

\$60; majors, \$80, and lieutenant-colonels, \$100, which amounts would at least go part way toward meeting the expenses necessarily incurred in holding a commission. At present each officer, irrespective of rank, is allowed \$1.00 per day for twelve days, and each non-commissioned officer and private fifty cents a day for the same period.

Another improvement could also be effected by doubling the pay of the men, as the loss of it through absence from drill would be more felt, and would give the officers more hold upon them. I will just briefly mention a few other pressing wants without enlarging upon them: The expenditure of a few hundred dollars a year in fire-wood to keep the frost out of the splendid forts at Point Levis, a proper armament for these forts; a larger reserve stock of rifles, ammunition and clothing; the assembling of the militia in brigade camps during the period of annual drill; the gradual purchase or manufacture of a sufficient number of armour-piercing guns to properly defend our seaports, the formation of companies of marine militia; the formation at St. John, N.B., for the Maritime Provinces, of a permanent battery of artillery, which could be trained in the use of torpedoes for harbor defence. Other desirable objects might easily be enumerated, but the above would suffice for some time to come. Before concluding this letter, I wish to protest against that most pusillanimous phrase, "Fenian Scare," as though a country possessing an organized militia, numbering over 40,000 men, was going to be thrown into a state of trepidation by a vague rumor of a possible raid by an insignificant Fenian rabble.

Montreal, Jan. 1st, 1881.

[It is said there are only 1,000 (?) stand of Martins in Canada, and out of these the R.M.C. Cadets are armed. In the event of emergency, the arming of city regiments in Montreal would probably lead to inadequate supply of ammunition, or to mistakes in issue between Snider and Martini. Besides, has the Henry Martini mechanical arrangement been sufficiently tested in the severe climate of Lower Canada? The Halifax garrison are trained soldiers who don't do small arm practice in winter.—Ed. C. M. R.]

Krupp's Meppen Experiments of 1879.

The purpose of this paper is to take a short review of the most characteristic features of the Krupp *Meppen* experimented on at Meppen last summer, calling attention chiefly to the best results, and comparing them with corresponding ones obtained in this country, with a view to promote the discussion of those matters in which it may appear that we have most to learn.

The principal feature in the Meppen programme was the trial of Krupp's 10m (15 75-in.) breech-loading gun, weighing about 70 tons 17 cwt., known commonly as the 71-ton gun. The trial was specially important for three reasons. 1st, it is the first breech-loader whose power approaches that of the 100 and 80-ton guns made in this country; 2nd, it is a steel gun; its proportions are based on results obtained during the last few years.

All these questions are interesting, and deserving of so much attention that it would be difficult here to deal fairly with all. For the purpose in hand, however, it is not necessary to discuss the question of the respective *metals* of the guns, because it can easily be shown that there was nothing in these experiments that bears upon this point beyond the negative fact that the steel guns in no respect exhibited any fault. We may safely say that our Woolwich guns would have done equally well, as far as the material is concerned, for the pressures in Krupp's guns were by no means excessive. The 71-ton gun for example, was not subjected to as high a pressure as our own 80-ton gun has borne. A test which tried the gun obviously furnishes us with no means of comparison, and hence the Meppen trials in no way furnish data for the discussion of the relative merits of wrought-iron and steel guns, but bear directly on the two other questions, namely that of breech loading and proportions—the former as concerns ease in working, and the latter power and good shooting.

The 71-ton gun was mounted as for coast defence, on a traversing platform, and a carriage nearly of the English pattern in all respects.

The gun was easily worked by a detachment of 15 men. Ten rounds, with chilled projectiles, were first fired; the time occupied by the last five rounds was 24 minutes. The breech-piece moved easily. A good deal of oil was used on it. The breech-loading certainly saved the men much labor, not only in the actual ramming home, but also in bringing up the projectiles, since it was not necessary for them to cross any of the racks of the Cunningham chain. The charge was made up in four cartridges, each containing 10 lbs. of prismatic powder. The least satisfactory part of the service of the gun was the difficulty experienced in the ignition of the charge and in remedying mis-fires. The vent was in the axis

of the piece, and a disc of calico was torn off the bottom of the cartridge last entered, to expose the powder to the flash of the tube. The latter was of a bad pattern, short and weak. No stress is to be laid on this, as the remedy is obvious. A primer of a stronger tube would rectify this fault. A rather more serious difficulty was apparent when a mis-fire had occurred. The position of the vent was such that it was unusually dangerous to approach it while there remained any likelihood of the gun firing. A gunner may insert a tube in a vent in the top surface of a gun with comparative safety, but to thrust his hand into a cavity in the breech, and in such a position tamper with a doubtful tube and charge, would indeed be dangerous. On active service the risk, no doubt, would be run, and it is possible if the man stood on the step of the carriage and reached round so that the gun in any unexpected recoil should carry him with it rather than run over him, that he might escape without injury. Nevertheless, while this modifies the objection, it remains sufficient to make it imperative to construct some arrangement to enable a tube to be removed and another entered with safety, even should a mis-fire be a much rarer occurrence than it was at Meppen last summer. The flash from the vent has been spoken of. This is an objection which belongs to all axial-vented guns. In Krupp's guns, there was but little flash at Meppen, owing to an arrangement by which a loose platinum ball in the vent is driven up out of the way by the flash of the tube, but pressed back so as to close the vent by the rush of gas from the charge. An Italian officer stated that this ball is not serviceable, but becomes worn and of little use after a time. Under any circumstances this difficulty is one connected with axial-vents rather than breech-loading.

