VOLUME VI NUMBER 2

APRIL-JUNE

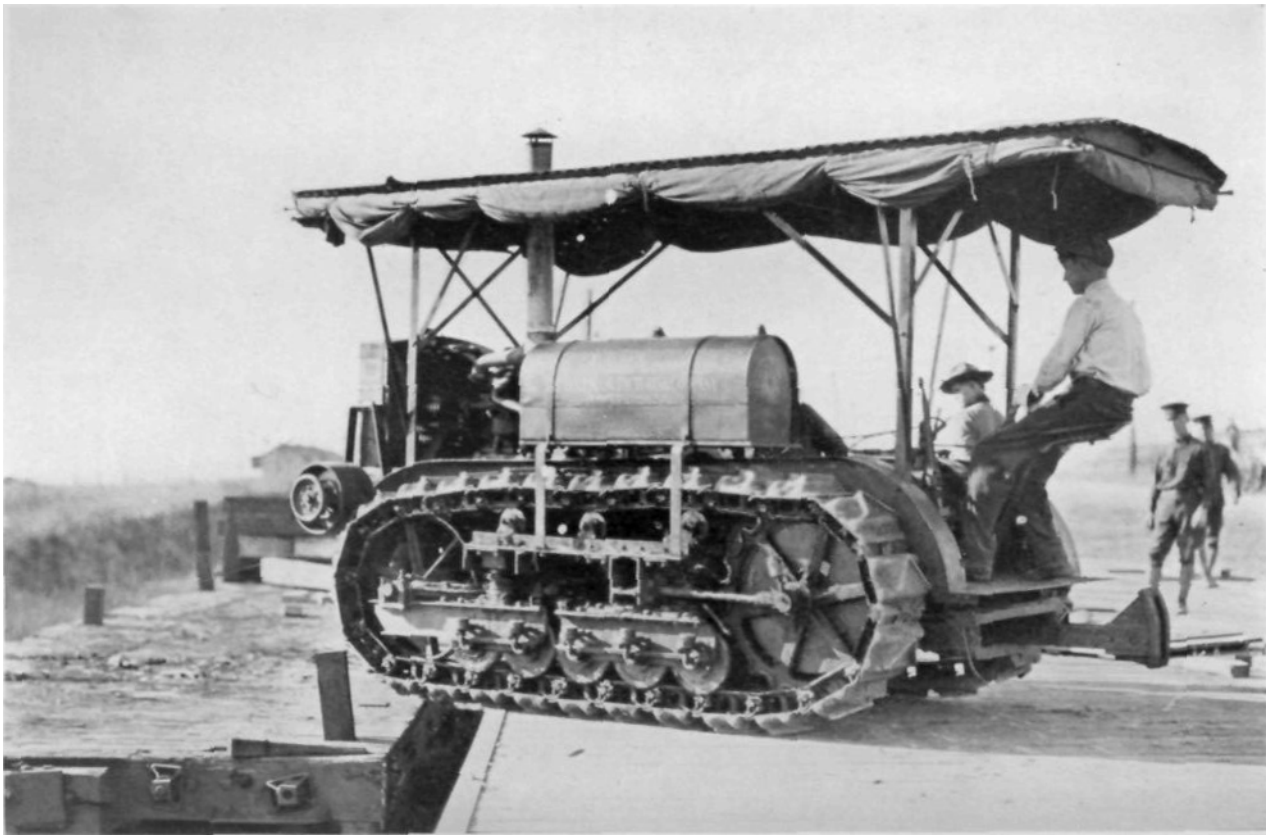
THE FIELD ARTILLERY JOURNAL

EDITED BY
DWIGHT E. AULTMAN
MAJOR, SIXTH FIELD ARTILLERY, ARMY WAR COLLEGE, WASHINGTON, D. C.

THE UNITED STATES FIELD ARTILLERY ASSOCIATION
WASHINGTON, D. C.

Contents

No. 2



POSSIBLY THE ARTILLERY HORSE OF THE FUTURE

THE FIELD ARTILLERY JOURNAL

VOL. VI APRIL-JUNE, 1916 NO. 2

The Day at Lens

A GLORIOUS RECOLLECTION OF MY HORSE ARTILLERY BATTALION IN THE BATTLE OF OCTOBER 4, 1914

BY MAJOR A. SEEGER, COMMANDING THE HORSE ARTILLERY BATTALION, 15TH FIELD ARTILLERY, GERMAN ARMY

(*From "Artilleristische Monatshefte," January, 1916*)

TRANSLATOR'S NOTE.—*The author of this article needs no introduction to the readers of this Journal. Two other articles in which he gives an account of operations in which his battalion participated, have already appeared in* THE FIELD ARTILLERY JOURNAL, *being published originally in "Artilleristische Monatshefte." In all of these articles there is not a trace of the drool usually found in the canned articles of so-called official correspondents or observers. Neither does one find even a suggestion of the venom and bitterness with which non-combatants and neutrals sometimes revile either one another or one or more of the numerous belligerents. To the trained professional soldier such feelings are unknown. To him war is brutal and ruinous, and he knows that it is hard to refine it. He treats his opponent with professional respect. To strike or insult a fallen foe is abhorrent to him.*

More than anything else, this article emphasizes the importance of the duties devolving upon battery and battalion commanders. Under modern conditions of warfare, by far the greater part of the fire efficiency of a battery depends upon

the efficiency of the Battery Commander, while its battle efficiency depends upon the tactical ability of the Battalion Commander. Above all they must be men of decision, leaders, virile men. Are our battery and battalion commanders prepared to meet the acid test?

WHEN at some future day the time comes to write the war record of the 15th Field Artillery, and it becomes necessary to think of some exceptional deeds of valor to which in the presence of our comrades we may point with pride, the 4th of October, 1914, will not be forgotten. It is one of the days which will always remain indelibly impressed upon my memory. With all its exalted, stern and sanguinary memories, it lies before me now after a year, just as if it had happened but yesterday. It proved to me that once again in this glorious war, as on the day of its baptism of fire, the battalion fought its opponents to a standstill and well deserved the confidence which our superiors had placed in it.

I consider it a special ordainment of fate that the English should have launched their great offensive of September 25, 1915, at Loos-Lens, exactly at the spot where we had a year earlier fought and bled. This offensive, as well as the simultaneous great offensive launched by the French in the Champagne, both failed completely after some initial success.

After the great Cavalry engagements at Bapaume in the last days of September, 1914, in which we were engaged mostly with hurriedly organized territorial troops, we were there relieved by the 27th Reserve Division (Württemberger and Baden). On October 2nd we, that is all the Cavalry Division around Bapaume, received the order to march off to the north, leaving Arras to our west, and to proceed to the district northwest of Douai, in order to cover the unprotected right flank of the German Armies, which flank was being threatened by the advance of strong French and especially English forces, then advancing from St. Omer via Bethune

toward the coal and mining districts around Lens, with the object of preventing this very important district from falling into German hands. The haste of our opponents was easy to understand because, as is well known, this district embraces the heart of the coal mining industry. The name given this district is *La Borinage*. It is composed of an endless communicating chain of pits, shafts and mines, making it very difficult to tell where the one begins and the other ends. In the last few years just preceding the war, a great amount of constructive work must have been done in the development and expansion of the coal industries. Anyway, our antiquated General Staff Maps, which had not been revised for several years, no longer checked up and especially failed to show the great number of recently constructed mine shafts and pits, power, factory and other industrial plants. Those who had new and up-to-date maps considered themselves lucky, and those who did not, had to fight their way through this immense and unknown district as best they could. The towns of Lens, Billy-Montigny, Sallaumines and Courrières, the latter so well known from the recent notorious mine accident, all formed a closed sea of houses, composed of laborers' and miners' homes, mine pits and shafts, and apparently endless streets lined with buildings, all of which offered material obstacles to the operations of our cavalry. Mammoth heaps of slag and dross, often twice as high as a church tower, were the landmarks of the district in addition to the giant furnaces and chimneys, the endless winding shafts, which gave a clear proof of the enormous importance of this district.

Here in this district, the scene of Zola's novel "Germinal," I saw with my own eyes the truth of those uncanny descriptions depicting the life of the workingmen's families of northern France and the awful destitution of these inhabitants and their neglect by the government. Again and again did we spend the night in these villages and were thus able to appreciate the depraved condition of these people and the absence

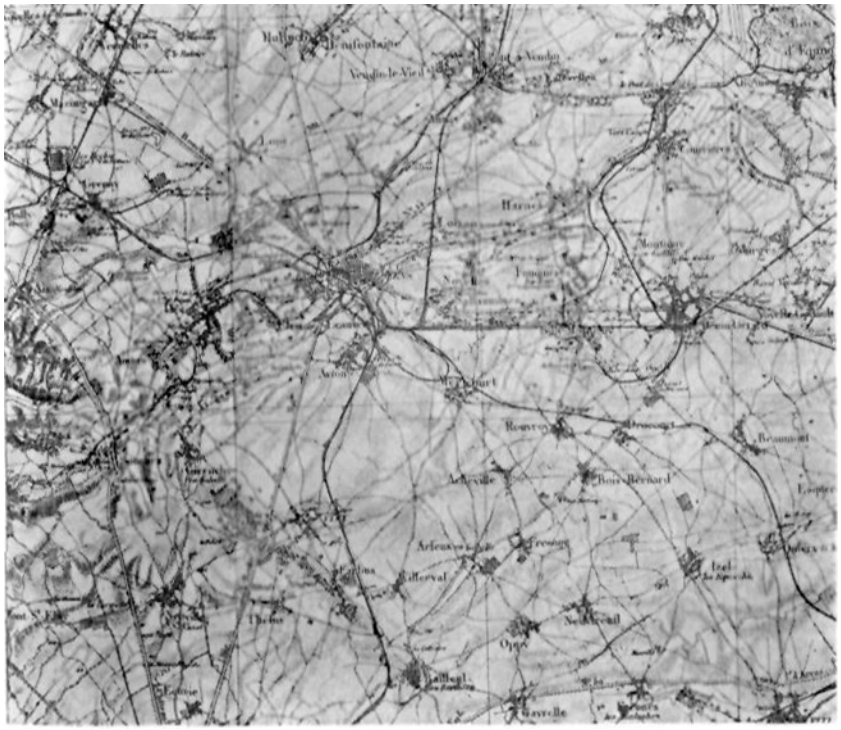
of all paternal governmental supervision, that is, the absolute want of labor regulations and protection to relieve the distressing condition of these workingmen.

One could see how prevalent were disease and sickness from the impoverished and exhausted faces. In addition, the general destitution and famine resulting from two months of war had greatly intensified all of these terrible conditions.

By a forced march on the 2nd of October, we had moved from the vicinity of Bapaume to the region west of Douai and that same night were quartered near Vitry-Artois (about 5 km. west of Douai) without having fired a shot, night having already fallen and the tactical situation not requiring a night attack. Once again every one was dead tired and exhausted, so that, after having settled in quarters, one scarcely took the time to eat the little that was absolutely necessary to appease hunger, unless one was lucky enough, as in my case, to have a good striker who at midnight brought a snatch to my bedside.

Early on the morning of the 3rd, we opened fire from Beaumont toward the north, firing on the towns of Henin-Lièтard and Billy-Montigny, both reported as being occupied by the enemy. It was a fire reconnaissance, as our regulations call it. Our mission was to cover the right flank of a Bavarian Reserve Corps with whom we also fought the next days on the Heights of Lorette near Arras. With the Bavarians we were the first troops to set foot on and to attack these places. In the course of the war they have become cities of the dead that have swallowed countless numbers of heroes. They will for all time stand as sacred historical landmarks of the war for all the participating armies; Lorette, Lens, Loos, Angres, Souchez, Givenchy and all the other blood drenched places.

This was also the day on which the Crown Prince of Bavaria issued his well-known battle order to the Sixth Army, in which he called attention to the fact that this was our first opportunity to fight against the English, and that it was our duty to show them what German valor could do.



MAP OF LENS AND SURROUNDING TERRITORY, REFERRED TO IN MAJOR SEEGER'S ARTICLE, "A DAY AT LENS."

Firing from the above mentioned village of Beaumont, my batteries began early on the morning of the 3rd of October to search the coal mines and pits about 3 km. distant and particularly the high mounds of slag which were surely being used by the enemy as observing stations. Their use in this manner in the fights which now developed was the cause of a great deal of trouble. One thing was certain, in this district the enemy was in every way making use of an admirable service of information and espionage, for which indeed all the necessary preliminary conditions were already existing in abundance. In this confused mass of buildings and in the innumerable hiding places and haunts common to such mining districts, it would have been impossible in so short a time to destroy or to render harmless all of these dens which only a few days before had been in the enemy's undisputed possession. Indeed, we all knew that the whole civil population was in collusion with the military authorities, and that careful and elaborate preparations had been arranged by which the supreme command would be kept constantly informed concerning our movements. Even early that morning I had noticed from my observing station that all around us signal lights were being used. Information was also being communicated in letter code by smoke signals from factory chimneys, or by signals from factory whistles or sirens. I therefore sent word to the Division Commander requesting that all localities already in our hands or which might be taken later, be minutely searched, that is as thoroughly as possible considering our deficient knowledge of the crafty system of espionage used by the French. Certainly, there was enough cavalry available for this purpose.

The heavy fighting which now developed on our left with the Bavarians whose flanks we were protecting, led in the course of the day to the occupation of the villages Rouvroy and Méricourt, both with heavy losses. This fight was continued for the next two days and led us, with the Bavarians next to us, through Avion and Liévin near Lens to the Heights of Lorette.

My statements are fully confirmed by an article recently appearing in the "*Fränkischen Kurier*" by a Bavarian Brigade Adjutant, who in highest praise acknowledges the valuable services which our cavalry and especially my horse artillery battalion rendered from the 3rd to the 9th of October.

During the afternoon (October 3rd), the Cavalry of the Division received the order to occupy Billy-Montigny. From this manufacturing town, hostile fire was still being directed at our 8th Cavalry Division which had already pushed its advance so far to the north that the enemy in this factory district was in a measure able to take them in rear, a very dangerous situation. Our Hussars dismounted to fight on foot, and advanced very slowly and cautiously against the town. My batteries were directed to support this advance and to take under fire the railroad station and its vicinity. The gun detachments of the 1st Horse Battery felt a keen delight in firing into this sea of houses, the range being scarcely 1000 metres, and with a few rounds dispersed the enemy who was evidently not in great force. Some of the houses began to burst into flames and we were able to observe that our field artillery projectiles have a very good incendiary effect. But it was a more difficult matter for our Jägers to take advantage of this effective artillery fire and to force an entrance into Billy-Montigny along the main road from the east. Without interruption, small arms bullets came whizzing down the whole length of the main road and our patrols could advance scarcely 100 metres at a bound without being taken under fire from all buildings. Once again our Hussars and Jägers called out: "Artillery forward to take the street under fire." One gun of the 1st Horse Battery under First Lieutenant Langfried was then dragged up by hand and while under hostile fire was pushed up on the main street at the first house of the village, where several dead inhabitants were already lying. Whether their death was due to their curiosity or whether they were caught red-handed with weapons in their hands and therefore shot as punishment, I

could not determine. At any rate they were persons of an age liable to military service, so that we were justified in taking them for soldiers in civilian clothes.

The village street was as straight as a right line, at least 1500 metres long and with eager expectation did we all, Jägers, Hussars and ourselves, await the effect of the first shot. I myself was present and gave the officer in charge orders to search the street with volleys at successive ranges, because a definite target could not be identified with certainty, and it was moreover impossible to establish positively from what houses firing was being delivered. At about 1200 metres we thought we could identify thin clouds of smoke coming from a tree lying across and blocking the road, and fire was directed upon it. The first shot caused all the windows of the houses in the vicinity of the gun to break. The shell sped straight down the street and struck close to the indicated target, whereupon the hostile fire diminished somewhat, only to be opened again with renewed energy as the position of our gun had been discovered. Under the protection of the shields the cannoneers served the gun as if on the drill ground, and soon shot after shot at different ranges was directed down the street, thus opening the way for our dismounted cavalrymen. In any way the enemy later evacuated the place and our flanks were here secure. In the meantime the fire of the other guns had been directed toward the centre of the town, at the church tower and the railroad station, and this fire also assisted materially. Our forces then occupied the town. Late the next evening we found shelter and cantonment in the place.

In the meantime the attack of the Bavarians had made progress and we were directed to support this with artillery fire. During my absence a Bavarian Commanding Officer had ordered my batteries to take position behind the confused mass of buildings surrounding a mine shaft, in order to take under fire numerous hostile groups which were withdrawing toward the west. I arrived just in time to indicate as observing station

for the batteries a mound of slag near a mine shaft to our right front. This mound exceeded in height all others in the vicinity. A thin veil of steam and smoke was constantly rising from it, an indication that the slacks were still hot. This and the very steep slope of its sides made us at once conclude that it would not be an easy thing to climb. With my staff I rode up close to the mound and immediately gave orders to establish the telephone stations of the battalion and the two batteries in position. We ourselves in the sweat of our brows, climbed this Vesuvian mound at the steepest part. It most certainly deserved its name. We could feel the burning heat through the soles of our shoes. The slacks constantly kept sliding down from under one's feet. This handicap and the dense suffocating smoke made the ascent extremely difficult. For me it was fortunate that I had been a fairly good mountain climber in my younger days. I was thus among the first to reach the top. Somewhat later the telephone was gotten up by a round-about way and with it came the reconnaissance officer of the 2nd Battery. From the top of the mound an extensive view could be obtained and we were eye witnesses of a beautiful infantry attack made by our pursuing Bavarians, executed as if in field maneuvers, although the losses suffered were by no means slight. In the distance we could see the redtrousered columns of the French in retreat. And such a target it was! A target such as one seldom has an opportunity to see! Here was a case where haste in establishing communications was necessary, because the batteries down below were all ready to open fire. The necessity of rapidity in laying the telephone line was never more forcibly impressed upon me than in this case. Some means should be provided to carry the cable reel on the back so that the wire may unreel itself and follow the advancing operator and thus at any instant be ready for use. Our system of communications must positively be greatly improved in this respect.

My adjutant, First Lieutenant G., reconnoitered and identified

the enemy with the scissors telescope and urged haste upon every one. His keen vision enabled him to observe accurately the strength, composition and direction of retreat of the enemy. Later in the evening he was thus able to make to headquarters a detailed and useful report of his reconnaissance which this splendid observing station had made possible. Such commanding points, although they should not be occupied by staffs and headquarters (because of danger from hostile fire) should at once be located and occupied by individual reconnaissance officers, or by agents or scouts, because the things which one has personally seen with the eyes very often lead to a quicker decision and more expeditious results than information obtained from the reports of Cavalry patrols, oftentimes delayed. On many occasions the Artillery, just as in our peace maneuvers, was able to give the best and most timely reports and information. If the Field Artillery correctly understands its mission and function and does not confine itself simply to the technical features of its arm and service but, thanks to its good field glasses and observing telescopes and the careful and systematic training of its officers, if it also extend its activities to the tactical features, it will always be in a position to be the first to make a general reconnaissance report which will be clear and concise. I purposely interpolate this observation in this place because it was exactly the events of these days at Lens which impressed me with the importance of a reconnaissance which is of general benefit. In my adjutant I found a powerful support. His keen vision and mind, and his expertness in map reading permitted him to instantly translate his observations into correct and useful reports.

From this commanding station he succeeded in transmitting rapidly to the battery below and nearest to him, the commands which enabled it to fire several effective volleys at the retreating enemy. To his infinite regret, his successful endeavors were interrupted by a break in the telephone communications, just at the moment when the fire promised to be most effective.

In the meantime, after a rapid estimate of the situation, I hurriedly descended from the mound, in order to select a more advanced position for my batteries farther to the west, which the progress of the fight imperatively demanded. In order not to lose contact with the Bavarian infantry and in order also to give our comrades no cause for reproach due to any omissions on our part (which is always easily done by simply going ahead and starring it alone) I rode rapidly forward in the direction of Rouvroy toward our firing line, with the object of giving our infantry the most effective support by firing over them. There remained only one musician to go with me, my agent and reconnaissance officer being absent on some mission. Upon arriving at the edge of the village I gave the order to have the batteries, all of them, to advance along the main road as rapidly as possible toward the infantry firing line. Our own infantry had in the meantime again disappeared from view, having moved off obliquely to the left front, so that I stood there all alone with the open fields in front of me absolutely vacant. The only protection for myself and the battalion which was advancing directly behind me, was given by two Bavarian infantrymen, who had become separated from their organization during the advance and were now coming toward me in search of information that would enable them to rejoin their organization. I pointed out to them in the distance the hostile infantry in retreat, among them a few stragglers whom the valiant Bavarians after a rapid estimate of the range at 800 to 900 metres, immediately took under fire, and as my observations clearly showed, with immediate effect. All three of us puntuated our delight with pithy and appropriate remarks as we observed five Frenchmen fall in rapid succession.

In the meantime the battalion had arrived and in the absence of any cover in this perfectly level terrain, it took position in the open, each battery going front into line at a gallop, a stunt which we had not pulled off since our baptism of fire.[1] In

1 See THE FIELD ARTILLERY JOURNAL, October-December, 1915, pp. 659-673.

order to mask the guns I gave orders to hurriedly fetch some sheaves of grain to cover them up. Even though this provided only an illusory protection from hostile fire, it nevertheless gave concealment. The hostile artillery, which especially in covering a retreat was very quick in taking up its new positions in rear, did not discover us and we remained here unmolested until darkness fell, continuing to fire on the village of Avion and the neighboring heights toward which the enemy had disappeared.

Late that night (October 3rd) the entire Division with some 5000 horses, made bivouac and was quartered in the town of Beaumont, from which place we had opened fire that same morning. This had been a great day for us and especially for the Bavarians, who had made large and important gains, but unfortunately not without suffering considerable losses. The crowded conditions in the town and the difficulties in finding sites for bivouac on the outskirts of the town were indescribable. I have never envied these officers in this disagreeable task of assigning bivouacs. Every one had only one thought and desire, namely to quickly find a place to rest, to eat something and then immediately to fall asleep.

The next morning we were to continue the work already begun, namely to cover more securely the right flank of the Bavarians, and to this end to gain as much ground as possible toward the north. Our orders were to advance on and to cross the highway Lens-Carvin-Lille and also to clear the highway Lens-La Bassée of all hostile troops. To accomplish this it was necessary to clear the Souchez Canal at many places of small hostile covering detachments in order to gain ground to the north. This task was assigned to the 5th Cavalry Division on our right, which in its turn was supported on its right flank by the Guard Cavalry Division at Carvin. At this particular time there were thousands of Cavalry troops under command of General von der Marwitz, concentrated in a relatively restricted area for the purpose of gaining and holding ground

pending the arrival of the army corps already following in march.

Our Cavalry Division was ordered first to get in close contact with the Bavarians and especially to support them with our artillery. But during the morning, which was later to be followed by so momentous an afternoon, we made very little progress because hostile troops were still reported in the big coal mining towns to our right (Sallaumines and Noyelles). We took a position in observation. To me fell the task of reconnoitering all possible positions from which we might be able to support the Bavarians and therefore, accompanied by my reconnaissance officer, Lieutenant Udo B., I rode in a westerly direction. We were otherwise alone. We rode through the neighboring villages being constantly on the alert and expecting at any moment to be shot at from some window or dark cellar pit. B. had no presentiment that this was to be his last ride in this world. Upon completion of this reconnaissance we returned to report to Division Headquarters which had established itself in the secluded garden of a roadside café that had been cleared out. Headquarters was here awaiting further orders. With the exception of the officer on guard, we found everyone fast asleep on the straw at ten in the morning. The exertions of the past few days had been so strenuous that even the Division Commander, Lieutenant General von H., who in spite of his age is an unusually active man, could hardly be awakened. It is incredible how much a soldier can sleep in the daytime during actual campaign. Very frequently, in the midst of hostile fire, we would take turns about and steal a little map. Many a comrade was struck by a deadly bullet while in the arms of Morpheus. One of the men of my battalion staff had rustled and found a store of eggs in the cellar of the house. They were at once distributed and eaten. My cook hurriedly made an omelet on the partly demolished hearth, and beginning with his excellency, we all ate so much of the stuff that for months afterward I could not bear to see an omelet.

During the afternoon a message was received informing us that the Cavalry Division next to us had succeeded in forcing the crossings of the Canal. We were directed to move forward in the direction of the town of Loos, now so well known, keeping in close touch with the troops on our flanks. In advancing we were ordered to make a thorough search of all the factory villages through which we passed. These formed a very strong obstacle to our advance.

On the other side of the canal at Loison, the roar of the guns of the horse battalion of the 10th Field Artillery could already be heard, firing in a northwesterly direction. We were directed to support this action with our guns, reports of the retirement of the enemy all along the line having been received.

In several columns our Division passed through the labyrinth of factory and mining towns, the staffs in advance in order to determine by reconnaissance at what points our support would be needed the most. At Loison I reported to the Commanding General of the 5th Cavalry Division, under whose orders I was temporarily placed, that my battalion was all ready and waiting orders. He directed me to his artillery commander, Major von W., whom I asked for instructions for my battalion. But here was a critical situation and good advice hard to give, as a rapid survey of the available space and the indistinct and difficult character of the terrain showed. However, the order which I received was to the point and in brevity left nothing to be desired: "Get your guns into action wherever you can find the place and fire on any hostile forces that you may see."

While my staff and I were thus engaged with the adjacent Division and awaiting the arrival of our batteries, we were the first to observe the retreat of large masses of hostile cavalry accompanied by individual sections of horse artillery, all withdrawing from mine shaft No. 7 in a direction across the highway Lens-La Bassée. I hurriedly rushed over to the battery commander nearest to me in order to call his attention to this

tempting target, the attack of which required great haste. But unfortunately he was too slow in changing target and first began to open fire as the last cavalry regiment disappeared over the crest. At the same time a report concerning the progress of the fight was received from our Guard Cavalry Division, whose action had caused the retirement of that part of the enemy just opposing us. The situation had therefore again suddenly changed, in other words we had to move forward again and follow up closely the withdrawal of the enemy.

The order for our Cavalry Division was brief and still exhaustive: "Pursue the retreating enemy in the direction of Loos." "Well then, let's turn loose,"[2] suggested our Division Commander who was always ready for a joke. We started out in front with the 15th Dragoons, the batteries following close behind us, and passed through the mass of buildings, factories and confused by-ways of Loison, first going to the railroad station of this place where a halt was made pending the arrival of reports from our cavalry patrols. These reports stated that although the enemy was withdrawing with his main forces, it was still necessary to push back the numerous small rear guard detachments which the enemy had thrown out to cover his withdrawal. Riding forward to reconnoiter a desirable position, I saw at about 1200 metres range what seemed to be scattered and detached groups of hostile infantry in disorderly retreat toward mine shaft No. 8. I immediately ordered the leading 3rd Battery to advance rapidly to the ridge ahead and to attack this vulnerable target without delay. It was lucky for us that the battery took a little longer than it should have in getting into position, for this time interval permitted us to make a closer reconnaissance of the target from a point behind the covering ridge. We were able now to identify that among the dark figures which hurriedly detached themselves from the small group of houses, our own dragoons were also riding, deploying as foragers in all directions and without

2 A play on the word "Loos", *Los* in German means "Let's go!"

firing a shot, immediately riding ahead at a gallop in order to reach the next crest in front. The riddle was not solved until my adjutant had scrutinized the target through the scissors telescope. In the nick of time he arrested the fire of the battery which was just then ready to open, by calling out: "Why, those are civilians!" He was indeed correct. They were fleeing inhabitants who, carrying a few belongings on their backs, were making every effort to get out of the danger zone. We saw among them women, children and aged people, also a few vigorous and robust men. I was indeed thankful that the keen eye of my adjutant had saved me and my battalion from another "Belgian atrocity," for it is not in the German nature to fire upon helpless inhabitants. In other places and under other circumstances, the outcome may unfortunately have been quite otherwise. In time of war this cannot be helped. Any premeditated intention on our part to fire upon helpless inhabitants was, however, absolutely remote to us. While I was engaged in preparing the order for the next change of position and had already sent my reconnaissance officer forward with the cavalry van-guard, a factory about 500 metres to our flank suddenly began giving signals with its siren and with smoke, which signals in this case could denote nothing else than "Look out! The Germans are coming!" Until our arrival the factory had been as dead as a corpse. I immediately sent a cavalry officer who happened to be with me, with orders to inform the occupants of the place that at the next suspicious indication from this apparently busy factory we would send a few salvos of shell crashing through the outfit and then hang every one in the place. The message was delivered; the factory thereafter remained silent. The concierge, an old man, protested that he knew nothing about the matter, but our Uhlans arrested a number of suspicious persons and marched off with them. . . . Again we had to advance, going forward to Hill 70, where many of us were to meet our death.

As I was riding forward to this prominent ridge which could be seen for a considerable distance and quite naturally suggested itself as the probable position, a cavalry officer came riding rapidly toward me and reported that from this commanding ridge in front a battery could be plainly seen, standing near a small wood, and that it offered a splendid target for an enfilading fire. He rode forward with me to a small café on the main road which stood all alone in this vicinity with not another building near it as far as one could see. From this place a splendid view could be had especially to the west. It was in fact Ridge 70 on the road between Hulluch and Loos, a hill that became so famous during the battles in the fall of 1915. Below us, at a range of 4000 metres, I could see very plainly the incessant flashes of the French battery which was firing due east, no doubt to oppose the attack of the Guard Cavalry Division. If we succeeded in surprising with an enfilading fire this apparently lone battery, then just as should have been the case at Moussey on August 21st,[3] this hostile battery would surely fall not only as an easy, but also as a rich prize to an enterprising cavalry.

To the Battery Commander of the 3rd Battery, who was following directly behind me, I pointed out, while still mounted, this target clearly visible and easily identified. I ordered him to make haste and to occupy a position behind the crest, being careful to remain concealed. Beginning with 4000 metres he was to get his adjustment and then destroy the battery by a continuous fire. The target was certainly worth while because several months had passed since we had had an opportunity to attack a visible hostile battery. It was very easy to get into the position, and with a few precautions one could get into it with perfect concealment. On the ridge itself and upon the ground in the direction of the enemy, there was a constant coming and going of galloping German horsemen, who were continually bringing reports concerning the progress of the fight.

