly. I can fight my guns with complete protection for the crew, as far as the impenetrability of an iron side can avail to exclude an enemy's shot or shell.

4thly. In case of a shot or shell penetrating the ship's side, the loose compensating plate will receive the splinters, and thus protect the men from the danger which has been remarked as so imminent whenever a shot pierces the sides of an iron-plated vessel.

5thly. The gun can be fought as an upper-deck gun entirely when exercising at a target, or at very long ranges, when the men are not exposed to an enemy's fire.

An objection might be raised as to the recoil of a very heavy gun, both regarding the concussion upon the platform and hence to the glands of the steam or water cylinders. But this model shows an

arrangement which obviates this danger. The five piston-rods are connected at their upper ends by means of a wrought iron plate, which is a counter part in form, but not in thickness, to the gun platform. Upon this the latter is entirely supported, without in any way being connected therewith, and I may add that the whole concussion of the discharge is received upon the beam-ends of the vessel.

The heavier the ordnance, it would appear the less the recoil, for, I find, upon reference to the official reports of the trial of the Horsfall gun, that with a charge of 50 lbs. of powder, and 250 lbs. projectile, at point blank range, the recoil was only 4 feet 9 inches.

In a heavy sea-way I employ an extra stanchion on the other quadrants of the platform not provided with the iron guides or upright beams before alluded to, but as these would only be required when the ship was rolling or heeling over, or in bad weather, they may be usually kept suspended to the beams overhead, as shown in the model.

It must not be lost sight of, that the gunners in both land batteries and ships, working guns on my system, are not liable to be inconvenienced by smoke; and the "din of battle" would be to them less distracting.

I have prepared a model of an iron mantelet, which may be employed to protect the gun carriage, and a gunner, should it be deemed more certain, in obtaining an aim, to take the final sight for firing from the piece itself, which can also be discharged by the same man.

I must now direct your attention to this model of a land battery. The arrangements for working the gun are identical with those I have explained in the ship model, but as the ramparts of a fortress are considerably thicker than any ship's-side, the method of laying the gun does not apply. It therefore becomes necessary, after the gun is loaded, to send up a gunner with the piece to take aim, and he takes his seat on a wooden saddle beside the gun, and from this posture he is able to look along the sights, and, assisted by the gunners below, to lay the gun at the proper angle.

I propose that in a case such as this, an iron mantelet (similar to that I have shown in the ship model) should form a portion of the traversing platform, and this will be shot-proof to shell splinters or musketry.

I must trespass a few moments longer on your attention whilst I explain the method of raising the gun in land batteries, for though I have provided this model with five cylinders similar to the lifting apparatus for the ship, I am of opinion that water counterpoises would be the more preferable method, as weight would be no object in a fortress, the balance might be so nicely equipoised, that very little manual power would be requisite to raise the gun to its required level, and I prefer tanks filled with water to be employed as the counterpoise, because, in case the enemy should succeed in effecting the capture of a gun, by turning the water out of the tanks, they would be at once placed *hors de combat*. Moreover, whenever a command of water could be obtained, the gun might be entirely lifted and

lowered by alternately supplying the tank with more water, or drawing it off.

I must ask you to remark also, that guns mounted on batteries or ramparts on my plan, have the peculiar advantage of being as easily fired upon the flank or rear, as upon the face of the work. I hold this to be no small advantage, and I am in hopes that when my plans have been subjected to the opinions of engineers, they may obtain consideration from this peculiar advantage.

When the guns are not required for service, they are placed in their lowest position, and a skylight covers the aperture, which is fitted in the centre with a funnel; this, in winter, would be used for the exit of smoke from the gunner's quarters, and would supply air at other times.

The delicate structure of modern-days ordnance, seems to demand that extra care should be taken of the guns, and by my arrangement they would be constantly under cover.

