NEW TORPEDO EXPERIMENTS BY CAPT. ERICSSON.

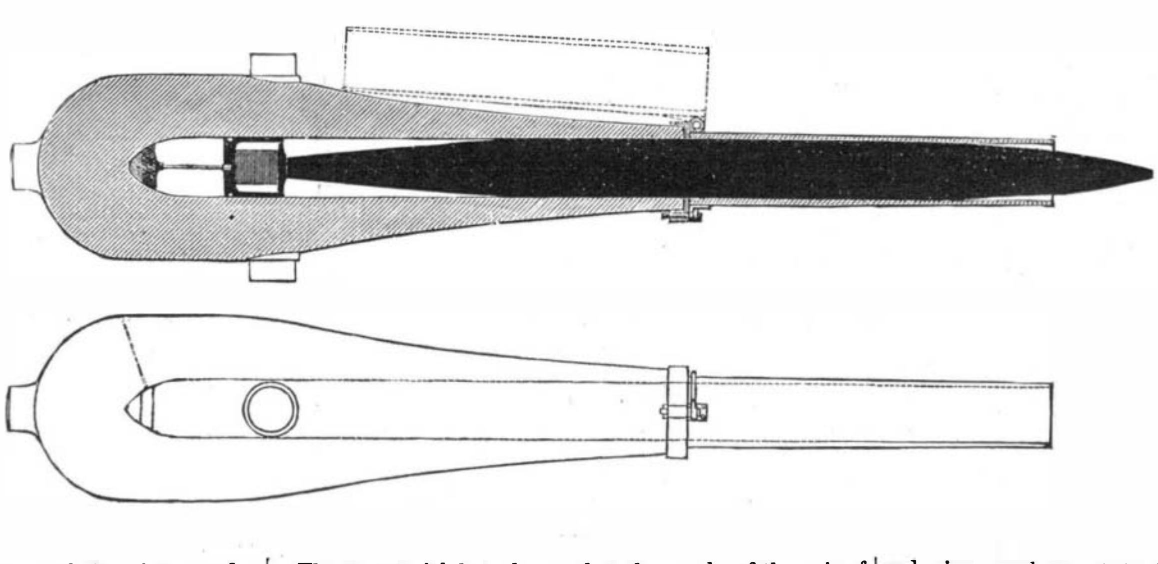
In the discharge and propulsion of torpedoes from a vessel, at a point below the water line, the use of compressed air has heretofore been employed. But the great expense of the apparatus and the difficulties attending the use of air under the enormous pressures required, has led Capt. Ericsson to seek for a substitute for the air. With this view he has made experiments with gunpowder in connection with a projectile of peculiar form and a gun with a novel appliance. We derive from the *Army Journal* the following particulars of the experiments.

By the direction of the Secretary of the Navy the Chief of the Bureau, Commodore Jeffers, caused a navy 15-inch gun and carriage to be mounted on the gun scow belonging to the Ordnance Department, at the New York Navy Yard. He also instructed the Inspector of Ordnance, Capt. Matthews, and his assistants, Lieutenants Hanford and West, and gunners, to assist during the experiments. The gun being thus placed at his disposal, Captain Ericsson applied to it a hinged cylindrical extension secured to a muzzle ring bolted to the termination of the chase, as shown by the annexed illustration, representing a sectional plan and side elevation of the piece. The principal object of this cylindrical extension (partially open at the top during the preliminary trial) is that of sustaining and directing a torpedo nineteen feet long, pointed at both ends, and proportioned to carry an explosive charge of 250 lb. at the head, the tail being provided with a cast iron armature to balance the weight of the charge and receive the thrust produced by firing the gun. The object of the hinge is that of enabling the gunner to swing the extension to one side for the purpose of facilitating the sponging of the piece. The sectional plan, on which the outline of the torpedo is marked, shows the propelling piston, composed of cast iron, employed to transmit the initial energy of the charge and the gradually diminishing energy of the expanding powder gases. The tail end of the torpedo is made blunt in order to withstand the crushing effect of the great pressure brought to bear upon it. An elastic cushion, composed of disks of pasteboard, is inserted between the bottom of the piston and a loosely fitting disk applied between the cushion and the blunt end of the torpedo. It will be observed that the propelling piston is placed at a considerable distance from the charge, the latter being located near the termination of the chamber and contained in a flannel bag supported by a conical piece of wood held by a slender iron rod inserted in the bottom of the piston. A charge of eight pounds of powder, composed of hexagons weighing 96 grains each, was employed during the entire series of experiments, its volume being 216 cubic inches, while the actual volume of the explosive body (weighing eight pounds) was only 135 cubic inches, and the unoccupied contents of the chamber 2,997 cubic inches. It will thus be seen that the air space was 2,997-216ths =13·83 times greater than the volume of the charge, and 2,997-135ths=22·20 times greater than the actual volume of solid power. Notwithstanding this extraordinary disproportion of charge and air space, it was found during the trial that a bright flame issued from the muzzle of the gun at each discharge, following the expelled propelling piston for a distance of nearly eight feet. This circumstance becomes the more remarkable when the fact is taken into consideration that the total internal contents of the gun in rear of the propelling piston, at the instant of leaving the bore, is 24,377 cubic inches, or nearly 112 times greater than the volume of the charge. The internal pressure, indicated by the flame issuing from the gun after such an extraordinary expansion of volume, can only be accounted for by assuming the combustion of the powder gases to be perfect owing to the presence of a large volume of atmospheric air. Obviously the great compression of the air in the chamber at the instant of explosion brings the particles of the oxygen of the confined air into closer contact than even in pure oxygen gas under atmospheric pressure. This consideration accounts satisfactorily for the perfect combustion indicated by the bright flame issuing from the gun, notwithstanding an expansion in the ratio of 112 to 1 as compared with the volume of the charge, and 178 to 1 compared with the actual volume of the explosive body. Experts cannot fail to regard the foregoing facts as very important, proving as they do that the explosive energy of gunpowder is not, as generally supposed, a mere momentary development of energy. The result of the trial is conclusive in this respect, and shows that the developed power may be controlled, and to some extent regulated, as we regulate the expansive force of permanent gases.

