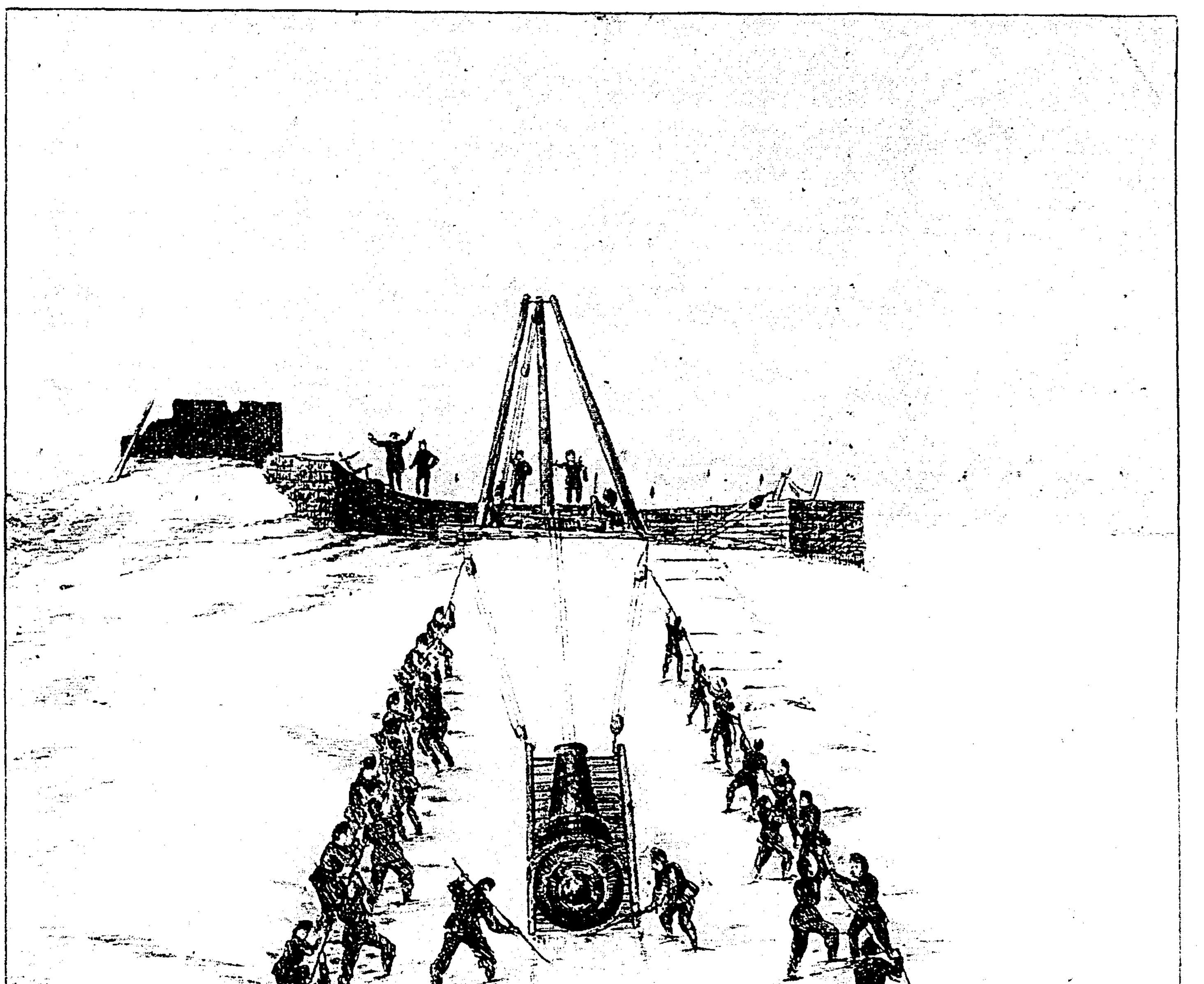
## THE SCHOOL OF GUNNERY, QUEBEC.

