

"Lieutenant Bucknill of the British Royal Engineers, after a visit of six weeks to the United States, has returned to England to write a pamphlet on the torpedo, in which he gives us credit for much greater advancement in the study and practical introduction of that instrument of defence than the English have so far shown. To use his own words, he found that in the United States "three special torpedo vessels were commenced, whose speed, it is hoped, will attain seven-teen knots per hour; that ten powerful steam-tugs were fitted with telescopic outrigger torpedoes, to be worked from the interior; that the monitors, about thirty in all, were fitted with boom torpedoes; that every vessel, whether corvette, frigate, or gunboat, in the United States Navy carried a number of outrigger and towing torpedoes, to be worked from the vessel itself; that the officers of the Navy were being thoroughly instructed, in classes of twenty at a time, in the art of practical torpedoing, the course of instruction lasting several months"; and "that many of the most experienced officers in the United States Navy believe that the torpedo is to be the principal weapon of future naval armaments." While the Italian, the Russian, the German, and other navies are like ourselves furnished with a weapon which tends to bring the strength of the weak maritime powers up to that of the stronger ones, the British seagoing fleet is not furnished with a single torpedo, and its officers have therefore no opportunity of acquiring skill in torpedo tactics, or of studying the manoeuvres which may prove most suitable to the successful application of this novel weapon to offensive warfare at sea."

The possibility of employing such an agent of warfare has been often questioned, and we quite agree with the following opinion from an English paper of high standing:—

"Experienced iron shipbuilders," says *Naval Science*, "though, perhaps, not with much experience as to torpedoes, have expressed the opinion that as the explosive power of the torpedo may be increased without limit, and as the stroke from even a very moderate charge is proved to be so destructive, any attempts to make an ironclad ship "torpedo proof" must be abortive; greatly more so, in fact, than to make her "shot-proof"—to a constantly increasing power of gun, because to the increase of the latter some limit is set by the nature of materials and otherwise, whereas there is little or no limit to the power of the torpedo. And those of this opinion come at once to the conclusion that it is not by further loading the already overburdened ironclad ship with a still stronger hull, or an armor-plated one, that we should proceed; but by contriving means, whether carried by the ship or otherwise, to push aside or away to a safe distance from the hull the torpedo which is encountered, 'permitting it then to explode or not; or by some means for fishing them out, or otherwise disabling them or their igniting apparatus, by "dredging" or "sweeping" from a distance. All that the more intelligent proposers of any of these methods can say is, that so far as they may be effectual, they oblige the opponent to employ a more powerful and expensive torpedo." The discussions on this subject which have from time to time appeared in the technical and military journals (in England at least), and that raised at the late meeting of the Institution of Naval Architects on Torpedo Papers read before it, evinced such loose or imperfect notions as to the nature of explosion generally, and the laws which govern those subaqueous torpedoes, that real progress either in more effective structural

resistance to, or in keeping off to the minor limit of safe distance marine torpedoes, is not to be expected until the fundamental conditions of their explosive stroke become better understood generally. Here, as in every other branch of engineering, if we are to make much or safe progress, we must begin by distinctly grasping the conditions of our problem as presented to us by the properties of the substances and the play of the forces concerned."

But that there may remain no doubt about the value of the proposed system, we give a letter of Lieut. Bucknill to the *Broad Arrow* in which his views are given with considerable emphasis:—

"Sir,—In each number of the *Broad Arrow*, for the first two weeks in June, you have taken prominent notice of a pamphlet on "Torpedoes versus Heavy Artillery." As the pamphlet was published for private circulation only, but few of your readers can refer to it after reading your criticisms. I think it possible to point out a few things in which you have apparently misunderstood me.

