

iron clads of twice the size without torpedo boats.

When Germany emerged from the late war with France she was not a naval power; but finding the necessity of becoming one to protect her coast and commerce, she took immediate measures to increase her naval resources.

Germany has now appropriated \$72,000,000 for the purpose of building up a navy, so that in 1884 she will have about twenty six iron clads and rams of the heaviest tonnage sixty swift clipper steamers, averaging 1,600 tons with heavy batteries; and thirty sea going torpedo vessels; leaving \$15,000,000 for docks and improvements in navy yards and arsenals.

This is independent of the annual appropriations, and shows how indispensable it is considered by a nation advancing in power and increasing in commerce to maintain a large force of war vessels.

In the aggregate, \$72,000,000 seems a large sum; but when apportioned to the several years in which it is intended to complete the work, it appears like only a moderate expenditure.

We could afford it just as well as Germany and we need an increase in our Navy more than any European power.

Six millions a year properly expended would in ten years put us in condition to resist encroachments, and to maintain our rights in any parts of the world.

England has built but one torpedo vessel, but the English, with their vast workshops, could turn out torpedo boats faster than we could steam launches. They are by no means indifferent to the importance of the sea torpedo, and we must not form an unfavorable impression of torpedo vessels because England has not done more in that direction.

The British have a number of quick working iron gun boats for harbor defence, that could soon be converted into torpedo vessels.

We cannot afford to look idly on while all other nations are adding so rapidly to their naval resources. Every step they take leaves us so much more inferior to them, and we must finally lose that naval prestige of which we are justly proud, and abandon all claim to equality on an element quite as natural to our own people as to any sea going nation.

While I am an advocate for the practice of naval tactics in large vessels, yet I think it would be better to commence with steam launches at the Naval Academy, where not only the evolutions of fleets should be taught, but also the best system of attacking in torpedo vessels and rams, to exhibit the confusion and difficulties incident to a battle. The text book in use at the Academy is well adapted for giving a general idea of the management of a fleet out of battle, but to manage an iron clad fleet during an engagement a different system of tactics will be required.

In whatever manner a line of battle may be formed, it will be found that the ships will have to be arranged in groups of three, that is, three vessels forming a triangle and preserving that order as near, as possible throughout a battle. Vessels in groups of three can support each other and preserve order better than by any other arrangement.

When a fleet is enveloped in smoke great uncertainty in regard to signals must exist, and, as I have said before, "at the commencement of a battle the responsibility of the admiral ends, and that of the commanding officer of ships commences." A long

line of battle would soon be disarranged, but it would be possible to keep three vessels together in a triangular form where they could attack in concert and defend each other with certainty. I invite attention to this subject, and trust it may be introduced into the study of naval tactics now taught to young officers. There are several matters which I have mentioned in former reports, and to which I again beg leave to draw your attention.

1st. The apprentice system, which is necessary, if only to educate a set of good petty officers for the Navy. It seems rather inconsistent to provide such an excellent school for educating officers while doing nothing for the seamen. In a few years more all the old stand bys, the petty officers, will have disappeared from the Navy, and it is a question as to who will fill their places. We require at least 1,000 boys in addition to the seamen, ordinary seamen, and landsmen now shipped for service, though 2,000 would be better. These, educated and drilled on the plan I submitted to you in a former report, would, in the course of ten years, furnish petty officers, seamen, and ordinary seamen for the entire Navy.

On a late occasion, when it was necessary to fit our ships with despatch, we had to enlist many inferior men, and the ships sailing in great haste, without time to properly drill their crews, were very inefficient as vessels of war. I received letters from the several commanding officers at the time, and did not envy them the responsibilities they had incurred. The entire expense of 1,000 boys would be, for pay, \$120,000; rations, \$100,000; total, \$220,000 per year; or, by reducing the number of ordinary seamen 700, we could maintain 1,500 boys at the rate of \$161,000 per annum. At the end of four years one half these boys should be able to do thoroughly the duty of ordinary seamen and after that time would add 750 ordinary seamen yearly to the Navy. In twelve years the Navy would be manned entirely by American seamen.

