

The inability of the naval specialists to appreciate the situation, and the consequent muddle that exists throughout Europe as to models of vessels, the character of armor, the purposes to which naval vessels may be put, and the methods of naval warfare, are indications of the coming revolution. To show the extreme to which they go, we find little kingdoms like Sweden and Norway building an insignificant number of broad-side ironclads, thus feebly following in the wake of Russia and Germany. Of course, these vessels are of no use to such a power for offensive purposes, and as for defensive purposes they are worthless, and their whole construction is simply a frivolous waste of money, prompted by vanity and foolish attempt at rivalry. It is hard for the naval minds to understand that the old ideas of naval power are fast approaching an end. A clear observer, informed as to the situation, must recognize the fact that twenty five years from now a navy will exist only as a means of defence for the great nations. The vast sums that are spent every year in maintaining and increasing the navies of Europe on their present system may, therefore, be regarded as practically thrown away. The comparatively inexpensive submarine monster, applied to defensive uses, will neutralize all the millions that are now wasted on enormous naval constructions.

### MUZZLE RIFLING.

(From the Army and Navy Journal.)

We have received from Quartermaster General Meigs, in the form of "Ordnance Notes-No. XXIX," a paper of exceeding interest as affecting one of the great military questions of the day—rifle practice. It seems that considerable excitement and interest have been aroused in English circles by a reported revolution in the whole system of rifling, denominated "Muzzle rifling." This change had its origin in the brain, not of a gun maker or ordnance officer, but that of Mr. W. Murphy, a distiller, of Richmond, County Cork, Ireland. His invention had an exceptional character. The peculiarity consisted in rifling, with inclined rifling only a comparatively small portion of the bore towards or at the muzzle, the rifling being dispensed with in a large portion of the bore in front of the seat of shot, where it has hitherto been an impediment to the initial motion of the projectile, and consequently a cause of recoil. The peculiarity and novelty of the system were in some measure in confining the rifling, not only to that portion of the bore where alone (as sought to be proved) rifling can be necessary, but to the very portion of it which has hitherto been considered the weakest; where, in fact, we have been taught to believe that any impediment to the free exit of the bullet would involve the destruction of the arm. The patentee claimed for his system the following advantages: First, a great reduction of recoil, without any reduction of charge or increase in the weight of the arm. Secondly, increased velocity of projectile, and consequent flatness of trajectory, without any loss of accuracy of direction. Thirdly, from the position of the rifling, facility for punching, drawing, or cutting, and accurately gauging the same; and, though last, not least, a very considerable reduction in the cost of manufacture, with more exact evenness of pitch and form of rifling, consequent mainly on the small portion of the bore that will be rifled. Mr. Murphy contended that the fact of the surface of the projectile having to travel along the incline of the rifling

towards or near the muzzle retards only slightly, without unduly checking, the velocity at that point, and that in consequence a large quantity of the powder charge is consumed, and a somewhat greater power is thus finally applied to expel the projectile from the bore than with the ordinary rifle. In the case of this latter, the increasing velocity of the projectile is unimpeded, save by the column of air in the barrel, until it escapes from the muzzle, except when increasing pitch is used.

Captains O'Hea and Selwyn, R. N., and Commander Dawson, R. N., together with Mr. W. Walker, in a discussion before the English Society of Arts, explained the immense advantages accruing from the invention, and described numerous experiments which proved to them that the invention would reduce the cost of rifling, increase accuracy, diminish recoil, and completely revolutionize rifle practice. General Meigs was so much impressed by the results claimed and the "statements of officers of reputation, which I could not believe to be false, fraudulent, or mistaken," that he addressed a letter to the Secretary of War, recommending that "consulting the paper published in No. LXXII. of *The Journal of the British United Service Institution*, exhaustive experiments be instituted upon muzzle loading rifling; upon the form of section of barrel, whether grooved or ribbed, which should be adopted; upon the least rapidity of twist which will be sufficient to secure the ball uniformly striking point foremost at 1,000 or 1,00 yards range, and upon the proportion of powder to lead in the cartridge. These experiments will not cost much either in time, labor, or money, and I believe they will lead to great change and a great improvement in the rifled arms of the United States."

