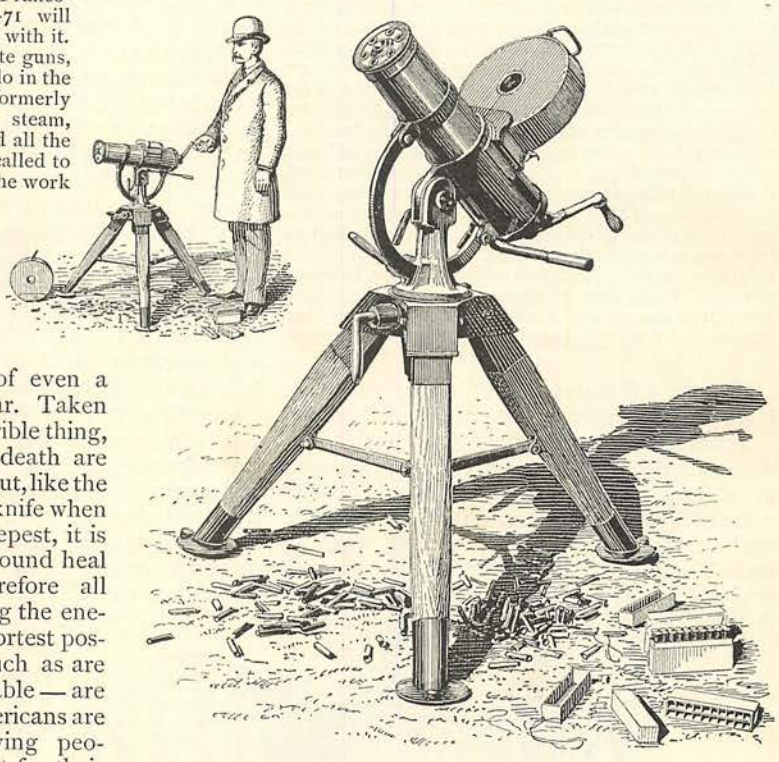
AMERICAN MACHINE CANNON AND DYNAMITE GUNS.

NOT long since, in New York, a distinguished general of the Union armies, now on the retired list, gave utterance to remarks the substance of which was as follows:

The next war will be marked by terrific and fearful slaughter. So murderous have warlike weapons become, and so fertile has the inventive power of man grown in producing means of killing his fellows, that the Rebellion and the Franco-Prussian war of 1870-71 will seem mild in comparison with it. Machine cannon, dynamite guns, and magazine rifles now do in the space of a minute what formerly required hours; while steam, electricity, chemistry, and all the agents which man has called to his aid will be utilized in the work of destruction.

It is indeed so; and yet in the extreme mortality of modern war will be found the only hope that man can have of even a partial cessation of war. Taken at its best, war is a terrible thing, and bloodshed and death are necessary attributes; but, like the cut of the surgeon's knife when at its sharpest and deepest, it is bound to make the wound heal the quickest. Therefore all means which will bring the enemy to terms in the shortest possible time — except such as are absolutely objectionable — are justified in war. Americans are dubbed a peace-loving people, and are laughed at for their small army and navy and antiquated armament. How passing strange, then, that not only the first, but the most perfect, of modern weapons are their creation! The Gatling gun, the Gardner, the Lowell, the Hotchkiss, the dynamite guns, and the best of magazine rifles are their inventions. History furnishes many proofs that it is to the improvements of arms that nations have owed their success in war; and in these utilitarian days that nation which first puts into intelligent practice on the battle-field the proper use of machine guns must inevitably come off the victor. Some of us remember the halo of mystery that attached to the mitrailleuse, at the breaking out of the Franco-Prussian war, and the tales told of this wonderful machine; we can also remember the cruel disappointment that its supporters were subjected to when it was put to the crucial test of service. It consisted of thirty-seven rifle-barrels arranged in a cylinder; the barrels being open at the breech, the cartridges were placed in a disk, which was then clamped against the barrels, and all the cartridges were exploded simultaneously. The cartridges were paper-cased, a vital imperfection in machine guns. Owing to the number of barrels, the gun and carriage were heavy and cumbersome, so as to absorb the recoil of so great a discharge. Moreover, the rate of fire was not rapid, as much time was necessarily taken up in loading.



GATLING POLICE GUN.

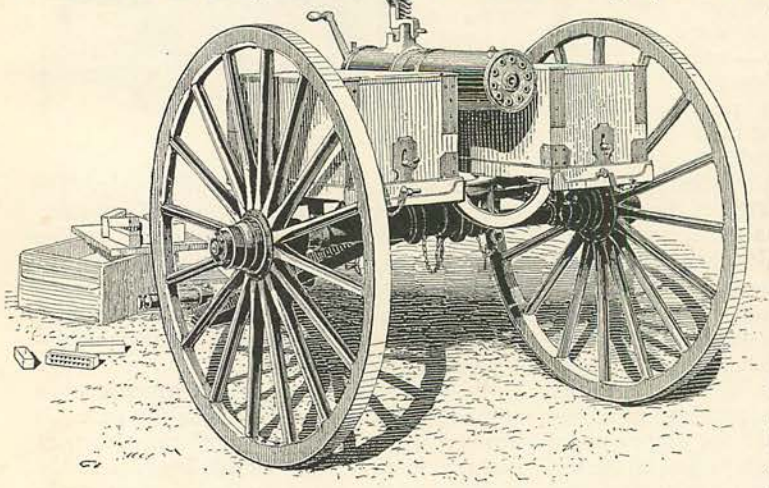
We have called the Gatling the progenitor of machine guns, because it was the first. It was invented by Dr. Robert Gatling, then of Indiana, in 1861; but though brought to the attention of the American Government, it was

