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Publisher: Routledge

Informa Ltd Registered in England and Wales Registered Number: 1072954

Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK

Royal United Services Institution. Journal

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/rusi19>

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Published online: 11 Sep 2009.

To cite this article: Captain Samuel Long R.N. (1881) Study of the Tactics of Naval Blockade as Affected by Modern Weapons, Royal United Services Institution. Journal, 25:110, 316-349, DOI: [10.1080/03071848109418263](https://doi.org/10.1080/03071848109418263)

To link to this article: <http://dx.doi.org/10.1080/03071848109418263>

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Friday, February 11, 1881.

VICE-ADMIRAL G. G. RANDOLPH, C.B., in the Chair.

STUDY OF THE TACTICS OF NAVAL BLOCKADE
AS AFFECTED BY MODERN WEAPONS.

By Captain SAMUEL LONG, R.N.

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I. THE blockade of an enemy's coasts, including his arsenals and commercial ports, is one of the most common, one of the most important, and we may add one of the most trying and monotonous of naval duties in war. And if this be true with respect to all nations, it is doubly so with respect to this country, to whom blockade by sea would be ruin, and whose commerce would suffer most seriously, should she at any time be unable to confine the majority of her enemy's war ships and privateers to their own ports.

We need but glance back at the history of the last hundred years to find ample support for these assertions. During the war waged against France from 1793 to 1802, and 1803 to 1814, we find the British Government alarmed¹ in 1801 by their experience that, notwithstanding the greatest maritime superiority, it was impossible at all times to

¹ Alison's "History of Europe," vol. iv, p. 604.

prevent a vigilant and active enemy from putting to sea during the darkness of autumnal or winter months.

Again, in 1805, when the Rochfort squadron paid a flying visit to the West Indies, the same historian tells us¹: "The successful issue of this expedition excited the greatest alarm in Great Britain, from the evidence which it afforded of the facility with which, notwithstanding the utmost vigilance of the blockading squadrons, the enemy's fleet might leave and regain their harbours, and carry terror into her most distant colonial possessions." On April 25th, 1814, the British Government² declared the ports of the United States north and south of New York in a state of blockade, and the United States Government issued a counter-proclamation stating that a blockade of 2,000 miles of coast line could not be enforced, and was an unwarrantable stretch of belligerent rights. As a commentary on this, the statement of the Secretary of the United States Navy in 1865 is interesting. He says³: "During the war of 1812, our navy of 301 vessels made but 291 captures. There were 517 commissioned privateers, and their captures numbered 1,428.

Passing on to 1854, we find⁴ the first head of the orders issued to Sir Charles Napier was to "keep the Russian fleet shut up in the Baltic and prevent their cruisers slipping out to the injury of our commerce and coasts."

In the war of 1861-65 between the Northern and Southern States of America, the first step taken by the Federal Government was to appoint a Commission to report on the best manner of effectively blockading the southern ports and coasts, and the work of the navy at sea during the war lay principally in carrying this intention into effect. The later wars in Europe have been fought out principally on land, and, excepting the naval campaign of Lissa in 1866, and the obstruction the Russian armies suffered during the late war, from the Turks having the command of the Black Sea, there have been no very striking instances of the importance of naval blockade.

The foregoing, however, may be sufficient to indicate the importance to the profession of sound views on blockading operations.

II. Naval warfare falls conveniently under three heads—open sea, coast, and river. Our present subject lies principally within the province of the second, and it may be as well to define its limits, which I conceive include all operations indispensably subsidiary to blockade, and therefore may involve the reduction of small outlying forts, but exclude any operations having for their object the attack of a regular maritime fortress.

Blockade by sea may be conveniently divided into—

- (a.) That instituted against an important arsenal, the head-quarters of a powerful fleet, with a view to prevent the issue of hostile expeditions. The proceedings of the Baltic and Black Sea fleets in 1854-55 furnish an example of this, rendered, how-

¹ Alison's "History of Europe," vol. v, p. 320.

² *Ibid.*, vol. x, p. 710.

³ Report of Secretary of United States Navy, 1865, p. 29.

⁴ "The Baltic Campaign of 1854." G. B. Earp, from Sir C. Napier's papers.

ever, very imperfect by reason of the inferior type of the Russian ships, consequent on the recent introduction of steam.

- (b.) That instituted against fortified commercial ports to stop commerce with the enemy and prevent the issue of privateers or war ships.

The proceedings of the Federal Navy on the coast of North America during the war of 1861-65 furnish the most conspicuous example of this kind.

The principles governing all warlike operations must here be noticed. Strategy, from the Greek word for Commander-in-Chief, may perhaps be defined the science proper to Commanders-in-Chief. General Hamley says¹: "The theatre of war is the province of strategy, the 'field of battle' that of tactics." The purely military advantages to be obtained by strategical operations are of two kinds—1. The probabilities of victory; 2. The consequences of victory.

No operation can be without risk to both sides, and none, says Sir Howard Douglas,² should be undertaken without weighing carefully both the successful and the unsuccessful issue.

Good strategy consists in so using your forces that defeat shall involve but small and unimportant losses, while victory involves large and important gains. Good tactics generally involve overwhelming a portion of the enemy's force with the whole or a greatly superior portion of your own. The operations open to a Naval Power desirous of blockading an enemy's coast will obviously depend materially on the amount and disposition of the naval force of that enemy. Should it be small and easily imprisoned, and should the fear of other political complications be absent, risks of the fleet may be admissible, which under other circumstances would never be contemplated. As an example of the former conditions, the bombardment of Sevastopol by the allied fleets on October 17, 1854, after the self-destruction of the Russian fleet, may be cited.

The fate of the Italian fleet at Lissa³ is a striking instance of the consequence of disregarding strategical principles in face of an enterprising enemy. Under the influence of an ignorant but enthusiastic public opinion, Admiral Persano was ordered to attack Lissa, situated 120' south-east of Ancona, with forts and batteries mounting nearly 100 guns, and garrisoned by from 2,000 to 2,500 men, the island being in telegraphic communication *viâ* Lesina with Pola, 150' to the north-west, where lay the Austrian fleet under Tegethof. Admiral Persano, against his judgment, left Ancona on July 16th, 1866, with his fleet of five formidable wholly ironclad ships, mounting 114 heavy guns, seven partially ironclad vessels, with 134 guns, and 18 unplated vessels, with 366 guns, in all 33 ships, 614 guns, and 9,727 men, besides a landing party of 1,200 more. He bombarded the forts on the 18th and 19th, and attempted to land his troops, and was on the point of renewing

¹ "The Operations of War explained and illustrated," 1878.

"Naval Gunnery."

³ "Revue des Deux Mondes," November 15th, 1866. "Lessons from Lissa," Capt. P. H. Colomb, vol. ix, No. XLIII, Journal R. U. S. I.

his operations on the 20th July, when the Austrian fleet, under Admiral Tegethof, consisting of seven ironplated ships, with 176 guns, and 19 other vessels of various sizes, mounting 355 guns,—in all 27 ships, 531 guns; and 7,906 men, hove in sight. The Italian Admiral had to engage with tired crews; 16 men killed and 95 wounded, several of his ironclads damaged, one of the most powerful, the “*Formidabile*,” *hors de combat* (from her engagement at 320 yards distance singly with the Madonna casemated battery at Port St. Georgio, where she was hulled ninety times), his shell-rooms and magazines partially empty (the “*Ré d’Italia*” fired on 18th 1,800 projectiles, or 72 rounds per gun, one broadside) his wooden ships and gunboats ill prepared to join in the battle; and the rest of his ironclads scattered over a length of eleven miles. Thus, in spite of the disparity of force (the “*Affondatore*” turret ram had been considered in England as a match singly for the whole Austrian fleet), the Austrians gained a decisive victory, which could hardly have been the case had the Italian fleet been unscathed.

III. I must now turn to the war of 1861–65 between the Federal and Confederate States of North America.

The portion of coast we are more especially to consider lies between Cape Lookout on the north, and Savannah on the south, and is about 60 miles distant from the inner edge of the Gulf Stream. The 20 fm. line lies from 25 to 40 miles off the shore; and the weather during the winter months is frequently stormy.

Fogs appear to occur occasionally, though in the Federal accounts they are not mentioned.

The objects¹ originally laid out for the Federal forces to achieve were:—

1. To blockade the sea coast of the Confederacy and prevent trade.
2. To open and keep command of the navigation of the western rivers.
3. To drive the Confederate Government from its chosen seat at Richmond.

This plan was known in the south as the “*Anaconda plan*,” from its analogy to the manner in which that serpent secures its prey.

At the end of August, 1861, the Confederates held the coast from Alexandria on the Potomac, down that river to its mouth, and along the coast round to the entrances of the Mississippi, and also onwards to the Mexican frontier on the Rio Grande. The Secretary of the United States Navy in his Report for 1863, says: “The extent of coast “blockaded, according to an accurate table of measurement carefully “prepared at the Coast Survey Office, covers a distance of 3,549 statute “miles; with 189 harbours or river openings or indentations, and much “of the coast presents a double shore to be guarded.”

The naval resources of the belligerents were very unequal. To begin with dockyards, the indispensable base of naval operations, the South possessed the remains of Norfolk which was burnt by the Federals on April 20th, 1861,² leaving the “*Merrimac*” only partially destroyed, and

¹ “*Campaigns in Maryland and Virginia*,” Capt. Chesney, R.E., 1864.

² Boynton’s “*History of the U. S. Navy during the Rebellion*,” 1867.

Pensacola an unimportant yard without docks. The North possessed Philadelphia, Brooklyn, Boston, and Portsmouth.¹

Mr. Donald McKay, an eminent ship-builder, says: "Our ship-building power has not in the least suffered by the loss of the seceded States, they did not build 1 per cent. of the ships built in the Union." As to ships of war, the South possessed only the broken hull of the "Merrimac," while the North had 42 steam-vessels, carrying 555 guns and 7,600 men; but of these only four were in Northern ports and available for service at the outbreak of the conflict.

To understand the position of affairs when the blockade of Charleston and Cape Fear River (Plate VIII) were fairly entered on, we must glance at the naval operations preliminary to maintaining those blockades. Immediately after closing the ports of the States in rebellion and giving that act the character of a blockade, the efforts of the Navy Department were directed towards securing several harbours at comparatively equidistant points, as bases of operations for the several squadrons, into which they could conveniently enter for repairs, refit, and supplies, instead of returning to the Northern ports for that purpose; which would have endangered the efficiency, and in some instances might even have involved the abandonment of the blockade. The first operation was the capture of the forts at Hatteras Inlet, of which a detailed account was given here by Rear-Admiral V. Hamilton, R.N., in May, 1878. This took place on August 29th, 1861, and was followed by the capture of Ocracoke Inlet on September 17th, and of Roanoke Island, February 8th, 1862.

