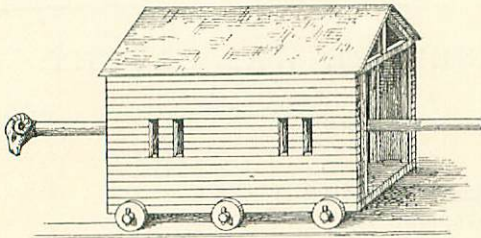


## ANCIENT AND MODERN ARTILLERY.

BY LIEUTENANT W. R. HAMILTON.

IN these days of wonderful cannon,—dynamite, Gatling and machine guns,—we are likely to forget the contrivances used by the soldiers of ancient times for throwing projectiles great distances, or for battering down walls;—or if we think of the matter at all, it is with considerable scorn when



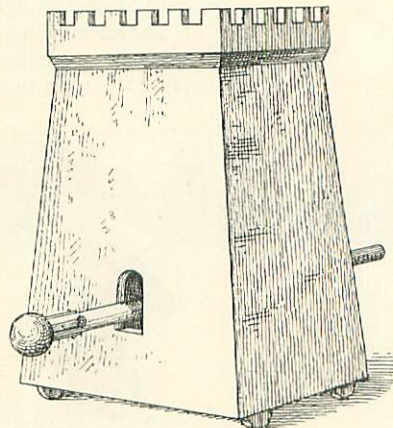
A BATTERING-RAM.

we compare them, as we must do, with the great and powerful guns of modern times. Nevertheless, the machines used by the ancients for warlike purposes were very powerful, quite ingenious, and to some extent even wonderful. Let us consider them for a moment before turning to the great guns of the present time.

In its widest and truest sense, the word Artillery is used to designate every engine of war for use on the field of battle in throwing projectiles or battering down walls. The first and earliest mention of them in history is found in the Bible, where, in II. Chronicles, chapter xxvi., verse 15, it is recorded that Uzziah, King of Judah, made engines to be put on towers and to discharge stones. The simplest engines used were battering-rams, for destroying the walls of towns and cities. These battering-rams were so called from the habit of the ram to butt with its head, which mode of attack was imitated by the engine of war. The technical name for a battering-ram was Belier, and the rams were of three general classes. The first were quite rude, and consisted only of a large strong beam with its front end, or head, covered with iron. A number of soldiers carried this beam on their shoulders toward a wall, and when they rushed forward, the iron head of the beam would strike with great force against the masonry. But of course the beam could not be very large, or it would be too heavy to carry; so the second class came into use. A long beam was fixed securely several feet from the ground on two or more sup-

ports, and from this beam was loosely suspended a much larger and heavier one with an iron head. This machine was placed close against the wall, and the suspended beam, being drawn back and then released, would swing forward with great force. The third class cost the most, and was, of course, more powerful than the others. In this, the beam was mounted on a number of little wheels, which traveled in grooved tracks laid for them, leading up to the wall. It can readily be seen that in this class the beam could be made of any size or weight, and that when pushed by a large number of strong soldiers, the enormous machine would travel with great velocity and strike the wall with terrible force. But the defenders on the top of the wall could easily throw down darts and arrows to kill the soldiers, and great rocks or boulders to crush the rams. So the besiegers and the ram were protected by a strong roof and walls which were fastened to the axles of the little wheels and thus always covered the ram and the soldiers, since the cover traveled with the machine, and indeed was part of it.

As to the power of these engines of war, history has preserved for us several very interesting examples. The Emperor Vespasian, during the siege of Jerusalem, built a ram having a brass head as large as ten men. It was armed with



A BATTERING-RAM AND TOWER.

twenty-five horns, each the size of a man's body, while the weight of the beam was 150,000 pounds, that is, seventy-five tons, or about three times the height of an ordinary locomotive. It took three hundred pairs of

mules to draw it, and fifteen hundred men to operate it. Now, the momentum or moving power

of a body is measured by the product of its weight and its velocity. Therefore if this ram, when worked against a wall of stone, was moved at the rate of two feet a second (a moderate estimate), its force on striking the wall would be 300,000 pounds, which would be exactly the same as the force exerted by a weight of 300,000 pounds in falling from a height of one foot. That is, it would exert greater power than any gun or cannon invented up to the year 1860. These battering-rams were probably as effective in knocking down a wall or staving in the side of a ship as the best modern cannon, but for making a breach, the guns are far superior. Such was the solidity and thickness of the walls of Jerusalem that, Josephus tells us, it took all of one night for this battering-ram to dislodge four stones!