3 See THE FIELD ARTILLERY JOURNAL, January-March, 1916, pp. 5-24.

This commotion and the constant traffic, all visible to the enemy, were later to be fatal for us. I made my reconnaissance to find the necessary position for the other two batteries. There was sufficient time at my disposal to do this because these two batteries were with the main body following us at some distance and therefore would not arrive until later. In spite of this the two battery commanders joined very quickly, so that all preparations could be considered and executed before the batteries reached the position. While I was thus hastily inspecting the preparations being made, my battalion staff had come forward without further instructions to the "chaussée-house," as we afterward called the little roadside café. Unfortunately more cavalrymen than pleased me also came to the place, so that a crowd of considerable size was soon collected there, something which I have always dreaded under such circumstances.

In the meantime my adjutant observed the movements of the enemy and designated the targets to the battery commanders, that is the same group of artillery previously assigned to the 3rd Battery. The instrument sergeants got their firing data promptly, and very quickly the batteries were ready to fire. Telephone communication, especially, was rapidly established, the line running along the highway which was lined with high poplars and crowded with traffic, to the guns about 200 to 300 metres distant. There was no time for constructing any cover for the observing stations; we were all straining our utmost to get off the first shot. About 20 or 30 paces from the house, stood two large stacks of straw and grain, which offered good concealment from hostile observation. Somewhat farther distant was another. All three, in a way, mechanically suggested themselves and were used to set up the battery commanders' shields and the telescopes.

I will admit that some of our men and the officers were entirely too careless and unconcerned during the occupation and the establishment of our observing stations and that these

movements undoubtedly did not escape an attentive opponent who with other batteries was already awaiting us in a position in observation behind the next crest and thus, exactly as was done a few days later at the Heights of Lorette, was able to accurately register this prominent point which could be seen for a great distance. The French have always been masters in the tactical handling of field artillery during a rear guard action or retreat. When the last wave has receded, the first has already arrived at the next crest, ready for action in a fully prepared position. The retirement is not always covered by whole batteries but often by platoons, as was frequently disclosed by the nature of the fire.

The succeeding events I am compelled to describe from memory, which ordinarily is fairly accurate. The account does not pretend to be complete and is in need of many valuable supplementary additions and corrections from the data of my staff and battery commanders, none of whom is available as I write. This, however, will be done later on.

The fight that now developed took place about as follows: Although the 3rd Battery had arrived first and a long time before the other two batteries, it had not in spite of this decided advantage as yet opened fire. But I had failed to notice this because I was too busily engaged with the other two batteries from which I quickly received the report that they were in position and ready to open fire. Next to me, between the two ominous stacks of straw, stood Captain Sch., quite isolated and observing through this space scarcely three paces between stacks. About six paces behind him lay his telephone operator. Under cover of the left stack lay a part of my staff, or to be more exact they were sitting there with their backs to the stack.

The observing station of Captain von V. of the 2nd Battery, to which I crossed frequently because I could see the target much better from this point, was located at the "chaussée-house," where he had set up his scissors telescope very close to

the building. Because it was difficult to estimate the range I directed him, just as was done in the fight at Moussey, to surprise the French battery with an echelon fire, using ranges from 4000 to 4300 metres, a method which I considered appropriate in this case. In the meantime Captain Sch. was to get accurate adjustment, being careful not to get off his salvos simultancously with those of the 2nd Battery. Everything went off as desired. The first volley went off beautifully, very nearly correct in range, but a little to one side in deflection, which was immediately corrected. Our observations gave us both shorts and overs, which of course is always the best indication upon which to base one's estimate of effect. Our fire was increasing in volume and rapidity. One volley followed another with only slight pauses between to make the necessary corrections. There was no doubt as to the effect being produced. The hostile battery at first fired more slowly and finally ceased fire altogether, the personnel having been either completely overwhelmed or the gun detachments having simply deserted their guns in order to save themselves, as we had observed on several other occasions.

Under this fire it would have been impossible for the battery to have made any attempt to limber up.

Once again, as upon an occasion during the battles in Lorraine, the idea recurred to me, to inform our cavalry of what had been accomplished and to request that the abandoned battery be taken before it find another opportunity to renew its fire. I therefore sent a message to this effect to Division Headquarters, at that time established in a group of buildings about 600 metres to our rear. The Division Commander also had the fullest intention of doing everything to bag this battery. This intention was, however, never carried out, due to the influence of later events.

We, up at our observing station, already were very much elated over our success, and wishing to make the most of it now searched the ground in rear with shrapnel. We paid especial

attention to the small stretch of woods in rear of the battery, where we believed the limbers to be located and toward which we had seen the detachments running, fleeing in search of cover. It is impossible for me to say now how much time had elapsed until we had attained this undoubted success. It may have been about a quarter of an hour. But true to their principles of combat, the French artillery here again did everything that could be done to rescue the endangered battery and to prevent its capture, exactly as they had done at Moussey on August 21.

Very probably other hostile artillery groups had observed the incident, had recognized the dangerous predicament of the battery, and had determined to give us a jolt by suddenly opening upon us an overwhelming fire. I still have a fairly clear recollection of the succeeding events. As I was standing at the "chaussée-house," never even dreaming of the possibility of the coöperation of other hostile artillery, there suddenly burst with a loud crash, about 50 paces to my right, the first hostile shrapnel. The shot came from a point on our left front and was absolutely on line with our batteries completely masked behind the crest. Shortly after this we saw the black burst of shell, whereupon a heavy searching fire was delivered at the batteries themselves, but this fire did not quite reach them. A few shots did, indeed, fall in the immediate vicinity of the guns, but without doing much damage. Then along came heavy volleys, always coming closer and closer to our observing station which the enemy undoubtedly had identified. And now with every second things were fast becoming more and more uncomfortable for us up there in front. Very soon after this we were shelled from another direction to our left, this fire being intended for our observing stations at the strawstacks. A hellish fire now was begun, one projectile following another, a veritable hail-storm. The first thing to catch on fire was the stack farthest on our left which was struck by a direct hit. This caused our horseholders, who were standing behind the stack, to move away, all of them coming a little closer to

the house. At this moment we discovered one of the hostile firing batteries by the flashes of the guns. By beautiful team work between the Battery Commander and the instrument sergeant of the 2nd Battery, and by perfect operation of the telephonic communications, the fire of this battery was quickly shifted to this target. But thereby the hostile fire did not diminish, in fact, if anything, it grew constantly more intense. And now in rapid succession several shells struck in our immediate vicinity, some a little short, some in among and others immediately in rear of the group of stacks behind which we were standing. The left stack was already in a full blaze, the flames giving off a terrific heat. Just then a shell struck about 5 paces from me, detonating with a crash so deafening that I experienced a sensation as if both of my eardrums had burst; otherwise I was uninjured. On the other hand several members of my staff, both officers and men, were struck either by this particular shell or by one of those immediately succeeding. I could tell from the painful and distorted expressions of their faces that their wounds must be serious. One man of the 1st Battery was wounded in the foot. Then Lieutenant St., Lieutenant G., and Lieutenant B., no doubt struck by the same shell also fell, bathed in their own blood. The latter rattled in his throat; his hand was pressed rigidly to his side and he foamed at the mouth, but otherwise not a sound of pain did he utter. He was mortally wounded and no doubt died within a very short time. The other two officers were less severely wounded, Lieutenant G. by a fragment in the thigh, and Lieutenant St. in the hip. In the interim the stack next to us was also set on fire by a direct hit and was soon in a roaring blaze. But in spite of the increasing intensity of the heat Captain Sch. continued to conduct the fire of his battery, for the time being, against the hostile battery. Later on when he identified another and very favorable target consisting of strong forces of cavalry in retreat, he quickly and accurately shifted his fire upon them, just as if he were solving a problem in service practice.

In this connection the highest praise is due the telephone operators, who valiantly stood by their telephones and in spite of the dangers, and of the intense heat and smoke, they continued to transmit the commands with the same accuracy as in time of peace. The only cover they had was a shelter tent which they had spread over themselves as a protection from the intense heat. I can still hear them, as they repeated with absolute accuracy, word for word, and in rapid succession, the commands of their battery commander as he followed the retreating target. I saw also the good effect of this fire, rapidly and carefully delivered by the battery which worked beautifully and indeed in the sweat of its brow, for with the ever increasing range of the target, it was continually necessary to dig down the trails to the extreme possible limit. The battery worked under this intense fire as if it were engaged in drill practice. The commands came down without interruption, Battery, 1 Round, 5400— 5600— 5800— 6000 . . . and the firing continued regardless of the intensity of the hostile fire which was being delivered without interruption by the enemy's batteries. The 2nd Battery which was to my right, fired at the same target but with somewhat shorter ranges and therefore did not quite reach the target. Before he fell wounded, Lieutenant G. had given a very appropriate order to the horseholders, who were doing absolutely no good by remaining here and in addition were running the danger of being needlessly killed. He directed them to simply face the horses to the rear and then to turn them loose. Our good old steeds were quick in sizing up the situation and in a quiet gallop started back for the battery in spite of the fact that the fire of the enemy not only passed over their heads but continued to follow them. With one exception they were all found later on with the limbers. The wounded officers were now carried to the house about 20 paces distant by the members of the battalion staff. The conduct of these men was intrepid, showing absolute disregard of the shells bursting all around them. Private

Buchholz, who as far as discipline is concerned had always been the black sheep of the battalion staff, here distinguished himself particularly. The body of Lieutenant B. who had been killed, we had to leave where he fell, first having pulled it out of the fire a little to prevent its incineration. No sooner were the wounded removed to the cellar when, as I had for some time feared, the house was also taken under fire. With a terrific crash two shells, one right after the other, smashed on through gable and roof, leaving the thin walls in danger of collapsing. A third shell struck Private Michel who was still holding a horse and who with a few Hussars had crowded in close to the wall of the house in order to get a little more protection. It proved to be the worst thing that he could have done. Then another shell came along and tore away both his legs, so that he fell to the ground but with the reins still in his hands. The same shell also struck several Hussars next to him together with their horses, spattering the wall of the house with blood which, literally speaking, flowed in streams.

Around the two stacks the heat was becoming more intense every minute. The remaining stack which still gave us more or less cover now also went up in flames. It was impossible to remain longer since our clothes were already beginning to burn and the battery commanders' shields were red hot. There was also danger that the telephones and wires would be destroyed. I can remember very well that at this moment I ran over to the other side of the house, very probably to escape the intense heat, but principally in order to get a better view from the Battery Commander's station of the 2nd Battery of the ground to our right. This battery was also continuing its fire regardless of the shell which were bursting in the house very close beside its station, until here also the heat made it necessary to vacate. In addition to the hostile battery obliquely to our front, one or two other batteries had gone into action against us with the intention of wiping us out of existence.

Just about this time I took up my scissors telescope which

had become very hot, and carrying it on my shoulders I started back to the rear. But the enemy again opened on us from the left with an uninterrupted series of volleys, which compelled me to lie down in the ditch along the road about ten paces in rear of the stack, until the hurricane of fire had passed. I lay down flat on the ground, expecting each moment to be my last, for our opponent simply had superb adjustment. At this moment I called out to Captain Sch., who was almost the only person remaining up in front: "Close station! Let's get out! There is nothing to be done here!" As a matter of fact the heat and the smoke had made our situation absolutely hopeless. There was nothing to do except to find another observing station. At this critical and dangerous moment, Lieutenant F., our agent with the Division Commander, came galloping right into the thick of this hellish fire in order to transmit to me a message from the Division Commander, asking whether the battalion could stick it out and if not then for us to close station. How he got to us, mounted as he was, I cannot understand. I shouted to him: "You fool! What are you doing here! You just get out as fast as you can! It's all off here." Instantly there burst between us another shell. I remember thinking to myself: "At last your time has come," and I was surprised to find that outside of a terrible pain and humming in my ears, I was alright. When the smoke and the suffocating gases had cleared away, I looked toward the spot where Lieutenant F. and his horse had just stood. I expected to see only his mangled corpse but the spot was vacant. In looking around further, I saw him whole and sound, still on his horse. His horse had no doubt made a mighty jump when the shell burst between us. Just as if nothing had happened, he shouted again to me: "Well, what is your reply to his Excellency?" Again I shouted to him: "You get out of here! Have no fear, we will get out also!" To this day I cannot understand how F. got away with his life. After he rode away I again lay down in the ditch because projectiles were flying about like

bumble-bees and threatened to destroy everything in the vicinity. Looking down the narrow road from my point of vantage, I could see how the enemy was taking under fire all the individual scouts and the larger and smaller detachments then in the act of withdrawing. Everywhere could be seen riderless horses and wounded cavalrymen who had stumbled into this destructive fire with us, all moving at a rapid gait in order to get under cover. At this moment another projectile struck scarcely two paces away and close to my head, completely covering me with earth. It was lucky for me that the projectile failed to burst or otherwise it would have been my end. I now jumped up in order to reach the road. Behind me everything was in flames and the hostile fire still continued. Captain Sch. also remained to the end and with the assistance of his men attempted to save his shields, telephones, etc. But on account of the intense heat it was impossible to do so. Everything that was left behind, the helmets, field glasses, pistols and other equipment of the officers, also a pair of boots, were burned up completely. Only our dead remained and they, as I have already mentioned, had previously been dragged away from the fire. Captain Sch. later on informed me that at this moment Private Michel, the horseholder, both of whose legs had been shot off, cried out to his battery commander nearby: "But Captain, I have no legs any more." To which his Captain, hoping to comfort him, replied reassuringly " Oh! That's not so bad. They will grow on again." The poor fellow's implicit faith in this assurance from his old battery commander was so strong, that he never again uttered a word of pain or complaint from that moment until his death shortly afterward. He passed away peacefully—and with the reins still in his hands. In the meantime our comrades who had taken refuge in the cellar, were given some emergency treatment by the occupants of the house and our own men, while above them the house itself was threatening to collapse any moment from hostile fire. It must have been an anxious half

hour for our men, every moment expecting to be buried alive. It also turned out that even before our arrival several wounded French soldiers had taken refuge in this cellar. But all mutually helped each other, no one entertaining even a thought of injuring his opponent. The slightly wounded assisted in opening a cask of wine, from which all of us, including the occupants of the house, refreshed ourselves. In fact the occupants assisted in the care of the wounded in a most commendable manner.

I now hastened to report to the Division Commander and asked for further orders, at the same time giving him an account of our difficult situation which the staff had already witnessed with feelings of anxiety. These gentlemen later assured me that they would not have given a penny for our lives under the circumstances. Undoubtedly it must have been a period of tense anxiety for the onlookers, who saw as they believed the destruction of my battalion staff and the staff's of two batteries as well.

I was ordered to put the batteries, which in the meantime had limbered up, into position again and to resume the fire because it was necessary by all means to hold the position until night. I felt absolutely deaf and it seemed that I could make myself understood only by yelling and shouting. After quickly refreshing myself on a bottle of wine, I again put the whole battalion into a position in a hollow behind a crest farther to the west. In this position we remained until night, firing in the direction from which we had observed the hostile fire. While in this position neither the batteries nor the observing stations were either discovered or fired upon by the enemy. In the first position the batteries had suffered very few losses from hostile fire, because the guns were well masked and could not be taken under aimed fire by the hostile artillery. But nothwithstanding, during this fierce encounter a great number of shots fell very close either within or beyond the batteries and the protection which our shields offered was welcome to everyone.

In this place I must also mention the quick and efficient aid which was given to our wounded by the prompt action of our Assistant Surgeon. I took advantage of my short stay at Division Headquarters to hunt up the nearest medical officer, which happened to be Assistant Surgeon B., and to direct him toward our unlucky observing station, which at this moment was still being kept under hostile artillery fire. In an extended gallop, he rode through the hostile fire to the "chaussée-house" in order to apply the proper first aid treatment to the wounded by whom he was received with great joy. When the hostile fire had ceased, steps were taken to rescue our wounded, and all of them were started to the rear in good shape. The two wounded officers were taken back to Cambrai in an automobile lent by Division Headquarters, and upon arrival at this place were placed in a hospital which was filled almost entirely with wounded French. At nightfall we rescued our dead, carried them back to the highway in order to give them a fitting burial in a spot that could be easily found later. To the brother of Lieutenant B., Lieutenant Dr. Hans B., whom I had appointed as my acting adjutant, fell the sad duty of burying his brother's body and after this to send the sad tidings of his death to his family and particularly to his dead brother's young wife.

We all lost very much in this young man. As a soldier he was efficient and absolutely dependable; as a comrade he was just as amiable and beloved. At this date (middle of October, 1915) his grave is no doubt well within the foremost German lines, very close to the road Lens-La Bassée and about 2 km. north of the former place. The two wounded officers, Lieutenants G. and St., returned to duty with their batteries in a few weeks, fully recovered from their injuries.

Whatever became of the hostile battery which we overwhelmed is unfortunately a matter of speculation. At nightfall the battalion withdrew from its second position. Our way home was illuminated by the brilliant glow still coming from

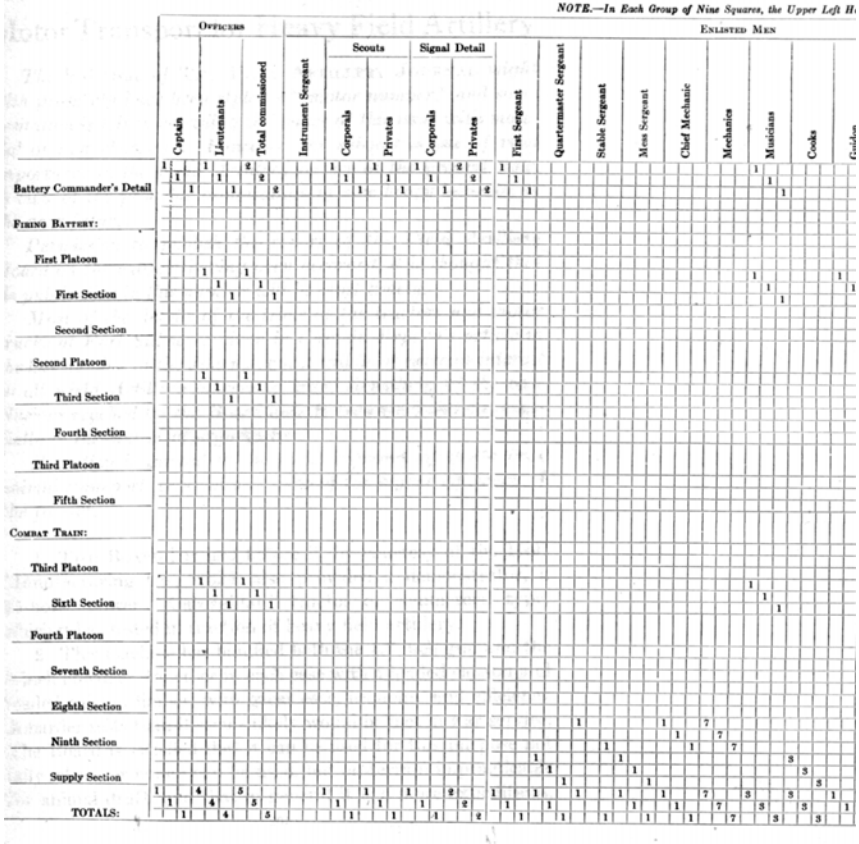
the smouldering fires burning everywhere. At times the smoke and heavy fumes from these fires darkened the roads of march. On this night our way led to Billy-Montigny, for which both sides had so hotly contested a few days before. We could still see there the indications of the previous firing. In spite of our losses the battalion was in high spirits. We had done our duty well and chiefly by our own fire had forced the enemy to finally withdraw. On the way back, our thoughts turned to our dead and to their sorrowing friends and relatives. My new adjutant very sensibly faced the inevitability of his brother's death with commendable stoicism, and for many months he stood by me as a true and dependable companion, accompanying me through many a succeeding battle not a bit less hotly contested than this day at Lens which will always remain a momentous day in the history of the battalion.

The very next day we were confronted by another sanguinary experience. We forced our way through Lens and for several days from October 5th to the 8th, fought side by side with the Bavarians on the famous Heights of Lorette, west of Lens. It is a cause of special pride for us that my batteries were the first ones, in fact probably the only ones, that have ever gone into position on this memorable and blood-drenched ridge. It is a spot which for all time will stand as a historical landmark in this mighty War of the Nations! Concerning these days I have already made my report to proper authority.

Written at Baden-Baden on October 15, 1915, on the anniversary of the battle of Neuve Chapelle, October, 1914.

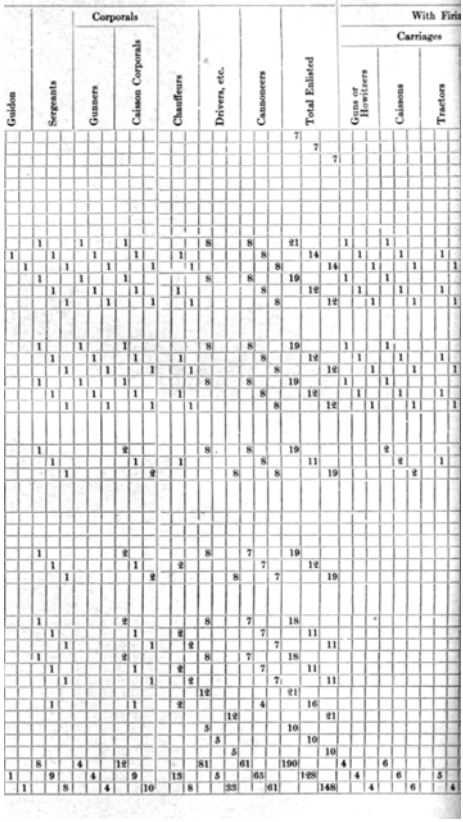
ORGANIZATION

NOTE.—In Each Group of Nine Squares, the Upper Left H



OF 4.7-INCH GUN, OR 6-INCH HOWITZER, BA

Hand Square Shows Present Organization; the Middle Square, the Proposed Organization on a Ba



ATTERY ON WAR FOOTING

axis of Exclusive Motor Traction; the Lower Right Hand Square, a Mixed Organization

CARRIAGES AND ANIMALS

ng Battery			Combat Train									Recapitulation								
	Horses		Carriages				Horses					Carriages						Horses		
Auto Trucks	Draft	Riding	Caissons	Store Wagon	Battery Wagon	Auto Trucks	Draft	Draft Extra Team	Riding	Supply Section Riding Horses		Guns or Howitzers	Caissons	Tractors	Auto Trucks	Store Wagon	Battery Wagon	Draft	Riding	
		9																	9	
		9																	9	
		9																		9
	16	5										1	1					16	5	
		4											1		1		1		4	
		4												1		1				4
	16	2										1	1		1		1	16	2	
		1											1		1		1			1
		1												1		1				1
	16	3										1	1		1		1	16	3	
		2											1		1		1		2	
		2												1		1				2
	16	2										1	1		1		1	16	2	
		1											1		1		1		1	
		1												1		1				1
	16	3											2					16	3	
		1											2		1				1	
	16	5											2						1	3
			2				16		5				2					16	5	
				2				2		3					2				3	
					2				16		5		2							5
			2				16		3				2					16	3	
						2			1						2				1	
			2					2		1						2				1
			2				16		3				2					16	3	
						2			1						2				1	
								2		1						2				1
				1	1		16		8		9					1	1	24	9	
					1	1		16		8		9					1	1	24	9
											2								2	
											2								2	
	80	24	6	1	1		64	8	20	2	4	12	5	8	1	1	1	152	46	2
		18				8			6	2									26	
	16	20	2	1	1	4	32	8	16	2	4	6	8	4	4	1	1	56	38	

Motor Transport for Heavy Field Artillery

The last issue of THE FIELD ARTILLERY JOURNAL *might with propriety have been styled a "motor number," and some hesitation is felt in crowding the pages of this issue with material of that character. However, the subject is one of vital importance to the Field Artillery service at the present time, in view of the probable organization of new heavy batteries in the near future.*

Permission to publish the report of the Field Artillery Board on the subject having been accorded, it is thought that its publication in this number will be most timely.

Most of the details of the trials of the tractors and motor trucks at Fort Sill were given in Captain Bryden's article in the last number of the Journal, but it will be of extreme interest to all Field Artillery officers to know something of the conclusions reached by the Board and its recommendations, especially in the matter of organization.

Attention is invited to the great economy of motor over animal transport, especially in view of the higher efficiency of the former.

1. THE BOARD has had before it, by courtesy of the Holt Manufacturing Co., which also provided a demonstrator, a 45-horse power "Caterpillar" tractor of commercial type, which it has tested in traction of heavy field artillery.

2. This machine has handled both the 4.7-inch gun and the 6-inch howitzer, together in each case with a loaded caisson and loaded caisson limber, with great ease, economy and efficiency in harder tests than it seems likely would be met in war service. The Board is satisfied that it can be used for this purpose not only wherever horses can be used, but on terrain impracticable for animal draft, and that in general it is a more expeditious,

reliable, efficient and economical means for heavy artillery gun traction than animal draft.

3. The case is not the same with the ammunition service, the vehicles for which must be capable for greater speed than the guns.

4. The Board has had before it and has tested, both as tractors and as ammunition carriers, commercial types of the Jeffery and Duplex two-ton trucks, and now has a Clintonville three-ton truck for which it is awaiting a chauffeur. A report on these will be made upon the completion of the test of the Clintonville truck and of a test of another Jeffery truck which will be loaned to the Board. But the Board is convinced that the Jeffery two-ton truck, or any equally good four-wheel drive and steer truck, will effectively take the place of a complete caisson in the combat train on roads or not difficult terrain while such trucks cannot be depended upon as tractors under service conditions.

5. In addition to its own practical tests the Board has read the reports of Rock Island Arsenal tests of the above named trucks and of a Holt "75" tractor, and has discussed those tests with the officer who made the reports.

6. A war organization of a heavy battery with motor traction has been drawn up tentatively. For convenient comparison with the present organization both are shown on an inclosure. Each large square of the inclosure is divided into smaller squares of which the upper left hand one contains the figures under the present organization, the centre square those of the proposed tentative organization and the lower right hand square those of a mixed organization.

7. The Board recommends that one 4.7-inch gun and one 6-inch howitzer battery be immediately organized with the suggested motor traction and transportation only, for a thorough test. Such a test is not possible with a few machines. The test would not be expensive even though the tractors proved entirely unsuitable, as there is no likelihood of their doing.

8. A comparison of the present with the proposed organization, both on a war footing, shows the following gains and losses in the various items, on the basis of which some approximate figures are given as an indication of comparative expense of supply and maintenance.

Personnel	Add	Subtract	Monthly rate		*Pay*
Corporals	. .	3	$21.00	–	$ 756.00
Chauffeurs	13	. .	36.00	+	5,616.00
Drivers	. .	76	15.00	–	12,960.00
Cannoneers	4	. .			
Pay saved annually					$ 8,100.00
Clothing saved annually					2,170.00
Rations saved annually					465.00
Annual saving					$10,735.00

Animals			*Estimated cost*		
Draft horses	. .	152	$230.00	–	$35,000.00
Riding horses	. .	20	200.00	–	4,000.00
Forage saved annually					15,480.00

Ordnance Matériel					
Caissons	. .	8	$1,950.00	–	$11,730.00
Tractors	5	. .	3,500.00	+	17,500.00
Auto trucks	10	. .	2,100.00	+	16,800.00
Store wagons	. .	1	3,870.00	–	3,870.00
Battery wagons	. .	1	3,930.00	–	3,930.00
Draft harness 8-horse	. .	19	580.00	–	11,020.00
Saddle equipment, sets	. .	19	49.00	–	931.00
Personal arms and equipments, sets	. .	60	21.00	. .	1,260.00

Many other items would have to be considered in arriving at the saving to be made by mechanical transport, such as the cost of recruiting men and of shoeing animals, overhead at remount

depots, quartermaster equipment of personnel, reduction of stable and barrack space, reduced cost of transportation by rail, etc. There are still other items that the Board cannot discuss advisedly, such as the comparative cost of maintenance, the life of the motor equipment, etc. The figures are only approximate, but they indicate that the complete equipment of a motor drawn battery would cost some $40,000.00 less than the horse drawn one, and that the annual saving of pay, clothing, rations and forage would be about $25,000.00

Two comparisons are startling: (1) If the life of the tractors and trucks be taken at five years, probably too short, and the life of the replaced matériel and animals at ten years, probably too long, the cost of the former would be the less. (2) If the saving on forage were spent for fuel and lubricants the battery could travel thirty miles a day for the whole year.

9. In the proposed organization, the musicians and guidon have been retained because their services are needed as mounted men; a sergeant has been added to act as chief of the 9th section, but he might be continued as stable sergeant also. The chief mechanic and mechanics have been left unchanged because it is not known what the changed conditions of service would require; from them and from the corporals, understudies for and assistants to the chauffeurs should be found.

10. Regardless of the question of original expense or that of upkeep, the enormous reduction in depth of columns by reason of the short draft units in the firing battery and the omission of draft horses from the combat train; the ability of this kind of transportation to follow railways instead of ordinary roads; the saving of space in supply trains; the ability to maneuver by night as well as by day; the simplifying of instruction of recruits; the avoidance of fatigue on the march, etc., etc., all of these considerations appear to call for the experiment on broad lines.

11. The Board recommends that one of the caterpillar tractors under contract for Hawaiian delivery be tested at Rock

Island Arsenal in the traction of a complete 4.7-inch gun or 6-inch howitzer section over a distance of 1000 miles or more with a view of discovering and correcting any weaknesses in either the tractor or the ordnance matériel.

12. The Board hesitates to recommend any changes from the commercial types of either tractors or trucks, because it believes that a chief advantage of motor transportation will lie in the facility with which it may be mobilized if machines actually in use or on the market may be utilized. However, the following suggestions are offered for consideration:

TRACTORS

1. *Speeds*. The tractor tested had speeds of 2⅛ and 3½ miles per hour. The former is a little high for the hardest pulls and the latter a little low for emergency use. Unless there are mechanical objections not apparent to the Board, it is thought that three speeds should be provided of 1½ miles for the hardest pulls, 3 miles for normal use with marching columns, and 4½, or the maximum considered practicable for this class of machinery, for emergency use only. These speeds are considered preferable to those of the three-speed tractors, having 1½, 2 and 4 mile speeds, being procured for Honolulu.