The capture of Newbern,² March 14th, 1862, and of Fort Macon, by which the important harbour of Beaufort, N.C., fell into Federal hands, completed by April 25th, 1862, the naval command of the North over Pamlico Sound and adjacent inlets.

Beaufort Harbour,³ henceforward the head-quarters and base of the squadron blockading Cape Fear River (is 83' N. of Cape Fear), has shelter from all winds, and is easy of access: 17 feet may be carried over the bar at mean low water.

A naval station south of Hatteras being needed for repairing iron-clads, and replenishing the ships with stores and provisions, that of Port Royal in Georgia, 55 miles south of Charleston, was fixed upon. The deepest channel carries 21 feet at low water,⁴ with a rise of 3 feet at spring tides, its capture⁵ is detailed in Rear-Admiral Hamilton's paper before referred to, and took place on November 7th, 1861, after which it became the head-quarters and base of operations of the Federal South Atlantic squadron, charged with the blockade of 300 miles of coast, a considerable portion of which is a network of inlets and sounds, and which includes the cities of Charleston and Savannah.

I will now pass on to Charleston Harbour. If an observer were

¹ "War Ships and Navies of the World," King, 1880.

² Boynton's "History of the U. S. Navy during the Rebellion."

³ "Sailing Directions for the principal ports in the United States."

⁴ *Ibid.*

⁵ It is stated by Pollard, "that the smoke drifting on Fort Walker greatly baffled the gunners."

Fig 1.

Fig 2.

anchored in the centre of the channel between Fort Moultrie and Cumming's Point, he would, looking seaward, have a sea horizon of 115° from the shore of Sullivan's Island E. by N. $\frac{1}{2}$ N. to that of Morris Island, S. $\frac{3}{4}$ W., and should the sea be rough, the whole of this arc would exhibit breakers, as the bar extends right across the entrance. Close to the shore of Sullivan's Island is Beach Channel, carrying 13 feet water. Next to this comes North Channel, with 10 feet; Swash Channel, 11 feet; and lastly, parallel to the shore of Morris Island, from which it lies on the average nearly a mile distant, is Main-ship Channel with 14 feet on the bar at L. W. S., the above depths being subject to an increase of 5 feet at neaps, and 6 feet at spring tides. As regards the batteries, a ship crossing the bar of the main channel would be 7,000 yards distant from Fort Wagner on Morris Island, and on turning up the channel 6,000 yards on reaching the buoy where the "Weehawken" sank, she would be 2,800 yards from Wagner, 5,600 from Fort Moultrie, 5,200 from Fort Sumter, and 5,300 from Fort Beauregard on Sullivan Island. When abreast Fort Wagner, she would be subject to the fire of some fifty heavy guns from 11 to 6 inch calibre at a range of about 3,000 yards. The harbour mouth is not the only sea route to Charleston. There is also communication between Ashley River and the sea south of Folly Island *via* Stono Inlet.

It is unnecessary to repeat the details of the obstructions and fixed torpedoes, both mechanical and electric, which formed part of the defences, and may be found described by Colonel von Scheliha, or in the report of the Secretary of United States Navy, 1865. After the capture of Charleston, Admiral Dahlgren reported that "quite sufficient" is certain to show that these several contrivances of obstructions and "torpedoes would have been as troublesome as it was expected they would be, in connection with the heavy batteries that lined the harbour and the enemy's ironclads."¹

The general plan of blockade followed by the Federal commanders seems to have been that of dividing the available force into two squadrons, an inshore one, drawn as closely in as the state of the weather would permit, and an outer one, at a convenient distance outside; the inner ships were not allowed to chase off, but the outer ones were, and the larger vessels composed the outer line. The blockade during 1861 seems to have been very inefficient, and on December 20th, 1861, fifteen old whalers filled with stones were sunk on the bar of Main-ship Channel, without any effect in closing it, as the tide soon swept a passage. At the same time Mr. Pollard² states that the South had begun to feel severely the effects of the blockade and that their privateers were pretty closely confined within their own harbours and rivers by the blockading fleets. In April, 1862, the Federal Government issued a proclamation placing the coast under blockade, and the Secretary of the Navy reports, December, 1862: "Each of our blockading squadrons, viz., the North Atlantic, South Atlantic, East and West Gulf blockading squadrons has secured and holds a

¹ Two plated gunboats were captured at the surrender of Charleston.

² "The Lost Cause," A. E. Pollard.

"considerable portion of the coast within their respective limits, and in each there is a commodious and open port for rendezvous, refitment, and supply." At the commencement of the blockade, constant annoyance was experienced from various sources, by means of light draught vessels which emerged from and retreated into the sounds and inner waters of the coast. In October, 1862, a Torpedo Bureau was established at Richmond, and General Beauregard¹ assents to the opinion that, had the Confederate practice of submarine warfare been nearly as efficient at the commencement as it was at the close of the war, the blockade of the Southern ports would have been rendered so inefficient as to have commanded no respect from European Powers.

On February 2nd, 1863, when nine vessels, of which the "Housatonic" was the principal, and the others the light class of purchased ships, were on blockade, two ironclad gunboats came out of the harbour at 4 A.M. by the main ship-channel in a thick haze, and attacked and disabled the "Mercedita" and "Keystone State," but on the rest of the squadron approaching to their rescue, the Confederate vessels returned into port. The "New Ironsides," "Powhatan," and "Canandaigua" were sent to reinforce the squadron, but the success of the enterprise shows how an inferior force may act from the shelter of its forts. As these raids are a distinctive and purely naval feature of the war, I shall here cite that of the ram "Manasses"¹ against the squadron blockading the Mississippi on the night of October 12th, 1861; and again that of the ram "Albemarle" in Roanoke River in the spring of 1864. To return to the siege of Charleston: the Federal Government having reinforced Rear-Admiral Dupont with the "New Ironsides," 17, and 7 monitors, each carrying 2 guns, and the "Keokuk," an inferior vessel of monitor type, also of 2 guns, he was ordered to attack Charleston, and proceeded to do so on the afternoon of April 7th, 1863. The Confederate forts are stated to have had 76 guns bearing on the squadron, which had but 33 in all. The squadron moved in line ahead in close order, but on nearing the obstructions, the "Weehawken" leading, was obliged to turn, and some confusion seems to have occurred, the "New Ironsides," doubtless on account of her difference of tonnage, nearly three to one, and speed, getting out of station and having to anchor twice to avoid grounding. After being under fire from 2.50 P.M. to 4.30 P.M. as detailed by Mr. Hamilton,² C.S., in his paper read here June 1st, 1868, the squadron withdrew. Of this attack I shall only remark, that it was based on an exaggerated idea of the powers of the monitors, and that their defensive advantages alone saved the whole fleet from the fate of the "Keokuk," which sank at her anchors the following morning. The Federal Government ordered the fleet to continue within the bar, and relieved Admiral Dupont by Admiral Dahlgren, at the same time ordering General Gilmore, with a force of 11,000 men, to capture Morris Island and destroy Fort Sumter. Morris Island is a low irregular mass of white quartz sand accumulated on the marsh land. At its south end are some sand hills about 36 feet high, and at Fort

¹ Col. Fletcher's "History of the War."

² Journal R. U. S. Institution, 1863, vol. xii, No. XLIX.

Wagner it has a width of only 25 yards and the neck is sometimes submerged. Fort Wagner was a sand work with bombproofs for 1,500 men mounting 18 guns, and at battery Gregg, on Cumming's Point, were seven more. Only a précis of the events of the siege, in many respects a remarkable one, can here be given, but full details can be found in General Gilmore's work. In less than a month he made batteries on Folly Island screened by the woods, mounting 48 guns and mortars, opened fire upon, and captured the defences at the south end of Morris Island on July 10th; assaulted Fort Wagner and was repulsed on the 11th; placed 25 rifled guns and mortars in position at 1,350 yards from Wagner by the 17th; silenced its fire and assaulted it on July 18th, and was repulsed with a loss of 1,517 killed and wounded; finally he constructed batteries to disable Fort Sumter, especially its upper barbette guns, whose fire (47 feet above the water) was especially dreaded by the ironclads. One 300-pr. 6 200-prs. and 9 100-pr. rifled guns, with others, were mounted at distances from Fort Sumter of 3,200 and 4,235 yards, and it was destroyed for offensive purposes over the heads of the other batteries by September 1st. On September 4th a heavy fire was opened upon Fort Wagner, which was evacuated after forty-two hours bombardment, and the whole of Morris Island occupied by the Federals on September 6th.

The "New Ironsides" assisted greatly in this last bombardment, during the day time, keeping up a regular, precise, and almost incessant stream of 11-inch shells ricocheting over the water against the sloping parapet of Wagner, whence deflected upwards with low remaining velocity they dropped nearly vertically, exploding within or over the work and vigorously searching every part of it except the subterranean shelters. On shore the calcium lights turned night into day, and while throwing around the Federal men an impenetrable obscurity, they brilliantly illuminated every object in front and brought the minutest details of the fort into sharp relief. General Gilmore remarks that the bombproof shelter remained practically intact, and states that 1 lb. of metal was thrown for every $3\frac{1}{4}$ lbs. of sand moved owing to the flatness of the slopes, and that the place could never have been reduced by a naval force. On the night of September 7th-8th, Fort Sumter was unsuccessfully assaulted by a strong landing party from the fleet, the army having also organized another, which did not come off as the naval one was expected to be successful.

After the capture of Morris Island, the monitors lay inside the bar, and at night two moved up to the entrance of the harbour, the outside squadron remaining on blockade off the northern channels. On October 5th, Lieutenant Glassell, C.S., attempted to blow up "New Ironsides" with a spar torpedo but failed. On November 17th a heavy fire was opened by the Confederates on Cumming's Point, and the monitors moved up to prevent any attempt at recapture. The "Lehigh" grounded and the "Nahant" towed her off in daylight under cover of the fire of the other monitors. General Gilmore says: "An attempt to illuminate the waters near Cumming's Point with the calcium lights" was only partially successful, as the distance, over 3,000 yards, was too

"great for the apparatus which we had. The idea was to throw a cone of light upon the water approach and station the guard-boats in the obscurity just outside the lateral limits of the cone. The plan I am convinced was entirely practicable with powerful reflectors."

On December 6th, the "Weehawken" sank at her anchors, the supposed reason being the separation of the hull and overhang. On February 17th, 1864, the "Housatonic" was destroyed by Lieutenant Dixon, U.S., with a spar torpedo, himself and crew perishing.

Admiral Dahlgren writes: "As a probable consequence, the whole line of our blockade will be infested by these cheap, convenient, and formidable defences, and we must guard every point." "I believe torpedoes to constitute the most formidable of the difficulties in the way to Charleston." However, we only find two other boat attacks on vessels of the Admiral's squadron, one on the "Memphis" in North Ediston River, and the other on the "Wabash," off Charleston, both of which failed. General Beauregard had formed the same estimate as regards the value of this kind of defence, but had not the means of putting the system into execution, and, moreover, great precautions were henceforward taken on both sides against such attacks. Admiral Dahlgren's orders were:—

"If vessels on blockade are at anchor they are not safe, particularly in smooth water, without outriggers and hawsers stretched round and rope netting dropped in the water. Vessels on inside blockade had better take post outside at night and keep under way until these precautions are completed. All the boats must be on patrol when the vessel is not in movement. The commanders of vessels are required to use the utmost vigilance, nothing less will serve."