I have now to thank you, Mr. Chairman, Ladies and Gentlemen, for your kind attention to my imperfect discourse. I owe my thanks also to the Council of this invaluable Institution for the courtesy with which (upon hearing of my invention) they afforded me this opportunity of making my plans public, and I trust they will accept from me the assurance that I feel much flattered at the honour they have conferred upon me; and last, though not least, to you Ladies, for your presence, and the interest you have manifested in my discourse. This, I presume, must arise from a belief that the comparative safety of those who do battle for you and your homes, is the object of my invention, and thus wisely you agree with the sentiments of our great English Poet, who declared that, "A victory is twice itself, when the achiever brings home full numbers."

Mr. OSBORNE called attention to a plan which has been patented by Captain Mathews, of the Leicestershire militia, also for raising and lowering guns on a moveable platform. Some conversation ensued as to the expediency of taking the plan into consideration on the present occasion, and eventually, it was arranged that the necessary papers should be submitted to the Council for their decision, as to whether they should be read in the Institution at a future day.

Rear Admiral Sir F. NICOLSON, Bart., C.B.: I do not wish to detain the meeting more than a few minutes. There are so many points connected with this invention, that I think it would be quite impossible for any officer, or even for any naval architect, and I see a very distinguished one present to give an opinion off-hand on the matter. I would suggest to Captain Inglefield that he should, when his paper is printed, give us all the details connected with it; all the measurements, of which I think we have had none this evening. We should like to know the size of all your cylinders. Could you tell us the draught of water of your ship?

Captain INGLEFIELD: This is a model of a ship of 1,800 tons burden, drawing 19 feet of water.

Sir F. NICOLSON: Where would the water line be?

Captain INGLEFIELD: This is a model to show the principle of the thing. I confess I have not calculated more than actually to obtain the area of the cylinder to lift a certain weight with a certain pressure of water. I find the pressure of water at a height of

20 feet would be 8·7 lb. at the bottom of the ship.

17 feet	"	7·66 lb.	"	"
15 feet	"	6·65 lb.	"	"
13 feet	"	5·64 lb.	"	"

Showing the variety of pressure at different heights. I should, of course, have entered more fully into the description, only I was limited to an hour, and I was anxious to make my paper short, in order to give gentlemen an opportunity to discuss the subject if they should be inclined to do so.

Sir F. NICOLSON: That is one point. There is another point I do not quite understand; you claim that those plates, which you call the counterpoises would protect your men. But when your gun is up, the plates are down on the next deck?

Captain INGLESFIELD: They are, of course. They do not protect the men at all times; but while the gun is being loaded and the men are in motion about the gun, the counterpoises are in some measure a protection not only to them, but to the man who is pointing through the aperture. It is merely an extra protection, used as a counterpoise to the gun, and made available to catch splinters.

Sir F. NICOLSON: But when that counterpoise is down in the lower position, it does not catch splinters.

Captain INGLESFIELD: Of course, it does not then, except in case a shot should come through the lower part; but the counterpoise need not remain so low, it may be carried up on the deck.

Sir F. NICOLSON: Then, with regard to the gun itself, I presume while it is on the deck it is completely exposed?

Captain INGLESFIELD: Not completely exposed when the mantelet is on, such as I have shown here.

Sir F. NICOLSON: It will not be exposed you mean to say, because your mantelet protects it. But if I understand the arrangement, your mantelet only protects it on one side. Then with regard to the pointing, I should like to know how far as to training either fore or aft, you can point the pointing tube; because as far as I understand the thing, your pointing tube labours under the disadvantage of a broad-side gun, while your gun on the upper deck by which it is pointed has a range all round?

Captain INGLESFIELD: Yes, it is so far true that the gun has a range all round; but we must always bear in mind that there are the masts and the rigging, and that though the gun bears all round, it could not be fired all round. Nor could any deck gun on a turret ship. The mantelet protects the gun in the direction of the line of fire. It may be made larger than what I have shown here.

Sir F. NICOLSON: Suppose an enemy on each side?

Captain INGLESFIELD: Then it is liable to be exposed on the unprotected side. But my claim is that the gun is only exposed for a very small portion of time; that time being while it is run out and fired; for the instant it is run in, it is lowered.

