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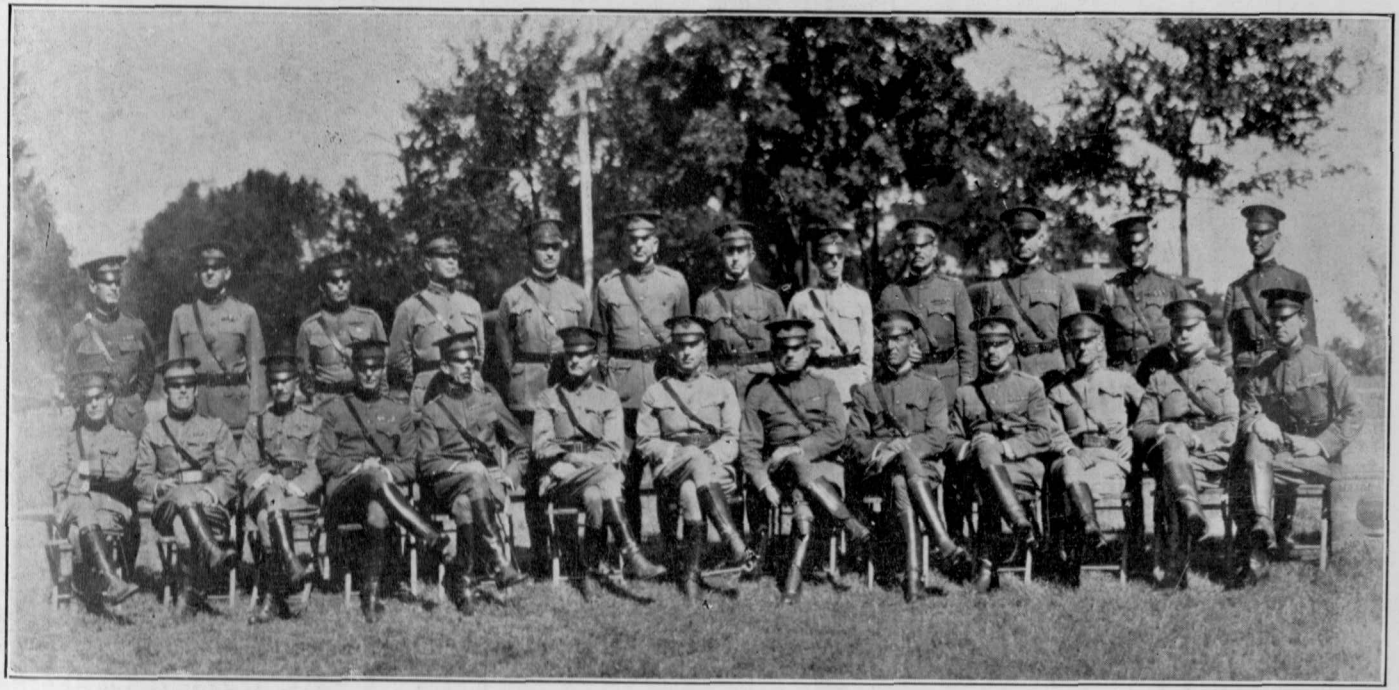

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Journal of the United States Artillery

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Field Service of the Coast Artillery in War

By Colonel S. C. Vestal, C. A. C.

Editor's Note. This article, prepared in 1912 and here published for the first time, brings the history of the Field Service of the Coast Artillery in War down to the year 1911. It will be followed in our next issue by an article by Colonel Robert C. Kelton, C. A. C., covering the field service of the Coast Artillery in the World War. Colonel Vestal's Summary and Conclusion given on page 220, could, with a slight change of words, be used as the summary and conclusion of the two articles considered as one connected history.

THE USE OF COAST ARTILLERY AS A FIELD FORCE

"HE was delighted to find a full strong company of artillery subject to his orders, well supplied with clothing and money in all respects," says General Sherman in his Memoirs, in speaking of General Kearney's arrival in Monterey early in 1847 after his terrible march across New Mexico. Kearney had left his worn-out and half-naked dragoons at Los Angeles and had pushed on with a small escort to Monterey, where he found Company F, 3rd Artillery. This company had taken passage for California in a naval transport; it had been recruited to full strength in New York, 113 enlisted men and five officers, W. T. Sherman being one of the first lieutenants. With a somewhat similar sense of relief a hard beset administration turn to the Coast Artillery for soldiers in troublous times when the enemy is not a maritime power, or when victories at sea have removed the danger of oversea attack. In such times the use of the coast artillery as a field force is

not a thoughtless, shiftless expedient in order to gain a little present advantage; it is a wise and sagacious use of the armed forces of the nation.

The Coast Artillery is an organized, uniformed, equipped, and disciplined body, with much of the training required of field troops; at every period of its existence, many of its officers and men have had all the service in war that the troops of the other arms have had; as field troops they are always much more valuable, serving in any arm, than a corresponding number of hastily raised troops; moreover, a time comes in every successful war when a large part of the Coast Artillery can be spared from the fortifications and the authorities never allow it to sit idle at home when it is needed in the field. It is of the utmost importance that the personnel of the Coast Artillery should recognize these facts, and, to the extent not directly prejudicial to their efficiency as Coast Artillery, fit themselves for field service in war.

The first and most important duty of the Coast Artillery is in the coast defenses; its use as infantry or field artillery at certain stages of a war is of the nature of a by-product. That such use may be made of it furnishes no argument for its increase, just as the fact that ships' crews have served ashore with great distinction, as in the relief of Lucknow and Ladysmith, furnishes no argument for an increase of naval personnel. Its strength depends upon the manning details required for coast guns. In war the Coast Artillery is called into the field simultaneously with large bodies of volunteers. It therefore does not enter into competition with other branches of the regular service for a place in the line of battle; the question to be decided in every case where it is called into the field is whether Coast Artillery or additional volunteers shall be taken. In any event the Coast Artillery will have little choice in the character of its field service which is determined, not by the desires of its officers, but by the necessities of the nation in perilous times. The duty of the Coast Artillery is to endeavor to anticipate what will be expected of it and to be prepared to meet the most probable emergencies. By foreseeing these emergencies, they may easily be provided for; but if we wait until they arrive, the time for preparation will have passed; and, to the difficulties of performing new and untried duties in the field, will be added the embarassment of obtaining material, and, in some cases, as in 1898, of giving that material its first field tests.

Coast Artillery is properly used in the field when it is sent to reinforce the field army for active operations; it should not be withdrawn from coast works for service merely as a force of occupation; such duty should be performed by other branches of the regular army. The separation of the Coast Artillery from the coast defenses unquestionably causes deterioration, for the time at least, in its efficiency as coast artillery; but the deterioration as a highly specialized arm which it suffers while it is serving against the enemy weighs lightly in the balance against the great benefits that arise from such service.

AN EXTENSIVE SYSTEM OF COAST DEFENSES DOES NOT SIGNIFY A POLICY OF PASSIVE DEFENSE

In discussing coast defense, it is necessary to assume that the enemy will be the attacking party with reference to operations about a particular work and that we shall be on the defensive. The habit of thought thus contracted is easily applied to the entire system of coast defense and thence to the military policy of the nation. It is hardly an exaggeration to say that most people who bestow thought upon our elaborate system of coast defenses tacitly assume that these defenses are intended to enable us to parry the blows of a powerful and ubiquitous enemy from the beginning to the end of an inglorious war. The fallacy of such an assumption will be seen by anyone who will take stock of our means of offense, military and naval, and compare them with the means of offense of the first class powers that can possibly be arrayed against us. Whether we shall invade or be invaded is purely a question of supremacy at sea. The primary object of the coast defenses is to shield the coast cities, important anchorages, and naval establishments from the fire of the enemy's navy and to permit our seagoing navy to contend for the mastery of the sea, unfettered by the onerous duty of coast defense. Without coast defenses, all the infantry, cavalry, and field artillery that could be concentrated at any one of our coast cities could do positively nothing to prevent battleships or cruisers from destroying the city. It is a great error, however, to infer from the existence of these defenses that we shall be on the defensive at all points, both at home and in the insular possessions, in our next war.

REASON FOR STUDYING HISTORY OF THE COAST ARTILLERY

Before deciding upon the training that should be given to the Coast Artillery for field service, we should come to some conclusion in regard to the duties that will be required of it. If we were guided only by the experience of the year 1911, we should conclude that it would never be used outside of the coast defenses otherwise than as infantry; if we looked only to its record in the Civil War, we should say that it would be used in the field only as light or horse artillery; if we were guided by the discussions that preceded the separation in 1907, we should conclude that it would never be used at all outside of the coast defenses. Happily the history of the Coast Artillery has been most honorable, most varied, and a brief but comprehensive sketch of its past record will supply parallels to illustrate and correct our views and material to formulate a guide for the future.

At first sight it may appear that most of the history of the artillery will furnish but a remote analogy to circumstances of present times. "Let the dead past go," says an entertaining writer whose letters had

a considerable influence on artillery opinion at one time; but his motto is a bad one in military affairs and government. "History of times is the best ground for discourse of government," says Bacon; and the remark is true of both civil and military matters. Notwithstanding the tendency of every generation to claim that the requirements for the instruction, discipline, and drill are more exacting than in former times, it is doubtful whether the artilleryman, fighting with shielded artillery in concealment or with disappearing guns in concrete emplacements, is more severely tried than when he fought at closer ranges either fully exposed to view in the open or in masonry casemates that shattered about his ears.

It must be confessed that the history of the artillery presents, on the surface at least, a confused and anarchical appearance, without regularity, order, or sequence of events. Artillery officers have appealed to the history of their arm mainly to illustrate those things which they think should be avoided in the future. That they have rarely found patterns of action in the organization and deeds of an arm that has supplied more illustrious names than any other in our service, is due, we believe, to the fact that they have never recognized the necessity of such a wide and careful study as would enable them to grasp their subject in all its natural relations. We regret that the limits of this paper will permit only a partial and incomplete consideration of this most interesting and most important subject.

EARLY HISTORY OF THE ARTILLERY

In speaking of a resolve of Congress dated June 2, 1784, General Upton says: "This law disbanded all that remained of the Continental Army, save one battery of artillery at West Point, which was raised by Alexander Hamilton in New York in 1776, and which is now in the regular service as the 4th Company, C. A. C., Manila, P. I." The first act of legislation under the Constitution, dated September 29, 1789, authorized the raising of a battalion of artillery and a regiment of infantry. The army was reorganized fifteen times between this date and the year 1821. The strength of the artillery varied from one company under the act of March 5, 1792, to one regiment of light artillery, one regiment of artillerists, and two regiments of artillery under an act passed at the beginning of the War of 1812. (Historical Register of the U. S. Army, 1789-1903, Heitman, Vol. II, pp. 560-580.) During this war companies of the artillery regiments or corps of artillery, as the foot artillery was called under an act passed in 1814, were mounted as well as several companies of the light artillery regiment; it was to its service, however, as infantry and heavy artillery that the light artillery regiment could most proudly refer. It should be a matter of inspiration and pride to all artillerymen that the unexpected and triumphant resistance of Fort McHenry, in the War of 1812, under the command of Major George

Armistead of the Corps of Artillery, has furnished the theme of our national air.

REORGANIZATION OF THE ARTILLERY BY MR. MONROE AND MR. CALHOUN

It is a fact not generally known, but true, that the author of the Monroe Doctrine was the persistent advocate of the military and naval measures necessary to give that policy its due weight in the world. Nor is it generally known that Mr. Calhoun, the author of nullification, was also the author of military institutions that made for national safety in 1861.

The best exposition to be found in our early state papers of what we think is the correct policy of national defense is contained in the Messages of James Monroe who was President from 1817 to 1825. "To secure us against * * * dangers from abroad," said Mr. Monroe in his first inaugural address, "our coast and inland frontiers should be fortified, our Army and Navy, regulated upon just principles as to the force of each, be kept in perfect order, and our militia be placed upon the best possible footing. To put our extensive coast in such a state of defense as to secure our cities and interior from invasion will be attended with expense, but the work when finished will be permanent, and it is fair to presume that a single campaign of invasion by a naval force superior to our own, aided by a few thousand land troops, would expose us to greater expense, without taking into the estimate the loss of property and distress of our citizens, than would be sufficient for this great work. Our land and naval forces should be moderate, but adequate to the necessary purposes—*the former to garrison and preserve our fortifications and to meet the first invasion of a foreign foe, and, while constituting the elements of a greater force, to preserve the science as well as the necessary implements of war in a state to be brought into activity in the event of war;* the latter, retained within the limits proper in a state of peace, might aid in maintaining the neutrality of the United States with dignity in the wars of other powers and in saving the property of their citizens from spoliation. In time of war, with the enlargement of which the great naval resources of the country render it susceptible, and which should be duly fostered in time of peace, it would contribute essentially, both as an auxiliary of defense and as a *powerful engine of annoyance*, to diminish calamities of war and to bring the war to a speedy and honorable termination." (Messages and Papers of Presidents, Richardson, Vol. II, p. 7.)

Mr. John C. Calhoun was Monroe's Secretary of War. He had borne a prominent part in the military legislation during the War of 1812 and had learned much from the disasters of that war. Acting in concert with his illustrious chief, he signalized his eight years of administration of the War Department by three measures that have had far

reaching effects. He reformed the Military Academy which he found in disorder and left in a most efficient state; he systematized and pushed forward the construction of our Third System of Coast Defenses; and he reorganized the artillery and founded the Artillery School at Fort Monroe. He saw the need of a large regular force of field artillery in time of war. Knowing that the country would not bear the expense of such a force in time of peace, his acute mind hit upon the expedient of keeping a small number of mounted companies as schools of instruction for artillery subalterns and of forming out of the Coast Artillery a trained reserve for the Field Artillery. It was also necessary to provide artillery garrisons for the coast defenses then building. The 1st, 2nd, 3rd, and 4th Regiments of Artillery date from the Act of March 2, 1821. Each regiment consisted of one light and eight foot companies. For the sake of clearness we shall refer to the foot artillery throughout this paper as the Coast Artillery, although it is the last of several terms that have been applied to the unmounted artillery. In accordance with the plan of Mr. Calhoun, (Historical Sketch of the Artillery, United States Army, Birkhimer, p. 132.) the Coast Artillery from 1821 to 1907 was a field artillery reserve which served in the coast defenses in time of peace, and in war when the country was threatened with oversea invasion; the mounted companies were schools of instruction for artillery subalterns; and the personnel serving in the coast defenses was instructed in siege and field artillery service. Small arms being a necessary part of the equipment of soldiers serving in fortresses, the Coast Artillery would also form a small but useful reserve for the regular infantry upon proper occasion.

For economical reasons no companies were mounted for seventeen years after the passage of the Act, the chief distinction between the light and coast companies being that the light companies had bugles, while the coast companies had fifes and drums. (G. O. 38, 1825.) Mr. Calhoun's plan for using the mounted companies as schools of instruction for artillery subalterns was not put into operation until twenty years after the reorganization. The plan was interrupted by the Mexican War but was revived on the return of the army from Mexico. After various changes the tour of duty of subalterns was fixed at two years; the number of subalterns was established at one second and two first lieutenants. The first lieutenants were relieved upon alternate years so as to secure constantly with each company at least one instructed subaltern. The service of captains with each branch was intended to be permanent, but unfortunately there was no statutory separation between the two branches for captains and higher officers, and captains were transferred from one branch to the other; and neither branch was given the tactical formation required for its particular duties.

Much confusion has arisen from a failure to understand Mr. Calhoun's plan. As the Coast Artillery was a partially trained reserve for

the field artillery, it was desirable, of course, to pass all coast artillery officers, while they were subalterns, through the field batteries. There was no similar reason, however, for training field artillery officers in coast artillery service, since the Field Artillery was not a coast artillery reserve. In practice, however, all artillery officers saw service with both branches, and captains were most unwisely transferred from one branch to the other. Hence the conclusion was drawn that the government was trying not only to make field artillerymen out of coast artillery officers; but it was also trying to make coast artillery experts out of field artillerymen.

We shall see that Mr. Calhoun's plan has been fully justified by the experience of ninety years. Its wisdom was thoroughly appreciated in 1861 when the government was compelled to raise an army of a million men and supply it with field artillery. His great principle of using fortress troops as a reserve for the field army has been adopted quite recently abroad. England, Germany, Japan, France, and Austria-Hungary have made siege or heavy field artillery out of their garrison artillery. (Siege Howitzer's Sphere of Action, Streffleur's Militarische Zeitschiff, July, 1907; translation in Journal of Royal Artillery, November, 1907.) Twice within fourteen years, in the wars with China and Russia, the Japanese Coast Artillery was converted into Siege Artillery. This branch of the service is now completely supplied with siege and "lighter guns * * * to be made use of when quick work is desired," and the greater part of the units are supplied with horses. (Journal of the U. S. Artillery, Jan.-Feb., 1909, p. 77.).

THE COAST ARTILLERY SERVES AS INFANTRY, CAVALRY, AND FIELD ARTILLERY IN THE SEMINOLE WAR

Practically all of the artillery was drawn into the field early in the Seminole War. This war began with the massacre of detachments of the 2nd and 3rd Artillery and the 4th Infantry under the command of Major Dade of the 4th Infantry while marching from Fort Brooke to Fort King, Florida, on the 28th of December, 1835. Only three men escaped out of a force of 110 officers and men. "There were no prisoners put to death," says Benton, who was not a friendly critic of the army, "for no man surrendered. There were no fugitives slain in vain attempts at flight; for no one fled. All stood, and fought, and fell in their places, returning blow for blow while life lasted. It was the death of soldiers, showing their steadiness in defeat which is above courage in victory." (Benton, Vol. II, p. 71.)

The garrison in Florida at this time consisted of nine companies of artillery and two companies of infantry. On the day following the massacre General Clinch took the field with five companies of artillery, one company of infantry, and some volunteers and on the last day of December defeated the Indians in an engagement at Withlacoochie in

which he lost 57 killed and wounded out of 200 regulars engaged. (Upton, pp. 162 and 163; Heitman, Vol. II, p. 394; Ex. Doc. No. 1, 1848, p. 167.)

THE COAST ARTILLERY SERVES AS FIELD ARTILLERY AND INFANTRY—BUT MAINLY AS INFANTRY IN THE MEXICAN WAR

The number of companies in a regiment of artillery was increased in the Seminole War from nine to ten. This number was increased to twelve in the Mexican War. At the time of Scott's campaign in the Valley of Mexico there were therefore 48 companies of regular artillery. Company C, 3rd Artillery (Ringgold's Battery), had been mounted as horse artillery in 1838 in accordance with the Act of March 2, 1821, which authorized the equipment of one company in each artillery regiment as field artillery. This was the first company mounted under the provisions of that act. In 1839 three other companies were equipped as field companies: K of the 1st, A of the 2nd, and B of the 4th. In the summer of 1845, Company E, 3rd Artillery, Lieut. Braxton Bragg commanding, stationed at Charleston, South Carolina, was equipped with two guns and two howitzers and, together with A of the Second, C of the Third, and B of the Fourth soon joined Taylor's army. (Birkhimer, pp. 54-63.) The mounting of Bragg's company as a "light company" was without authorization of law and was evidently considered as a bold innovation. We shall see that Mr. Lincoln was not limited by similar scruples. By the Act of March 3, 1847, Congress provided for mounting four more companies. This legalized the service as field artillery of E of the Third; in addition I of the First, M of the second, and G of the Fourth were mounted. (Birkhimer, p. 63.)

In the summer of 1845 President Polk ordered the four light batteries previously mentioned, 1 regiment of cavalry, and 5 regiments of infantry under General Z. Taylor to the western frontier of Texas in anticipation of trouble with Mexico. About the 1st of September twelve additional companies of artillery were ordered to join Taylor to serve "as infantry or with batteries" according "to the requirements of the service in the field." (Ex. Doc. No. 60, 1848, pp. 103, 470, 642.) The sixteen companies of artillery with Taylor numbered 923 officers and men in November, 1845. (The Mexican War, Mansfield, p. 20.) In May, 1846, after hostilities had begun, four additional companies, C, F, H, and K, 1st Artillery, joined Taylor. Beginning with the Battle of Palo Alto, May 8, 1846, and until after the capture of Monterey in September, an artillery battalion varying in number from 8 to 12 companies, served as infantry, under Brevet Lieutenant Colonel Thomas Childs, 1st Artillery. The remaining companies were variously employed. Thus at Palo Alto and Resaca de la Palma, a company of the 3rd Artillery under Lieut. W. H. Churchill manned two 18-pounder

iron guns drawn by oxen. (Memoirs of U. S. Grant, Ch. III.) Churchill's guns, by their superior weight and greater range, overmatched the Mexican guns; they completely surprised the Mexicans, and carried havoc into their ranks, and even to the reserves and trains in rear. (History of the Mexican War, Wilcox, p. 58.) At this time A of the First and G of the Fourth garrisoned Point Isabel; and Light Battery E of the Third*, Company I of the Second, and the 7th Infantry garrisoned Fort Brown opposite Matamoras which was besieged in the absence of General Taylor. Company I manned four 18-pounders which fired hot shot into Matamoras during the siege. In July Taylor ordered K of the First, which had joined in May as a foot company, to be mounted as a light battery, and Company C of the First to be mounted as a heavy gun battery. In the attack on Monterey Company C manned two 24-pounder howitzers and a 10-inch mortar. (Ex. Doc. No. 60, p. 494; Haskin, p. 84; Mansfield, p. 60.)

In June 1846 five companies of artillery were ordered to Mexico, from Rhode Island, New York, Virginia, and South Carolina; seven were ordered in September; and three or four more in November. These companies were eventually concentrated at Tampico for Scott's expedition. They were joined during the winter by others ordered from the Atlantic and Gulf ports and by all the regular troops in Taylor's army except parts of the 1st and 2nd Dragoons and several companies of artillery. A of the First remained at Brazos; E of the First at the Citadel of Monterey; C of the First garrisoned a redoubt at Saltillo; and light batteries C and E of the Third and G of the Fourth were with Taylor's advance troops. E of the First was hastily equipped with two 18-pounders and two brass 8-pounders (Mexican guns) and was rushed forward from Monterey when Santa Anna advanced on Taylor in February, 1847; C of the First assisted in repulsing an attack on Saltillo during the Battle of Buena Vista and in pursuing the retreating Mexicans. General Taylor was so pleased with the services of the light artillery at Buena Vista that he "deemed it no more than just to mention all the subaltern officers" in his report in addition to Major Monroe, his Chief of Artillery, and his three battery commanders, Captains Washington, W. T. Sherman, and Bragg.

Major General Winfield Scott landed at Vera Cruz, March 9, 1847; he besieged and bombarded the city and took it on the 29th of March; after winning the battle of Cerro Gordo on April 18th and experiencing a long delay for reinforcements at Puebla, the old general marched on the City of Mexico, stormed its defenses against greatly superior forces,

* The officers on duty with this company were 1st Lieutenants Braxton Bragg, George H. Thomas and 2nd Lieutenant J. F. Reynolds, all of the 3rd Artillery. Bragg and Thomas became famous in the Civil War as commanders of opposing armies and Reynolds was killed at Gettysburg as a corps commander in the Union Army.

and, after severe fighting, effected an entrance in the night of September 13-14, 1847.

A brief outline of the services of two companies of the First Artillery will give a conception of the varied character of the duty required of the artillery in Scott's campaign. Company G of this regiment left Pensacola on the 1st of February, 1847; it was shipwrecked that same night on Chandileur Island, losing no lives, but saving only such property as was washed ashore; it was rescued by a fishing smack and finally reached Vera Cruz on April 11th; on the 13th it set out to join the army acting as infantry escort to the Ordnance siege train; it manned part of this siege train in the Battle of Cerro Gordo on the 18th; it joined the regiment as an infantry company after this battle and participated as infantry in all of the battles around the City of Mexico; it started back to Vera Cruz on December 9th as escort to a wagon train; it arrived at Vera Cruz on the 23rd and was assigned as part of the garrison of Fort Concepcion.

In the siege of Vera Cruz Battery I, First Artillery, manned a battery of 24-pounder siege guns; it charged up the hill at Cerro Gordo as infantry; and was mounted as field artillery at Jalapa after that battle. The following account of the mounting of this company is given by a corporal serving with the company: "We had got as our captain, * * * * a dashing sort of fellow called Captain Magruder, who being particularly distinguished for his skill in light artillery maneuvers, got charge of two twelve-pounder guns; our company was thus converted into horse artillery, and had charge of a battery. We therefore gave our muskets into the charge of the Ordnance Department, and received in exchange about forty of the quartermaster's best horses, for which a number of Mexican saddlers were immediately employed in altering and fitting harness, and in a few days we were fully equipped as mounted artillery. Our battery, which was principally for the purpose of being used on the march, as it was expected that the enemy would oppose us at some of the mountain passes between Jalapa and Puebla, consisted of two twelve-pounder brass guns, and a small brass howitzer." At Puebla this armament was exchanged for two 6-pounder field pieces and two 12-pounder howitzers. The men were armed with sabers. (Adventures in the U. S. Army during the Mexican War by an English Soldier, pp. 215, 234, 262.) At Contreras Company I had ten horses killed and three pieces disabled; its first lieutenant, J. P. Johnstone was killed; the conduct of its second lieutenant, T. J. Jackson (Stonewall), "was conspicuous throughout the day." The battery was rehabilitated by evening of the following day and took part in the later battles around the city in one of which the captain was wounded. (Haskin, pp. 95—120.)