2. *Winch*. A drum or winch with several hundred feet of cable should be installed at the front of the tractor, in lieu of the belt pulley furnished commercially.

3. *Brakes*. It should be possible to lock the brakes after setting them, if so desired.

4. *Noise*. Should be reduced as much as possible by providing a muffler with cut-out and reducing noise of tracks. The latter is apparently taken care of by using on trucks being procured for Honolulu four upper track rollers instead of three.

5. *Pintle*. An artillery type pintle at standard height should be provided, so attached to a member of the tractor that it will have no side or vertical motion with corresponding weaving

of the line of vehicles. A pintle might be convenient at the front end, but details are not important as the tractor can turn in its own length.

6. *Canopy*. That provided is in the form of a large sheet iron roof and has given trouble by catching on trees, etc. It is thought that a roof over the engine, about the height of the radiator, such as is shown on pages 16 and 17 of the Holt catalog, would be more satisfactory. This roof should have metal sides and back resembling the hood of an automobile, so arranged that they can be left open or closed. The parts left unprotected will require no more attention than the parts of artillery matériel now unprotected.

7. *Steering Handle*. A somewhat more convenient installation could probably be easily arranged, but this is not important.

8. *Lights*. A generator for electric headlight is highly desirable, because night maneuver will be a common occurrence. Otherwise, gasoline light should be provided.

9. *Accessories, etc*. Provision should be made for carrying on the tractor the tools, accessories and spare parts frequently required in daily use. Those for repairs requiring considerable time should be carried in the battery or store wagon.

10. *Armor*. Armor for the engine, radiator and gasoline tank is considered desirable, but it is not desired to sacrifice accessibility. The armor for the gasoline tank might be bolted in place and that for the engine and radiator consist of the metal roof, suggested in 6 above, with hinged sides so arranged that when not needed for protection from projectiles or weather, they would lie flat on top of the roof.

11. *Seat*. A seat sufficiently wide to accommodate two men should be provided. With the present seat vision ahead is difficult. The seat should preferably be slightly higher.

12. All nuts and other small parts liable to loosen due to vibration should be secured with locking devices.

13. A suitable supply of spare parts should be provided.

The initial supply should be limited to that considered as essential or highly desirable by the company furnishing the tractors. The additional articles required should be established as a result of a year's experience with batteries equipped with motor traction. It is believed that the spare parts, etc., first issued to *each battery* should be the same as for *each tractor* for Hawaiian service.

14. The tractor subjects bridges to less severe stresses and shocks than the towed vehicles and a pair of rails should be carried for reinforcing short weak structures, bridging narrow deep ditches, etc., so that the vehicles can pass where the tractor can.

15. A suitable method of securing a connecting pole to the piece limber should be devised. The present parts are sufficiently strong to hold the artillery pole, but are not believed strong enough for towing.

TRUCKS

1. *Engine*. The Jeffery 2-ton truck has 4 cylinders of 3¾-inch bore. This is not thought to have the reserve power desirable for artillery ammunition service. A 4¼-inch bore is thought about correct.

2. *Chassis*. The chassis frame, springs, etc., should be strong enough to carry a gross load of 6000 lbs., with a sufficient safety factor. A suitable body will weigh about 700 lbs. and 56 rounds of 4.7-inch gun ammunition boxed, weighs about 5200 lbs., 28 rounds of 6-inch howitzer ammunition, boxed, about 4700 pounds.

3. *Winch*. A drum or winch with several hundred feet of wire cable should be on each truck, so arranged that the cable may be run out either to the front or rear. Such a device has been developed by the Four Wheel Drive Auto Company of Clintonville, Wisconsin, and should be applied to the truck of that make now here without delay for testing purposes.

4. Chains usually furnished are insufficient for bad situations.

Extra heavy chains of a type that can be attached with the truck in mud should be provided. Light chains or mud hooks to supplement them, would also probably be satisfactory.

5. *Speeds*. The lowest speed should be such that the power will be sufficient to turn the wheel evenly and slowly until the chains begin to dig badly into the ground. The truck must be able to travel long distances at two or four miles per hour without excessive heating of engine or boiling of radiator. The maximum speed should be at least fifteen miles per hour and the greatest consistent with the first two conditions.

6. *Self-starter*. This is desirable, but the machine must operate with the starter out of commission.

7. *Pintle*. An artillery type pintle at the standard height should be provided with each truck for emergency towing purposes.

8. *Lights*. Electric lights supplied by the starter storage battery should be provided, if there is a starter. In any event lights burning oil or gasoline, preferably the latter, must be provided.

9. *Carburetor*. This must be placed as high as possible to prevent flooding by water, when truck pulls itself over deep fords by the use of its own winch. Unless the gasoline tank is set very high a vacuum feed system for supplying the carburetor with gasoline would seem to be desirable, as this permits the carburetor to be higher than the bottom of the gasoline tank and makes the gasoline supply independent of the grade.

10. *Magneto*. This should be of a type which will permit the engine to be started by hand without the use of either dry or storage batteries, which may both fail under continued field service. The impulse attachment used on tractors, which permits starting with the magneto with quarter turns of the engine, should be provided unless the engine can be readily spun by a man of ordinary strength.

11. *Gasoline tank*. The tank should be so constructed or the outlets so arranged that practically the last gasoline in the

tank can be utilized independently of longitudinal or transverse tipping of the truck.

12. *Steering mechanism*. The rods connecting the steering knuckles, etc., should preferably be in rear instead of in front of the front axle, to lessen the chance of injury when passing over obstacles.

13. *Brake*. An efficient transmission brake should be provided in addition to efficient wheel brakes.

14. *Spare parts*. The remarks under "tractors" apply.

15. Should this paper be favorably acted upon, the necessary steps should be taken to supply adequate amounts of fuel and lubricants.

1. Under the above instructions tests were conducted here of a Jeffery 4-wheel drive and steer truck, and a Duplex 4-wheel truck in draft service of heavy artillery and in ammunition service. The Duplex truck is not considered to be suitable for either purpose. The Jeffery truck is suitable for ammunition service, but not for economical or trustworthy traction off good ground. Under easy conditions trucks may be depended upon to handle light tows, but under what may fairly be called ordinary difficulties they are not equal to horse draft. And even the addition to their equipment of winches carrying wire rope, although that would greatly add to their power to overcome many obstacles, cannot be expected to obviate the disastrous delays that this kind of draft will meet in column at had fords, on steep grades, on soft roads. This fault cannot be overcome by the installation of more powerful engines, alone, because failures in traction appear to be due to lack of necessary friction with the ground. Nevertheless, motor trucks for artillery service should be very powerful, provided with winches and wire rope for extricating themselves and other vehicles when stalled, and furnished with artillery pintles at one or both ends for towing moderate loads when practicable and desirable.

2. The program prepared for the test of these two trucks is inclosed herewith. It was not completed because the trucks could not perform the work, but it is considered to contain no unreasonable demands upon machines intended to replace animal draft.

3. As a result of these tests and of the test of a 45-horse power Holt "Caterpillar" tractor, the Board submitted a report with recommendation for the organization of two batteries with motor draft only, to which attention is invited. The program prepared for the test of the tractor is inclosed herewith, together with a map[1] of the reservation showing some routes followed by the tractor towing a complete loaded 4.7-inch gun section. With half a section the auto trucks failed at the crossings marked *C* and *D*. The tractor was never in difficulty on these hard climbs, or in these bad crossings. From *A* to *B* are two cattleguards, a railroad bridge, with one tie gone, a trestle; at *B* is a difficult turn; at *C* is a very crooked ford with sandy, steep approaches; at *D* are very steep banks in *V*-shape; at *E* are sand and gravel. On the other route shown were considerable stretches of sand and loose cobble stones; at *F* two narrow channels about 3 feet deep; at *G* a washed out bridge over a spring branch, necessitating going over a bank and a mud covered ledge. The remarkable features of this route were the difficult grades and bad footing.

4. Although the trucks with comparatively light tows were stalled in moderately soft fields, the tractor was tested satisfactorily with a complete loaded section in clay soft enough, when passed over twice, to permit the gun wheels gradually to sink to the apron shield. By dividing the tow, the caisson was pulled out without difficulty, and the gun with difficulty because there was no footing for the tractor. There was no trouble after a chain was procured to lengthen the connection and place the tractor on solid ground.

1 NOTE: The program, map, and photographs, which formed part of the report of the Board, were not available for publication.

5. A number of photographs are inclosed showing the tractor in use. They do not fully illustrate the difficulties of the situations pictured.

6. Under paragraph 12–5, Board's report of November 30, it was recommended that the pintle of the tractor should have no side or vertical motion in draft. For convenience in hitching to a tow, however, there should be some movement provided for. But the pintle should be fixed, or nearly fixed, in draft.

7. Under A. G. O. 2297127, the Board has before it for test a Clintonville truck, awaiting a chauffeur. The Board is satisfied that 4-wheel drive and steer auto trucks equal to the Jeffery 2-ton truck will prove suitable to replace a caisson and caisson limber in service of ammunition. If more power can be installed and greater carrying strength provided, so much the better.

8. No tests have been conducted sufficient to determine the life of tractors or trucks, their cost of maintenance, or, except very roughly, the cost of fuel and lubricants, etc. Approximately, however, the tractor seems to be able to haul the complete loaded section for 8.8 cents per mile; the Jeffery truck its ammunition at 5 cents per mile.

9. No suggestion is made for special types of trucks for the 9th section because it is thought that the supplies carried should be packed in chests removable by two or four men. No chests should be provided for ammunition trucks until the necessity for them is developed, but the ammunition box covers should be secured by wing nuts in order that they may be readily removed with the fingers.

1. The Field Artillery Board has noted with satisfaction the favorable consideration accorded its recent recommendation (F.A.B. 650. 20-q) dated November 30, 1915, relative to the organization for test of batteries of heavy field artillery equipped for motor traction.

2. After further consideration of this subject the Board

desires to amend its former recommendation and exclude all animals from the proposed battery organization, as it is believed that the presence of any animals will limit more or less the mobility of such a battery.

3. A chart of the proposed organization, as amended, is attached hereto. It differs from the previous one in that the 26 riding horses for officers and men are replaced by one 5-passenger automobile, 4 motor cycles with side cars, and 6 motor cycles. These vehicles would be used as follows:

On the march:

Automobile used by officers.

Motor cycles slung on trucks and tractors.

In reconnaissance or action:

Automobile used by lieutenant and musician of combat train.

Motor cycles with side cars used by

(1) Captain and musician;

(2) Instrument sergeant (chief of the 5th section) and signal private;

(3) Range finder (guidon has been retained to act as range finder) and signal private;

(4) Executive and musician.

Motor cycles used by

(1) Reconnaissance officer;

(2) Scout corporal;

(3) Scout private;

(4) Signal corporal;

(5) First sergeant;

(6) Chief mechanic (agent of communication between firing battery and combat train).

The effect of this change in the expense of first cost and maintenance will be to increase still more the difference in favor of motor traction as set forth in the letter mentioned above.

4. Since submitting its former letter on motor traction, the

Board has had an opportunity, through the courtesy of the Thomas B. Jeffery Co., of Kenosha, Wisconsin, to test the latest model of the two-ton truck manufactured by that company.

Although the Board has not yet completed the test of motor trucks and, consequently, is not prepared to submit a final report, in view of the fact that trucks are soon to be procured for the batteries to be organized, the Board wishes to recommend the two-ton Jeffery truck, No. 40-16, as the one best fitted for the work that would be demanded of a truck forming part of the equipment of a battery.

5. Whatever trucks may be procured, however, it is believed that the efficient administration of a battery would be enhanced by causing all trucks assigned to it to be of the same manufacture, and that the working efficiency of the trucks would be greatly increased if all were equipped with the following-named features which have been found to be very desirable:

Four-wheel drive;

Four-wheel steer;

Regular artillery pintle on rear;

A motor-driven winch on rear with several hundred feet of wire cable.

Notes on Artillery Aviation and Artillery in Trench Warfare

BY GEORGE NESTLER TRICOCHE, LATE LIEUTENANT FRENCH FOOT ARTILLERY

ARTILLERY AVIATION

THE question whether the French are absolutely satisfied with their Aviation Corps is a difficult one to answer, for the meager particulars gathered from the press, or from private correspondence, are somewhat contradictory. On the one hand, we are told of deeds of prowess accomplished by daring aviators; on the other hand, it has been rumored lately, in France, that, at the time of the resignation of General Gallieni, the lack of efficiency of the Aviation Service caused General Joffre to advocate the appointment of a Secretary of War specially conversant with that branch of the army.

In so far as the artillery *avions* are concerned, one cannot fail to notice that these machines were often conspicuous by their absence when they were most needed. To confine ourselves to operations described in the columns of THE FIELD ARTILLERY JOURNAL, we may point out that there were no French avions with the horse batteries of the cavalry division when it was surprised by the Germans on the 9th of August 1914, at Autrepierre in Lorraine.[1] No aircraft was handy, on August 15th, at Arracourt, to prevent German aeroplanes from marking the position of the battalion of Field Artillery mentioned in "The Scout's Note Book." Again, on August 21st, the French batteries protecting the retreat from Avricourt were not provided with aerial scouts—which also led to a very disagreeable surprise.[2] Hundred such occurrences are of record; and the logical conclusion from these is that, at least,

1 "Our Baptism of Fire," THE FIELD ARTILLERY JOURNAL, Vol. V, No. 4, p. 662, etc.
2 THE FIELD ARTILLERY JOURNAL, Vol. VI, No. 1, p. 12, etc.

there were not enough avions in the French army at the outbreak of the war.

To tell the truth, there was, at that time, little inclination, on the part of the War Department, to increase the number of these aeroplanes, especially because artillerists were very skeptical as to the efficiency of avions for observation purposes. Indeed, the Field Artillery Regulations for the 75-mm. gun (Annex IV, Title IV, No. 3) state that one must not, as a rule, use avions to adjust the fire of a battery, or to discover the hostile artillery, this proceeding being considered, so to speak, "a last chance," when all other means have failed. In July 1914, the method of observation by aeroplanes was rather complicated. When the avion had succeeded in finding the objective, it had to describe great circles, with that target as a centre. Two observers placed at different points and communicating with the battery by telephone determined, by angular measurements, three points on the avion's circular trajectory. These were communicated to the battery commander who used these points for the determination of his data. After the guns had opened fire, the observations made by the aerial scout were transmitted to the battery by means of curves and figures described by the avion. This was altogether too scientific for common—and rapid—use. The method in question was subsequently discarded, as we shall see later but, at the time, its impracticability was instrumental in preventing the general use of avions in the artillery service. Moreover, it was admitted by the Regulations that aeroplanes could not be relied upon for the adjustment of fire, except at medium ranges. This may be theoretically true, and the reasons therefore seem obvious; yet it seems that the French artillerists gave too much weight to this consideration, for, as late as the spring of 1914, neither the Firing Regulations for long range guns, nor the best technical essays mentioned the possibility of using avions in connection with pieces of larger calibre. It is rather interesting to note that, when the new 105-mm. gun was first issued

to a few of the heavy batteries, some of the most widely known artillerists in France were in favor of the adoption of a huge, very powerful telescope, drawn on a special vehicle, which, in their opinion, was the only practical means of adjusting the fire of these long range guns. These officers contended that such telescopes would be so much the more useful because according to the principles enunciated as the basis of the tactics of heavy field artillery, these batteries were supposed to be used mostly for a cross, or enfilade, fire against hostile heavy artillery which was itself engaged with French light batteries *in its front*. The hostile guns, which might be invisible to the observer of the "75" battalion, would very likely be easily seen by the big telescopes of the 105-mm. batteries, for the latter would have had time to take position on vantage ground. Such was, at any rate, the reasoning of the supporters of the rolling telescope. However, in April 1914, some one, in *La France Militaire*, expressed timidly the belief that aeroplanes *should sometimes succeed* in helping very materially in the adjustment of fire of a French heavy battalion. The author reminds us of the fact that it is much easier to observe the bursts of the 16-kilogramme shells used by the 105 *long*, than those of the high explosive shells or the shrapnel of the 75-calibre, weighing less than 8 kilogrammes.

Be it as it may, it seems that events have justified to some extent this way of thinking. It is well known, for instance, that when Dunkerque was shelled at a very long range by a certain heavy German gun, the latter was finally discovered by a French aeroplane; its location carefully marked; and the batteries of the defense had little difficulty in silencing the hostile "305" which had been for a while extremely troublesome.

At the present time, the artillery avions are mostly biplanes, of the Caudron type; they are not as powerful as the Farmans or the Voisins, but are able to rise quickly and need but very little space to land. These aircraft do not appear to have been very effective when they flew higher than 1500 feet; so special

attention has been given to their protection against infantry fire; almost the whole of the inferior surface of the avion is covered with a V-shaped armor, while with German avions only the motor and the crew's seats are protected.

Photography by aerial scouts has proven of little value in marking accurately the objectives of mobile artillery, except as regards, of course, large gatherings of troops, parks, etc. The French aviators very soon abandoned the complicated method of signalling we mentioned above; they copied the Germans and adopted a code of signals by means of rockets, whose trail is plainly visible for a long time and upon which the artillery opens fire; other signals help the latter to adjust its fire. Moreover, most artillery avions are now provided with very light wireless outfits. It is said that on one occasion, a single avion, during a single flight, was able, by use of that apparatus, to adjust the fire of three batteries upon three different targets.

Of course, all aeroplanes supplied with bombs may be, in a general way, considered *auxiliary artillery;* but, in many instances, "combat avions"[3] have been operating in very close connection with, and as real adjuncts to, some particular batteries. Lieutenant Colonel Borel, of the Swiss Army, in his "Causeries sur l'Aeronautique" (*La Revue Militaire Suisse*, Feb. 1916), said:

"Artillery may beat hostile trenches; counter-beat hostile batteries; direct a barrier fire to the rear of the zone which is to be attacked; but

3 It must be remembered that it is customary, in Europe, to classify military aeroplanes as follows:

- Reconnaissance ..... } Avions (armed for defense only).
- Observation ..... } Avions (armed for defense only).
- Fire Adjustment ..... } Avions (armed for defense only).
- Combat Avions ..... } Chase Avions (armed with machine guns);
- Combat Avions ..... } Bombardment Avions { armed with guns (in France 37-mm.), machine guns (2 in France), and supplied with bombs and shells (in France 90- and 155-mm.).

The French bombardment avions are mostly triplanes and carry six men. They are provided with an apparatus which causes the projectiles to present themselves automatically to the men acting as "throwers".

it is powerless to prevent reinforcements . . . from coming, by marching or by rail, to points situated farther back of the enemy's lines, in order to make a counter-attack."

Hostile counter-attacks, on the contrary, may be much handicapped, if not altogether prevented, by combat avions or, more accurately, bombardment avions, if these aeroplanes succeed in destroying communications, trains, stores, and ammunition depots. This was done, on a larger scale, in Champagne and Artois.

Since trench war began, and batteries became, so to speak, stationary, it has been deemed advisable to keep, as far as possible, the same artillery aviators attached to a given sector, so that they may become thoroughly familiar with the zone assigned to the batteries, and detect any change in the objectives and the hostile lines in general.

As this class of avions is but lightly armed, it has been repeatedly suggested by French officers that a "chase avion" should always soar *above* the aeroplane engaged in observation or fire adjustment, so as to engage the hostile aircrafts which too often attack it or compel it to flee to its base without fulfilling its mission.

ARTILLERY TACTICS IN THE ATTACK OF TRENCHES

The following has been compiled from "Etude sur l'attaque dans la période actuelle de la guerre," a pamphlet written by Capitaine Laffargue, of the 153rd Infantry Regiment, French Army, and which seemed so remarkable to General Joffre, that he had it printed by the War Department Press and distributed to the officers at the front. For the sake of unity, no distinction has been made in the present article between the comments of the translator and those for which we are indebted to "La Revue Militaire Suisse" of February 1916 (*Comment percer le Front Allemand? by "X"). These extracts refer solely to the remarks of the author dealing with the use of artillery in the attack of trenches.*

Although it is almost axiomatic that an attack on trenches should be thoroughly prepared by artillery fire, this theory has been recently opposed by some officers, belonging mostly to the Infantry. They base they contention upon the fact that, to succeed fully and with a minimum of losses, such an attack must be a surprise to the forces garrisoning the trenches. Now, an artillery preparation lasting hours, and perhaps days, cannot but "advertise" the coming attack and call hostile reinforcements to the threatened sector. In the opinion of these officers, the artillery must be brought into play *only* after the first line of trenches has been captured by surprise; the action of the guns is therefore limited to a barrier fire, the object of which is to prevent reinforcements from coming to the rescue of the defenders of the trenches.[4] It goes without saying that in case the attack is repulsed, the artillery opens fire to cover the retreat of the infantry.

Like many theories, this one could not withstand a practical test. The infantry is unable to get through the wire entanglements which protect the hostile trenches, unless a well directed artillery fire has thrown down or scattered the wires—and even then the progress of the infantry is far from easy.

Although many devices have been tried for cutting the wires, knocking down the posts, etc., none has been found as efficient as the high explosive shell of the "75." Here—as everywhere else—that projectile has proven its superiority over the shrapnel. Much stress had been laid, at first, by French artillerymen, upon the advantages afforded by the extent of the shrapnel cone of dispersion. In fact, the action of that projectile manifests itself mostly in depth. The cone of dispersion covers a more or less elliptical area, the major axis of which measures from 100 to 200 metres (according to the height

[4] It must be remembered that, as a rule, there are but few men in the first line of trenches. The latter, when an attack is feared, are filled up by troops kept under shelter, often in the second and third lines of trenches. However, there is a tendency now, from the German, to keep more men in the first line, or near by, in very large underground shelters, fairly well protected against artillery fire.

of burst), the minor axis being about one-tenth as great. With the high explosive shell, the major axis is only 20 to 30 metres; the projectile acts normally to the direction of its trajectory; and the velocity possessed by the fragments is considerable. Therefore its action has often been likened, by the French, to the stroke of an ax.

The high explosive shells of the "75" have often inflicted heavy losses upon German infantry during the "simulated attacks" on German trenches, on this wise: a violent bombardment of the first line of trenches, followed by a lull, caused the Germans to expect an infantry attack; consequently, they filled up the first line with men; at that moment, the French, instead of storming the trenches, directed an intense artillery fire, with high explosive shells, against the hostile infantry massed therein. This stratagem was repeated, on several occasions, three and four times in succession. Nowadays, the Germans do not often allow themselves to be deceived by this clever ruse; besides, as we saw before, they have formed the habit of digging deep, large and well protected shelters into which a great many men are able to hide when the hostile artillery fire becomes too violent. The shells of the 75-mm, gun are powerless against these dugouts, which can be damaged or destroyed only by the projectiles of heavy guns and mortars. This consideration affords the author an opportunity of extolling the aerial torpedo, of which he is a staunch supporter. As the pamphlet in question has received, so to speak, an official sanction and contains a preface by General Joffre himself, one may infer, at least, that the theories expounded therein are by no means displeasing to the high military authorities of the land. Captain Laffargue explains that, owing to the relative lack of accuracy of curved fire, it is not possible to rely much upon the effects of heavy projectiles as regards *the complete destruction* of bomb-proof shelters—"cavern-shelters," as they are called by the French. The torpedo is extremely

destructive; and even when it fails to annihilate the shelter, it has a very depressing influence upon the personnel, whether sheltered or not. Says Captain Laffargue:

". . . (the torpedo) overthrows the fire trenches from top to bottom; causes slides; bottles up the men in their shelters. By its terrific explosion, the extraordinary effects of the commotion it produces, the shaking up of the surrounding ground, it paralizes all energy among the trenches' defenders, who expect to die at every instant . . ."

In respect to the preparation of the attack, there is a wide difference between the action of the "75" alone, and the fire of the "75" combined with the aerial torpedo. (The author quotes from his own experience, which covers about nine months). He goes farther and asserts that the projectiles of the "75" are far from being as effective as many people think against strongly built trenches, no matter how lavishly ammunition is expended.

". . . the preparation of an attack upon the first line of trenches can be done, to a great extent, by the use of aerial torpedoes. But the torpedo guns must be a very small distance apart (one gun for every 100 metres of trenches) and have each a well defined zone of action . . ."

Captain Laffargue considers it very important that hostile machine guns should be silenced, or nearly so, before the infantry attack is made. If everyone agrees with him on that subject, many artillery officers do not admit his assertion that the "75" often fails to perform that particular part of its task. Captain Laffargue contends that, first, battalion and battery commanders are "too stingy" with their ammunition; second, they show too much reluctance to open fire on objectives which are not sufficiently definite; third, they have to divide their attention between so many different objectives, that they cannot always devote sufficient time to the search for machine guns; fourth, the adjustment of fire is by no means what it should be, even at short range.

"The shots fail too often to hit the target; very many rounds are often necessary to hit the small space occupied by the hostile machine gun.

"I remember that, before the attack of the 9th of May, I was stamping my feet impatiently; I was constantly running up to the artillery observer, because an accursed rectangular loophole remained obstinately safe and sound till the end. When we started on (to storm the trenches), this loophole lit up and two of my platoons were destroyed . . ."

A little farther, the author tells us of a similar experience. His company had gone beyond the main German trenches, and was advancing on open ground towards a cemetery and a mill. The former had been abandoned by the enemy; but two hostile machine guns remained in the mill:

"That was all the resistance we met; but that was enough. Impossible for my men to go on, the fact was signalled with difficulty to the artillery, which was then in the same condition as on an open field of battle. The batteries opened up a long time afterwards . . . on the wrong target. Then, before the eyes of my men, almost mad with rage and despair, the cemetery filled up with Germans. Four hours later the 146th came up; it was mown down by the machine guns. On the next day, the 229th took its place; same performance—a gain of a few metres at an enormous cost.

"We should have some means of silencing instantly these machine guns which reveal themselves thus, when it is impossible for us to foresee their location; and which take up a position, to stop us in a region that is no more familiar to us."

Captain Laffargue does not believe ordinary field artillery could be used for that purpose, because its batteries are too far in the rear; it is hardly possible to communicate with them after one has advanced beyond the end of the telephone lines. In the author's opinion, it is absolutely necessary that the infantry of the attack, after it has gone farther than the first line of hostile trenches, should be followed by very light guns (for instance the 37-mm. calibre) drawn by hand. The Captain thinks that it should not be difficult to organize many small batteries of such guns, with infantrymen as gunners, and artillery sergeants and officers.

The author, if we understand him well—which is not always easy—wants the "75" either to spend its ammunition liberally without being afraid of shelling places where there is nothing worth hitting; or to leave to the mountain gun (calibre 80-mm.) the task of destroying the machine guns. The mountain pieces would not be, like the "75," 1500 metres back of the trenches, but in the trenches, in close contact with the infantry, unmasking themselves during the preparation of the attack in order to shell, at short range, the loopholes, cupolas and sundry shelters occupied by hostile machine guns. They would have also the advantage over the "75" of being able to *devote all their attention to the needs of the attacking infantry*.

It is hardly necessary to say that Captain Laffargue's remarks have called forth strong protests from French artillerymen. It is not easy to comprehend how a pamphlet, which might shake somewhat the confidence of the French army in its beloved "75," could be described, in the semi-official Foreword to the work, as able to elevate the morale of the troops. At any rate, artillery officers, although they admit that the author is right when he shows much concern in respect to the activity of German machine guns, contend that their comrades of the infantry are prone to see *mitrailleuses* everywhere and very often where there are none. They emphatically deny that the "75" is not accurate and consider this charge absolutely preposterous. The real trouble is that, most of the time, objectives are not clearly indicated to battery commanders by the infantry observers who think they have detected machine guns' locations.

As regards the formation of numerous "horseless batteries of 37-mm.," with officers and noncommissioned officers detailed from the artillery, it is out of question, for the present, for the latter has no sergeants or officers to spare. Already one is compelled, as the French have it, "to make arrows out of any kind of wood." Many men have been promoted who have had neither sufficient experience nor the habit of authority.

And this is partly why the "75" batteries have not always been, in 1915, as efficient as they were at the beginning of the war. It is a fact that the "75" was at its best on open ground, with the excellent personnel which had been so carefully trained before the war. We must also remember that, at the beginning of the present conflict, before the artillery became "stationary," the French batteries derived a great deal of their superiority from their ability to conceal themselves, while the German artillery was often careless in respect to defilading itself.

The charge that battalion commanders are too chary of their ammunition is not borne out by facts. But it jumps to the eyes that, precisely because it is necessary at times to spend enormous numbers of projectiles, it is the duty of the battalion commander to be economical when there is no definite clue to the location of objectives. To be sure, as "X" remarks very aptly in *La Revue Militaire Suisse*, French artillerymen are now divided into two schools. Some, who are desirous of saving as much ammunition as possible, do not believe in extensive searching of areas during fire for effect. Others, on the contrary, are not in favor of a minutely adjusted fire which, in their opinion, loses too many opportunities of hitting hostile formations undetected by the observers. However, even these supporters of the "searching theory" do not believe it possible to agree with Captain Laffargue when the latter asserts that one should not hesitate to open fire upon "anything suspicious" and especially upon "hypothetical machine guns."

Before concluding, let us remark that the author is rather skeptical as regards barrier fire. He admits the principle, but denies that battery commanders generally succeed in partitioning off any given zone so that hostile troops cannot get out of it, nor receive reinforcements.

Laboratories in War Time

TRANSLATED FROM THE FRENCH, BY RENÉ BLACTOT

TRIALS OF CANNON AND AMMUNITION

EFFICIENCY OF THE PROJECTILES.—To verify efficiency of the projectiles, various targets are erected on the proving grounds. Figs. 1, 2 and 3 show a few examples. Accuracy tests are made on large wooden targets. Shrapnel efficiency tests are made on panels or silhouettes representing infantry troops in action. To verify the result of explosive shells on artillery matériel, actual cannons and caissons are sacrificed, the latter even being loaded with munitions.

For explosive projectiles they verify the fragmentation, which constitutes an important element of their action against personnel. As naturally one cannot hope to find on the ground a large fraction of the pieces, the explosion takes place in armored cases placed in the centre of a well, specially arranged to avoid any risk of accident.

After the explosion takes place, they go into the well and gather from the armored case all the fragments, the number of which is verified as well as the weight and nature of the pieces.