Captain JASPER SELWYX, R.N.: As an old messmate, I get up to compliment Captain Inglesfield on the ingenuity and talent he has displayed in doing that which is a very novel thing, making the column of water which is necessarily displaced by the ship a source of motive power. However we may disagree from him with respect to the peculiar conditions under which he employs it; still it is a very valuable feature, and it is a novel one, which promises very considerable results. Whether the counterpoise will go on acting with exact equality under the circumstances of heeling, of course is a point open to doubt; but I have no doubt Captain Inglesfield has provided sufficient surplus power for that purpose. But there is a point on which I have remarked before, with regard to the cupolas—(Captain Coles has not been here to give me an answer on that subject); and I should like to ask Captain Inglesfield how the difficulty that I alluded to is got over. It is this: in all centrally placed guns, the instant the ship heels over, it is true on the broadside you may get a depression of six degrees; but on the bow and not very far on the bow, or towards the quarter, you must necessarily fire through the deck, if you want to bring your guns horizontal. It strikes me that that is a considerable objection to the employment of a very large proportion of pivot-guns as the armament of large ships. If, in the course of Captain Inglesfield's answer, he will be kind enough to touch upon that point, and show how far his ship may heel over without interfering with the bow or the quarter, in pointing the gun to windward, it will be a very great difficulty set at rest. With respect to the angulated

sides, I think that feature has received its chief blow from the fact that the very heeling over brings the angulated side on the lee side, in as unfavourable position as it would be if the side were upright. At long ranges where the trajectory causes the shot to impinge on the plate at an angle, all the advantages to be obtained from the angulation are lost. Some gentlemen think the trajectory a piece of professional slang; but I think those who are accustomed to artillery will scarcely doubt that it has its effects, and that the deck is the most vulnerable point in all ships owing to that very fact. With regard to the employment of the pointing tube, I am happy to be able to relieve a brother officer of a difficulty, by drawing his attention to the fact that by means of a small prism of glass, you may deflect the ray of light coming from the object, so that a person on the main deck or the lower deck can see his object quite as well as if he were looking at it. So that the tube is not a necessity, it can be done away with. I am afraid we shall find the counterpoise liable to very considerable difficulty. It is a familiar fact to all engineers that whenever you have to deal with a moveable platform, the weights vary, the weight increasing with the upward movement and decreasing with the downward, that is to say, if having a pound weight on my hand I move it downwards with a velocity of one foot per second, I have positively subtracted from the pressure of that weight; if, on the other hand, I move my hand upwards with a velocity of one foot per second, I add to the weight. That is a consideration which is of considerable importance in all these cases, and which would lead to complications, that I am afraid would throw the counterpoise out of work. There is also, as in all these cases of supporting heavy weights on stanchions rising from the bottom, very considerable variation in the pressure due to the moveable platform from the heeling and tossing about of the ship at sea. These are considerations which would require very accurate and close calculations before we could admit that they were perfectly met. That has shown itself a good deal in the cupola ship that has been sent out, the "Royal Sovereign." They have shown that, owing to a want of consideration to that fact on the part of some gentlemen connected with it,—I beg distinctly to say that I am not referring to Captain Coles,—the bottom has bulged, and the whole of the bearings have altered.

Sir F. NICOLSON: I met Captain Osborn to-day, and asked him about it; and I assure you it is quite a mistake.

Captain SELWYN: I take the published accounts.

Sir F. NICOLSON: I pit Captain Osborn against the published accounts, and I leave it to the meeting to say which authority they will take.