Other companies and detachments were, upon occasion, equipped as field artillery. About three-fourths of the artillery, however, served as

infantry in Scott's army. While this was the case, a siege train and a howitzer and a rocket battery, officered and manned by the Ordnance Department were serving against the enemy. "This," says Birkhimer, "the artillery arm felt to be a deep wrong. It seemed strangely inconsistent then, and no less so now, that a branch of the service which had maintained that its exclusive function was to manufacture material, whose enlisted men were designated in the law as mechanics, should seek to exclude from its duties in the field a combatant arm of the service, and to appropriate those duties to itself." (Birkhimer, p. 201.) In his annual report dated November 30, 1847, the Adjutant General of the Army, adverting to this subject, made the following remarks: "It may not be irrelevant to state in this place that, while probably not more than ten companies of the four regular artillery regiments are serving with their appropriate arm—the other thirty-eight companies are armed and equipped as infantry—there are two batteries with the main army in Mexico served by ordnance men (with several officers) and one by the Maryland and District of Columbia volunteers. The men of the Ordnance Department are enlisted as artisans and laborers, and receive a higher rate of pay than is allowed by law to soldiers of the light artillery. At the last session of Congress an increase of the Ordnance Corps was authorized, because the number of officers was deemed inadequate to the wants of that branch of the service. It would seem, therefore, peculiarly proper to confine officers of the Ordnance to the defined objects of that department. * * * Economy as well as military propriety requires that all the harnessed batteries be transferred to the artillery; and it is respectfully recommended that the transfer be directed accordingly. No corps in the service has been more distinguished than the artillery, and they are justly entitled to be equipped with the arm which they have proved themselves capable of using so efficiently against the enemy." (Birkhimer, p. 205.)

THE FIELD ARTILLERY BETWEEN THE MEXICAN AND CIVIL WARS

In the interval between the close of the Mexican and the beginning of the Civil War, the number of mounted companies varied from two to eight. K of the 1st Artillery was the only company that was not at some time dismounted; it was given a field equipment after its return from Mexico and has kept it ever since. During this period of thirteen years, A of the 2nd, C of the 3rd, and B of the 4th were each dismounted and remounted once; I of the 1st and E of the 3rd were dismounted and remounted twice; G of the 4th was dismounted three times and remounted twice; while M of the 2nd was three times dismounted and again remounted. (Birkhimer, p. 134.) There were seven mounted companies at the beginning of the year 1861.

Company C, 3rd Artillery, was mounted as horse artillery in 1838;

served as such in the Mexican War where it became famous under its captain, Braxton Bragg; it marched to Sante Fe, New Mexico, after the war where it was for a time converted into a troop of cavalry; it returned to Jefferson Barracks in 1850 where it was rehabilitated as field artillery, but this time as light, not horse artillery; it was dismounted in 1856 and mounted again in 1858 for service in Utah. Thus in a period of twenty years, this organization served as coast artillery, horse artillery, cavalry, and light artillery according to the exigencies of the service. It was again converted into horse artillery in 1861. (Birkhimer, pp. 67, 68.)

THE COAST DEFENSES IN 1860

At the beginning of the Civil War the Third System of Coast Defenses, begun in 1816, was well advanced towards completion. The term First System of Coast Defenses, was applied to the small protective works supplied to most of the ports on the Atlantic and Gulf after the breaking out of the French Revolution in 1789. The Second System comprised "small and weak" batteries provided prior to the War of 1812 for all towns of any magnitude on the coast. "Being built," says Colonel Totten, "for the sake of present economy, of cheap materials and workmanship, they were very perishable." The war with England being over, the government promptly entered upon a permanent system of coast defense. The names of General Bernard and Colonel Totten of the Engineers are indelibly connected with this system. In a report which these officers made in 1826, they stated "That the total expense of completely fortifying the maritime frontier will amount to $16,537,454.68; the troops necessary to guard these fortifications in peace to 3,911 men, at most, and 33,842 men in time of war, supposing them all, which cannot happen, besieged at once." (Fortifications of the United States, 1862, House Report No. 86, 37th Congress, pp. 2, 49.) This scheme was modified from time to time as conditions changed and the maritime frontiers were increased by territorial acquisitions. It is worthy of note that in those days of slow firing guns, 100 rounds of ammunition per gun were deemed necessary. The most important works were either completed or in condition to be completed within one year after appropriations were available. Most readers will be familiar with the following names of works which were practically completed at that time: Preble, Constitution, Warren, Adams, Trumbull, Schuyler, Hamilton, McHenry, Washington, Moultrie, Sumter, Pickens, Barrancas, Morgan, and Monroe. (Ibid. pp. 330—339.)

The old works at Fort Monroe are a good type of the more elaborate defenses of the Third System. It is a tradition of the Engineer Department that the plan of Fort Monroe was designed by General Simon Bernard, who had been a personal aide of Napoleon. He was appointed an assistant engineer in 1816 with the pay and emoluments of a briga-

dier general; he resigned in 1831 and became a lieutenant general of engineers and Minister of War in the reign of Louis Philippe. If we had gone to war with France in 1836, during President Jackson's administration, the French Minister of War would, in all probability, have been the able man who had taken such an important part in designing our system of coast defenses. Fort Monroe was begun in 1817 on a site which Lord Cornwallis had examined in person with a view to establishing a strong British post and had rejected in favor of Yorktown. From early in 1822 until February, 1824, all able bodied soldiers sentenced at the different posts on the Atlantic coast to hard labor for periods exceeding six months were put to work on Fort Monroe. At one time nearly 200 convicts were thus employed. (Memo., A. G. O., Oct. 25, 1875, in relation to Fort Monroe.) In 1851 the sum of $2,402,471 had been expended for construction and repair and $75,000 were required to complete the works; total number of guns—371; garrison in peace—two companies; garrison in war—2,450 men; estimated cost of armament and 100 rounds of ammunition—$335,210. (Fortifications of the U. S., 1862, p. 332.) The post was first occupied in 1823 by Company G, 3rd Artillery. In February, 1824, its garrison was increased by the arrival of Companies C, D, and I, 4th Artillery. About this time a School of Practice for Artillerists was established there. (Memo. A. G. O., 1875.)

STATIONS OF THE ARTILLERY EARLY IN 1861

At the beginning of the year 1861 the First Artillery garrisoned the Southern and Gulf forts; E and H and eight men of the regimental band garrisoned Fort Sumter. Four of the five artillery officers on duty with this command became general officers—Anderson, Doubleday, Jefferson C. Davis, and Seymour, and the fifth, Norman J. Hall, as Colonel of the 7th Michigan, led the party of volunteers that crossed the Rappahannock in boats in the face of Lee's army at Fredericksburg to cover the building of the bridges in December, 1862. G of the First occupied Fort Pickens; B, Fort Taylor at Key West; D, Baton Rouge Barracks, Louisiana; M, Fort Brown, Texas; F, L, and Light Battery K, Fort Duncan at Eagle Pass, Texas; I, Fort Leavenworth; C, Fort Monroe. As the gathering storm came on the Baton Rouge garrison escaped to the north end and occupied Fort Washington on the Potomac the day the news came of the firing on Fort Sumter. The Texas garrisons were sent to reinforce Fort Taylor at Key West and Fort Jefferson, an important work on Dry Tortugas built for 298 guns and a garrison of 1500 men. This fine regiment furnished 40 general officers, 28 to the Federal and 12 to the Confederate service.

The Second Artillery was in New York, New England, and along the Lakes. C of the Second was sent to Fort Jefferson in January, while K and M and light batteries A and H arrived at Fort Pickens in

April. The Third Artillery was on the Pacific Coast, except F and K which were at Fort Monroe; the Fourth Artillery was on frontier duty with headquarters at Fort Randal, Dakota Territory. (The Army in the Civil War, Major John C. White, Military Service Institution Journal, No. 164, March and April, 1911, pp. 277—298.)

VALUABLE RESERVE OF FIELD ARTILLERY OFFICERS AVAILABLE IN 1861

The attention given to the subject of field artillery instruction subsequent to the Mexican War, and the strenuous efforts of Lieutenant General Scott, an old artillery officer, to keep the eight organizations mounted, bore fruit in the Civil War in the number of officers of the regular artillery who were acquainted with the rudiments, at least, of field artillery duty. This reserve of officers was invaluable in the emergency that had arisen. (Birkhimer, p. 206) In his report McClellan says: "The creation of an adequate artillery establishment was a formidable undertaking, and had it not been that the country possessed in the regular service a body of accomplished energetic artillery officers, the task would almost have been hopeless." (Birkhimer, p. 81.)

FIFTY-SIX OUT OF SIXTY COMPANIES OF ARTILLERY SERVE AS LIGHT AND HORSE ARTILLERY IN THE CIVIL WAR.

Soon after the attack on Fort Sumter, the 5th Artillery was created, by executive order, as a field artillery regiment. The importance of placing on a field artillery footing every company of the four old regiments that could by any means be made available was quickly appreciated; and as the enemy was not a maritime power, it was easy and reasonable to take practically all of the companies from the coast defenses. On the 23rd of August, General William F. Barry, chief of artillery of the Army of the Potomac, addressed General McClellan on this subject as follows:

"To insure success it is of vital importance that the Army of the Potomac should have an overwhelming force of artillery. To render this the most effective, the batteries should, as far as practicable, consist of regular troops. With every disposition to do their best, the volunteer artillery do not possess the knowledge or experience requisite for thoroughly efficient service. I would therefore recommend that companies of regular artillery may be withdrawn from many of the forts on the Atlantic and Pacific sea-boards and ordered to this point (Washington, D. C.) at as early a date as practicable, to be mounted as field artillery."

A few days later, the commanding general urgently appealed to the Secretary of War to send the 3rd Artillery from the Pacific coast, and to give him half the companies forming the late Artillery School at Fort

Monroe. He followed it up later with the recommendation "that the whole regular artillery, old and new, be ordered to report here (Washington), excepting the mounted batteries actually serving in other departments, and the minimum number of companies actually necessary to form the nucleus of the garrisons of our most important permanent works." These recommendations had the effect to bring into the Army of the Potomac, as field batteries, twenty-nine of the sixty companies that now constituted the regular artillery of the United States. (Birkhimer, pp. 69, 93.) There were at least twenty-eight regular batteries credited with service at Gettysburg. Only four companies remained in the permanent works, H and K of the 2nd Artillery and B and D of the 3rd Artillery. B and D, 3rd Artillery, remained on the Pacific Coast throughout the war; H, 2nd Artillery, was, as a matter of fact, mounted before hostilities began but was sent to Fort Pickens, as we have seen, in April, 1861, leaving its horses behind. H and K were in action in the successful defense of Fort Pickens. (Major White, M. S. I. J., No. 164, pp. 294 and 297, and No. 165, p. 475.) The remaining fifty-six companies served as field artillery and of these about twenty were horse batteries. In some instances two and even three distinct organizations were united to form a complete battery.

Practically all of the horse artillery was of the regular service. Some time in the fall of 1861, Tidball's company, A of the 2nd, was equipped as horse artillery at Washington, the first company of horse artillery in the army since Bragg's company was dismounted at Santa Fe after the Mexican War. This was soon followed by M of the Second, and in March, 1862, by B—L of the Second (consolidated for want of men), and C of the Third. The number of horse batteries had been doubled at the date of the Battle of Chancellorsville, May 2, 1863. After this battle the horse batteries of the Army of the Potomac were organized into two brigades, that they might alternate campaigning with the various cavalry commands. At the beginning of the Wilderness campaign a year later, the First Brigade consisted of the NewYork Light Artillery, B—L, D, and M of the Second, and A and C—E of the Fourth; the Second Brigade, E—G, H—L, and K of the First, A and G of the Second, and C, F, and K of the Third Artillery. (Birkhimer, p. 70.)

THE STATE REGIMENTS OF HEAVY ARTILLERY SERVE THE SIEGE TRAINS AND MAN THE COAST DEFENSES

The regulars took little part in siege operations with the heavy calibres. This duty was performed mainly by the state regiments of heavy artillery. In the Army of the Potomac the important batteries of siege guns were served by the First Regiment of Connecticut Artillery. Large siege trains were brought into use in the campaigns of 1862 and 1864 and two batteries of siege guns accompanied the Army of the Potomac in the campaigns of 1863. Eight Cohorn mortars and many 8-inch and

10-inch mortars accompanied the army in 1864 and were brought into effective use at Cold Harbor and again before Petersburg where 13-inch mortars weighing 17,000 pounds were used. (Major White, M. S. I. J., No. 164, pp. 279-281; 1st Lieut. Henry J. Reilly, Fifth Artillery, JOURNAL U. S. ARTILLERY, Jan., 1894, p. 22.) As the coast artillery companies were withdrawn from the coast defenses, their places were likewise taken by the state regiments of heavy artillery. As an instance the garrison of Fort Monroe averaged about one regiment of heavy artillery, say one thousand men.

SERVICE OF THE ARTILLERY BETWEEN THE CIVIL AND SPANISH WARS

About two and a half months after Mr. Lincoln directed that the 5th Artillery be raised, Congress passed a law legalizing his action. This law designated as "batteries" the tactical units of this regiment. This was the first time that the term "battery" had been used in the law, although for several years the term "light battery" and "light company" had been treated as synonymous in orders from the headquarters of the army. The term "Field Artillery" does not appear in the act. The personnel of the battery therein described was, with slight modification, that which had been fixed for field artillery in the authorized manuals for that arm. The act of July 28, 1866, directed that thereafter the organizations of the four old regiments should be similar to that of the Fifth. The designations of their tactical units, "companies," were thereby changed to "batteries," each of which, like the batteries of the Fifth, was eligible for equipment as field artillery. A general dismounting of both regular and volunteer batteries had begun within a few days after the last Confederate army had surrendered on the 26th of May, 1865. In September a general order designated the following units as field batteries: I and K of the First; A and M of the Second; C and E of the Third; B and G of the Fourth; and F and G of the Fifth. In 1869, I of the First, M of the Second, E of the Third, G of the Fourth, and G of the Fifth were dismounted. L of the Second was equipped as field artillery from February, 1878, until October, 1880, when its equipment was transferred to F of the Second. The following batteries were designated as additional light batteries by General Orders 96, Adjutant General's Office, August 15, 1882: E of the First, F of the Second, F of the Third, F of the Fourth, and D of the Fifth. (Birkhimer, pp. 71—74, 369.) The following were equipped as light artillery at the beginning of the Spanish War: E and K of the First, A and F of the Second, C and F of the Third, B and F of the Fourth, and D and F of the Fifth.

Notwithstanding Mr. Monroe's prediction that the Third System of Coast Defenses would be permanent, these defenses became practically obsolete shortly after the close of the Civil War, owing to the improvements in rifled ordnance and in ships' armor. The coast guns were neg-

lected, because they were obsolete; the Coast Artillery practically became an infantry force; and the new siege material, instead of being placed in the hands of coast companies, or batteries as they were called, was stored in arsenals. The wise rule of Mr. Calhoun looking to the formation of a reserve of field artillery officers was followed, however, and nearly all subalterns of artillery served tours of duty with the Field Artillery. When the Coast Artillery began to man the new rifled mortar and gun batteries in the early nineties, interest in coast defense began to revive, but a conviction began to prevail that the future service of the Coast Artillery would be entirely in the coast defenses. Based upon this idea, serious proposals were made to transfer the Coast Artillery, Mr. Calhoun's field artillery reserve, to the Navy. Discussions on this topic were interrupted by the Spanish War.

THE COAST ARTILLERY SERVES AS SIEGE ARTILLERY IN THE SPANISH WAR AND AS INFANTRY IN THE SPANISH WAR, PHILIPPINE INSURRECTION, AND CHINA EXPEDITION

The artillery was increased by two regiments, the 6th and 7th, immediately before the Spanish War broke out, organized as were the five old regiments; so that there were now 70 coast companies or batteries and 14 field batteries.

A battalion of the 3rd Artillery serving on the Pacific Coast was sent to the Philippines in the first expedition and participated in the capture of Manila and the suppression of the Philippine Insurrection. "Probably the largest companies that ever saw service in the United States Army," says Captain Bernard Sharp of the 3rd Infantry, "were the batteries of the 3rd Artillery battalion which went to the Philippines in 1898 as infantry. These batteries left the States in June with 200 men each and at the beginning of the insurrection took the field with about 150 men each, or a total of about 600, under three Civil War veterans and five second lieutenants. The battalion was the backbone of the Malolos expedition. In one short campaign the batteries lost in action from 15 to 30 per cent but the morale remained intact."

Long before Cervera's fleet was bottled up at Santiago, coast companies were drawn from the Atlantic Coast defenses and concentrated in Tampa, Florida, to organize a siege train for service in Cuba.

"Upon the declaration of war with Spain," says Captain G. N. Whistler who commanded one of these companies, "the service was entirely without any organized siege artillery. No siege train or batteries had been maintained, nor had any modern siege guns been issued to the troops for practice or drill.

"In the olden days each artillery post had at least a battery of siege guns, generally consisting of guns, howitzers, and mortars, with the

proper complement of platforms, mortar wagons, and implements for mechanical maneuver.

"All heavy batteries in the service had more or less instruction and practice with this armament.

"After these guns became obsolete and the carriages useless the Ordnance Department constructed a number of siege guns and mortars after the most approved foreign models, and only lately completed six 7-inch siege mortars and beds.

"These guns were never issued to the troops, and the artillery had had no experience with this armament and no practice with the guns.

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"Four batteries of artillery that had had no experience with modern siege artillery, most of whom had never seen a modern siege gun, were assembled at Camp Rodgers, Tampa, Florida. The greatest strength of any battery was sixty men. This number was increased within about thirty days to 200, giving each organization about 140 perfectly green recruits. Two of these batteries were soon ordered to Cuba, leaving two batteries (M and K, 5th Artillery), to organize, assemble, and prepare this train for foreign service, to train green horses, drill and instruct perfectly raw recruits in the duties of a soldier, infantry drill and riding, and to teach green horses to work together in the hands of green drivers. In addition to this, ammunition had to be prepared, shells to be filled, and the entire train prepared for service in Cuba.

"Soon afterward several more batteries joined the train, which were recruited to the maximum strength.

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"My experience at Camp Rodgers taught me that any seacoast battery can pick up the artillery work of a siege train very quickly.

"The chief difficulty we had to contend with at Tampa was in training horses. With green horses in the hands of green drivers, I am of the opinion that it would take at least two months to begin to get into working trim. If we are to have and use siege artillery, some plan must be devised by means of which we can instruct our drivers during the time of peace and have a sufficient number of trained drivers in siege artillery work at the breaking out of war." (Siege Artillery, Captain G. N. Whistler, 5th Artillery, JOURNAL U. S. ARTILLERY, September-October, 1899, pp. 119, 130.)

"Everything in the way of supplies," says Lieutenant E. W. Hubbard who was adjutant of the camp, "had to be drawn from the depots in Tampa, and a good portion of the time of officers was devoted to getting their men equipped, getting artillery equipment, and supplies of all kinds, etc. * * * To procure the smallest allowance of equipment, it was necessary for an officer of the battery to go to the issuing officer [in Tampa] and procure what he could get or get his share of what had arrived the day previous.

"In carriages the lack of interchangeability of parts caused much trouble and annoyance. The guns and carriages seemed to have been assembled separately, and expert mechanics had to be employed in the field to assemble and fit regular parts, elevating arcs, etc.; work which should have been done at the arsenal and which was here performed under great difficulties. This only emphasizes the necessity of keeping at least a portion of our siege artillery equipped and in practice all the time." (Siege Artillery Train at Tampa, 1st Lieutenant E. W. Hubbard, 7th Artillery, JOURNAL U. S. ARTILLERY, March-April, 1900, p. 149.)

The collapse of the Spanish resistance almost immediately after the destruction of Cervera's fleet prevented a more extensive use of the Coast Artillery in the field which would naturally have followed the destruction of the Spanish Navy. After the Proctocol was signed, the 2nd Artillery was sent to Cuba as a part of the army of occupation; the 6th Artillery was sent somewhat later to the Philippines; and in 1900 another battalion of the 3rd Artillery participated as infantry in the China expedition and later saw service in the Philippines. Had the Spaniards made a stout resistance in Cuba, such as we expected, it is certain that practically all of the Coast Artillery, except that in the Philippines, would have seen service in the siege of Havana, either as siege artillery or infantry.

ORGANIZATION OF THE ARTILLERY CORPS IN 1901

By the Act of March 2, 1899, the strength of the artillery regiments was increased to 14 batteries; by the Act of February 2, 1901, the regimental organizations were abolished and an Artillery Corps consisting of 126 coast companies and 30 field batteries was substituted.

Now indeed would have been the time to carry out in full the spirit of Mr. Calhoun's plan by correcting defects in the law and reforming certain abuses that had crept into the administration of the law. Recent experience in the Spanish War had shown the great value of coast artillery as a field artillery reserve and the necessity for the instruction of the coast artillery companies and of all coast artillery officers in the duties of field artillery. The separation of the captains and field officers of the field and coast should have been made complete by statute and the field artillery should have been given a regimental organization. The field artillery regiments should have been made schools of instruction for all artillery subalterns who should have been continued upon a single list. As the Field Artillery was not a reserve for the Coast Artillery, captains of Field Artillery should have been relieved from passing examinations for promotion in coast artillery subjects. On the other hand the instruction of all grades of Coast Artillery for their duties as a field artillery reserve should have been clearly defined and made a requirement by law.

SEPARATION OF THE FIELD AND COAST ARTILLERY IN 1907

Meanwhile a school of thought had grown up in our service and waxed strong which favored confining the service of the Coast Artillery to the coast defenses. The extreme adherents of this school would have taken the rifle from the hands of the coast artilleryman, as a useless encumbrance, forgetful of the fact that the coast artilleryman is sure to need a small arm for personal defense in case serious attempts are made to capture coast batteries. This school carried all before it in the years following the Spanish War when all the energy of the Coast Artillery was absorbed in developing the capabilities of the new coast defense material; and, as a result, the laws on our statute books in 1912 divorced the Coast Artillery from all duties with the field army, as far as it was possible to do so without introducing absolute prohibition into the laws. By the Act of January 25, 1907, the Coast Artillery was separated from the Field Artillery and the Field Artillery was given its long needed regimental organization; the Coast Artillery Corps of 170 companies was created and the Field Artillery was organized into six regiments of six batteries each. All drills with field and siege armament ceased in the coast artillery and infantry instruction was reduced to a minimum.

When this separation was consummated, the units of the 1st Artillery had taken part in 133 engagements, great and small, the long siege of Petersburg being counted as a single engagement; 7 were in the War of 1812; 11 in the Seminole War; 12 in the Mexican War; 6 in Texas and Florida between 1856 and 1859; and 97 in the Civil War. Of these only four were coast defense actions, one at Fort Sumter and three at Fort Pickens. (Haskin, p. 571.) Is it impossible to believe that the general causes which were responsible for the participation of this regiment in so many field actions had ceased to operate?

THE EFFECT OF THE COMMAND OF THE SEA UPON THE NECESSITY OF MAINTAINING GARRISONS OF THE REGULAR COAST ARTILLERY IN THE COAST DEFENSES

There are three distinct aspects with reference to the command of the sea under which the service in war of the Coast Artillery must be considered: 1. When the command of the sea is doubtful. 2. When our navy has such command of the sea that we may undertake oversea invasion. 3. When the enemy's navy has such command of the sea that he may undertake oversea invasion.

1. When the command of the sea is doubtful, our ports are liable to attack and the coast defenses require maximum garrisons of Coast Artillery as well as protection on the land fronts when they are so badly placed as to have land fronts. This protection will be furnished by the field army which cannot leave the country until our navy has gained command of the sea.

2. If the enemy be a minor power unable to dispute command of the sea, or if our navy obtains the mastery after a contest, the major part of the Coast Artillery, and all seasoned troops of the field army will be available for service abroad. Every trained soldier that can be obtained from any source will be used for oversea invasion. The naval powers able to dispute the command of the sea with us have military forces sufficient to defeat attempts at oversea invasion of their home territory; but the vast armies of these great powers can do nothing to protect their distant possessions when their fleets have lost command of the sea. The experience of our wars with Mexico and Spain would not furnish a bad index as to the use that would probably be made of the Coast Artillery for oversea invasion. This arm may expect to serve in varying proportion as heavy artillery, and infantry.

3. If, contrary to expectation, the enemy should secure command of the sea, either on the Atlantic or on the Pacific, we might be confronted with an invasion of our own territory. We believe, with Mr. Lincoln, that no combination of foreign armies could, by force, take a drink from the Ohio, or make a track on the Blue Ridge or on Pike's Peak, in a trial of a thousand years. Granting, however, that the enemy should be able to effect an invasion of our territory and capture a number of our important coast cities with their coast defenses, our land forces would be opposed to a foe occupying contiguous territory as was the case in the Civil War. We would bring great armies into the field and the Coast Artillery would furnish the best personnel out of which to improvise a large force of field artillery. The coast defenses outside the immediate theater of war would be gradually occupied, as in the Civil War, by state coast artillery troops.

DANGER OF INTERVENTION OF THIRD POWERS WHILE THE COAST ARTILLERY IS ABSENT FROM THE COAST DEFENSES

A study of our national history and of the history of other nations discloses the fact that a country is never in greater danger of attack by foreign powers than when its forces are already engaged with foreign or domestic enemies. This tendency to take advantage of a neighbor's embarrassments caused England, at the time of the Trent affair, to reverse her views upon the rights of belligerents at sea; it accounts for Russia's violation of the neutrality of the Black Sea during the Franco-German War; and has been signally illustrated many times within the last decade.

