

in Modern Artillery, "the centre of gravity of projectiles be very far forward it is possible to fire them from smooth-bores at short ranges," but this is the only case in which elongated projectiles could be fired without rotation. If rapid rotation be established upon the longer axis of the projectile, the velocity of rotation will prevent it from being turned over. Any one who has amused himself with a gyroscope, or even a child's top, will know that a spinning motion gives a stability to the axis of motion, which as long as the spin is strong enough, sets other disturbing forces at defiance. Thus, a top, or gyroscope, will spin on an angle with the horizon which it could not possibly maintain if it were not in motion. Indeed a top could not stand at all without being spun, and the wobbling movement which precedes its fall, indicates the point at which the force of gravity is beginning to re-assert its sway, and to overcome the falling rotation.

It is a fallacy to suppose that rifling a barrel produces greater range or velocity, its object being to correct the flight of the bullet. With a smooth-bore the bullet fitted loosely in the barrel; there was thus an excess of windage and consequently a loss of propelling power, and the bullet passed through the barrel with a series of rebounds from side to side, generally taking the direction, after leaving the muzzle, of the last rebound. With the elongated bullet the explosion of the charge forces the plug into the cavity in the rear (of a Snider ball), expands the sides into the grooves, constraining it to turn with their spirality, and so receiving a spinning or rotatory motion around its longer axis, which continues during the remainder of its flight. This not only prevents rotation in any other direction, but is in itself a rotation calculated to ensure accuracy in flight, by constantly presenting any imperfections of surface to the air in opposite directions. The Snider ball rotates about 200 times per second when leaving the muzzle, and that of the Martini-Henry, 700 times, and the stability of the latter is therefore greater than that of the first. Take two humming tops of the same size, spin one with a low rate of velocity, and the other five times as fast, and if both be struck a smart blow with a light rod, the slow one will stagger and not recover its equilibrium, whereas the fast one will soon resume its perpendicular, and "go to sleep," as the little boys say.

As the base of a projectile leaves the muzzle the gases behind which impelled it up the barrel are necessarily capable of traveling at a greater rate of speed than the bullet, and they consequently rush past it, and if its stability (gyroscopic action) is not very great, it receives a slight deflection to whichever side may offer the greatest resistance to the impact of the gases. That this is really the case has been proved by firing at paper targets at 200 yards, the holes being made oval and not round, thus showing that the balls had passed partially sideways instead of point on.

Mention has been made of the grooves (cannelures) around the cylindrical part of the Snider bullet. These do not offer any resistance to the air when the point is in the direction of translation; but as soon as the point droops and leaves this direction, the resistance of the air, which acts in an opposite direction operates against the edges of these grooves on the upper or lower part as the case may be, and the resistance being unequal, and the tail of the bullet is thus raised or depressed until it resumes its primitive direction, just where the resistance is equal on both sides. In fact it is owing to these cannelures that the axis of rotation is kept more steadily in the direction of the trajectory, the grooves being to a bullet what the feathers are to an arrow, or a stick to a rocket.

(To be continued.)

Sergeant Walter Bulmer, of the 2nd Volunteer Battalion, Lincolnshire Regiment, the winner of the Queen's Prize, on his arrival at Spalding, Lincolnshire, from London, on Monday afternoon, was welcomed and fêted in a royal fashion. He was met at the station by a full muster of his company, numbering about 100, in full dress, and the band of the battalion, and was accorded a magnificent public reception. There were large contingents of volunteers from other corps in the district; and the railway station and streets presented an animated scene, the like of which Spalding has never previously witnessed. On alighting from the train he was warmly congratulated by the Captain and Lieutenants of the corps, and loudly cheered by the spectators, and preceded by the band playing "See the conquering hero comes," was conveyed through the town in a four-in-hand carriage. After parading the town, he was conveyed home in the same way, and having stayed there for a short time was taken to the Corn Exchange, where a sumptuous dinner was given in honour of the event. A promenade concert was held in the evening in the gardens of Mr. T. M. S. Johnson, which were brilliantly illuminated by Japanese lanterns. A large triumphal arch was erected over the station gates, on which were the words, "Bravo, Bulmer," and several were fixed across the streets near the Market-place. Bunting was also displayed by nearly all the tradesmen in the town, and flags hoisted at every available spot, especially along the road on which the Queen's Prizeman for the year resides. During the day peals were rung in the various church steeples. As Bulmer is of a modest and retiring disposition it was rumored in the town that he intended coming home by an early train and alighting at a village station a few miles from Spalding, from which he would walk to his residence. In order to avoid this, however, the drill-instructor was dispatched to London, who kept in company of Bulmer until he arrived at his destination in safety.—*Volunteer Record*.