Captain SELWYN: I had not heard it; and I am glad to hear it on the authority of Captain Osborn. Still I think the objection will apply, because if there is any alteration in the ship in harbour, there will be much more alteration after she has been at sea. With regard to the system as applied to fortifications, I think Captain Inglesfield, when he spoke of tanks in the battery, must have contemplated getting the water from tanks at a distance. Because it would be imprudent to rely for raising your guns upon tanks in the battery which might be pierced. And as to the power of firing to the rear of forts, if that applies to sea-faced forts, I think by the time you have to fire at an enemy in the rear, you would have to get out of the fort altogether. For other forts, particularly in the nature of a martello tower, it would be a most valuable peculiarity to be able to fire landward or seaward. The application of the principle to large ships I have ventured to call in question. But I must now say that by no means do my remarks apply to small gun-vessels, which have no such protection as they require, and which must evidently have some protection when we go to war, with the iron-cased ships now forming the bulk of fleets. For I must deny that the "Enterprise" is a well-protected ship. Captain Inglesfield has said it is known that no four-and-a-half inch plate is a good protection to a gun. Therefore it is folly to rely upon no better protection than this for our small gun-vessels. Moreover, a ship whose velocity may be ten knots an hour on trial, I beg leave to doubt whether she will get more than nine knots, when she gets all her stores on board. If that be so, and this vessel be a corvette, of what use would she be? The light vessels, which should be the eyes of a fleet, if we are ever to have a fleet again, should have the greatest speed. Vessels such as the Confederates have, skimmers of

the sea, may come down on your convoy and snap them up and be off again before your corvette can get near. Therefore I do not think the "Enterprise" is to be named as so satisfactory a class of vessel as some of the papers give us reason to believe. I shall be glad to see (and I have no doubt, as time progresses, that Mr. Reed will be able to give us) something much better than the "Enterprise." No one will be unwilling to recognise the readiness which he has shown to adopt improvements as they arise, and to give us some of his own. Therefore I hope some of the improvements he will in future adopt, may give us an efficient light tonnage vessel, well armed.

Commander SCOTT, R.N.: I will merely make one or two remarks. It appears to me that the introduction of that sort of machinery on board ship is out of place, for I think the heaviest gun can be worked very readily without. My own view is, that rather too much stress is laid on the disadvantage of ports, from not considering how armour-clad vessels are to be fought. Seeing that you will have very few guns in future, and very heavy guns, I think you should discharge those guns, and then sheer your vessel off slowly, and that will close the ports. If you have to raise the gun and lower it, you lose a great deal of time, just at the very moment when you want your gun to be fired as rapidly as possible in close action. At a distance, the raising and lowering of your gun certainly cannot be of much value, nor would you attempt to do it. With regard to supporting the gun, as Captain Inglefield proposes by columns of water, I very much fear whether the holes in the ship's bottom would not tend to weaken her considerably. I agree with what Sir Frederick Nicolson has said about the gun being exposed, that it is a very serious objection in a large gun. I think the closing of the apertures over the gun by shutters is not likely to be attended with good effects, because if a heavy shell fell on deck, a one-inch shutter would not keep it out, and if you had a two-inch shutter, you would have such a mass to move, that you would not be able to work it at all. In truth, the more simple you have all the things connected with naval warfare, the better. The observation Captain Inglefield made just now, about the delicate guns we are likely to have, rather confirms this. We have those delicate guns, but they have been already shown to be a mistake. Those guns are fast disappearing. No breech-loader is being made at the present time; the whole of the breech-loaders will be removed, and we shall soon have no heavy breech-loading guns at all. So that we shall have guns as simple as possible, that will stand work, and will not require any arrangement of the kind proposed to protect them.

Commander DAWSON, R.N.: I should like to ask a question with regard to the want of uniformity of pressure on the ship's bottom. I suppose there will be two or three guns mounted towards the extremities. There must be some parts of the ship being raised out of the water while others are being dipped into the water, and there will necessarily be a difference of pressure. How is that to be got over in the working of the gun? Again, I do not quite apprehend this point, when a gun is fired with great elevation, there will be a great pressure downward, which may come upon one side of the platform; and thus, it appears to me it would act upon one or two of the cylinders only. I did not catch the explanation of how that was to be got over. Another point I did not quite understand is, how the connection between the telescope and the traversing of the gun is to be kept up in the rolling and pitching motion of a ship, so as to follow the object quickly, and to communicate the wishes of the captain of the gun as to its movements, without the interposition of several second captains to read off and regulate the several elevating and training arcs. Those are the only points that occur to me at present; and I believe I am doing a service in asking these questions.