not given a trial till some years after the war of the Rebellion, when, in an improved condition, it was finally adopted. Since then all the governments of the world have used more or less of them. Its first actual service of importance was in the war of 1870–71 between Germany and France. To be sure, it was not till nearly the close of the war, and when the failure of the mitrailleuse was acknowledged, that it was used. If it had been used in the beginning, the result might have been different. The following, taken from the war correspondence of the "London Journal" at the time, shows its effects:

> Up to this time we had not seen any Prussians beyond a few skirmishers in the plain, though our battery of Gatlings had kept blazing away at nothing in particular all the while; but now an opportunity of its being in use occurred. A column of troops appeared in the valley below us, coming from the right — a mere dark streak upon the white snow; but no one in the battery could tell whether they were friends or foes, and the commander hesitated about opening fire. But now an aide-de-camp came dashing down the hill with orders to pound them at once — a French journalist, it seems, having discovered them to be enemies, when the general and all his staff were as puzzled as ourselves. Rr-rr-a go our Gatlings, the deadly hail of bullets crushes into the thick of them, and slowly back into the woods the dark mass retires, leaving, however, a trace of black dots upon the white snow behind it. This, their famous and 4 o'clock effort and its failure, has decided the day. That one discharge was enough.

The main features of the Gatling gun in the latest form may be summed up as follows:

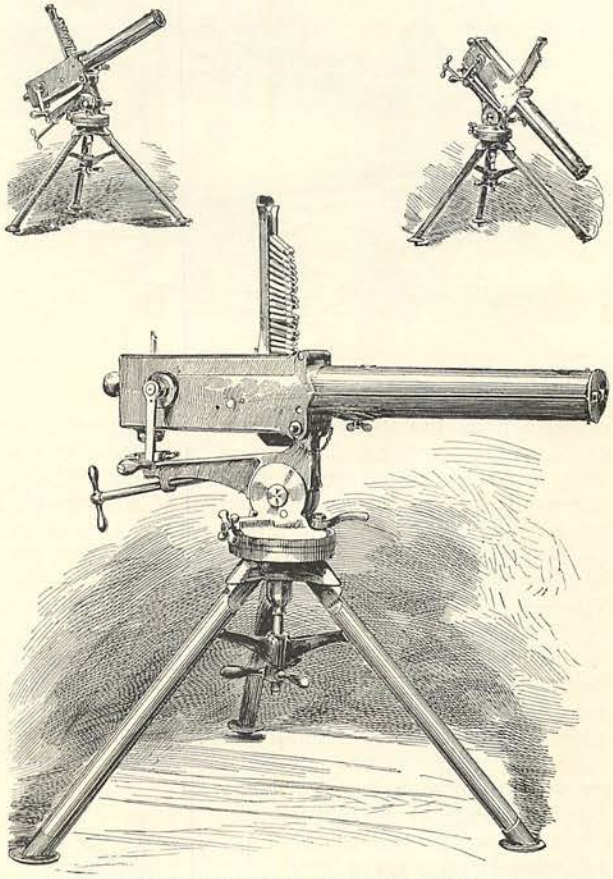
It has from six to ten rifle-barrels, each with a corresponding lock. These barrels are grouped about and revolve around a central shaft to which they are parallel, and the bore of the barrels extends through from end to end. The breech-ends are firmly screwed into a disk or rear barrel-plate, which is fastened to the shaft, and the muzzles pass through another disk. The shaft projects beyond the muzzles and extends backward for some distance behind the breeches. The barrels and locks are revolved together around the shaft by turning a crank on the side of the casing surrounding the breech. Besides this motion, the locks have a forward and backward motion of their own, the first of which places the cartridges in the barrels and closes the breech at the time of each discharge, while the latter one extracts the empty cartridge-cases after firing. It is only when the handle or crank is worked forward, which turns the barrels from left to right, that the gun is loaded and fired. On the top of the gun is a hopper, which receives the cartridges from a feed-case; and when the gun is in action there are, in the ten-barrel gun, five cartridges going through the process of loading and five more in different stages of extraction. These several operations are continuous, and the operations of loading, firing, and extracting are carried on uniformly. The cartridge falls from the hopper into the breech-block at the top, and before it revolves so as to be underneath it is shoved into place, the hammer drawn back, and, as it reaches the lowest point of revolution, the breech is closed, the hammer released, and the cartridge fired. As it comes up on the left-hand side, the ejector and extractor is at work, the empty shell falls to the ground, and the barrel is ready for another cartridge as it reaches its place on top. Therefore in one entire revolution ten cartridges can be fired, and the number of cartridges that can be fired in a given space of time will depend upon the strength, endurance, and rapidity of action of the man who turns the crank. A new feed called, from its inventor, the Accles feed, makes the supply of cartridges positive and certain in action, and with it, it is claimed the gun can be fired at the rate of 1200 shots per minute, and at all degrees of elevation and depression. Of course it will be understood that this rate cannot be kept up long, since the heat evolved by the discharge of 1200 cartridges is so enormous that the gun cannot stand it; the barrels heat, and the parts of the breech mechanism become jammed and clogged. Still, this gun has passed through the severest tests known on the experimental ground,



