RIFLES AND RIFLE SHOOTING.—VII.

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In the Chassepot of the French service and the needle-gun of the Prussians a "consuming" cartridge was used, and as the whole strain of the explosion was borne by the breech-action there was in consequence a great escape of gas at the breech joint. With the metallic cartridge the force of the explosion is sustained by the case and there is no escape of gas, and therefore no loss of propelling power. In 1864 the British Government, instructed by the Dano-German war, decided to arm the army with a breech-loading rifle; and, after testing fifty different systems for converting the Enfield (muzzle-loading) rifle then in the hands of the troops, that submitted by Mr. Snider was adopted, though the principle was nearly the same as the breech-loader before referred to as made in the time of Henry VIII. The rifles so converted were submitted to many severe tests and passed successfully through them all; but it was not until Col. Boxer, of the Royal Laboratory, elaborated the cartridge now in use and so generally know that the converted arm was pronounced to be really a success. As to its durability, that was proved at Woolwich, where 30,000 rounds have been fired from a single rifle without affecting its efficiency.

An advantage the breech-loader possesses over the muzzle-loader is that in actual use it cannot be overloaded. After the battle of Gettysburg, 27,574 guns were picked up on the field, 24,000 of which were loaded, One-half of this number contained two loads, 3,000 had three loads, and the remainder contained over ten loads apiece. Many were found having two to six bullets over one charge; in others the powder was placed above the ball; one gun had six cartridges with the paper untorn; in one Springfield rifle twenty-three separate charges were found, while one smooth-bore musket contained twenty-two bullets and sixty buckshot rammed in promiscuously. From this it may be seen what an immense amount of effective force was rendered useless, and that, too, in the heat of battle when every available means was being exercised to obtain victory.

In the early days of breech-loaders they were objected to on the grounds that being easily loaded and as easily discharged, the soldier would fire away his ammunition hastily and without effect, and perhaps find himself helpless at a time when he most required to act in defence or attack. Actual experience has, however, proved the fallacy of this objection. Very rapid firing in actual warfare is not at all desirable, for ten well directed shots per minute are more effective than thirty fired wildly, but the rifle that can be fired the greatest number of rounds per minute must certainly be the easiest to load, and all things else being equal, the best to place in the hands of troops. For quick or rapid firing magazine rifles have been introduced, and up to the extent of the number of cartridges each is capable of containing is their rapidity of fire. But they all are constructed to fire single shots when loaded in the ordinary, leaving the supply in the magazine available for an emergency. When the history of the unfortunate rebellion now in progress in the North-west is written then it will be known what service the Winchester repeaters rendered.

Successful as the Snider has been, and, up to a certain point, powerful as it is, it has been superseded by the Martini-Henry, and this last is now in the hands of the regular army, the militia and the volunter force of Great Britain. Owing to its flatter trajectory and increased spirality it has proved to be superior at all ranges beyond 500 yards, up to which distance only the Snider can be relied on for accuracy. But even the Martini-Henry does not give a full measure of satisfaction, as its shooting beyond 900 yards is not certain, and the British Government has been experimenting with a rifle to supersede it. This rifle is only ·40-inch diameter of bore, and about the same length and dimensions of the Martini-Henry, but with a thicker barrel, the extra weight of which is compensated by a lighter fore-end stock. The powder charge is 85 grains and the ball 400 grains in a tapered shell. Its trajectory is much flatter at all ranges than that of the Martini-Henry, its muzzle velocity being about 1600 ft. per second, as compared with 1355 ft. The rifling is poly-groove of the "rachet" pattern, one turn in fifteen inches. It is provided with auxilliary sights up to 3,000 yards, the ordinary ones being up to 1,000 yards. The barrel where grasped by the left hand when being fired is covered with wood to prevent burning the hand when the barrel becomes heated during rapid or even ordinary firing on a hot day.

Having thus far traced in a very condensed manner the instrument from which the smaller kind of projectiles are propelled, it now follows as a matter of course that attention should be paid to the means employed for producing propulsion, and also as regards the projectile used.