The CHAIRMAN: I have some observations to make. In a vessel of that size, with a gun of a calibre for a 400- or a 500-pounder shot, what time would you allow for raising the gun and lowering it, and for the process of loading again, lifting it up and firing it? I must express my gratification at hearing this application of a power which has never been made use of before; and which, if not exactly carried out upon the principle you have laid down, will, I think, be a useful hint that may be improved upon and applied by and by. I quite agree with Captain Scott, that when you have a heavy gun upon the deck, if you are fighting



at a distance, you will not want to lower it. Your gun will be sufficiently protected by the distance, and you will take your chance; by not being lowered down every time, you can fire a greater number of shots. Therefore, taking one objection with the other, I think the advantage of being able to fire much faster, though the gun may not be so well protected, is a greater advantage than that of lowering the gun down to load after every discharge. This remark applies to firing at a considerable distance. When you are near your enemy, then rapidity of fire is a matter of the utmost importance. I remember, in the action off Trafalgar, the ship I was on board, engaged a Frenchman. She ran aboard us with her spritsail yard into our main rigging. We had six guns on each deck to bear upon her; and it was the rapidity of the fire which changed entirely the fortune of the day. In the course of thirty-six minutes she had 434 of her crew killed and wounded, and all her masts were by the board. She came alongside us with her royals set, and in thirty-six minutes that was her state. It was the rapidity of fire that did the mischief. Fortunately ours was one of the few ships in those days in which gunnery had been very much attended to; and our men were able by their superior rapidity of fire to beat down the fire of the Frenchman. The result was, that throughout the whole action we had only about 90 men killed and wounded, while the Frenchman lost 434 men, and was disabled in thirty-six minutes. That shows how important it is to be able to have rapid fire in close action. Then, again, it is a most important object to make use of heavy guns in the simplest manner possible. I am glad to see men of your talent and genius occupying yourselves in so important a subject as that of working very heavy guns, because we certainly must come to the use of heavy guns. With guns of calibre for shot of 400 lbs. or 600 lbs. no thickness of armour-plating could ever be made that would resist such shot. I mean for sea-going vessels. Therefore it is a matter of great importance that we should be able to make use of the heaviest guns, by land and by sea, in the simplest and easiest manner. About two years ago, in a pamphlet I published, I proposed to make the ship the gun carriage, and to take up the recoil by a succession of buffer springs, and always to fire these heavy guns on a line with the keel. I believe, according to the size of the ship, you might have two, three, or four of these guns at each end, with screws at each end, and guns at each end. Of course, a new system of tactics would be required with ships of that kind. When they fight, they must always keep the bow towards the enemy, and combine the action of the ram with the guns. As this is the first time I have heard the details of the plan which you have given us, I confess that I have not quite followed them. But as a sailor, I think you will agree with me, that for the firing of your guns you cannot have the arrangement too simple. When you are very close, you must have very rapid firing; and when you are at a distance, protection is not of much importance. I must make an observation with regard to Mr. Reed. Mr. Reed has had a hard task to work. In the handiness of his vessels, he has certainly made great advances upon the former most unhandy vessels, which (as far as my experience goes) are deficient in all the material qualities which are essentially necessary to constitute an efficient man-of-war for coast service as well as for ocean service. We shall require coast service more frequently than ocean service; therefore vessels of extreme handiness and rapidity are very necessary.

Captain INGLEFIELD: I came here quite prepared for a discussion of my plans, so novel as they are. I did not expect to find all my brother officers agree with me; and I am glad to find that they have no more serious objections to urge than those which have been brought forward this evening. In reply to those questions, I will answer the Chairman first. First, with reference to what has fallen from you and myself upon the subject of Mr. Reed's vessel, I would like to explain the expression I made use of in my lecture, when I said that until the time Mr. Reed became Chief Constructor of the Navy, we had all but one opinion; naval architects and naval men believed it was only possible to have very heavy guns and very heavy armour on large ships.