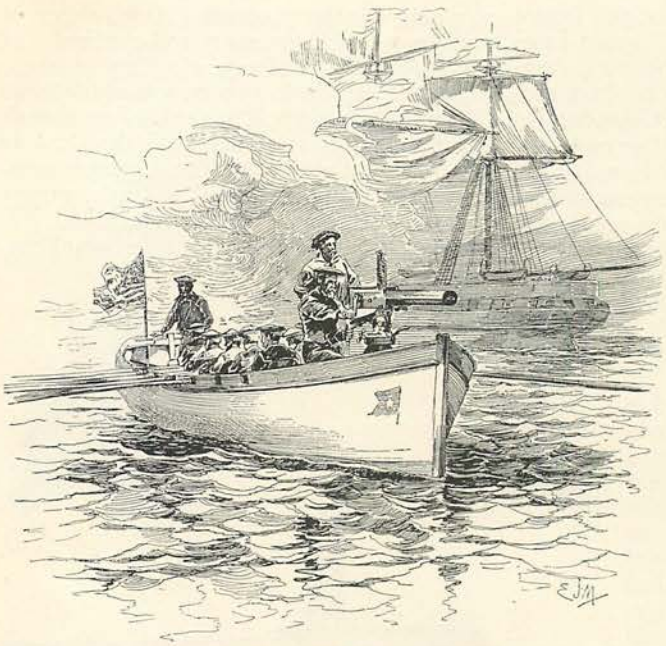
LATEST MODEL OF GATLING FIELD GUN.

has been fired at angles of elevation from 0 to 89 degrees, has been turned upside down and fired continuously in that position, showing that its feed was positive. The drum contains 102 cartridges, and the gun has a number of times emptied the drum in 2½ seconds, and eight drums in 41.4 seconds. At one trial 63,600 cartridges were fired without stopping to wipe out or clean the barrels, and the working of the gun proved satisfactory. The gun is made in different sizes, from .42 caliber up to 1 inch. This latter size makes it practically equal to a field-piece, and indeed its range, upwards of 3000 yards, is nearly as great. The gun has a lateral motion from side to side, so that as the crank is turned it sweeps, with its fire, a wide zone. The illustrations show the different styles of gun for different purposes. The practical value of an invention is determined by the results attained in actual service, and under this test the Gatling has shown even greater superiority than on the experimental ground. During the Russo-Turkish war, the war of Chili and Peru, England's fights with Zulus, with Ashantees, in Egypt, wherever the Gatling was used, it did its work well, and rained upon the foe a hail of bullets so deadly that he was absolutely paralyzed. In the Zulu war it is stated that in one place, within a radius of 500 yards, 473 dead Zulus lay in groups of from 14 to 30, mowed down by the fire of one Gatling. The annals of war do not present any greater slaughter than that. It is claimed that the Gatling can fire for short spaces of time more shots than any other machine gun, and at greater degrees of elevation and depression. When mounted on a tripod it can traverse an entire circle, thereby covering any point desired. In naval service the smaller calibers can be mounted on tops, and thus cover the decks of an enemy's vessel, while the larger sizes are especially valuable against torpedo boats. In common with other machine guns, it requires but few men and horses to manipulate it or to transport it. For the clearing of mobs in streets, for the protection of buildings containing treasure, for use in revolts in penitentiaries, it is a terrible weapon of defense and destruction. Its adaptations for the purposes of flank defense; protecting roads, defiles, and bridges; covering crossings of streams; increasing infantry fire at critical moments; repulsing cavalry; covering the retreat of a column; and its intensity and continuity of fire—all render it of surpassing importance.

Another machine gun, now world-famous, and of a different type from the Gatling, though the invention of an American, is the Gardner gun. If the Gatling can fire a greater number of shots per minute and at greater ranges than any other gun, on the other hand it is claimed for the Gardner that for simplicity, durability, lightness, ease of operation, and accuracy it has no equal. It is made in all calibers from .45 inch up to 1 inch. It consists of two simple breech-loading rifle-barrels placed parallel to each other 1.4 inches apart, both inclosed in a case. These two barrels are loaded and fired and relieved of shells by a mechanism at the breech which is operated, as in the Gatling, by a hand-crank. One man inserts the heads of the cartridges projecting from a feed-case into the feed-guide; another man turns the crank by which the gun is fired, and as the cartridges disappear down the feed-guide their places are supplied from another case. The operations of inserting the cartridge,



TWO-BARRELED GARDNER GUN ON TRIPOD.



