

required that the ball shall expand, or be upset to fill the grooves, for with such rapid ignition takes place, causing a sudden expansion of the bullet, while the continued combustion maintains an increasing degree of heat, which in turn augments the force of the gases evolved up to the time the projectile leaves the muzzle. When a charge of gunpowder is burnt in a confined space a large quantity of gas is generated in a highly condensed state, and its power of expansion is moreover greatly increased by the heat evolved; and this gas exerts a pressure in the interior of the vessel equal in all directions. Thus, it is stated, the products of combustion are 57 per cent. by weight of ultimately solid matter, and 43 per cent. of permanent gases, which last at the ordinary pressure and temperature, occupy about 280 times the volume of the original powder. The tension of the products of combustion where the powder entirely fills the space in which it is fired is about 6,400 atmospheres, or 42 tons per square inch, and the temperature of explosion is about 4,000° Fahr. When fired in the bore of a gun the products of combustion, at all events as regards the proportions of solid and gaseous matters, are the same as in the case of powder fired in a close vessel, and the work on the projectile is effected by the elastic force due to the permanent gases.

The use of a slow-burning powder is most important for breech-loading arms, because, as the gas expands gradually, the metallic cartridge case and the breech chamber of the gun are less strained; and the bullet in passing from a state of rest to one of motion is not altered, and thus excessive friction is avoided. On the supposition that at the moment of ignition there is a pressure of 30,000 lbs. per square inch in the chamber of the gun, the pressure on the base of a Martini bullet is 4,771 lbs.

Besides gunpowder there are now very many explosives in use, principally in connection with railways, quarries, mines, &c., which are known by the high-sounding appellations of nitro-glycerine, gun-cotton, litho-fracteur, mataziette, dynamite, glonoin, tonite, cotton-powder, dualine, glyoxiline, saxafragine, blasting gelatine, &c., the whole of which are the product of one substance, that is, they are all nitro-compounds. Some are liquid, some pure, some mixed, but they all spring from the same basis—nitric acid. Gun-cotton is obtained by steeping cotton in strong nitric acid, or a solution of nitric and sulphuric acids. It is then washed to cleanse it from acid or other impurities, and may be stored in that form or mixed with other ingredients. Cotton-powder is merely gun-cotton reduced to a powder, and tonite is the same body mixed with a nitrate or similar chemical body. Gun-cotton cannot by any process yet known be deprived of its explosive qualities without destroying the compound by fire. For submarine and war purposes gun-cotton is stored in a wet or damp state, and may be used and its full strength employed when in this condition, its explosion being effected by the discharge of a small quantity of dry gun-cotton, called a "primer," by percussion, in immediate contact with the wet cotton. The use of gun-cotton has not proved to be successful in the case of firearms or cannon, this want of success being due to its sudden explosion, as no gun could long resist the shocks given to it, or if it could, sufficient time would not be given to overcome the inertia of a heavy projectile, and the bulk of the force obtained would be wasted in imparting vibration to the particles of metal of the gun, and in "setting up" or breaking the projectile. This sudden development of force has led to the use of gun-cotton where shattering is the principal object in view, and it is therefore used in torpedoes, mining, breaching, &c. It has been stated that the ignition of gunpowder is comparatively slow, but the ignition of compressed gun-cotton is second only to electricity and light in the quickness of its travel, its velocity having been calculated to range from 17,000 to 19,000 feet per second, or 200 miles per minute. To illustrate this a train of gunpowder is crossed by a train of gun-cotton; if the powder be fired it will burn down to the gun-cotton which will ignite and be consumed, leaving the portion of powder on the other side intact; or, if the gun-cotton be fired it will all explode without igniting the powder. Nitro-glycerine is a mixture of nitric acid with glycerine, which is allowed to fall into a narrow stream of water, when the nitro-glycerine at once separates. By mixing this fluid with a spongy clay, called *kieselguhr*, a soft plastic material is obtained, which is called *dynamite*; and if to dynamite be added certain quantities of sulphur and saltpetre, the product is called *litho-fracteur*. *Dualine* is small granules of gun-cotton soaked in nitro-glycerine, and the compound possesses most ungovernable strength.

(To be continued.)

The case of John Garrow, a member of No. 1 Company, 32nd Battalion, Port Elgin, who was sentenced to 20 days' imprisonment in the county jail for neglecting to respond to the call to arms when they were ordered to the front, amply illustrates the penalty which may be enforced upon a volunteer for disobedience of orders and cowardice, and will doubtless serve as a wholesome warning to all other members of the volunteer force, that when the country requires their services there is no option but to promptly obey.

### THE D. R. A. PROGRAMME.

(Except where otherwise specified rifles to be Snider and position any with head to target.)

#### The Bankers' Prize—Nursery.

Open to members of the Association who have not at any previous prize meeting of the Dominion Rifle Association won a prize of \$10 or upwards, exclusive of team or extra prizes; 500 yards, 5 rounds. Entrance fee, 50 cents.