2d. A more perfect method of ventilating ships is required. Imagine a crew of 250 men shut up at night on the berth deck of a ship in the tropics, inhaling the foul air from the vessel and the fetid atmosphere of each other's breath. No wonder ships' crews contract epidemics which often decimate them. I have examined a plan of ventilation devised by Assistant Engineer G. W. Baird, of which I highly approve, and I cannot do better than inclose his statement herewith.

3d. The introduction of steam engines into all ships of the Navy.

4th. Steam cutters to be built with more buoyancy and more flare to the bow. Those we have at present are wet in a sea way and unsafe.

5th Uniformity in boats' sails. This was at one time established, but at present the subject does not receive that attention which it merits. The plans furnished in 1869 were good and serviceable, and should be adhered to.

We have gone back to the use of the old lug sail for boats, an unsightly and unserviceable arrangement; and commanding officers, unable to make it useful, rig their boats pretty much according to their own fancy.

The Alarm and the Intrepid.—On the 28th ultimo I went on board the torpedo vessel Alarm to witness the working of the "Flower Steering Propeller," with which she is fitted. For this purpose the vessel proceeded down New York Harbor to within a short distance of Sandy Hook. The trial was not for the purpose of testing the

vessel's speed; the engines were not quite in condition, and as I had given only twenty four hours' notice of my intention to make the trip, the engineer in charge did not think it advisable to work the engines up to full power. The trial was in every respect gratifying, and the performance of the vessel exceeded my expectations. The working or manœuvring capacity of the Alarm is extraordinary, and I doubt if any vessel afloat can equal her in that respect. She worked up to eight knots, carrying only fifty pounds of steam, throttled off and all the furnace doors wide open. When running at full power, the vessel is calculated to carry ninety pounds of steam, the boilers having been tested at one hundred and twenty pounds hydraulic pressure. With fifty pounds of steam she made forty eight revolutions; with seventy five pounds she would make about seventy five revolutions. The Catalpa, a fast tug of 196 tons, making fifty turns, only kept way with the Alarm, showing that there was very little difference in the power of the two propelling forces, the Alarm being 311 tons.

The model of this torpedo vessel seems perfect, as she did not break the water on any part of the hull, or show anything more than a slight ripple astern, while running eight knots. While going at a speed of about seven knots the wheel was reversed and in thirty one seconds the vessel was moving in the opposite direction (astern) with nearly the same steam and speed, and working as well as when going ahead. While going about seven knots and making forty five turns the wheel was put at right angles, to the keel, when the vessel made a complete turn on her centre in about 3 min. 30 sec. and she would turn even quicker than this with more revolutions. I noticed that an increase of about five turns above forty five made a great difference in the speed of the Alarm, and without doubt when carrying all steam and making the full number of turns of which she is capable she will run over ten knots (or 11.5 miles) an hour.

The condition of the engines, however, was such that the engineer did not deem it safe to run them with power on that occasion. The journals heated considerably and there was a good deal of thumping of machinery, but all this will disappear when the engines are run for a short time. I think the contractor has furnished the Alarm with a good pair of engines; the work appears to be well done throughout. On the whole I am pleased with the vessel, and am satisfied she will fulfill what is expected of her. She carries her fifteen inch gun well, and could have been fitted to carry a twenty inch gun, provided she did not have to encounter a heavy sea: this is remarkable in so small a vessel.

I also examined the Intrepid, and found her a good, strong vessel, having made considerable speed with full steam power. She is rather heavy for a torpedo vessel, not working so handily as is desirable for that purpose, and not being fitted with outrigger torpedoes, but she is an admirable ram, and with her weight and momentum when under way would sink any vessel with which she came in contact without injury to herself. She is well adapted to harbor defence, and, perhaps, would do more damage to an enemy than a torpedo vessel, the ram ranking higher than the torpedo in naval warfare. The Intrepid could easily be arranged to carry a fifteen inch gun by taking out her mast and placing her pivot house a little differently; in which event she would be a formidable vessel for harbor defence. In fact, for harbor and coast defence, I think