"To commence with your first leader. In no part of the pamphlet are "many comparatively light guns advocated versus few heavy artillery," nor is it considered "that the 7 inch gun would be more suitable for defending torpedoes from a hostile *Sultan* or *Glatton* than a heavier gun which could pierce the sides of those ships"; but it was distinctly stated as an opinion that submarine mines, whether electrical or mechanical, can protect themselves against the larger vessels, but that smaller craft sent in to grapple for or otherwise destroy the mines or render them harmless, should be kept at bay by other means, in order to save the mines; and that comparatively light guns, properly placed, could perform this duty. It was shown how it would be possible to protect such guns from the heavy artillery of a hostile fleet by arranging the mines in a line with the forts, and by placing huge traverses and blindages to protect the guns which sweep them from the fire of an enemy outside the line of defence obtained by the mines. This plan is in direct opposition to that generally advocated, in which the mines are spread out in front of the forts with intention to assist in their defence. But if the mines thus placed be also within such distance that heavy artillery in the forts can sweep the mined waters, then heavy artillery of the same power on board the vessels just outside the mines can also reach and in time silence the fire of the forts. Now, nine out of ten forts are more pregnable to capture from a land than from a sea attack. If then greater attention be devoted to making the forts as impregnable as possible to capture from assault, and the guns therein, as well as the electrician's operating room, secure from the fire of an enemy, we at one and the same time guard the mines from attack by small craft, and hold the key of the position by a stronghold which can only be taken after a tedious siege. It is not considered probable that commanders of costly ironclads will run the risk of destruction by taking their vessels into waters which are even only supposed to be mined, before the latter are thoroughly searched or the electrician's headquarters captured. Should commanders be so rash, the mines protect themselves.

"The application of submarine mines to "wide spaces and open roadsteads" may be possible, but in the pamphlet you criticise it is evidently opined that the narrowest portions of a navigable channel are the proper places to defend, the mines being placed as close as possible to their supports. You

state that "a number of mines separated by a wide expanse from the firing stations could only be managed by single cables; they could only be exploded by contact." This is not so; mines can be fired singly by contact, although several are grouped on one cable, the explosion in no way destroying the subsequent efficiency of the remainder; and mines can be fired by cross bearings at considerable distances with much accuracy—in which case, however, single wires are necessary.

"Again, the difficulties you mention with regard to strong currents and great rise and fall of tide have been overcome. In the pamphlet I recommended that important harbours should be permanently defended by mines; but the whole point is lost by filling the cases, as you propose, with sand or coal-dust. It would be as tedious to raise and load such mines as to lay down new ones. An electrical submarine mine, with quantity of fuzo incapable of being accidentally ignited by currents induced in the cables during thunderstorms, is fully as safe as a loaded cannon without the friction tube inserted. If it occupied ten days or so to load and lay our guns, should we not keep them ready loaded, but the friction-tubes under lock and key?

"Allow me now to add a few remarks on your second leader, June 8th, in which the naval questions raised in the pamphlet are more especially criticised. Torpedoes proper, as applied to cruising vessels, differ from submarine mines and from torpedoes as applied to small craft for coast and harbour defence, in this: that the former are utterly untried and unknown, except experimentally, whereas the latter have been practically proved as most successful in actual warfare. All arguments, therefore, on offensive torpedo warfare must to a great extent be shrouded in theory, all opinions hypothetical. Your statement that the torpedo vessels proposed in the pamphlet would be "easily sinkable" and "fragile," is an opinion, as was my statement that she would be extremely difficult to sink; and I cannot pass without remark that you emphasised the thin skin above the water-line, but omitted to mention the double and cellular skin below it, as well as the proposed armour for protecting the engines. As regards automatic torpedoes, discharged from the side of a vessel at a foe, I did not think it necessary to state that they would not be used over waters "traversed alike by friend and foe." In Captain Colomb's late paper on the attack and defence of fleets, it is conclusively demonstrated that the attack by means of "a narrow front with small depth" was superior to any other. The arguments he uses apply equally for automatic torpedoes as for guns, and the waters on either side of each vessel are not then "traversed alike by friend and foe." Should the attack be made in single line abreast, or by groups in line, your remarks are quite called for. There is another weapon you hardly mentioned in your leader, and yet it is the very torpedo of all others which the Americans seem to place most reliance upon. I mean the telescopic outrigger torpedo. As I said in my pamphlet, they have already fitted it to several of their own tugs, and I have reason to suppose that it is intended to fit such a contrivance to the beak of the new torpedo vessels they are now building; but in your paper for June 15, is found, "We do not hear that anything is yet decided as to the manufacture of Harvey torpedoes, and yet these are the only weapons of the kind that can be used with safety or effect in offensive operations at sea." Take the word of one who has lately seen the telescopic apparatus which is used in the American Navy