Vitruvius has left us the description of a ram weighing 480,000 pounds; but probably the most celebrated of all the ancient moving-tower rams was that constructed by Demetrius Poliorcetes at the siege of Rhodes. The base of the tower was seventy-five feet square. The ram itself was an assembly of large square beams resting on wheels in size proportioned to the weight of the structure, and all riveted together with iron. The felloes of the wheels were three feet thick and strengthened with iron plates. From each of the four angles of the tower a large pillar of wood was carried up to a height of 150 feet, and these pillars were inclined toward one another. The tower had three stories, communicating by two staircases each. Three sides of the machine were plated with iron to protect them against fire. In front of each story there were loop-holes, screened by leather curtains, to keep out darts, arrows, etc. Each story was provided with machines for throwing large stones and darts; and in the lower story was the ram itself, thirty fathoms long, and fashioned at the end into an iron beak, or prow. The entire machine was moved forward by 3500 soldiers.

But it can easily be understood that among so many men some must be more or less exposed to the enemy's darts and arrows; and so, to drive the enemy from the walls and open places, to break the roofs of his houses, and otherwise annoy him, machines were necessary for throwing missiles, from small darts up to huge bowlders. All these were included under the general name, *Tormenta*; and the catapult may be said to have been the *Gatling gun*, and the *Ballista*, the siege cannon of the ancients; while the *Onager*, the *Scorpion*, the *Trebuchet*, the *Mangonel*, and others variously named, all were varieties of one or another of these classes. They received special names because it was fancied they possessed some characteristic of the animal after which they were named.

Thus, the *Onager* is the wild ass of the desert, which kicks up showers of small stones with its hind feet when pursued; and the machine called the *Onager flung* showers of small stones by a sort of kicking action. The *Scorpion flung* showers of poisoned darts. All varieties of the *Catapult flung* showers of small stones, darts, arrows, javelins, etc., while all varieties of the *Ballista flung* but one large stone, or large dart, at a time or single discharge. But the motive power was the same in all, and was obtained either from weights or from springs, made of cords of hide or sinews, stretched or drawn back by levers. The power thus produced was sometimes very great. Weights as great as 1200 pounds could be thrown a distance of 800 yards. Think of that,—a power great enough to throw a big horse a distance of over half a mile! It is surprising, is it not?

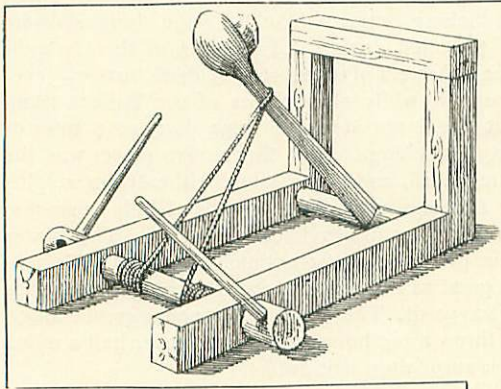
These machines were carried about with the armies; but often the largest were built before the besieged walls; and when the army moved away these were taken apart and transported in pieces. Besides throwing great stones, the ballista was often used to hurl fire-pots and red-hot iron balls over the walls into the city, to set fire to it. The fire-pots were filled with resin and the wonderful composition known as Greek fire. This latter was made of naphtha, pitch, and sulphur; and, once lighted, it could not be put out, even by water. It was used against fleets; and the whole surface of a harbor was sometimes covered with the blazing mixture, so that vessels could escape it only by sailing away.

Notwithstanding the great force with which the ballista and catapult threw projectiles, there was wonderful accuracy in their aim. Josephus tells us that he himself saw the head of a man taken off and carried more than six hundred yards by a large stone thrown from a ballista. Again, it is told that during the siege of Palmyra, the Emperor Aurelian, on visiting the outer trenches of his army, was exposed to a storm of fierce invective and bitter sarcasm from the garrison assembled on the walls. One of the enemy was particularly exasperating. A soldier in charge of a catapult offered to rid the emperor of the foul-mouthed fellow. The emperor consented, the catapult was discharged, and a huge arrow going swift and straight to the mark, hit the man in the breast and passed through his body, killing him instantly.

Now let us pass at once over two thousand years, and consider the wonderful artillery of modern times.