The specifications regarding projectiles demand that a projectile of a certain calibre must produce, for instance, a certain number of fragments of more than 5 gr., and a certain number of fragments of more than 10 gr. The pieces most jagged and sharp are those naturally which cause, at equal weights, the most murderous effects. Fig. 8 represents from this point of view fragments from a shell of a 105 calibre tested at the shooting pits of the Schneider workshops at Hoc. When the steel contains the desired composition, and when the explosive charge has been carefully studied, hundreds and hundreds of pieces are produced by the explosion of a single shell.

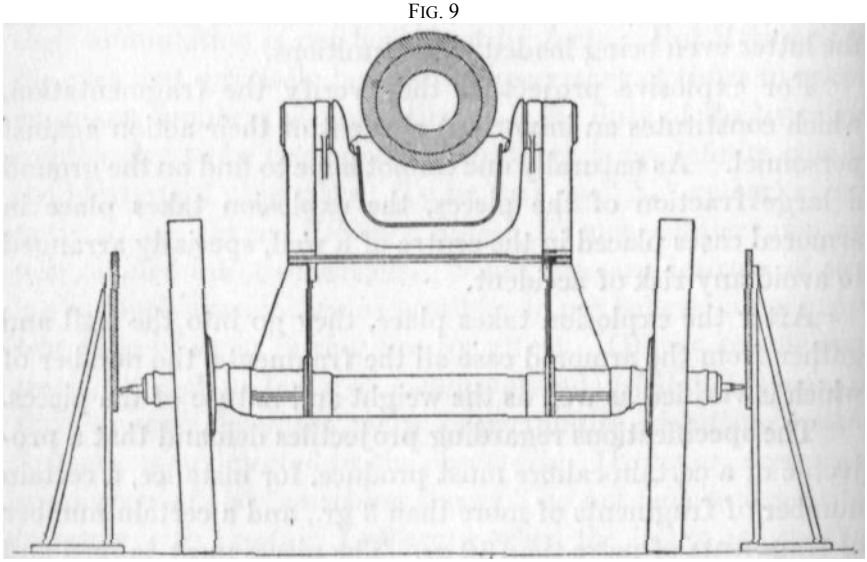
They also make firing tests in the proving grounds with the object of determining the range as a function of the angle of fire, of studying the dispersion of the shots in depth, height

and breadth, and of measuring the size of the cone of burst, etc.

STABILITY DURING SHOOTING.—To verify the stability of the gun carriages, the panel method is employed.

By a suitable method of fixing, they arrange on the axles of the wheels, for instance, a tracing point, opposite which they place in a plane parallel to the axis of the piece, a panel coated over with a layer of white lead. The contact of the point and of the panel is ensured by a spring arrangement. If movements of

FIG. 9

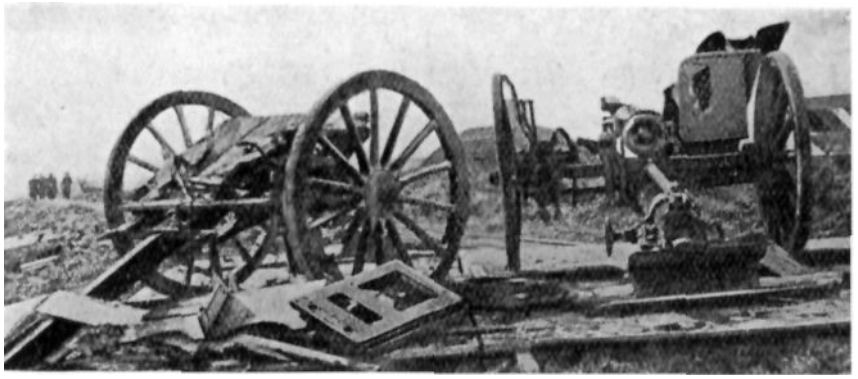


INSTALLATION OF PANELS TO DETERMINE JUMP, RECOIL AND THRUST.

the gun carriage take place during the firing, the point is moved and traces on the panel a curve which gives all the elements of longitudinal and height displacements (jump, recoil and thrust). A similar arrangement can be used for the transversal stability.

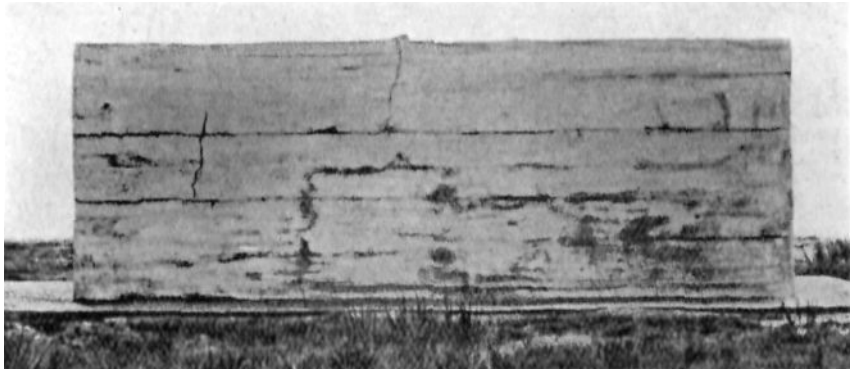
LAWS OF RECOIL AND RETURN IN BATTERY.—The reasons are known for adopting in the construction of modern guns the long recoil of the cannon on its carriage. Most of the progress realized in artillery these last twenty years has merely been in consequence of this invention by our officers and engineers. It is also known how the energy, due to the reaction on the matériel of the pressure developed by the powder in the

FIG. 1



EFFECT OF AN EXPLOSIVE SHELL ON AN ARTILLERY BATTERY

FIG. 2



EFFECT OF AN EXPLOSIVE SHELL AGAINST A CONCRETE WALL OF 11 METRES LENGTH, 4 METRES HEIGHT, AND 2 METRES THICK, SUPPORTED BY THREE BUTTRESSES. VIEW OF THE WALL BEFORE FIRING

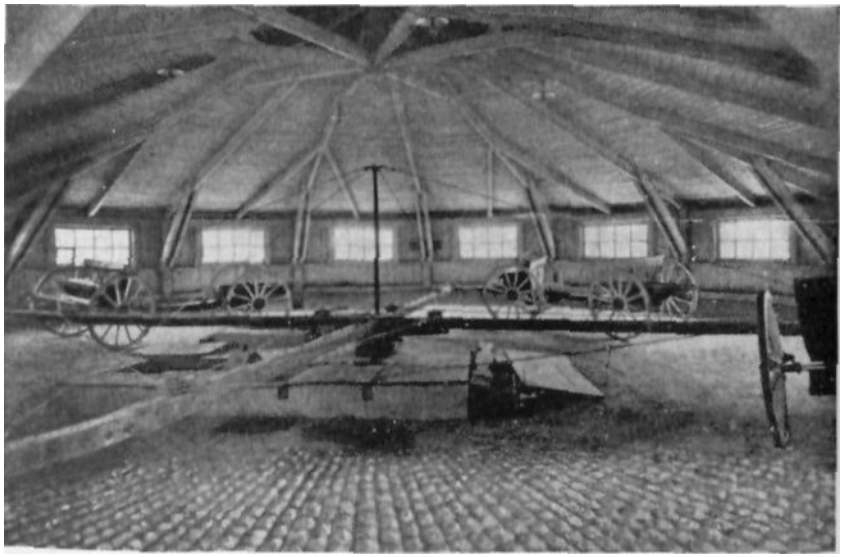
FIG. 3

THE SAME WALL AFTER SEVERAL SHOTS

FIG. 4

PROVING GROUND OF THE SCHNEIDER WORKSHOPS AT HOC. ARMORED BURSTING PITS FOR TESTING EXPLOSIVE SHELLS

FIG. 5

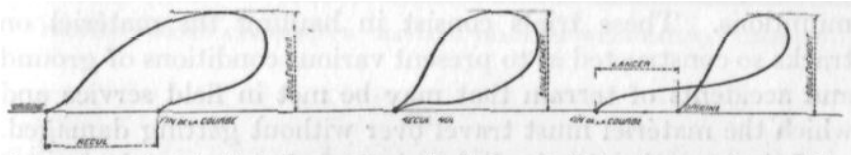


CREUSOT WORKSHOP, ROUNDHOUSE WORKED ELECTRICALLY FOR ROLLING TRIALS

bore of the cannon is partly absorbed by a brake which limits the recoil; another part of this energy is absorbed by a "recuperator," which returns the cannon in battery; towards the end of this return in battery, a "moderator for return in battery" prevents the shocks at the end of the course and the "thrust" of the piece. It is of the highest importance to know the laws governing these different movements. Knowledge of these laws implies the determination of the total length of the recoil, then the calculation of the lengths of the recoil and of the return in battery as a function of the time, finally, the measurement of the pressures developed in the brake and the recuperator.

To determine the length of the recoil they use a "recoil needle," simple tracing point installed on a fixed part of the cradle and before which moves the mobile part which is the

FIG. 10.



Origine-Origin; Recul-Recoil; Soulèvement-Jump; Fin de la courbe-End of the curve; Recul nul-No recoil; Lancer-Thrust.

DIAGRAMS TRACED ON THE PANELS BY THE NEEDLES SHOWING LIFTING MOVEMENTS

sled. The course of the needle is traced on a layer of fresh white lead. To find out the displacements as a function of the time, recourse is had to the velocimeter, to use which it is necessary to install the barrel on a fixed gun carriage. This instrument, which must register a phenomena, the duration of which is about 1/100th of a second, is composed essentially of a tuning fork electrically controlled, mounted on the fixed gun carriage, and the branches of which are fitted up with a stylus.

The vibrations are registered on a steel plate covered with lamp-black, attached to the recoiling part, and moving itself before the tracing point of the tuning fork. The isochronous vibrations of the tuning fork have a known duration. One can find out the time elapsed since the origin of the recoil or of the return in battery up to the moment of the registration of one

of them, by observing the number of vibrations produced. Furthermore, the registration takes place at a distance from the origin which is measured directly. Thus the relations between time and space are obtained, from which are deduced other relations which give the speed of the recoil and of the return in battery at a determined instant. A special unlocking arrangement prevents the vibration curves of the recoil and of the return in battery from superposing themselves.

To obtain the value of the pressure in the brake a special type of spring gauge is used. By the intermediary of a tracing point this gauge records on a plate covered with lampblack and fixed on the cradle, a diagram of pressures at the different moments of the recoil.

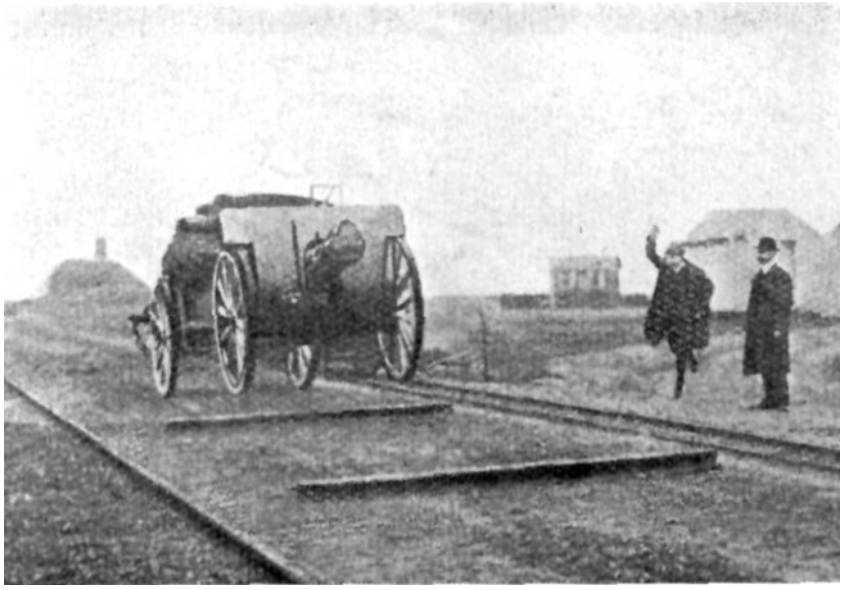
ROLLING TESTS.—Important tests are finally undertaken to verify the reliability in service of cannons, caissons and munitions. These trials consist in hauling the matériel on tracks so constructed as to present various conditions of ground and accidents of terrain that may be met in field service and which the matériel must travel over without getting damaged.

In proportion to the lightening of the gun carriages and caissons designed to increase the mobility without diminishing the power, more severe and lengthy rolling trials have become necessary. The distance covered is sometimes several hundred kilometres. The tracks for hauling are of various arrangements. At the Creusot workshops there is a covered roundhouse with macadam and paved floor, on which the cannons are attached to electrically moved arms.

At the Schneider workshops at Harfleur there are more elaborate open tracks, having sections of macadam and paved roads, with ditches, slopes, irons rails, etc. Cannons and caissons are most often hauled by a locomotive to which they are attached by a lateral arm. Figs. 6 and 7 give a fairly good idea of the violence of the shocks undergone by the matériel.

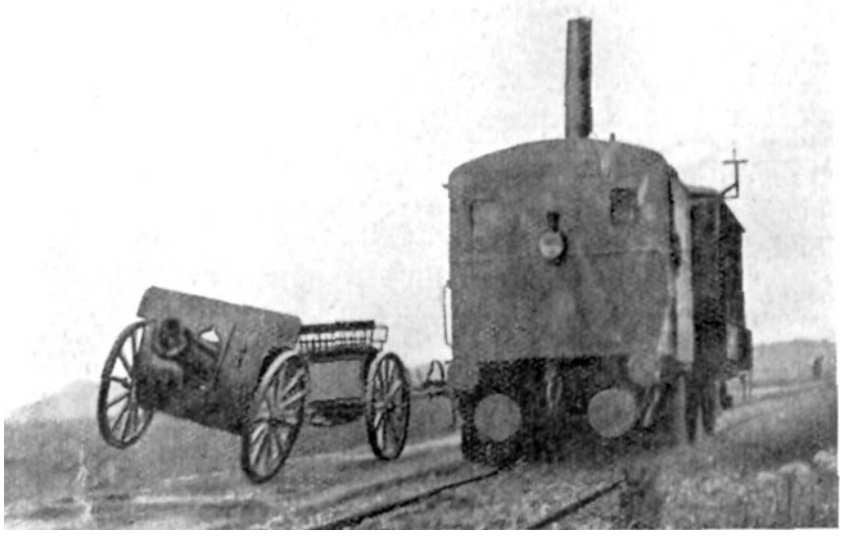
Mechanical traction is, besides, harder than horse traction: the latter method of traction calls for special trials, either on

FIG. 6



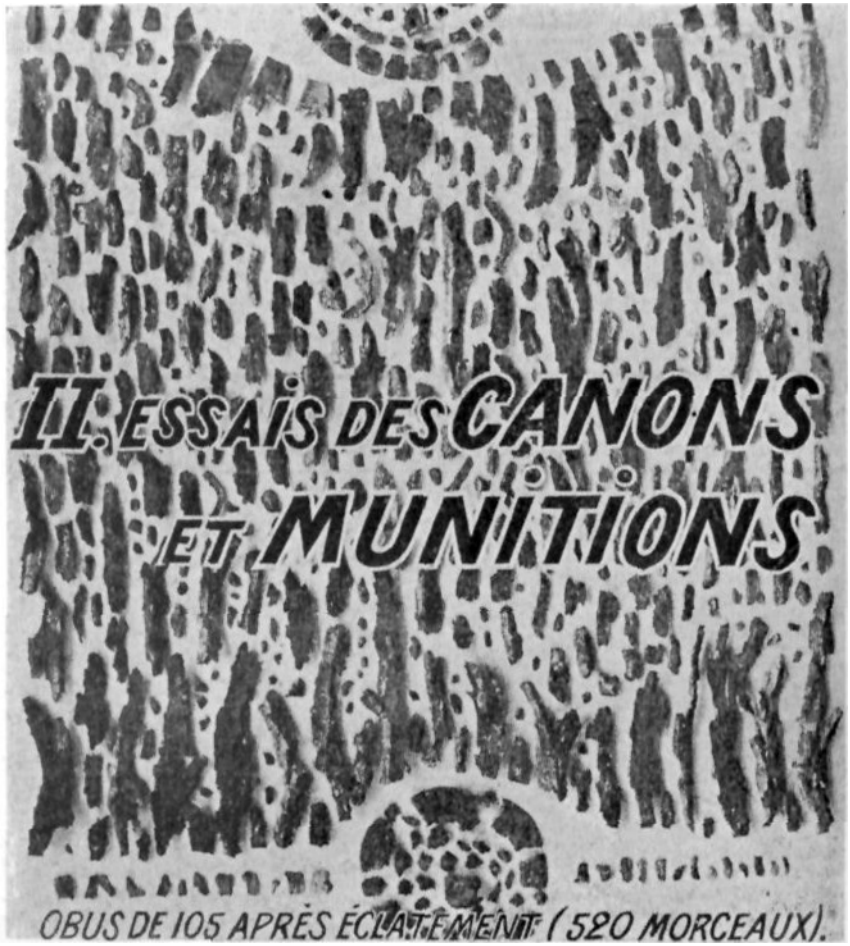
PROVING GROUND AT HARFLEUR. HAULING TRACK SHOWING RAILWAY CROSSING

FIG. 7



HAULING TRACK. CROSSING A TRANSVERSAL DITCH

FIG. 8

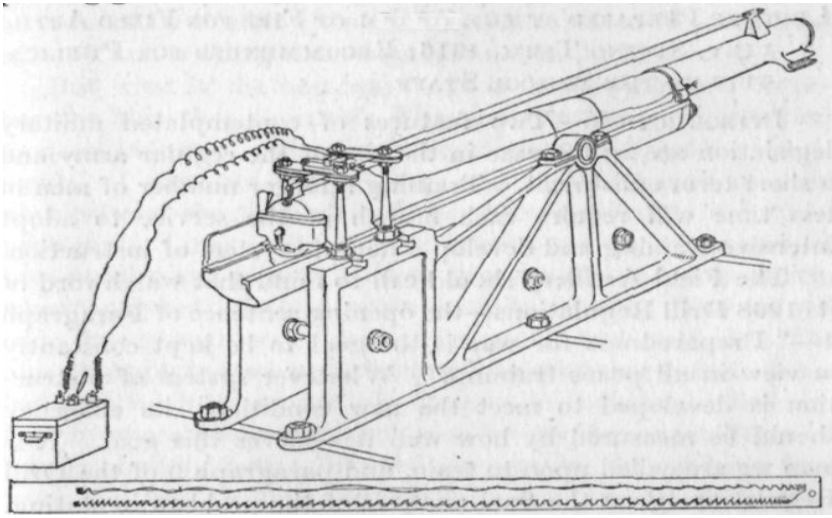


SHELL OF 105 MMS. AFTER EXPLOSION (520 PIECES)

hauling tracks or roads, especially to study the value of the systems of draft harness and the weight limit that the horses can drag, without entailing an excessive fatigue on the latter. In the same order of ideas, trials are made with mules carrying mountain war matériel.

This résumé of a certain number of tests carried out in the proving grounds of the "War Workshops" is necessarily both

FIG. 11.



INSTALLATION OF A CANNON FOR MEASUREMENTS WITHIN A VELOCIMETER. VIEW OF THE VELOCIMETER AND DIAGRAM OF RECOIL AND RETURN IN BATTERY.

incomplete and brief. It may, perhaps, show how long and methodical the studies must be, how it becomes necessary to bring in science and practical experience and minute care to construct cannons of all calibres, of which we cannot accumulate too many on our front and the front of our Allies, and to feed these cannons with munitions as abundant as efficient.

We possess to-day, either in the State establishments or in our national industry, the powerful and delicate machinery necessary to solve these complex problems: our recent victories in Champagne give a new and comforting proof of their excellent realization.

The Principles of Scientific Management and Their Application to the Instruction and Training of Field Artillery

BY FIRST LIEUTENANT WILLIAM E. DUNN, 3RD FIELD ARTILLERY

LECTURE PREPARED AT THE SCHOOL OF FIRE FOR FIELD ARTILLERY, SPRING TERM, 1916; RECOMMENDED FOR PUBLICATION BY THE SCHOOL STAFF

INTRODUCTION.—Two features of contemplated military legislation are an increase in the size of the regular army and a short term enlistment. Training a larger number of men in less time will require each branch of the service to adopt intensive training and develop a definite system of instruction.

The Field Artillery should call to mind that watchword of its 1908 Drill Regulations—the opening sentence of Paragraph 1—"Preparedness for war is the goal to be kept constantly in view in all peace training." Whatever system of instruction is developed to meet the new conditions, its efficiency should be measured by how well it achieves this goal. It is men we are called upon to train, and paragraph 9 of the Drill Regulations gives the final analysis of the problem in stating, "Thorough training of the individual soldier is the basis of efficiency."

It is intended to study the principles of Scientific Management, or industrial efficiency, and investigate their application to the problems of attaining military efficiency. Competition in the industrial world between manufacturing industries is to-day what warfare is between armies—a struggle for supremacy. In this struggle, both armies and industries depend upon organized human labor, trained and directed to accomplish its task. The tasks are different, but the principles that make for efficiency in handling men in the industrial world should have some bearing on handling men in the military service.

These principles are not new; in fact, most of them are plain common sense. The common sense of efficiency is, first of all, to prevent and avoid waste of all kinds—waste of time, waste of energy, and waste of property. Planning and coördination of work can eliminate much waste of time. Inspection and supervision can prevent much waste of property. But the most useless of all wastes is the waste of labor. This can be reduced by selecting the workmen best suited for each kind of work and training them to perform it in the best way.

But what is the best way? It is in showing how to determine this that Scientific Management has revolutionized modern industry. The scientific method of careful experiments, of accurate observations and measurements used in physical and chemical research has been applied to industrial problems. Long series of experiments and investigations, of time studies and motion studies, give results and data which, when analyzed, disclose waste and its causes. The knowledge thus gained can be used to determine best methods. The idea of applying scientific methods to studying human labor has resulted in a remarkable increase in industrial efficiency. Not by more strenuous labor, nor by greater expenditure of energy, but by better directed energy; by determining how work can best be done; by selecting workers fitted for their work; by training them in the best methods of performing this work; by planning, coördinating, and directing their work through proper executive organization.

It would seem on their face that many of these features can also be applied to increasing the efficiency of our military service. The following features and their application to the special problems of the Field Artillery will be discussed:

Eliminating waste of time, effort and property.

Scientific investigation and measurements.

Analysis of resulting records and statistics.

Best methods. Standards.

Directions for performing work. Instruction cards.

Schedules for coördinating work. Plans and programs.
Teaching and Training.
Health. Welfare. Recreation and Contentment.
Inspection and Tests.
Incentives and Discipline.
Organization. Management. System.

No claim of originality is made for the discussion of these features of Scientific Management.

SCIENTIFIC INVESTIGATION AND RESEARCH. MEASUREMENTS

DATA AND RECORDS.—The efficiency expert does not allow modern industry to be run on guess work. Guess work must be replaced by knowledge. The old axiom, "Knowledge is power," is the keynote of efficiency. So important is it to have accurate knowledge on which to build that all the time, study, labor and cost of obtaining it are a paying investment in any industry.

The scientific method of investigation and research insures that the data and results obtained are accurate and reliable. This method requires that each problem investigated be carefully studied before the actual experiments are undertaken. Each piece of work should be subdivided into its elements. All the necessary attendant conditions should be considered. Each variable factor which affects the problem should be noted. No detail is too insignificant for thorough investigation. When the work has been subdivided into its elements, time and motion studies are made of each element and the records tabulated. The variable factors which affect the problem are studied separately by series of experiments in which all factors but the one under investigation are kept constant. The results from one isolated experiment cannot be accepted as authoritative. The work of one individual cannot be taken as the standard. Enough experiments must be made to insure that the information secured is truly representative of the work.

The stopwatch is the measuring instrument used in time studies. Taylor recommends one with a decimal face, for convenience of handling the records. Each time study requires a special form of tabulation to fit the problem. Each detail of operation is lettered, blank spaces for the number of observations to be taken and for their average are provided, headed by the letter designating this operation. It happens that results obtained from one experiment differ from those of another. Where this difference is serious the records will be valueless, unless they contain the information which will account for the discrepancy. This requires that there be noted on each record, in painstaking detail, the various conditions surrounding the work and exact description of all conditions, even when seemingly unimportant.

TIME STUDIES.—Tabulated forms must be prepared for recording data. These forms must be devised by a person so familiar with the problem to be investigated that he knows what data will be necessary. It is not possible to sit down and make out, off hand, a form calling for detailed time study. The proposition must be carefully thought out at all stages. Considerable study is required before starting experimental work to insure that the work of investigation will be conducted advantageously, and that the data which are desired will be obtained in a form which can be analyzed and used. Elements which it is necessary to measure separately must be separated in the tabulated form for record. In some cases when these elements are too small to measure accurately be themselves, the following device can be used to obtain an accurate measurement of them:

To time some particular motion which takes a very small fraction of time, select a group of motions of which this is the last. Time this group the required number of operations. Repeat the timing, with this particular motion omitted from the group. The difference of the average of the two groups is the average time for the motion desired.

Skill and judgment are necessary in dividing the work into its proper elementary units. The advantage of studying each clement is that this can be done more readily and accurately; also that the results obtained are less difficult to analyze and the causes of waste time and effort can be more definitely located.

In work involving strenuous physical exertion, or concentration of thought and attention, it is important to record separately the amount of working time and rest time, as will be seen in investigating the effect of fatigue.

The methods, care and painstaking thoroughness in studying these problems are so similar to those used in research work in the sciences, that this system of insuring industrial efficiency was called Scientific Management by its originator.

The records and data obtained by this method are accurate and reliable. It then remains to analyze them and thus to obtain the information they can reveal.

Besides the information derived from time studies, motion studies and special investigations, each manufacturing plant makes use of the records and data obtained in the regular conduct of its business. The time and cost records for each piece of work, records of materials, tools and output, are all filed for reference. These records are all studied and analyzed. Information derived from them, as well as that from special investigations is applied to increase the efficiency of the plant.

In fact, as will be seen later, under proper organization this record department, with its system of records, filed for reference, indexed for immediate use, furnishes the data on which all work is planned.

FORM FOR RECORDING DATA.—The information in a set of data must be in a form that is available for immediate use. Tabulated data, convenient for reference, is a suitable form where it is desired to obtain various particular values.

However, in place of selecting particular values, it is often desired to use a set of data to obtain information on general

relations, or to make comparisons between different series of numbers. The mind is unable to grasp large masses of figures, no matter how clearly they are tabulated, and the longer a list of figures becomes the less impression it makes on the mind. In such cases it is possible to do away with the mass of figures altogether, and to show their relations in graphical form, by plotting corresponding values on a system of rectangular coördinates. A curve through the points so plotted represents by its distance from one axis (usually the horizontal one) the varying magnitude of the quantity under investigation. The eye can take in the entire curve at a glance and can judge very accurately of distances and slopes. The distances represent the varying magnitudes, the slope of the curve represents the rate at which the quantity is changing in value. The mind can obtain this information from the plotted curve with an case and readiness, which make this device an efficient and laborsaving one. A number of practical applications to which it can be put by an executive in keeping informed of the progress of different parts of the work under his supervision and of the results that are being obtained will be given later.

It thus appears that it is, in many cases, a device of efficiency to have the same data recorded in two separate forms, the tabulated form and the graphical form, depending on what use will be made of it. The important point is to have the data so recorded that its information is immediately available for use. Then, when referred to, it gives the information in the exact form needed.

ANALYSIS

A set of data may contain most valuable information and yet this information be not apparent from the figures. Having obtained the data it is still necessary to analyze it to find out what information it can yield. Analysis takes thought and study. Relations must be studied out. Some are fairly easy to obtain. Simple and direct relations are often apparent

from inspection of the sets of curves, plotted to represent the quantities under investigation. Examples of these will be given later in discussing the practical application of these principles of Scientific Management to the problems of Field Artillery.

But in many cases the relations are neither simple nor direct, but are complex and extremely difficult to determine even by the use of the most advanced methods of mathematical analysis. The mathematical results expressing these relations may also be difficult to apply. As examples of this may be noted the complicated system of slide rules designed in the Midvale Works under Frederick W. Taylor to make use of the information obtained by long series of experiments in relation to speed tools. He says that it would have been impossible to make use of the information obtained at such expense, had it not been for the invention of these slide rules, some having as many as eight different scales for the different variables affecting the problem.

It is purposely intended to refrain from all illustrations of the methods of applying the principles of scientific management to industrial concerns and to limit the first part of this discussion to a statement of the principal feature of scientific management. It is intended, then, to suggest means of applying these principles to Field Artillery problems. In this connection slide rules expressing relations of various quantities of the range tables for the three-inch gun are already in use in the Statistical Office of the School of Fire in analyzing the firing records and results of service practice.

ANALYSIS OF TIME AND MOTION STUDIES.—By analysis a complex process is separated into its parts so that each may be studied in detail. Time studies and motion studies give information by which it is possible to determine what elements are necessary, how each may best be performed, and what is the best sequence or arrangement of the series.

By eliminating unnecessary elements, by cutting out

unnecessary and unproductive motions, by arranging those retained in the most efficient order, it is possible to devise a standard method for performing each piece of work.

The standard method is best, because it is least wasteful of time, material and labor. When the best method for performing a given task has been studied out, workers are trained to use this method, and by repeated trial what should be the standard time for this method and what task should be accomplished in a given time are verified.

Standardization is one of the most important features of scientific management.

STANDARD METHODS

Methods picked up by workmen are seldom the best. Habits of doing work are seldom the best. But by time studies and careful analysis, it is possible to determine what methods are the best. The best methods should be made the standard methods and all workmen trained to perform them. It is of no use to spend time and labor in ascertaining what methods are best, unless this information is put to actual use.

The best working conditions, plant, equipment, shop arrangement, tools, machines and materials should also be ascertained.

It is then possible to arrive at what shall be the standard task. For its accomplishment tools and surroundings have been standardized. The best methods of work are prescribed and taught. The time for work has been scientifically determined. Proper allowance is made for rest from fatigue. The quality of work is prescribed. There is no guess work about the standard task, because it is based on accurate knowledge and has been verified by actual trial.