GARDNER GUN IN THE BOW OF A LAUNCH.

drawing back the hammer, releasing it, and extracting the empty shell all go on automatically within the casing around the breech, and alternately on each barrel. The weight of the two-barreled gun is about 110 pounds. It is easily carried on the backs of pack-animals, or in small boats, as shown in the illustrations. The rate of fire of this gun is barely 500 shots a minute, but this rate can be kept up continuously, and 10,000 rounds have been fired without intermission or mishap. The gun has been fired successfully and practically adopted in Italy, Denmark, Mexico, the United States, and England. In the war of the latter with Burmah a four-gun Gardner battery did great service, as will be seen by the following extracts taken from the report of Captain Lloyd, R. A., commanding a battery of four Gardner guns in that campaign:

> . . . Having thus satisfied ourselves that we had a good weapon in our hands, we set to work to equip a battery of four guns. . . . The favorite tactics of the dakoits is to lay in ambush in dense jungle, where they are at home and comparatively safe; they then fire a volley into our unsuspecting troops and depart. When the dakoits oppose our advance by clinging to the jungle in front, their position, never extensive, would be quickly searched out by our machine guns. Again, their value would be appreciated in storming stockades, some of which are bullet-proof, and some are not. In the latter case the guns, having a range of two thousand yards, would keep up a stream of bullets out of the enemy's reach. . . . In like manner they would be utilized in the attack on dakoit villages. . . . Moreover, the power of these guns for counter-attack as well as for passive defense cannot fail to be recognized.

The aim of Mr. Gardner, the inventor, was not to make a powerful gun, but rather to establish a minimum of weight and space, and within that limit to achieve the greatest possible rapidity of fire. As compared with the Gatling, the Gardner has not so rapid a rate of fire; but the breeches being incased in water-jackets, the firing at its maximum rate can be kept up longer. The gun is easier of transport, and moreover is, after some firing, much steadier and more accurate. The feed-case of the Gatling having a powerful spring to press the cartridges into the hopper, and this spring being operated by the turning of the crank, it follows that much more strength is required of the man who turns the crank in the Gatling than in the Gardner. A very interesting bit of history to Americans is the present given by General Grant to the Viceroy of China and the Mikado of Japan. Desiring to give these dignitaries a present which would show to some extent his appreciation of the courtesies extended to him when in China and Japan,

GARDNER GUN IN TRANSPORT.

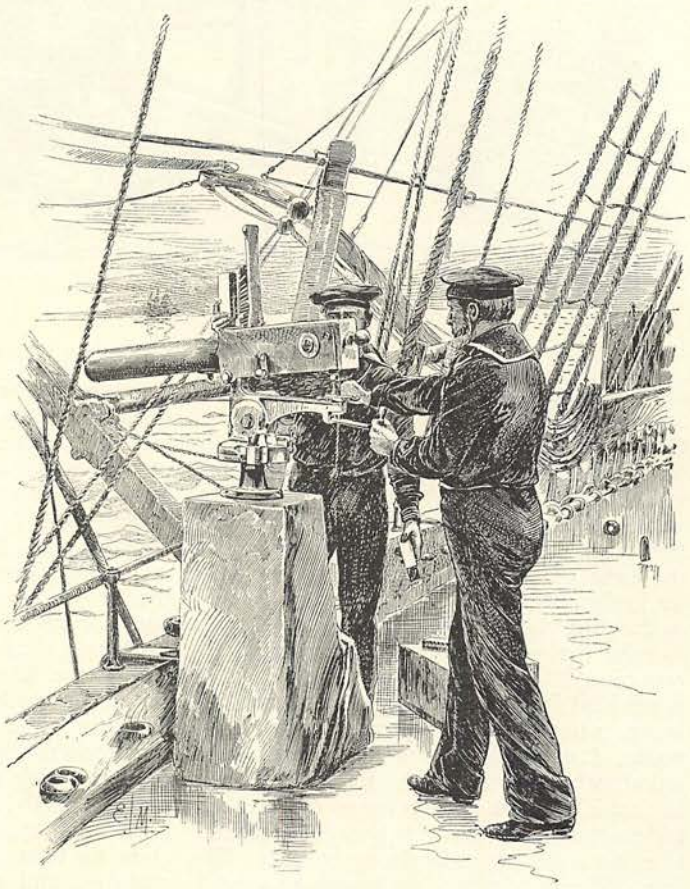
he ordered two Gardner guns of special design to be made. On the breech of the barrel-chamber of one of the guns is the engraved inscription:

TO HIS EXCELLENCY
VICEROY LI HUNG CHANG,
FROM
U. S. GRANT.

The other gun is similarly inscribed to the Mikado of Japan. While the regular models were followed, yet special attention was given to nicety of finish of every part. The carriages and mounts of the guns are made entirely of bronze and steel. The wheels are finished in wood, the felloes of oak, and the spokes of hickory. The limber-chests, each with a capacity of 7200 rounds, are of oak and highly polished. It is understood that these guns occupy positions of honor and ornament in the palaces of their respective owners.