But all of this well-labored theory founded on the supposed danger of foreign intervention is annihilated by a single fact now too well appreciated to admit of any doubt, and of too decisive a nature to leave room for any argument. The Coast Artillery will be ordered out as a field force in troublous times by the administration in office whenever it

is not restrained from doing so by imminent danger of oversea attack. The administration itself, be it remembered, is responsible for our foreign relations; it is the best judge of the danger of foreign aggression; and it is accountable for the economical and efficient use of our armed forces. The Coast Artillery unsupported by a field force could not, in any of the instances we have cited, have carried on a war with the enemy's navy; conditions with reference to the command of the sea which tie the Coast artillery to the coast defenses, operate in almost equal measure to tie the field force to the defense of the coast line. It is a significant fact, which should not be overlooked, that the longer a war lasts, the better becomes the preparedness of the United States to meet oversea invasion.

THE COAST ARTILLERY SERVES AS INFANTRY ON THE MEXICAN FRONTIER IN 1911

A rapid and complete revulsion of opinion soon followed the separation of 1907. This may be seen not only in current literature, but also in War Department orders and regulations. The Field Service Regulations of 1910 require that the Coast Artillery be instructed in the management of siege and heavy field artillery and War Department orders now require infantry field exercises, heavy artillery instruction for designated organizations, and firing with such field guns as may be at posts.

The conditions under which three provisional regiments of Coast Artillery were mobilized as infantry on the Mexican frontier in 1911 need not be recalled to readers. Let it suffice to say that this was a logical use of the Coast Artillery. There was no danger of an attack from abroad requiring the service of the Coast Artillery in the coast defenses and the need for infantry was greater than for field artillery.

SUMMARY AND CONCLUSION

In minor wars and disturbances the Coast Artillery has been used in the field chiefly as infantry. In the only great war that we have had (up to 1912) its field service was entirely as light and horse artillery. As the wars have increased in magnitude the proportion used as field artillery has increased, and the proportion used as infantry has decreased. In a minor war practically all of the Coast Artillery may be called upon to serve as infantry in a difficult country where little field artillery can be used; in a great war where much field artillery is needed, practically all of the Coast Artillery may be required to serve as field artillery.

We therefore believe that all of the Coast Artillery should be trained as infantry. In addition each company of Coast Artillery, should be trained as some form of field artillery. Those who accept these conclusions should accept the logical consequence and acquiesce in the measures necessary for the instruction of the Coast Artillery for field service.

Intelligence

A Lecture by Lieut.-General Sir G. M. W. MacDonogh, K. C. B., K. C. M. G., &c., &c.

(Present Adjutant General)

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SIR Ian Hamilton, in the book which he has recently published, states that the functions of the General Staff are to sit and think, while those of the Adjutant General are to act. As he does not say that the Adjutant General has to think, the presumption is that that is not one of his functions.

However that may be, I have had very little time to think of this lecture. When I was on leave last September, I meant to revert to my General Staff life and to sit and think about it, but I am afraid that, like the man in Punch I merely sat, and consequently, when last week end came I found I had prepared nothing. Such thought as I have been able since then to give to my subject has led me to the conclusion that it is impossible in the short time available to give you anything like a complete account of the Intelligence Service. I therefore propose merely to make some discursive remarks strung upon an intelligence string.

I do not propose to tell you that intelligence won the war, but I will suggest to you the reverse proposition, namely, that it was bad intelligence that lost the war, and with your permission I will make later on a few remarks on the opening phases of the campaign of 1914 with the object of proving that proposition.

The value of a good Intelligence Service has been appreciated from the earliest times, and the principles on which it has been erected are the same now as they were in the time of Moses. It has always been necessary for a commander to be well informed of the nature of the country on which he is about to operate, and of the strength of the armies and of the reserves of his enemy before he can formulate a reasonable strategical plan. You will all remember that Moses sent out from the wilderness of Paran one man from each of the twelve tribes for the purpose of searching the land of Canaan. The instructions which he gave to his intelligence agents were similar to those which would be given at the present day. He told them to reconnoitre the country,

he gave the routes which they were to follow, he told them to report about the inhabitants, whether they were weak or strong, whether the population dwelt in tents or in fortified cities, and what supplies of food and fuel were to be found in the country. They obtained all these particulars and the way in which they presented their reports gives us a very important lesson. They did not confine themselves to stating what they had seen, but they drew conclusions and said that the enemy was far too strong for the Israelites to have any chance of beating them. That was not their job, and their interference in matters with which they were not concerned gave rise to just as great trouble 3,500 years ago as a similar action would today. The lesson is that it is the duty of the intelligence agents to collect information, but it is for the commander-in-chief, or rather for his staff officer in charge of intelligence, to draw deductions from it. I shall say nothing more about ancient history but go straight on to the Great War.

I will venture to say that the chief reason why the Germans lost the war was because they had a bad intelligence system. This service was in charge of a certain Major Nicolai, and it failed from the very outset of the campaign. As far as the eastern frontier was concerned, it grossly overestimated the time that the Russians would require for the mobilization of their armies, for it led the German higher command to believe that Russia would not be in a position to advance in force into Galicia and East Prussia before the middle of September, and that consequently there would be some six weeks available in which to defeat the enemy on the Western front before it became necessary to turn towards the East. The whole Austrio-German plan of campaign was based upon this assumption, and at its outset von Moltke informed Conrad Von Hotzendorf, the Austrian Chief of the Staff, that he considered that the decisive action in the West would be fought about the 39th day after mobilization, i. e., about the 9th September. I may say parenthetically that this forecast of the operations branch of the German staff was extraordinarily accurate, as the battle of the Marne was being fought on that date, but that battle was lost, not won, and the reason why the Germans lost was that the intelligence branch had failed. Far from having to wait until the middle of September before advancing, as the Germans had expected, Rennenkampf's army commenced to invade East Prussia on the 18th August, that is, on the same day as the Germans commenced their advance westwards from their positions of concentration, on the German-Belgian frontier. A very few days later, Ivanov's group of four Russian armies entered Galicia and on the 25th August battles were in progress along the whole of the Austrian Northern front, resulting by the middle of September in the withdrawal behind the San of all the Austrian forces.

Intelligence regarding the Western front was equally faulty. Little or nothing was known of the movements of the British Expeditionary

Force. On the 20th August, by which date as you all know, four British divisions had not only landed in France, but had concentrated about Le Cateau and were about to advance on Mons, German G. H. Q. issued a communication that though a British landing had taken place at Boulogne it was believed that a disembarkation had not yet been effected on a large scale. Three days later when von Kluck arrived before Mons he was unaware that the British were holding that city, and were drawn up along the Mons-Conde Canal, in fact, he had been informed by his Cavalry only a few hours previously that there was no enemy within fifty miles of that position. From this it is clear that the German front line or tactical intelligence was as bad as its strategical intelligence. One reason why their strategical intelligence was bad was that the British intelligence authorities had not been asleep and had arrested all the important German agents in the United Kingdom the moment hostilities were declared. All through the period of the battle of the Mons and Le Cateau and for some days subsequently, von Kluck persisted in the belief that the British were based on Boulogne, Calais and Dunkirk, and it was owing to this misapprehension that after the battle of Le Cateau he directed his pursuit south-westwards towards Peronne, in the hope of severing their communications, instead of pressing southwards through St. Quentin on the heels of the retreating British.

The estimate made by the German intelligence of effect of the opening battles of the War on the morale and upon the powers of resistance of the Franco-British armies was as faulty as their knowledge of their movements. Major General von Tappen, who was head of the operations section at German G. H. Q. tells us that on the 25th day of August von Moltke considered that the great decisive battle in the west had been fought and decided in Germany's favour, and that the time had come when forces might be transferred to the Eastern Front. The result of this miscalculation was that two corps were actually moved away from the German right wing on the 26th August and were transferred to East Prussia where they arrived some days after the victory of Tannenburg. That is to say, they were wasted as they were too late to do any good in East Prussia and they were absent from the battle of the Marne, where their presence might have exercised a decisive influence. Not merely were these two corps actually taken away, but von Moltke intended to transfer eastwards four more corps, but as these corps had to be withdrawn from the front line and important events took place, these orders for their departure were cancelled, and they returned to their armies.

An equally grave mistake on the part of the German intelligence was their failure to appreciate the importance of General Maunoury's 6th Army, which the French commander in chief commenced to build up northwest of Paris during the last days of August. Von Kluck seems to have considered it to be of minor importance, or at any rate to have thought that the defeat which he inflicted upon it on the 29th

August, followed by its retreat from Amiens and the Avre on the 30th, had rendered it innocuous. The supreme command was equally ill-informed, otherwise it would not have permitted von Kluck to have swerved south-eastwards of Paris, and to have crossed the Marne on the 3rd September and then to have advanced half way between that river and the Seine, as he did on the 5th September. It was only on that date that they seem to have realized that danger might be anticipated from the Paris garrison and from General Maunoury's army, which had advanced on that day to a line running north and south through Dammartin, that is to say, half way between Paris and the Ourcq and was being rapidly reinforced by troops from the French right wing. It was then that von Moltke issued orders, which caused von Kluck to withdraw north of the Marne, and to leave that gap between his own and von Bulow's army into which the British, who were supposed to be demoralized and incapable of an offensive at once advanced. It was this British advance threatening to cut the German line in two, which was the direct cause of the German retirement from the Marne.

To recapitulate, if the German intelligence service had been efficient it would have anticipated the date of the Russian advance, and would have enabled more adequate steps to have been taken to meet it in the East. In the west it would have reported on the departure and ports of disembarkation of the British Expeditionary Force and this information would probably have induced the German Admiralty to take steps to interfere with the movements. It would not have allowed von Kluck to blunder into the battle of Mons, but would have indicated the British positions and would have given him an opportunity of bringing up his right flank corps and of enveloping the British left. It would have given accurately the direction of the British lines of communication and would thus have enabled von Kluck to have pursued after Le Cateau in the most dangerous direction. It would have appreciated the gap between the 4th and 5th French armies on the 22nd August, and would have pointed out to the Supreme command that the advance of the 3rd German Army Corps across the Meuse about Dinant might have resulted in the cutting off and surrounding of the Franco-British armies west of that river and have produced that second Cannae of which von Schlieffen and other German strategists had dreamt. It would have made a better estimate of the morale and spirit of the British and French armies after the opening battle of the campaign. It would have prevented von Moltke from falling into the error that he had already won the war in the West and that a transfer of troops from the Western to the Eastern theatre on the 25th August was permissible. It would have appreciated the great importance of the garrison of Paris and of Maunoury's army long before the 5th of September, and it would have noticed the transfer of large bodies of troops from Alsace and Lorraine to the vicinity of Paris. It would thus have prevented the creation

of that false strategical position in which the Germans found themselves on the 5th of September, and it would have prevented the complete reversal of the Schlieffen plan. The essence of that plan was that the Germans should have on their right wing a sufficient superiority over the French left to enable them to deal the latter a knock-out blow. Owing, however, to the withdrawals which had been made from the 1st, 2nd and 3rd German armies, the retention of an unnecessary force with the 6th German Army in Lorraine, and the transfer of French troops from the Eastern to the Western extremity of their line, the German right flank armies at the battle of the Marne were actually weaker than their Franco-British opponents. I would not like to say that the German intelligence should have known all about the matters which I have just detailed, but I do say that they might and ought to have known far more than they did, and that consequently the German failure to win the war during its first few weeks was directly due to the shortcomings of the German Intelligence Service.

Having now told you how the German intelligence failed in 1914, I should like to say a word as to how the British intelligence succeeded in 1918. You will remember Lord Allenby's great campaign in Palestine in that year, and you may have wondered at the audacity of his operations. It is true that in war you cannot expect a really great success unless you are prepared to take risks, but these risks must be reasonable ones. To the uninitiated it may sometimes appear that the risks taken by Lord Allenby were not reasonable. That, however, was not the case, because he knew from his intelligence every disposition and movement of his enemy, every one of his opponents' cards was known to him and he was consequently able to play his own hand with the most perfect assurance. In these circumstances victory was secure.

I hope you will not think that in this or in any other remarks which I may make I am taking away the real credit of victory from him to whom it is above all due, that is, from the British soldier, English, Irish, Scotch, Welsh, Canadian, Australian, New Zealander or Indian. No commander, however determined, no operations staff, however brilliant, no intelligence, however omniscient, could have gained success or have prevented defeat had it not been for the splendid gallantry of our men. It was they who had won the war, and all I am claiming is that it was the good work of our own intelligence and the bad work of the enemy's which rendered it possible for them to do so.

The public has been often regaled with stories of the Secret Service. It is far from me to depreciate the service, as I think I may claim to be its founder, at any rate in recent times, and I received inestimable assistance from it in the war. That service has one great value, namely, to act as a test of the reticence of those connected with it, and I much regret that many distinguished men have failed when that test has been

applied to them. All I intend to say of the Secret Service is that its essence is secrecy and the less said about it the better.

I should like, however, to warn you against supposing that an Intelligence Officer ever gets like the heroes of Mr. William Le Queux's novels or that the secret service is the back bone of intelligence. Sensationalism enters but little into its work, its results are produced by hard work, great diligence and untiring watchfulness, and the painstaking collection and collation of every possible form of information. Nothing is too small to be unworthy of the attention of I. D. and no problem too big for it. Even the most unlikely rumours should be forwarded by intelligence agents to Headquarters, for it is there alone that their worth can be appraised.

I remember one case during the war, when most important information was held back by the officer in charge of a group of agents abroad because he thought it too good to be true—it was true all the same—and if he had transmitted it it might have had an important effect on the issues of the campaign. Do not suppose that I wish you to think that all these rumours should be believed, they are often set about by the enemy for purposes of deception, but even then important deductions may often be made from them. I remember during the latter part of the first battle of Ypres receiving from Lord Kitchener most circumstantial reports of the despatch and arrival of German reinforcements on our front. These reports emanated from Amsterdam and created much alarm and despondency in London when Lord Kitchener communicated them to the Cabinet without having them first properly verified. I well recollect Mr. Asquith coming to my office in St. Omer about this day seven years ago to ask me about them, and my telling him that I felt sure they were direct from the Great General Staff and that their object was to conceal the withdrawal of large masses of German troops from Flanders to Poland, and I was able to assure him from incontrovertible information in my possession that the battle was practically over.

Intelligence personnel may be divided into two main groups, a very large one, which collects information and whose main characteristic is acquisitiveness, and a very small one which extracts the substance from that mass of facts and fiction. The mental requisites of this last class are (1) clearness of thought, (2) grasp of detail, (3) a retentive memory, (4) knowledge of the enemy, (5) the power of projection into his mind, (6) imagination tempered by the strongest common sense, (7) indefatigability, (8) good health including the absence of nerves and (9) above all others, absolute impartiality. A high intelligence officer who allows himself to have any preconceived notions or prejudices is useless. He must look at friend, foe and neutral alike, that is, merely as pieces on the chess board. I remember one of the very best intelligence officers I ever had failing at a critical moment because he had be-

come so imbued with the idea of German efficiency that he was incapable of realizing the significance of their great defeat by the British 4th Army at Villiers Bretonneaux on the 8th August, 1918. I know no quality that is so rare and so valuable as this of impartiality or keeping an absolutely open mind. Englishmen seem to have a strange facility for identifying themselves with the ideas of the extreme nationalist parties of the peoples amongst whom they are living. I remember, when I was D. M. I. the cases of more than one officer attached to the armies of our allies, whose reports were almost valueless as they would look at everything from the ultra-national standpoint, who could see no fault in the army to which they were attached and who appeared to be ignorant that there was any theater except that in which they found themselves. Speaking broadly and neglecting many important accessories, intelligence may be divided into two main parts:—*offensive* intelligence, in which we are attacking the enemy and endeavoring to find out everything concerning him, and *defensive* intelligence, in which we are doing our utmost to prevent him acquiring information about our service. Both of these divisions are equally important, and I regret that time will prevent me from saying anything at all about the latter.

If you were to ask me which is the most important function of the offensive intelligence, I should probably surprise you by saying, that it is the building up and constant verification of the enemy's order of battle. When we went to Flanders in August 1914 we knew very little of what reserve units the enemy might bring against us. We knew of course, of what his regular corps consisted, and that, behind them there stood large numbers of Landwehr Ersatz reservists and Landsturm, but we were very uncertain as to how they would be organized, and what new units, if any, would be formed. If we were uncertain of these points, you may imagine how far more uncertain the Germans must have been about our own organization.

It very soon became apparent that there were many units in the field of which we knew nothing, and that we must, at once, collect every scrap of information that would enable us to construct the enemy order of battle. The advent of the four new German corps in the middle of October, 1914, made this all the more necessary.

I dislike mentioning the name of any person who is living, but I think I may be permitted to do so in the case of one who is dead, and to whom I should like to pay the most sincere tribute of affection and admiration. This work of building up the German Order of Battle was taken over by the then Captain Edgar Cox, in my opinion one of the most brilliant officers that has ever passed out of the R. M. A. into the R. Engineers. He combined in an unusual degree an exceptionally quick and accurate brain with an almost tireless body. He used to sit far into the night compiling every shred of information, and it was entirely due to him that in November 1914 we were able to issue the *first* edition

of the German forces in the field, which shortly became the Vade Mecum of every intelligence. From that day on Cox went forward, and I think that Lord Horne will agree with me in saying that when, as the youngest Colonel in the army and with the rank of Brigadier General he went to France in January 1918 as head of the Intelligence at G. H. Q. his clearness of exposition of the German plans made an almost electrical impression on the commander in chief and on the Army commanders. His untimely death by drowning on the 26th August 1918 robbed the British Army of its finest Intelligence brain and myself of a very dear friend.

I find I am now drawing to the end of the time allotted to me, and that I have barely touched on the fringe of my subject. I should have liked to have told you something of the work of the R. F. C. in the early days of the war. They were then a very small and very excellent band. Many of them including their very brilliant leader, David Henderson, we shall never see again, but they have left an imperishable name behind them. In those early days, as they were so few in number, David Henderson used, whenever possible, to send the pilot or observer to see me after any important reconnaissance. I remember particularly two which they made and which were of the first importance. One over Brussels and to the west of it just after the German occupation of that city, when they saw a great force correctly estimated at a corps marching along the Brussels-Nihove road and then turning south westwards, towards Grammont. This was the German second corps of the 1st army, von Kluck's right flank, which if Sir John French had not wisely fallen back from Mons might have enveloped the B. E. F. Again, and even more important was their reconnaissance on 3rd September 1914. Up till then we had thought the Germans were marching on Paris, but on that day our British aviators saw von Kluck's corps turn to the southeast. I shall never forget myself watching those reports on the maps in my room in Melun, and being stupefied to see great columns stretching across the map through Manteuil and Betz and La-Ferte and Milon, marching towards the Marne between Chateau-Thierry and Trilport. It was this information which made it possible for Joffre and Gallieni to plan those movements which resulted in the victory of the Marne, the "turning point of the world war," as even German writers call it.

I should like also to tell you of the services of the topographical section, of the superhuman efforts which it made, and of its success in supplying the army with maps during the Retreat, of the survey section, of the sound ranging section and of all the numerous developments that flowed from it.

Then there was the censorship, a most irksome business. But one which obtained information of untold importance to the nation, besides preventing the leakage of our own secrets. Then there was the propa-

ganda department, which Ludendorff admits to have produced disastrous results on the morale of the German troops and nation, and which was chiefly the work of the intelligence directorate.

The whole story is one of enthralling interest, but I doubt if it can ever be adequately written. I hope that what I have told you may give you some slight idea of what a vast concern it was, and how great was its importance. I think I may say too with truth that, starting from the humblest beginnings it expanded, thanks to the zeal and talents of its many distinguished workers, some of whom I am glad to see here tonight, into the best intelligence service the world has ever seen.

I fear you may think I want to take credit to myself. That is far from my intention, I was a mere cog in the wheel, but I do want you to give all possible credit to all those hundreds, nay thousands, of workers who made it what it was. I was its father during all but two months of the war, and I am more than proud of my children. Any honors I have gained I owe entirely to them and I thank them from the bottom of my heart for all that they did for the glory of the Empire and the honor of the British name.

Professional Note.—FIRE CONTROL MATERIAL.

Reprint from Army Ordnance, January-February, 1922

The Wilson Range Computer which has been under development at the Arsenal for some months past, has now been completely assembled and is ready for test problems. As its name indicates, this device is an apparatus for computing the range and azimuth of a target, having given the length of a base line and the two azimuth angles from its ends. It is universal in its operation, or in other words, will perform its functions under all practicable conditions in regard to location of target with respect to base line, length of base line and location of base line with respect to the battery. The solution of the problem is obtained, as in a plotting board, by reproducing on a small scale the triangle made by base line and target. In the Wilson Computer, however, the scale is very small, viz., one inch equals 5,000 yards, and the device is therefore quite compact, although capable of computing ranges up to 50,000 yards.

The New Optical Plotting Board which is now under construction at the Arsenal is designed to solve the same problem as the Wilson Range Computer. In this case, however, instead of using material arms for the reproduction of the sides of the target-base line triangle, rays of light are employed to determine when the moving parts are in the proper position. The optical board will also be practically universal in its operation, and very much more compact than a plotting board of the same capacity.

Use of Rectangular Coordinates in Heavy Artillery Fire

By Colonel R. S. Abernethy, C. A. C.

IN the very interesting papers in the JOURNAL of the past year, on the subject of fire control for seacoast guns, there has been no mention of the possibility and desirability of making use of rectangular co-ordinates and the rectangular grid instead of the polar co-ordinates as at present.

It is my present purpose to point out some of the advantages and disadvantages of the use of the rectangular grid.

At the outset it must be admitted that our guns are in effect laid by polar co-ordinates, that ordinary position finding by vertical base or self contained horizontal base reads polar co-ordinates direct, and that the result of long horizontal base observation (including Sub-Aqueous Sound Ranging) is readily converted into polar co-ordinates.

Why then is it desirable to make the double conversion to and from rectangular co-ordinates? Before attempting to answer this question, I propose to try another, and that is: Why have a grid at all?

If for example we consider the case of a gun located on one of the outer islands of Boston Harbor and a target 30,000 to 40,000 yards to the eastward, advantageous observation stations may under some conditions be found on Cape Cod or near Gloucester or both. To relocate by our present system requires the plotting on a single chart of gun, target and observation stations. It is obvious that with such a system and the smallest possible scale, tremendously cumbersome relocating boards will be required. (See diagram. N. B. Smaller charts may be used in relocating by successive steps). With a grid once established the plotting board for the gun needs show only the positions of the target and gun, and there may be several plotting boards for different parts of the field of fire.

Moreover the grid is always independent of the observers' location be they in mobile or anchored aircraft, be they few or many, and be the observations in sequence from a given pair of stations, or in irregular order from various combinations of stations.

At this point it occurs to me that I am suggesting to the reader nothing that is not already clear to him, and that he can think of numerous other good reasons without further assistance, so I shall break off the argument with the admission that the present tendency is toward

the furnishing of all position finding data in terms of azimuth and range from one fixed point in each defensive area.

This suggests at once that we may simplify our methods of relocating by constructing polar grids with this one fixed point as origin of co-

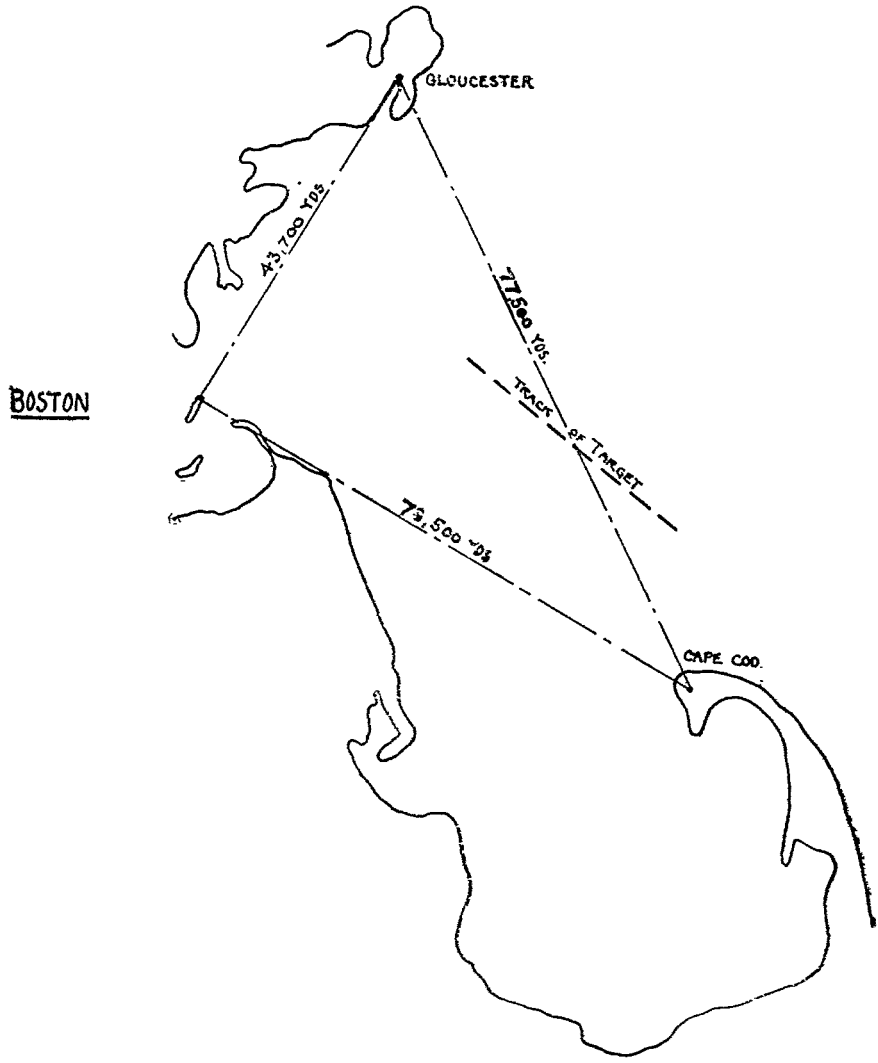


FIG. 1.

ordinates. But polar grids have serious disadvantages, some of which are:—

(a) Difficulty of drawing polar grid unless origin of co-ordinates is plotted as origin of azimuth lines and center of arcs.