As already stated, the torpedo employed during the experiments is made of wood, nineteen feet long, exactly fitting the bore of the 15-inch gun, its weight, including that of the propelling piston, being 1,281 lb. It should be mentioned that the flight of the torpedo during the trial presented several remarkable features, especially in regard to the position of its axis, which, in place of retaining parallelism with the axis of the gun, gradually changed its inclination, corresponding exactly with the curvature of the trajectory near the termination of the course. On the other hand, no deviation whatever was observed in the vertical plane of the trajectory, the course being perfectly straight.

The experiments were commenced on the west side of the Hudson, but as the bottom there proved very soft, the gun scow was towed to the Horse Shoe, near Sandy Hook, where the bottom is very firm, being composed of fine sand. It should be mentioned also that during the experiments on the west side of the Hudson two torpedoes were lost by striking the water at a considerable angle, and entering the soft bottom at nearly full speed. The entering force, estimated at upwards of one million foot-pounds, caused both torpedoes to disappear completely. At Sandy Hook, however, the bottom proved to be so firm that the torpedo, the weight of which is somewhat less than its displacement, invariably floated to the surface at whatever angle it struck the water.

It will be asked, What became of the propelling piston which, being composed of cast iron, of course dropped into the sea after having parted company with the torpedo during its flight through the air? The answer is, that owing to the firmness of the bottom the piston was recovered at each discharge of the torpedo, excepting the one which terminated the trial. It is scarcely necessary to mention that spare pistons were provided, and at hand, in case of such accidents.



The recent trial has shown that the angle of the axis of the torpedo on striking the water at the end of its course coincides with the angle of fall of the trajectory. Again, the original torpedo experiments on the Hudson, before referred to, showed that when the torpedo, after a short flight through air at a small elevation, is laid flat on the water, it proceeds at a high rate of speed in a straight course near the surface. Our professional readers will be interested to learn that Commodore Jeffers thinks that this mode of projecting torpedoes towards an enemy's ship will prove very effective.

As we are only dealing with the question of substituting powder for compressed air in manipulating aggressive torpedoes, it has not been our intention to present a record of the experiments conducted at Sandy Hook to determine the flight of the torpedo through the air, nor its behavior on striking the water; but we deem it proper to mention the interesting fact established by the trial, that by attaching to the head on opposite sides in the horizontal plane, thin disks placed at an angle of 13° to the axis, the inclination of the torpedo during the flight can be regulated very accurately by simply changing the width of these disks. It will be well to mention, that no recoil of the gun has been experienced during the trials, although the friction gear applied to the slide has been but slightly tightened. Captain Ericsson has accordingly offered to build, for the Ordnance Department, rotary gun carriages without slides, suitable to be placed on the decks of vessels, for expelling torpedoes in the manner before explained.

It remains to be stated that, apart from the possibility of attack by throwing aggressive torpedes from the decks of vessels, the dispensing with the internal propelling machinery employed by Whitehead opens a wide field for the application of the submerged torpedo tube. Such a tube may be suspended from the sides of vessels of all classes, and submerged at any desirable depth. Nautical experts can best determine the utility of aggressive torpedoes expelled from such tubes in a naval action.

