# THE VOLUNTEER REVIEW.

#### THE IRISH EMIGRANT'S LOVE.

In pensive thought she passed the church, And up the sunny woodland came, Until she found the silver birch, Where long ago he carved her name. And "Oh " she sighed, as soft she kissed With loving lips the gentle tree, " Alone, alone, I kept the tryst-O love, my love, return to me.

"Return, Columbia's realm afar, Where year by year your feet delay, We cannot match for sun or star, by sliver night or golden day; Yet here the levin flashes dire, Alarm not oft, we never know Hór awful rushing forest fire, The slient horror of her snow.

"Her birds are brighter far of wing, A richer lustre lights her flowers. A richer tustre lights her flowers, But still they say no bird can sing. Or blossom breathe as sweet as ours, Her people's heart is wise and bold, Her borders beautiful and free, But oh ! the New is not the Old, Come back to Ireland love-and me.

### THE ROTATION AND FLIGHT OF PRO-JECTILE .

# (From the Broad Arrow.).

We referred in our last impression to the paper read by Mr. Hope, and the discussion which ensued, in the Mechanical Science Section of the British Association, relative to "the Woolwich",--or, strictly speaking, "the "French"-system of rifling. Mr. Hope's complaint that the laws of nature are set aside, capped by Mr. Merrifield's equally strong assertion that all mechanical laws are set at defiance in this system, have already we cannot doubt, made their due impression on our readers. We now turn to Mr. Froude's apology for the lack of rotatory power ex hibited by the short bearing study system, as a matter deserving of the most serious attention.

Mr. Froude, like Mr. Morrifield, is a mathematician whose experience in other provinces of scientific research demand for his roude stated, very lucidly, the scientific principles, which explain a fact well-known to artillerists, viz., that under certain cir cumstances, a projectile ejected from the bore with a slightly unsteady motion, fre-quently steadies itself at a certain period of its flight. Mr. Froude is of course aware that this phenomenon occurs only within pertain narrow limits. It depends upon the amount of the irregularity originally impressed upon the projectile, or, in other words, upon the degree of perfection with which it is spun. A properly rifled shot leaves the gun without any irregularity of motion whatever,\* making a sharp continuous whizz in the air. But. if the same angle of spiral and weight of profectile be retained, and its interior be hollowed out, so that its length may be gon siderably increased, the rotation impressed upon the projectile will be imperfect in proportion to its additional length.<sup>†</sup> If these projectiles of great length are to be ulequately spun, the angle of spiral must be proportionately increased; otherwise that irregularity occurs which is sometimes called by the popular designation of "wobbling," and which we have before likened to the irregular gyrations of a schoolboy's top before it has steadied itself. Should the disproportion between

is called from the French "derivation," is not here in ducstion. 'Ling pr jectiles require a more rapid rotatory motion than short ones of equal weight. for the resultant of the resistance of the air, which, press-ing in front of the centre of gravity of an elongat-ed shot and below the ground, tends to give the projectile a rotation round its shorter axis, acts with a greater leverage as the length of the shot is inoreased.—See Lieut.-Col. Owen's Principles and Practice of Modern Artillery.

the length of the projectile and the angle of the spiral be smaller, the imperfection of the spin may be so inconsiderable that the projectile may steady itself before reaching a distant object. But if the disproportion be great, the result will become manifest in the misdirection of the shot, and the loss of the penetrative power in proportion to the amount of work expended in its irregular movements. The obvious cure for this evil is to increase the angle of the spiral, but this cannot be done in very heavy guns so long as the whole effort of rotation is concentrated upon a single stud in each groove, in the bore. "The studs in the projectile," says the Superintendent, Royal Gun Factory, "confine us to a less twist than I would like to give any gun." Another remedy has, therefore, been adopted, viz., to diminish the hollow space in the interior, and thus adjust the centre of gravity by shortening the projectile

The 12-inch projectiles afford an apt illustration of the moderate limits within which Mr. Froude's explanation applies. Mr. Froude will remember the devious manner in which the seven shortest 12 inch projectiles fired by the Hotspur against the Glatton, played around the bull's eyes, now striking above, now below, now to right, and now to left of them-the two that struck the turret hitting eighteen inches below the marks. Much of this difficulty arose, as we stated at the time, because the ships were only 200 yards apart, and the shortest 12-inch projectile does not steady itself till it reaches 400 to 600 yards in its flight; so that an enemy less distant enjoys a chance of escape not given to one a little farther off. Hud the Hotspur fired the original 12 inch common shell, which was, 3 calibres long, and contained 43 tbs. of powder, and which, as officially stated, "proved so exceedingly unsteady in flight and shot so indifferently," Mr. Froude would have seen what occurred with them, viz., "the shell appearing to turn over in flight." We are officially told that this was owing hito the unfortunate introduction of the 12-inch gun with such a twist as rendered it neoessary to discard its two longest projectiles, viz., its common and shrapnel shells, constructed at first to weigh about 60010, in the score of bad shoating, for two shorter and less powerful ones," ("Ammuni-tion" One the score of bad shoating for two shorter and less powerful ones," ("Ammunition " Part 11.) The relative proportion between the length and angle of spiral, to ensure perfect spin at starting is well known, having been worked out experimentally by Sir Joseph Whitworth; but the stud in the projectile limits us to a less twist than the manufacturer would like to give any "gun,"; The consequence is, that reduction of pewder capatity, consequent on the short-ening of the projectile has been resorted to as the only available expedient.