(b) Increase in linear dimensions of angular units with distance from origin.

(c) Difficulty in interpolating with either dimension.

(d) Difficulty of connecting with neighboring grids.

None of these objections is applicable to the rectangular grid. While the rectangles cease to be such at a distance from the base meridian, right lines may without appreciable error be used throughout, and the size of the alleged rectangles within the range of any one gun vary so slightly that the simple L interpolating device may be used.

As to the question of connecting with neighboring grids, most Coast Artillery officers know that a single grid system was made to cover the entire Western Front and much more.

And here we come logically to the facts that a grid system for land warfare covering the greater part of the U. S. in the vicinity of our coasts is under construction and that our harbor defense grids could and most certainly should fit right in to the former.

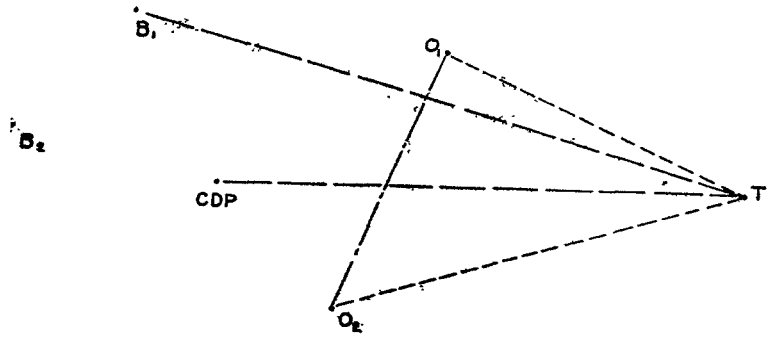


FIG. 2.

I hardly need point out the advantage of the use of the grid in our daily work in the instruction of our officers and men in land warfare methods, or the readiness with which the temporary positions of railway artillery may be tied into a harbor defense grid.

The necessity for increased flexibility in the position finding service for Coast Artillery due to increased range of the batteries, and to heavy cost of installation and maintenance of complete position finding systems for separate batteries has rendered necessary some means by which a number of widely separated batteries may make use of the data furnished by one of a number of base lines. As this data is not, as a rule, referred to battery directing points, methods of relocating must be developed. Considering now Figure 2, B_1, B_2, and B_3 are directing points of batteries. T is a position of the target and O_1 and O_2 observation stations.

It has been proposed that a central plotting station be provided capable of furnishing to all batteries the result of observations of any two base end stations, in the form of ranges and azimuths from C. D. P., a central directing point. Each battery should then be provided with

means of relocating from C. D. P., and of predicting and correcting. I believe most Coast Artillery officers regard this as a distinct advance for long range fire.

In applying this system with plotting boards, it is necessary to have both at the Central plotting room and at the battery an arm and auxiliary arm (or graduated azimuth circle) for the C. D. P. This is of course far simpler for the battery plotting board than to have an arm for each observing station.

The application of mechanical computers or slide rules to this system is complicated because all triangles are oblique.

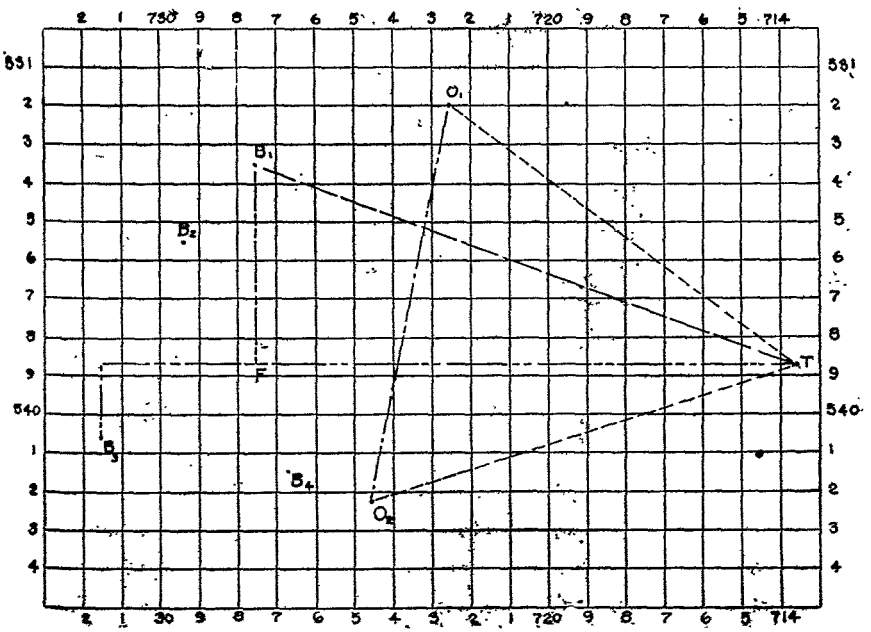


FIG. 3.

The application of rectangular co-ordinates to the central plotting system is indicated in Figure 3. In this case the central plotting room sends to the battery the co-ordinates of the plotted position of the target X=713.53 Y=538.65. The rectangles are 100 yards on the side. The origin of co-ordinates need not be shown and the grid can be constructed on any plotting board. Here the central plotting board needs arms only for the observation stations and the battery plotting board only for the directing point.

Moreover for battery B_1

$$\text{Range} = \sqrt{\overline{B_1F}^2 + \overline{FT}^2} = B_1T$$

$$\text{Azimuth} = 360^\circ - \text{Angle whose tangent is } \frac{FT}{B_1F}$$

$$= 360° - \text{Angle whose cosine is } \frac{FT}{B_1T}$$

or calling X_b and Y_b battery co-ordinates and X_t and Y_t target co-ordinates

$$R = \sqrt{(X_t - X_b)^2 + (Y_b - Y_t)^2}$$

$$\text{Tan. } (360° - \text{Az.}) = \frac{Y_b - Y_t}{X_t - X_b}$$

These equations are very readily solved by slide rules with battery co-ordinates permanently set. NOTE: In all cases arithmetical subtraction of the lesser co-ordinate, whether battery or target co-ordinate, from the greater is made.

It will be noted that once the co-ordinates of a battery directing point are known it is immediately connected in to the system. This is especially advantageous for the use of mobile artillery including railway guns and when the coast defense grid is—as it should be—tied in with the grid of the land area of the United States.

An important reason however, for experimenting with this system is its simplicity of application to spotting. It will be seen at a glance that knowing the co-ordinates of the splash and the course of the target the deviations are readily obtainable, or that knowing course of target and relative position of splash to target, co-ordinates of splash may be plotted at once.

Going back to Figure 2, the data furnished in that case are polar co-ordinates with C. D. P. as origin. It may be asked why a polar grid may not be substituted for the proposed rectangular grid. The objections are:—

(a) Polar grid is difficult of construction unless origin of co-ordinates is plotted. This may not always be practicable.
(b) Interpolation is much more difficult than with rectangular grid.

I propose the following methods in applying rectangular grid:—

(a) Central plotting room sends out rectangular co-ordinates of plotted position of one or more targets.
(b) Battery is assigned to target and connected to proper data phone line.
(c) Battery keeps curves of Time—X_t and Time—Y_t.
(d) Battery makes simultaneous prediction for X_t and Y_t.
(e) Battery applies slide rules to obtain range and azimuth corresponding to predicted X_t and Y_t.
(f) Battery applies correction to range and azimuth.
(g) In Case II battery solves for range and azimuth but uses latter only in obtaining range correction and sight deflection.
(h) Same slide rules may be used in application of co-ordinates of splash or special slide rules may be applied. In this case there is no prediction or correction.

For simplicity's sake I have omitted from the discussion corrections with rectangular co-ordinates to compensate for the sphericity of the earth's surface. These corrections when necessary may be combined with ballistic and atmospheric corrections (corrections of the moment).

In the central plotting room, plotting boards with grid drawn on, or with sliding graduated T squares will serve. Mechanical computers however need not be so complicated as with C. D. P. method and slide rules appear possible.

An advantage which can not be overestimated is that the use of the rectangular grid in ordinary fire control work will acquaint our personnel with an important part of their work should they be assigned to duty with artillery firing on land. Finally, the system offers a wide field for development in connection with sound ranging, sound spotting, aerial observation of fire, and the like.

Professional Note.—A New French Gun.

Reprinted from The Engineer, February 3, 1922

During the month much interest was evinced in a new gun which is the invention of a French officer, Lieutenant Delamare-Maze. Experiments with the weapon have been in progress for some time, principally in Belgium, and next week some official trials of it are to be carried out at Liége under the auspices of the Belgian Government, which holds the Belgium license for the patent. Details of the invention, which, it is claimed, can be applied equally well to field and machine guns, as well as to rifles, have not at present been divulged; but it is claimed that as a result of its application the recoil is eliminated and the speed of the projectile practically doubled. In past trials with a French "soixante-quinze" it is stated that a muzzle velocity of 850 m.—say, 2789 ft.—per second was obtained, the ordinary velocity being about 1740 ft. per second. It is hoped, as the result of improvements since made, that a muzzle velocity of something approaching 3300 ft. per second will be reached. The inventor asserts that with the recoil done away with it will be possible to build guns as powerful as those at present in existence at only a third of their weight.

Suggestions for the Marching of Tractor Artillery

By Major G. Ralph Meyer, C. A. C.

THE writer was fortunate enough to be in command of the 2nd Battalion (155 G.P.F.) of the 51st Artillery (Tractor) during the movement overland from Camp Jackson, S. C., to Camp Eustis, Va., during September and October 1921. The movement covered a period of 40 days and the distance travelled was approximately 600 miles.

Because of the reorganization of the regiment and the attendant confusion and calls upon the time of the battery officers in settling their property accounts, all the necessary preparatory work could not be done. An attempt however was made to overhaul all tractors and put them in the best possible condition.

It is believed that the experience gained as a result of this movement should be made a matter of record in order that officers who in the future may be confronted with similar problems may have something to work on and not be compelled to "go it blind." The points mentioned in this article are not the only ones which need attention. They are merely those which forced themselves upon us during the trip. The ideal condition, of course, would be to have only tractors which had been completely overhauled by a thoroughly capable repair section; tractor drivers who were experts and a group of experienced repair men available to make the many repairs which are necessary on the road. This is the ideal condition and like most ideal conditions it will not be a practical possibility.

The points to be remembered have been grouped under two heads: Preparation, and On the road. Each of these have been further subdivided into: Tractor, and Gun. It is assumed that some enlisted man in the battery is competent to direct the work on the tractor.

PREPARATION

A. Tractors

Complete overhaul of the tractor with special attention to the following:

1. Motor.
   Clean carburetor.
   See that the clamp screw will hold carburetor adjusting needle in place.

Clean vacuum tank.

See that breaker points in circuit breaker are clean and open well.

Have all valve springs in good condition.

Have rocker arm working freely and oil hole felts clean and free from dust See that bushings in rocker arms are in good condition.

Have air intake to carburetor connected to air cleaner and have the latter clean.

Have cylinder head gaskets in good condition. Use copper faced asbestos gaskets.

See that all crank and connecting rod bearings are in good condition and all cotter pins in place.

Clean all gas lines and see that all couplings are tight. Clean outside of motor.

2. Lubrication.

Overhaul track oiling system and clean thoroughly.

Clean crank case and oil-pump strainer.

See that grease passages are clear in truck roller bearings, in drive sprocket and blank sprocket shafts. All grease cups to be in place and grease passages clear. Particular attention must be paid to this on the steering clutch shifter ring, and the master clutch shifting fork. It will often be found that grease has hardened in the grease passages and this must be picked out and cleaned so that the grease can reach the bearing surfaces.

See that there are no oil leaks around the external drive gear housing.

See that oil guage functions.

Lift top transmission and clean lower case. Clean the oil strainer there.

3. Cooling system.

See that radiator brace is intact.

Examine radiator foot studs. These have a tendency to break off near the tractor frame and leave the radiator loose on the frame.

(It is believed that the change in radiator braces now being made by the Ordnance Dept., will obviate much of this trouble. The change consists in the installation of a heavy brace on each side of the radiator running from near the top of the radiator to a point well back on the tractor frame.)

Have fan and pump belts, if "V" type, treated with neatsfoot oil if new. If no neatsfoot oil is available ordinary engine oil will add materially to the life of the belt.

Look for leaks in cooling system and repair them.

See that bolts on pump shaft stuffing box follower are tight.

4. Track Assembly.

Take out thrust rod and have threads cleaned. Clean hole into which threaded part extends. Pack grease in this hole around threaded portion of the rod and put piece of waste in to cover the opening. This will keep the threads clean and lubricated so that track can be adjusted.

Examine all track roller supports and replace any that are cracked.

Tighten all nuts holding supports to frame.

Have track adjusted.

5. Transmission.

While upper transmission is raised to clean lower part, test the bearings of the intermediate shaft and see that the intermediate shaft nut is tight and locked. Take the steering clutch shifting ring coverplate off and examine the hexagonal nut which secures the thrust bearing to the pressure ring. This nut is kept from turning by a set screw which sometimes shears off. Failure of grease to reach this thrust bearing will cause the nut to break or the threads to strip, resulting in complete loss of that steering clutch.

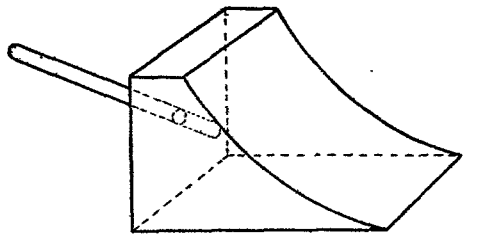


FIG. 1.

B. GUN

Get wheels with tires in good condition.

Clean hub liners and axles with gasoline. Be careful that there are no particles of loose metal in interior of hub.

Grease with heavy axle grease and have closed can in which grease can be carried on the road.

Adjust the brakes carefully.

If caterpillar bands are to be carried on the guns use new carriers if available. If not reinforce old ones by nailing 3×8's to them. The lifting bar should be carried at the limber end of the carriers to allow them to be kept as far from the ground as possible at the gun axle end.

Have several chocks with handles attached for use in chocking when going up steep grades. Have some for left wheel and some for right. Carry timber blocks 6×6, 3×12 and 10 ×10, all 18″ to 2′ long. Also two gun jacks per battery.

On each gun have 150 ft. of 5″ rope for use in crossing bridges where tractor must be uncoupled.

For use in steering gun along way planks in crossing bridges when tractor is uncoupled, devise an extension for the draw bar. If a line is made fast to the end of this with an end to each side so that four men may take hold on either side, the

gun may be easily steered. Without some such appliance it is extremely difficult and very dangerous to move the draw bar. It requires the combined efforts of four men to move it and they are so close to the limber wheels that a slip may cause a serious accident. The drawbar should be pinned in the horizontal position. The sketch herewith is a suggestion for a drawbar extension. It can undoubtedly be improved upon.

In many cases it will be possible to take the guns across bridges by hand. With a slight down grade on the bridge 15 men can pull the gun across. One man should remain on the brakes.

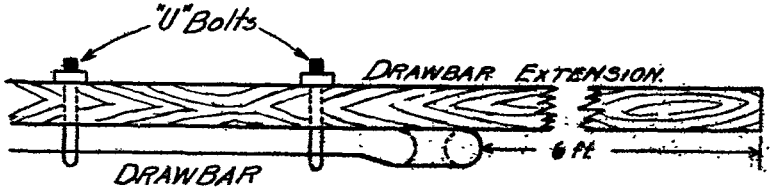


FIG. 2.

ON THE ROAD

A. TRACTOR

Too much cannot be said about keeping the tractor clean throughout. If possible the tractors should be gassed every evening before dark. During the summer months this can be done after the day's run, assuming the run completed by 5:30 P. M. As the days get shorter this becomes impracticable as there is constant danger when gassing after dark when lanterns are being used and side lights are lighted. A halt at 4:00 P. M. for this purpose will permit an early start next morning.

The hourly stop should be utilized by the tractor drivers and assistants in cleaning the tractors, turning up grease cups and inspecting for loose nuts and connections. Battery officers during these halts should inspect the tractors paying particular attention to the same things mentioned above under preparation. If the tractor is kept clean it will greatly assist in making these inspections of value. This systematic inspection will prevent many breakdowns by locating weak spots before the break occurs. Remember that many things can happen to a tractor in a 45 minute run. A track roller support, for example, can very easily loosen up in that period and when once loosened up it may break at any time.

The length of the runs as well as the stops between will depend much upon the weather. During hot weather the stops must be more frequent and for a longer time. It was found possible at times on this trip to run for 1½ hours at a time and then stop for 15 to 20 minutes. This could be done on cool days or for night running. On hot days however

it was necessary to stop for from 10 to 20 minutes every hour. The guiding factor is overheating of the motors.

After stopping for the night the tractor should be thoroughly cleaned, the outside of the motor cleaned, oil put in the crankcase, all grease cups filled and the grease gun used where necessary on bearings. At all times grease should be carried in cans with tight fitting tops to exclude all dust and dirt.

The hand book of the 10-ton tractor prescribes that the crankcase be cleaned with kerosene every two weeks and fresh oil put in. At this time the bearings in the crankcase should also be inspected. After washing the crankcase with kerosene be sure that all kerosene is taken out of the upper crankcase.

The successful operation of the tractors over the road for any extended period is largely dependent upon the "stick-to-it-iveness" of the drivers, the ability of the tractor mechanics to make road repairs, and the ability and desire of all officers to keep after the care and maintenance at all times. There are innumerable accidents and breakdowns which can and will occur, and it will be necessary to work very long hours at times on any extended move. Experience is the only teacher from whom it is possible to learn the many expedients which can be used to save long delays, and the only way to prepare in order to properly benefit from that experience is to know the tractor and to know it perfectly.

Towing the G. P. F., the tractor can negotiate almost any kind of road. In very wet places or in very bad roads where the gun bogs down in deep sand or mud it may be necessary to put two tractors on the gun. However, if the caterpillar bands are put on the gun wheels in such ground one tractor should pull it. Some difficulty was experienced in going up steep grades on concrete or Belgian block roads. The surface of such roads is so smooth that the tractor cannot take hold. Such grades should be avoided whenever possible.

In crossing bridges it is always well to have the tractor run slowly in first speed. Even though the bridge is strong enough, this reduction of speed greatly reduces the racking effect on the bridge.

In running over narrow roads where two tractors could not pass it is advisable to send a spare tractor ahead so that it may be used to pull out any which may get stuck. In crossing railroad tracks where there is a steep grade up to the track it is well to have a spare tractor at hand to assist if the tractor with the gun is stalled. Have flagmen out whenever crossing a railroad track. One thing which must be impressed upon all tractor drivers is the necessity for shifting gears at times. The tendency of the average American driving any motor vehicle up a grade is to "make it in high" if possible. The tractor driver exhibits the same characteristic. In his case it is more important to avoid changing gears on the grade, for he so often kills his motor doing it. The same is true

in shifting from 1st to 2nd or 3rd after crossing a bridge. Have him get his gun well clear of the bridge before he tries to shift. If he kills his motor then he will not hold up everything behind him. In going up grades the best rule to follow is: if in doubt as to ability to make it in a certain speed, shift to the next lower speed before starting up the grade.

Never allow the tractor drivers to make any changes on the carburetor or magneto. This should be done by the tractor mechanic or battery officers only. The tractor mechanic should be moving along the line constantly while the convoy is moving and should be on hand to make all adjustments and repairs.

B. Gun

Occasionally, while the gun is moving, the gun commander should feel the hubs of all the wheels to see if they are running warm. If a wheel runs hot it may become necessary to take it off and clean it with gasoline and put in fresh grease. The grease at all times should be kept in tightly closed cans. A very little grit in the grease will make a wheel run hot and will score the hub liner badly.

For any long move, the spare wheel furnished the battery must be carried. Running on high crowned roads wears the rubber tires badly and if the rubber is old or dead will pull the tire off the rim.

Before starting on the trip it was desired to know the actual weight of the tractor, gun, howitzer etc. A large scale was available and the weights were found to be as follows:

10 Ton Tractor	21500 lbs.
Wt. on limber wheels of G. P. F. travelling position	13100 lbs.
Wt. on Gun axle	19000 lbs.
Total wt. of G. P. F.	31500 lbs.
8″ Howitzer limber and gun	23500 lbs.
Platform	9000 lbs.

The weights given for the G. P. F. are for the gun with all equipment ready for the road—spades, caterpillar bands, lifting bar, blocking and rope.

Professional Note.—Motorizing English Field Artillery.

From United Service Gazette, December 29, 1921.

The War Office have given instructions for the four batteries of the 9th Brigade, Royal Field Artillery, now stationed at Deepcut, in the Aldershot Command, to be "mechanicalised" for the purpose of practical experiments. All the horses of the Brigade, except those of the officers, have been withdrawn and sent to the Remount Department. The personnel of the Brigade are now being trained to drive and to repair the kind of tractors to be used. It is understood that a tractor fitted with caterpillar tracks has been officially recommended for the trials, which are to take place shortly in the Aldershot Command. It is urged in favour of mechanical draught that it is economical in man power since the personnel of a battery might be reduced to approximately one half, when compared with one relying on horse draught.

More About the Coast Artillery Rifle Team

By Major H. W. Stephenson, C. A. C.

ABOUT twelve years ago a Second Lieutenant of Coast Artillery asked to be sent to the School of Musketry at Monterey. The Coast Artillery at that time was authorized to send one officer for each twelve companies of artillery. The officer making the request had recently been a member of a national match rifle team, was greatly interested in shooting, and wished to continue further work along that line. He was informed in just about so many words that he was "now in the Coast Artillery" and should "forget the small arms" and devote his time to great guns. This little incident well illustrated the feeling that existed at that time throughout the Coast Artillery.

The rifle was looked upon as a necessary ornament for parades and ceremonies, and an additional part of a soldier's equipment requiring extra polishing to avoid company punishment. When most organizations went on the target range for small arms practice the idea uppermost in the minds of those subjected to the inconvenience, was to expend the required amount of ammunition and get the reports in to headquarters.

Since then a growing interest in small arms shooting has been a natural development, first, because shooting is a clean sport and second, because there were enough officers in the Coast Artillery who recognized the benefits to be derived therefrom. Other things being equal, the soldier who as a growing boy passed through the slingshot, air gun, "twenty-two rifle" stages of his development and became expert with his then important weapon will today make a better Gun Pointer or Gun Commander than the boy who never became interested in the playthings named. Likewise the soldier or officer who understands the general principles of small arms rifle fire will recognize the great similarity between making a 30-calibre bullet hit a certain spot on a target and making a 12-inch projectile hit a certain target on the water.

The World War, coming when it did, undoubtedly delayed the real entry of the Coast Artillery into the small arms game. As is now quite generally known, the last three years, the only ones in which the Coast Artillery has entered teams in the National Matches, it has stood in 34th, 10th, and 6th place. It is the youngest of the service teams competing in the National Matches and its progress has been most gratifying. Now that small arms shooting is looked upon with favor by the Chief of Coast

Artillery there is no further argument necessary to establish the fact that it becomes the duty of all Coast Artillery officers to develop skilled marksmen within their commands.

A brief outline of the method used in selecting the team of ten men to represent the Coast Artillery in 1921 may be of interest. A series of try-outs was conducted in various coast defenses and training centers during the month of May. An officer was detailed to conduct the try-outs in each particular locality, keep records of scores made and submit with his recommendations the names and scores of those taking part in the try-outs. These letters and lists of riflemen were sent to Washington where they were studied by the officer selected to be Team Captain for the year. From the list of names submitted to the Team Captain, about seventy five officers and enlisted men were ordered to the Navy Rifle Range, Wakefield, Mass., for further training and elimination.

After shooting on the range at Wakefield during parts of July and August, the squad was reduced in number to thirty who, in the latter part of August, were ordered to Camp Perry, Ohio.

There the training continued until the National Match began. As a result of previous records and the showing made in various matches and in practice at Camp Perry, a team of ten was selected out of the squad of thirty. The National Matches, generally held in August, were held the 21st-22nd-23rd of September.

In this article no attempt is made to go into details of training or coaching after the members of the squad have been selected by local try-outs. The object is to discuss what is considered the best kind of preliminary work in the Coast Defenses and the type of man needed to form a valuable addition to the rifle team squad. The ultimate object of the training is to develop a team which will win the National Team Match. Therefore the object in the selection and training is to perfect the individual so that he becomes a *team* shot.