So great and marvelous are the powers and the effects of gunpowder and the huge cannon of to-day, that it seems hard to decide which wonder

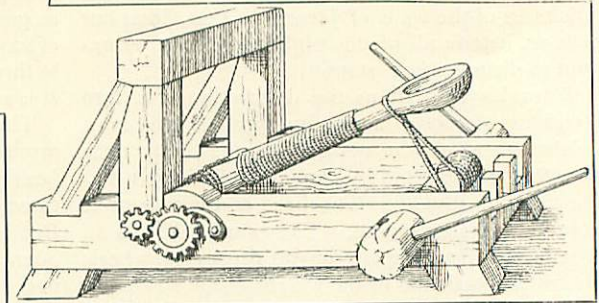
I should first describe. Let us commence with "machine-guns," as they are termed. These are guns which, by means of mechanism or machinery,



rapidly discharge a great many bullets. The best, as well as the earliest, machine-guns, are American inventions. The Gatling gun is the invention of Dr. Gatling, a citizen of Hartford, Conn., where also the manufactory is situated. It consists of a number of rifle-barrels—generally ten—arranged around a central shaft. At the rear of the barrels is a casing of metal containing the breech mechanism. One man holds a case containing cartridges over an aperture of the casing, and they drop in and fit themselves in the barrels. Another turns a crank which revolves and thereby operates the mechanism inside, so that as each barrel comes underneath, it is discharged, and the empty cartridge-shell thrown out. When the man turns the crank twice around he has discharged all the barrels; and as he can turn the crank, if he be adroit, two or three times a second, it is possible to discharge as many as one thousand shots a minute. Of course no gun can be fired so rap-

erick the Great of Prussia could load and fire six times a minute. As there are one thousand men in a regiment, it will be seen that six of these guns, requiring only five men each—thirty, all told—to operate them, could do as much firing as one thousand men, one hundred years ago. Indeed, the amount of work accomplished is much greater, since the Gatling gun throws its leaden bullets a thousand yards, and kills at that distance, while the old flint-lock of the Prussians was useless for any range greater than two hundred yards.

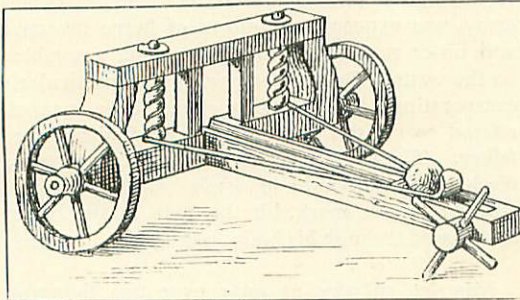
The Nordenfeldt and Gardner guns are machine-guns in which the barrels are horizontal and



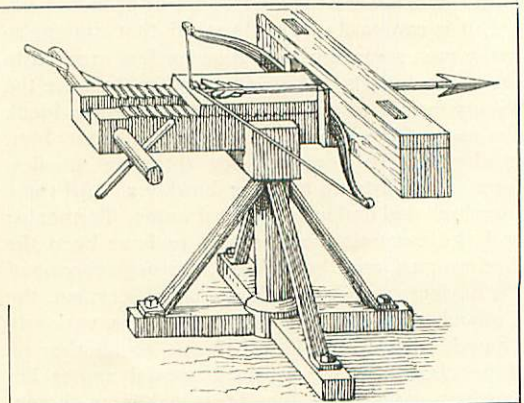
BALISTAE.

in one plane, instead of mounted together in cylindrical form as in the Gatling. But the most wonderful gun of all is the Maxim gun. This is actually a weapon that loads and shoots by itself. Think of how astonished the ancients would have been if suddenly confronted with one of these machines, a half-mile away from them, striking down their men with imperceptible missiles!

It is well known by every boy that when he fires a gun or pistol it gives a backward jump. This is called the "recoil," or, as the boys term it, the "kick"; and it is this force that is made use of in the Maxim gun. The gun consists,



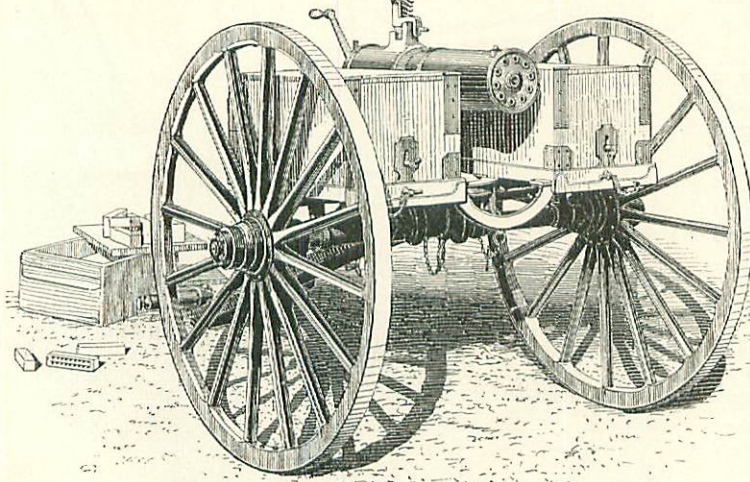
idly very long, for the barrels would get too hot, and all the parts become so fouled with soot and gas as to jam together. Only a century ago, it was thought wonderful that a regiment in the army of Fred-