SCHEDULES AND INSTRUCTION CARDS

Schedules and instruction cards are both made out by the planning department. An instruction card is the set of directions

which goes to the individual workman. The directions are concise in form, make use of well-understood terms and phrases, and are arranged in the order of operations to be performed. They tell a workman what to do, how to do it, how long it should take, on whom to call for assistance, to whom to report the completion of the work.

Where a workman performs continuously the same set task, the card is no longer needed after he has learned his task.

The instruction card is to scientific management what working drawings are to engineering. Their standard form, clear phrasing, and short sentences, make for clear thinking on the part of the workman. He stands no chance to overlook or forget, as each operation is given in its proper order. No time is lost in making up his mind, or in decision of choice. Exactly what he shall do is prescribed, even to the method.

It is understood that it takes training to understand and make the right use of instruction cards. The provision which is made for this will be discussed later.

The advantage of the instruction cards is that they give definite direction which cannot be forgotten. They prevent waste of time, eliminate waste by cutting out the possibilities of wrong methods through prescribing right ones. By using standard terms, that is, those understood in the particular industry, it is possible to give very definite direction in a few brief terms. The order of the work is an important thing. When this is prescribed the workman can devote his attention to carrying it out instead of having to plan and decide how to conduct his work.

When the workman completes his work, he turns in the card with certain required data recorded on it; such as the time of commencing and completing, the inspector's check on quality of work and on the time, number of pieces turned out, etc.

The card then goes back to the cost accounting section of the planning department.

SCHEDULES AND PROGRAMS

Schedules for work orders are prepared by the planning department to insure that the work shall be properly routed through the shop, so that no time shall be lost because of lack of coördination. They provide that required materials shall be delivered on time where needed, and that the workmen in each department are ready for the work when it reaches their department.

The schedule for routing each separate piece of work through the shop is carefully planned, but this is not sufficient to insure its completion on schedule. A means of reporting must be provided, so that the planning department can follow its progress, as a train despatcher follows his trains. This is done by route sheets, by various graphical devices, by schedule boards or racks, by whatever device is best suited to keeping track of this particular kind of work.

Reports of the progress of the work are turned in by inspectors and also by the workmen and foreman in each department. These reports are checked up with the retained schedule to note whether the work is passing through the plant on time, or what change in orders will be necessary to meet conditions as developed. Where many men are to be handled efficiently, schedules are an absolute necessity. Without them waste of time is a certainty. Lack of proper coördination may mean that entire groups of men are idle while waiting for material to be delivered, or while waiting on some overworked group to complete its part of the work. The routing of the work must be planned so that the work of each department fits in with that of all the others, so that delays and idle waiting are avoided.

When accurate information is at hand on which to prepare instruction cards and schedules, it is possible to plan work so that, barring accidents or other unforeseen causes of delay, the work will pass through the plant on schedule time. Coördination of effort makes for efficiency by eliminating one of the great sources of waste, waste of time.

The principles of efficiency are all interrelated. Scientific investigation and measurements give accurate data on which to base analysis. This in turn gives best methods, and standard tasks and times.

Based on these standards, regular schedules of work can be planned and the proper directions for its performance issued.

For these orders to be carried out in the most efficient manner, the workmen must have been taught how best to perform the work, and trained in using standard methods until they can perform the set task in standard time.

Standards are valuable in that they give everyone something to work for, something by which to gauge his progress or his efficiency. They represent something definite to be attained and, as will be shown later, they tend to encourage good discipline as well as good work.

TEACHING AND TRAINING

Teaching and training of workmen are necessary features in a plan for industrial efficiency. It is useless to spend money and labor in finding out what are the best methods of performing work, if these methods are not used and followed, once they have been obtained. Before they can be followed, the workmen must be taught to use them, and be trained until proficient in their use.

As was noted in the opening sentences of this article, the final analysis of this problem is, "Thorough training of the individual soldier is the basis of efficiency." Change the term soldier to workman and this is equally true in any industrial concern.

For any system of industrial efficiency, to work and work properly, the individual workmen must each be trained to perform their special work. It is just as good an investment to spend the time and labor necessary to teach the workmen how best to perform their work, and to train them until they are expert in performing it, as it was in the first place to spend

time and labor in determining best methods and standard tasks.

It is the function of teaching and instruction to impart knowledge, and of training to impart practical skill.

It goes without saying that there must be a definite scheme for teaching and that the teacher must be not only qualified but also trained to teach.

WHAT TEACHING DOES.—Teaching uses and trains the senses. The importance of sense training in forming habits of work and in the control of semi-automatic actions will be especially referred to in illustrating applications of these principles to Field Artillery training. Skill and motor control are results of proper sense training.

Teaching stimulates the attention and develops the power of attention. By this is meant *real* teaching. It seems the attribute of much so-called teaching to have the opposite effect.

It develops the keenness of the imagination, and the faculty of thinking.

It builds up a useful store of information, and develops reason and judgment in making practical application of this knowledge. It induces habits of clear thinking. It strengthens and assists the memory.

Real teaching is based on making good use of the principles of psychology. It means something quite different from the usual attempts to force a fund of information into a mental reservoir. Real teaching should be a mental training that increases the powers of the mind in much the same way that physical training will increase the powers of the body, that is, by *exercising* them. The only power of the mind exercised by most teaching is the power of memory.

The teacher must know the process the mind follows in acquiring knowledge, and he should plan his lessons so as to follow this process.

The mind can communicate with the external world only through the senses. It has no knowledge not dependent in some way upon sense impressions. The first principle of real

teaching should be, then, to make use of sense impressions, and to make as full and complete use of as many different senses as possible, especially the three, sight, hearing and touch. Some people learn best by seeing, some by hearing, and we all learn by doing, as is evidenced by the force of the axiom, "Learn to do by doing." For in doing are combined a great multitude of complicated mental activities, reception of numerous sense impressions, use of memory, of association of ideas, of judgment, of reason, of foresight and planning, of coördination of motor impulses and muscular control, all to be handled simultaneously in consciousness.

It is no wonder that we learn to do by doing, for when we come to analyze even the most common things, we find that the mind in directing and controlling them performs feats of mental activity which we do not recognize as remarkable only because their results are so familiar we do not stop to analyze the process by which they are obtained.

It is a fact that the mind can gather itself together for active effort, concentrate the attention along some particular channel, direct the force of its activities upon some object in consciousness, and make just as active a use of its mental powers, with a corresponding expenditure of energy, as does the body in performing physical labor. Just as well-planned bodily exercise will develop physical strength, so will real teaching develop mental strength, and what we might term skill, that is, the ability to act quickly and accurately in performing some definite process.

This brings up the related subject of habit.

HABITS

Habit forming is the greatest labor-saving device of industry. This is shown by the difference in time and effort required to perform habitual tasks and unfamiliar tasks.

Habits relieve the brain of the necessity of conscious effort in controlling automatic actions.

When an action becomes a habit it seems to dispense wholly with conscious guidance.

Skill, dexterity and speed are based on habit, and speed resulting from habit is smooth and never hurried.

Based on these well-known facts, it is a profitable investment to train individual workmen in best methods of operation, until their performance becomes habitual. It is important to understand how to go about this training. As has been noted, the mind in directing and controlling any conscious action, performs an exceedingly complex process, even considering only the one feature of timing and coördinating motor impulses so as to produce a certain succession of bodily movements.

All the sense impressions received have to be properly recognized, and at the right instant the proper message sent to each motor centre to start each particular muscle to action, and to control its action in coördination with all the others. It is like directing a complicated switchboard, where whole sets of connections must be made, some simultaneously and some in definite sequence, where many messages must be received and none overlooked, no matter how many are coming; a switchboard where, depending on what messages are received, it must be decided what messages shall be sent out, to what places, and at what exact times. It can be seen that this is an exceedingly complicated process. Psychologists suppose that each time the process is repeated it becomes easier to make the connections in their proper sequence, that the messages received are sensed with more certainty, that those to be sent are determined with more accuracy, that there result fewer mistakes in connections and messages and that it becomes easier to make the proper connection, and to time and send the right messages.

It is seen that it is important to repeat the action many times and in exactly the same manner. To form a correct habit quickly, the mind and attention should be concentrated on identical repetition.

The process should be repeated until skilled performance is

reduced to a habit. Efficient management sees not only that its workmen are properly taught but that they are carefully trained in using best methods until these methods become habits. The standard of proficiency that such trained workmen can attain is absolutely beyond the utmost effort of the untrained men. Not only so, but the trained man can perform his greater task with actually a less expenditure of effort. This is because the energy expended is spent on actual performance of work, and is not wasted by being poorly directed.

Waste due to poor habits is a total loss. Skill is largely a matter of habit. From the view-point of efficiency, it is a very important matter to have workmen trained in standard methods of performing work until their use becomes a matter of habit. This eliminates waste of effort and increases the returns for effort expended.

HEALTH AND WELFARE

Health and welfare of the workmen are closely related to their output of work. Health means a true eye and a steady hand for full time. Large industrial concerns realize that it is important to look after the health and welfare of their employees.

Health should be safeguarded, both at work and at home. Working conditions and living conditions should be comfortable and hygienic.

The rate of doing work should be one that can be maintained without physical, mental or nervous strain, and should not overtax the strength or impair the health. Outside of his work, the workman should have good food, regular rest, wholesome recreation and amusements, and comfortable living conditions.

A contented workman is more efficient than a discontented one. The same is true of the healthy man and the man physically fit; their work will be more efficient than the man whose health is impaired, whether by disease, intemperance, overstrain

or lack of proper rest or nourishment. It is a principle of efficiency to promote conditions that will insure healthy, contented workmen, in good physical condition.

INSPECTION AND TESTS

A system of inspection is necessary to insure the proper and efficient conduct of any enterprise. It holds everyone up to the responsibilities of his position, and the proper performance of his duties.

Inspection of materials, inspection of machines, inspection of methods in use, inspection to locate the cause of defective work, inspection of the work of each workman as to amount and as to accuracy of standard parts, inspection of completed product to insure it is in working order and up to standard, are of vital importance in every manufacturing industry.

Inspection is the great bulwark to guard against waste, to prevent the lowering of quality to obtain quantity.

Inspection insures that the plans of the planning department are efficiently carried out and that the final output is up to standard.

INCENTIVES AND DISCIPLINE

Executive ability in the control of man avoids much of the necessity of administering discipline by preventing from materializing those occasions or causes which will require disciplinary action. It is better to foresee events and to direct energy into desired channels than it is to have to administer discipline to check and punish undesired manifestations. So the problem of maintained discipline will be best treated from its positive side of foreseeing and so directing energy and activities that work will be properly performed and the occasions for any other disciplinary action reduced to a minimum.

That is, consider first proper direction of activities and then what action must be taken in those cases where proper direction

has not been sufficient to insure the form of work, conduct or action desired.

Whether in the positive form of direction, or in the negative form of punishment, maintainance of discipline reduces to a personal matter. Each man lives his own individual life, and is affected by what concerns him personally.

In considering the problem of discipline, it is well to start from this basic fact and to build on it. For whoever expects to handle men, must study men. To handle them successfully he must understand them.

Interest, loyalty and whole-hearted enthusiasm make for efficiency. They can be promoted by sympathy, personal interest, and appreciation of efforts. Loyalty is reciprocal and not a one-sided affair. Coöperation does not come all from one direction. The efficient executive works to foster the spirit of coöperation and loyalty. His workers are made to feel they are an integral part of the organization working together for a common purpose. He realizes that their attitude is governed by their feelings. In directing and controlling their activities, he uses means that will enlist their coöperation instead of arousing their resentment or opposition.

There is a group of feelings or instincts that it is folly to arouse, fear, dissatisfaction, discontent, dislike, aversion, opposition, scorn, envy, resentment, hate, and revenge.

There are others which should be fostered in such a way as to promote efficiency: pride, ambition, and hope of reward should be directly appealed to in all work. Conditions should be so arranged as to make use of the instinct of imitation and the power of suggestion to further efficient work. The spirit of emulation, the desire for personal recognition and approval, the spirit of competition, and the love of racing, are useful aids to the executive who understands how to use them.

Human nature is full of energy. How best to control and direct it, how best to stimulate it to action are problems of scientific management. Incentives move to action. Is it much

the wiser course so to choose incentives that work will progress smoothly as desired, than to be confronted with outbursts of misdirected energy and the resulting necessity of appeal to active discipline to reëstablish working conditions on the basis desired.

It is thus seen that incentives are related to discipline, and that the more wisely incentives are chosen the less necessity will there be to resort to disciplinary measures.

Ideals enlist the imagination and set up a standard regarded with emotion. It is wise to foster ideals, loyalty and ésprit de corps.

Hope and expectation of reward give direct control over all men. Anything which shines in the eyes of men can be used for their reward. Psychological rewards, such as power, position, responsibility, prestige, reputation, public recognition, can be used to appeal to the pride and ambition.

Good discipline cannot be maintained in an industry which is handicapped by poor organization and lack of system in administration. In the same degree that men respond to sympathy and personal interest, so are they influenced by order and system, by justness and fairness in the exercise of control. By these means, and by using wisely chosen incentives, effective discipline can be maintained with a minimum of compulsion.

Authority should be clearly defined, every worker should be responsible to higher authority. Authority is given to promote efficiency, and not to be misused or abused. Every worker has the right to expect dignity, justness, fairness, and self-control from those over him. He has a right to expect that the men in responsible positions shall be approachable, sympathetic, impartial and self-controlled, that they will not lose their temper because of trivial matters, and but rarely under trying circumstances. The attitude of workers who know that their executives and foremen look upon them with personal interest and approval, aiding, supporting and directing their endeavors, is much different, from the point of efficiency,

from the attitude of the discontented man, resentful of the treatment accorded him. Good discipline can be aided by keeping a record of each individual, all his good points as well as his delinquencies; a record of his performances at work assigned, his training and skill, neatness, thrift and industry, perseverence, firmness and good temper; a record made up of reports of foremen and inspectors who are familiar with him and his work. The knowledge that his record is on file, that his good points are made matters of record, is a powerful incentive to an ambitious man and is a matter of pride to every good workman.

This record enables promotions to be made intelligently, by furnishing data needed in the selection of the men best fitted for the places and duties.

Discipline can be promoted by care in employing men; by the use of such tests, and inquiries as will avoid the employment of obstinate, ill-tempered, sullen, careless and slovenly men, as well as those physically or mentally unfit for the work required. It is the part of wisdom to investigate the character of applicants and not to employ shiftless, unreliable men, or men whose temper and disposition render them chronic trouble makers.

When all these positive means of securing good discipline are in action, the necessity of resorting to punishment of offenses will be reduced to a minimum.

For one thing, carelessness and mistakes will be guarded against and will not be of frequent occurrence. Proper organization, good ésprit, a spirit of loyalty and coöperation, kindly personal relations,—all will reduce the occasions for the necessity of resorting to punishment of offenses.

Where offenses do occur they should be impartially investigated and the responsibility therefor definitely located. When due to the acts of any man, the cause and motives should be determined in order that the action to be taken may be intelligently determined. Intent and extenuating circumstances

should be taken into account. When punishment is awarded it should be definite and adequate.

Punishment should be impersonally administered without any exhibition of personal anger or vexation. Its certainty should be unquestioned.

The investigation of an offense, that is, its trial or hearing, the determination of punishment and its infliction, should be administered by a person or department other than the foreman under whom the employees work.

The efficient executive, the real leader, is the one who directs his work with a minimum of friction and compulsion, who is able to produce order and coöperation with the least necessity to resort to punishment to attain his ends.

ORGANIZATION AND SYSTEM

Although first in its practical application the feature of Organization and System has been reserved to the last in discussing the principles of Scientific Management.

Management is the act of directing activity under scientific management—each man from superintendent down has as few different kinds of work or duties as possible. Organization is the assigning or proper division of duties and work. System is the basis of efficient organization. System is an organized method of transacting business. It saves time, assures accuracy and dispatch, cuts expenses, eliminates inefficient and unnecessary efforts.

System causes coördination of all the best efforts of the organization, coördination assures regular and simultaneous effort, to a common purpose, each element working to capacity, and each of the others depending upon its so working.

The essentials of coördination in an industrial plant are:

1. Proper planning and routing of work.
2. Regular arrival of materials and supplies.
3. Proper quality of supplies.

4. Prompt repairs to machines and equipment.

5. Assignment of workers to work.

6. Directions and instructions to foremen and individual workmen.

Modern management centres in the planning department. One of the essential features of Scientific Management is separating the planning of work from its execution. Trained experts are employed in the planning department.

The work in this department is subdivided as follows:

1. *Order of Work and Route Clerk*.—The route of the work through the shop is planned and the exact order of operation is prescribed.

2. *Instruction Card Clerk*.—He prepares written cards of instruction to men and foremen, prescribing what piece of work, what drawings, tools, machines, what time and materials should be used; detailed instructions as to method of performing work; to whom to go for directions, to whom to report delays, to whom to report completion of work.

3. *Time and Cost Clerk*.—He receives reports from workmen, foremen, and inspectors, records of time, amount of material and tools used and what output is produced.

Records are obtained from the results of all shop work, from all cost and time records of regular work, and also from special studies and investigations.

The use of these records in the planning department makes Scientific Management possible. In fact the use of these records constitutes the main feature of Scientific Management.

One other point in regard to records of individual performance has already been noted by inference. This is the effect upon discipline, and upon the quality of work produced that recording individual performance has.

The workman does better work when he knows he is given credit for his work, and where this record determines his pay and his chance of advancement. Such a record is in itself a very effective means of maintaining discipline.

SHOP WORK

The actual performance of the work, or its execution in the shops, is systematized. Trained foremen supervise the shop work.

1. The gang boss gets everything ready. While a workman is still working on one job, all materials and tools for his next job are assembled. When he is ready for it, the gang boss shows him how to set up the work.

2. The speed boss is in reality an inspector who sees that the proper tools, speeds and cuts are being used as directed on the instruction cards. He acts as a demonstrator in showing how to do the work at the rate prescribed.

3. Inspectors inspect the quality of the work; stop work on spoiled pieces, check up the amount of work turned out, check to see that it gauges to standard, and check the assembled work.

4. The repair boss inspects the use and care of machines and tools, and executes repairs.

EMPLOYMENT BUREAU AND DISCIPLINARIAN

Records of each man are kept so that it can be determined who are the efficient and who inefficient; if inefficient at one thing, whether or not there is some other feature of work for which they are adapted.

Promotions are made on the basis of these records. This bureau also has charge of testing out applicants, and employing those who show natural qualifications or possibilities of answering to training along desired lines.

The work of Shop Disciplinarian is related to records of employment and promotion.

Taylor makes a point that the work of Shop Disciplinarian is more that of a peace maker, to insure harmonious action, than it is to administer punishment.

APPLICATIONS

It has been attempted to discuss the above features of Scientific Management in a form free from their special adaptations to various manufacturing industries where they are at present employed, and to arrive at essential principles which may be applied to the problems of the Field Artillery.

It is not be hoped that all applications, or even the most profitable ones will be discovered on a first study of the problem by one person.

Many of the following suggested applications will undoubtedly be greatly modified in form as a result of actual trial, or better forms devised as a result of study and experiment. Scientific Management has been productive of such a remarkable increase in efficiency in the manufacturing industries in handling large numbers of workmen, that it seems that the service in which we are all interested can profit and its efficiency be increased by applying to its problems the lessons learned from Scientific Management in industrial organizations.

FUNCTION OF THE FIELD ARTILLERY

In studying how to apply the principles of Scientific Management to increasing the efficiency of the Field Artillery, the first thing necessary is to determine very definitely and very clearly what this branch of the service is for, what will be expected of it in campaign and upon the field of battle. It does not lie in the province of Scientific Management to determine what the function of Field Artillery shall be; but once this function has been definitely and authoritatively determined, the principles of Scientific Management will be a good guide in showing how best to prepare Field Artillery to fulfill its function.

If the present war has demonstrated anything, it has shown that no branch of the service can arrogate to itself the premier rôle on the field of battle and claim that all other branches are of importance or use only in so far as they render it assistance.

Time devoted to fruitless discussions of relative importance can much better be employed in preparing for service. When it comes to the battlefield, *victory* is the thing which counts, and each arm should be used as best fitted to aid in attaining this common goal. It takes *coöperation* to win. The present war has demonstrated that no branch can win alone.

It seems that the claims of any one branch to supreme importance upon the field of battle should be effectually silenced, and that it would be well for all branches diligently to prepare themselves to render the most effective service possible in *coöperating* to attain victory in battle.

The power of Field Artillery depends on the weapons with which it is armed. How these weapons can best be used, what is the proper tactical employment of Field Artillery is now being put to the iron test on the battlefields of Europe. The lessons of that war will be our guide for the use of Field Artillery. Of these we know enough to be certain that the effectiveness of Field Artillery lies in the power of its fire. The Field Artillery exists to deliver an effective and overpowering fire, *where needed*, on the field of battle. With this determined as the function of the Field Artillery, we may now consider what measures are best adapted to prepare it for its task, and study how the principles of Scientific Management may be applied to promoting its efficiency.

The first thing to consider in each application will be exactly what it is desired to accomplish and then how to go about it.

INSTRUCTION AND TRAINING.—The Ordnance Department furnishes our matériel ready for use, but it takes instruction and training to prepare our men for their duties. Every man and officer should be trained until he is an expert in his duty. Anything less than this leaves his organization short of the efficiency it should attain. Scientific Management gives real meaning to the sentence, "Thorough training of the individual soldier is the basis of efficiency." Each man should be trained until the proper performance of his duty has become a habit.

Military training must also take notice of the fact that this training in time of peace will be put to the test in time of war. The measure of the value of this training will be how well it fits each man to perform his duties in actual service in time of war. Qualities that will be needed in the stress of action are resourcefulness, initiative and self-reliance. Our regulations prescribe that our instruction should develop these qualities "on the part of field artillerymen of all grades," and that "officers should be trained to think quickly and logically, and to assume responsibilities unhesitatingly."

Since these qualities are regarded as necessary and desirable, definite measures should be taken to develop them. That is, if we want our men to be experts we must train them to be experts. If we desire to develop self-reliance, resourcefulness and initiative, we must plan our instruction and training with this object in view. If we desire to develop these qualities we must exercise them. If we desire our officers to assume responsibilities unhesitatingly we must give them responsibility and encourage them to meet it.

Such matters must not be left to chance or circumstance; nor can it be hoped that the unguided exercise of initiative or unlimited assumption of responsibility will result advantageously to the interests of the service, where there exists the necessity of ordered coöperation in the performance of military duty. So very careful thought should be devoted to working out situations calling for the exercise of these qualities. This may be done in some cases by assuming situations and difficulties to be encountered in the form of a problem and turning the solution over to a designated officer. This is, of course, more or less theoretical. But the best means and one that is eminently consistent with the maintainance of military discipline, is to delegate the performance or direction of a task calling for the exercise of judgment, decision, or exercise or initiative without prescribing the means or manner in which the task shall be performed. If self-confidence is aimed at in this training,

or if preliminary instruction is necessary before the person delegated is properly prepared to handle such a situation, see that he is trained up to the point where he is prepared to handle the situation on his own responsibility. It is a mistake to doom anyone, officer or enlisted man, to failure by placing him in situations he is not prepared to meet. Failure is a very wasteful and inefficient method of teaching.

Be very slow to make any criticisms. Nothing kills initiative more quickly. Instead, show how, if the same situation is to arise again, it can be handled more advantageously. Helpfulness is never resented; criticism always is.

In cases where it becomes apparent that emphasis must be placed on certain points in order to attain the desired degree of proficiency, make special mention of these in assigning the task. Draw out, by discussing the matter, how the man proposes to meet these special requirements. Where his proposed action is wrong, lead him to see his own mistake and to rectify it by his own judgment and decision. The advantage of this process is that the man is led to make the right decision for himself.

Prepare other problems, or assign similar tasks, until the person under instruction has gained self-reliance and is able to handle the situation efficiently. This method will accomplish things in the way of developing self-reliance and initiative that mistakes and criticism can never accomplish.

In other words, if it is desired to develop initiative, go about it in a way really calculated to develop it and do not adopt a process that will most certainly repress it.

It is so much easier to give arbitrary orders than it is to take all this trouble, that the tendency in the military service is all toward repressing initiative instead of encouraging it. In other words, while the importance of initiative is recognized in writing our drill regulations, it has not as yet been made the object of a definite system of training to develop this quality in our officers and men.

Place reliance upon subordinates, each in his particular field. Train them up to the responsibilities of their positions, and then hold each up to attaining results. Whoever does not trust his subordinates as to details will soon find that they will not assume to take any action on their own initiative. The man who understands how to command will place responsibility on his subordinates, will not hamper them in their efforts, but will give them credit for an interest in the welfare of the organization and a desire to make good in meeting the responsibilities of their positions.

In delegating any responsibility, do so in a manner that convinces the man or officer that this is an opportunity for him to make good and to show what he can do. Hold him up to results and the work will be well done. Do not neglect to give his work full recognition. If anything give it more than it deserves. He will do all the better on his next job.

Make your officers believe in themselves. Train them for advancement. Every chance they have to exercise their initiative makes them just that much better officers, more valuable to the service and more competent to fill responsible positions.

Do not be afraid to delegate power and authority. The real executive does not have to fear his authority. The finest training in discipline that a subordinate can receive is to show you respose enough confidence in him to delegate responsibility to him. Thereafter he has, in his own mind, a position he will strive to retain.

His own pride and ambition will exact from him a discipline that no outside authority could force upon him.

This will be taken up later in considering the means of maintaining discipline. It is mentioned here to show that training in self-reliance, resourcefulness, the exercise of initiative and assumption of responsibility are not inconsistent with proper military discipline, but that, when wisely used, they will foster a spirit of loyalty and a self-imposed discipline which no compulsion could exact.

One feature that is left even more to chance and circumstance than is the development of initiative, is the development of the art of exercising command. It is a matter of such vital importance to an officer's efficiency, that it should not be left to chance. It is a costly practice to permit an officer to pick up this knowledge little by little and usually by making mistakes.

There is no one thing which would make a more immediate improvement in our service than to go about the study of the art of command in a scientific manner, and to find out how executive control can most efficiently be exercised. It is apparent that a resort to anger, force, and the threat of military discipline are very crude and particularly inefficient means of exercising command.

Some notes will be given later of a few special devices found to be helpful in training noncommissioned officers to exercise command.

The subject is an important one and can be studied with profit in every regiment in the service. Methods should be tried out under such variety of circumstances as to prove their practical value.

The study of psychology as related to the problem would also throw light on the question. "The Executive and His Control of Men," by E. B. Gowin, Macmillan Company, 1915, and a French text on "L'art de Commander" are works suggestive of good practical ideas.

A good manual on this subject and a careful system of training officers in the art of command are needed to promote the efficiency of our service.

Who Shall be Trained? In considering the subject of instruction and training, we shall consider two questions. Who shall be trained? What means shall be adopted for their instruction?

When it comes to deciding who shall undergo instruction, it is apparent that the more important and responsible the

position a man is to fill the more he needs careful instruction and training to fulfill his duties efficiently. It is the part of common sense efficiency, then, to see that this instruction is provided and that he receives it and such practical training as will fit him for his position. Send him to a training school, or put him through a practical course under expert supervision.

OFFICERS' SCHOOLS

The Field Artillery should have a school for all Second Lieutenants newly commissioned. The School of Fire is already in operation, and in its special sphere is proving the value of training officers to fill the responsibilities of their positions.

A mechanical and electrical school should be provided for practical instruction in ordnance matériel, repairs, automobiles and gas engines, and electrical apparatus.

It should also be the policy to send as many officers as possible to the Army Service School for tactical instruction.

REGIMENTAL SCHOOL FOR OFFICERS

Attendance at each of the above schools would take an officer away from his regiment. It is required that the majority of our officers be on duty with their regiments. Measures should be taken to continue their professional instruction and training while they are doing regular duty with troops. Every officer should be an expert in his profession. The Regimental School can be conducted so as to insure that all attain and maintain this proficiency.

The work carried on in the Regimental School can take a number of aspects. For the officers whose length of service has fitted them to undertake the work with profit, the study of special features of field artillery work or of special lines of investigation may be assigned. This study is of benefit to the officer who makes it. When his report is prepared it may be read at a conference of the regimental officers and the other

officers will receive the benefit of having the matter brought to their attention. If it seems desirable, there may be an informal discussion after such reports, with interchanges of views and opinions.

Senior officers may be detailed to prepare tactical studies, tactical problems and situations, to be put to actual use in battalion and regimental work. The problem may be used as a terrain exercise for officers or as an exercise where battery and headquarters details are used, or it may be used for an exercise with troops, actually worked out on the ground.

The Regimental School should include a carefully prepared course in Artillery Tactics. Certain experienced officers should be detailed to prepare for written solutions problems involving special features of artillery employment, maps, sketches, reports, orders and the assumed conditions of the problem being given. Written solutions may be required of such officers as need this instruction. When they have been examined and corrected, it will be well to fix the lessons of the problem by an actual exercise with troops acting under the situation assumed. This will give a good check on the criticisms as well as on the solutions.

Flash practice and blackboard or indoor terrain drill should be conducted to keep officers skilful in handling firing problems.

A course in the preparation of firing data could be advantageously undertaken. In conducting such a course methods and geometrical principles should be studied. Then each day a few problems illustrating the particular feature studied may be given and the work actually checked at the time. The check should be made while the problem is fresh in the mind. One quick method is to have the data computed from one position, "A," for the guns at another position, "B." Then by proceeding to "B" and computing data for guns at "A," a quick double check on all work is possible without waste of time.

It should be the aim in all work undertaken in the Regimental

School to make study of some benefit. If performed as a matter of routine duty, study fails of accomplishing its best purpose. Training should fit an officer to use his brain for creative effort. Study where one works out some actual production, whether in the shape of schedules, directions, essays, plans or methods, is what should be required. Study in the Regimental School should be planned so that it will call for something actually to be produced as a result.

Officers should be professional experts on each phase of military work and duties, the same as civilians in industrial pursuits are experts in their work.

The professional education of our officers and soldiers of all grades should be as carefully studied and planned as is the course in any professional college. The courses for different grades can be standardized so as to include the essentials and those methods of instruction known to be most efficient should be used throughout the service.

The important point is that if it is desired to have an efficient corps of officers who are experts in their profession, a consistent effort must be made in each regiment to afford a stimulus to professional study that will insure every officer being up-to-date and that his training does not fall off through disuse.