As in football, baseball, rowing or any other form of sport, a man must have constantly in his mind the welfare of his team. Further than that he must be a good sport. There is probably no game outside of horse racing, playing the stock market or shooting craps in which there are as many ups and downs as in the game of rifle shooting. The shaking down or elimination period of training is most trying. A man will pile up a fine score one day and be "on the rocks" the next day. He will make a possible at one range, then have a clip break or get a "jam" at rapid fire, ruin his whole day's score and maybe land at the bottom of the squad when the list showing that day's standing is posted.

There are certain types of humanity which, although they may be good shots, are not worth keeping on a squad because of their evil influence on the other members. The chronic kicker, the loud mouthed braggart, the habitual grouch and the irritable neurasthenic have no place

in a squad of men who have to be thrown together as closely and for as long a time as do those comprising a rifle team.

As a rule a man who has been in athletics understands the spirit of competition. That in itself is, to him, an advantage, but many men who have never engaged in school athletics have learned in other walks of life that to win they must keep plugging till the last shot is fired—to fight for every point till the end. No matter if a man gets a two or even a miss he should not cease his efforts to make good the remaining shots of his string. He should feel as does the distanced runner or the boxer that the other fellow, his opponent, is just about as tired as he is and has about the same chance of making a miss as he has.

The physical make up of a man should, generally speaking, not be considered as a handicap. To appreciate the meaning of that statement one has only to attend an assembly called for the presentation of trophies at the completion of the National Matches. Cups and gold medals are awarded the tall and the short, the fat and the lean. The skirmish run in which an active man in good physical condition had an advantage has been abolished. Rapid fire at 200 yards sitting and at 300 yards prone require speed and dexterity which can generally be acquired by proper training. When a team composed of shooters of average age about nineteen years can stand third place out of seventy three teams in the National Team Match and a man over sixty years of age can make more than sixty consecutive bulls eyes with the service rifle at a thousand yards, one is convinced that expert shots exist or may be developed at almost any age.

There are two types of riflemen, however, who although they may be excellent individual shots, are more or less dangerous as members of a team. They are left handed men and those with poor eyes.

The left handed man, in the first place, is handicapped by the bolt action of the service rifle being right handed. This is most noticeable at rapid fire. Furthermore, lying as he does with his legs inclined in a direction opposite to that assumed by right handed shooters he is invariably either kicking or being kicked by the man on his right. In a crowded firing point it may even be necessary for the left handed man to take turns with the man on his right getting on the line and getting up and off the line after each shot. The worse feature of this is that his shooting mate is by rule placed on his right so that he, rather than a member of another team, is the one annoyed by the left handed man.

The good shot with poor eyes may make phenomenal scores on certain days, then on other days, make misses which are due only to his inability to see the target clearly. When the same man has an "off day" while in an individual match nothing much is ever heard of it, but when the same thing happens during a team match it is at the expense of the entire team and his hard luck becomes quite well known. A man with

poor eyes may break his glasses or have eye trouble after a team match begins, at which time his menace to the team is most keenly felt.

In the earlier training at posts every effort should be made to develop new material. The regulations governing the National Matches require that at least one half of the shooting members of a team be individuals who have never before shot on a National Match team. It matters not whether a man shot last year or fifteen years ago, whether on a Service Team, National Guard Team or Civilian Team. He who has once shot on a team in a National Match becomes an "old member."

The kind of training to which special attention should be paid may be emphasized by the following: In the National Team Match there are three general classes of shooting (1) slow fire off hand (2) slow fire prone and (3) rapid fire. Several of the special matches as well as the National Individual Match require shooting in the kneeling position. The International matches, such as those in which the United States* team recently won the world's championship at Lyons, France, require shooting at standing, kneeling and prone positions. The matches to be held during the Olympic games in Paris in 1924 will doubtless be similar to those held at the last Olympic games on the range near Antwerp. They included the standing, sitting, kneeling and prone positions. There is every reason to expect the Coast Artillery to have representatives on the team representing the United States in the next Olympic games. The chance of again seeing Paris should be incentive enough to make most aspirants work hard at the shooting game.

Many matches at Camp Perry, Sea Girt and Wakefield consist of both off hand and prone shooting. When a man acquires a certain degree of expertness at prone shooting the matter of his winning a match or standing five or ten in it out of a field of several hundred competitors, is largely a question of fate or luck or whatever one may call it. The sun may come out or go behind a cloud at the wrong time; the mirage may shift quickly; his eye may blur, or any one of several things may happen to change into a three or a four, a shot which otherwise would have been a bull's eye. The shooter always has an alibi; maybe not one which suits his inner self but one which he tries on his sympathetic team mates.

The point is that there are more expert prone shots than expert off hand shots, so the competitor who gets a good lead at the off hand stage has a better chance thereby of winning many matches.

Last year in the National Team Match the Marine Corps Team and the Infantry Team got a lead in the first stages of the match, 200 yards off hand, and maintained the lead over the other seventy one teams throughout the match. In the A. E. F. Roumanian Trophy Match the team representing the Coast Artillery had high score at 600 yards

*Technical Sergeant James Christian of the Coast Artillery Corps was a member of this team.

out of the 34 teams entered but lost their position at 200 yards off hand. These cases are mentioned to show why improvement should be made in off hand shooting.

Another place where we should exert every effort to develop likely candidates is at Rapid Fire. A man will dig and scratch for one or two points on his string of twenty shots at 600 or a thousand yards, then throw away six or ten points at a string of rapid fire in one minute. Fortunately, in the Coast Artillery we can find ranges at which practice in off hand and rapid fire can be held. It is true that the long grind at the prone position is what most people consider *real* shooting, but the few points that are picked up on the other fellow at "off hand"and the 48's and "possibles" one is *sure* of at rapid fire are going to win many a match. Much beneficial training for off hand shooting can be obtained even indoors by using a Hollifield Target Rod outfit or by using an ordnance gallery rifle on a miniature range. Certain muscles can be developed, certain nerves steadied down until, eventually, the "communication system" from eye-to-brain-to-finger will be "in order" when a man enters a match.

In training for rapid fire splendid results are derived by the practice of getting into position quickly and "snapping" successive strings until one really "feels" the time limit, till the mechanical operation of getting set, pumping in five, loading in another clip, firing the last five, will become a habit. Speed in operating the bolt gives more time for aiming and also allows a margin of safety for emergency in case of a miss fire or a broken clip. Something unexpected is always liable to happen in rapid fire. Every man should know how to get the most out of his rifle. By that is not meant that he should "doctor" it in any unauthorized way but that he should get every part so thoroughly cleaned, or worn down, or adjusted that it approaches a perfect machine. The rifle, as a rule, is better than the man shooting it; but rifles, like men, are not always perfect.

At posts where long ranges are available it will be most advantageous to get experience at that class of fire. On the other hand, for team shooting one of the most valuable types of men is a good "holder." The good holders can be spotted firing prone at 300 yards, then when they later join the first training squad they can be kept in the bull's eye at long ranges by proper coaching.

Bearing in mind the type of men needed and the kind of training considered most important, one should adopt a schedule of instruction which will show to greatest advantage what is in the available material. As soon as local interest is aroused and the preliminary steps have been taken to begin shooting, either in the gallery or on the range, a series of matches should be held. These can be between batteries, battalions, regiments and Coast Defenses, or even with other branches of the service where conditions permit. There are two good reasons for

having matches; one being that men naturally become interested in any kind of competition. The other reason is that by placing a man under the little additional nervous strain occasioned by his being "in a match" or "on a team" you are better able to size him up as a future possibility. Many men will make fine scores in practice day after day but when entered in a match they will get "buck fever." Others there are who do well in individual matches where they are responsible to themselves only, but when shooting as a member of a team and realizing that by poor shooting they will ruin the score of their whole team they break under the strain and "blow up." Some men who are nervous in their first matches may improve. Others probably never will. Those in the first class have advanced just that certain amount by the time they reach the first training range. Weeding out in the Coast Defenses those of the second class will save the government mileage and save the Team Captain the trouble of dropping them after a week or so on the training squad.

After interest has been aroused and the personnel are talking about who are going to be ordered away for further try-outs is the time to do something for those who are going to carry the cross guns to Camp Perry. There are a number of little things best left unmentioned. A sufficient number of last year's squad have been scattered throughout the service and have probably given "those at home" a fair idea of conditions.

Last year a shortage of funds worked inconvenience if not hardship on members of the Coast Artillery Rifle Team. This should be prevented from now on. As long as we are going to have a team and we expect it to play the game to the limit of its ability we should try to give to the team members certain little advantages which are within our power to obtain.

Sending a team to the matches at Sea Girt, New Jersey has its advantages and its disadvantages. Last year the only visible means of getting the team to Sea Girt was at the personal expense of the individuals. Considering the condition of the squad at the time the New Jersey matches were held last year it is believed that it was to their advantage to remain at Wakefield for further training as a team. Possibly next year circumstances may be such as to make it advisable to get certain experience, to be gained only in competition, by sending members of the Squad to Sea Girt.

There are always a number of little things which require money not officially appropriated. Team members are expected to wear some mark or insignia on their shooting uniforms by which they may be readily distinguished. The insignia vary from whole maps of states to the modest white letters U. S., C. A. C. on a red background. The arm bands do not cost a great deal, but the team members wearing them should no more be required to buy them than is the college football man required to buy his jersey or his head gear.

The shipment of special telescopes, the procurement of cleaning material and brushes when the available allowance is exhausted, the payment for entries in matches at Wakefield and at Camp Perry all require that certain amounts of money be available for immediate use.

More important than any one of the above mentioned is the question of food. A substantial ration fund could certainly be used to advantage. A real training table is not essential although a man to be sure of himself in the shooting game should train and care for his body much the same as tho he were engaged in some more strenuous form of athletics. What is essential is a mess which will insure that the team members get wholesome food, properly prepared and suitably served, at regular hours.

The answer to all this is to collect a fund for next year's Rifle Team. There are plenty of ways in which to acquire it. "Tag days" and "drives" are quite fashionable. There are "drives" for the starving people of Central Europe, for the poor Armenians, for the Irish and for the Russians. Let every Battery Commander or every Coast Defense Commander have a spring drive for next year's Rifle Team. The money can be sent to the Editor, JOURNAL U. S. ARTILLERY. If each Coast Defense would get up a circus, each Officer's Club a raffle or a badger fight there would soon be enough money to take care of the things mentioned.

It would mean more than that. It would make the Coast Artillery at large feel a personal interest in their Team and, most of all, it would give the Team the one thing most essential to any Team—Morale.

Rapid Range Finding for Fixed Armament

By Major Fred Seydel, C. A. C.

1. The desirability of a short observing interval and a nearly continuous supply of data to the guns is recognized. The time required by the range section to compute data and transmit it to the guns has prevented a shortening of the observing interval. To offset the disadvantages of a thirty second interval, time range boards of various designs have been used in an effort to give the guns data enabling them to fire when loaded without regard to the observing interval.

2. When a time range board is used, data supplied by it is data computed and estimated for a period equal to the observing interval (30 seconds), plus the time of flight plus the interval after the bell at the end of which the data is supplied. This latter interval may be ten, twenty, and, in case of a failure of supply of data from the range section on the bell, even as great as fifty seconds. Thus data used by the guns may be calculated for a period of about two minutes in advance of the last observation. The improbability of a target following a course for which this data would be correct has caused the time range board to fall into disuse.

3. The long observing interval remains and it takes as long as ever for the range section to supply data to the guns. Obviously, before the observing interval may be shortened the range section must be speeded up.

4. I submit a system by the use of which accurate data may be supplied the guns six seconds after an observation and the observing interval may be shortened to ten seconds. I have tried this system at Battery Saffold at Fort Winfield Scott in competition with a 110 degree board and have verified all the claims I make for it as regards speed and accuracy.

5. The system is simple. To install it at a battery will require the time of two men for about a week. All required materials may be obtained on the post.

6. Referring to Figure 1, B′ and B″ are observing stations at the extremities of a base line B′ B″. DP is the directing point or directing gun of a battery. T, T′, etc., are successive positions of a moving target. To each position of T, T′, etc., there is one and only one azimuth and range from each of the following points: viz., B′, B″, DP. Each and every combination of azimuths from B′ and B″ definitely fixes a position of only one range and one azimuth from DP.

7. With the finding of the ranges and azimuths from DP to posi-

tions of T, a series of curves may be drawn as shown in Figure 2. The azimuths of T from either B′ or B″ may be represented as vertical lines spaced at any convenient interval—say one inch for each degree. Any scale for range may be adopted—say 1 inch equals 200 yards. Upon the vertical lines representing, say, azimuth from B′ lay off to the range scale adopted points whose ranges from DP correspond to the intersections of azimuths from B′ and B″. Connecting the corresponding points will give curves representing the azimuths from B″. The intersection of any curve with any vertical line is the range, measured from the line taken as origin, from DP to T. For example, an azimuth of 91 degrees from B′ and an azimuth of 71 degrees from B″ indicates a position of

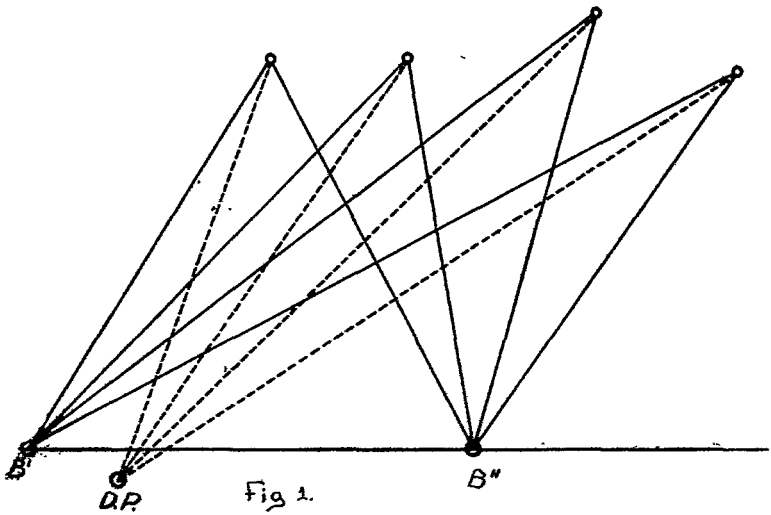


Fig 1.

range m from DP and an azimuth of 97 degrees from B′ and 74 degrees from B″ indicates a position of range n from DP.

The foregoing gives a method by which ranges from DP are determined. To obtain azimuths from DP a separate series of curves must be drawn, similar to those shown in Figure 2, but in which the vertical scale is degrees instead of yards. The intersection, then, of a vertical line and a curve represents a position of a certain azimuth from DP, instead of range as shown in Figure 2. Ranges and azimuths to T from DP may be found simultaneously.

8. In order to obtain a series of curves for actual test, I used a plotting board drawing lines with primary and secondary arms and using the gun arm to obtain ranges and azimuths to the intersections. (See Figure 3). Mathematical computations checked various intersections. The curves were placed on a board and a T-square constructed as shown in Figure 4. The edge of the T-square bearing the scale graduated in yards was placed at the azimuth telephoned from B′ by means of the sub-scale (a) (reading from one of the vertical lines). The azimuth from

B″ (on curve) at the intersection of the B′ azimuth enabled the plotter to read the range to the position on the scale. A pin marked this range in the range scale. Second and third positions were similarly found and marked on the scale.

9. At the time of marking the first position the travel rule (c) was placed in its groove with its zero opposite the first pin. This rule was graduated to a scale twice that of the range scale in order that *two* observing intervals might be used instead of one to get the predicted and set-forward points. After the third pin is placed the travel during the

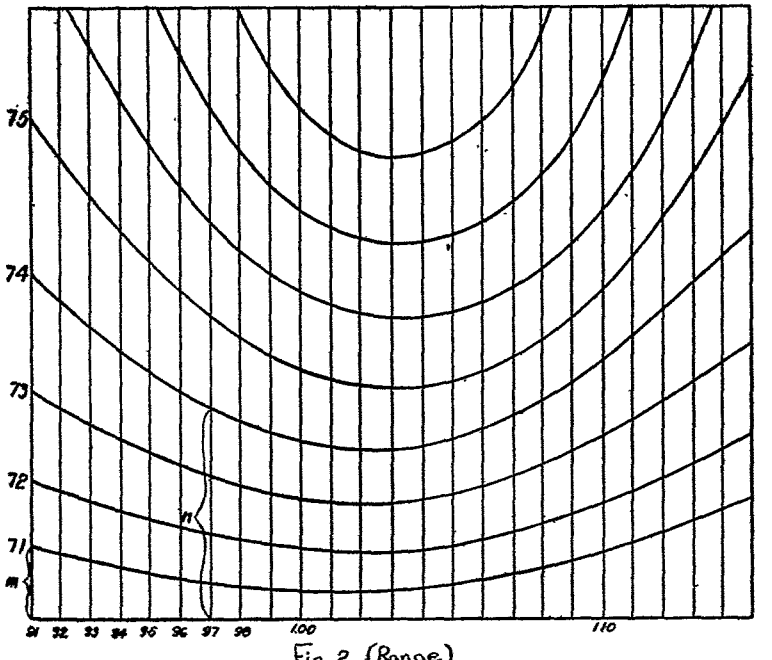


Fig 2 (Range)

two intervals is read and the travel during the next observing interval plus the time of flight of the projectile obtained from an auxiliary ruler. The small travel slide (d) mounted in a groove of the travel ruler (c) and graduated to the same scale as the range scale (b) was placed with its zero opposite the third pin, at the time travel during the observing interval is called off by the plotter. The travel to the set-forward point as read from the auxiliary ruler and read from the slide (d) being opposite the range to the set-forward point on the range scale (b) the range of set-forward point is read at once. The first pin is now removed and is placed at the fourth position of the target (the operation of the travel rule being the same as before) and the range to the second set-forward point read.

10. In order to get a visual representation of the course of the target a sheet of transparent paper is placed over the curves, under the T-square, and each plotted position marked.

11. The above described method is applicable to any type of gun or mortar battery using a horizontal base line. With a slight modification, it is applicable to a vertical base line.

12. Additional modifications may adapt the method to position firing for aircraft. This will involve plotting the horizontal and vertical projections of the angles made by the line of sight from each observing station to the target with the horizontal and vertical planes through the station. The vertical projection of an angle as it revolves through a quadrant from a position parallel to or perpendicular to the vertical

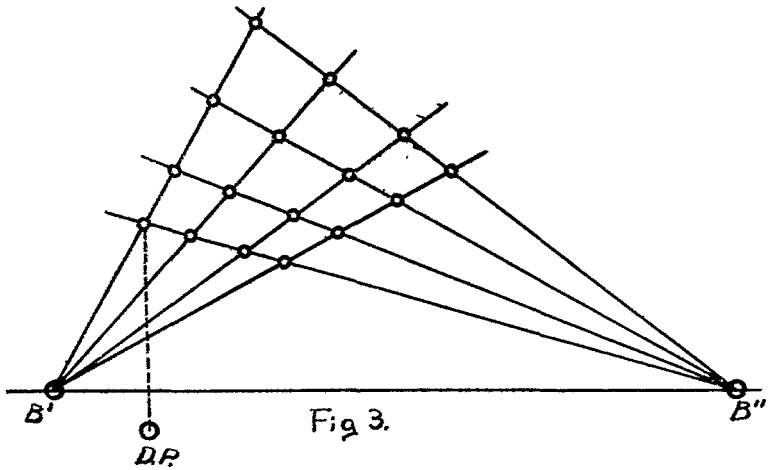


Fig 3.

plane bears a fixed relation to the angle and its position, and will vary from the value of the angle when parallel to the vertical plane to 90 degrees when perpendicular to the plane. The vertical representations of the angles from the two observing stations are then used as are the two azimuths from B′ and B″ in Figure 1, and the height above the plane through the anti-aircraft battery of the set-forward point determined. Simultaneously the horizontal projection of this set-forward point is found. A third set of curves gives the range of the hypotenuse of the right angled triangle so determined. It is believed this operation will require about twelve seconds.

13. The advantages of the system are obvious. It affords faster and more accurate tracking. A change in direction is caught almost instantaneously.

14. Under the present system, if a gun or mortar is not ready for firing on the bell it must wait thirty seconds to get the correct range. This proposed system will reduce that period of waiting to ten seconds.

15. The disadvantage of the proposed system is that a separate system of curves must be drawn for each base line; that is, the system is not adapted to the principle of interchangeability of base lines.

16. The scales mentioned were those I used in testing the system. A scale of 300 yards or 400 yards to the inch will serve as well as 200 yards to the inch. The degree scale may be ¾ inch equals 1 degree.

17. On any plotting board and under any system the azimuth intersections at a target on the right and left flanks of the right and left base end stations are such as to limit the use of the base line to a field of fire of approximately 160 degrees.

18. With a range of 18,000 yards and a field of fire of 160 degrees (for that base line) a set of curves 45 inches × 120 inches will answer (scale 400 yards equals 1 inch and 1 degree equals ¾ inch).

19. A range of 36,000 yards would require a set of curves 90 inches × 120 inches.

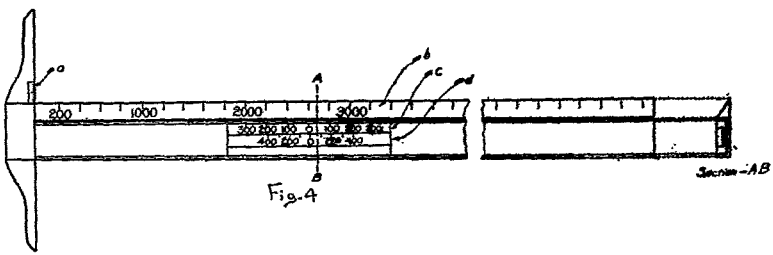


Fig. 4

20. The curves may be mounted on a drawing board, flat, or on a cylinder of approximately 40 inches in diameter. The cylinder could then be turned to set at the azimuths from the proper station. The T-square would be fixed in position. Still another method would be to mount them on rollers similar to those used on the mortar azimuth correction board.

21. A battery with four base lines would require four cylinders or four sets of curves, however mounted. The space required is not greater than that required for two plotting boards and changes from one set of curves to another may be more easily made than changing the position of arms on the plotting boards now in use.

22. An excellent method of spotting may be devised by drawing the curves for that section of the field of fire which includes the course of the target. The T-square may be shortened, the first range on it being the inner limits of the ranges included in the practice. The method of operation is to set on the T-square the range of the set-forward point as called by the plotter. When the observers call the azimuth of the splash a pin on the T-square marks the intersections of the azimuths and the distance of the splash (over or short, right or left) is read on the slide on the T-square. The location of a splash may be obtained in four seconds from the instant of splash.

Vertical Spotting

By Lieut. Colonel Hartman L. Butler, C. A. C.

VERTICAL spotting was first introduced to our service by Commander W. S. Sims, United States Navy, in a lecture given to the writer's class at the Artillery School, Fort Monroe, Virginia in 1907.

He was heard with interest but as there was no Coast Artillery target practice held enabling the class to witness a demonstration, the plan was discussed with skepticism as a method pertaining to the Navy only.

We could not get away from the atmosphere of the early days at Fort Monroe, shortly after the Spanish War, when all officers assembled on the low battery parapets during the target practice—some with field glasses, but most of them without—and guessed how the shots were falling. If the impact were close, there would be as many estimates over as short and the estimated deviations would run the length of the scale.

In 1912, Second Lieutenant L. H. Campbell, C. A. C., recently from the United States Navy, introduced this method in the Coast Defenses of Portland, Maine. It was used that year and again in 1913, and most of the batteries in the Coast Defenses improved their shooting by its employment.

Shortly after the 1913 summer practices all adjustment of fire in heavy gun practice from observation of splashes was prohibited by War Department orders. We were to depend entirely upon trial shot data.

This prevented any official use being made of spotting except for rapid fire batteries for several years, notwithstanding the magnificent demonstrations during the early years of the World War, when fire was opened at about 20,000 yards and the German cruisers *Scharnhorst* and *Bluecher* were put out of action—it is true with a large expenditure of ammunition—at ranges exceeding 10,000 yards, fire being adjusted from data received from spotters stations about 130 feet high.

The late General John W. Ruckman, United States Army, in his article on "Observations on Artillery Practice," in the JOURNAL of November, 1920, last paragraph, page 477, states:

"With reference to direct observation of shot splashes, in the opinion of the writer, every officer should be trained therein so that in case of injury to the standard method he can continue the combat without

serious embarrassment. An officer with a pair of good glasses or telescope upon a station of sufficient height can learn to determine the character of shot errors and estimate with fair accuracy the value thereof. If this were done at all practices where suitable stations exist and officers required to note the estimates of errors observed and compare the same with errors officially determined, at least some information would be gained and considerable interest would be added to the subject. This policy would cost nothing."

He also advocates the necessity of the development and application of a method of observation of fire making use of the high natural sites existing in several of our Coast Defenses. (See Paragraph c, page 482.)

The writer submits such a plan and is optimistic enough to think that it can be used to a certain extent in all the Coast Defenses. There are very few forts where there are no light houses, water tanks, radio masts, etc., which are not over 100 feet above mean low water, and which cannot be equipped with spotting telescopes.

The writer uses the navy vertical method of spotting. This method consists briefly of estimating the number of feet above or below the water line of the target that the line of sight to the slick of the splash strikes, and its transformation in yards, over or short, by consulting his previously prepared spotting table. In the spotting table, the equivalent of yards *up* or *down* as a correction for an observation feet *down* or *up* from the target for a given height of spotter, is noted for every thousand yards, thus:

SPOTTING TABLE VERTICAL METHOD, 10" BATTERY

Spotters height above M. L. W., 480 feet.