CATAPULTS.

unlike the rest, of but a single barrel breech mechanism. A long strip of cartridges is put in position, the released against the first cartridge,

and a the Franco-Prussian war, fired eighty-five cartridges at once; but they all went nearly to the same mark, and, once discharged, it required some and a time to load the gun.



GATLING FIELD-GUN.

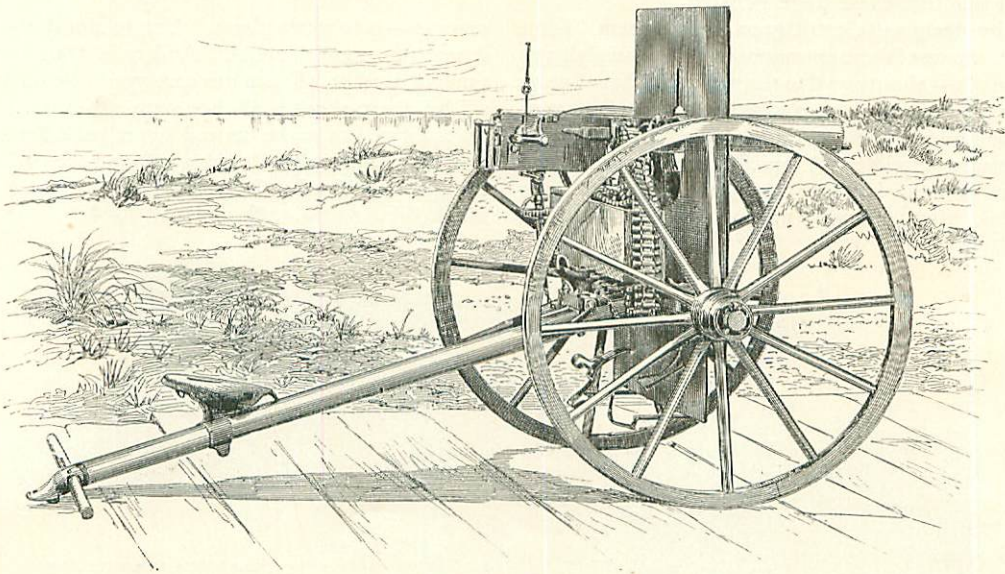
cartridge is thus fired. The recoil strikes a pin, which puts another cartridge in position, fires it and casts out the old shell, and the next recoil is utilized in the same way. This is repeated until all the cartridges are gone. It is possible to fire as many as 666 cartridges, only the first having to be fired by hand; the gun automatically discharges all the rest.

The famous Mitrailieuse, used by the French in

army wherever it goes. These rarely throw shells of over eighteen pounds in weight. 2d. Siege-guns, which are too large to be moved rapidly, but still may be carried from place to place in special wagons, cars, or boats constructed for them, and used in laying siege to places. These throw shot or shell from eighteen up to two hundred pounds in weight. 3d. Sea-coast guns, or permanent guns. These are too large to be

have a motion from side to side, so that their fire sweeps over a wide stretch of ground and is practically continuous. Going a step further, we have what are called revolving cannon, as the famous Hotchkiss—another American invention. These are cannon similar to huge revolvers, and throw shells from a half-pound up to thirty-two pounds in weight, and discharge five to twelve shots a minute.

All cannon are divided into these general classes: 1st. Field-guns, or cannon which are light and can be carried about by an



MAXIM FIELD-GUN.