REGIMENTAL CONFERENCE

A short regimental conference at officers' call can be made a valuable means for the interchange of professional ideas, especially of practical ones that have come up in connection with regular work. To be efficiently conducted, everything should be stated concisely and to the point. The conference should be short.

Long discussion of matters of opinion are out of place. When they tend to arise, the Regimental Commanders should direct certain officers to investigate or make desired tests and to report results. That is, facts instead of opinions are of value.

Clear logical thinking makes for brief, accurate statement of ideas. By placing a premium on such a statement of ideas, officers can be encouraged in habits of clear thinking.

The regimental conference is a clearing house for ideas. When efficiently handled, it can be made a means of mutual professional inspiration among regimental officers.

INSTRUCTION OF BATTERY OFFICERS

The instruction of the Battery Officers by the captain is especially important in promoting the efficiency of the battery. This instruction will be largely practical, consisting in placing an officer in charge of certain features of battery work. The proper direction of these duties will require that he prepare himself on them. The manner of giving out work should be such as to insure coöperation instead of arousing resentment or opposition. The same piece of work can be given out in a manner which will make it a disciplinary task, or it can be given out so that the officer will look upon it as an opportunity. There is no question, from the stand-point of scientific management, which is the proper method to be followed. In assigning any work make an officer feel that it is offered to him *personally* as an opportunity to improve himself professionally or to show what he is capable of doing, and that he will receive credit for doing it well.

Even those duties which are considered as routine duties will receive a degree of attention and an amount of thought from the officer who feels that he has a chance to make a showing by the efficient way he conducts them, which they would not receive if regarded merely as tasks.

It is efficient management to encourage officers to put thought and effort to making a record in the performance of any work entrusted to them. Be on the lookout for the opportunity to give an officer credit for his work. It is a better incentive than a reprimand and will go far toward making an

efficient organization. Everybody wants to succeed, and naturally is better satisfied to do things and do them well than to do them poorly. Praise and commendation are much more efficient means of getting a man to do well, than are censure and a resort to discipline.

A commanding officer whose attitude is that of developing young officers to fill responsible positions, of giving them every opportunity to make good, to undertake work and succeed at it, with the assurance that their success will be noted and recorded and that it will reflect to their credit—such a commander will have a group of subordinates eager to work and active in their coöperation. He will be loyally supported by every one of his subordinates. And in the end, the real test of a commander's efficiency is the character of the work he obtains from his command. If he has everyone under him working with him, eager for an opportunity to assist in making things come out right, the commander has a really efficient organization and one which can be relied upon to accomplish things, especially under the stress of adverse conditions when difficulties are encountered and active intelligent support of subordinates must be relied upon to save the day.

INSTRUCTION OF NONCOMMISSIONED OFFICERS

It is admitted as axiomatic that the noncommissioned officers are the backbone of the army. It is seen that any means taken to promote their efficiency will react to the great advantage of the service.

Our noncommissioned officers are selected men. Following an introduction of the methods of scientific management, complete records will be kept of the work of every man. They will be carefully tested in various duties and their progress under training in each will be noted. Under this system, when it comes to selecting our noncommissioned officers we shall have reliable data on which to base selections. That is, those men

will be selected whose work and records indicate that they are the men best fitted for the place.

These men can be sent to take the course in the Regimental School for Noncommissioned Officers, and those found qualified on the completion of this course appointed noncommissioned officers.

The subjects in this course of instruction should be selected for their practical value. Theoretical work should be reduced to that which has practical application. The school should teach those practical things a noncommissioned officer will have to know in order to be well fitted to perform his duties in his battery. It should be taken into consideration that the noncommissioned officer will be an instructor and that he can perform this duty more intelligently when he understands his work well enough to know why certain methods are the best. But every bit of theoretical work in the course should be limited to that which has a really important practical application.

When a man has completed the school course and is appointed a noncommissioned officer, he still has to learn how to handle the men under his charge. The real test of a noncommissioned officer's value to his organization is how well he can handle his men.

It is not to be expected that a newly made noncommissioned officer will be proficient in this feature of his work. Intelligent coaching will transform him into an efficient and valuable man. Every man who is made a noncommissioned officer is anxious to make good. If only shown *how*, he can be relied upon to *try*. It is the part of wisdom, then, to make the most of this desire in training noncommissioned officers, and to lead them to feel that their officers are the ones who will show them how to make good.

The following is a device which has been found to work well, as it increases the prestige and authority of the noncommissioned officer with his men. It is observed that some noncommissioned officer is not getting the results he should, either

from mistaken methods in handling his men or other apparent cause. If his mistakes were pointed out to him before the men his authority would be lessened, his pride more or less touched, and as a result, even when he changed to the proper method, he would do so with more or less of a feeling that he had been publicly reproved, which would greatly lessen his enthusiasm, even if it did not arouse some resentment.

If the work can be stopped for a short time without detriment, give the corporal permission to let his men rest. This is understood by the corporal to be a direction that you wish to speak to him. So after giving his men rest, he comes over to see what is wanted. Even this in itself increases his prestige in the eyes of his men,—to see that he can engage an officer in conversation during what seems to them an interval of rest.

When the corporal comes over, explain to him just how to go about accomplishing the desired result. When he has the situation well in hand, let him take up his work again. This method has been found to produce excellent results. When coached up privately in this manner, the corporal will feel that he has been saved from humiliation before his men and that the one purpose of the instructions is to help him along. He will go back to his squad with his self-confidence increased by the certainty of knowing exactly what to do and how to handle the situation. If he is allowed to handle it for himself, the result will be that he is enthusiastic in his endeavors. And when he succeeds he will have learned a lesson in handling men that will increase his value to the battery.

Another device that produces the same effect is to inspect a squad at work under a corporal, then call them to attention and commend some point which has been well done. This point may not be the one you desire to mention, but is referred to in order to pave the way for your following remarks and insure that your directions will receive active coöperation from both the corporal and his men.

Some statement such as "Corporal, your men are making good progress, in such a particular. I hope that by tomorrow (or whatever time is desired) each man will be able to do so and so (or each man will have completed so and so)," giving directions for the work.

The advantage of this method is that it commends the corporal in his work and the men in theirs and places another goal before them, with the implied understanding that you will also note their work toward it and be ready to commend that work if properly performed.

It has all the effect of holding them up to a standard and insures that their attitude of mind will be favorable to attaining it. By using this means, you can give necessary directions to a noncommissioned officer without creating the impression that you are publicly correcting mistakes.

Such devices as these, when used in coaching an inexperienced noncommissioned officer in the act of command, make use of his desire to succeed by showing him how to make good, but by directions which do not arouse opposition or belittle his authority before his men.

Teach a noncommissioned officer how to look after his men, his animals, his property; how to go about it; what things to do; what things to keep watch of; what to look for, how to foresee and prevent mistakes; how to manage, to look ahead, to systematize his work; how to act as an instructor; how to become proficient as a drill master; how to manage men, to give directions so as to insure their performance; to avoid reproofs in correcting mistakes and instead to make the important feature a positive direction how properly to perform the work when occasion for it recurs. Lead both noncommissioned officers and men to feel pride and satisfaction in work well done. This sort of a spirit in an outfit will be a wonderful aid in making it a well disciplined organization.

NONCOMMISSIONED OFFICERS AS INSTRUCTORS

The efficiency of our service can be increased by making more use of our noncommissioned officers as instructors. Instruction of enlisted men must be largely practical. It is not an efficient method of instruction for one officer to attempt to instruct any considerable number of enlisted men,—only a few can be actually engaged in performing the work, a large number are kept standing idle. Their attention is not fixed on the work to the same degree as though they were performing it themselves.

The efficient method is to have our noncommissioned officers trained and qualified to act as instructors; to turn over to each the number of men he can handle to best advantage in any particular kind of work. This number will be small With instruction organized in little groups each man is actually engaged at work instead of standing idle. He receives individual attention from his instructor, gets much more of a chance to practice on the work under supervision, and makes more rapid progress than when he is one of a large group with but little chance to practice compared with the amount of time he spends in waiting his turn.

METHOD OF INSTRUCTION

There is one method that can be followed to advantage in all instruction. This is to teach a man by having him actually perform the work. Show him how to do the work, explaining each operation. Then have him repeat the operations step by step. Correct his work, showing him how to improve his performance. Repeat this, having his mistakes corrected until he masters the way of doing the work. Then train him until its proper performance becomes a matter of habit.

It can be seen that a lot of patient individual instruction is required in any such method. The advantage is that it is

worth the work, for it produces a man who is a trained expert and who is correspondingly valuable to the battery.

The following example will show how, in using such a method, the natural process of the mind in learning is followed and use of the senses and sense impressions.

Take as an illustration a lesson in teaching a group of four recruits what tools are carried on each caisson and on each limber. If told what tools were carried on the caisson, the average recruit would have forgotten most of them by the time the list of those carried on the limber was completed. The lesson is inefficient because it has failed to accomplish its purpose.

The proper method is first to make use of the sense of sight; have the men find and name every tool carried on the caisson. The instructor gives the name of any article such as the spanner, which may be unknown, and requires it to be repeated by each man. Naming the tools aloud makes use of the sense of hearing and there is an association of ideas in repeating names. Then use is made of sense impressions in actually handling each tool, removing it from the caisson. As each tool is removed the instructor asks where it belongs.

Then a sort of quiz is held. Each man with his back to caisson and tools is required to name each tool and where it belongs. This calls on memory and visualization. In a test, the instructor requires the tool to be replaced, having previously removed one from the lot. This requires that memory be called upon in a slightly different form and also makes use of the impressions of actually handling the tools. The ommission of the tool which had been removed should be discovered and all tools returned to their proper places.

This makes a short lesson. To make certain that it is properly learned, it is repeated on the following day, and again after an interval of one week. After three such lessons, the sense impressions should have made such an indelible impression on the mind that the man could name the tools off-hand

and find or replace them in the dark any time during his enlistment.

On the noncommissioned officer's instruction card this lesson is noted as follows: 10:00 - 10:15, Tools on caisson and limber, 6th Section. One man on caisson, one on limber, find, name, remove tools. Quiz,—name and tell where carried. Replace tools, one missing. Each man to qualify on both caisson and limber.

The general principle of the method is to teach by sense impressions, actual manipulation and use of sight and hearing in aiding the memory.

The general principle of time is to have short periods of instruction. The reason for this is that the mind must be concentrated on the work, the instructor must have the attention of his men fixed on the work. Long periods of fixed attention are fatiguing. The power of the mind to grasp and retain ideas falls off rapidly and the instruction becomes inefficient because wasteful of time and energy. Mental fatigue should be relieved by scientific rest periods. It is a well-known psychological fact that the mind is rested by change to an entirely different kind of work. Also that a change from mental exertion to physical exertion affords relief from mental fatigue. Each lesson should be short, should be planned so that it will stop while the power of attention is still keen, and should be followed by a change of activity. This will be discussed later under the schedule for each day's work.

In teaching it is necessary to have the attention and to hold it. The responsibility is on the instructor not to let the lesson grow monotonous or lag. By giving him a fixed time on his instruction card and a definite task to accomplish in this time, he will be encouraged to a definite effort. Such lessons will really be a wonderful training in discipline for both instructors and men.

Each noncommissioned officer who acts as an instructor should be coached on the general principle of methods and

shown how to make his teaching appeal to the senses,—to the sense of sight, by having the men look for, find and point out things; to hearing, by having them coördinate in their minds, and express in words, things it is desired for them to remember; to motor impressions, by having them do things and make actual use of knowledge. Each lesson should make them think, relate different facts to each other and reason regarding them. Memory should be called on in reviews. The final step in teaching is to make use of knowledge, to put it to actual test in operation.

It is the technic of efficient teaching to make use of these methods. The instructor must realize the necessity of interest and attention if he is to make an indelible and lasting impression. Distractions should be eliminated. His teaching should be skilfully planned to avoid opposition or indifference.

He should be careful in his manner not to arouse opposition. The attitude of the instructor and its effect on the men under instruction are a matter of psychology. An impatient or faultfinding attitude is fatal to efficient instruction.

The attitude of the instructor should be so plainly a helpful one as to impress every man with the feeling that the instructor is not only showing him how to make good as a soldier but that he is also anxious to help him make good.

This personal attitude is a big factor in efficient instruction as well as in efficient leadership. The general attitude of the men and the spirit with which they do their work will be largely determined by their attitude toward the men over them.

COURSE OF LESSONS

The first requisite in planning the instruction of a field artillery battery is to have a very clear idea of what is to be accomplished and then to select the best means of accomplishing it. A standard course of lessons should be prepared for each special kind of work. The number of the lessons, the

length and subject matter of each, the methods to be used and the standard of proficiency to be obtained should be prescribed. Officers should make a daily inspection and cheek of the character of the instruction being carried on, and of the progress and the results which are being obtained. A system of records should be devised and kept. Progress curves will show marked differences in ability of different men to profit by training, also different rates of progress by the same man in different subjects. These data are valuable in selecting for special positions the men best fitted for the duties.

REGULAR TRAINING

Training is supposed to follow instruction. After a man has been instructed in any duty, he should be trained in its performance until he becomes an expert. It is not enough to let instruction end when a man understands his duty. He should be trained till its proper performance becomes a matter of habit.

Training may be individual training, group training, as in the case of one squad, or organization training, where groups performing different duties are trained to coöperate.

Recruit training is largely individual training. The recruit is trained to perform the regular duties that will fall upon him when he is turned for duty with the battery.

We should have a manual on training, giving each subject of instruction, its purpose and object, a schedule of lessons and methods of instruction. For instance, when a squad of recruits joins it should be known to a day when they will be turned for duty with the battery. It should also be known when each step in this instruction will have produced the required degree of proficiency. When a system of intensive training is adopted, there will be no waste time during the actual working day. We shall live up to schedule and will accomplish results that would seem impossible to us under our

present system of training. And we shall accomplish them so much more efficiently than we do at present that we will have the impression of having lightened our work; that is to say, the time and effort we employ will be used to advantage.

We shall make practical application of psychology in instruction and training. This has been indicated in a general way. But each subject of training will require its own particular application. Thus it will require certain applications to work best in training drivers and an altogether different set in training signal men. This is because the mind is handling two very different kinds of work. Consider the psychology of training the signal men on the buzzer. Here are two different activities, sending and receiving. In sending, reflex motor control is the goal to be reached. The mind is always ahead of the hand. The problem is fairly simple from the stand-point of psychology.

Receiving is an entirely different process. The problem is instead one of automatic recognition through the auditory nerves. The mind is always behind the ear in point of time. By prolonged training a reflex can be built up, when the hand will follow the ear without the necessity of conscious sensing of the letters involved. This is, of course, a degree of proficiency we cannot hope to obtain, for the reason that we do not start our men young enough or train them long enough. But we can hope to attain the proficiency of automatic recognition by ear, so that a certain combination of sounds will mean a certain letter without the necessity of reflection or reasoning. This indicates the method that should be followed in training. If it is desired to dispense with the time and effort lost in reflection before recognizing the letter by sound, the training must be planned with this in view. Sense training of the ear must be followed from the start. Necessity for reflection and judgment must be eliminated. If the mind is trained to recognize the letters by reflection, it will always be slow. The habit formed in the mind will be the one followed.

To develop automatic sense recognition, the ear must be trained by constant repetition on one letter at first, later on short combinations of letters and finally on entire words, until it recognizes the sound of the entire word as readily as if it had been spoken.

Psychology will be an important aid in analyzing our problems of training and indicating the methods to be followed in each problem.

It is the intention in the present discussion to do no more than call attention to the possibilities of applying psychology to the study of our problems of training, and of what we may hope for in the way of practical results in methods and in increased efficiency of our training.

STANDARDS OF PROFICIENCY

For each subject of training undertaken, we should set a definite standard of proficiency to be attained. This standard should be such that the average man can attain it in the time allowed for the training. For certain duties we desire men especially expert. For these positions we should give increased pay and should require a correspondingly higher standard of proficiency.

Speed and accuracy standards for the performance of work set before men and officers a certain goal of proficiency to be obtained. Having this goal in view aids in concentrating effort to attain it. It gives a definite object to work for. Whoever obtains this goal should be suitably rewarded by recognition. If the attainment is such that it increases the value of the man's services to the government over those of his comrades, he should receive increased pay for the increased usefulness of his services. We should make a study of methods of inspection to insure that standards once attained are really maintained.

The effect of attaining a standard upon the mind of the

soldier is to increase his self-confidence and his belief in himself. His desire to retain this place in the eyes of his comrades can be relied upon to secure his efforts to maintain his proficiency. A visible badge as a mark of distinction has value as an incentive in the eyes of all men and can be used to indicate proficiency. Just as our methods of doing each part of our work should be devised from careful study of the details of the work and all the factors involved, so should the standards of proficiency we set in each feature of our work be devised from a careful study of what our best methods ought to be when used by our trained men.

Our standards should be possible of attainment by men who make a consistent and conscientious effort to make good at their work, that is by men who really try. Since these standards are the goal we set before us in our training, it is important that our system of instruction and training should enable our men to attain them. It can be seen that the only effect of designating standards known to be impossible of attainment would be to discourage the ambitious men, the very men whom we should be most anxious to encourage.

The questions of methods and standards are going to be two very important ones in any system of increasing the efficiency of our training in the field artillery. It will not always be possible to decide what methods are best or what should be accomplished, until sufficient information on which to base a correct judgment has been obtained by trial.

The long series of trials and measurements to secure data on any subject under investigation, and the analysis of this data, fall within the province of the statistical department. This is a department of our organization which is going to point the way to great improvements in all our work.

The following method of making an investigation is taken from the method used by the Ordnance Board at the Sandy Hook Proving Ground.

When it is desired to make a special investigation of any

particular feature, the matter is referred to the board. The board makes a preliminary study of the subject, obtains all the information on file relating to the subject, and then prepares a set of plans for the experiments to be undertaken. This preliminary study is of value, because a proper plan for investigation will save a lot of time, effort and property that would otherwise be wasted. This plan is prepared by experts chosen for the work because of their experience. A set of directions is drawn up stating the purpose of the experiment, giving, step by step, detailed directions for its performance and exactly what measurements are to be made at each step.

This proof test is given to one of the younger officers, who is placed in charge of the test. He takes the program as prepared by the board, makes a study of it, and then makes all arrangements for the actual conduct of the test. For this purpose he is supplied with the necessary workmen and materials.

When everything is arranged for the test the board is notified and the members are present to witness it, so that they also have their personal observations on its performance.

The data obtained from the measurements are then entered on the program for the test and returned to the board. This is studied and in case the preliminary experiments develop the necessity for further data or a modification of the methods used, a supplementary program is made out calling for these changes.

Nothing is left to chance. As far as intelligent study of the problem can foresee, what is needed is provided for. Changes whose necessity becomes apparent from the first experiments are provided for. The planning of the test and the analysis of the data are done by experts.

It is believed there is much in this method of investigation which can be applied with advantage to the study of the problems encountered in the Field Artillery.

Statistics are hard things to handle, so little of the information

they contain is apparent from inspection. Most of it must be obtained by mathematical analysis. Subject Number 20, School of Fire Publications, contains an analysis of the problems peculiar to Field Gunnery. Each problem has its special conditions and an appropriate method of analysis must be studied out to fit them. The results when obtained are in mathematical terms and must be translated back into ordinary language to express the facts or relations deduced.

RECORDS

Besides the data from special experiments and investigation, we should keep records that will inform us at once of what is being done and what can be done in each particular phase of battery work, also those which will give us information about each man, what he can do and what he can do best.

Records of progress, of stage of completion of work, or of degree of proficiency during training can conveniently be kept in graphical form, as a glance will show the degree of proficiency attained, which is the height of the final ordinate, or the rate of progress that is being made, which is shown by the slope of the curve to the horizontal.

One form of individual records is kept at present: the record of pistol practice. A record of individual performance should be kept for each important duty in which our men are trained. It will take a great amount of work. Some system of record keeping will have to be devised that will reduce the amount of work as far as possible. But these records will give accurate information in regard to each man and will enable a battery commander to select for each position the man best qualified to fill it. This will promote the efficiency of the organization and will also have a good effect upon discipline.

SCHEDULES

Schedules mean coördination of effort and elimination of waste of time. Each day's work of army training in time of

peace should be run on schedule. When the principle of intensive training is adopted there will no longer be such a thing as an organization commander taking his outfit out for the morning's work without any definite plan of work.

Work will be conducted according to a carefully prepared schedule, so as to make the best use of each day's time for the instruction and training of each man in the organization.

Our present waste of time through lack of schedule is surprising. Take a battery having its quota of 133 enlisted men. If the working hours are limited from 7:30 to 11:30 A.M. and from 1:00 to 4:00 P.M., the working day consists of 7 hours. $7 \times 133 = 931$ hours of time, at the disposal of the battery commander for each day. Suppose that only five minutes delay or waste of time occurred in the organization. This five minutes for 133 men would total 11 hours or nearly the entire working day of two men. Until we compute the time lost we do not realize the waste that even a slight delay causes when it affects any considerable number of men. The cause of the greatest waste of time is the lack of definite well-arranged plans and programs. When the work of a number of men is to be directed it must be planned. A battery commander, for instance, cannot take his battery out of the stable yard in the morning trusting to inspiration for an idea of how to conduct the morning's work and hope to be efficient.

The French have a system of the Regimental Schedule for the Day. This is given out at officers' call each day and gives the schedule for the following day, so as to coördinate the work of the different batteries of battalions. Only part of the day's time is usually accounted for on the Regimental Schedule. The remainder of the time is at the disposal of the battery or battalion commanders to use as they see best in arranging their own individual organization schedules.

Certain events come on regular days, for instance, battalion or regimental formations on a prescribed day each week.

Every bit of work we do should be planned,—for instance,

recruit instruction should be planned as to what subjects should be included in the course; the amount of time to be devoted to each; just when this subject can be most profitably taken up; what subjects must come first; how much should be attempted in each daily; the length of time for each daily lesson; the sequence in which different lessons follow each other in each day's work. In fact to plan a course of recruit instruction so as to accomplish this training in the best way, without waste of time, requires careful thought and study.

Every time a class of recruits is put through this course, the officer in charge of the instruction should from his observations be able to improve the course in subject matter, arrangement and methods.

The same is true for every kind of work we undertake.

BATTERY TRAINING

A battery should be a regular beehive of industry. The work should be planned so that waste of time during working hours is reduced to a minimum. There should be no idle men. There should be no men waiting on some other group of men to complete their work. For instance, the work of the cannoneers should be so coördinated with that of the drivers that no cannoneers are standing around waiting for the drivers to complete harnessing in the morning before battery drill.

No time should be taken up at battery drill for instruction of individual men in duties they should learn in squad drill. Battery drill is no place to carry on the instruction of an individual cannoneer or driver. This individual instruction should be carried on in small groups under noncommissioned officers as instructors. Battery drill should be training in smooth-working coöperation of the different groups composing the battery. It should take only a portion of the day's schedule. The rest of the time should be arranged according to schedule so that a great number of different activities are

being carried on simultaneously, a small group of men engaged at each.

The noncommissioned officer in charge of each group has his instruction card which gives him his directions,—the time for each special task, men assigned, place, matériel to be used, each class of work, and brief detailed directions as to what records are to be turned in to the office with the card and where to send his men when he is through with them.

When this system is adopted, the discipline in an organization will improve because the orderly way of doing work, and its definiteness, will have the direct effect of promoting good order and discipline. Order and orderly conduct are a matter of habit.

To prepare schedules of training for the different features of artillery work, to devise the best methods of accomplishing this work, to determine what standards should be obtained, are details beyond the scope of the present discussion, which is merely intended to call attention to the possibilities which these features offer. The preparation of manuals of training involving these features will increase the efficiency of the Field Artillery. But these manuals should not be based on individual judgment; they should embrace the best knowledge and combined experience of our service; they should be carefully compiled, analyzed and tried out before being issued in authoritative form.

HEALTH, WELFARE AND RECREATION

To get the most efficient service from our men their health must be preserved. They should be kept in good physical condition through plenty of exercise and physical work. They should have plenty of good, wholesome food and regular habits of rest.

To keep men contented do not leave them in idleness, without money and with nothing to do. Keep them at work during

the working day; make the work interesting; make them think. When the work is over, see that they have good comfortable living conditions and provide them wholesome recreation and amusements.

In these days of the phonograph good music can be provided for every organization. Good books and magazines, comfortable chairs and settees in the day room and good pictures on the wall are a wise investment of the battery fund. Enthusiastic support of athletics in all forms should be especially encouraged in every organization. Nothing encourages battery spirit like enthusiasm for the battery team in an athletic contest.

It is the part of efficiency to keep our men in the best of condition, not only capable of doing good work but also enthusiastic in support of their organization and anxious for its success.

INSPECTIONS

A very radical change can be made in our method of inspections, one which will result in inspections being a real test of efficiency and a means of insuring its maintainence.

Battery officers should be supervising inspectors of all work carried on in the battery. A system of special Saturday inspections to ascertain if guns and harness have been cleaned or whether men are supplied with proper uniform should be unnecessary in an efficient organization. The battery officers should see that the guns and harness are cleaned daily, and when the army does away with its present system of one-half day's work per day every piece of harness and every article about the guns and carriages will be kept in shape by daily care.

Inspections in the nature of efficiency tests will be conducted by the field officers. On Friday the Regimental Schedule for Saturday will contain a specification—Efficiency tests, 1st Battalion, Parade Ground.

8:00 – 8:15; A Battery—Harnessing.

8:20 – 8:40; B Battery—Athletics; running; jumping.

8:45 – 9:00; C Battery—Mounted drill; limbering and unlimbering.

Each organization appears at the place and time scheduled with extracts from the battery records to show the average performance of the battery in the work to be tested. For instance, A Battery's average, as compiled from its records, for harnessing in the field is 4 min., 20 seconds. The Major times the test, which is completed in 3 min. 56 seconds, a driver and cannoneer working in each pair. The Battalion standard is 3 min., 40 seconds. The test is graded as satisfactory, for it shows the battery is actually able to attain the average indicated in its records. Efficiency is graded 93 per cent., on time. An inspection of harness indicates that performance was satisfactory. The battery is turned over to its captain.

B Battery's average record for standing broad jump is 6 ft., 4 in. This distance is laid off. Each man in the battery in rapid succession steps up and takes the jump. If one-half the battery or more can exceed this distance the test is rated as satisfactory. The average time for 100 yds. is 12 2/5 seconds. The battery is lined up, is started and at the end of 12 2/5 seconds the Major makes an estimate of the proportion who have failed to cross the finish. If it is apparent that this exceeds one-half the test is unsatisfactory.

That is, on each test the battery should equal or exceed its average as indicated from the records of its training. In many features well-known standards of proficiency will have been established. The relation of actual performance to this standard will indicate the efficiency of the organization.

Other series of tests depending on the team work of an organization as an indication of its proficiency can be devised to test the organization as a working unit, and a method arranged for judging of the relation of this work to that which will be required of it in actual service.

Such tests as we now have depend largely upon opinion for their grading. Accurate standards and methods of judging will have a stimulating influence upon an organization by holding a definite standard before them for attainment.

Our efficiency tests should include all the subjects in which it is necessary that a battery should be trained. The record of what has been accomplished in battery training can be compared with the result of the test. The test acts as a check on the accuracy of the records as well as on the progress of the training.

With the inspection of all work during its performance, made by battery officers, and with an inspection test of any designated feature weekly, we should find battery training showing a steady progress toward the recognized standards of efficient work in each feature of training.

Battery records of this work, whose reliability and accuracy are checked by these efficiency tests, will show what the battery is accomplishing, what features require more careful attention, whether or not the methods employed are producing the results which should be obtained. If the battery is doing well the records will show it; if it is not, they will show where the trouble lies and steps can be taken to make the necessary corrections.

The records and these efficiency tests are an accurate means of ascertaining what is being accomplished. What we see at our present inspections has so little relation to the actual work being carried on in the battery that a Saturday inspection at present is no indication of the efficiency of the organization.

DISCIPLINE

NECESSITY FOR DISCIPLINE.—The necessity for discipline is one of the basic facts of military service. By discipline is meant the ordered coöperation which insures the proper action of all in support of common interests.

It devolves upon those in command to determine the proper course of action and to give definite directions for its

accomplishment. It is incumbent on all subordinates to further the proper execution of these plans to the limit of their ability.

Discipline is not a one-sided affair, to give one in authority an opportunity to exercise personal wilfulness or to give vent to his likes or dislikes. Authority is given to any commander for the sole purpose of being used in his country's service. It should be exercised in an impersonal manner and with but one purpose in view—that of best serving his country's needs.

No commander has any rights of ownership over the organization assigned to his command. No man has enlisted to serve him; they have all enlisted, however, to serve their country and the duty of this service rests as much on the commander as on his men.

Discipline is not a one-sided affair in which all the obligations rest upon the subordinate. Any commander who acts on such an assumption commits a most serious offense against good discipline.

It is incumbent upon a commander to promote good discipline in his command. The higher the commander the greater his military authority and the greater his responsibility. His country and the men under him have a right to expect this authority to be wisely exercised. The misuse of military authority on the part of a superior is as grave an offense against the true spirit of military discipline as is the disobedience of military authority on the part of a subordinate.

Every officer who approaches the subject of discipline should do so first from the view-point of his own obligations, what he owes to the service and to those under him in the exercise of his authority.

His men have a right to expect of him cool judgment, courage and personal bravery, a mind too broad to be annoyed by petty personal vexation and a self-control that makes him a true leader in time of stress. They have a right to expect these qualities in him.

And in his relations with them, they have a right to expect

that these qualities will lead to calm judgment, just and fair decisions on his part.

As a means of promoting good discipline, the first step for every officer is to examine his own qualities and how they show in his actions and relations to his subordinates.

We have all food for reflection in Napoleon's reply that, "There are no poor regiments, there are often poor colonels." The lesson for us to learn is that discipline, like charity, begins at home and that if we desire to have well disciplined organizations we should see that our actions in the exercise of our authority are such as will promote good discipline.

The problem of promoting good discipline is a most complex one. There is no doubt that it is profoundly affected by the character of the personal relations involved. In controlling the action of other human beings it is absolutely necessary to know something of the workings of the human mind. It is possible for one with the best intentions in the world to succeed only in arousing intense opposition through lack of understanding of how to go about it to secure coöperation.