Sir F. NICOLSON: With great speed.

Captain INGLEFIELD: With great speed. That, I think, was thoroughly understood. Now Mr. Reed has produced vessels that, so far as the experiments are re-

ported, have been highly successful. So I read in the official report in the public prints, and that much I quoted in my paper. Captain Selwyn has referred to the counterpoises that I employ for assisting to raise the guns. He thinks they would not rise and fall with sufficient accuracy, and that there would be a difficulty in guiding them. It is possible there might be. But I do not find there is any difficulty, however much a ship may heel, in the rising and falling of the pistons of the cylinders in the larger ships, or of the slide valves, or in the rising and falling of the sliding gear in a vessel, that rises and falls many times in a minute. Therefore I think with a suitable arrangement there would be no difficulty in working these counterpoises, which have nothing but their own gravity to keep them in their places. They might be carried in the lower part of the ship, in convenient slides and uprights for making them work exactly. Objection was made to the holes in the bottom of the ship, by which the water is to be supplied to the cylinders. But it must be borne in mind that all ships of modern times have some eight or nine holes in their bottoms, and yet we never hear of much going wrong. They are fitted with valves. These holes are employed for blowing out and supplying the boiler. And with such openings as these I would feed my cylinders by which the water is supplied to the pistons. Therefore I do not consider that any great difficulty would be occasioned on that ground. The shutters which I use for covering the aperture are not intended, like the deck which is covered with a certain thickness of iron plate, exactly to keep out a falling shell; but it is intended to protect the crew from the splinters of a shell which may burst over the aperture. Of course, if they were made of the weight and thickness of the deck, there would be great difficulty in moving them.—With reference to the pressure of water when a ship heels over in a seaway, I may reply, that if one portion of the ship is heeling over, and is thus much out of the water, the other portion of the ship is so much the more immersed. Therefore the pressure upon the cylinders would be equalised in that manner; upon one side the pressure might be greater, while upon the other it might be less. Conveyed through a tube or a platform such as I have in this model, quite independent of the gun-platform, and worked in suitable slides, I consider that the gun itself would always rise at a perfect level, and that the platform would carry it perfectly truly. One gentleman spoke of the difficulty of aiming the gun, while the captain who is looking through the telescope is not actually at the breech of the gun. But I should explain, what must be familiar to most of you, that the captain of the gun does nothing himself with regard to the laying of the gun, except to look along it. He orders the hands-pike-men, and the men at the side tackles, "Muzzle to the right! Muzzle to the left! Elevate! Depress!" And so the captain of the gun, in this instance, will look along the tube, and will read from the arc the angle at which it should lie; and, instead of saying, "Muzzle to the right," he will say, "Two degrees before the beam!" or, "Two degrees abaft the beam!" At long ranges, I think you said, Sir George, that it would not be necessary to lower the gun. You remember, perhaps, that in my paper I said specially that when firing at a target and at long ranges, the gun might be fought entirely from the upper deck; and I believe, moreover, my gun would be applicable to fighting from the upper deck with less exposure to the crew. For I showed you by this arrangement the gun is run out entirely by the crew below; and if this mantelet is employed, the gunner may sit in a protected position looking along the gun, and giving his orders through the open aperture to the men below, who will train the gun by means of the pinions and ratchet work in the direction required. The gun upon its running in, if it is a breech-loader, may be loaded on the upper deck easily; or if the men are fighting upon the upper deck, they may load it, two men being exposed only for a moment, and retiring upon the gun being fired. Therefore I think the gun may be fired even as an upper deck gun. With regard to the advantages of a central gun or pivot gun over a broadside gun, I conceive that one point has not been alluded to, which should not be lost sight of. It is this: we are coming to a period when nothing but the heaviest ordnance can avail for our war ships. We find that ships, however thickly they may be coated with iron, and however well-protected with teak backing or iron lining, can nevertheless be penetrated. Therefore we must employ heavy guns for such work; and if heavy guns are to be employed, I do not think that they can be carried upon a broadside; that, in fact,

they must be in some position where a ship can carry in a seaway, or in a gale of wind, such an immense amount of metal as is contained in this very heavy ordnance. I therefore believe that such heavy guns must be carried as central guns. I propound this plan for carrying very heavy guns in a central position, as having the advantage of carrying half the number that I should require in a broadside ship. For clearly my guns can be fought on either side, instead of carrying a double number, which you must always do in a broadside ship.