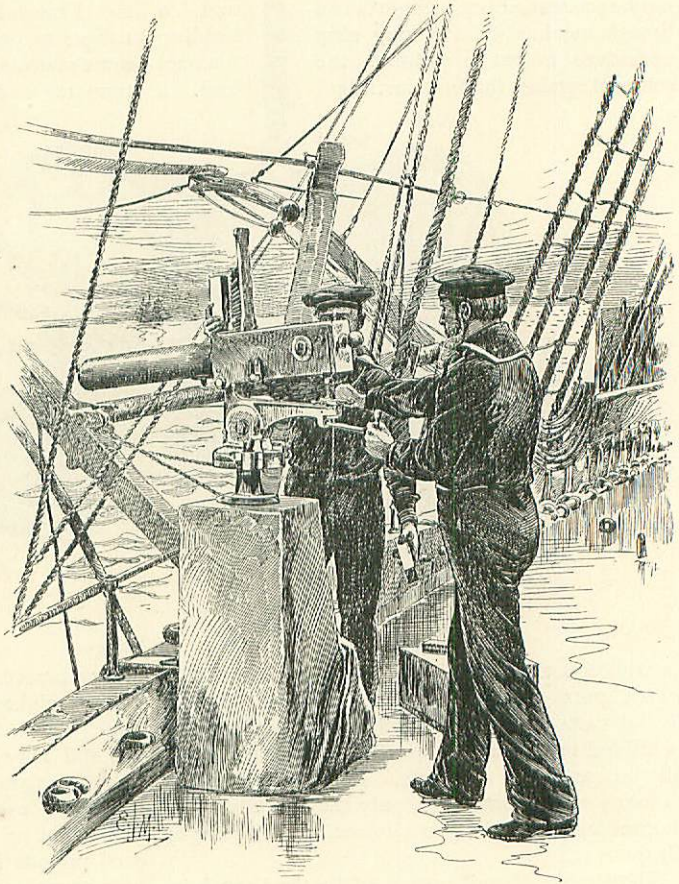
moved about, and are mounted on special carriages in sea-coast or other large forts. They throw projectiles of from 100 pounds up to 3300 pounds, and require the aid of steam and electricity in loading and firing.

As an example of field-guns, a new gun which has just been made for the United States army is perhaps the finest in the world. It is made of steel, and weighs less than eight hundred pounds. It is mounted on a steel carriage and throws a thirteen-pound shell, requiring a charge of three and one-quarter pounds of powder. It will throw this shell, which is a little more than three inches in diameter, over seven thousand yards—that is, about four miles—with terrific power and wonderful accuracy.

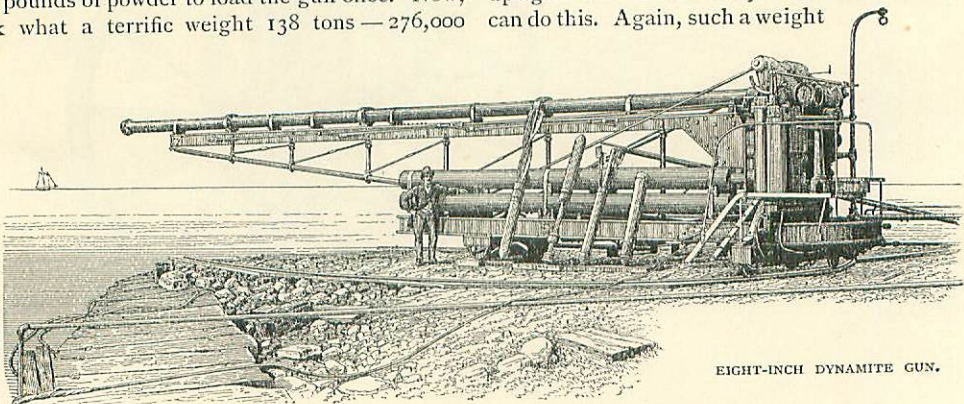
As yet, in the United States, we have no siege or sea-coast guns which will compare favorably with the huge monsters found in European countries. There are a few in the navy, and it will not be long before we shall have in the army many guns which will be quite as good as anything of the kind abroad, and perhaps even better.

I said that these huge guns require steam and electricity to operate them. Let us see. Some of these enormous steel shells weigh 3300 pounds—about equal to the weight of three horses. They are six feet high, and as large around as a man. The gun which fires them is called a 138-ton gun, because it weighs 138 tons. It requires one thousand pounds of powder to load the gun once. Now, think what a terrific weight 138 tons—276,000