First prize, \$20; second prize, \$15; ten prizes of \$10 each, \$100; fifteen prizes of \$5 each, \$75; twenty prizes of \$4 each, \$80; thirty prizes \$3 each, \$90; total, 77 prizes, value \$380.

#### The Manufacturers' Match.

Open to members of the Association; 500 yards, 7 rounds. Entrance fee, 50 cents.

First prize, \$25; second prize, \$20; third prize, \$15; eight prizes of \$10 each, \$80; thirty-five prizes of \$5 each, \$175; thirty-five prizes of \$4 each, \$140; total, 81 prizes, value \$455.

#### The Rideau Match.

Open to Members of the Association; 500 yards. 7 rounds. Entrance fee, 50 cents.

First prize, \$25; second prize, \$20; third prize, \$15; five prizes of \$10 each, \$50; twenty-five prizes of \$5 each, \$125; thirty-five prizes of \$4 each, \$140. Total, 68 prizes, value \$375.

#### MacDougall Challenge Cup Match.

Open to efficient members of the Active Militia, members of the Staff, and officers of the Active Force who have retired retaining rank; and to all officers, non-commissioned officers and men of Her Majesty's Regular Army and Navy stationed in Canada, who are also members of the Association. The Cup to be the property of the member winning it twice consecutively. 400 and 600 yards, 5 rounds at each range. Entrance fee, 50 cents.

First prize, the cup presented by Lady MacDougall and \$25; second prize, \$20; third prize, \$15; ten prizes of \$10 each, \$100; twenty prizes of \$5 each, \$100; thirty prizes, of \$4 each, \$120. Total, 63 prizes, value \$380.

#### The "Oumet" Match.

Open to all members of the Association; 600 yards, 7 rounds. Entrance-fee, 50 cents.

First prize, \$25; second prize, \$20; two prizes of \$15 each, \$30; eight prizes of \$10 each, \$80; twenty-five prizes of \$5 each, \$125; thirty-five prizes of \$4 each, \$140; total, 72 prizes, value \$420.

#### The Hon. the Minister of Militia's Match. (Affiliated Associations.)

Open to members of the association. 500 and 600 yards. 7 rounds at each range. Entrance fees, for each individual, 50 cents, and for teams, \$3.00. No coaching will be allowed.

Teams to be selected from the competitors entered as individuals, and composed of three previously named representatives of any affiliated association, whose names shall have been given in writing to the secretary of the Dominion Rifle Association, and vouched for as having been members of such affiliated association on or before the 1st July, 1885.

Names of competitors selected to form the team to be handed to the secretary before the commencement of the match.

First team prize, "The Caron" challenge cup and \$36; second team prize, \$30; third team prize, \$24; fourth team prize, \$18; fifth team prize, \$15; sixth team prize, \$12;—\$135.

First individual prize, \$25; second individual prize, \$20; third individual prize, \$15; fourth individual prize, \$10; ten prizes of \$8 each, \$80; twenty prizes of \$5 each, \$100; twenty-five prizes of \$4 each, \$100;—\$350. Six team and 59 individual prizes, value \$485.

#### Dominion of Canada Match.

Open to all efficient members of the Active Militia, members of the staff, and officers of the Active Force who have retired retaining rank; and to all officers, non-commissioned officers and men of Her Majesty's Regular Army and Navy stationed in Canada, who are also members of the Association. 200, 500 and 600 yards. 7 rounds at each. Position, at 200 yards, standing or kneeling. Entrance fees, for each individual, 50 cents, and for teams, \$5.00. No coaching will be allowed.

The team prizes to be awarded to the five highest aggregate scores made by any five previously named members from the Cadets of the R. M. College; from the schools of Cavalry, Artillery and Infantry; from any regiment, squadron or troop of cavalry, field battery or brigade of field or garrison artillery; from any corps of engineers, battalion or independent company of the Active Militia, or of the same denomination of the forces of H. M. Regular Army or Navy stationed in Canada, provided that all are members of the Dominion Rifle Association.

Names of competitors selected to form the team to be handed to the secretary before the commencement of the match.

In the event of the Province of Prince Edward Island, Manitoba or British Columbia not being able to send a full battalion team as herein stated, the Special Committee may accept entry for any battalion or corps having not less than three men on the ground, being competitors, and two from any other corps belonging to the same province.

First team prize, and a badge to each member, \$60; second team prize, \$50; third, team prize \$40; fourth team prize, \$30; fifth team prize, \$20—Total, 200.

First individual prize, \$30; second individual prize, \$25; third individual prize, \$20; ten individual prizes of \$15 each, \$150; ten individual prizes of \$10 each, \$100; Twenty-five individual prizes of \$5 each, \$125; Thirty-five individual prizes of \$4 each, \$140—Total, \$590. 5 team and 83 individual prizes.

#### The London Merchants' Cup.

Open to teams of eight members of any affiliated Provincial Association. 500 and 600 yards, 7 rounds at each. Entrance fee, \$15 each team. No sighting shots allowed. First prize, the cup and \$80; second prize \$64; total, \$144.