Captain SELWYN: Will Captain Inglefield be kind enough to remember the question I asked about the bow to windward when the ship is heeling over?

Captain INGLEFIELD: I do not think that that is a question that any one is in a position to answer; for let the ship heel, place your gun as you may, you cannot fire from the centre of your ship across your bows without firing through your deck, unless you have a turret placed so high, that you can point clear of that immense range of deck.

OLIVER LANG, Esq.: I have one remark to make, viz., the lecturer has stated that all naval architects thought it impossible small sea-going ships could be built to carry armour plates, and that until Mr. Reed showed us how to do so we had no idea of anything of the kind. For myself and every naval architect I am acquainted with, I entirely repudiate that statement. The lecturer tells us the "Enterprise" is a vessel that "has done wonders, that she has attained a speed of near ten knots." Now the speed of the "Warrior" is about fourteen knots, and what chance would a vessel like the "Enterprise" have at sea with the "Warrior," but if the "Enterprise" is designed only as a coasting ship, then a vessel could be built of the same size as her that would do everything she can do, and draw from two to three feet less water. That naval architects supposed the "Defence" the smallest size ship that could be built to carry armour plates, I entirely repudiate.

Captain INGLEFIELD: In reply, I can only say that the reports I have read of the experiments with the "Enterprise" and "Research," are such, as have led me into this error, if error it be, that they have achieved very large advantages, which had not been anticipated by naval architects and by seamen. I have had no opportunity of going out in the vessel. I have read the report from which the words, pretty nearly, that I have used myself have been quoted, that until Mr. Reed laid down these vessels, the "Research" and "Enterprise," it had always been considered that great speed, heavy armaments, and sides iron-protected far below the water-line, could only be carried in large vessels.

Mr. LANG: Then ten knots you consider to be high speed? I do not; and although I do not believe the "Enterprise" will realize more than nine knots, I give her ten; but what chance would such a ship have with one like the "Warrior," having a speed of fourteen and a-half to fifteen knots. Why *she would be out of sight in less than two hours*. It is well known that a ship that has to carry heavy weights must, if required, to attain high speed, have less displacement given by size and not by filling the fore and after ends, as with a bad formed ship it is impossible to obtain high speed, and that if ships are equally well designed, and have power in proportion, the speed of the large ship will always exceed that of the smaller one; but when the large one has a speed of fourteen and a half and fifteen knots, and the small one only ten, what chance can the latter have; it is absurd to compare the one with the other.

Sir F. NICOLSON: You used the word "official report," just now. Is it the report in the *Times* that you have read, or have you seen any other report?

Captain INGLEFIELD: I confess I have seen no other report; but this was often spoken of as an official report.

Sir F. NICOLSON: I want to explain to the meeting the value of these reports. I have had some experience of the reports under the head of Naval and Military Intelligence, which appear in the newspapers. At Woolwich I have had two years and a half experience of the accuracy of these reports, and if the meeting will be good enough to take it upon my testimony, I can assure you that they are frequently very inaccurate.

Mr. LANG: An old master shipwright who had been at Chatham a considerable number of years, told me the most surprising thing was, that when he saw anything

in the papers of which he had the means of knowing the correctness or not, he always found the report incorrect.