A more important question is the shooting of the gun as regards power and accuracy. The chilled projectiles had 0.078 in. windage, which is about the same as that in Woolwich projectiles, namely, 0.08-in. over a copper rim. The common shell subsequently fired, however, had the unpractical windage of about 0.02-in. over an iron body.

The diagrams, Nos. 1 and 2, show a remarkable degree of accuracy, chiefly in the vertical direction, which argues well for the regularity of the charge, which has been attributed to the prismatic powder employed. But while the regularity of the powder is a necessary element in such a result, I cannot see how it alone explains it. The effect of variation in powder doubtless would be seen in the deviation of the shot in the vertical direction only, but it appears to me that bad shooting from the faults in the bore of the piece would be seen in irregularity both in the vertical and horizontal direction. If the vertical deviation is very small, then it argues not only that the powder was regular but that the bore also carried true to within the limit exhibited, and a cause for the error in the horizontal direction must be sought elsewhere. With regard to the powder, it stands to reason that a charge composed of a fixed number of prisms of uniform size and density gives promise of greater uniformity being attainable than when pebbles are employed; and there seems no reason to doubt that whatever difficulties were at first experienced this has been achieved. Surely if two attempts were made to obtain regularity in powder—one by employing prisms, each uniform in size and shape, and if possible pressed uniformly, and another by means of pebbles of an accidental shape from uniformly pressed powder cakes—the former, though it may be difficult, offers promise of ultimate success in the higher degree. As to the windage, stress can hardly be laid on the great reduction in the case of the common shell; the two kinds of projectiles made pretty nearly equally good practice. Lastly, as to the proportions of the bore and chamber. The most striking feature is the length of the bore. Figs. 2, 3, and 4 show the relative lengths of the best heavy guns at present in existence, by which it appears that the bore of the 71-ton gun is only 20 inches shorter than that of the 100-ton gun, and 15 in. longer than that of the 80-ton gun. The chamber in length is 18 in. that of the 100-ton gun being 59 in., and of the 80-ton gun 83 in. The calibre of the 71-ton gun is 15.75 against 18 in the 80, and 17.72 in the 100-ton gun. Consequently, the bore of the 71-ton gun is 21.8 calibres long against 18 in the 80, and 20.5 in the 100-ton gun. The diameter of the chamber of the 71-ton gun is 17.32 ins., that of the 80 and 100-ton guns being 18 0 and 19 7 in. respectively, that is to say, it is 1.67 ins. greater than that of bore as compared with 2.0 ins. increase in the 80, and 1.68 ins. in the 100-ton gun.

Speaking generally, the bore of Krupp's gun is relatively rather longer, and the chamber less enlarged than in the 100-ton gun, while in the 80-ton gun the bore is actually the shortest, and the enlargement of the chamber actually the greatest of the three.

It should be understood that our own investigations have led to the adoption of far greater length of bore than is exhibited in any of these three guns. I am informed that a breech-loading gun of 40 tons, 28 calibres long, is in course of construction. I am speaking, therefore, of the 71-ton gun which was made last, simply as having actually embodied in it a further stage of progress than the 80-ton gun. The first gun with an enlarged chamber, that I know of, was a field gun fired by Sir J. Whitworth, at Southport, in October, 1872.

On the proportions of bore and chamber mainly depend the power of the guns. To be able to make a comparison between them, discrimination is necessary. It would not be right to take equal or proportionate charges as the basis of the comparison, because the principle on which a long gun is advocated is that any greater result can thus be got from a gun with a given strain on it, but at the expense of some waste of powder.

It is clear, then, that looking to the endurance of the gun rather than the expenditure of powder, the basis of comparison should be proportional pressures. It would scarcely be right to say equal pressures, because the thicker gun can fairly be expected to bear a greater strain than the thinner one. Now, the best results obtained from these three guns are as follows:—

The 80-ton gun at Woolwich with a proof-charge of 457 lbs. giving a pressure of 21.5 tons, discharged a projectile weighing 1,25 lbs., with a velocity of 1,638 f.s.—having 22,538 ft. tons stored-up work, or 63.77 ft. tons per inch circumference—equivalent to a penetration of a 2 3/4-in. plate of wrought-iron. The 71-ton gun at Meppen is reported, on one occasion, with a charge of 457 lbs., giving a pressure on the gun of 20.32 tons, to have discharged a projectile weighing 1,715 lbs. with a velocity of 1,708 f.s.,—having, therefore, 24,433 ft. tons stored-up work, or 69.72 ft. tons per in. circumference—equivalent to the penetration of a plate 33.6 ins. thick.

During the public trials in August, the 71-ton gun was not tested so severely, and it is therefore right to class the above in the same category as the Woolwich proof-charge above mentioned. In August the average weight of the chilled projectiles was 1,712.8 lbs.