On January 16th, 1865, the "Patapsco," while on picket duty at the entrance, struck a submerged mechanical torpedo which had been laid down with 70 lbs. powder the night before, and sank, 62 officers and men being drowned. On reporting this, Rear-Admiral Dahlgren remarks: "The 'Patapsco' had her torpedo fenders and netting stretched round her as usual, and three boats with drags had preceded her searching to some depth the water they had passed over. Nothing more can be done to bar the chance of accident, save the fitting of permanent torpedo-catchers, substantially made and attached to the bows so as to be entirely submerged and thus not exposed to shot in action. This cannot be done here. No one who has not witnessed it can appreciate the harassing nature of the never ceasing vigilance with which the monitor duty is maintained in this harbour, no matter what the weather may be, amid the heat of summer, the cold of winter, or the heavy gales and bad weather which so often visit this anchorage." In February, 1864, the Admiral had asked for more vessels on the outer blockade, saying: "The great wear and tear of the heavy weather of the season always keeps an inconvenient number off duty."

I must now conclude my notice of the principal events of the Charleston blockade. At the end of 1864 the Secretary of the Navy reports that after the withdrawal of the troops from the neighbourhood in May, 1864, the presence of the ironclads was indispensable to the continued possession of Morris Island, which, as well as the blockading

fleet, would have been assailed by the armoured vessels of the enemy. Rear-Admiral Dahlgren, in his report on the services of the monitors,¹ says: "The completeness with which four little monitors, supported by "an ironclad frigate, have closed this port is worth noting, . . . they "muster 8 guns and 320 men, which is almost insignificant in comparison "with the work done." After adverting to the delay incident to the distance whence labour and materials for repairs had to be procured, he remarks: "The bottoms were cleaned, having become so foul with "oysters and grass that the speed was reduced from 7 to 3 or 3½ "knots, which, with the strong tide of this harbour, added considerably "to the difficulties of working the vessels properly under fire. One "night I was caught by heavy weather from south-east while close up "to Sumter, and it was well that the darkness of the night prevented "the slowness of our motion being perceived by the enemy."

He also remarks on the disadvantage of a ship possessing no end-on fire, which with the "New Ironsides" was particularly and frequently inconvenient in attacking the works on Morris Island, for at certain stages of the tide vessels tail nearly across the channel.

The report further states: "On this coast 10 or 11 feet is the most "convenient draught of water for penetrating all the principal sounds "and rivers and navigating them to any extent." The "New Ironsides" draught (16 feet) could not always pass the bar. The gallant Admiral had good reason to respect torpedoes, for on March 1st, 1865, his flag steamer "Harvest Moon" was blown up, at Georgetown, on ground which had been previously swept, and the ship sank immediately. The Admiral was waiting for his breakfast at the time, but as the explosion fortunately occurred under a large hatchway there was only one life lost.

With reference to the foregoing I remark:—

- 1st. That the monitors,² though admirably adapted for fighting in sheltered waters, were not equally suitable for sea work, and their weakest point is the small reserve of buoyancy, making subaqueous missiles their most formidable enemy.
- 2nd. That the small height of Fort Wagner above the water, and the lowness of the approaches, rendered it a most favourable object for the attack of vessels which could approach within 300 yards at high water, and take it in reverse without being nearer Forts Sumter and Moultrie than 2,300 yards. And as Admiral Dahlgren states that the monitors stood the enemy's shot well at 1,200 yards, it must be admitted to be a striking instance of the power of such works to resist mere cannonading.
- 3rd. Rope obstructions were found to be of value by the Confederates. General Beauregard remarks: "Shortly after these cables "were in position, a blockade runner attempting at night to "pass through the gap purposely left open near the Sullivan's "Island shore under the guns of Fort Moultrie, accidentally

¹ See Appendix I.

² Appendix II, Record of Firing.

"crossed the end of the rope obstruction, when one of the streamers got entangled round the shaft, checking its revolutions. The vessel was at once compelled to anchor to avoid drifting on the torpedoes or ashore, and afterwards had to be docked for the removal of the streamer before she could again use her propeller."

- 4th. That no attempt was made by the Federals to diminish the space to be blockaded by adopting the tactics of their enemy and anchoring mechanical torpedoes across the three less important channels, inside the bar, which might probably have been easily done and would have been a more efficient stoppage than the outside squadron.

The Confederates laid down many more mechanical mines latterly, shortly before the destruction of the "Patapsco," and it appears¹ that it was owing to them, quite as much as to the presence of the monitors, that blockade running ceased at Charleston.

IV. Cape Fear River, on which is situated the town of Wilmington, a point of great strategic importance to the Southern cause, was the last port open to Confederate commerce. It may be entered by two channels, the north-east of which carries 8, and the south-west 12 feet at low water, subject to a rise of $3\frac{1}{2}$ feet at neaps, and $5\frac{1}{2}$ at spring tides. The north-east entrance called New Inlet is distant from the south-west one called Western Bar Channel about 8 miles in a straight line, or 10 miles by interior navigable channels. To pass from one to the other outside, however, a vessel must round the light-ship off the south-east end of the Frying Pan shoals, and traverse a distance of at least 40 miles. There were powerful forts at each entrance, but Fort Fisher at New Inlet being higher up the stream was necessarily the key of the position. It was situated on Federal Point, the north-east or land face about 530 yards in length, extended from within a short distance of the ocean, right across the neck of land which gradually narrows into Federal Point, from which the ocean salient angle was distant $1\frac{1}{2}$ mile. The land face mounted 16 guns, and was heavily traversed with sand revetted with marsh sods. From the ocean salient a line of batteries fronting south-east and mounting 32 guns extended along the shore for 1,350 yards, terminating in an artificial hill of sand 52 feet high, called Mound Battery. The parapet at the salient was 15 feet above the sea level, and the traverses 28 feet above it. Western Bar Channel was commanded by some 30 heavy guns, mounted on Fort Caswell and Smith's Island. The same arrangement of the blockading squadrons, one of which was stationed off each entrance, seem to have obtained here, as at Charleston, but no sheltered anchorage was available. The Secretary of the United States Navy states: "Some idea of the difficulty of closing these entrances may be formed, when it is considered that with fifty of our steamers, some of them the fastest in the service, stationed and distributed off these entrances by naval officers of intelligence and experience, blockade runners, watching their opportunity, and availing themselves

¹ "Never Caught, &c." Roberts, 1867.

"of dark nights, good pilots, and extraordinary speed, have succeeded
"in breaking the blockade."

It was finally considered that nothing but possession of the entrances could enable the port to be entirely closed to commerce. Hence, on December 14, 1864, a powerful naval force of fifty vessels under Rear-Admiral Porter, and a land force of 6,500 men under General Butler, prepared to concentrate against Fort Fisher. The co-operation, however, was very imperfect, and it was principally owing to this that the expedition withdrew again on the 27th December, having inflicted but trifling damage on Fort Fisher. A second expedition, with a land force of 8,000 men under General Terry, succeeded in effecting its capture, although the garrison had been increased to 2,300 men. It was subjected to a very severe bombardment and carried by assault on January 15, 1865, in spite of a most determined resistance protracted from 3 P.M. to 10 P.M., by holding each traverse in succession. Space forbids me to linger on this part of the subject, but full details will be found in the report of the Secretary of the United States Navy for 1865.

From the blockade of Charleston and Cape Fear River it appears :—

1. That a secure and commodious port within a moderate distance is essential to the effective conduct of a blockade.
2. That the blockading force actually on the spot must be sufficient to meet any force the enemy can send out, with a division of light ships available for intercepting others trying to escape under cover of the engagement. And that for this purpose a certain number of spare vessels for reliefs would be absolutely necessary, say one-third of the total force.
3. That the spar torpedo-boats, rude as they were, formed a very important item in the defences, but that the difficulty was effectually met by improvised defences rigged by the ships' companies.
4. That unless the channel of entry be continuously commanded by the blockader's guns or mines, an entirely effective blockade is impossible; more or less of those attempting the passage may be captured, but if the inducement be sufficient, many will succeed in passing.
5. The possibility or not of obtaining such a command will depend upon the nature of the approaches, as regards depth of water, and the configuration of the land in the vicinity of the port. Harbours like Port Jackson or Milford Haven would be difficult, and ports like Liverpool easy to blockade, supposing the meteorological conditions similar.

V. I must now endeavour to form an estimate of the influence of the changes in armaments on the foregoing conclusions. The great increase in the power, range, and accuracy of guns makes it improbable that blockading ships will lie at anchor within 9,000 yards of important forts; and it is possible that by the aid of telescopic sights an even wider zone may be rendered unsafe; as an instance, the "Union" struck at over 8,000 yards by "Angamos" 8-inch gun at Callao.

As regards shell-fire for silencing earthworks, it is doubtful if the present guns are more powerful, but they would be largely supplemented by machine-guns. A remark of Captain Fraser, R.E., seems very applicable to small detached maritime fortresses. "We conclude, therefore, that the power of resistance of small fortresses has relatively decreased, the more so as their defences are now exposed to be bombarded in reverse by far-ranging guns."—R.E. "Prize Essay," 1876.

VI. In no department of naval architecture has such remarkable progress been achieved as in that of small and rapid vessels. The sinking of the "Housatonic," February 17th, 1864, by Lieutenant Dixon, C.S., off Charleston, was accomplished in a submarine boat used on the surface, and propelled by manual power applied to a crank working a screw. In 1877, Mr. Donaldson gave us here a full account of the torpedo-boats made by Messrs. Thornycroft's firm, the pioneers in this department. Again, in 1879, Mr. Ravenhill gave us an account of Messrs. Yarrow's latest torpedo-boats, and full information up to the end of 1879 may be found in Mr. Sleeman's work. I have tabulated some information published in "Engineering," which may be useful to members, and some facts concerning consumption of coal kindly furnished by Messrs. Thornycroft, Yarrow, and Normand.