Commander SCOTT: Will you allow me to say one word more, as Captain Inglefield has mentioned a point which ought not to be passed over without comment; that is, as to working heavy guns on a broadside.—No heavy guns were proposed to be worked upon the broadside at all, until it was proposed in this Institution about two years ago.—The proposal was first mentioned here in 1862. But the vessels that Captain Inglefield has been speaking of, were only built to take the guns then in the service, the 68-pounders and the 110-pounders, which are not the heaviest guns. I wish to mention that, because it was in this Institution that the plan of working heavy guns on the broadside was first brought forward. If Captain Inglefield will refer to the journal, to the report of Mr. Barrass's lecture (I do not know whether it has been published or not) he will there find not only that heavy guns were proposed to be worked on the broadside, but that the means by which they were to be worked was particularly described—guns up to 24 tons.

The CHAIRMAN: With regard to the *critique* upon vessels, that, I think, is not the immediate subject of your lecture; it is the working of the gun.

Captain INGLEFIELD: Certainly; but reference is made to what I have stated. One more remark with regard to the newspaper reports, that Sir Frederick Nicolson has endeavoured to explain. I may say, and I think it is known to you all, that it is a very common thing to bring before much larger and much more important assemblies than this, the reports of the newspapers. In the House of Commons we frequently find paragraphs read and discussed from the newspaper reports. Therefore, I am not very much out of the road in having taken for granted what appeared in the *Times*, which I may perhaps qualify by calling it a semi-official report respecting the trial trip of the "Enterprise." Upon the semi-official report I based my argument. If I am in error, those gentlemen who have been in office, and who know what were the actual performances of the vessel, are far better able to give an opinion upon the subject than I am. I yield to them in that respect; nevertheless, I cannot desert the gentleman whom I spoke of before (Mr. Reed); though I have never seen him but once in my life, and therefore, he is no acquaintance or friend of mine, I believe him to be a very talented gentleman, very well adapted to the position in which Government has placed him.

Mr. OLIVER LANG: When the statement was first mentioned by the lecturer, I thought it was so foreign to the subject of the lecture, that it would have been encroaching on the time of the company had I noticed it; but when the lecturer repeated that naval architects did not know that a smaller ship might be built to carry armour plating, I thought then, that I really could not leave the room without setting him right; as it would have been thought that I agreed with the lecturer in every word he said. The lecturer tells us that he has given us these statements on the reports of the *Times*, that the "Enterprise" is a most signal success. I ask him what he conceives to be a signal success? If by a stretch I make the speed of the "Enterprise" ten knots, and if by a stretch in the same proportion, I make the speed of the "Warrior" fifteen, then I ask him whether he thinks ten knots in proportion to fifteen, a great success?

Captain INGLEFIELD: In reply to that observation, I think I quite meet the views of the Council in saying that this is not the time nor the occasion for discussing the merits of the "Enterprise," or any other ship. I therefore feel that I am not called upon to respond exactly, or to defend this vessel or that. I merely alluded to it as having read what I understood was the feeling of naval architects, and of naval men with reference to armour-plated ships of various sizes.

Captain SELWYN: As the discussion has taken rather a conversational shape, and as some points have been raised to which, as Captain Scott remarked, a reply could not be made previously, I may briefly notice a question which is a very interesting one, that of broadside guns against pivot guns, as regards the possibility of carrying broadside guns. I am totally at a loss to understand why, if corvettes like the "Tartar" can be built to carry ten 68-pounders of three tons each on the broadside, the same vessel cannot carry two ten-ton guns. It is very true the weight is more locally placed; but I conceive any naval architect will tell us that that can be met

by increasing the strength at the point which is called upon to bear it. Therefore, I do not see any very material difficulty as regards the carrying of the very heaviest guns that artillerists choose to make on the broadside of a ship, properly calculating for them.

The CHAIRMAN: If no other gentleman wishes to make any remark, we will thank you, Captain Inglefield, for the paper you have read,—for the able manner in which you have treated subjects of so much importance to the sailor as well as to the soldier. I am glad to find men of your character giving attention to matters of so much importance; and I hope they will continue their investigations. We are in a transition state. Everything connected with naval construction and artillery is a question of life or death to us. I hope the attention of both services will be called to it, and that we shall frequently have papers read on the subject with the ability and ingenuity which you have shown.

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