It is possible to play upon the feelings of our soldiers, their pride, ambition, courage, determination, loyalty, love of action and of responsibility—all the complex qualities which make up personality—in the same way that a musician plays on the keys of his instrument. But one must know the instrument before attempting to play on it, and mistakes in handling men produce more discordant results than mistakes in operating the keys of the piano.

A study of psychology, not the theoretical study of years gone by but the practical psychology an officer needs in handling men, will enable him to dispense with the necessity of force and coercion and in their place to make use of the men's feelings and desires to produce a spirit of enthusiastic and loyal coöperation, which is what good discipline is founded on.

It is wrong to think that discipline must be enforced, that is in the sense of being forced on the men. The efficient way

to maintain discipline is to have it self-enforced, where each man is working to attain a standard he has set before himself.

IDEALS

This brings up the subject of Ideals. An ideal is a standard regarded with emotion—an emotion which exerts a real influence upon our thoughts and acts. Soldierly Ideals and Esprit de Corps are two very, very important factors in promoting good discipline. They cannot be forced on a man, he must be led to adopt them for himself.

Here it is that the commander who is a good judge of human nature, as we say, is able to manage men. He is a real leader, knowing how to appeal to them so that they feel impelled to follow his lead.

They may not be conscious of why they do, but the real reason is that he has appealed to the springs of action in them and they respond.

It is natural to admire force, decision, courage and bravery. It is natural to value the opinion and regard of our fellow men. The power of suggestion, the force of example, the influence of numbers, our unconscious tendency toward imitation, all offer means to the skilful leader of men, and enable him to control their action, it may be without even a spoken command.

While we cannot hope for the remarkable personality that makes such things possible without effort, yet a knowledge of how the mind works and what incites it to action will help us in our problems of exercising command.

INCENTIVES

The problem of efficient command is not how to force action on subordinates but how to incite them to enthusiastic coöperation in support of your plans.

Forcing action on subordinates is not efficient. It is a quality of the human mind, without regard to how well advised the action may be, to oppose being forced. All the centuries

in which men have laid down their lives for what they called freedom show that a man will oppose with his very life, if need be, an arbitrary form of govenment in which his actions are forced upon him. His opposition will go on piling up little by little until it breaks forth at last in violent disobedience of all authority.

It is the part of efficiency to take note of this fact. To create opposition and have to resort to force in overcoming it is no more efficient than to drag our guns by force without oiling the axles.

We use oil to overcome friction in our carriages. We should use incentives to overcome the natural tendency of opposition of the human mind to submit to outside control.

What shall we use as incentives? How shall we go about it to make the right use of them?

Whatever is of value in the eyes of men can be used for their reward. It may be pay or some material object or it may be an immaterial thing having its existence only in the mind, as for instance the opinion of our fellow men.

The manner in which it is held forth also determines its value in the eyes of men. Even our personal relations with the person offering the reward determine whether or not we will accept it, let alone strive for it.

Personality is a wonderful thing. Every man in an organization has his own personality. Time spent in studying it is by no means lost. In fact the commander must understand the personality of his men to get the best results from them.

Every man is different, yet in the main there are some common tendencies of human nature which we all seem to possess. Pride, ambition and love of personal recognition are rooted in us all. Take the meekest man in the world and the one injury he will never forgive is an injury to his pride, especially when inflicted before his fellows. Human nature has an unconscious instinct of imitation. We are just coming to see something of the powers of suggestion. The spirit of emulation,

of competition, especially of personal competition in some form of racing, or striving to excel, is strong in all men. A desire for ownership, or personal possession, is also inherent in us all.

The commander whose personal relations with his men are such as to increase his personal influence and who knows how to appeal to the above characteristics of human nature by the incentives he selects can build up around him an organization where resort to force to maintain discipline is unneeded. Discipline in his organization will be self-enforcing. Not only that, but the enthusiasm and coöperation with which his plans will be executed will make his work far more efficient than any work executed under enforced discipline.

Discipline and order are not ends in themselves. They are necessary only to insure efficiency. Whatever means of discipline best attains this result is the best means of discipline.

In our military system there is always punishment as a last resort, but fear of punishment never produces enthusiastic coöperation. Instead of being a positive means it is a sort of negative deterrent. It is not discussed here because the army has a carefully worked out system of administering punishment when a resort to this method of maintaining discipline is necessary.

There is one further feature in maintaining discipline, the influence exerted by personal relations. These relations may vary in intensity all the way between extremes, from love to hate. We are familiar with the action manifested in these extreme forms. It is no uncommon thing, in all walks of life, for men to sacrifice their lives for those they love, to do so willingly and gladly, not only in moments of heroic devotion but also in long continued daily sacrifice. It is also common to see men willing to pay the penalty of their lives to secure revenge on those they hate.

It is well to consider any force which leads men to these extremes of action. It certainly cannot be disregarded in any

scientific system of control. The influence of personal relations in determining our actions and the character of our actions is a thing the efficient commander will use to his advantage. No man will do his best work under a man he personally dislikes. Every commander should see to it that he is not only respected but beloved of his men. There is nothing of sickly sentiment in this statement. The commander who expects his personality to exert its best influence, whether in daily training in time of peace or on the field of battle in time of war, must see that he has a hold on the affections of his men.

ORGANIZATION

We have a form of organization in the Field Artillery which will work well in the main. Our system of supply could be changed to advantage. There are a number of features of our work which can be improved, not by a change in our organization but by a change in the system under which we work.

Some of these changes have been noted as the features were discussed. The most important ones are:

A radical change in our system of inspections.

Inspection tests should be real tests of efficiency, of preparedness for war.

Inspections in the nature of supervision of work and of results should insure efficiency throughout our work.

In administration all our work should be planned. The present organization can handle this work. We have regimental and battalion headquarters and staff and battery officers who can put this system into operation. We should have every day's work planned on schedule. Written directions in the form of instruction cards can be used to promote efficiency in much of our work.

Our system of records should be kept for use, and that use to promote efficiency. Our records of our work should show us what we are accomplishing and how it compares with what

we should accomplish. Records for each man should show us what use to make of him; what position he is best suited to fill.

We should have a system of standards for all our work, standardized courses of instruction and training and standardized methods. At present our matériel is the one thing we have standardized.

Our system of promotion of both men and officers should be designed to promote and to secure efficiency.

Our system of discipline should be positive in character, designed to secure desired results through correct use of psychology, incentives and personality.

Study on the Development of Large-Calibre Mobile Artillery and Machine Guns in the Present European War[1]

1. ARTILLERY

AT the outbreak of the present European War two schools of artillery thought had gradually developed among the European nations. One school, fostered by the French, believed in the low-power, rapid-fire field gun of about 3-inch calibre, and contended that with a reasonable supply of ammunition it was possible to render heavy field or siege artillery powerless with such a gun; the second school, headed by the Germans, although believing in the low-power, small-calibre, rapid-fire fieldpiece, believed that they must be reinforced by a considerable number of heavier howitzers or field guns, which were to be used to combat the ordinary fieldpieces, as well as such entrenchments as could be constructed by armies in the field, and for long-range firing when necessary.

In general, Germany and Austria were the only European countries that had developed efficient large-calibre mobile artillery at the outbreak of the present European War, but this war has developed the use of the large-calibre artillery by all of the belligerent countries. This development of heavy mobile artillery in Germany, Austria, and France is shown in attached "Notes on Development of Large-Calibre Mobile Artillery."

How the thoughts of the majority of the field artillery officers influenced the artillery organization of France and Germany is best shown by their army organization as it existed at the outbreak of war, as shown by the following table:

1 War Department, Document No. 509, Office of the Chief of Staff.

Country	Number of 3-inch field guns per 1,000 rifles	Number of light field howitzers per 1,000 rifles	Number of heavy field howitzers per 1,000 rifles	Total
France	4.66	.....	0.206	4.87
Germany	4.12	1.37	.61	6.1

This table shows that at the outbreak of war Germany had about one-half of a light field gun (about 3-inch) less than France per 1000 combatants. Germany, on the other hand, had 1.37 light field howitzers per 1000 combatants more than France had, and had 3 heavy field howitzers of about 6-inch calibre for every one possessed by France.

The proportion of heavy field howitzers was in reality much more than the table indicates, for, as is well known, France only had a total of twenty-four 4-gun batteries of 6-inch howitzers when the war opened, whereas Germany had more than one hundred and ninety 4-gun batteries of 6-inch howitzers.

We may say that the results of the war have justified not the French but the German organization, and that as a result the French have taken up the German idea and are now doing, and have been doing for many months past, everything they can to meet the German preparedness in heavy field artillery matériel by equipping their army with heavy field guns and howitzers. It is of interest to note that the French 6-inch howitzer had a maximum range of about 6600 yards, whereas the corresponding German gun, although older in years, had a maximum range of 7700 yards. In other words, the French were not only outclassed in number but also in the power of the individual gun.

In addition to this 16-centimetre (6-inch) howitzer, which was assigned at the rate of 4 batteries of 4 guns each to each army corps, Germany had a certain number of heavy gun batteries of 10-centimetre (3.94-inch) and 13-centimetre (5.12-inch) calibre and a field 28-centimetre (11.3-inch) mortar battery. The exact number of these batteries is unknown.

The successes of the German army for the first four months of the war can be attributed, in a great measure, to the heavy field artillery with which they were equipped, and to its proper handling. Our observers all state that the moral actual effect produced on the French in the opening battles of the war by the heavy German field artillery was tremendous, and came to most of the Frenchmen, who had been taught and had believed that the 75-millimetre gun was the ruler of the artillery world, as a terrific shock. At the commencement of the war the French did not take the trouble to entrench nor conceal their artillery the way they do now; the result was that the heavy German batteries, when used as counterbatteries and assisted by aeroplanes, had a clear field and managed to destroy whole battalions of the light 75-millimetre French guns without the latter being able to do them any harm. After the opening battles of the war the French realized that they must have heavy field artillery, and made every effort to obtain it as soon as possible. The result was that between August, 1914, and March, 1915, they had sent a number of 4-gun batteries of 10.5-centimetre guns to the front and had adopted and issued to the service a considerable number of new 15-centimetre rapid-fire howitzers, and had started to construct 14-inch mortars. In other words, a few months after the war started the French school of artillery thought had completely veered around and adopted the German artillery idea.

From the artillery point of view, the lesson to be learned from the war is the same lesson that has been taught by every war since the discovery of cannon, namely, that everything being equal, the side having the heaviest gun and the best ammunition-supply system is the one that is best able to give the proper support to its infantry, and therefore has the greatest chance of success.

Before the present war started most of our artillery officers believed that the heaviest field gun or howitzer which would be needed by an army was the 6-inch howitzer firing a 120-pound

projectile, and in justice to them it must be stated that, with the exception of the German and Austrian armies, this belief was general. They also believed that the function of the heavy field guns of more than 6-inch calibre, which it was known Germany and Austria possessed, was to destroy field forts of steel and concrete, and that it would not be possible to transport either of these guns or the ammunition they required with the field armies. How wrong this assumption was is shown by the present war in which the Germans and Austrians have actually transported with their field armies 11-inch howitzers, 12-inch howitzers, 16-inch howitzers, and 17.7-inch howitzers and used them, not for the purpose of destroying works of steel and concrete, but for the purpose of destroying field fortifications, supply depots in rear of the line, villages in which troops are quartered, wire entanglements and other obstacles. All reports now indicate that the great successes obtained by the German and Austrian armies on the eastern front were due in no small measure to the use of these enormous fieldpieces, which must hereafter be considered as essential to success in war.

The lesson to be learned as to the amount of artillery to be assigned to the different units has been taken advantage of by the General Staff, who, in the organization recommended in their military policy, have increased the number of Field Artillery regiments with each Infantry division from two to three, and in the report of a board of officers which recently recommended that the heavy field artillery with each field army be increased from one to three regiments. These recommendations, if carried into effect, will result in the following proportion of guns per 1000 combatants:

Country	Field gun	Light field howitzer	Heavy field gun and howitzer	Total
United States	2.70	1.35	1.12	5.17
Germany	4.12	1.37	61	6.10

The percentage of guns provided by Germany for her army is shown above for the purpose of comparison. It shows that before the war Germany had 1.42 more field guns per thousand combatants, about the same number of field howitzers, and 0.51 of a heavy field gun less than we now contemplate. The number of heavy field guns given in the above table for Germany does not include any guns heavier than the 16-centimetre (6-inch howitzer), whereas for us it included the heavier contemplated fieldpieces. The proposed contemplated scheme for procuring enough guns, ammunition, and other necessary field artillery matériel to equip 1,000,000 men will involve the expenditure of about $470,000,000 over a period of 8 years, and, when completed, will only provide for about twice the number of guns used by Marshal Mackensen's army in the Galician campaign. In other words, if the scheme is approved by Congress, in eight years from now we will have about enough guns and ammunition and other necessary stores to supply two German field armies.

2. ARTILLERY AMMUNITION

Before the present war no one ever dreamed of the amount of ammunition that would be required to keep the armies supplied, and if he did dream of it he kept his dream to himself for fear of being called crazy. It was known that at the beginning of the war both France and Germany had a reserve supply of small-calibre field-gun ammunition of about 2500 rounds per gun, and a corresponding amount for the larger fieldpieces on hand, and were splendidly equipped with facilities for manufacturing ammunition of all kinds in large quantities. Notwithstanding their reserve supply, which was considered immense at that time, and their facilities of manufacture, both these nations found themselves confronted with a most serious shortage of ammunition before the war had been going on very long, and in the case of France at least forced her to practically suspend operations for a protracted period.

At the present time the reserve supply of ammunition to be kept on hand per gun is considered as that necessary to wear out the gun; in other words, during peace a sufficient amount of ammunition should be accumulated for each gun to permit it to fire as long as it is capable of doing so. For a 3-inch field gun this amounts to about 5000 rounds per gun.

The question of ammunition supply has become such an important one that France and England have both placed cabinet ministers in charge of it; and England, so far as we know, has not solved the problem to date.

3. AERO SERVICE FOR FIELD ARTILLERY

Aeroplanes are now recognized as indispensable adjuncts of the Field Artillery. The following will illustrate some of the services performed by the Aviation Corps:

(1) General reconnaissance work.
(2) To discover exposed batteries of the enemy.
(3) To test concealment of their own batteries.
(4) To direct artillery fire on enemy's batteries and trenches.

Observation captive balloons are employed, as shown by the following report:

> The officers who conduct the fire of these guns are well up in the trenches connected with their guns or batteries by telephone wires, which are usually run along the walls of the communication trenches and held in place by staples. In one second-line trench I counted 11 different telephone wires running out to different observation trenches. In addition to the observation posts in the advance trenches there is another method employed by both sides during the day; it is the *Drachen*, or sausageshaped captive balloon, which is sent up at daylight and remains all day until dark, at altitudes varying, I should estimate, from four to eight hundred yards, and far enough in rear of the lines to escape artillery fire, if directed against it. The observer in this balloon is equipped with telephonic communication and powerful glasses. This silent sentinel remains up rain or shine, and both sides have the greatest respect

for its power of observation. We were not allowed to assemble in groups in view of them at the front.

These observers are on the alert at all times, and we were informed that where groups of 5 or 10 appeared in the open, a shell was usually sent in their direction as a warning that nothing escaped their observation. These balloons are so generally used by both sides that during a clear day they can be seen up and down the lines as far as the eye can reach. I counted eight along the front—Notre Dame de Lorette—St. Eloy. They are used also, I was informed, very often in directing the fire of heavy artillery. The steadiness of this shape of balloon, even in a strong wind, is quite remarkable.

The War College Division has not made recommendation as to aviation equipment needed, as tests are now being made under direction of the Field Artillery Board at Fort Sill, Okla.

4. CONCLUSION

In general, the opinion of foreign officers and all of our observers abroad is that the *largest* calibres are the most effective and have done the work in this war with high-explosive shell.

The large-calibre howitzers and mortars with high-explosive shells are employed not only to reduce concrete forts, but are generally used now against fieldworks and entrenchments of all kinds.

Every effort should be made to provide our army with large-calibre mobile artillery and ample aero equipment.

5. MACHINE GUNS

Machine guns have played a most important part in the present war, and have been extensively used by all sides, under all conditions, and have proven their worth.

The following table shows the number of machine guns per 1000 men of Infantry or Cavalry provided for by the organizations of the European armies at the opening of the war, and

also the proposed proportion contemplated for our Army in the tables of organization:

Country	Army Corps		Infantry Division		Reserve Infantry Division		Cavalry Division
	Infantry	Cavalry	Infantry	Cavalry	Infantry	Cavalry	Cavalry
Germany	2	.....	2	.....	2	.....	1.67
France	2	2.2	2	.....	1.32	2.2	1.67
Russia	2	.....	2	.....	.....	.....	2.20
United States	.....	.....	2.12	3.24	.....	.....	3.24

Since the war started it is positively known that all the warring nations have greatly increased the number of machine guns with their armies. Exactly what this increase has been is, however, unknown. Reports received from our observers indicate that there is about one machine gun for every 30 yards on the western front. At the commencement of the war the Germans had 64 and the French 66 guns per army corps.

6. CONCLUSION

It is believed that machine guns at the rate of 6 per battalion of Infantry or squadron of Cavalry should be provided for our Army, or 18 machine guns per regiment of Infantry.

NOTES ON DEVELOPMENT OF LARGE-CALIBRE MOBILE ARTILLERY IN EUROPEAN WAR

GERMANY

The Germans had 42-centimetre (16.5-inch) mortars, 28-centimetre (11.023-inch) Krupp siege howitzers, and 21-centimetre (8.4-inch) howitzers at the outbreak of war. These mortars and howitzers were employed in the reduction of the Belgian fortifications.

The *42-centimetre* (*16.5-inch*) mortars are transported by rail, and spur tracks are run directly to the edge of the pits in

which they are emplaced. It is probable that a derrick car is used to mount the parts of the carriage and the mortar and also to handle the shell, which weighs about 2000 pounds.

In the recent German-Austrian offensive in Galicia, May 2 to June 25, 1915, large-calibre howitzers and mortars were used with marked success against field entrenchments and field works.

In addition to the regulation quota of artillery pertaining to the divisional organization, there was assigned to the army for the special mission a large quantity of heavy artillery, including certain 21-centimetre howitzers, 28-centimetre seacoast mortars, 30.5-centimetre mortar batteries, and probably some 42-centimetre mortars, as these were used later in the campaign at Przemysl. . . .

The present war has shown that we must revise our views as to what constitutes "field" artillery. With ordnance having calibres as large as 30.5 centimetres, moving steadily along with the troops, the artillery features of present-day combats have received a marked development. Thanks to this heavy ordnance, the German-Austrians were enabled to break down the material and moral resistance of the Russians at all their strongly prepared positions, and to prepare the way for assault of the Infantry, which found its task relatively easy. At —— the —— had a ring trench about 200 feet in diameter on the summit of a low knell forming a closed work about 250 yards in rear of a long rifle trench lower down a gentle slope. Within this ring trench were seven craters made by 30.5-centimetre (12-inch) mortar shells, some of the craters intersecting and sections of the trench having been obliterated. At Hill —— on the —— position in front of —— the Russians had a strong fieldwork consisting of a double tier of trenches with overhead cover, traverses and splinter proofs. This was assaulted and carried by a division after about 2 hours' artillery preparation by 21-centimetre (8.25-inch) howitzers and 30.5-centimetre (12-inch) mortars, with almost negligible losses. This work was inspected before the field had been cleared, and it was easy to understand how demoralized and shaken its defenders must have been in consequence of the effective artillery fire. About 100 corpses lay in or close to the trenches, most of them terribly mangled, even with clothes torn from the body by the blast which occasionally blew them out of the trenches on the ground in the rear. Whole sections of the parapet were obliterated and splinter proofs were wrecked. This work was built along the edge of a pine grove which was almost leveled to the ground by the artillery fire. Again at ——, the work on

knoll ——, to the west of ——, a very strongly built fieldwork with strong, wide wire entanglements, was bombarded for an hour with heavy artillery with similar effects to those described above. The attack of field fortifications by 12-inch ordnance is a novel feature in war, but in no other way can the strongly built positions, which an enemy can build in a few days, be prepared for assault by infantry. The transport of such heavy field ordnance, and, more particularly of the needful ammunition supply, of course, presents tremendous difficulties, and, without fairly good roads, is impracticable. . . .

During long trips, on four different days, over practically all the roads between the —— and ——, military transportation of every kind, from the light, native country wagon, hauled by two diminutive horses, to the heavy motors, hauling 28 and 30.5 centimetre mortars, where encountered moving steadily to the front without any serious difficulties. . . .

In their previously prepared positions, the —— showed some fine examples of technical work, their fire trenches being invariably provided with overhead cover, and with plenty of splinter proofs close at hand. It was only because of their free use of the heaviest artillery that the German-Austrians were able to break the lines.

The Germans have, on several occasions, fired 38-centimetre (15-inch) shells into —— from a distance, it is estimated, of 30 kilometres (18.7 miles); where these shells have fallen they have caused great destruction.

The success of the 42-centimetre mortar and the excellent results secured from this weapon have steadily spurred the Krupp Co. on to developing even larger and better calibres of guns. It is claimed that the Krupp Co. has now perfected the 54-centimetre (21.26-inch) gun with a range of about 38 miles.

AUSTRIA

The Austrian army infantry division had, at the outbreak of the war, about 42 field guns and howitzers per division of 12,000 rifles. This percentage is exclusive of the corps artillery which is composed of 8 heavy howitzers.

As the war went on the number of batteries has been increased in various ways until there are now probably 50 field guns per division. The corps artillery remains as at the beginning, but the field army artillery,

composed of 24, 30.5 and 45 centimetre (17.7-inch) mortars, is being constantly increased and is used as field artillery.

The Austrians are using their large guns up to 45 centimetre (17.7-inch) against fieldworks, field guns, storage depots, railway stations and villages, where troops are quartered, and to tear up barbed wire and other entanglements. These uses are made because the guns are available.

The writer visited three forts of —— shortly after the fortress was captured. The Germans had used 42-centimetre mortars to prepare the forts, but what part of the destruction of the concrete work was done by the German shells or what part by the —— when they surrendered the fortress to the —— is not known, but it may be stated that the moral effect of the bombardment was very great, for the —— defense was weak when the infantry assault took place.

The —— had very few guns of position in —— and the mobile artillery was reduced as much as possible to provide field artillery for the field army. In one artillery position were found two 8-centimetre field guns and a 5-inch gun stood on the road nearby, showing that it had been in use in the vicinity. In one of the forts there was a rapid-fire gun pedestal mount of 3-inch calibre. These were the only guns seen.

The writer has seen the effect of fire of the 30.5-centimetre (12-inch) and 45-centimetre (17.7-inch) mortars on semipermanent earthworks. The craters on the hill in rear of the line of works were 20 feet deep and 30 feet in diametre, and the blast from the explosion of the shells must have been tremendous. The usual killing radius mentioned by —— officers was 200 metres, but it is scarcely that great, but it is great enough to cause the —— to have a profound respect for the "ammunition wagons," as the soldiers called them.

Artillery fire is very effective when the target is suitable; for instance, enfilading artillery fire is feared. It is to be doubted whether the 3-inch gun produces the effect on moving lines in the open which might be expected; but the heavy shell fire from field howitzers is very effective as a morale destroying agent.

FRANCE

At the outbreak of war, the mobile artillery consisted of substantially the following calibres:

65-millimetre (2.56-inch) mountain.
75-millimetre (2.92-inch) field guns.
155-millimetre (6.1-inch) rapid-fire Rimailho gun.

The following artillery, considered as obsolete at outbreak of war, was put in action as soon as possible after the superiority of the German heavy artillery was demonstrated:

Old matériel:

120-millimetre (4.73-inch) long and short gun.
155-millimetre (6.107-inch) long and short gun.
220-millimetre (8.66-inch) mortar.
270-millimetre (10.66-inch) mortar.

About one month before the outbreak of war, 6 regiments of 105-millimetre (4.14-inch) guns were authorized, but the guns were not ready for issue at the outbreak of the war. Since the outbreak of war these regiments have been furnished with the 105-millimetre (4.14-inch) guns, and the following other calibres have been introduced:

150-millimetre (6-inch) Schneider rapid-fire howitzers.
260-millimetre (10.5-inch) howitzers.
305-millimetre (12-inch) navy gun, mounted on railway carriage.
340-millimetre (13.8-inch) navy gun, mounted on railway carriage.

The French have been making a new 370-millimetre (14.6-inch) mortar. Six or eight have been completed and are to be sent into the field immediately. This piece was under study when the war broke out, and is comparatively simple in construction; the trials have given most satisfactory results.

The 75-millimetre field gun is now seldom used by the French in bombarding field entrenchments.

The new legislation is now at hand, and for purposes of comparison, as well as for the information of the Field Artillery, a table has been prepared showing the proportion of guns and howitzers to combatants.

A rough computation of the number of rifles per regiment shows that the Infantry will have an effective combatant strength of about 115,00 men, and the Cavalry a strength of

about 35,000 men, a total combatant strength of the two arms of approximately 150,000 men. A tentative scheme of the Field Artillery organization provides for ten regiments of light field and two of horse artillery, four of light howitzers, three of heavy field, and two of mountain artillery. The strength in guns and the number of guns per thousand rifles, computed on this basis, is as follows:

Type of gun	Light field gun	Light field howitzer	Heavy gun or howitzer	Mountain gun	Total
Number	288	96	72	48	504
Number per 1000 combatants	1.92	.64	.48	.32	3.36

The proportion permitted by the normal divisional organization prescribed by Section 3 of the law is higher. The combatant strength of the Infantry and Cavalry of an Infantry division is about 17,500, and the Artillery strength is forty-eight light field guns and twenty-four light field howitzers. The proportion is therefore 2.74 light guns and 1.37 light howitzers per thousand combatants. In the Cavalry division there are approximately 12,000 combatants and twenty-four horse artillery guns, the proportion being two guns per thousand combatants.

Computation of the relative artillery strength of a corps is impossible, as the corps may vary in the number of its Infantry divisions, and in the number of Cavalry brigades up to a Cavalry division.

It is to be noted, however, that the strength of field artillery authorized by the recent law falls considerably short of that recommended by the General Staff.—EDITOR.

Smoke Bomb or Flash Practice

BY CAPTAIN WILLIAM BRYDEN, FIELD ARTILLERY, SECRETARY, SCHOOL OF FIRE FOR FIELD ARTILLERY

NOTE.—*Officers recently at the School of Fire may recognize in this article some minor changes in the methods with which they were familiar while at the school. If so, they will understand that these modifications of the course are to be followed in the work during the next session.*

JUDGING from replies that have been submitted during the last few years by student officers at the School of Fire for Field Artillery in answer to questions on smoke bomb or flash practice as conducted in the regular field artillery regiments, it appears that such practice is engaged in with more or less indifference, and that the results obtained are generally unsatisfactory. On the other hand it is believed that few officers who have attented a course of instruction at the School of Fire have failed to find flash practice as conducted there a most interesting and instructive preliminary to service practice. This difference of opinion is undoubtedly due to difference in the methods of conducting the practice.

The following description of flash practice as conducted at the School of Fire during a four months' course of instruction for officers of the regular army is submitted in hopes that it may be of some assistance to instructors elsewhere and that it may thereby help to stimulate interest in this practice throughout the Field Artillery.

As is well known in the service, smoke bomb or flash practice consists in representing shrapnel bursts in the vicinity of a target at an artillery range from an observation point, the positions of the bursts being varied in accordance with the commands given by the student officer conducting the fire and with the firing data assumed as correct by the operator at the target.

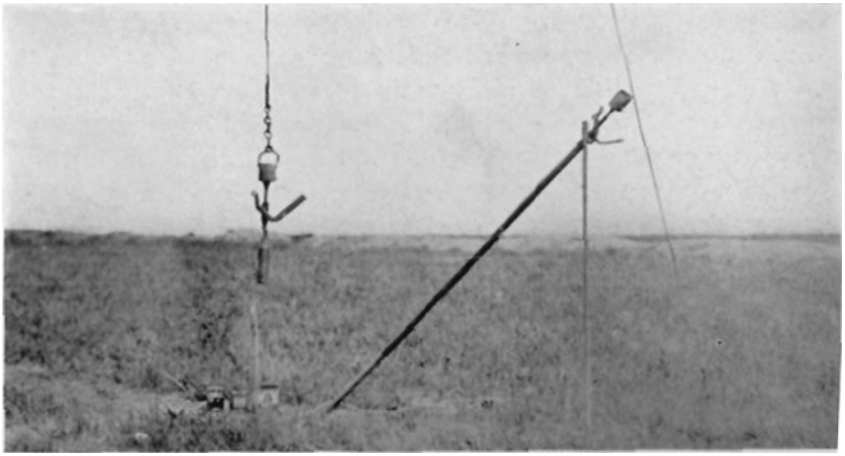
The object of the practice is to develop the powers of

TARGET OPERATOR AND PARTY, AS SEEN FROM THE FRONT

FIG. 2

TARGET OPERATOR AND PARTY, AS SEEN FROM THE REAR

FIG. 3



EQUIPMENT OF FLASH-MAN

FIG. 4

POSITIONS AT WHICH FLASHES ARE FIRED

observation and to drill officers in manipulating the several elements of adjustment until the determination and announcement of appropriate corrections become to a greater or less extent matters of second nature.

METHOD OF INSTRUCTION

The first aim of this instruction is to drill officers in handling deflection and distribution. In this training all bursts are shown as low and short of the target. Officers are, therefore, not only not required but they have no opportunity to make corrections for heights of bursts and range. While there are some disadvantages in this, the method is nevertheless adopted for the reason that it is believed the advantage of giving the officer only one thing to consider hastens the time when the necessary mental processes become more or less mechanical.

While the flash detail at the target reproduces errors of all kinds, it is instructed not to show abnormal ones. For the first salvo of a problem the detail shows errors not greater than 30 mils in direction, and a distance between the first and fourth bursts of not more than 45 mils.

In this preliminary practice an officer, when called upon to conduct fire, first announces complete data for an assumed battery under the assumption that it has just occupied its position and has not yet fired. After the first salvo the officer gives the necessary commands for changing the deflection and distribution based on his observations of the bursts shown by the flash detail, and announces a new range according to some reasonable hypothesis which he has formed in his own mind based on his assumed observations for range in the first salvo. The officer firing continues to announce deflection and distribution changes and ranges until he is satisfied with the deflection and distribution shown by the flash detail. He then announces merely a range.