We thus see that a blockading squadron will have to contend with a swarm of boats capable of steaming at a speed of 22 knots 37 fs. ahead, of going astern 13 knots, and steering the while as well as with headway, and of turning the circle of a diameter of $3\frac{1}{2}$ lengths in less than $1\frac{1}{2}$ minute. Under the present system of propulsion, the use of coke gives a very slightly decreased speed with an absence of smoke. The experiment of hydraulic propulsion now in course of trial by Messrs. Thornycroft may show sufficiently satisfactory results as regards speed, with a safety against the fouling of the propeller, of great value in war. The fact that these boats as at present constructed can be perforated and disabled by machine-gun projectiles, is met by the equally ascertained fact that the first class boat loses speed only about $\frac{1}{4}$ knot by the addition of a ton weight. It is, therefore, evident that efficient protection to vital parts may be given at the cost of a slightly decreased speed or of an increase of driving power and cost. These boats carry three Whitehead torpedoes which can be discharged efficiently against a ship at a distance of from 300 to 400 yards, and they cost from 7,000*l.* to 8,000*l.*, while a first class ironclad costs from 300,000*l.* to 600,000*l.*

But greatly as the powers of the torpedo-boats have increased, the weapons they wield have received an equal increment of power. The self-propelling torpedo loaded with guncotton or other nitro-glycerine explosive to be detonated on contact, is as superior to the 60 lbs. of powder of the torpedo of 1864 as the boat which carries it is to the "David." The tendency is to enlarge the masses of explosive matter which can be launched against an enemy, and the only thing which prevents the use of shells from guns containing guncotton to be detonated on striking, appears to be the impossibility, in the present

¹ Appendix II.

state of the arts of war, of firing them without premature and disastrous explosion. This, however, does not extend to impulsive projection, and Mr. Ericson's destroyer, described by Mr. Sleeman, has, as lately reported, ejected a projectile of 1,500 lbs. weight, including a charge of 250 lbs. of explosive matter, which traversed the first 350 feet in three seconds. Captain Fraser, R.E.,¹ states that wooden cylinders, over 700 lbs. weight, have been fired on the Continent, from holes lined with battens, with charges about $\frac{1}{10}$ th of the weight of the shell. They ranged for distances slightly over 350 yards, and only went about 12 inches into the ground on falling. Both the shells and their time fuzes were fired by electricity. Also that before the assault of a breach, means must be found for throwing in large masses of the new explosives, which by the shock of their detonation will clear away everything in their neighbourhood. It seems worth considering whether any similar means might be adapted for naval countermining. On the side of the defence as against the swift boats, a new weapon has appeared since the war of 1861-65. A kind of machine-gun was used at the siege of Fort Wagner, but of late this arm has been greatly improved.

VII: In a report of the Captain of H.M.S. "Excellent" of some trials at Spithead last year with a Nordenfelt and Hotchkiss machine-gun mounted on the forecastle of the "Medway" gumboat and fired at a model of a torpedo-boat, at speeds up to 8 knots, the following conclusions are recorded:—²

It would appear that in daylight, and at speeds up to 8 knots, it would be impossible for a torpedo-boat to approach a ship defended properly by the fire of either of these guns, provided the gunners were sufficiently trained, and remained cool and collected.

The number of hits also in any one run was so largely in excess of what would be required for the purpose of disabling a torpedo-boat that a very considerable margin is left, to balance the advantages which the attack would derive from greatly increased speed, confusion, or surprise on the part of the defence, and guns being worked by men not so well trained in their use as they were on this occasion.

It was remarked by observers who were in boats abreast of the targets, during the "end-on" runs Nos. 5, 6; 7, 8, that although the fire at first, more particularly in case of runs 5 and 6, and between 1,500 and 1,000 yards, was somewhat wild, several volleys and shells falling beyond, and others short of the mark, although even then some rounds were effective; yet directly the range and variation of elevation due to distance was obtained, the effect of the fire did not seem to be influenced much by the nearer approach of the gunboat, most of the shot and shell taking effect, and others falling short of the target until the range was reduced to from 400 to 300 yards, when the larger mark and growing confidence of the men in hitting it caused the rapidity of fire to be greatly increased, and nearly all the shot seemed to strike, and this when the change of position of target was greatest, and opportunity of observing most thorough.

¹ R. E. Prize Essay, 1876.

² Parliamentary Report.

The effect of the fire was that the iron rods placed in the sections to represent slide and piston rods of engines were nearly all cut through, or bent by shot and shell, and the boxes to represent steam chests were riddled.

By careful examination of the target boats, the great destruction of the end-on fire was plainly manifest. These runs were made at speeds up to 8 knots, and the rate of fire appears to have been—

Nordenfelt	..	..	..	42 rounds per minute.
Hotchkiss	..	..	..	14 „ „

At the trials for penetration in Portsmouth Harbour at 300 yards against a target representing the bow of a torpedo-boat from the stem as far aft as, and including the fore end of the boiler fired at end-on, the Hotchkiss 1.42-inch gun, steel shot, went through side of boat $\frac{1}{8}$ steel, four thin bulkheads each $\frac{1}{8}$ steel, and also the $\frac{1}{2}$ -inch steel plate, representing the end of the boiler. The Nordenfelt 1-inch bullet got as far as the boiler plate, but failed to penetrate it. The remarkable fact about the projectile of both guns is, the extremely acute angle at which they will bite into the thin side plates. In one case a Nordenfelt bullet penetrated, making a large jagged hole, where the angle could not have been more than 10° .

From the above it is evident that the question of torpedo-boats *versus* machine-guns is still far from being decided; but it seems probable that the result must be an increase of weight in the boats, and a lowering of speed.

The recent exhaustive trials at Shoeburyness with machine-guns firing rifle ammunition, have shown the vast difference between firing at a moving and at a stationary object. When the target was drawn diagonally across the range from an initial distance of 800 yards at a speed of about 8.4 knots, the same guns which, when firing at a stationary mark, had struck it nearly every time, now (if we take the three ten-barrelled ones as the most favourable example) only hit once out of twenty-one shots, and took a mean time of five seconds per hit. The gun which made the best practice, the ten-barrelled Nordenfelt,¹ scored one hit for eleven-and-a-half shots, and made one in a small trifle under three seconds. Guns capable of perforating torpedo-boats would not fire so quickly; and if we add the effect of a vessel's movement, the boat would seem to have a fair chance at all ranges over 400 yards, when it appears from the Spithead experiments that greatly increased accuracy may be expected, and this might be predicted from a consideration of the trajectories alone. A torpedo-boat exposes 3 to 4 feet of freeboard, and at 400 yards the maximum height of trajectory begins to fall below that.

VIII. What modifications of the proceedings before Charleston and

1 Weighing 256 lbs.	{	4 barrel, 1 inch,	448 lbs.
		2 „ „	280 „
Gatling, 254 lbs.	{	1 „ 1½	224 „
		2 „ 1½	500 „
Pratt-Whitney, 261 lbs.			
Hotchkiss 1.5 inch wt.			= 441 lb.
1.85 „ wt.			= 11 cwt.

Cape Fear would the improvements summarised below have necessitated? They are:

- (a.) Great improvements in submarine and electro-contact mines.
- (b.) Great improvements in torpedo boats and locomotive torpedoes.
- (c.) Great increase in available illuminating power.
- (d.) Great increase in power of covering a given space with man disabling missiles.
- (e.) Great increase in range and accuracy of heavy guns.
- (f.) Steadier gun platforms owing to progress in naval architecture.
- (g.) Subaqueous injury more localised and less fatal, owing to watertight sub-division, except as against destroyers or large mines.

First taking the side of the garrison we find:

- 1st. (a.) Would enable them to close their channels against hostile ships, wherever a fort was at hand to protect the electric communications.
- 2nd. (b.) Would enable them constantly to harass the vessels on blockade, and to fire locomotive torpedoes at them from the shore if they entered a channel.
- 3rd. (c.) Would keep their passes and concentrating points for artillery amply illuminated in all weather but dense fog.
- 4th. (d.) Would make boat work within 1,000 yards of heavy batteries impracticable, except under shield cover.
- 5th. (e.) Would make the anchorage inside the bar of Charleston Harbour unsatisfactory, except for picket-ships, even after the capture of Morris Island.

Next taking the side of blockading squadrons:

- 1st. (c.) Would afford them both at Cape Fear and Charleston the power of so illuminating the arcs of approach that it would be almost impossible for a vessel to pass in clear weather, however dark.
- 2nd. (b.) Would enable them to fill the approaches with patrol boats and confine the garrison's torpedo-boats, or force them to engage their counterparts. This would make entry or egress more difficult.
- 3rd. At Charleston, the garrison would probably have numerous electro-contact and submarine mines in "Main-ship Channel," and would cover them by heavy batteries on Morris Island, commanding the channel from the bar upwards. Now, (f) and (e) would enable them to obtain a superiority of fire over the batteries at the south end of Morris Island in conjunction with a land force on Folly Island. Next (a) and (d) would enable him to countermine the south end of the channel and clear it under cover of suitable vessels. Thirdly, moving his vessels into the space so cleared would enable him, in conjunction with his land force, to effect a lodgment and ultimately capture the batteries on the south end of Morris Island, which would then be

converted into a *tête de pont* for the attacking force, and under its fire would be placed submarine mines which would close the channel. In the meanwhile the other channels would have been sown broadcast with mechanical mines.

4th. At Cape Fear River, the garrison would possess an immense advantage from their two entrances, as, by acting on interior lines, they would compel the blockaders to keep a force off each entrance, capable of coping with the total inside force. In other respects, as they had no unoccupied channel, they would reap no further advantage from the improvements. Moreover, were a new Fort Fisher constructed, as suggested by Admiral Porter, 1 mile further in, (e) and (f) would enable the Power in command of the sea to enfilade the channel face from 4,000 yards, and the land face from 2,800 yards, with ample room for his vessels. The new artillery would necessitate the advance battery on Federal Point being covered by heavy fortifications on the west side of the river. Again (d) would place the low peninsula ending in Federal Point under command of ships.

5th. It appears, then, that where, as at Charleston, the navigable channel is suitable for submarine mining, and runs parallel and near to the land, ending in deep or disturbed waters within gunshot of the batteries, recent improvements are most favourable to the defence, for although points (1) and (2) are most strongly in favour of the attack, yet they are not decisive, in view of the vicissitudes of weather, hence the type of operations conducting to a decisive issue remaining the same, we find that for such places effective blockade will make greater demands on the assailant, and extend those demands over a longer period.

6th. On the other hand, where, as at Cape Fear River, there is no channel, but open sea external to the batteries, and the positions suitable for mining are under the command of those batteries, the conditions remain tolerably similar, but (e) would enable the garrison to command the left bank from the right one; (e) would also render the shelter of shore batteries of little use to merchant vessels, and the blockader would reap immense advantages under heads (1) and (2).