Time of Flight Sec.	Danger Space Over yds.	Range Yards	Down and Up Feet				
			1¼′	2½′	5′	10′	20′
			Up and Down Yards				
28	20	15,000	35	70	140	280	560
24	26	14,000	30	65	130	260	520
		Etc.					

For quick commutation the spotter notes the nearest thousand yards range to target from time to time and the corresponding value in yards up or down the target for say 5 feet, a height about equal to the canvas above the float of the pyramidal target, or ½ the height of the material target or ¼ the height of the lowest deck of a battle ship. This is kept in mind and without again referring to the table, the spotter can readily halve, quarter, or multiply this value when the shot strikes. The values in the table are determined by the simple solution of similar triangles, thus—the value over is approximately to the range in yards as the height of the slick up the target is to the corrected height of the spotter above M. L. W. in feet. This value of the over or short cor-

responding to a given height of a distinctive part of the target may also be determined with a D. P. F., by taking the difference of the average range readings to target water-line and average range readings to the point 5′ up the target, just prior to the firing and during each interruption. The spotter would then apply these values by the method just described.

The writer as Fire Commander of the First Fire Command, Fort Mills, Philippine Islands, applied this system during the Coast Defense Battle Practice conducted by Colonel R. P. Davis, C. A. C., in the Coast Defenses of Manila and Subic Bays, December 17, 1920.

"Three batteries of two Fire Commands, were firing at the same group of targets, 100 yards apart and the writer's two gun batteries were assigned the rear target. A few shots from the mortar battery of the other Fire Command fell near this target during the first part of the firing, and there were several cases where the splashes occurred about the same instant. The mortar splashes were identified by their size, and the two gun batteries by the time of flight and lateral deviations, one battery being a material distance to the flank.

The observations were as follows:

SPOTTING AND TUG OBSERVATIONS,
Target No. 2, towed by "Hunt"
Fort Mills, P. I.

December 17, 1920.

Average Range, 10,500 yards. Height of Spotter, about 500 feet.

No. Shot	R. Rake Dev. yds.	Boat time of splashes	Battery	Shot No.	Spotting F. B. C. Az. Instr.		R. Dev. re-plotted yds.	Total correction ordered	Cheney Observer D.P.F. at B. C.	B. C. Error Cheney
					Dev.	Error				
1	+115	12– 1–30	Cheney	1	+125	4	+121		+170	49
2	+155	12– 2–30	Cheney	2	+250	83	+167		+190	23
3 *a*	+180	12– 3–30	Cheney	3	+250	57	+193	−150	+120	73
4 *a*	−350	12– 3–35	Grubbs	1	−350	2	−352			
5 *b*	−220	12– 5–00	Cheney	4	−200	12	−212	−200	−300	88
6 *b*	−280	12– 5–00	Grubbs	2	−250	40	−290			
7	+155	12– 8–30	Grubbs	3	+100	78	+178	+325		
8	+ 20	12–10–00	Grubbs	4	target	18	+ 18	+325		
9	+125	12–11–30	Grubbs	5	+100	23	+123	+325		
10	Proj. broke up		Grubbs	6	No splash			+325		
11 *c*	−155	12–16–00	Grubbs	7	− 50	120	−170	+250		
12 *c*	−215	12–17–30	Grubbs	8	−175	68	−243	+250		

Average Error.....24% 46 yds. 33% .58 yds.
Average Accuracy of Observation.....76% 67%

a. Only 5 seconds between splashes of 2 batteries.
b. Both splashes instantaneous.
c. Interference in spotting by receiving and sending messages."

Both batteries made proper corrections from these spots: Battery Cheney, "down—150 yards" after the second shot, this correction however was not applied until after the third shot and as the powder for the fourth shot came recently from a different battery, the gun did not respond. At Battery Grubbs where each powder charge had been reduced 5 pounds since the last firing, a proper correction of "up+325 yards" was applied after the second shot and netted the battery 1½ hits in the remaining five shots.

Ordinarily range spotting is a one-man job at each battery, but on this occasion the Fire Commander not only spotted for 2 Batteries, but was required to control his station as well, receiving and sending messages and giving orders during the firing. This, of course, reduced the accuracy of the spots but notwithstanding this, better results were attained by the vertical spotting method, than by taking the difference of ranges to target and splash by D. P. F. at B. C. Cheney.

From 1912 to date, except during the World War, the writer has spotted successfully at least 400 shots in at least 50 different day firings, 3" to 14" guns, 3,000 to 13,000 yards range and from heights of spotter, 50 to 600 feet, and it is his opinion that it is a most valuable adjunct for all batteries of any caliber and is most necessary for short range firing, where the position finding system is liable to be "knocked out."

With the heights that prevail at Corregidor, I believe it is more accurate than vertical balloon observation where only field glasses can be used with habitual wind vibration interference.

In the writer's fire command during the target practice year 1920 there were two occasions where it was impossible to observe the splashes from the single balloon station due to a small cloud coming by at the instant of firing.

It is admitted that Vertical Spotting is not as accurate as Horizontal Base Methods, but the former is believed to be more direct, certain and quicker; does not depend as a rule on electric communications and does not suffer through personal errors of many operators.

With separate Battery Spotters it is possible during concentrated fire to identify the battery splashes whereas with the latter methods it will be most difficult, if not impossible.

Attention is invited to the following extract report by the writer when he commanded Battery Blair:

SPOTTING

TARGET PRACTICE——FORT WILLIAMS, ME.[2]

Battery Blair, August 30, 1913.

* * * * * * * * *

5. (Contd.)—I believe vertical spotting is practicable and is at all times valuable. Of course with low sites or during a concentrated fire or if a ship happens to be enveloped in smoke it would be more difficult.

If the target can be seen I believe the large slick of heavy gun splashes could also generally be seen. During the F. C. target practice of the Ft. Williams Fire Command in 1912, Lieut. L. H. Campbell, C. A. C., spotted and caught all of the splashes,—39 in number from 4 batteries, and all those pertaining to Battery Blair, so far as they could be identified by time of splash records, and from the range rake observations, were in the right direction and were accurate enough to be a valuable aid in making corrections. Ordinarily it is not difficult, for with little experience I spotted unofficially the shots from the R. F. Battery at this post in a recent day practice. All of the splashes, 14 in number—some very close together—were caught in the right direction. The range was 5800 yards, height of observer 65 feet above M. L. W. Using field glasses and acting as my own recorder, the average error of the "spots" was only 25 yds., or less than one third of the danger space. Attention is invited to the following observations of the longitudinal deviations during the Blair night practice:

SPOTTING

Range 6,000 Yards

Observations—Yards

Shot No.	B″	Lt. Armstrong B′–Az. Instr.	Actual by plotting	B′ Errors	Total range corrections applied
1	− 75	−100	−182	82	
2	+300	+190	+276	86	
3	−100	−100	−118	18	
4	+ 35	−160	−178	18	
5	+ 25	−190*x*	− 84	106	+150
6	− 40	−190	−173	17	+150
7	− 15	Hit	− 36	30	+250

(x) 5th shot was interfered with by succeeding splash which came about three seconds later. Average error 51 yards, or less than one-half of the danger space. A trained sergeant was at B″ on the flank of the field of fire and Lt. Donald Armstrong, C. A. C., was at a position in rear of the battery near B′, 100 feet above M. L. W. and 25 feet under the searchlight beam, using an azimuth instrument, Model 1910. Two of the B″ observations are in the wrong direction due I believe to catching the richochets instead of the original splashes. The day spotting of Lt. Armstrong was conducted from the searchlight tower, 125 feet above M. L. W., range 8,000 yards and the results were very accurate. Considering the very poor illumination during the Blair practice I believe the night work of Lieut. Armstrong was remarkable.

* * * * *

Spotting station should be as high as possible and located near the firing battery, but a little above or to the flank in order to avoid smoke interference. They should be equipped with high power telescopes having horizontal wires that are horizontal in order to water-line the slick of a shot having a wide lateral deviation.

The Spotter must have no other distractions and attempt nothing but observation of range deviations and should have one assistant — a recorder who acts as a time of flight announcer, equipped with a stop watch.

The observation must be made when the slick—which appears as a white line radiating from the center of the splash—is fully developed after the splash subsides, which occurs from 1 to 6 seconds after the shot strikes, depending upon the caliber of the piece,—the larger the caliber, the longer the time.

In order to develop the necessary skill the spotters must receive progressive training. The best spotters are those with good eyesight, who are cool and possess good judgement. This instruction begins with indoor instruction using miniature equipment, as described in his article by Lieut. L. H. Campbell, "Notes on Spotting," pages 38 to 42, July-August, 1913, number of this JOURNAL, followed by sub-caliber and service spotting. Within about 6 weeks the candidate will be securing surprisingly good results.

As stated before, the prime requisites are height of spotter and a high power large field telescope mounted on a tripod or pier, both being equally important.

In 1914, at Fort Williams, Maine the writer conducted experiments using a 2½-inch telescope in order to determine the minimum height at which reliable spotting could be made for ranges 7,000 to 8,000 yards.

Starting at 100 feet he finally worked down to 50 feet where on August 17th, 28 shots were observed at two practices each at Batteries De Hart and Sullivan, average range 7,500, with the following results: average range deviation 78 yards; average spotting error 43 yards or about one third of the danger space.

In the navy with their vibrating, swaying platforms in the tops, at a height of 120 feet, the spotters expect the average range error not to exceed 100 yards up to and including 12,000 yards.

In the Coast Artillery with stationary platforms and large fixed telescopes, our errors should be considerably less, and in the cases cited in this article they are about one-half.

In the writer's opinion, after proper training and with good definition of target and splash, our spotters should make proper sensing in all cases and secure reasonable accuracy, for a height of spotter of 10 feet for each thousand yards range.

There follow records of deviations and spots at five miscellaneous firings:

It will be noted that in all except the first, in the absence of an available telescope, the writer had to use field glassess which are greatly inferior due to lack of definition.

In the last three firings a comparison of the balloon, aeroplane, D. P. F. and spotters observations can be made.

1ST PRACTICE

BATTERY BLAIR

Fort Williams, Me., July 6, 1915

VERTICAL SPOTTING

(Navy Method) By Captain H. L. Butler, C. A. C.

Shot	Spotted Yds.	Replotted	Error
1st	+ 50	+ 47	3
2nd	+100	+120	20
3rd	+ 50	+167	117
4th	+200	+249	49
5th	+100	+133	33
6th	+400	+277	123
	900	6)993	6)345
		166 Av. Error	57 yds.

Or 57/166.....34%

Average Accuracy.....66%

7 Shots fired, One not observed.

Range, 10,500; Height, 100 ft.; Curvature and Normal Refraction, 20 ft.; Instrument, 3" Telescope for French 60" Searchlight. Sea rough; weather fair.

2nd and 3rd splashes ½ second interval; 4th and 5th splashes, 4 sec. apart; 6th shot, target dove in trough of wave.

Fort Mills, P. I., Nov. 29, 1920.

BATTERY Geary. Mortars Max. RANGE Spotter to target 12,000 yds.

Shot No.	Replotted yds.	Spotter with Field Glasses. Ht. 560 ft.	Error
1	− 30	− 40	10
2	−227	−150	77
3	+ 37	+ 30	7
4	− 60	− 25	35
5	− 27	00	27
6	+ 63	+ 30	33
7	− 66	− 40	26
8	− 24	− 20	4
			8)219
AVERAGE - - - - - -			27 yds.

BATTERY Ramsey. RANGE 8,000 to 7,000.

Shot No.	Range Rake Yds.	Spotter Ht. 350′ Field Glasses	Balloon Ht. 1500′ Field Glasses	Observer F2 D.P.F.
1	−426	−250	−125	−350
2	+308	+200	+150	+300
3	−182	−100	− 50	−180
4	+296	+180	+125	+190
5	−132	− 50	− 65	−120
6	− 84	− 50	− 45	− 80
7	+273	+250	+100	+100
8	+272	+175	+100	+250
9	+126	+125	+ 65	+110

Fired as an R. F. Battery, target R. to L.

No replotting. If replotted Overs would be slightly increased and shorts lightly decreased.

The spotters height was about one-half that of the F2 observer.

FORT MILLS, P. I., December 3, 1920.

BATTERY Crocket. RANGE 12,200 yards.

Shot Number	Replotted	Spotter	B. C. Observer D. P. F.	Aeroplane Reports
1	− 13	− 10	−100	− 20
2	− 45	− 25	− 60	− 50
3	−270	−150	−240	−100
4	−502	−350	−880	Interference
5	+415	+200 Smoke Interference	+420	+300

The spotter as President of the Analysis Board observed loading and firing and hastily caught splashes with field glasses. Height 500 ft.

Nov. 30, 1920.

BATTERY Wheeler. RANGE 10,500 yards.

Shot Number	Replotted	Spotter Field Glasses Ht. 550 ft.	Observer F2, D.P.F.	Aeroplane Reports	Remarks
1	−52	−75	−90	−100	Last shot cut towline
2	− 7	−10	−30	+ 10	Target covered by splash.

There follow records of deviations in the first two Observation and Adjustment of fire problems where both the Vertical and Gray methods of observation were employed:

Fort Mills, P. I.
November 17, 1921.

OBSERVATION OF FIRE

Battery Johnson—Rifle.
Range 4000 to 5500. Target right to left coming in.

	Tug. Range Rake Yards		Vertical Ht. 240 ft.		Gray Spot. Board Base line 1000 yards.		Corrections Ordered
1 V	−150		−200		− 75		up +75
2 V	− 35		− 50		− 75		up +75
3 V	Hit +		+ 20		+ 30		
4 V	Hit +		+ 10		− 25		
F G	− 5		− 30		− 25		
6 Tie	− 20		− 10		− 30		up +50
7 Tie	+ 50		+ 50		+ 50		
8 G	+ 30		+ 80		+ 30		
9 G	Hit +		+ 20		Hit +		

The Spotter used a B. C. Azimuth Instrument whose vertical slow motion mechanism was out of order, making water lining impossible. Water lining was desirable as several shots had wide deflection deviations. Weather was fair and sea rough.

Fort Mills, P. I.,
November 15th, 1921.

OBSERVATION OF FIRE
Target Practice, Battery Morrison, Rifle.
Range 5500 to 6500 yards.

Shot No.	Tug. R. Rake	Vertical Spotting	Gray Spotting Board. Base Line 1900 Yards.
1	−200	Field Glasses −200	−400
2	+115	+ 75	+100
3	Off Rake Est. +375	+300	Over, out of Telescope
4	−100	− 80	−150
5	Off Rake Est. +500	+250	+360
6	−195	D.P.F. Telesc. −200	−140
7	Off Rake Est. +575	+400	+200
8	+ 20	+ 20	− 40
9	− 30	− 40	− 30
10	+180	+150	+180

a. Target proceeding from right to left.
b. Range slightly increasing.
c. No camera observations, towline length, 250 yards.
d. The Spotter used field glasses at Battery for first 5 shots Ht. 370′ and D.P.F. for last 5 shots. Ht. 270′.
e. Weather rainy, and hazy; small light pyramidal target about 10 ft. high rose and fell at least 3 feet on swells.

SUMMARY OF PROCEDURE

In subcalibre practice the spotter should begin at B′ or Battery Height where the conditions are most favorable and then work down to lower levels approaching a height of 30 feet.

Final height above the sea can be obtained by tape or taken from a contoured map.

Prepare a spotting table containing "Ups" and "Downs" for the different target elements for every 500 yards range. The horizontal equivalent over or short in yards corresponding to one foot up or down target can be quickly computed by dividing the range in yards by the

observer's height in feet. For short subcalibre ranges—about 2,000 yards—for large deviations, 200 to 400 yards, add 10 to 20 % to spotted overs and subtract from shorts.

Ranges can be transmitted by megaphone or estimated from the known vessel courses.

Compare each series of spots by observations taken by the Observer at the B′ or B. C. D.P. F. The D. P. F. should be accurate for short ranges. By this means, both spotters and observers get good practice.

In service practice occupy highest station which should be as near the firing battery as practicable.

After firing compare with the replotted overs and shorts.

Take advantage of firings at other batteries, in order to secure additional practice.

Field glasses can be used with reasonable accuracy up to 5000 yards range but beyond that, a fixed telescope with horizontal wire—D. P. F spider thread preferred—should be used and is desirable for all ranges.

Be sure cross wire is horizontal by traversing the instrument through the length of the wire on the water line of a fixed point.

In all practices announce your observation as a correction; i.e., for an *over* 100 yds., call out *down 100*, and if short, *up 100*. If too close to target to estimate, then announce *target*. This will enable the Battery Commander to announce his corrections more quickly.

If splash has a large deflection deviation and cannot be seen in telescope have your assistant announce *Right* or *Left* as the case may be.

Your assistant, equipped with a split hand stop watch, starts it when the gun is fired and announces, *ready* 3 seconds before and *splash* at the end of the time of flight. If the second shot follows quickly then the assistant notes its relative position by stopping the split hand.

Waterline the middle of the "slick" with the top of the cross wire. The "slick" forms one or more seconds after the splash subsides.

Have confidence in your method and make bold estimates.

Notes on the Instruction of Fire Control Details

By 1st Lieut. A. Norton, C. A. C.

(See Editor's Note, page 562, Journal U. S. Artillery, Dec., 1921.)

WITH the beginning of the outdoor period, the really practical work of the year commences. While having certain advantages, indoor instruction is but a beginning and, as in any well developed system of education, the beginning must be elementary. The outdoor instruction should be made progressive until finally a high state of efficiency is obtained. Then every effort should be made to maintain this efficiency and to develop further improvements. Care must be taken to prevent overtraining and this will require careful planning and considerable ingenuity on the part of the battery commander.

To obtain efficient service of a battery, teamwork between all parts is essential. In each section and between sections, the personnel must work in perfect harmony. To obtain this teamwork and harmony, every individual must be trained to perform his particular duty in the most efficient manner and at the right moment. Evidently, the individual must be thoroughly drilled and trained in his particular duties before any attempt can be made to perfect and synchronize the work of the section.

When the individuals are capable of satisfactorily performing their assigned duties, it is possible to proceed with section drill. Unless the individuals are proficient, it is a waste of effort to attempt to operate the details as a unit. At first the drill should be conducted slowly, exactness being the prime consideration. Speed should not be attempted until later. Careful training should inculcate deliberate care in all operations. Patience and carefulness are required in order that accurate results may be obtained.

With the inevitable changes in the manning party occasioned by discharges, transfers, sickness, it is necessary to be continually training new men for the various positions as they become vacant. Provision should be made for at least one alternate for every position; for the more important ones, more than one. When these have been trained, frequent changes may be made during the drill to accustom the individuals to the duties of their alternate positions.

The proper training of the fire control section is of first importance, primarily because correct firing data must be determined. Unless correct firing data be transmitted to the guns, it little matters how perfect

the work of the gun detachments may be; there will be no hits except by chance.

The essential features in training the observing detachments are to impress upon the observers the necessity for carefully observing on the designated point of observation of the target and to stop following the target exactly on the third stroke of the time-interval bell. When the horizontal base is the normal system, observers should be trained also to acquire the habit of keeping the target constantly waterlined. This will eliminate delays in changing from the horizontal base to the vertical base system. If observers are properly trained, there should be no excuse for missing a single reading, if the system is changed while tracking a target. Of course, where the vertical base is the normal system, the target *must* be kept constantly waterlined. Members of the observing detachments should be familiar with their instruments, know the adjustments and must be capable of making them.

The azimuth and range of datum points should be kept posted in every observing station. Care must be taken that the data with regard to datum points are correct and legible at all times. The height of the trunnions of the instrument above mean low water also should be conspicuously posted. Due to lack of instruction, many observers think they must know the height of tide in order to adjust their D. P. F.'s for reading ranges.

Readers should be trained to read the azimuths and ranges quickly and correctly, the latter requirement being the more important. The whole degree of the azimuth should be announced by the reader not later than on the third stroke of the time interval bell. If the readers practice this method, one to three seconds of time can be gained in the plotting room in the setting of the arms on the plotting board. Where the observing interval covers a period of but thirty seconds, it is necessary to economize on time, eliminating all unnecessary delays, that the plotter may be allowed the maximum amount of this interval for plotting and predicting.

The best training for the observing detachment is the actual practice of tracking targets, but they should not be required to observe for too long periods at one time. To observe for three ten minute periods with intervals of rest will produce better results and accomplish more good than to observe for one period of thirty minutes without interruptions for rest.

In order to give the observing detachment the necessary practice with actual tracking there must be some target on which to track. In some localities there is little shipping activity and targets are scarce and some means should be improvised for furnishing a target or simulating the necessary conditions.

As with the observing detachment, familiarity with the apparatus in the plotting room is absolutely essential for the plotting detail. Each

man should be taught to meet the requirements of his position. When each member of the detachment is thoroughly familiar with his duties, the actual drilling or training of the detachment as a unit can be commenced. The plotter should have made his prediction and all data should have been sent from the plotting room before the end of the observing interval so that there will be no confusion due to the data being sent to the guns while new data is being received from the observing stations.

First of all there must be some data with which to work. If no target happens to be in sight or in the field of the plotting board, previously prepared courses should be used for purposes of practice. For this, the battery commander should have several courses prepared in the following manner: A straight line in any favorable direction is drawn on a piece of paper placed on the plotting board and on this line are marked points so selected that the travel represented will be constant or uniformly increasing or decreasing. Using the primary and secondary arms, the azimuths of these plotted points from the base end stations may be determined and tabulated. Several courses can be prepared in this manner and each course should be given a number for convenience of reference. The tabulated readings can then be given to the readers in the observing stations. Having made such preparations, the battery commander can drill his detachment when there is no target to observe. He would give such a command as "B′—B″, COURSE NO. 3"; when the observing stations report ready, he would command "NEXT BELL." At this command, the readers would call off at the end of each observing interval the azimuths listed under Course No. 3 pertaining to their respective stations. Obviously, the plotted course, if correct, will be practically identical with the track previously prepared and from which the azimuth readings were taken.

As soon as the plotting detachment becomes familiar with these prepared courses it would be well to prepare new ones, varying materially from those to be discarded. In some Coast Defenses, the batteries go for a week at a time without being favored with a target because of fog or some other reason and this is sometimes used as an excuse for not drilling the fire control section. Obviously, this is not a legitimate excuse for not drilling the fire control section at all times.

After the fire control section has become fairly proficient, the work they are doing should be checked for accuracy and possible refinements of the drill should be inaugurated from time to time. Arm setters should be taught to note the azimuth differences between successive readings and in the event of no data being sent by the reader at one of the base end stations, or both for that matter, the arm or arms can be set approximately to the aximuth of the next plotted point and no prediction need be lost. The practice of noting the azimuth difference is a good one as the arm setters can then set their arms in advance to the expected

azimuth of the next plotted point, and but little time will be required to set the arms correctly. In order to check the work done by this section, each man should record the data he sends or receives or both. A target should be selected, and say for some 25 or 30 observing intervals the target is tracked, records of course being kept. Then the tracking may cease and by means of the records the entire course can be gone over from beginning to end, and any errors noted should be fixed upon the person responsible. There is something psychological about this system of checking and it is just this: When a man knows that he can be detected in making errors he will make an effort to avoid them even if the individual is not ordinarily painstaking. The practice of keeping records should be inaugurated as soon as possible at all batteries and the checking just referred to should be done at least once a week.

It is of course impossible to have the base end stations reobserve the target for this checking, but the readers should record the data they send and compare it with the records kept by the armsetters. Then in the plotting room, if the arm setters records check out with those of the readers, differences between consecutive readings may be calculated. These differences should be tabulated and they will indicate fairly accurately whether or not any errors were made at the base end stations in taking and reading of observations.

EDITORIAL

The Wadsworth-McKenzie Pay Bill

TO recite the history of the Wadsworth-McKenzie pay bill, now before Congress, would be superfluous. Every reader of either *The Army and Navy Journal* or *The Army and Navy Register* has been kept advised from week to week of the developing conditions which have created the necessity for a pay bill, and which have resulted in the specific form of the bill agreed upon by the Congressional Joint Committee.

The fact is that we now have ready for Congressional consideration a draft of an act intended to ameliorate the conditions of all the people in six of the Governmental services to the greatest extent that can be hoped for under present conditions. The question is, what is going to happen? A little prophecy based on the opinions of the representatives of the services who are in touch with the situation may be in order.

First, it cannot be prophesied that the bill will pass, although favorable action by the Senate may be anticipated, and the attitude of the House, so far as it is ascertainable, is not unqualifiedly hostile.

Second, it may be prophesied that if active opposition to any of the detailed provisions of the bill by members of the services is forced on the attention of individual Congressmen, amendments will be introduced which will call for protracted debate on the floors of Congress.

Third, that if the passage of the bill is to be delayed by the occurrence of any such necessity for debate and amendment, the present attitude and preoccupation of the House are such that no bill will be passed.

And finally, that if no bill is passed, all of us in the Army will revert on July first to the 1908 basis and will stay there for a long time to come.