We give this week an illustration of the mounting of a Seven-inch Armstrong breech-loading gun on the Prince of Wales bastion, at the ancient Capital. The work is being done by the members of Battery "B," which battery we are well assured is progressing most satisfactorily under Colonel Strange, a distinguished officer of the Royal Artillery, who is in command of the District. Everything is done for the advancement and comfort of the men at the School of Gunnery. Besides the daily drills at the guns and mortars, the men are instructed by means of lectures delivered in the Model Room by the Commandant. The men have the use of a splendid gymnasium and a fine library, in which can be found books of every class. Besides this there is a library specially devoted to works on the military profession, which contains all latest scientific works treating of modern warfare. The pleasure of the men is by no means neglected, for they have a large recreation room in which, when off duty, they may exercise themselves in what is called "the manly art" either with gloves or foils. It is satisfactory to know in these times of possible trouble, that military organization in Canada is making such rapid progress.



SCHOOL OF GUNNERY, QUEBEC.—BATTERY "B" MOUNTING A 7-INCH ARMSTRONG GUN ON THE PRINCE OF WALES BASTION, CITADEL.—FROM A SKETCH BY A. W. MOORE.

## "THE WOOLWICH INFANT."

The London *Engineering* says :—

The maladies of heavy guns, and the causes which lead to their wearing out, cracking their linings, being otherwise disabled, or bursting, formed the subject of two lectures, last week at Plymouth, by Capt. Dawson, R.N. The one lecture was delivered to the regular forces of the two services at Davenport in the presence of the two commanders-in-chief, the other to the volunteer forces at Plymouth, Major Harrison, Royal Engineers, presiding. On the latter occasion, Captain Dawson stated that the 35-ton gun had not yet passed beyond the experimental stage, but a small crack had occurred in the steel lining at the usual spot, viz., in the bottom groove near the seat of the shot, where the stud on which the 700 lb. shot rested was hammered down by the escaping gas. They were, however, without those official records on which he had solely relied in discussing the rifling of other guns. These guns were intended for the Devastation class of ships, and if they realised every expectation, might supersede the 25-ton gun in other turret-ships; and as an exceptional gun in broadside vessels. They had to balance the multiplied chances of hitting by employing two pairs of eyes in aiming two 400 lb. shells from two 18-ton guns against the concentration of effect in hitting with one 700 lb. shell from one 35-ton gun. The authorities evidently thought that the balance was in favour of concentration of effort. The 35-ton was 16¾ ft. long, and was of Fraser construction, built up of six parts. The inner lining was a steel tube, 14½ ft. long, and 3½ in. thick at the breech, and tapering away to an inch less at the muzzle, with a 12-in. bore rifled with nine grooves 11¼ ft. long, 1½ in. wide, and 2 in. deep, the spiral increasing from nothing at the breech to one turn in 35 calibres at the muzzle. This was the same maximum increasing twist which proved so fatal to the 11-inch shell. The gun cost about £2,500, and was designed to fire a 700 lb. projectile, with 120 lb. charge from a 11.6-inch bore; but had subsequently been increased to a 12-inch bore. Comparing the 11-inch and the 12-inch bores in the 25-ton gun, they saw that although the latter had the largest bore and had the most powerful shell, the smaller bore gave the best penetrations. The resistance of the air was in the proportion of the squares of the diameters; and the facility of perforation being inversely as the diameters. On the other hand, a larger bore consumed more powder and brought less strain on the gun. The effect of increasing the calibre was very apparent in the 25-ton gun, both firing 85 lb. of pebble powder; but the 12-inch gun threw a 600 lb. shot, and the 11-inch gun a 530 lb. shot. The maximum pressure in the 12-inch gun was only 18 tons, whereas in the 11-inch gun it was 29 tons. But there was a limit to the extra consumption of powder due to this increase of diameter of bore, caused by the length of the gun being regulated by its weight, and by the convenience of muzzle-loading on shipboard. It was a balance of qualities, a sacrifice of extra shell power on the one hand, and of extra perforation on the other; while the "Woolwich" rifling did not rotate either shell, but caused slightly less sacrifice of shell power with the larger calibre and shorter projectile. Passing to the accident, they found that before the "incipient crack" occurred in the steel lining, the experimental gun fired the following pebble powder charges with 700 lb. projectiles: With an 11.6 in. bore, 4 rounds, 75 lb.; 2, 100 lb.; 16, 110 lb.; 6, 