IX. Hitherto we have confined ourselves to historical cases, but examples of type (a) Sec. II, are wanting, and where this is the case, we are compelled to supplement historical lessons by imaginary instances. Admiral Jurien de la Gravière¹ tells us: "The imagination—who would have believed it?—has become, even in these technical studies, a safer guide than routine. The torch she waves serves at least to reveal the horizon." It remains then to consider the case of harbours of a different type by the light of the foregoing

¹ "La Station du Levant."

facts, and to sketch the conduct of a blockading fleet. There is an evident contrast between such a harbour as Sebastopol, and the low shores of those we have been considering; but before leaving them, let us suppose that the same shallow channels we have in view are prolonged beyond effective gun range from the shore. Here we have clearly, unless the owner, at a vast cost, build forts upon the sand, the advantage recounted under heading (1) for the garrison, transferred to the blockader, who moves up his armoured vessels, and closes the channel by submarine mines protected by their guns, possibly mooring an armoured torpedo lightship as a picket vessel. Turning to the other extreme, let us consider a harbour of the perfect kind. Such a one is Port Jackson, formed by nature for the head-quarters of a fleet. Its entrance about a mile wide, formed by cliffs from 200 to 300 feet high, steep to and forming part of a straight coast line, affords no possible advantage to a blockader, while it ensures an overwhelming fire against an enemy attempting to enter. The north head is, in fact, a natural fortress of enormous strength, flanked by another on its right rear. Compared to such a position, Sebastopol or Cronstadt sink into insignificance. In such a case we may imagine an Admiral quoting the words of Lord Collingwood,¹ written off Cadiz, December 9th, 1806: "I have little to tell you from here; the enemy's squadron are quite ready for sea, but in the upper part of the harbour, out of the way of storms; while we contrive to watch them, that they may not go out without an encounter. A battle is really nothing to the fatigue and anxiety of such a life as we lead. It is now nearly 13 months since I let go an anchor, and, for what I see, it may be as much longer."

At the same time if the conditions alluded to in Sec. IV are fulfilled, a blockade of more or less stringency, according to the meteorological conditions, may be instituted against a naval arsenal possessing such advantages. A squadron for such a purpose would require to be composed of:—

- (a.) A number of first-class fighting ships, equal to those of the enemy, with one-third in reserve.
- (b.) A number of vessels of "Hotspur" and "Polyphemus" type to cope with any such vessels possessed by the enemy and one-third in reserve.
- (c.) A number of torpedo-boat ships, sufficient to ensure that in all suitable weather a barrier of patrol boats formed the advanced pickets of the fleet, and as the duties of the crews would be severe and incessant, it would be necessary that the same crew should never be on duty two nights running, but should have commodious quarters in a suitable vessel. Unarmoured vessels would be adapted for this service; their primary duty being to act as a base for the patrol boats.

The torpedo-boats of the fighting ships will thus be always ready for their proper duty, that of defending their own vessels.

¹ Selection from Lord Collingwood's letters.—G. G. Newnham Collingwood, F.R.S., 1828.

The torpedo-boat ships should be capable of hoisting up their boats when fully armed and provisioned, so that the delay of so doing may be reduced to a minimum. At least one of them should have a factory on board, of sufficient resources to repair any ordinary war damages to the boats.

The difficulty of the problem introduced by the locomotive torpedo is to prevent small and inexpensive vessels injuring large and expensive ones. So long as the enemy meets torpedo-boats with torpedo-boats, the forces are on equal footing; but if he make a vigorous attack with his boats supported by armoured vessels on the line of patrol boats, the armoured vessels in support would become engaged, and one or two small very fast lightly-armed vessels, capable of sea keeping in all weather, would be required to cut off any boats attempting to get out during the *mêlée*, and torpedo the first-class fighting ships. It seems, however, that the latter would, by moving very slowly, with torpedo netting down, be secure from attack by such boats.

An important problem presents itself here. How best to defend a vessel under way at night by the electric light?

Captain Abney, R.E., F.R.S., has pointed out the best position for the observer with reference to the light to be as close to the illuminated sector as possible, but at an angle of 60° with the axis of the beam. If we take the present range of Whiteheads as effective at 400 yards, the first condition is that no boat shall approach to that distance without being seen. A second condition is that the field of fire must be clear, so that an enemy approaching may get the full benefit of the battleship's fire. If we take the article on torpedo-boat tactics translated for us from the German last year by Mr. T. Brassey, M.P., as a fair sample, a division for attack is to consist of eleven boats, of which six are to expect to be sunk, even if the attack is successful. Now part of my tactics has already been laid down to consist in having such a quantity of patrol boats in the front line that none but exceptionally fortunate ones could pass. It is true that the blockader's boats would be second-class ones, unless his base were within 100 miles, in which case he might have as many first-class ones as the blockaded squadron; but considering the vicissitudes of weather, he would probably do best with boats he could hoist up, and make up in number for want of speed. It does not appear expedient for the ship to be protected to exhibit a light herself.¹ Its great height would serve as a leading mark to her from a great distance and if she had three, as has been recommended, flashing in various directions, the eyes of all look-out men would be dazzled and bewildered. She must then surround herself with an illuminated space at the proper distance, and this can be done by her boats, or if she be stationary, by projecting light balls from a mortar or gun. I assume it would be done with her boats. Two boats must be stationed together on opposite sides as shown in Fig. 1 or 2. In both a circle of 400 yards radius is drawn round the vessel, and the axes of the electric beams are to form tangents to the circle. In Fig. 1 they form a circumscribing square. In Fig. 2 an equilateral parallelogram. In Fig. 1 the

¹ Her own lights would be in reserve to play upon a discovered enemy.

ship's centre bears 45° from the axis of the beam; and in Fig. 2, 60° . I prefer Fig. 1 because the distance of the ship from the axis of the beam varies only from 400 yards to 570 yards; whereas in Fig. 2 it varies from 400 yards to 800 yards, and it seems unlikely that a difference of 15° in bearing could greatly affect a ship's power of sight, but experiment alone could decide such a question. I assume the beams to have an

FIG. 2.

B—Battle-ship. → Course.
 L—Source of light in a boat.
 Limits of beams dotted.
 Axes of ditto plain.
 Scale $\frac{1}{4}$ inch = 100 yds. 111100.

azimuth of 15° and a vertical plane of 5° . Being low down, the ship's look-out men would have the advantage of the depth as well as breadth. It is also worth remarking that, after practice in station keeping and illuminating, the certainty as to range would be a great point in favour of this method.

It would be possible so to connect a number of divergent machine-

gun barrels that the shots at each discharge should strike every part of a transverse section of the beam, and thus make hitting an object in the line of fire a certainty. It is hitting an object for certain in a given time that is needed, the table shows the time a torpedo-boat at 20 knots would be crossing such a beam on opposite course to ship.¹ The fire of the boats in line with the beam would be formidable against an enemy passing close, and if the enemy pass far from the source of light, he is longer illuminated. It is obvious that though the ship could not fire towards the boats, they could fire towards the ship, and it would be advisable to have a third boat at each light station, to keep in the prolongation of the line joining lights and ship, act as an outlying picket to the light boats, and give increased fire at those points. A boat 50 feet long, steering parallel to the ship, would, if placed as in Fig. 1, subtend an angle of less than 5° from the ship's centre, and experiment would show within what limits the ship's fire must be restricted, considering her length, not more than 15° should be masked, hence the battle-ship could fire around 330° and the boats round the whole circle. Thus I leave the battle-ship, steaming as slowly as possible, with torpedo netting down and outriggers out, six boats on patrol, and machine-guns, wall pieces and rifles, ready to pour a stream of projectiles on any intruders. It has been said that ships could not carry netting out while under way, but I think this merely a question of speed and fitting. If the blockader possessed a secure harbour close at hand he would certainly keep his heavy vessels there, defended by obstructions and mines, and perchance in telegraphic communication with the commander of his advanced squadron; but failing such accommodation, he must either relinquish the blockade, or preserve a naval superiority on the spot. Ships in such a case would only need steerage way, to keep them in station for the advanced squadron to fall back on, if the enemy emerged in force. On necessity occurring, the outriggers should go up by steam and the netting fall into suitable crutches placed round the vessel above the water-line. A current of over 4 knots is found in the Medway, and no more speed would be required under the circumstances contemplated. The only alternative to such protection is speed, which is impracticable under such circumstances. The adoption of torpedo-boats as part of the defences of a maritime fortress would render such reconnaissances as we read of during the Russian War impracticable, and very high speed would be necessary in a ship charged with such duties. There remains the case of fog, equally adverse to both sides, except in the case of vessels coming out; but the battle-ships should change their position and keep quiet, while the patrol boats would form a chain and keep up communication by sound. One of the points needing most careful arrangement would be the system of rendezvous, and precautions against mistaking a friend for an enemy, and *vice versa*, where such numbers of boats would be under steam. I think that with patrol boats on the alert and closed up, near the entrance as they could be under cover of fog, such instances of escape as that narrated by Captain Roberts from New Inlet at 4 P.M.

¹ Supposing B is going 4 knots.

could not occur, and fogs are seldom accompanied by strong winds.

Such vessels as the blockade runners of the war of 1861-65 are widely different from men-of-war, being only 8 feet out of the water and burning anthracite coal with a forced draught; they would be visible but at a short distance and offer a small target. The precautions taken and extraordinary escapes are interesting and instructive. I have been told by an Officer who served on the blockade, that the bow wave was frequently the only visible thing about a vessel at night, and in all such operations, the position of the side with regard to any source of light is an important point. Another advantage which the electric light would give the blockaders, is the extended range it would afford for night signals, whereby a vessel passing one enemy would immediately be signalled to all the rest, fully half-an-hour in advance. Rockets and blue lights appear to have been the principal means of communication at night with the Federals. It must also be observed that if the blockader has enough vessels he may place some about the limit of a night's run, according to the state of the moon, from the blockaded port; these might extend over an arc and with the aid in fine weather of captive balloons, might watch a large surface and pick up many ships who had passed the first line. The main dependence, however, must always be on narrowing the approach as much as possible and covering a small portion of it through which ships cannot pass unseen, with an overwhelming fire.

X. To sum up, then, it appears that where it is required to institute a blockade, the best mode to render it efficient is to seize an island or point commanding the channel, and lay down electro-contact mines. Where this is impracticable, but the channel narrow and extending far from land, to lay down mines resting on a floating base. Where neither are possible, organize a suitable squadron, with numbers of light swift vessels, resting on a favourable base, and after practice and with a fair proportion of time off duty, it is probable that a fairly efficient blockade would be maintained, and that squadrons would find it more difficult to escape unperceived than formerly. Every increase of speed and of economy of coal¹ brings a maritime Power nearer its base and makes it easier to concentrate on a given point by telegraph. One of the dangers of extended blockades is that of a squadron escaping from one port, and taking that blockading another port between two fires, which could always be arranged beforehand with far more certainty than in the time of the famous naval combination of Napoleon I. In future wars the Navy may have to draw largely upon the experience of the great Telegraph Companies and the Trinity House, and I cannot conclude better than by quoting the words of Lord Nelson² when in command of the squadron opposed to the Boulogne flotilla, September, 1801: "Care should be taken to keep our squadrons compact and in good order never to risk being crippled or driven into the North Seas; thus we shall always be sure of an effective force, ready to act whenever the occasion calls for it."

¹ See Appendix for "Probable Coal Consumption of a Blockading Squadron."

² "Despatches and Letters of Lord Nelson," Sir H. Nicolas, vol. iv, p. 494.