These experiments have been conducted at the National Armory, Springfield, Mass., with results that show how much circumstances alter cases, and that we need not be afraid to put our American guns besides the Martini Henry, whether wholly or in part rifled on the English system,

We give the results of the experiments, the details being too long for present publication, but remarking that they are fully borne out by numerous and exhaustive trials. Major Benton, commanding the armory, reports that: "as regards the superiority of part rifling over full rifling, the experiments made by me have been for the purpose of comparing the merits of part rifling on the Henry plan with the full rifling of the present Springfield system. From the report of these experiments, I think it will be seen that the part rifling system on the Henry plan, while it sometimes give excellent results, does not always do so, and is, on the whole, inferior to the present Springfield system of full rifling. The special advantage claimed for part rifling, viz., greater flatness of trajectory, is not confirmed by the experiments when compared to the present Springfield mode of rifling. As regards cost of construction, the part rifling on the Henry system is more expensive than the full rifling on the Springfield system, inasmuch as the additional operation of reaming out costs not only more than the difference from the length of rifling, but more than rifling the full length of the barrel."

He further reports, on the claim that a twist of twenty two inches is too great for our .45 calibre rifle, and on the proposal that trials be made with barrels of four and six feet twists. It was also proposed to increase the charge of powder and reduce the weight

of the bullet so as to get increased velocity. Both of these suggestions have now been tried and have failed to give satisfactory results, owing to very great falling off in accuracy of fire. The 300-grain bullets, which were fired with 90 grains of powder, were lightened by shortening the 405 grain bullet. The mode of lightening by hollowing the chamber and filling the cavity with a plug of wood, would hardly be applicable to projectiles of this calibre. It is employed in England only for the Snider bullet, which has a calibre of nearly .58.

Major Benton, in his further report, sums up the results of his experiments thus:

I. Regarding accuracy of fire at 300 and 500 yards range, with ammunition prepared at this armory, there is little, if any, difference between the Springfield full rifled barrel and the two Henry part rifled barrels with 22 twist. With service cartridges, as received from the Frankford Arsenal, the accuracy of fire is decidedly in favor of the Springfield barrel. I attribute this disparity mainly to the difference in the lubricants employed. The Frankford lubricant, being pure Japan wax, is not so perfect in its operation and does not lubricate the bore near the muzzle so thoroughly as that used here, which is composed of beeswax, sperm oil, and graphite. The part rifling after a few rounds was observed to be entirely covered with dirt, whereas but a portion of the full rifling was so covered, and the lands had necessarily a better hold on the bullet than in the former case. II. As regards flatness of trajectory, as shown by the position of the centre of impact for the same angle of fire, there seems to be little difference between the Springfield barrel and the Henry part rifled barrel. For some reason, which I cannot explain, the drop of the bullet from the Henry part rifled barrel was much greater at all distances than from the other two barrels, and, therefore, had a higher trajectory. A careful inspection of No. 7 barrel was made, and no difference could be detected between it and barrel No. 2. The English experiments, to which General Meigs refers, were made to compare full and part rifled barrels on the Henry (ribbed) system of rifling, and are not therefore, perfectly analogous to the experiments referred to in this report, which were made to compare the merits of the Henry part rifle with the Springfield full rifle systems. I can only say that, so far as the experiments, made at this armory go, they do not confirm the results of the English experiments, which showed that part rifling gave a much flatter trajectory than full rifling. III. The firing from Henry part rifled barrels, with four foot and six foot twist, was very wild at 500 yards. As the target was frequently missed, no record is given of the firing with these guns. Frankford service cartridges prepared at this armory with 90 grains of powder and bullets weighing 300 grains. IV. The results for recoil (table No. 11) show rather less pressure for the full rifled Springfield gun than for the Henry part rifled barrels Nos. 2, 7, and 5. Barrel No. 5, with six foot twist, gave somewhat greater pressure than the others. The pressure from a charge of 30 grains of powder and 300 of lead is also a little more than for charges of 70 grains of powder and 405 of lead. V. The initial velocities obtained with the Henry part rifled barrel (No. 2 and No. 4) are a little greater and more uniform than that with the full rifled Springfield barrel, while the Henry part rifled barrel (No. 7) was about equal to the latter in both respects. The conclusion from the foregoing is that no advantage is