The Proposed International Park at Niagara.

A conference between the Ontario Government and the New York State Commissioners was held recently at Niagara Falls, relative to the setting apart of the grounds on both sides of the Falls for an International Park. It was estimated that Canada would have to purchase properties valued at about $400,000, and New York would have to expend something like $1,000,000 for like purposes. The desirability of the proposed scheme was generally agreed upon, provided it should not cost too much. The boundary of the contemplated reserve would run from the Clifton side of the Bush property to beyond the burning spring. On the American side it could run from the new suspension bridge along Canal street to a point above the rapids. The islands of course would be included in the reserve.

The programme of the conference suggested, 1st, that no effort be made to make the lands into a park, but rather that the natural characteristics of the locality be restored and preserved, as far as practicable, and that the grounds be thrown open to all, subject to such regulations as may be deemed requisite; 2d, that the islands in the river and a strip of land on each side of it should be acquired, and that the latter should be planted with trees so as to form a belt sufficiently dense to shut out all incongruous objects; and, 3d, that a toll to defray cost of improvements and maintenance should be levied, but that such other fees as are at present collected —unless, perhaps, for special services, such as guides— should be abolished.

METALLIC FENCES.

It is nearly fifty years since experiments with wire fencing began to be made, and twenty-five years since it began to be much used. The method promised great economy, both in first cost and in the saving of ground space. Besides, the wire fence was less liable to be blown down, and it would not occasion snow drifts. On the other hand, it was soon found that it was rapidly corroded by the weather, and being inconspicuous was liable to be run down by cattle and horses. When "galvanized" the wire was more durable and more easily seen; and in spite of its inability to stop unruly cattle, wire fencing became widely adopted, particularly in the West, where, it is estimated, as many as 150,000 miles of plain wire fencing have been set up since 1850. To make wire fencing stock proof several devices have been invented and patented during the past ten years, to provide for arming the fence with cattle-repelling spines or barbs of metals.

The *Holyoke Manufacturer* states that during the four years since the first barbed wire was put upon the market, the sales have amounted to between fourteen and fifteen thousand tons, and the demand is rapidly increasing both at home and abroad. There are several manufactories, and in one instance the works cover three acres and give employment to 1,200 men. The wire is made from Bessemer steel, and is drawn in the usual way. The "galvanizing," or zinc coating, is done by heating the wire in suitable furnaces, and drawing it from them, first through tanks of acid, and then through tanks of boiling zinc. A thin and even coating of zinc adheres to the wire, giving it both a handsome finish and a perfect protection from the chemical action of the atmosphere. The barbing is done by automatic machinery. These machines, as described by the *Manufacturer*, are good specimens of American mechanism, and do their work with lightning-like rapidity, yet with mathematical accuracy. One of the main wires passes through the machine longitudinally. A second wire is fed into the machine at right angles to the first. At each revolution of a certain disk or wheel, the sharp end of wire number 2 is twisted firmly around number 1, and cut off so as to leave a sharp point on the incoming wire as before, while the bit of pointed wire cut off remains as a steel thorn attached firmly to wire number 1. This wire, thus armed with barbs at regular intervals, passes on to a revolving reel, where it is met by wire number 3—a plain wire without barbs—and by means of the reel motion is loosely twisted with it. The completed fence wire is thus really a two-strand steel rope, armed with barbs projecting in every direction. The great advantage, besides additional strength, that is secured by the second strand and twist, is an automatic adjustment to changes of temperature. When heat expands the metal the twist simply loosens, and when cold contracts it the twist tightens—all without altering the relative length of the combined wires. The reels upon which the finished product is woven are light, strong, wooden ones, suitable for shipping, and provided with cross pieces at the ends, on which they can stand, and the barbed wire be protected from injury. Each of these barbing machines turns off 1,200 pounds of barbed wire a day.

At present wooden posts are usually used as supports for the wire in putting up the fence. But it is believed that iron posts will sooner or later supplant the wood. For study, with a view to new and useful improvements the subject of metallic fences is a promising one for inventors. The demand increases not only with the decay of the old wooden fences, but also with every acre of new land that is opened up to cultivation.

AT a recent meeting of the New York Chamber of Commerce, Mr. E. F. Shepard (who had just returned from Europe, where he had made special inquiries into the cost of handling and storing grain abroad) said that the grain charges in the port of Liverpool amounted to one dollar a ton. In Havre the charges surpass the original cost of the grain. In New York the elevator charges aggregate only nine and one third cents a ton.