APPENDIX I.

STATEMENT OF FIRING BY U. S. STEAMER "NEW IRONSIDES." L. 220, B. 60.
M.D. 15½ FT. ARMOUR, 4½ IN. ARMAMENT, 14·11 IN.; AND 2 150-PRS. D. 3,296
TONS. OFF CHARLESTON HARBOUR.

Date.	Rounds Fired.	Hits by Enemy.	Distance.	Object.	Remarks.
1863.			Yards.		
July 18	805	4	1,400	Fort Wagner	At anchor.
20	168	13	1,300	"	"
21	464	5	1,200	"	"
29	183	2	1,200	"	"
29	25	..	2,500	Fort Sumter	50-pr. on spar deck.
29	2	..	1,900	Fort Gregg	"
30	329	2	1,800	"	At anchor.
30	1	..	2,250	Fort Sumter	50-pr. rifled on spar deck.
Aug. 17	400	31	900	Fort Wagner	Most hits from 10 in. guns in Wagner and Gregg.
17	30	..	1,700	Fort Gregg	"
17	2	..	2,700	Fort Sumter	50-pr. rifled.
18	118	..	1,200 to 1,400	Fort Wagner	Under way.
19	50	..	1,100	"	At anchor.
20	158	..	1,150	"	"
20	2	..	3,400	Confedt. steamers	50-pr. rifled on spar deck.
21	70	1	1,300	Fort Wagner	Hit by Sumter's 11-in. solid shot.
22	115	..	1,100 to 1,300	"	Under way.
23	90	4	1,100 to 1,300	"	"
Sept. 2	41	7	1,000	Fort Gregg	Night, ship at anchor, hits from Gregg and Moultrie.
2	9	..	1,500	Fort Sumter	"
5	488	..	1,300	Fort Wagner	At anchor.
5	32	1	1,800	Fort Gregg	Hit by Gregg.
6	184	..	1,300	Fort Wagner	Firing to noon.
6	38	..	1,300	"	At anchor noon to sunset.
7	152	24	1,200	Fort Moultrie	Anchored at night. Weehawken ashore.
8	483	70	1,200	"	Anchored. Hits on 7th and 8th from Sullivan Island Batteries.
On 17 days	4,439	164			14 days at anchor. 2 nights at anchor. 3 days under way.
Under-way	323	4			
Anchor, day	3,923	129			
Anchor, night	193	31			

SERVICE OF IRONCLADS, SOUTH ATLANTIC BLOCKADING SQUADRON. SHOTS FIRED, AND HITS RECEIVED BY THEM DURING OPERATIONS AGAINST MORRIS ISLAND.

Vessels.	No. of Shots Fired.		Hits.	Hits April 7, 1863.	Hits at Ogechee.	Total Hits.
	15-in. 400-pr.	11-in. 170-pr.				
Catskill	139	425	86	20	..	106
Montauk	301	478	154	14	46	214
Lehigh	41	23	36	..	..	36
Passaic	126	243	93	..	..	247
Nahant	119	107	90	35	9	134
Patapsco	170	276	69	36	..	105
Weehawken	178	230	96	47	1	144
Nantucket	264	633	134	53	..	187
Ironsides 3,296 tons D..	44	155	53	51	..	104
	..	4,439	164	..	..	164
Total mounting of 9 ships, viz.:—22 11-in., 8 15-in.—30 guns, and 2 150-pr. rifles.	1,255	6,771	882	256	56	1,194

NOTE.—This gives 157 rounds each 15-inch, and 308 rounds each 11-inch. Compare "Weehawken" and "New Ironsides" displacements 1,200 to 3,296 tons. Surface of exposed longitudinal vertical plane is 443 and 2,860 square feet. " " transverse " 253 and 780 " " submerged longitudinal " 2,300 and 3,465 " " transverse " 517 and 945 "

As targets "Weehawken" offers above water only 15·6 per cent. of the surface "New Ironsides" does, broadside-on, and 32·4 per cent. of what she does end-on.

As submarine targets "Weehawken" offers broadside on 66·3 per cent. of what "New Ironsides" does, and end on 54·7 per cent.

"Weehawken's" reserve buoyancy is about 216 tons or $\frac{1}{10}$ th total.

"New Ironsides" " 2,200 tons or $\frac{2}{3}$ ths total.

"Weehawken" carried 12·5 per cent. of guns of "New Ironsides."

" " fired 20·2 " of shots of " "

" " was hit 81·7 " of times of " "

APPENDIX II.

Mr. Yarrow has kindly supplied the following information as to his boats:—

Coal consumption varies very considerably. At the maximum speeds it is about $3\frac{1}{2}$ lbs. per I. H. P. per hour, say from 17 to 18 cwt. per hour. For long runs at a slow speed, however, the economy is very great, and we have recently tried some experiments bearing upon this point with our 100 feet torpedo-boats, and find 1 ton of coal is

APPENDIX II.

Boat builder and date of Trials.	Tons Displacement.	Dimensions, feet.				Nature of Trial.	Speed of Boat.	I.H.P.
		Length.	Beam.	Mean draught.	Maximum draught.			
Messrs. Normand & Co., Havre, No. 20. 23 9 78.	31.1	89.0	10.83	2.82	5.97	Three hours	Knots. 18.27	...
Ditto, No. 21. 3 3 79.	Same. In draught given is a midships.	Messrs. Normand's boats the				French Government	19.42	463
Ditto, No. 27. 22 4 79.	38.0	103.0	10.83	2.69	5.9	...	18.33	440
Ditto, No. 41. 10 3 80.	33.3	89.0	10.83	2.95	6.17	...	19.31	...
Ditto, No. 42. 23 2 80.	...	Same.		...	...	...	19.83	...
Ditto, No. 47. 16 6 80.	31.8	89.0	10.83	2.85	6.07	...	18.59	...
Ditto, No. 48. 12 7 80.	...	Same.		...	...	...	19.71	...
Ditto, No. 49. 27 8 80.	...	Same.		...	...	...	19.78	...
Mr. Thornycroft. 15 1 80.	29.73	At 89.33	L. W. 9.46	L. 2.28	about 3.0	Preliminary mean of 6 runs.	22.01	460
Same boat.	32.5	...	...	...	...	Official mean of 6 runs on mile.	21.75	463
Trial by H.M. Dockyard officials to ascertain consumption.	...	...	...	...	...	...	18.75	340
Messrs. Yarrows. Oct. 1879.	27.0	86.0	11.0	...	...	Trials to ascertain relations of I.H.P. and speed.	13.3	94.9
		At 82.0	L. W. 10.0	L. 2.79	...			
Co-efft. of fineness, this boat 40.	Same boat.			2.79	...		14.25	125.5
Ditto.	...	...	...	...	...		15.3	164.4
Ditto.	...	...	...	...	...		16.2	196.8
Ditto.	...	...	...	...	...		17.0	233.3
Ditto.	...	...	...	...	...		17.5	271.0
Ditto.	...	...	...	...	...		18.25	317.3
Ditto.	...	...	...	...	...		19.0	365.0
Ditto.	...	...	...	...	...		19.5	401.4
Ditto.	Maximum speed attained by this boat				21.9 knots.		20.0	425.2
H.M. Twin-screw diagonal wood built.	7.6	43.0	9.25	3.04	3.41	Mile trial.	over 13.0	120.0

TORPEDO BOATS.

Coal, lbs. consumed per hour.	Coal, lbs. per I.H.P. per hour.	Boiler Pressure,	Vacuum in Con- denser.	Revolu- tions per minute.	Air pres- sure in inches water.	REMARKS.	
1,850		lbs. 123	in. 24½	313·1		Engines compound surface condensing, water cir- culated by motion of boat.	
1,290	2·75	123	26	339·2	3½		
1,065	2·42	119	27½	336·5	2		
1,200	...	124	28½	325·2	3½		
1,290	...	122	28½	323·6	3	In Admiralty experiments with boiler of one of these boats, air pressures in the ash pits were 1·47, 2·29, 3·26, and 5·25 inches of water, the corresponding consump- tion of coal per hour being 925, 1,177, 1,472, 1,815 lbs.	
1,170	...	118	27½	307·7	1½		
1,250	...	126	28½	313·7	2½		
1,250	...	128	27½	324·3	2½		
...	...	123	24½	433·5	...		
...	...	133·8	23·3	443	...		
1,333	3·92	Not including I.H.P. used for fan engine.			and circu-		Pressures from 2 to 6 inches.
...	...	40	23	263			
...	...	50	27·5	280			
...	...	60	27·2	310			
...	...	70	27	330			
...	...	80	27	352			
...	...	90	26	374			
...	...	100	26	397			
...	...	110	25	420			
...	...	120	24	442			
...	...	130	23·5	460			50 I.H.P. consumed in working fan engine.
...	...	120	...	340			

sufficient for a run of 100 miles at the rate of 12 to 13 miles per hour, and no doubt at a slower speed a still greater distance could be run.

In order to obtain the best results in economy at slow speeds it is necessary to work at a full boiler pressure and work the engines with the greatest possible degree of expansion. If instead of doing this the boiler pressure is low and the expansion small, at these slow speeds it is found to be almost as much as double the consumption.

These boats carry 10 tons or more of fuel, from which it will be seen they are capable of going considerable distances without coaling.

Mr. Yarrow has imported anthracite coal from the United States, but has not found it answer well in the boats.

The newest type of boats carry three Whitehead torpedoes, the orifices lying together and somewhat countersunk from the upper part of the stem. The whole are covered by a cap which can be raised at pleasure. The funnels are made to point nearly horizontally at an angle with the keel aft of about 30°. The cost of a first class boat approximates to 8,000*l*. Boats are building for the Austrian, Italian, Dutch, Portuguese, Brazilian, and Greek Governments.

Messrs. John L. Thornycroft kindly supply the following information as to boats built by them:—

Coal-carrying power:—

1st class boats, say 5 tons.

2nd class boats, „ 1½ „

Coal consumption:—

1st class boats at 12·8 knots per hour, 500 lbs. per hour.

„	13·81	„	564	„
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„	20·07	„	1,647	„
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2nd class boats	17·00	„	421	„
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Captain Tuxen, of the Danish Navy, narrates a most successful voyage from Gravesend to Copenhagen *via* the Eider Canal, coaling once; weather principally fine. As stokers had been forgotten in the crew brought from Copenhagen, two sailors performed the work satisfactorily under the Engineer and Captain.

Passage of No. 5 first class boat from Spithead to Plymouth in 10½ hours under command of Lieutenant Roxby; weather foggy first part of the time. There were 5 tons of coal on board, and the average consumption for an hour was 8 cwt. Sea perfectly smooth, except when nearing the Start, when a slight swell was encountered. Account states that after passing the Needles to Plymouth Sound a mean speed of 18 miles was maintained. The distance being 118' if 8½ hours are allowed, it would make rather below 14 knots over the ground, but the actual route taken may have been longer.