115 lb.; 6, 120 lb.; and 1, 130 lb.; making a total of 35 rounds. With a 12-in. bore, 6 rounds, 110 lb.; 13, 115 lb.; 14, 120 lb.; total, 33 rounds. Total, with both bores, 68 rounds, making about 3¼ tons of pebble powder, and over 21 tons of shot. Suddenly, at the twentieth round, with a 120 lb. charge, the extraordinary internal pressure of 66 tons per square inch was registered in the powder chamber; and the steel tube being calculated to withstand only 55 tons, an "incipient crack" took place in the bottom groove at the seat of the shot. Why did this sudden increase of the powder pressure take place? And was it the powder pressure which caused the crack, or did the crack arise out of an accident which led to the extra powder pressure? It was noteworthy that the crack was not in the chamber where the maximum pressure arose, and that these guns rarely cracked where the maximu pressure took place. On the contrary, guns were destroyed in the grooves or lands in the bore, to which the maximum powder pressure did not extend, and this was due generally to the erosion of the bore by gases escaping through the deep wide grooves and around the studs, or to the hammering the grooves and lands by the wabbling projectile. These injuries were attributable to the vicious system of grooving on an increasing twist, which necessitated the concentration of rotary effort on a single row of studs incapable of giving adequate rotation with the present amount of spiral, and this angle of spiral could not be increased, because the studs would not endure the extra effort, but could be sheared off and cease to act at all. Contrasting other long iron bearing systems which had undergone official trial with the present short bearings, he showed that while the whole effort of rotating a 700 lb. shell was now thrown upon a total of 5¼ in. of stud bearing, it would under the Scott iron flange system be diffused over 13 ft. of bearing; and that this latter system had narrower, shallower grooves, which took only one-fourth the quantity of metal out of the gun, and therefore, made less space for escaping gases to erode the bore; whilst instead of the lower groove being spiked by its own stud, Scott's iron flange would receive the shock on a rib 22¾ in. long. In the trial between two 7½-ton guns on this system, the Woolwich rifled gun was declared incapable of further firing, except "under precautions" against bursting, whilst the grooves and lands of Scott's gun were perfectly uninjured. Yet Scott's guns gave the greatest hitting power at the muzzle, and projected its shot 1,500 yards with 2 deg. elevation, using 20 lb. of powder, whilst the Woolwich one required 25 lb. to reach the same distance. Many able artillery officers were averse to the present system, and amongst those quoted was Colonel Campbell, R.A., superintendent of the royal gun factories, who stated in writing to the Ordnance Council on the 35-ton gun, that "the 'Woolwich' system of rifling adopted in the service required metal studs on the projectiles, which are objectionable from their liability to shear, and thus prevent the correct centering of the shot, and their liability to become damaged in transport and on service. In heavy guns the liability to shear necessitates an increased number of grooves if a quicker twist than now is given. The system has the great advantage of local scoring. I mean to say that there are disadvantages in the 'Woolwich' system in that way, and a better system of rifling may be found." Being asked, "Do you consider that the increase of the twist given to this (35-ton) gun will entirely obviate the inaccuracy of flight now observed in the 12-in. gun of 25 tons at very short ranges?" Colonel Campbell replied: "No. I should not think it would altogether. I think it will improve it very much. I should like to have given a greater twist." Again, "Should you be afraid if you adopted a sharper twist, say, 1 in 25, that the studs would be sheared?" "I should be afraid so, or I would have adopted it. The stud in the projectile confines us to grooving a less twist than I should like to give a 'gun.'" To which Sir Joseph Whitworth truly added, "If you have projectiles of a certain length you must have a 'greater twist,' because with less the 'projectile turns over.'" After contrasting with the Scott and Whitworth long iron bearing systems, it was pointed out that great differences of opinion existed at Woolwich as to the cause of the "incipient crack" in the "Infant." Three theories had been started: 1st. That the bottom stud flattened by the blow above the shot caused by the escaping gas overrode the groove, causing a squeeze which delayed its exit, and lead to an accumulation of gas in the powder chamber. 2nd. That the wabble caused by balancing the shot on two studs, and the irregular action of the powder above it, due to the non-centering of the shot, wrenched out or sheared off the stud and set up a motion of