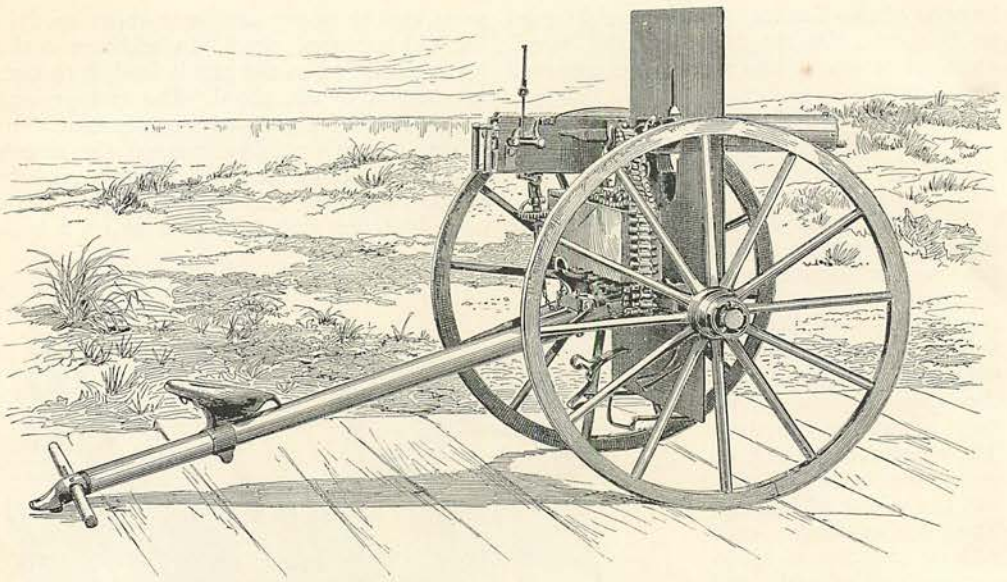
But great as is our admiration for the Gardner and Gatling guns, it must give way before the astonishment and wonder excited by another American invention but very recently perfected. It is the Maxim automatic machine gun, invented in 1883, but only within a year past brought to a state of wonderful and ingenious perfection. It is with a feeling almost akin to shame that we state that this gun is made in England, although the inventor is American. It is, as its name indicates, an automatic machine gun, and only requires the pressure of the finger on the trigger to explode the first cartridge, and the gun, then left alone, will load and fire itself as long as cartridges are fed to it. The gun proper consists of an ordinary gun-barrel, two-thirds of which are surrounded by a casing of metal in which water is automatically injected by each discharge of the barrel. By means of this casing, or water-jacket, it is impossible to overheat the gun by firing.

The remaining third is surrounded by a steel case of rectangular shape, inside of which is the mechanism for operating the gun. This mechanism consists of a main-spring, tumbler, sears, and firing-pin, similar to those used in the old-fashioned pistol. In addition is the lever, which, when the gun is fired, is thrown into action by the recoil. The arrangement is at once set in motion—the empty shell withdrawn, a new cartridge inserted, the breech closed, a cartridge fired, and a certain quantity of water admitted into the water-jacket. The cartridges are placed in pockets on a belt.



GARDNER GUN ON DECK.

Each belt contains 333 of these pockets, and two or more belts may be joined together. The end of the belt is introduced in the breech-casing, and the finger pressed on the trigger to fire the first cartridge, after which the gun may be left alone, and the automatic action, set in motion by the recoil, fires the rest. As the recoil is but three-quarters of an inch, some idea may be had of the wonderful ingenuity of the gun by considering that it will fire the 666 cartridges of the double belt in a little over a minute, or at the rate of ten a second; in other words, it requires but one-tenth of a second to load the gun, fire a cartridge, throw out the empty shell, and put in a full one. Again, the recoil of the gun



MAXIM FIELD GUN WITH BULLET-PROOF SHIELD.

does another work. Over the casing is a small tank of water, and at each discharge of the gun a small quantity of cool water is injected from the cistern into the water-jacket, and after the heat of the gun has risen sufficiently, the water escapes in the form of steam from two little apertures at the front end of the jacket. The cartridge contains from 70 to 90 grains of powder, and the heat evolved in the discharge of one cartridge is sufficient to raise the temperature of the water at the rate of 1½° Fahrenheit per pound. And as much heat is required to melt four pounds of iron as is necessary to evaporate five pounds of water. It can be seen from this what an effectual absorbent of heat is the water-jacket, and in fact it requires the discharge of 1000 cartridges before the water is heated sufficiently to cause steam to make its appearance. The rate of fire is regulated by means of a quadrant graduated from 200 up to 700, so that by putting the hand on this the gun not only can swing from side to side, and thus traverse with its fire a wide arc, but also can throw out such fire as is wished. The field-piece is 3 feet high, 4 feet 9 inches long from muzzle to rear of breech, and weighs but 50 pounds, and its carriage about 100 pounds. The maximum rate of firing is about 600 shots per minute, but it has fired continuously 5000 shots, and so accurately that it is said its inventor, by putting his hand on the traversing lever, has written his name on a target board 400 yards from the muzzle, *in the dark*. Comparing this gun with other machine guns, its advantages become at once apparent. Indeed, it can hardly be compared with other guns, since the field it opens is entirely new, and of broader range than others. In machine guns the causes that render guns unserviceable are as follows: First, cartridges may and often do hang fire, due to age, or perhaps to dampness in the atmosphere at the time of firing, or to deterioration due to climate, etc. It follows, therefore, that the crank being turned by a skillful man very fast, the breech is unlocked, and the cartridge partly or wholly withdrawn while in the act of exploding, thus driving the forward end of the empty case into the chamber, and rendering the gun useless for the time being. Secondly, it has been found impossible to fire many more than 1000 rounds in rapid succession, because of the heating of barrels and expansion of parts. Thirdly, when the cartridges are fed by *gravity* they are dependent on their own weight alone for falling into the proper position in the chamber, and therefore a skillful man may work the crank so rapidly that it becomes impossible for the cartridge to attain its proper position when fed by gravity alone, and it is crushed in the act of falling. If the cartridges are not fed by gravity but by positive feed, such as a special spring, the spring also has to be worked by the man at the crank, requiring an outlay of strength that soon renders him useless, and which jars the gun and injures its accuracy. Fourthly, the machine guns are all dependent upon a single spring extractor for throwing out the empty cartridge-case, and in rapid firing the chamber becomes clogged, the case adheres so strongly to the walls that the extractor is unable to work, and sometimes breaks.