Now then, we may freely admit that the Pay Bill is not a perfect instrument; that it does not represent an advance over the 1908 basis proportional to the increase in living costs since 1908; that it does not afford an absolute equity as between all officers in each grade; that it is unfortunate to reduce the pay of privates who enlist in future. Nevertheless after making a thorough study of the bill, it is the opinion of the Editor—

First, that the bill provides for the most that can possibly be expected from Congress;

Second, that the possible inequities perpetuated had better have been corrected, if at all, by legislation prior to and independent of the consideration of the present bill, and that any attempt by this bill to disturb the *status quo* would almost certainly doom it to defeat;

Third, that while permitting a substantial saving to the Government from the 1920 basis, the bill does insure to every Coast Artilleryman some increase over the 1908 basis.

Already the discussion of the bill shows that many people have not read its provisions with sufficient care. For instance, one officer had the idea that in computing longevity pay, he would start his fogies all over again every time he stepped up to a new base pay, whereas the language of the bill makes it clear that longevity is computed from the beginning of his service, increasing each three years up to thirty years. Others have missed the point that the "saving clause" refers to pay alone, and not to pay and allowances, so that any officer whose pay alone under the new bill, would be less than his 1908 pay, will receive the 1908 pay plus the allowances under the new bill.

Whoever is disposed to criticize the reductions in the rates for the junior grades of officers, would do well to take pencil and paper and quietly compute for his own information the total compensation he would receive during a normal life time under the Wadsworth-McKenzie Bill and under the 1908 Schedule, on any reasonable assumptions as to promotion. Among other things, such a computation will show that the slower the promotion, the greater is the comparative benefit from the new bill. Let's not forget that promotion is going to be slow hereafter, and then slower.

So then, as one Coast Artilleryman to another, let us urge that nobody knock the bill publicly *until he is sure of his ground for objection.* Again let us not forget that under any circumstances a half a loaf is better than none, and that very likely he who gets up on his hind legs now and hollers that the loaf is too small, poorly baked or ill-flavored, will merely succeed in losing the loaf not alone for himself, but for all the rest of us and our wives and families. Above all there is now the least justification for the dog in the manger attitude of him who would jeopardize the welfare of the whole service by opposition based on the ground that someone else may obtain a greater advantage.

Naturally, many of us are not consumed with enthusiasm for the provisions of the new bill as compared with our present pay. Nevertheless we are not blind to the political situation, and having this in mind, we can entertain a very sincere and profound feeling of appreciation and gratitude for the infinite and gratuitous pains taken by Senator Wadsworth, Congressman McKenzie, and the other members of the Joint Committee, in their whole hearted effort to accomplish the greatest

measure of justice to the services which lies in their power. May the outcome justify their effort!

✣ ✣ ✣

Why Not?

Here are an idea and a scheme based thereon which seem sufficiently worth considering so that an attempt will be made to explain the one and set forth the other. This suggestion is based upon the following premises:

(1) Within the Battery, the development and training of the range section is a longer and more difficult process than the making of the gun sections.

(2) Within the Coast Defense, the coordination of communications, observation and intelligence necessary to the flexible and positive tactical control of all elements of the defense is a hard thing to attain in any case, cannot be improvised, and at the present time the whole matter of a system of command is still in a lamentably inchoate and experimental state.

(3) While the small peace time strength of the army will always require the maintenance of the Coast Defenses on a reduced basis in peace, with so few companies that many batteries must be kept out of commission, yet the peace time organization and training of the Coast Artillery should be directed toward the placing of the Coast Defenses on a war basis in the minimum of time.

(4) The most essential thing to reduce the time necessary in putting a Coast Defense on a war basis is to have a completely developed organization for command, ready to function completely and smoothly in all its technical and tactical details. It has been considered preferable to avoid skeletonizing individual battery organizations, so that while the total number of batteries in service may be very much reduced, yet each battery that is in service will be kept sufficiently manned so that the coordinated development of battery training may proceed. There has not apparently been recognized the same necessity for avoiding the skeletonizing of the organization of the command personnel of the Coast Defense. Yet the necessity exists for the maintenance of this organization in functioning form to an even greater extent than in the individual battery, for two important reasons; first, because when the reinforcement of the Coast Defense to a war basis is ordered, this command personnel will have to carry full load from the start, in getting the batteries individually on their feet and then fitted into fire commands and battle commands, and second, because the whole theory and practice of a system of command is the least developed element in coast defense operations today.

(5) In attempting quickly to man batteries out of commission with entirely new organizations, the period necessary to convert the battery

into an efficient fighting unit will depend upon the time necessary to train the range sections, as it is well known that a good gun commander and gun pointer can quickly polish off a green gun section. Therefore if newly organized c ›mpanies of National Guard or Reserves, upon reporting to a Coast Defense, could have transferred to them complete range sections, the period necessary to prepare them for action would be materially shortened. It is not of course intended to suggest that range sections should be supplied to National Guard companies which had been organized and trained before the outbreak of war.

(6) From a technical standpoint, the rehabilitation of communications and fire control apparatus sometimes is the most difficult part of the work involved in putting a battery in commission, especially if the battery has been out of commission for a long time. Many officers who have ever had to undertake this task will testify to the fact. Consequently any scheme which would keep all communications and fire control apparatus constantly in service would forestall deterioration and loss of adjustments and data, and thereby would shorten the time necessary to put a battery in commission.

(7) The smaller the peace time Coast Artillery, the greater the necessity that every individual therein should be fitted, not only through instruction, but as well by practice, to exercise in war the greatest responsibility of which he is capable. Every lieutenant should be practised in commanding a battery, and every soldier, who is sufficiently capable, should be able by practice to do the most difficult work of the battery, namely that of the range section.

Now then, the combined consideration of these seven premises has developed the idea that the Coast Defense command organization should be fully manned and should function all the time, and that the range sections of all batteries, both in and out of commission, and all communications within the Coast Defense, should be in service, manned, and in training constantly.

So much for the idea. Now the scheme to accomplish it is simply this:

First, do not disturb the present company organizations nor the present method of administration, but in addition to requiring each company to man and fire its assigned battery, assign a lieutenant and the necessary number of men from each company to put in service the fire control system and communications of a battery out of commission. The lieutenant, in addition to his subaltern duties with his own company, will be the battery commander of the battery out of commission, for which he trains a range section, and for which he is charged with full responsibility.

Second, by the organization of a proper Headquarters Company, or lacking that by detail from among the other companies, provide a complete command, observation and intelligence organization for the Coast Defense.

Third, in starting the operation of the scheme, take a time of year after the conclusion of the battery target practices, and until the training of all the men in their alternative positions has proceeded far enough so that the whole system is working smoothly, neglect regular battery drills, and concentrate on training the full fire control and command organization, individually and collectively. This would be especially necessary where telephones, wiring, and apparatus would require overhauling and repair.

Fourth, after the system had been well developed, devote say one or two days each week to drill of the full fire control organization, the remaining days to be left to company commanders for their regular battery training. In each year for a period of perhaps one month prior to the target practice season, the training of the full fire control organization could be omitted, devoting all of the time to battery training.

Fifth, if there are not enough regular officers to provide the full complement for battle and fire commands, and a battery commander for each battery in the Coast Defense, complete the complement by assigning noncommissioned staff officers who are Coast Artillery Reserve officers. In fact it would be well to give commissioned assignments to such noncommissioned staff officers anyhow.

Sixth, after all of the men assigned to positions in the full fire control organization have become proficient, assign every soldier possessing the requisite intelligence not previously required for the manning detail to a position as an understudy for another trained man.

Now in conclusion it may be observed that this scheme would serve to eliminate the gap between the present condition of attention merely to the routine training of soldiers and the development of a few organized companies, and the readiness to accomplish the full mission for which Coast Defenses are installed. The scheme would develop the tactical sense of all officers by allowing them to see daily the whole tactical organization working full blast. It would insure that every lieutenant was instantly fit for the duties at least of a battery commander. It would stimulate the interest of every soldier, and on the outbreak of war would provide the full fire control personnel required for new organizations. It would not cost the government an extra cent, and would actually save money by the prevention of deterioration of communications, stations and apparatus otherwise out of service. It would not add to the administrative problems, as administration would remain with the present companies. Probably it would not even call for orders from higher authority than the Coast Defense Commander to put the scheme in operation. Finally by the constant practise in the combined functioning for all the elements of defense, it would reveal the weaknesses, suggest the corrections, and give us all the assured confidence of actual performance in the efficacy of our methods and resources.

Solution of Problem No. 51—Gunnery

Elevation of target = ½ (600 − 580) = 590 feet

$$n = \tan^{-1}\frac{600-580}{190} = 107 \text{ mils}$$

(a)

$$S = \tan^{-1}\frac{590-390}{3\times 6175} = +11 \text{ mils}$$

$$\omega' = \omega + S = 470 + 11 = 481 \text{ mils}$$

$$n' = n - S = +107 - 11 = +96 \text{ mils}$$

$$E'_p = E_p\frac{\sin\omega'}{\sin(\omega' + n')} = \frac{34 \sin 481}{\sin(481 + 96)}$$

log 34	1.53148
log sin 481	9.65788
colog sin 577	0.27030
log E'_p	1.45966
E'_p	28.8 yards.

(b)

$$S = \tan^{-1}\frac{590-1081}{3\times 6175} = -27 \text{ mils}$$

$$\omega' = \omega + S = 470 + (-27) = 443 \text{ mils}$$

$$n' = n - S = -107 - (-27) = -80 \text{ mils}$$

Doubly interpolating into the table (tabular values shown bold face)

	−51 mils	−80 mils	−102 mils
400	**1.14**		**1.32**
443	1.12	1.22	1.29
500	**1.10**		**1.24**

whence it is seen that $\sin\omega'/\sin(\omega' + n') = 1.22$

and $E'_p = 1.22 \times 34 = 41.5$ yards

(c)

Using the formula of page 16,

S [from (b) above] = −27 mils

$\omega' = \omega + S = 470 + (-27) = 443$ mils

$n' = n - S = +107 - (-27) = +134$ mils

$$E'_p = E_p \frac{\sin \omega'}{\sin (\omega' + n')} = \frac{34 \sin 443}{\sin (443 + 134)}$$

log 34	1.53148
log sin 443	9.62463
colog sin 577	0.27030
log E'_p	1.42641
E'_p	26.7 yards

Using the table on page 17 (tabular values being in bold face type)

	+102 mils	+ 134 mils	+152 mils
400	**.81**		**.74**
443	.83	.79	.76
500	**.85**		**.79**

from which is seen that $\sin \omega'/\sin (\omega'+n') = 0.79$

and $E'_p = 0.79 \times 34 = 26.9$ yards.

Solution of Problem No. 52—Gunnery

In tabulating the deviations of these shots, it is seen that:

(a) Shot No. 6 may be discarded as erratic since inspections shows that the lateral deviation is abnormal; (b) Shot No. 9 should be discarded as erratic since inspection shows that the longitudinal deviation of this shot is abnormal.

Shot	Range Deviation		Deflection Deviation		Errors	
	Over	Short	Right	Left	Range	Deflection
1	10		22		.67	20
2	290		26		213	24
3	250			26	173	28
4	150			10	73	12
5		110	2		187	0
6	50			106	abnormal	
7	30			10	47	12
8	150		2		73	0
9		560		2	abnormal	
10	10		14		67	12
11		90		2	167	4
Totals	890	200	66	48		
	−200		−48			
Sum	690		18		1067	112
Dividing by 9	+77		+2		118	12.4
Multiplying by .845					100	10

from which we see that the range probable error may be taken as 100 yards while the deflection probable error may be taken as 10 yards.

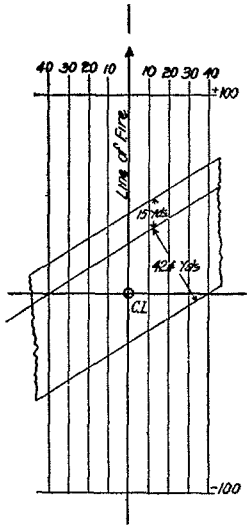


FIG. 1.

Using these values, sketch a portion of the ladder of dispersion and superimpose on it, the target, as shown in Figure 1. To determine the equivalent ground plan of the target, the height of the target must be projected onto the horizontal by multiplying the height of the target by the cotangent of the angle of fall. Then 8 cot 28°04′ = 15 yards, the additional danger space due to the height of the target. Add this to the target in the sketch of the ladder of dispersion.

From inspection of this figure, it is seen that no part of the target is included in any but the longitudinal 50% zone and that the target is equally extended across the lateral 100% zone, so that the deflection probability of hitting is 100%. Further inspection shows that the target proper covers ¼ of the 50% zone and for this part of the total target, the probability of hitting is then, ¼ × 50% = 12.5%. In addition to this there is the danger space of 15 yards due to the height of the target. The probability of hitting this portion is $\frac{15}{2\times100}\times$ 50% = 3.75%. Combining these, the probability of hitting for each gun is 12.5 + 3.75 = 16.25%.

The probability of missing for each gun is 100% − 16.25% = 83.75%. Since there are two guns in the battery, the probability of both missing in a salvo is $(83.75\%)^2$ and the probability of hitting for a battery salvo is 1 − $(83.75\%)^2$ = 29.86%.

Problem No. 53—Gunnery

DETERMINATION OF BALLISTIC WIND—SINGLE STATION METHOD

Reference: Chap. 7, Part I, Gunnery for Heavy Artillery (Provisional).

GIVEN:

The following data was recorded during a pilot balloon flight, the observation being made from a single station only.

Rate of ascent: 200 yards per minute
Zero setting on north.

Time min.	Elevation degrees	Azimuth degrees	Altitude yards
2:30	28.3	27.9	500
5:00	26.4	38.4	1000
7:30	27.1	54.7	1500
10:00	28.4	56.9	2000
12:30	28.2	49.9	2500
15:00	29.6	39.6	3000
17:30	31.0	29.8	3500
20:00	30.0	20.0	4000

REQUIRED:

Compute the ballistic winds for maximum ordinates of 1000 and 4000 yards. Use the table of weighting factors printed herewith instead of those in Table A of the text.

TABLE OF WIND WEIGHTING FACTORS

Zone	Max. Ord. yds. / Altitude yds.	500	1000	1500	2000	2500	3000	3500	4000	4500	5000
1	0 - 500	1.00	0.10	0.28	0.21	0.17	0.14	0.12	0.11	0.10	0.09
2	500 - 1000		.59	.27	.20	.16	.14	.12	.11	.09	.08
3	1000 - 1500			.45	.20	.16	.13	.11	.10	.09	.08
4	1500 - 2000				.39	.17	.13	.11	.09	.08	.08
5	2000 - 2500					.34	.14	.12	.10	.09	.08
6	2500 - 3000						.32	.14	.10	.09	.08
7	3000 - 3500							.28	.12	.10	.08
8	3500 - 4000								.27	.11	.09
9	4000 - 4500									.25	.10
10	4500 - 5000										.24

Solution of Problem No. 3—Orientation

Angle ECF = 180° − (∠CEB + ∠BEF + ∠CFE)

∠CEB = 30°01′30″
∠BEF = 29°02′30″
∠CFE = 57°13′00″

sum = 116°17′00″
and ∠ECF = 63°43′00″

In the triangle CEF, by the Law of Sines, $CE = \frac{EF \sin \angle CFE}{\sin \angle FCE}$

log EF 1.0888446
log sin CFE 9.9246535
colog sin FCE 0.0473939

log CE 1.0608920

Similarly, in the triangle CAE, $\sin \angle CAE = \frac{CE}{AC} \sin \angle AEC$

log sin AEC 9.9638722
log CE 1.0608920
colog AC 6.5086383

log sin CAE 7.5334025
∠CAE 0°11′44″

Angle ECA = 180° − (∠CAE + ∠AEC)

∠AEC 66°57′08″

sum 67°08′52″
∠ECA 112°51′08″

From the given coordinates of B and C

side $CB = \sqrt{(x_B - x_C)^2 + (y_B - y_C)^2}$

x_B 204262.4 y_B 561391.8
x_C 204187.6 y_C 561152.6
dX 74.8 dY 239.2
$dx^2 + dY^2 = \overline{CB}^2 = 62812$
log $\overline{CB}^2$ = 4.7980404
log CB = 2.3990202

Erratum. In Table of Wind Weighting Factors, the value 0.10 for Zone 1 and Max. Ord. 1000 should be 0.41.

The Y-azimuth of CB is determined from the tangent formula

$$\tan U_{CB} = \frac{x_B - x_C}{y_B - y_C} = \frac{dX}{dY}$$

log dX	1.8739016
− log dY	2.3787612
log tan U_{CB}	9.4951404
U_{CB}	17°21′54″

and from the tables Y-azimuth of CB

In the triangle CBE, by the Law of Sines, $\sin \angle CBE = \frac{CE \sin \angle CEB}{CB}$

log CE	1.0608920
log sin CEB	9.6992981
colog CB	7.6009798
log sin CBE	8.3611699
∠CBE	1°18′58″
∠CEB	30°01′30″
sum	31°20′28″
∠ECB	148°39′32″
∠ECA	112°51′08″
sum	261°30′40″
∠ACB	98°29′20″
∠ABE	78°17′29″
∠CBE	1°18′58″
∠ABC	76°58′31″
∠ACB	98°29′20″
sum	175°27′51″
∠BAC	4°32′09″

$\angle ECB = 180° - (\angle CBE + \angle CEB)$

$\angle ACB = 360° - (\angle ECA + \angle ECB)$

In the triangle ABC, $\angle ABC = \angle ABE - \angle CBE$

$\angle BAC = 180° - (\angle ABC + \angle ACB)$

From the Law of Sines, $AC = \frac{CB \sin \angle ABC}{\sin \angle BAC}$

log CB	2.3990202
log sin ∠ABC	9.9886806
colog sin ∠BAC	1.1019193
log AC	3.4896201
AC	3087.6 yds.
Y-azimuth of the line CA = 360° + U_{CB} − ∠ACB	360°00′00″
U_{CB}	17°21′54″
sum	377°21′54″
minus ∠ACB	98°29′20″
Y-azimuth of line CA, U_{CA}	278°52′34″

Using the usual formulae for the determination of coordinates from the length and azimuth of the line CA,

log CA 3.4896201	log CA 3.4896201
log sin U_{CA} 9.9947676	log cos U_{CA} 9.1883612
log dX 3.4843877	log dY 2.6779813
dX − 3050.6	dY + 476.4
x_C 204187.6	y_C 561152.6
x_A 201137.0	y_A 561629.0

For a check, in triangle ABC, $AB = \frac{CB \sin \angle ACB}{\sin \angle BAC}$

log CB 2.3990202
log sin ACB 9.9952158
colog sin BAC 1.1019193
log AB 3.4961553

Y-azimuth of the line BA = $U_{CB} + \angle ABC + 180°$

180°00′00″
U_{CB} 17°21′54″
∠ABC 76°58′31″
Y-azimuth of line BA = U_{BA} 274°20′25″

Determining the coordinates as above

log AB 3.4961553	log AB 3.4961553
log sin U_{BA} 9.9987527	log cos U_{BA} 8.8789795
log dX 3.4949080	log dY 2.3751348
dX − 3125.4	dY + 237.2
x_B 204262.4	y_B 561391.8
x_A 201137.0	y_A 561629.0

Results: Angles in triangle ABC: ∠ABC 76°58′31″
∠BAC 4°32′09″
∠ACB 98°29′20″

Length of side AC 3087.6 yds.

Coordinates of A: x 201137.0 y 561629.0

Orientation

QUESTIONNAIRE ON CHAPTER VIII

What quick approximate methods are available for determining the meridian? p. 131.

How do you identify Polaris? p. 133.

What is meant by sidereal time? How does it compare with apparent time? p. 135.

How may standard time be converted to mean time?

What is the procedure in the determination of the meridian from a solar observation? p. 144.

What values must be measured in the field?

What is the advantage of an observation on Polaris at culmination? at elongation? at any time? p. 148.

In making an observation on Polaris at any time, what is the procedure and what values must be measured? p. 149.

Describe the method of meridian determination by observations on a star at equal altitudes. What is the advantage of this method? What precautions must be observed? p. 155.

How may the meridian be determined by observation on terrestrial points? What is the difference between an arithmetical and a weighted mean? p. 156.

Problem No. 4—Orientation

MERIDIAN DETERMINATION BY SOLAR OBSERVATION USING SINGLE ALTITUDE METHOD

Reference: Chapter VIII Orientation for Heavy (Coast) Artillery
Ephemeris of the Sun and Stars for the year 1921

GIVEN:

The following field notes from a solar observation.

Sta. No. 4 Mark No. 4 Latitude 37° 00′ 02″
Date Dec. 2, 1921 Watch 0^m 2^s slow Longitude 76° 18′ 00″
Mark to left of Sun.

Point sighted	Time (a.m.) h m s	Altitude ° ′	Vernier A ° ′	Vernier B ° ′
Mark D			0 00	180 00
Sun D	9 38 19	21 15	136 45	316 45
D	9 41 26	21 06	138 00	318 00
R	9 43 47	21 55	137 55	317 55
R	9 48 07	21 54	139 27	319 27
Mark R			180 00	0 00
Sun R	9 55 50	23 21	321 08	141 08
R	9 58 40	23 06	321 08	141 08
D	10 1 16	23 58	321 41	141 41
D	10 6 15	23 57	323 27	143 27
Mark D			0 00	180 00

REQUIRED:

Compute azimuth of Mark No. 4 from Sta. No. 4.

Problem No. 5—Orientation

MERIDIAN DETERMINATION BY OBSERVATION ON POLARIS AT ANY TIME

Reference: Chapter VIII Orientation for Heavy (Coast) Artillery
Ephemeris for the Sun and Stars for the Year 1921

GIVEN:

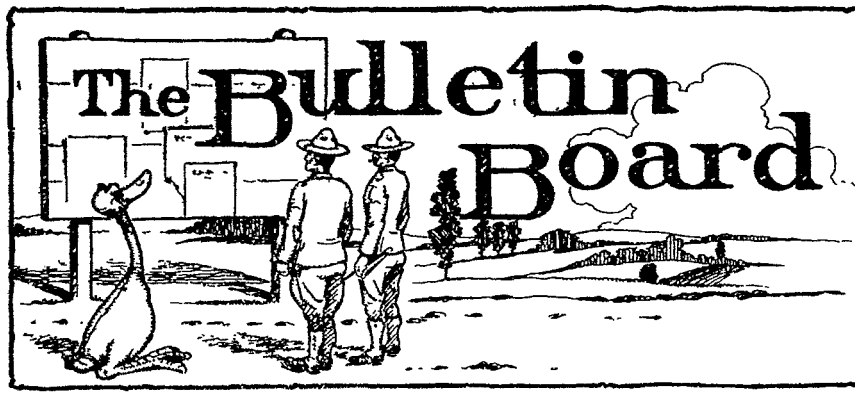
The following field notes from an observation on Polaris.

Sta. No. 5 Mark No. 5 Latitude 76° 18′ 00″
Date Dec. 3, 1921 Watch Error 2^s fast Longitude 76° 18′ 00″
Star – Polaris Mark east of star

Point sighted	Time (p. m.) h m s	Vernier A ° ′	Vernier B ° ′
Mark D		0 00	180 00
Star D	7 19 30	355 11	175 11
Star R	7 22 30	175 10	355 10
Mark R		180 00	0 00
Star R	7 27 20	175 09	355 09
Star D	7 29 35	355 08	175 08
Mark D		0 00	180 00

REQUIRED:

Compute the azimuth of Mark No. 5 from Sta. No. 5.



"In Times of Peace We Prepared for War"

To My Friends
The Officers and Enlisted Men
of the
Coast Artillery Corps
United States Army

A Brochure by Captain Harry L. Jones, U. S. S. BARRETT

My dear Clark—

I got this from the master of one of our Coast Defense vessels.

It bristles so with the *Spirit of Service* that I think it might be printed with this little note from me.

Sincerely,
(Sgd) RICHMOND P. DAVIS.

TARGET PRACTICE

We have day after day of fair clear weather, until Full Service Target Practice is ordered when it gets foggy and hazy and days are spent waiting to fire. Until one day it is clear and visibility good, the Coast Artillery Companies man the Batteries that guard the GOLDEN GATE and the people within. While the Artillery steamer "BARRETT" creeps out of the Harbor along the North Shore onto the range.

Off POINT BONITA we meet the tumble and send of the seas from the bar and "Potato Patch" and things begin to liven up and everyone gets action on. With decks awash and spray flying the Engineer tries to keep water out by plugging up key-holes, while the Range Officer disappears for a time and returns looking pale and thoughtful as if he had lost something he valued. While the detail of soldiers feed the dear little fishes and the man with the range-rake wishes he was back on the farm raking hay, instead of here, trying to keep his breakfast down and the rake up. And the Radio man thinks he hears the Angels singing, "Come to me" and wishes he could only go. When the Wireless Phone buzzes "go out to the 14,000 yard range" and out we go in a smother of foam.

Then the order comes "RANGE CORRECT, READY TO FIRE" and we are off, with red danger flag up. The tow-line seems, though known to be right, alarmingly short and the target awful close to the boat and a little error in deflection would crop the TAIL FEATHERS off the vessel, but the Boys SHOOT

STRAIGHT so what's the difference. The target detail are now calling out E-U-R-O-P-E and N-E-W- YO-R-K while they feed NEPTUNE and the Master Gunner tries, like the Soldier Boys of old, admonished to "KEEP THEIR POWDER DRY," to do the same with his camera, while the spray chases him around the upper deck. When away off at the batteries there is a *big puff of smoke* with a Heart of fire and all hands wait a MINUTE or so when with a ROAR the shot strikes with a splash of a SUBMARINE GEYSER and more shots follow fast, all spattering around the target, making hits or close to hits until the LAST SHOT, then as if to show what the boys can do when they try hard, they wipe the LITTLE PYRAMID OF RED off the face of the troubled waters, for THE SOLDIER BOYS of the COAST DEFENSES do shoot SOME STRAIGHT.