With the first discharge of gun-powder in battle, the doom of the feudal system then in force went forth and, paradoxical as it may seem, the mission of the fire-arm was the mission of civilization. Prior to its use, the whole of Europe was held in a state of bondage, and the Knights and Barons, and Lords of the land ruled their Serfs and Vassals with strong and powerful hands. Living, as they did, in their castles or strongholds; surrounded by bands of armour-clad retainers, and with the power of life and death as their right, each noble was an independent ruler, and knew no law save that of his own power and might; but with the advent of gun-powder, guns and cannon became powerful weapons available in the hands of Serfs and Vassels, against which the armour of the Knight and the stronghold of the Baron, offered but slight resistance. The wonderful force developed by gun-powder, gave to the people the power of contending successfully against the nobles, and by degrees they arose to liberty, and suppressed the tyranny of the petty lords who had for so long a time held them in subjection.

There does not appear to be any certainty at what time, or by whom, gun-powder was invented; but it appears to have been known in India and China far beyond all periods of investigation, and there are many ancient words of these peoples signifying weapons of fire, heaven's thunder, devouring fire, ball containing terrestrial fire, and such like expressions. Its introduction into Europe took place early in the Christian era, some believing that it was brought by the Moors into Spain, and others that it came through the Greeks at Constantinople. Both of the suppositions may be correct, for it is certain that it, or a substance analogous thereto, was used at the siege of Constantinople in A.D. 668. The Arabs, or Saracens, are said to have used it in A.D. 690, at the siege of Mecca; and there are those who affirm that Mahomet was acquainted with its use. In 846, Marcus Grecœcus, in his MS. entitled *Liber iynium*, describes gun-powder as composed of six parts of saltpetre and two parts each of charcoal and sulphur. This MS. is still in the Royal Library in Paris, and proportions stated in the receipt thus quoted, are nearly akin to those now employed for mixing the ingredients of gun-powder. There is in the Escurial collection of Spain, a treatise upon gunpowder, written in 1249, and it is probably from this work, or the writings of Marcus Grecœcus, that Roger Bacon (who is credited with being the inventor) may have obtained his knowledge of gun-powder—as he had visited Spain, and wrote an account of his travels in 1267. Berthord Swartz, a monk of Fribourg, in Germany, studied the writings of Bacon, and manufactured gun-powder whilst experimenting, and the honor is due to him for making known its recondite properties, and its adoption in central Europe about 1320, quickly followed his announcement. The earliest records show that it was not until 1346 that gun-powder was manufactured in England, for in that year Edward III. ordered all saltpetre and sulphur on sale to be bought for him. In 1377 Richard II. ordered the purchase of sulphur, charcoal, and saltpetre; and in 1414 Henry V. forbade the exportation of gun-powder without special license, but it was not until the reign of Elizabeth that its manufacture can be said to have been established in England.

The objects to be attained in the production of an explosive agent for artillery and small arms, are—1, the maximum of propelling force; 2, the minimum of initial pressure in the bore of the gun; 3, uniformity of action; 4, freedom from fouling—especially in small-arm powder; and 5, durability: *i.e.* power to bear transport and keep well in store; and of all explosive substances at present known, gun-powder alone can be said to fulfil the first three conditions. Its advantages may be summed up as follows:—(a) The rate of combustion of gun-powder is gradual compared with that of most other explosives; and by adjusting the proportions of the ingredients, and varying the mechanical processes of its manufacture, its explosiveness can be modified to suit every description of weapon; (b) the ingredients are comparatively cheap, and can be easily procured; and (c) with proper precautions it is safe in manufacture, in store, and in transport, and keeps well in a moderately dry atmosphere.

Gun-powder is made of saltpetre, charcoal and sulphur; and that manufactured for the British service is composed of 75 parts of saltpetre, 15 of charcoal, and 10 of sulphur, and these proportions may be said to have been adopted by other countries. Wherever cheapness is the object in view, the quantity of saltpetre is lessened, and the other two components increased, and though this reduction is made to produce a cheaper and inferior article, yet such powder is the most effective for the removal of large masses of earth or soft rock, as from its slow-burning quality, the local effect is more destructive.

Saltpetre, or nitrate of potash, occurs as a natural production on, or near, the surface of the earth in several warm climates—especially the plains of India and China—sometimes as an efflorescence, and sometimes disseminated through the upper stratum of the soil. Large quantities are artificially formed in many countries of Europe, by imitating the conditions under which it is naturally produced. Before being fit for use, the natural product has to be thoroughly purified, and cleared of all extraneous matter—the salts of sodium especially, which are most injurious from their property of absorbing moisture. It is