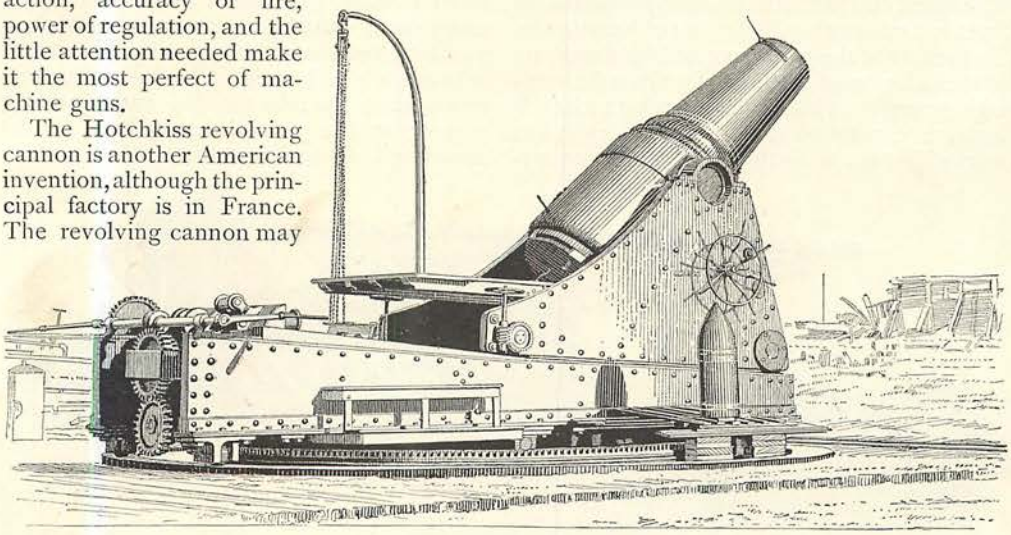
As compared with the foregoing faults of

other guns, the Maxim stands as follows: First, since there is but one barrel, but *one cartridge* can enter at a time; and if it is bad or unserviceable it will not explode, and the gun, without recoil, stops at once, and the cartridge must be ejected before a fresh one can be inserted. The cartridge is in no danger of being prematurely exploded by hot parts, since overheating *is rendered impossible* by the water-jacket, and therefore the fire can be practically continuous. Again, the cartridges being *drawn in one by one*, automatically, the objections open to the positive and gravity feeds are obviated, and the empty shell is thrown out, since a grooved slide, moving in a transverse direction, seizes it by the head and moves it bodily. The cartridge shell cannot fasten to the walls of the chamber, because this grooved slide is an independent piece. There is also another advantage that the Maxim possesses over other machine guns. It can readily be seen that any gun having two or more barrels, in order to shoot accurately, must have both barrels absolutely parallel to the vertical plane passing through the line of sight, and when there are more than two barrels they must also be parallel to each other. An error of the smallest fraction of an inch, in the direction of the line of fire, will, at a distance of one hundred yards, amount to several feet. If a gun has errors of this sort, then is there accounted for one of the principal causes of inaccuracy of fire; and rough usage, heating, etc. only render this trouble greater. But no such mechanical difficulty exists with the Maxim, since there is but one barrel. It is simple in its mechanism, is easily taken apart, oiled and cleaned, and put together again; while its automatic action, accuracy of fire, power of regulation, and the little attention needed make it the most perfect of machine guns.

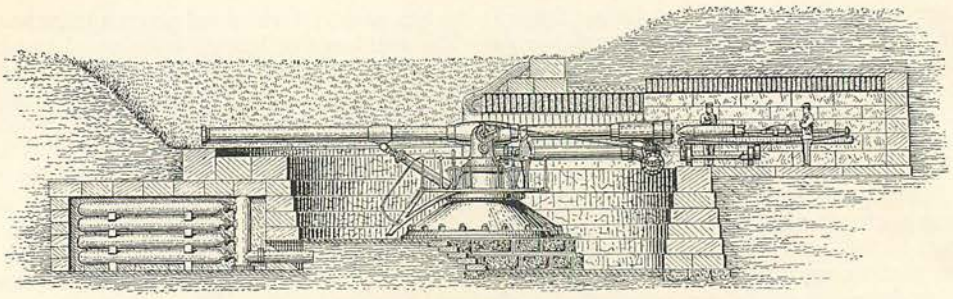
The Hotchkiss revolving cannon is another American invention, although the principal factory is in France. The revolving cannon may be best said to be the revolver on a large scale. The gun has five barrels and five chambers, which, as they are slowly revolved, are fired in succession, and can be quickly reloaded by hand. A rate of twenty shots per minute is easily obtainable with the 6-pounder gun; but as these are cannon, the heat evolved by expenditure of so much powder is immense, and therefore makes it practically impossible to fire but a few shots at this rapid rate. The gun is made so as to throw shells from 1 pound up to 32 pounds in weight.