And then the order comes out of space by WIRELESS TELEPHONE "CLOSE PRACTICE" and all hands welcome it and are glad to get back in the QUIET WATERS of the HARBOR where all regain color and forget THEIR TROUBLES and what they lost and become husky again and THE DAYS WORK IS DONE.

Except the STR. BARRETT to keep in training for another day, plants Mines, transports troops or freight, tows a rock barge or something for exercise while resting up. While the soldiers go to their barracks and dream of seas as high as mountains chasing them up the mast and seeing lovely MERMAIDS with purple hair and yellow eyes, beckoning them to come to them and be a MERMAN and live happy ever after among the CRABS, FISH and SEAWEED.

THE PRICE OF LIBERTY

** * * An insert after the War * * **

And these same officers and men of the regular army, C. A. C. who had such good times, enjoying themselves so much when out on the Str. Barrett in the days of yore, were the solid rock of foundation when war came. Upon which were built the units of heavy artillery that went "over there" and COVERED THEMSELVES WITH GLORY and did so much in helping chase the "HUNS" over the Rhine and would have run them into Berlin and out again if permitted, and when the day came to go, the Str. Barrett transported them over the placid waters of the bay to entrain, the best of American Manhood. We always felt a strange lump rising inside as we watched them go and hoped they WOULD *ALL* COME BACK safe and sound but knew many wouldn't for these officers and men of Coast Artillery companies of the United States Army I had known long and liked them, and SURELY WISHED THEM WELL.

But when we brought them "HOME AGAIN" we missed many and I knew some of my soldier friends had made the SUPREME SACRIFICE for their COUNTRY AND FELLOW MEN. While many others returned broken in body and health, the price of OUR COUNTRY'S FREEDOM and HAPPINESS.

Sincerely,

HARRY L. JONES.

Major Fulton Again Captain of Rifle Team

Major William S. Fulton, C. A. C., stationed at Fort Terry, New York, has been designated by War Department Orders as Captain of the Coast Artillery Rifle Team for the National Matches in 1922. It is desired that all Coast Artillery Officers and men who are interested in Rifle Shooting, or who would like to tryout for the Rifle or Pistol Team, communicate directly with Major Fulton. Warrant Officers serving with Coast Artillery troops are eligible.

The National Matches will be held at Camp Perry, Ohio from September 2 to 28. Preliminary tryouts however will be held several months prior to that date.

The Coast Artillery Rifle Team won tenth place in 1920 and sixth place in 1921. Our team is now traveling in fast company and the co-operation of the whole Corps is necessary in order to boost the team to a higher place in 1922. *It can be done*, so give us a hand and lets climb higher this year.

Additions to Rifle Team Fund

Between February 9th and March 6th the following additional contributions to the 1922 Rifle Team Fund were received, and are gratefully acknowledged on behalf of the Rifle Team.

While these additions, amounting to $149.91, added to the amount previously acknowledged—$257.57, bring the total to $407.48, yet we are still nearly $200.00 short of the amount needed, with seven active Coast Defenses and many detached officers yet to be heard from.

SOURCE OF DONATIONS	AMOUNTS
1st Coast Artillery District	$2.00
9th Coast Artillery District	2.00
Coast Defenses of Pensacola (Additional)	2.91
Coast Defenses of San Diego	8.00
Coast Defenses of Delaware	11.00
Coast Defenses of Sandy Hook	21.00
Coast Defenses of Pearl Harbor	42.00
Colonel J. C. Johnson, C. A. C.	1.00
Major Donald Armstrong, C. A. C.	.50
Major Eugene Villeret, C. A. C.	.50
Coast Defenses of Puget Sound	34.00
Lt. Colonel W. H. Wilson, G. S.	1.00
Coast Defenses of Long Island Sound	24.00
Total this month	149.91
Previously acknowledged	257.57
Grand Total	$407.48

Enlisted Specialists' Examinations

The annual entrance examinations for admission to the Artillery, Clerical, Engineering, and Radio Courses, Department of Enlisted Specialists, Coast Artillery School, will be held at all Coast Artillery posts and stations beginning May 1, 1922. From the successful candidates, students for the courses beginning in September, 1922, will be selected. The examinations are open to all enlisted men of the Coast Artillery Corps. Applications for examination must be submitted to the applicant's coast defense or regimental commander on or before April 15, 1922.

On account of a surplus of warrant officers in the Army Mine Planter Service, the Deck Course and the Marine Engineering Course, which prepare enlisted men for appointment in this service, will not be given during the school year 1922-1923.

Brigadier General Maitre

From Major Donald Armstrong, C. A. C., Assistant Military Attache in Paris we have learned that the former Chief of the French Mission with the American Artillery A. E. F., is now to be addressed as Brigadier General Maitre. The General is only fifty years old, and it very rarely happens that the rank of general officer is conferred at that age in the artillery. Very few promotions have been made in the French Army, and American Coast Artillery officers will learn with pleasure of the honor that has been bestowed on one of the French Officers with whom they came in contact to so great an extent during the war.

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Strategy and Air Strategy.—*UK-13*, November, 1921.
Strategie et Operations dans L'est.—*F-12*, January, 1922.
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Tirs D'Accompagnement de L'Artillerie de Campagne.—*F-10*, January, 1922.
Utilization of Artillery on German West Front during World War.—*Sn-1*, 4th Quarter, 1921.

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Notes on the Rapid Instruction of Firing Batteries from Untrained Personnel.—*US-27*, September-October, 1921.

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From Trireme to Dreadnaught.—*US-65*, November, 1921.
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Naval Construction in 1921.—*UK-8*, January, 1922.
Sommercibili Moderno.—*I-4*, November, 1921.

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BOOK REVIEWS

The Management of Men. By E. L. Munson. New York. Henry Holt and Company. 1921. 5½" x 8¾". 900 pp. 53 il. Price $6.00.

Under this title, the author has given us the benefit of his years of study of soldier psychology and of his labors in charge of the morale organization of our army during the World War. Believing that the management of men and the development of morale are inseparable, he has combined the two in this study and has made use of the Army as a psychological laboratory. For the benefit of those whose memory it has slipped, Colonel Munson was Chief of the Morale Branch, War Plans Division.

After a treatment of general principles, the many varied factors affecting morale are discussed. Chapters on the mechanism and functioning of the military morale organization follow. The remainder of the volume is devoted to the problems of leadership in its many phases and their application to the "Management of Men." All phases of military life are discussed painstakingly and solutions to the many problems confronting an officer are suggested. The frequent diagrams and charts assist in the demonstration of the principles involved.

Coming from an author whose experience and study so well qualify him, this book forms a valuable source of inspiration to the officer who is in command of a body of soldiers and who has the will to win.

The New World, Problems in Political Geography. Dr. Isaiah Bowman. The World Book Company. Yonkers-on-Hudson, New York. 1921. 638 pages. 6½" x 9¾". 65 Ill. 215 Maps and Charts. Cloth. Price $6.00.

In some respects this is the most remarkable book yet seen on the world problems forging to the front today. If it be a treatise on problems in political geography, it is indeed much more unless political geography be taken to include history, internal economics, ethnological problems, the questions arising from the financial condition of all the countries in the world, and the racial and religious differences affecting the world's outlook today.

The author is peculiarly qualified for such a task by reason of his position as Director of The American Geographical Society and the fact that at the Peace Conference at Paris he was Chief Territorial Advisor of the American Commission and Executive Officer of the division of territorial, economics, political intelligence. In a most unusual way he has arranged the mass of material at his command so as to show the inter-relation for each of the countries of the world considered of the racial, political, ethnological, and economic problems now facing the world.

The mechanical make-up of the work is excellent, with a free use of marginal sub-heads, and a remarkable series of diagrammatic maps and charts.

The author is concerned only with setting forth facts and marshalling data, leaving conclusions to be drawn by the reader. The book is a mine of informa-

tion to the officer who may be looking for military intelligence in the economic and geographic field. An examination of the extensive bibliography at the end of the book will reveal the extent to which the ordinary student would need delve in order to obtain and classify the information which is here gathered in condensed and logical form for his use.

Les Methodes Actuelles de la Balistique Extérieure. By Dufrenois, Risser and Rousier. Paris. Gauthier-Villars & Co. 6½″ x 10″. 1921. One vol. 244 pages, 38 figures. Paper covers. 40 francs.

In the preface to this excellent work written by M. Paul Appell of the *Institut de France,* explanation is made for the methods adopted by the authors whose aim has been to produce a work thoroughly revised in accordance with the experiences of the late World War. To do this they have commenced with the pre-war methods of Didion and Siacci for direct fire and Euler for curved fire, and with the aid of more recent modifications and deductions by Charbonnier, have compiled a comprehensive handbook for the artillerist, or engineer. To add to its practicability, type problems are given, which with the aid of tables of values of functions, will serve to assist in the solution of practical problems arising in the field.

The following is the table of contents by chapters:

I. Laws of air resistance. F(v).
II. General properties of trajectories.
III. Method of calculating trajectories by alteration of the law of air resistance, or by an analytical representation of this law.
IV. Method of calculating trajectories by successive arcs.
V. Ballistic Tables.
VI. Calculations of corrections by differences.
VII. Calculation of corrections—Differential Method.
VIII. Wind Problem.
IX. Representation of trajectories.
Firing with a large angle of site.
X. Use of ballistic tables to make Firing Tables.

Trois Conférences sur Ludendorff Chef D'Armée. By Colonel G. Becker, Breveté D'Etat-Major. Berger-Levrault, Nancy-Paris-Strasbourg 1920. 106 pp. with 16 maps.

This book comprises three lectures given by Colonel Becker during the spring of 1920 to the officers of certain garrisons in France, being a general analysis of the preparation and conduct of the war by Ludendorff. The author states in his foreword that the lectures are given during a course where the object is to develop closer bonds of friendship and esteem between officers of the different parts of the French Army. He states in summing up at the end of the book that "the French school with the Will combined with the Event has triumphed over the German school: Obstinacy and Pride." It is evident from the above that no discussion of Ludendorff will be given that would tend to criticise French tactics or strategy, and this must be kept in mind in considering the book.

The author starts out by showing that it was Ludendorff who was at the head in preparing for and directing the war; that while he was under the orders of Hindenburg and Emperor William nominally, that actually he was able to obtain their approval to most of his plans. The first lecture is devoted to "The reunion of the forces." Ludendorff from 1904 to 1913 was a member of the operations section of the general staff, during 1911 to 1913, its chief. Anything that he has said to the contrary, Ludendorff believed that a war was going to come and that

it would be with France; furthermore he had no illusions as to the non-intervention of Russia and England. Neither did he place any value on help from an alliance from Austria-Hungary and Italy but felt that Germany must rely on her own resources. In 1912 he deemed that three new army corps were necessary for his plans but was refused; he insisted and incurred the displeasure of the Emperor with the result that in 1913 he was sent to a regiment at Dusseldorf. Colonel Becker then proceeds to show how the Emperor in opening the war deviated from Napoleonic strategy and made fatal errors. Napoleon always united his forces for an attack against the strategic point of the enemy; Emperor William and his advisers were obsessed with the fear of an attack on the Russian front and instead of concentrating their forces for an attack on the French front vacillated between attacks on both fronts with the result of failing of a definite decision on either.

The second conference treats of the strategy and tactics employed by Ludendorff as Chief of the General Staff on the Russian front from 1914 to 1916. The operations against the Russians are taken up one by one and it is shown how in each case he minutely searched out the sensitive point of the enemy's line where the maximum strategic advantage would be obtained, concentrated his forces and attacked. In doing this Ludendorff did not follow the formula of the grand master of the German school, Moltke, "seek the principal enemy army and fight it where you find it"; his strategy rather followed that of Napoleon. But according to Colonel Becker the genius of Ludendorff was not that of Napoleon; they both seized the maximum strategic advantage at the sensitive point—Napoleon went further—he created the sensitive point himself.

The third conference is on "The conduct of battle." Ludendorff, in August 1916 was called to German general headquarters and given virtual conduct of the war. Colonel Becker shows how the application of his strategic principles brought success in the campaign in Roumania, in the fallback of the German army on the Oise in 1917, and in the offensive in Italy. But in his great attack on the Somme, March 21, 1918, strategic principles gave way to tactical principles,—and he failed. Strategy would have dictated an attack in the region of Lens, the shortest distance to the sea, thus separating the French and English; instead the attack was launched between Arras and La Fere where the terrain was not difficult and where the enemy's forces were feeblest—result, gain of prisoners, material and ground; strategically—none. Then followed the three successive attacks, Flanders, Chemin Des Dames and Champagne, independent one from the other and all on the principle of the least resistance, with the result of some tactical gains but no strategical ones. Ludendorff had now used up all his reserves and in July when the French launched their counterattack, he was outmaneuvered and the ability to command events passed from him forever.

Audel's Engineers' and Mechanics' Guide. By F. B. Graham. New York. Theo. Audel & Company. 1921. 6½" x 4¾". 8 vols. Price, $12.00.

Another of *Audel's Guides* has come to hand, this time for Engineers and Mechanics. It is published in a series of eight volumes of pocket size. Volume I covers the Theory and Practice of Steam Engines, Valve Motions and Valve Setting. All types of engines and valves are discussed. The second volume begins with a discussion of the Corliss Engine and covers the Theory, Construction and Operation of Steam Engines including Uniflow, Poppet Valve Engines and Locomobiles. The third volume discusses the Locomotive, Marine Engines, Turbines, Rotary Engines, the Indicator and Lubricants. Gas, Gasoline, Oil, semi- and full Diesel Engines, Aeroplanes and Aviation are included in Guide No. 4. The next volume includes the Theory and Construction of all types of Steam Boilers with discussions of combustion, fuel and flue gas. In volume 6, will be

found Boiler Construction with specifications and notes on the selection of a boiler. Heating, Ventilation, Refrigeration, Elevators, Condensers, Distilling Apparatus, Cranes, Pipe Fitting, Ropes and Cables form the subject matter of Guide No. 7. The final volume, Guide No. 8, covers electric wiring and engineering of every nature.

The subjects are covered in question and answer form in a manner in which the matter may be readily assimilated. The numerous tables and 8,700 illustrations indicate the completeness of the work. The Guide is so made up that either the set or any single volume may be obtained. This is well up to the standard set by the previous Guides published under Audel's name.

History of the United States. By C. A. & M. R. Beard. New York. The Macmillan Company. 1921. 5¼" x 7½". 663 pp. Ill. Maps.

A text suitable for high schools. According to the preface, the first contribution which this book makes towards an improvement over former histories is "One of omission." Stories of explorations and biographies of heroes are omitted, as it is thought that "if pupils know little or nothing" about explorers and heroes "by the time they reach the high school, it is useless to tell the same stories for perhaps the fourth time." Descriptions of battles are also omitted. "To dispose of Gettysburg or the Wilderness in ten lines or ten pages is equally absurd." "Diplomacy, foreign affairs, world relations and the reciprocal influences of nations" have been given "their appropriate place."

The make-up of this book is worthy of comment. The paper is of good quality, the illustrations clear and distinct, the registration of colors on the maps is excellent and the shades well chosen, and the signatures are strongly sewn on tapes. As examples of the up-to-dateness of the book might be mentioned illustrations of "Troops Returning from France," "The 'Big Four' of the Peace Conference," a map showing Reconstructed Europe and one showing Battle line of the Western Front Nov. 11, 1918.

A small but complete index makes this book of value in every home where there are growing children, as a parent can often glance at such a book and explain perplexing historical problems clearer than if the information were sought in the textbook the child is using.

Au 3ème Bureau du Troisième G. Q. G. (1917-1919). By Commandant Laure. Paris. Plon Nourrit et Cie. 1921. 4½" x 7½". 275 pp. 9 maps. Paper. Price 9 francs.

The title of this book is best thus explained:—There were three successive commanders of the French Army—Joffre, Nivelle and Pétain—who organized their respective staffs, hence the title may be translated as "G—3 of the THIRD GENERAL STAFF."

This is a valuable book for the student of strategy and tactics and bids fair to become one of the post-war classics. Not only was Major Laure in a position to observe the inner workings of the French General Staff during the critical period from 1917 to the end of the war, but that he has accurately portrayed them may be inferred from the endorsement of General Buat, Petain's G—3 and head of the author's bureau, who writes the preface.

The work derives merit from the fact that it is practically devoid of personal inferences or opinions concerning the various operations. The latter are narrated chronologically in succinct style, with occasional comment as to reasons which influenced certain decisions.

Probably the most interesting single subject treated is that of the re-education of the French Army to prepare it for a war of movement after the stalemate of

trench warfare. This also includes interesting studies of how to use most advantageously the newly acquired engines of war—the tank, high-powered mechanically drawn artillery, etc.

Little space is devoted to praise of the French Armies, and practically none to their American and British allies. But for this parsimoniousness of praise the author must not be too readily criticised, as he limits his statements to his personal experiences, which are admittedly restricted to limited localities.

Americans will find added interest in the very candid discussions of our military forces—what was expected of us before our entry into combat, our conduct in battle and other liberal miscellaneous criticisms. Whereas the high fighting efficiency of American troops is admitted, yet our staffs are described as green, poorly instructed and generally below par. The failure of the Americans to gain full success on the line Grandpré-Brieulles in October, 1918, is attributed to the "unfortunate" political considerations which had removed General Pershing from under the direct control of Marshal Foch. According to the author, this failure was retrieved through the good offices of General Maistre who was sent by Marshal Foch to co-ordinate the forces of Generals Liggett and Gouraud. There are thirty-two different occasions on which the Americans are mentioned in the book.

The book closes with a discussion of the considerations which influenced the reorganization of the French Army for the occupation of the Rhine Valley.

The Marines Have Advanced. By Lt. Col. Giles Bishop, Jr., U. S. M. C. Penn Publishing Co., Philadelphia, 1922. 5½"x7¾". 393 pp. Illustrated. Cloth. Price $1.75

Shades of Henty and Trowbridge! How can these old-timers keep their hold on the throbbing hearts of boy readers of today, when up-to-the-minute books appear like *The Marines Have Advanced* written by an officer and weaving in true enthralling fashion the tale of our own Marines, in action in Mexico and Haiti, frustrating German Spies in the Philadelphia Navy Yard, and voyaging over submarine-infested seas to the shores of France!

This is the second in a series of three boys' books on the Marines. Properly there is a hero—Dick Comstock—who has enlisted and wins his way to a commission in spite of intrigue and suspicion. However the distinctive thing which marks this book is the manner in which a deal of sound military instruction has been interwoven with the thrills.

The War Powers of the Executive of the United States. By Clarence A. Berdahl, Ph.D. Illinois. University of Illinois Press. 6½" x 9½". 296 pp. Price $2.25.

Is a treatise on a phase of our Constitutional Law to which our commentators have devoted but scant attention. It is one, however, which is important to every citizen who gives to his civic duties the same attention and care which he devotes to his personal affairs.

To the military man this phase of our basic law is vital as it is the source from which he derives all legal sanction for his acts.

The book takes up in order:

In Chapter I. The general concept and sources of executive powers.

In Chapters II to V, the President's powers relative to the opening of hostilities.

In Chapters VI to XI, the President's military powers during war.

In Chapters XIII to XV, the President's powers as to the termination of War.

The book as a whole is a well written and scholarly performance. The author has traced the various views of the executive powers as taken at different stages

of our constitutional development and set them forth in an orderly fashion singularly free from partisan bias.

The historical incidents illustrating the principles are well chosen. By judicious use of these, the author has contrived to make what would otherwise prove very dull reading to the layman a very readable work.

From the point of view of the military reader, the book is one which should be present at all headquarters and in the personal library of all officers whose duties or rank are such as to require independent action or legal opinions.

For the civilian it holds an interest for every voter though the vast powers conceded to the executive will cause any Jeffersonian Democrat (if such there be) some hours of serious reflection.

Lexique Technique Anglais-Francais. By Lieut. G. Malgorn, French Navy and M. Desmarets. Paris. Gauthier-Villars & Cie. 1920. 5″ x 7½″. 216 pp. Price 10 fr.

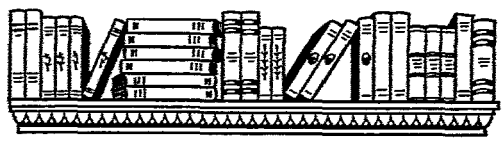
Lieutenant Malgorn has prepared a very good English-French dictionary of technical, i. e., engineering terms. As a result of his research, the latest terms are included. Upon going to press, the publishers arranged to include the more copious notes of M. Desmarets, but which were complete only through the letter F. The result is a well arranged serviceable dictionary.

The Evolution of Naval Armament. By Commander F. L. Robertson, R. N. New York. E. P. Dutton and Co., 1921. 6″x 9″. 383 pp. 23 il. Cloth. Price $7.00

From time to time, we find an article or treatise or hear a lecture on the evolution of the modern warship as illustrating that of the use of armor. With but very few exceptions, these begin not earlier than the middle of the nineteenth century. Often the evolution attributed to the warship as a whole is narrowed down to a discussion of that of guns and armor rather than of the ship as an entire composite structure.

The volume under discussion does more than that. It begins with the galley, the common form of fighting vessel of the fourteenth century, built solely of wood, propelled by oarsmen and manned by "soldiers clad in mail and armed with swords and lances." From that beginning until the early eighties of the last century, the development of design and materials of construction, the motive power, the offensive weapons and their manner of use, and the protective measures or armor are traced coincidentally.

One must not expect to find here a technical discussion of these developments. The book was purposely written to furnish a popular description of the evolution of naval armaments up to and including the *Admiral* class of battleships of 1882. In it one will find an excellent description of the evolution of cannon in the earlier stages, setting forth the methods of adaptation of the land weapon for use aboard ship. The real value of this volume lies in its connection of the modern with the medieval in a readable, single volume and as such it fills a long felt want.



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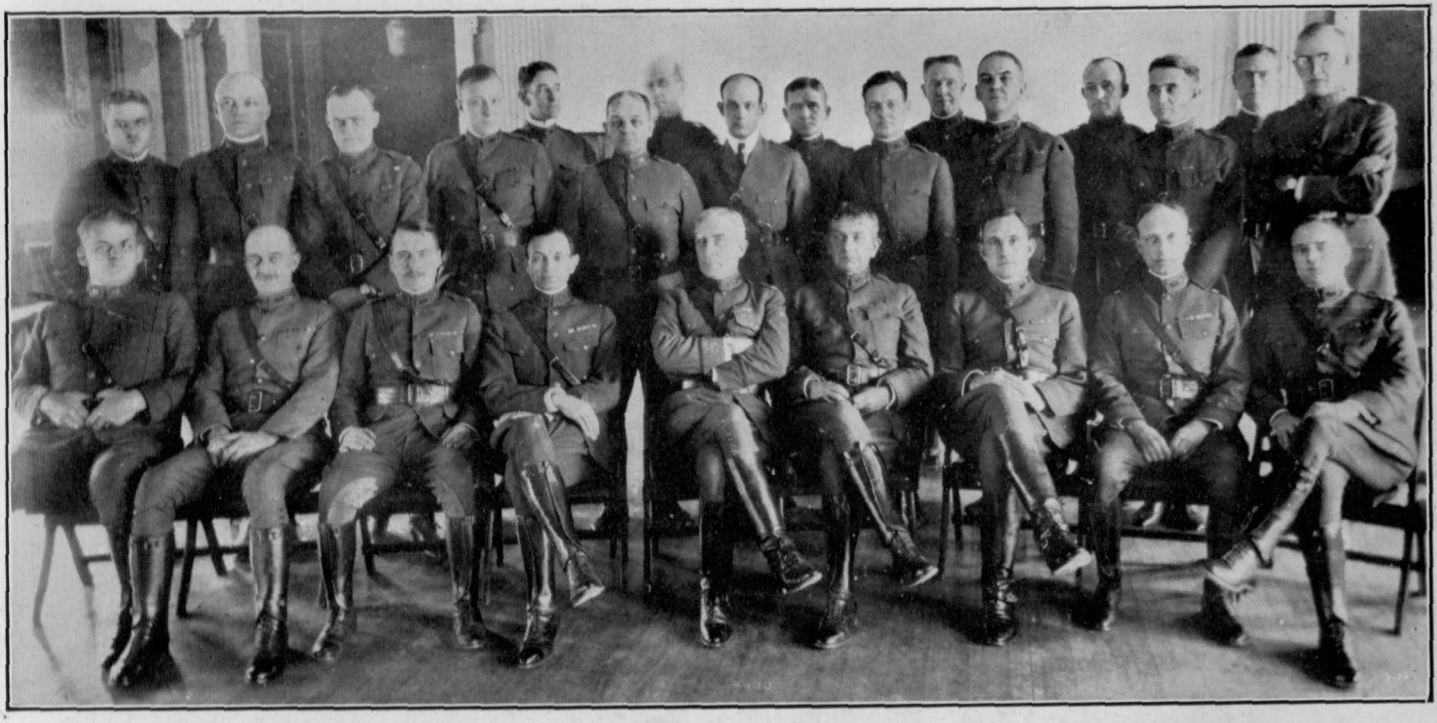

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