Now the relative values of shells is as the equares of their bursting charges in pounds. What we have lost by this failure of rotatory power in the 12 inch common shell may be seen by comparing the squares of their charges, thus .--

12-in. 35-ton gun. 12-in. 25-ton gun. 12-in. 25-ton gun Common shell. Original shell. Pre-ent. shell. 405. 2070 (225

In other words, the shell power of the "Woolwich Infant" is only one lifth that. which the 25 ton gun was designed to have and one third that to which it has been reduced for lack of rotatory powers, As rotation is entirely a question of proportion between length, angle of spiral, and refocity, it is evident that if a 495 lb, shell having a cavity to contain 35 lbs, of powder be the maximum length for a 12-inten 25 ton gun; then, if a 700 lb. shell of similar length is to

in the interior must be greatly reduced, as it is, to 20 lbs. bursting charge. It would, indeed, be much less than that, but that the 35-ton gun has a sharper angle of twist, giving more rotation, and consequently admits of the use of a 700-lb. shell 41 inches longer than the 495 lb. one for the 25-ton gun.

The cored shot fired at the Glation were only one-fourth shorter than the original 12inch common shells, yet their unsteadiness in flight was apparent to all who had eyes to see or ears to hear; but they would probab-ly have steadied themselves at 400 or 600 yards' range. Still, Mr. Froude must remember that whatever motion the projectile had on leaving the gun must have been impressed upon it by an expenditure of power within the bore. The power so used is a subtraction from the onward driving force, and results in a diminution of velocity and of blow. In the 7 inch gun competition, this misapplication of force was found to be equivalent to 59 feet initial velocity. Supposing this to be the amount of velocity lost in the 25 ton gun-and, looking at the wedge shaped stud in the United Service Institution, we can well believe it is at least so,-the loss of striking force upon the Glatton's turret due to this cause was 653 foot tons, or about one eleventh of the actual hitting force. Except, then; for the irregu larity which Mr. Froude witnessed at Portland, the Glatton's turret must have been completely perforated by both of the hitting shot.

Mr. Froude must have observed at Portland that both of the hitting shot broke up through their studholes in the Glalton's turret, the rear pieces thrown violently backwards into the sea, causing a further loss of penetration. To lessen this hability, the ar-mour piercing shells have their walls thickened in their interior, behind the studholes. This way of strengthening the shell is, of course, attended with a corresponding reduction of powder capacity; and as the value of the projectiles, as shells, varies as the squares of their bursting charges, their relative explosive powers are -

12-inch 85-ton Gup. Palliser Shell. 81	12-inch 25-ton Gan. Orignal Palliser Shell 225
_12-inch 2	5-ton Gun.
Present P	alliser Shell.
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So that the studs in the projectile' reduce the bursting power of the armour-piercing 12 in shell for the 35-ton gun to little more than one third that of the original one for the 25 ton gun, and to less than one half that of the one now in use.

We quite concur with Mr. Froude in deprecating the reduction of windage, which is necessary for easy loading in continuous firing. The proper way of centering the projectile in the bore, which is essential to per-fect rotation, is by adopting a centering sys-tem of rifling. No reduction of windage will make French studs centre their projectile in the bore. Centering ribs accomplish this purpose without any reduction of windage. 11.4 1 ۰,

# THE WOGLWICH SYSTEM OF RIFLING AT THE BRITISH ASSOCIATION.

At a meeting of Section G (Mechanical Science) of the British Association, on Monday, Mr. W. Hope, V. C., read a paper en-tutled "A suggestion for estimating the error in the flight of heavy projectiles due to the Woolwich system of rifling." Commencing with an apology for his subject. Mr. Hole said it was as much as if he were to offer a be fired from a 12-inch 35-ton gun, the cavity suggestion for ascertaining the error in the

<sup>•</sup> That form of deviation to the right or left common to all elongated projectiles, and whith is called from the French "aerivation," is not