Although a great deal has been said about the failure of Americans to turn out heavy guns equal to those of same caliber made abroad, yet the 8-inch rifles in the navy, and the new 12-inch rifled mortar or howitzer made by the United States Army Ordnance Department, certainly are the superiors of guns of their caliber the world over. This latter gun, of which we present a picture, has a caliber of 12 inches, is rifled, and fires a 630-pound shell with 35 pounds of powder. It has been fired at angles of from 30° to 75° elevation, and at 60° gave a range of 5½ miles. Moreover, this range is accurate; that is, if a space the size of a vessel of war be marked off, five out of every seven shots would fall either on the decks or near enough seriously to injure her at this range.

Lastly, we turn to the torpedo weapon that has excited so much wonder and interest not only at home but abroad. We mean the dynamite gun. As is well known, many attempts in years past have been made to throw shells charged with dynamite from guns fired with gunpowder; but, due to the terrific shock of discharge, the shells generally burst in the guns, and were more dangerous to those firing than to those fired at. Mr. Mefford of Ohio, in



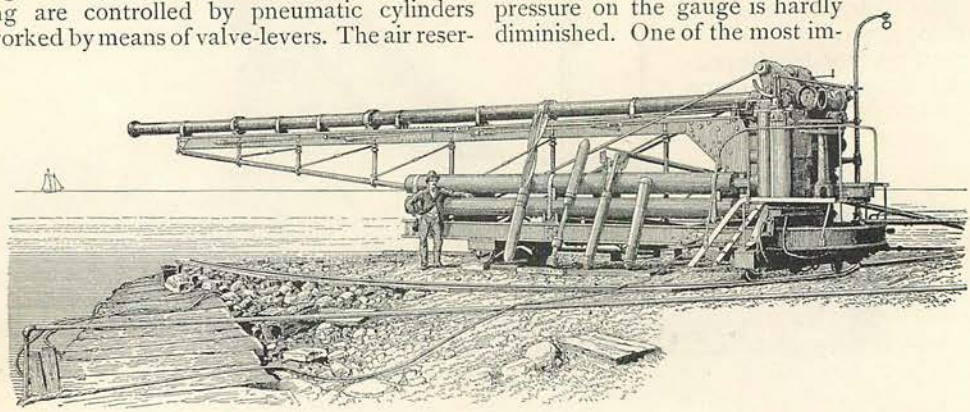
UNITED STATES 12-INCH RIFLED BREECH-LOADING MORTAR, OR HOWITZER.



PNEUMATIC DYNAMITE SEA-COAST GUN.

1883, devised his first pneumatic gun, in which he used compressed air as the propelling power. The use of compressed air is of great advantage, the pressure being low, and diminishing so slowly as to be, for practical purposes, constant; and by automatic arrangements it can be cut off as the projectile leaves the bore, so that there is no waste. Again, the pressure is kept entirely under control by means of valves, and a constant muzzle velocity is obtained. Also, instead of heating the gun, the use of compressed air actually cools it. The gun first made was 2 inches in diameter; this was followed by one 4 inches in diameter, and then by the one represented in the illustration — 8 inches in diameter. The experiments have been conducted under the supervision of Captain C. L. Zalinski, 5th United States Artillery, and they attained a degree of perfection that astonished the world. The gun may be briefly described as follows: The barrel consists of four lengths of wrought-iron tubing ⅝ of an inch thick and lined with ⅛-inch seamless brass tubing. This barrel is supported on an iron truss, which in turn rests on a carriage which is supported by two hollow cast-iron pillars. The pillars rest on a platform, which is pivoted at the front in a manner similar to that of heavy guns. To the rear of the gun, protected by a wall, are placed a boiler-engine and air pumps for keeping the reservoirs full. The traversing and leveling are controlled by pneumatic cylinders worked by means of valve-levers. The air reservoir consists of eight wrought-iron tubes 12½ inches diameter, and with a total capacity of 137 cubic feet. They are arranged in two tiers on each side of the platform. On the gun are two sights resting in *V's* on the left trunnion, and on the same side is the firing-lever, so that the same person can aim and fire the gun. A pressure-gauge, showing the air pressure at any time, is also in such a position that the person firing can see it, and thus, by changing the air pressure, can correct any shot desired. The projectile has a brass body 3 feet 4 inches long, and a conical point of wrought iron 12 inches long, and a tail made of pine wood. This is inserted in the breech, which is opened and closed by a flat disk opening inwards, and sealed by a felt wad.