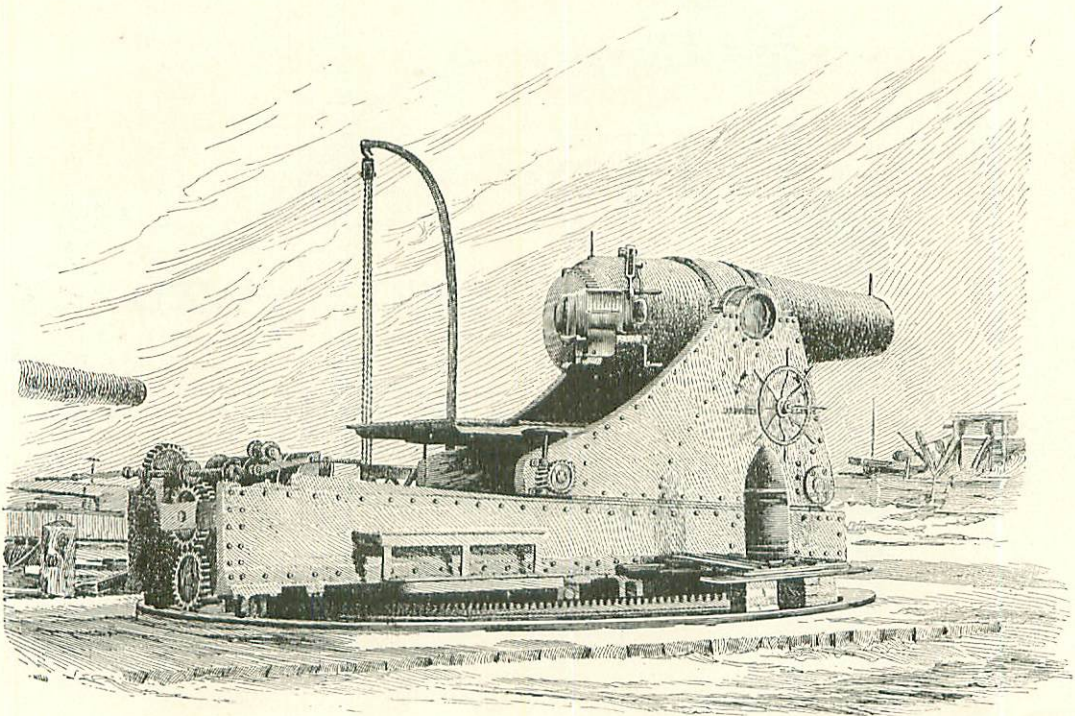
pounds—is to move about. Yet, to aim the gun, it must be moved about. And as it takes some time to load it, all the gunners would be picked off by sharpshooters if they were not protected. So the gun has to be moved down behind a safe wall or rampart while it is loaded, and then raised up again to be fired. Only steam can do this. Again, such a weight



GARDNER GUN ON DECK.



EIGHT-INCH DYNAMITE GUN.



UNITED STATES 12-INCH RIFLED MORTAR: SHELL, 630 LBS.; CHARGE, 35 LBS.; RANGE, 5½ MILES.

as 3300 pounds of steel and 1000 pounds of powder can be lifted and inserted in the gun only by the help of steam. The noise of the discharge and the danger of exploding 1000 pounds of powder are so great that it is not safe for a man to fire one of these huge guns close by, as he could fire a small one. So electricity is brought into play, and the powder ignited by means of the electric spark.

Now, let us measure the power of these huge machines. A foot-ton is the force with which one ton raised one foot, and then let fall, would strike the ground; or the force with which one pound raised two thousand feet from the ground would exert in falling that distance. Now, the force, or energy, exerted by a projectile from one of these huge guns is more than 57,000 foot-tons at a distance of 1000 yards from the gun. Very few of us can understand what a tremendous power this is; but if we were to take the Obelisk in Central Park, and carry it bodily to the very top of the spire on Trinity Church, and then let it fall, it would strike Broadway with far less force; still it would be sufficient to crush any building on which it should

happen to fall. These great guns, if they could be given the proper elevation on board ship,—that is, if the construction of war-ships allowed the muzzle of the gun to be pointed upward sufficiently,—could throw their shells from far outside of Coney Island into the heart of New York City, to crush whatever the missile might strike. Yet this distance is over twelve miles. If one such projectile could retain the velocity with which it leaves the gun,—2000 feet a second,—it would reach the moon, 270,000 miles distant, in eight days. Yet, wonderful as are these guns, the limit of their power is not yet reached; and in a few years more, the present weapons will appear small beside the new ones to be constructed. Before long there will be guns to fire shells charged with dynamite or other high explosives, so that nothing can withstand the bursting shells.

These guns will add to the horrors of war, but some philosophers are of the opinion that it is only by making war so frightful that human beings cannot endure its terrors, that the Millennium will be brought about.