The following results of turning experiments made at Chatham with one of Messrs. Yarrow's boats fitted with his drop balance bow rudder is extracted from the *Engineer* of January 29th, 1880.

Length of boat, 86 feet; area of stern rudder, 1,500 sq. in.; area of bow drop balance rudder, 500 sq. in.

At a speed of about 19 knots the mean time of turning circles to port and starboard was, with stern rudder, only 2 min. 10 secs., the diameter of circle being 196 yards. At same speed, using both rudders, the time was 1 min. 21 secs., and diameter 107 yards.

At a speed of about 14 knots, using after rudder only, the mean time of turning port and starboard circles was 2 min. 18 secs., and the diameter 178 yards. At same speed, using both rudders, the mean time was 1 min. 44 secs., and the diameter 99 yards.

APPENDIX III.

PROBABLE COAL CONSUMPTION PER DIEM, IN TONS, OF A BLOCKADING SQUADRON
IRRESPECTIVE OF CHASING.

Number and Description of Vessels.	Steaming.	Cooking.	Condensing.	Total.
Three 1st class Battle-ships each	24	25	5	74½
Six 2nd " "	18	2	4	111½
Two fast chasing ships "	14	2	3	29
Six torpedo and patrol boat ships "	14	25	5	88½
Sixty torpedo and patrol boats "	1	..	..	60
Seventeen ships and sixty boats under steam ..	71 one of	9 each	17 class	3634

Say, 2,541 tons a week, or 132,132 tons a year; and large additional quantities would be required at the base to provide for chasing, attacks, &c.

Lieutenant BETHELL, R.N.: There are one or two remarks I should like to make, not as to the detail of the lecture which we have just heard, but on the general subject. The lecturer speaks of its being necessary in blockading to have one-third of the ships spare. Now as ships are at present constituted that is a very serious consideration, because they are so very scarce; and the reason for requiring that the blockading squadron should have one-third of its ships spare must evidently be the necessity of sending their ships away to get coal and stores. It appears to me that it is quite possible that stores should be brought to the blockading ships, and thus you would save a considerable number of vessels in these operations. The necessity of providing squadrons with coal and other stores necessarily forces itself upon the mind of any man who has thought upon these subjects; and there is no doubt if we were engaged in war, some system would have to be arranged by which coal could be supplied. I should, therefore, hesitate to assent to the lecturer's decision as to the proportion of ships that should not be engaged in blockading.¹ One other very interesting point is the use of the electric light in the

¹ The idea I intended to convey in this sentence was, that the necessity of providing a blockading squadron with a proportion of vessels more than actually required for the blockade, is, in my opinion, over-estimated.

blockading squadron. Captain Long says, and it is no doubt true, that if the ship that is to be attacked uses her light, she renders herself a very conspicuous mark, and he suggests that the light should be exhibited from some other point; but it appears to me since the illuminated radius which would be given by a light from another point would be so very quickly crossed by a torpedo-boat, it would be practically impossible for a vessel about to be attacked to concentrate her fire on the boats about to cross, and therefore I should say that it would be desirable for the vessel herself to show the light. One other point I may just allude to is, the system of throwing hawsers and spars around the ships. This is a manœuvre that takes a considerable time, and it is suggested that they should be hoisted up by steam and laid alongside the ship. Now that would be a very good thing, but I should think it might be still more quickly done and better arranged by means of a stout steel telescopic rod that should be made to slide in and out of the vessel. There is no doubt such a thing could be done, and if the system of spars and hawsers is at all useful, that system should be applied which can be carried out in the quickest way.

Captain OXBRIAN BRIDGE, R.N.: I think the Officer who has just spoken drew attention to a very important point, namely, the necessity of having your blockading squadron of sufficient strength to enable you to withdraw a part of it at a time to replenish supplies of coal and other stores. At the same time I do not think the reason he gave is the only one why it is absolutely necessary that you should have 80 per cent. more force than that which you are attempting to blockade, or, as he says, "one-third spare." In the two cases which Captain Long dwelt upon particularly in his lecture—the blockades of Wilmington and of Charleston—I think he said the blockading squadron had a base in each case some 50 or 60 miles off.

Captain LONG: 80 in one case and 55 in the other.

Captain BRIDGE: That was not more than a few hours' steaming for even very slow vessels, and it would not have been necessary (in order to replenish the stock of coal) to remove any large force at one time; so, therefore, if the base of operation is selected, as it should be at no great distance—for otherwise it would be very unwise to attempt to blockade a great naval fortress—that difficulty would not arise. But I think there is another very much stronger reason, indeed there are many other reasons why you should have a great superiority of force—in addition to the undoubted necessity of having to withdraw your ships from time to time to replenish their supplies, as they cannot be expected to do it within range of the enemy's guns, and that is, the multiplicity of accidents to which ships keeping the sea for months together are liable, and the absolute necessity of having a reserve upon which you may draw to make up for these accidents. It is very curious that until to-day I do not think there has been any paper read for years in this Institution specially devoted to this subject, and that I take as rather a proof that a very small amount of attention has been devoted to the attack of fortresses by ships in our Service. Some four years ago I investigated the question myself, and I cannot say that my labours resulted in anything of any value, for the simple reason that I had nowhere to go for information. I found that the study of the naval attack of fortresses was absolutely and entirely neglected amongst the Officers of the British Navy of late years: there was nothing which anybody had written or said to which I could refer which gave us any information at all. Incidentally there are certain papers, such as those on the American Civil War, in which it has been dealt with; but there was no deliberate attempt made to tackle the question; and one of the things which came out most obviously in examining the question with the very poor light thrown upon it up to that time, was the absolute necessity of having an enormous reserve of force. I do not think anybody who has not examined the question with the view of finding out up to what standard he should bring his force, can have any conception of the immense force that is required. For instance, take the war in America. The Federals were engaged with an enemy which was not in the least degree a naval enemy. I do not think he had half-a-dozen *bond fide* sea-going ships amongst the whole; but notwithstanding that, the Federals had to increase their ships from something under 100 to over 400, and the number of men from 7,000 to over 40,000. Of course the whole of the naval warfare in which they were engaged was fortress warfare—warfare against fortresses or land defences—and, therefore, as you may imagine, if we were to find ourselves engaged in a war with an enemy with a

navy and naval fortresses, and a certain number of sea-going ships able to attack those interests which it would be one of our most important duties to defend, we should see the utter inadequacy of anything like the present number of ships that we have actually in existence and building, or that could be quickly prepared for commission, to make any satisfactory attempt at shutting up the enemy's fleet in his own ports. I must say I admired very much Captain Long's proposal for illuminating the area round the ship with the electric light. Rather more than a year ago I witnessed the torpedo operations by night at Portsmouth. I accompanied a large number of Officers of the Army, and I think every person present was struck by the extreme weakness of the electric light; not that it did not illuminate the area and point out the boats as they came up fairly well, but it was such a terrible foe to the people using it, for it pointed out exactly where they were. I understand some experiments were made at Shoeburyness, by which it was found that the use of the electric light positively enables the enemy to make absolutely certain of hitting with his guns. By placing a sheet of white paper on which the beam of light should fall behind the sights of the gun, and letting the shadows of the two sights fall upon this paper, moving the gun until the points of the sights become exactly coincident, if your gun has any accuracy at all, you must hit the object aimed at. Therefore it is essential that the electric light should be removed to a distance from the ship or fort which you intend to defend against guns. If you do not do anything else but explode a shell pretty close to it, you will probably put it out and render it useless, but in all probability you will hit the ship; and if what I was told was correct, I do not think it is possible to miss it.¹ There was one observation made by Captain Long as to which he may perhaps give us some further information. He said that some attempts were being made to further develop the hydraulic system of propulsion. I am one of that very small minority of people connected with the sea who think it a most unfortunate thing that the hydraulic system of propulsion should have been so discredited as it has been. My only knowledge and experience of it are derived from having made a certain number of short cruises in the despatch and, it must be added, not very efficient "Waterwitch;" but in spite of seeing it under most unfavourable circumstances, I carried away a recollection of it which makes me think that it is a thing which we ought certainly to know more about. We had an instance in the paper which has been read, of a ship getting her screw fouled and having to anchor for fear she would have gone on shore or got amongst torpedoes. Now fouling appears to be absolutely impossible with a hydraulic propeller. I do not think during the war, of which Captain Long has related so many instances, there were any double-screw vessels used, if so, they were very few indeed. The screw vessels used were vessels with screws at the very least half as liable to be fouled as a great many of the ships we have in the Service at this moment; that is to say, they had one screw instead of two, and that screw being in a hole was more protected against fouling than one protruding from either quarter. In addition to that another advantage of the hydraulic system of propulsion is that it is under absolute control, and the Officer of the watch, or the Captain, or anybody stationed to do so, can with his own hand in a second stop the ship, turn her ahead, make her go to starboard, spin her round in her own length, or to port, or make her go slow, or anything you like, without the help of the engineer. Let people say what they like about its being uneconomical,² for us that is not the question. What we want is efficiency. If we can get efficiency with economy, by

¹ In these days, of course, no coast fortress likely to be attacked would be without the means of accurately ascertaining the distance of a ship which might come within range of its guns and within the arc covered by its obstructions. Of late years great care has been taken to ensure the garrison's being able to discover such distance. In the case of fortresses so placed that hydrographical conditions permit ships to assail them, the chart and the lead—even if the usual marks were invisible—have long given the crews the means of ascertaining the distance with reasonable exactness. Where this is not so, a naval attack on the fortress is not likely to be made.—C. A. G. B.

² Uneconomical of power.—C. A. G. B.

all means let us have it ; but if we cannot, by all means let us have efficiency first. With regard to the effect of torpedoes, I do not think there is a well-established instance on record of any ship being destroyed or injured by a locomotive torpedo. There is one case said to have taken place at Batoum, but that has been distinctly denied by the people said to have lost their ship—the Turks; but as the question is in dispute, it would be rather interesting to know if it really did happen, because, if not, although the locomotive torpedo has been used on several occasions in earnest, there is no evidence that it has ever done any injury to a ship. Knowing that, and knowing also the very small number of cases in which under favourable circumstances the spar-torpedo or the fast torpedo-boat of comparatively modern type has succeeded—it very rarely having succeeded where proper precautions against it were taken—I think we may to a certain extent modify our views about the enormous efficiency of the torpedo as a method of attack. I am not saying anything about it as a weapon of defence. And we ought also to remember that not only were the circumstances under which torpedo attacks were made in the late war in the south-east of Europe favourable from the want of discipline or peculiar habits of the people assailed, but they were not made in the face of modern machine-guns. A Commission of Swedish Officers reported some year or two ago that machine-guns, such as they were then, appeared to render it practically impossible to make a torpedo attack by daylight against ships armed with them. If I read the reports in the “Times” aright, and they have been given very fully and bear accuracy on the face of them, the machine-guns lately tried at Shoeburyness are very much more efficient and formidable than anything in existence even as lately as 1879. Therefore it seems that these are the facts:—that no locomotive torpedo used in earnest has ever succeeded; that the number of torpedo attacks where proper precautions have been taken which have been successful is exceedingly small, and are likely to be still smaller if carried out in the face of a defence well provided with the very newest weapons.