The gun, on account of the uniformity of pressure of air on the projectile, can be fired with great accuracy up to two thousand yards, and, as has been demonstrated time and time again, with perfect safety. The shells are charged with from fifty to sixty pounds of gelatine or gelatinous dynamite, and in experiments made September 20, 1887, proved that within given ranges the shell was perfectly under control. So perfect are the automatic arrangements, that to fire any number of shots within a given time the reservoir does not have to be entirely recharged. The instant the projectile leaves the tube the air is cut off, and the pressure on the gauge is hardly diminished. One of the most im-

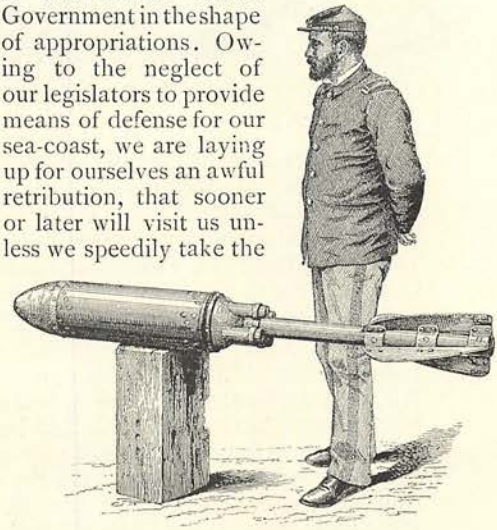


8-INCH DYNAMITE GUN.

portant features of the shell is the electric fuse — the invention of Captain Zalinski. In each shell there are two batteries — one a wet one, kept charged, and the other a dry one, which is put in action by moisture. These two are on one circuit, arranged in series, part of which is composed of fine platinum wire surrounded by gunpowder, and the end of which is in a capsule, while the other end is surrounded by fulminate of mercury, which, when detonated, explodes a small tube of dynamite, and this then explodes the main charge. The wet battery explodes the shell on impact either direct or oblique. The dry battery is arranged so that the circuit is closed by being moistened, as on striking the water, which rushes through holes in the head of the projectile, which are covered with thin metal flaps.

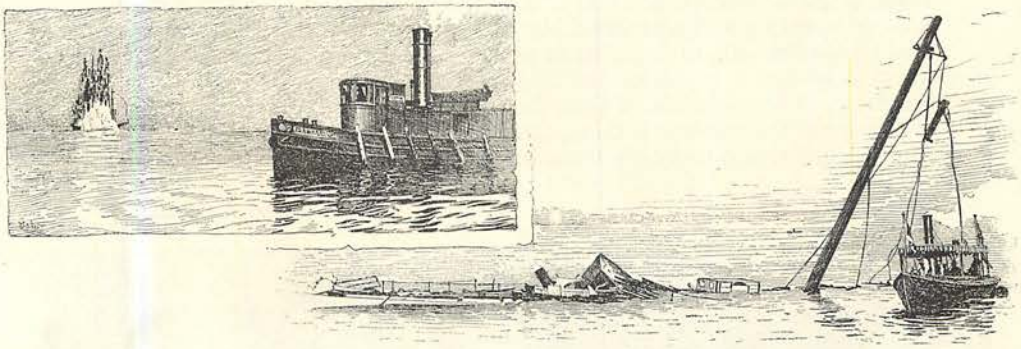
So perfect are the arrangements of this fuse that the shell can be exploded by the slightest contact with water, or at any depth. The gun as designated is a torpedo gun. It has not, and probably never can have, the range that powder guns have — certainly not without destroying its qualities as to accuracy; but as a torpedo, it is superior to all others. It has greater speed, costs less, is far more accurate and sure, and has a field of action above as well as below water. Arrangements are made now to mount three guns of 15-inch caliber on a special gun-boat just constructed for this purpose, and it is safe to say that this vessel is in itself capable of entering any channel and harbor in the world and clearing it of torpedoes. A few of the huge charges of dynamite detonated on the bottom would explode every torpedo, either singly or in groups, placed there, and charged with high explosives.

So terrific is the force of detonation that a charge of 200 pounds of dynamite dropped on the deck of a vessel, or exploded in the air above it, would probably kill or render *hors de combat* every human being in that vessel, by concussion and shock alone. Of all American inventions, the dynamite gun is the only one that has had the practical encouragement of the United States Government in the shape of appropriations. Owing to the neglect of our legislators to provide means of defense for our sea-coast, we are laying up for ourselves an awful retribution, that sooner or later will visit us unless we speedily take the means to correct the evil; and through our national egotism and belief in our military genius we are losing track of the very means that help the inventive powers of our countrymen to devise wondrous weapons of offense and defense. "In peace prepare for war" should be hung up in great black letters on the walls of the council chambers of our national legislators, to warn them that the same fate has overtaken every nation that has neglected its opportunities, and that the people will not hold them guiltless when the invitations and premiums to attack us we are offering to other nations shall finally be accepted.



8-INCH SHELL.

William R. Hamilton.



WRECK OF THE UNITED STATES COAST SURVEY SCHOONER "SILLIMAN" BY A 55-POUND SHELL FROM THE PNEUMATIC DYNAMITE GUN, SEPTEMBER 20, 1887.