THE DUTIES OF FIELD ARTILLERY IN ACTION.

BY LIEUT.-COLONEL W. KEMMIS, R.A.

(Continued from Page 107.)

THE GUNNERS.

The details of the duty of each man of the gun detachment must necessarily vary with the particular description of ordnance in use, as determined by practice and experience; the aim of each and every gunner will, notwithstanding, be the same, namely, with unflinching steadiness and ready obedience to carry out all points of his duty and by intelligence, precision and quickness, render the service and effect of his gun as perfect as possible.

One number of the detachment must remain at the limber, charged with the care, preparation, issue, etc., of ammunition; this man should be particularly reliable, self-reliant and conversant with the details of the ammunition, both in itself and its packing, he should therefore to a certain extent be selected for the post and should not be changed from it unless absolutely necessary.¹

The duty of the spare gunners with the wagons will be simply to follow the instructions of the N.-C. officer in charge, holding themselves at all times ready for work or for movement; if any are told off and posted as vedettes it will be their business to keep themselves on the alert, signalling and reporting accurately.

THE DRIVERS.

The duty of drivers in action, and we may include with them horse-holders, is to follow implicitly the orders which they receive from their N.-C. officers, keeping themselves and their horses steady and ever ready for any possible movement; they should carefully look round the horses, harness, etc., whenever they have an opportunity, caring for and easing the former in every way open to them, and reporting anything amiss.

In the event of any casualty happening in the team, it is the driver's duty to sit steady, maintaining his horses as quiet as possible, until he is directed to act in any particular manner by the N.-C. officer in charge.

THE TRUMPETERS.²

The first trumpeter—supposing that there are two to the battery—has simply to attend the battery commander³ and to obey exactly his directions.

The second trumpeter remaining with the wagons should follow the directions of the officer or staff N.-C. officer in charge of them.

THE RANGE-TAKERS.⁴

As already mentioned, preparatory to the battery coming into position for action,⁵ the range-takers take such ranges as the commander directs and inform him of the results without delay; having done so they should ascertain what further ranges he is likely to require and measure them together with the distances to all notable points, the knowledge of which might prove of assistance in firing at moving bodies: all these should be written down⁶ for the commander.

THE ARTIFICERS.

In action with either the limber or wagons there is not much scope for the exercise of the special powers of a farrier; a properly qualified shoeing-smith can do anything that is likely to be needed, while it is undesirable to bring a highly trained man, who cannot easily be replaced, under fire, without commensurate gain. The proper place for the farrier will therefore be in the second line with the forge wagon; this carriage⁷ he should have charge of and, when he is so ordered, establish it for the purpose of doing such work as may be required.

¹The so-called "limber gunner" is the proper man for this duty, instead of being, as in our service, a number at the gun (No. 4-9 or 16 pr.) because having the care of the carriage (under the N.-C. officer in charge) he knows better than anyone where exactly to put his hand upon any article required, and is usually a man picked out for his good qualities; in the same manner the second limber gunner should not be at the gun (No. 5-9 or 16 pr.) but with the wagon, to take the principal part in the removal of ammunition from, and repacking ammunition in it, and also to replace the man at the gun-limber when required.

²It seems to us a great mistake, and but poor economy, to have boys as trumpeters.

³Except when he leaves the main body of the battery to select the position, etc.

⁴The importance of accurate range taking cannot be over-estimated—surely then the "range-taker" and his "assistant" in a battery should stand distinct from the N.-C. officers and gunners, and be, not only specially selected and trained, but specially paid and horses particularly allowed for them. By "Army Circular," Dec. 1st, 1882, provision is made for prizes for proficiency in signalling, and for extra duty pay to the N.-C. officer appointed to impart instruction therein for garrison artillery, infantry and cavalry. Why should not the same be applied to range-takers of field artillery?

⁵Or, it may be, as the battery comes into action.

⁶For this purpose, they should be supplied with convenient means, as, for example, cards printed with lines radiating from a centre—when, the latter representing their position, the former would indicate directions of the objects, which objects and the distances, respectively, to them they should write on the lines.

⁷Under the N.-C. officer in charge of the whole—the pay sergeant we before suggested.