The CHAIRMAN: Before I call upon Captain Long to reply to the observations that have been made, I will make one or two short remarks myself. I certainly think that to lay down any law as to the conduct of a blockade is absolutely impossible, excepting in the most general way. The locality must be considered, and the character and object of the blockade sought to be established may vary almost as much as the locality. The American blockade was peculiar in itself, and its circumstances and object. Captain Long has favoured us with some very interesting anecdotes connected with it, but the fact is, it was very different from any blockade that ever preceded or is likely to succeed it. In the first place, the Federal force was entirely inadequate to the blockade which the Government endeavoured to undertake, and, on the other hand, the object and tactics of the Confederates were different also from those of most previous defensive operations. Blockades may be established, and have been established for the purpose first of all of keeping an enemy's fleet inside her port; sealing them up as in the blockade of the Baltic, where Sir Charles Napier was under orders to endeavour to keep the enemy in his ports. Again, it may be established for the very opposite purpose of inducing them to come out to sea for the purpose of bringing on an action, as was the case with Nelson off Cadiz. A blockade may be established for the simple purpose of preventing supplies being thrown into an enemy's country, or it may have a twofold object, as in the American War, where the latter object was combined with another one, that of attacking the enemy in his own territory. A blockade would also depend very much on the relative force at sea of the two belligerents. The blockades we have generally had to do with in the past have been those with the object not of sealing the enemy up in his ports, but of inducing him to come to sea for the purpose of bringing him to action, or of preventing his escape on the ocean to attack our commerce and distant colonies. This was certainly absent from the object of the Confederates on the occasion referred to. They never wanted to send ships of war to sea, not even privateers from the blockaded ports. Our object has been to catch ships going out, and prevent them roaming over the seas, and I think in the carrying out of any future blockade we shall have much greater facility for carrying out that object than we had in the past, because when it was done under sail, ships were constantly blown off either by winds from the weather shore, or had

to keep off the lee shore, and in the interval of their absence the enemy escaped. Under present circumstances such a blockade can be maintained much more easily; ships will keep their stations not only more constantly but closer in shore, and even if the enemy does escape, whereas in former times there was no knowing where they had got to (we all know the stories of Nelson going about all over the world after them), now-a-days, with the increased facilities of inter-communication all over the world, and the vast fleet of despatch vessels we have at our command, we shall ascertain where they are in no time. So much for blockades of that description. If we come to the tactics which we should have to adopt in the event of our ports being blockaded, there have been two or three very apposite remarks made with which I entirely concur. If you consider the danger to which our own ports are subjected of being blockaded, let us ask who is to blockade them? I am very well aware that there is a section of the mercantile community of this country, great alarmists, who have no faith in the British Navy or its power, and in their panic, just like a drowning man catching at a straw, they grasp at something just as flimsy and powerless to save, viz., a simple piece of paper that they call a "Declaration" which is, I think, the most mistaken, and I should say mischievous, if I did not think it futile, instrument that this country was ever drawn into agreeing to. I may just say in passing I condemn it as false in principle and in fact, but I shall not expatiate upon it now because I suppose it might be considered outside our subject, although it does refer to blockades; but I must just remark that this beautiful valid piece of paper was signed in 1856. The first Article says privateering is and remains abolished for ever, and in 1862 and 1863 the Confederate States of America snapped their fingers at it, and the "Alabama" campaign ensued; surely that is quite enough to prove it ridiculous. To revert to the alarmists who cling to the protection of the Declaration of Paris, I myself entertain a different creed from theirs. I am not yet quite convinced of the imbecility, or the disappearance of the English fleet. Captain Bridge has just referred to the "enormous" superiority of force necessary for attacking or blockading a fortress with efficiency. Now, where is that amount of superiority to the British Navy to be found? As to the safety of our commerce at sea, I am tired of the vainglorious boast of Britannia ruling the waves, but I do protest against the idea of "Alabamas" doing so—we have not come to that yet at any rate. Gentlemen conjure up in their disturbed minds a phantom fleet, they do not believe in the real fleet of England, but they do believe in a phantom fleet of "Alabamas;" where are they to come from? One came once from England, and cost us some three millions, I believe; where are they to come from again as against ourselves, or what country is to find money for their production? I should like to comfort these gentlemen by telling them how they may get their protection. I think I can refer them to a more substantial one than a Declaration. What is a Declaration? It is not even a Treaty, and if it were, what has become of the Treaty of Sebastopol, which excluded the Russian fleet from the Black Sea? It is not an Act of Parliament, and if it were, what is an Act of Parliament but a document for a coach and four to be driven through every line of it, and to be cancelled. The moment the shoe pinches, or it is found inconvenient, I will tell these gentlemen where they can get their protection very simply and cheaply, with little trouble and less expense. They have nothing to do but to ascertain by means of their numberless and ubiquitous agents and correspondents all over the world where these "Alabamas" are building or being equipped for sea, and if the Admiralty do not provide two "Kearsages" for every one of them, they ought to be impeached. I do not mean, of course, they are to provide two men-of-war for every privateer, but I do mean to say they are to provide a force sufficient to draw all the teeth out of these wolves before they can much injure the sheep; they are only imaginary ones after all. There is, however, a weak point which has been alluded to, viz., the security of our foreign coaling stations, to which I would gladly draw attention. In spite of the Declaration of Paris, which says that an enemy's property under a neutral flag is to be respected, I do not think we shall find it so, and I think our danger is that not only our own coaling stations, such as those at the Cape and Simon's Bay, but also those at St. Vincent, Madeira, and other places which are on neutral soil will not be safe, and I think with our chronic want of foresight, a man-of-war might very easily, in the early weeks or even months of a war, make a raid

upon these coaling stations, set them on fire, and give us a blow from which we shall take many months to recover. I entirely endorse what Captain Bridge says about the hydraulic propellers. I think they have never been done justice to. I do not think the cause of its not having had more success is the question of economy. I thought the great drawback was, that it failed to give the speed other propellers had.

Captain BRIDGE: I mean economy in power.

Admiral Sir F. NICOLSON: You have alluded to the Declaration of Paris; what I am going to say will rather support your views. I do not know whether you remembered when you alluded to the Declaration not having been considered by the Confederates and Federals, that the United States never agreed to the Declaration at all: neither did Spain. So that we have a large maritime nation like the United States, where plenty of privateers might be equipped, not agreeing to the Declaration by which it was intended that privateering should be abolished.

The CHAIRMAN: I quite understand that, but I think it carries very little weight after all. I am quite aware the United States repudiate it, but if they could repudiate it so could we, and so will any country whenever they think it proper and convenient to do so.

Captain BRIDGE: When I made use of the phrase "enormous superiority of force," I meant for the express purpose of keeping the enemy's war fleet in his fortress behind his guns. I only used the American illustration as the best that there was, although a bad one.

Captain LONG: I quite agree with our Chairman in all that he has said about the Declaration of Paris; I do not believe in paper, but in the Navy. As a matter of fact, the Declaration of Paris was jointly executed by all nations excepting the United States, Spain, and Mexico, but the United States have since practically assented to every part of it except with regard to privateers. With regard to the number of vessels in reserve, of course I cannot pretend to lay down any exact rule. I quite agree with Captain Bridge that a great superiority of force will be required. Captain Bridge has just mentioned his lecture¹ which I had the advantage of reading, and also some other papers which he was kind enough to send me, from which I derived considerable benefit. I think his lecture a very valuable one; I am only sorry it was not delivered in this Institution, when we should have heard more of it. It is not only a matter of supply; there is also the question of refitting, the question of keeping the bottoms of ships clean. Then there is the liability to damage, and damage with a ship in nine cases out of ten means going into a dockyard. I do not think myself any blockade could possibly be carried on unless you have a commodious port to which to go to refit. That is one of the points I have laid down as far as I can gather from what I have read on the subject. With regard to the arc having too small a vertical extension, of course I am entirely in ignorance practically on that subject. I have simply read up all I can find about it, and I am in the same position as nine-tenths of the Officers of the Navy. The arc having a vertical extension of only 5° would I should certainly say be too small, because the boat that carried it would probably roll more than that. But that is, of course, merely a question of detail; there is no occasion to confine the vertical arc within 5°; you can make it as much as you like, subject to a consequent diminution in the intensity of the light. Of course, wherever the vessel has a light, on seeing the boat coming through the beam, she would turn her light on to it, but I do not think it would do to trust the ship's light to discover the boat. I once saw the light on board the "Hercules;" it was a hazy night, and certainly it was very far from being what I expected. As for seeing torpedo-boats I could not I am quite sure. Mr. Soutter says, taking a state of weather in which the unit of light is lost sight of at 500 metres, a light to be seen at 1,000 metres ought to have 1,600 Carcel burners, that is, 14,400 candle-power. So that if you put a light on a ship it is sure to be seen, and Captain Bridge's testimony is very important on that subject. The remark made by Captain Bridge about lighting the sights of an enemy's guns is something new to me, and is very important. With

¹ "Attack of Maritime Fortresses," read before the Royal Engineer Institute by Captain C. A. G. Bridge, R.N.

regard to the hydraulic propeller, Admiral Selwyn is going to give us a paper on that very subject; I have not, therefore, looked it up particularly. I quite agree with what our Chairman and Captain Bridge have said about it. I have often talked to naval architects on the subject, and they have said the reason the other was preferred was that it was more economical, that you get better results from your power when employed in another way than by the hydraulic propeller; and I have always replied that was not always the most important matter. I think Captain Bridge's remark about the twin screws, which my experience fully bears out, is an important one. With regard to the torpedo attacks that took place in the Black Sea, my information is derived from an article that appeared in the "North British Review," written by Hobart Pacha. He gives an account of the attack at Batoum, and considers the failure arose from the night being very dark, and Batoum, being a little port under high land, was difficult to find. In the first place, the boats spent half the night in trying to find it, and in the next place they did not understand how to use the torpedoes, for they left the safety-pins in. I must say, reading about the attack at Batoum, and taking that in connection with what was done by such men as Cushing and Dixon in the United States, I came to the conclusion that such men as they would inevitably sink a ship with a torpedo if she was not protected. The machine-guns are certainly a great point in favour of the ship. I have every confidence in the Navy and its administration; but I think we naval Officers do well, especially in the present changing state of armaments, to meet occasionally and discuss these questions, so that our minds may be decided as to what we are going to do. We may rely upon it a country that is governed democratically will never be too ready for war beforehand, and when it comes, a great deal will be expected of us.

The CHAIRMAN: I have only now to ask the permission of the Institution, which I am sure will be given with very great pleasure, to return our best thanks to Captain Long for his very able paper.