There is a great difference among officers at the beginning of a course at the school in what may be termed initial aptitude.

Some of this difference may be due to natural causes while, frequently at least, a large part is due to the character of service recently performed by the several officers. Much of this difference soon disappears.

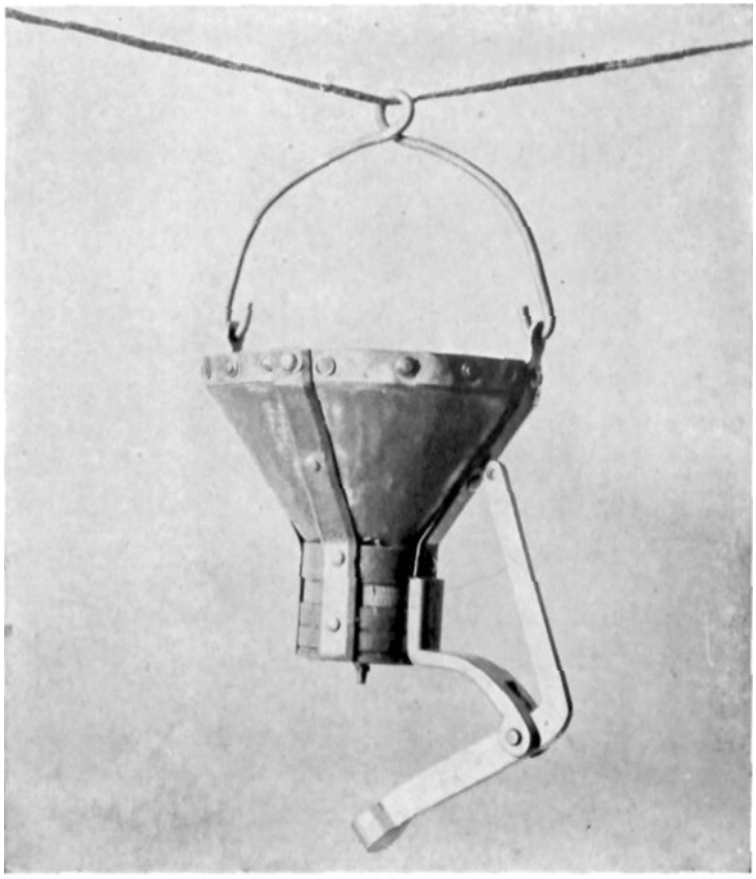
The limited number of instructors and other considerations render it inadvisable to attempt any grouping of officers according to aptitude. In preliminary training in deflection and distribution it is considered better, therefore, to set aside ample time for all, rather than to attempt to qualify those officers who have had more practice than others.

Tentatively, a period of two weeks is set aside for the preliminary instruction in handling deflection and distribution. At the end of this time it is expected that all officers will be prepared to qualify. If practically all members of a section show that they are able to qualify before the expiration of two weeks, the section is examined earlier. If, on the other hand, a number of the members are slow, the preliminary training may be extended over a longer period.

The standard that has been adopted as indicating the necessary degree of proficiency in handling deflection and distribution is that an officer shall fire promptly and properly, first ten successive battery salvos from the right and then ten from the left. In each of these tests, as soon as the officer is satisfied with the deflection and distribution shown by the flash detail he announces merely a range, and when this command has been transmitted to the flash detail new initial errors in deflection and distribution are shown. To qualify it is required that no interval between the last burst of any salvo and the announcement by the conductor of fire of the range for the succeeding salvo shall be more than four seconds, and that in every instance the commands for changes in deflection and distribution shall be correct in sense and approximately correct in amount.

Inasmuch as all officers of a section are advanced together, and as those who do not become able to qualify in this work find themselves greatly handicapped later on, it is of special

FIG. 5



DEVICE FOR REPRESENTING GRAZE BURSTS

importance that officers succeed in reducing the handling of the deflection and distribution to a mechanical process, at least to the extent required to qualify in the tests mentioned.

The first day of this period of two weeks is devoted to an explanation of the foregoing provisions and to practice in adjusting the deflection with a single piece, no records or time intervals being taken. On the second day the firing is by platoon from the right; on the third by platoon from the left, and thereafter by battery from the right and from the left on alternate days.

As soon as the section has completed its preliminary training in deflection and distribution the adjustment of the corrector is taken up. The training continues exactly as before, except that the flash detail varies the heights of bursts and the officer firing gives the necessary commands for adjusting this as well as the deflection and distribution. While changes in range are not shown the officer conducting the fire announces changes in range in the same way as has been previously described. Satisfaction with the adjustment of the deflection, distribution or height of burst is indicated by the omission of changes in any of these data when giving commands.

In handling these three elements that have been introduced no definite qualification is required and the moment of taking up the next step is left to the judgment of the instructor. Tentatively, a period of one week is fixed for instruction in the adjustment of these three elements, and, as a rough rule for the instructor, it is expected that officers will not require a much greater interval than four seconds between the burst of any salvo and the announcement of the range for the succeeding salvo.

The next step is the introduction of ranging. In this practice the flash detail introduces all errors previously shown and in addition shows shorts and overs in accordance with the announced range and the one assumed by the noncommissioned officer in charge of the detail as the range of the target. All

the elements of fire being now represented the practice approaches that of actual firing. Inasmuch as certain features of the flash practice are necessarily somewhat unreal it is necessary for officers, in their own interest, carefully to avoid taking advantage of any indications which would not exist in service firing.

As soon as bursts with reference to range are introduced, complete records are kept.

After the introduction of the range element, the officer adjusts with whatever number of guns and method of fire he deems appropriate to the target assigned.

In order that different targets may be assigned so as to make various methods of adjustment appropriate, and also in order that practice may be had in identification of targets, instructors habitually designate targets outside the flash area. It is therefore necessary for officers to bear in mind the assumption that, during the firing, the flash target represents the *assigned* target.

In all practice after the introduction of the range element, officers conducting fire give their commands for fire for effect as soon as they are satisfied with the adjustment. As in service practice, no other indication of satisfaction with adjustment is necessary or is permitted unless specifically called for. In flash practice the Battery Commander is required to announce his observations for height of burst and for range, whereas in service practice this announcement is not required.

Flash practice is held daily until the commencement of service practice. After that time the work is continued on days when there is no service firing until all officers have had two or three opportunities of observing the work of the flash detail at the target, after which no more flash practice is held.

RECORDS

On the second day of flash practice and thereafter, records of commands given and of time are kept. These records are

SMOKE BOMB OR FLASH PRACTICE

Slieet No ..... Date .....

Observer .....

Write name of B. C. above observations of his first salvo.
Record ranges in hundreds.

RN	Observations	RN	Observations	RN	Observations
	.....		.....		.....
	.....		.....		.....
	.....		.....		.....
	.....		.....		.....
	.....		.....		.....
	.....		.....		.....
	.....		.....		.....
	.....		.....		.....
	.....		.....		.....
	.....		.....		.....

FORM NO. 4, SCHOOL OF FIRE FOR FIELD ARTILLERY.

RECORD AT BATTERY COMMANDER'S STATION.

Problem No.....Sheet No.....Date.....191 .....

Battery .....Officer firing.....

Range Finder used .....

Range..... meters. yards. Used by B. C? Yes. No.

Target.....

Commands given	Range	Round No.	Observations of B. C.

FORM NO 5. SCHOOL OF FIRE FOR FIELD ARTILLERY.

kept by two well-instructed noncommissioned officers. One known as the *recorder*, keeps a record of commands exactly as they are given by the officer conducting the fire. This record is kept on a blank (Form No. 5), that is used also in service firing, and, as is seen, calls for some information not required to be recorded in flash practice. The other noncommissioned officer is the *timekeeper*. He is provided with a stopwatch, and after each announcement of a range calls out in a voice loud enough to be heard by all members of the section the time that has elapsed between the last burst of the preceding salvo and the announcement of the new range. This interval is in each case noted by the recorder.

The senior officer in the section is usually the first to conduct fire, and is followed by the others in order of rank. Officers not conducting fire or otherwise engaged are required to keep a record of their observations for range (Form No. 4). On the reproduction of the blank shown herewith appear instructions for its use. It should be remembered in connection therewith that bursts from 0 to 2 mils above the target are classed as low; from 2 to 4 mils above as normal; from 4 to 6 mils above as high, and above 6 mils, very high.

At the close of the practice the officers hand their records of observations for range to the recorder who immediately takes them, together with the record of commands kept by him, to the statistical office. There the recorded observations for range are corrected by comparison with the record kept at the target, and the results recorded. The corrected records are then returned to the officers.

TARGETS

The target used by the flash detail in its work usually represents four gun sections.

Ordinarily on days when flash practice is held, it is preceded by instruction in reconnaissance of targets. There are usually ten or twelve targets available for reconnaissance, placed in the

sector occupied by the flash target by the noncommissioned officer in charge of the flash detail, and representing all kinds of objectives.

During the early part of the instruction in reconnaissance, the targets are placed so as to be easily discovered and identified, and the officers are allowed ten minutes in which to complete the reconnaissance.

As the instruction progresses, the targets are made less visible until finally they are made as inconspicuous as possible without being entirely hidden from the view of the observers, and the time is reduced by one minute each day until only five minutes are allowed. At the indication by the instructor that the allotted time has expired, the records are promptly given to the recorder.

The following methods are used in determining the ability of students in the reconnaissance and identification of targets.

The direction of each target is noted by the observer who records on the blank (Reconnaissance of Targets) the angular distance in mils from the right (as he faces the target) visible element of the target to the designated reference point. The determination of the deflection of the target using the reference point as an aiming point is not required.

In comparing the record of the student with the official record made in the same manner by an officer or noncommissioned officer equipped with an angle-measuring instrument, a target is considered as correctly found:

(a) When the nature is correctly stated, as infantry, artillery, etc.

(b) When its direction is indicated to within 20 mils, either way, of the correct direction.

A target is considered as incorrectly found:

(a) When its nature is incorrectly stated.

(b) When its direction is not indicated to within 20 mils of the correct direction.

A target within the sector announced and visible from the observing point is considered not found:

SMOKE BOMB OR FLASH PRACTICE

Reconnaissance of Targets.

Ref. Pt.——————————————Sector { ——″ right. ——″ left.

Target	Mils, R. or L.	

	Out	Found	Incorrect
Btry.			
M. G.			
Inf.			

Observer..... Date .....

(a) When it is not shown on the record.
(b) When it is shown but marked "?".
(c) When the indication of its direction is omitted.

A target shown on a record is disregarded without prejudice:

(a) When it is outside of the announced sector.
(b) When it is a target or other object taken as a target, which was accidentally within the field of observation and was not intended for the purpose of the reconnaissance.

As machine gun targets closely resemble stationary infantry targets and are similarly attacked, their indentification as infantry targets are not marked as erroneous, and *vice versa*.

In the notes made on the records in the statistical office, "Out" indicates the number of targets available for reconnaissance; "Found" the number correctly found, and "Incorrect" the number incorrectly found. Errors in the marking of the records should be communicated to the statistical office without delay. When by reason of other duty an officer makes no reconnaissance and record, he should turn in, in place thereof, an initialed note stating the duty upon which he was engaged.

During the first part of this work and at other times when deemed advisable, the instructor points out the targets, one at a time, as soon as the records have been turned in. It is the duty of the noncommissioned officer in charge of instruments to familiarize himself with the positions of the reconnaissance targets so as to be able to point them out to the instructor.

OPERATION OF THE FLASHES

In order not only to approach a representation of what really happens in service practice but also to maintain that interest on the part of the students without which it is hopeless to attempt giving instruction, it is essential that the changes in data announced be quickly followed by an accurate representation

at the target of the results which would actually be obtained. To this end it is necessary that there be a satisfactory telephone line between the firing point and the flash target with a well-instructed operator at each end; that a capable and thoroughly instructed noncommissioned officer or officer be in charge of the flash detail; that a *permanent* flash detail of one noncommissioned officer (in addition to the one just mentioned) and twelve intelligent privates be available. The noncommissioned officer of the detail acts as assistant to the officer or noncommissioned officer in charge and as recorder. Ten of the privates, called flash men, handle the flashes, the other two privates, called powder men, assist the flash men, especially in the replenishment of powder.

The flash target, is, as a rule, a battery of four gun sections at a distance from the firing point of from 2500 to 3500 yards. For the first part of the training and until the student officers become very proficient, the interval between sections, from centre to centre, is five or ten mils, obtained by actual measurement from the firing point. The object of this exact interval is to form the habit among officers of making distribution changes in terms of multiples of five mils until such time in adjustment as the range may be closely determined.

The ground upon which the flash target is located must be such as to enable the flash detail to be hidden from view from the firing point. Practically, this requires a sharp ridge, upon which the targets may be placed, with a ravine in front and one in rear in which the men handling the flashes may be concealed. As the noncommissioned officer operating the flashes must control these men by voice from a central station, it is essential that the ravine be abrupt enough to afford concealment not further away from the target than 150 yards.

A flash target at the school is provided with trolleys about 40 feet from the ground both in front and in rear of the target. By this means higher bursts may be shown and more practice in the adjustment of the corrector may be obtained than otherwise,

but the lack of overhead flashes detracts but little from the value of flash practice.

As has been said, the first aim in flash practice is to train the students in handling deflection and distribution. For this phase of the work the flash detail shows low bursts only and ignores range changes. The disposition of the detail is as follows: The flash men are numbered from one to ten. As seen from the observer's point, Nos. 1, 2, 3 and 4, in order from right to left are posted short of the four gun sections of the target. With them are posted respectively, Nos. 5, 6, 7 and 8. No. 9 is to the right of No. 1 at an interval equal to the interval between adjacent sections of the target, normally about 20 yards. No. 10 is similarly posted to the left of No. 4. As soon as posted, the noncommissioned officer in charge, who is known as the target operator, sights over each section and verifies the posts of Nos. 1, 2, 3 and 4 by aligning them, one at a time, on the line, gun section—observation point, and sees that Nos. 9 and 10 are properly posted. Each of these six men then marks this, his *permanent* post, by a stake. Two or three other posts on each flank of this line of men are then similarly marked, the interval between adjacent posts being the same as the interval between sections. In moving from post to post the flash men normally step in yard paces, but time is saved by having them learn the number of paces between stations, so that when told to move 20, 40 or 60 paces they can run to the proper stake quickly without taking the time actually to step off the distance. Nos. 5, 6, 7 and 8 are posted with Nos. 1, 2, 3 and 4 in order that the men at these double posts may assist each other when necessary, and that when the firing is rapid they may be required to fire alternately and thus prevent the flash cups getting hot.

When flashes are to be fired at posts on the flanks, the necessary number of men to assist No. 9 when on the right and No. 10 when on the left, are chosen from among Nos. 5, 6, 7

and 8. In such cases it is found best always to have No. 9 or No. 10 take the post farthest to the flank.

Unless specially directed, an initial distribution of more than 15 mils between the first and fourth bursts when the fire is crossed or more than 45 mils when the shots are in proper order is not shown. The object of thus limiting the initial errors is more nearly to approach reality.

When an officer is first called upon to conduct fire he gives complete firing commands. Just before the officer is called upon and while he is giving the preliminary commands, the target operator posts the flash men for the first salvo, the numbers being so chosen and the men so placed as to show initial errors not greater than those given above. As soon as everything is ready at the target the target operator causes his telephone man to transmit the word *ready* to the firing point. The telephone operator at the firing point repeats the word *ready* and, unless the instructor is giving some instruction at the moment, immediately gives the command *fire*. If the instructor is engaged at the moment *ready* is given, the operator delays giving the command *fire* until told to do so by the instructor. In order that officers at the firing point may have ample time to adjust their field glasses after the command *fire,* the first flash is fired as nearly as possible two seconds after the command has been given by telephone. Unless otherwise directed, the interval between flashes of a salvo is two seconds. The rules given in this paragraph apply to all flash practice.

As the corrector and range are taken up the target operator assumes a corrector and a range for each problem. Based on the commands given and corrections made by the officer firing, the target operator causes the flashes to be fired so as to represent the probable results. No satisfactory method of accurately representing graze bursts has yet been made use of during a school course. The nearest approach to such a burst has been obtained by holding the flash cup close to the ground when exploding the powder charge.

For the operation of the flashes for all the elements of firing the detail is disposed as described above except that, as seen from the observing point, Nos. 5, 6, 7 and 8, in order from right to left, are posted beyond the four gun sections. Nos. 10, 4, 3, 2, 1 and 9 compose the front line; Nos. 8, 7, 6 and 5 the rear line. One powder man is assigned to each line. The target operator aligns the flash men of both lines from the rear line. These posts are the *permanent* posts for this work; at the command *"Take your posts,"* these are the ones taken.

The target operator, the recorder and the telephone operator are usually concealed from the observation point by one of the sections.

When the wind is unfavorable it may be necessary for this party to take post elsewhere, as it is essential that the target operator's voice be heard by all the detail.

From the formation of the detail it is evident that the flashes representing bursts short of the target and within the target for direction are fired by Nos. 1, 2, 3 and 4; similarly those representing bursts beyond, by Nos. 5, 6, 7 and 8, while Nos. 9 and 10 as well as other numbers when posted on a flank by virtue of their being posted outside the target for direction may be called upon to fire bursts representing either shorts or overs, due care being taken to be sure that the wind cannot cause the smoke to drift into the target and allow sensings that were not intended.

Each private operating flash cups is equipped with two or three small cans (tobacco) filled with black powder; a quantity of caps and a pole type smoke bomb outfit. Nos. 1 to 8 inclusive have also an overhead outfit. The quantity of powder given out at any one time is so small as to eliminate great danger from premature explosion. The target operator should use a megaphone.

The recorder makes a record (Form No. 12) of all data received from the firing point with the exception of the site which does not interest the flash detail. The target operator

SMOKE BOMB OR FLASH PRACTICE

Date ..... Sheet No .....

Officer firing..... Assumed range .....

No. of salvo	DF and DD	KR	M of F	RN	+	-	No. fired

FORM NO. 12, SCHOOL OF FIRE FOR FIELD ARTILLERY.

assumes and prepares for the initial errors in deflection and distribution before the beginning of each problem. He assumes a corrector and a range for each problem after the initial data for those elements have been announced. Thus the representation of the first salvo in each problem is fired according to certain assumptions. To respond to corrections the noncommissioned officer in charge must know the exact range from the flash target to the firing point; the width of this target and its elements. His men move at yard paces and movements are referred to by compass direction instead of the indefinite "right" and "left;" *e.g.*, the noncommissioned officer commands, "One and two, forty (paces) west," or "Four, twenty east," etc. Corrections are made mentally by the noncommissioned officer. The telephone operator stationed at the target is in constant communication with the operator at the firing point.

For each flash fired the target operator announces the number of the man, the position from which the flash is to be fired, and the command for firing. The recorder notes the number of shorts and overs fired in each salvo. At the close of the practice this record is taken to the statistical office.

The four position used are shown in the photograph herewith. Looking from left to right, these positions are designated, respectively, as *on the wire, on the staff, high bursts on the staff, medium burst*, and *on the ground*. Flash men should be cautioned that when firing from either of the two lowest positions they should hold their staffs so that smoke and burning powder will not be blown in their faces.

A printed sheet bearing the following instruction is furnished each member of the flash detail:

INSTRUCTIONS FOR MEMBERS OF FLASH DETAILS

Causes of explosions are many and are due mostly to carelessness; one cannot exercise too much care in the handling of powder in the loose form in which it is used for smoke bomb practice.

The following "dont's" will, if kept in mind, eliminate much of the danger:

1. DON'T smoke a cigarette, cigar or pipe while you have powder on your person or if it is in your immediate vicinity.
2. DON'T ever load a flash cup before looking into it.
3. DON'T put a primer on the primer seat until after you have loaded with powder.
4. DON'T fire a smoke bomb over a can of powder.
5. DON'T keep powder on your leeward side, but always on the side from which the wind is blowing.
6. DON'T put a can of powder either in front or in rear of you; if it is in front you might explode it by the fire from your flash, and if it is in rear you are liable to knock it over and spill it; then the spilled powder may become ignited at any time.
7. DON'T lay a loaded flash on the ground; the powder is liable to spill and in a great many cases you will not be ready to fire when ordered.

A man operating both a staff and an overhead flash, when ordered to fire the overhead flash and a misfire results, will, without further orders, fire his staff flash as high in the air as possible.

A man when ordered to move in any direction will do so quickly, and will, when changing post, make every pace one yard; if a change of post is for only one shot the man will be so informed, otherwise he will always remain where he was last posted.

When either No. 1 or No. 4 have a misfire, Nos. 9 and 10 will, when posted on the front line of flashes, hasten to Nos. 1 and 4, respectively, and fire their flashes in place of the misfires. In order to do this promptly they must at all times keep on the alert and pay strict attention to the heights of burst called for. After firing they will, without further orders, resume their posts.

Each flash man will inspect his flash cup as soon as he receives it and will test the same by exploding two or three primers with no powder in the cup.

He will also be sure that the vent from the outside of the primer through to the inside of the flash cup is not clogged; this may be done by running a piece of wire through the went. He will report at once any flash that is out of order.

If at any time the flash cup becomes hot, he will notify the noncommissioned officer in charge who will replace it with a spare one. A flash cup sometimes becomes so hot that powder will explode as soon as it is poured in. This condition is very dangerous, not only because of the premature explosion of the cup charge, but also on account of the danger of exploding the powder in the filling can.

Flash men are required to keep their flashes loaded at all times; they will always load them immediately after firing. This must be done quickly, and each man must bear in mind that slowness is not tolerated.

Each powder man must be on the lookout for men who are about to make mistakes. He will correct them without any instructions from the noncommissioned officer in charge. He will also see that each man has a sufficient amount of powder and will watch for carelessness in the handling of the same.

A flash man will never allow himself to run out of powder. He will notify the powder man of any shortage as soon as he has only one can in his possession, but he will not leave his post to get powder except when so ordered.

Powder men will pay strict attention to the commands given and will assist the noncommissioned officer in charge by repeating commands when necessary.

At the close of each smoke bomb practice all flashes will be unloaded; the primers on the flash cups will be removed and the powder put back in the can; each lanyard will be properly coiled about its flash cup outside of the firing hammer, and all primers and powder will be turned in to the powder man who will put the primers in a box separate from the large can provided for powder.

Powder men will inspect the box where the small powder cans are kept and will not allow any loose powder to remain in the same. At all times a piece of target cloth will be kept in the bottom of each box to prevent accidental ignition of loose powder.

The following example illustrates the methods made use of in firing a problem, and in operating the flashes therefor.

EXAMPLE

Instructor: "Captain Smith. To our front, a bare hill; directly below the highest point of that hill, a small bushy tree; about 50 mils to the left of that tree, a battery. That battery is firing upon our infantry apparently without effect. You are ordered to silence the battery."

Telephone operator at Battery Commander's station: "Captain Smith firing."

Telephone operator at target: "Captain Smith firing."

Recorder notes the name of the officer firing.

Meanwhile the target operator posts the flash men for the initial salvo by the command, "One, two and three go to nine."

Battery Commander, Captain Smith: "Aiming point, blockhouse on Signal Mountain. Deflection 6300. On second piece, open 5. Site 300. Corrector 30. Battery right. 3900. Fire."

Telephone operator at Battery Commander's station repeats all the data except the command *Fire*.

Telephone operator at target repeats all data received.

Recorder notes the deflection, distribution, corrector, method of fire and range, but does not record the site.

Target operator to recorder: "Assumed range, 4300;" to detail, "Nine, on the ground; one, on the wire; two and three, on the staff, high burst; ready."

Telephone operator at target: "Ready."

Telephone operator at Battery Commander's station: "Ready, fire."

Telephone operator at target: "Fire."

Target operator: "Nine, fire; one, fire; two, fire; three, fire."

The bursts are converged at No. 9's post.

Battery Commander: "Low, short. High, doubt. Normal, doubt. Normal, doubt. Add 5; on first piece, open 5. Down 5. 4100."

Data only transmitted as before.

Target operator: "Take your posts, one, two and four, on the ground, three, on the staff, medium bursts; ready."

Ready and *fire* transmitted as before.

Target operator: "One, fire; two, fire; three, fire; four, fire."

Battery Commander: "Low, short. Graze, short. Normal, doubt. Low, short. 4300."

Data transmitted as before.

Target operator: "One, six, three, eight, on the staff, medium burst, ready."

Ready and *fire* transmitted as before.

Target operator: "One, fire; six, fire; three, fire; eight, fire."

And so on.

At the school the average time from the announcement of the range by the Battery Commander until the first burst of the salvo is about thirty seconds.

As stated above no satisfactory means of representing graze bursts has yet been made use of during a school course, but thanks to the ingenuity of First Class Signal Sergeant James J. McQuillan, of the School of Fire Detachment, it is believed that at the next term, these bursts will be shown very realistically by means of the device shown in the accompanying photograph.

Suspended close to the ground from cables stretched between the same poles that hold the upper trolleys, or on stakes if on a flank without the target, a sufficient number of these devices will be strung to show bursts short of or beyond the target. The representation of the graze is obtained by putting a very little coarse grained powder in the bottom of the flash and covering it with about a shovelful of dry sand.

In the smoke bomb outfit issued to regiments at present the charge is exploded by striking a primed cartridge case, calibre .38, with a pointed hammer mounted on a pivot. This arrangement necessitates accurate centering of the point, and when the pivot of the hammer becomes at all worn, misfires occur frequently. At the school this firing arrangement has been replaced by one devised by First Class Signal Sergeant Birdie E. Sauers of the School Detachment. On the flash cup is fitted a nipple which takes a percussion cap similar to those used with old muzzle loading shot guns, and the point of the hammer is replaced by a relatively large flat surface. This arrangement not only does away with the necessity for accurate centering, but also with the labor attached to the decapping and cleaning of cartridge cases and the shipping of the same to and from an arsenal.

Examinations for Officers of the National Guard Field Artillery

BY MAJOR H. M. BUSH, OHIO FIELD ARTILLERY

THE new law provides for examinations conducted by a board of three commissioned officers appointed by the Secretary of War from the Regular Army or the National Guard, or both.

This law in all probability refers to promotions from and after the date of its going into effect, as well as to the examinations for the first commission. At least, that is the interpretation put upon it by General Foster of Florida (the position of the War Department not being known to the writer at the time of writing). For the sake of future efficiency let us hope it will be so interpreted; for weeding out is as necessary as a high standard of admission.

The fear expressed by a good many officers is that the opportunity will be seized by those inimical to the Guard to make the standard for commission so high that no one will be able to pass the examinations without devoting more time to study than the average Guard officer can afford. The existence of this fear is mentioned, although not shared in, by the writer.

In correspondence and conversation with officers of the Regular Army the desire has been expressed for an expression of opinion on the part of officers of the Guard as to what would constitute a fair examination for such officers. It is with an idea of starting the discussion, although somewhat belated, that this paper is written.

As an index of what the War Department has considered a proper examination for officers of volunteers in the past, let us first consider the provisions of Paragraphs XIII to XV, inclusive, General Orders, No. 54, War Department, 1914. Taking the examination for second lieutenants as the basis, we

have the following; grammar, arithmetic, geography, history, in what is known as the elementary examination, and which may be waived if the candidate "present a diploma or certificate of graduation from some educational institution of good repute, or when the board is satisfied from the record of the candidate that he is sufficiently educated in the subjects mentioned." The professional examination consists of Administration (certain parts of the Army Regulations), Field Artillery Drill Regulations, Field Service Regulations, Small Arms Firing Regulations, Manual of Guard Duty, Military Law, Topography, Tables of Organization, Hippology, Field Artillery Matériel, a test in equitation and the equipment of the saddle horse; moral and physical requirements.

The order expressly states, "The examination shall be especially directed to ascertain the practical capacity of the applicant, and the record of previous service of the applicant shall be considered as a part of the examination."

With the exception of the examination on the Small Arms Firing Regulations, which are valuable but not essential, for a second lieutenant at least, there does not appear to be anything in the foregoing list which should prove objectionable or too difficult for our officers to pass.

In fact, the writer is of the opinion that one or two subjects and tests should be added, notably First Aid and Hygiene, to include the examination of recruits (the latter being a standard job in the Guard for some one), signaling and telephoning. He would also be in favor of requiring both the Gunners' and Gunner Specialists' tests to be given and passed, except in those cases where the holding of a Gunner's certificate or rating had been obtained in previous service or enlistment.

The attached schedule of examinations is in force in the writer's command and, as will be noted, is carried down to the promotion of corporals. It is appended hereto for what it is worth and, while not covering all the ground which ought to be covered, represents a considerable advance from the time when the examinations covered the three R's and a little on

the Drill Regulations, a condition which obtained less than five years ago, or 216 drills and four camps, a total of about 94 days of eight hours, all told, in which time practically the entire enlisted personnel has changed at least twice, and of the commissioned personnel only three are left. Progress is therefore materially hampered by this constant shifting and change.

The problem of new organizations is one which will have to be dealt with in some manner, as the expansion which is called for under the new law will require very considerable additions to the number of units, as well as increases in the size of the present.

When a new organization is mustered in there is a requirement at once for the commissioning of a lot of new officers. If we could shift our officers and promote men who had served in other batteries, the solution would be easy; but we are confronted with the fact that men must live, and earn wages or salaries to do so. Further, the class of men we want as officers should have a local standing which new-comers cannot have. The solution may lie in the provisional commission section of the law, if it can be made to apply to the Guard; but it apparently does not read that way and some other method must be found.

The plan suggested, but not tried out as yet, given in the attached schedule is an alternative which has been approved by the officers of the Ohio Battalion; but it has its objections, most of which are answered by the efficiency board section of the law; a drawback here being in the difficulty at times experienced of getting an Adjutant General to come out boldly in the open and stand for the public elimination of some officer.

In order to obviate the trouble, and at the same time meet the requirements of the law, it will be necessary as one of the first steps in the formation of a new organization to select the officers and then enlist them in the nearest battery, where they can be given a special course of training as far as the possibility of their attendance will permit. An experiment along this line is under contemplation as this is being written. Once the

reserve officer instruction feature of the new law is in effect, there may be some relief from there; but its operation is likely to be slow and the chances of getting qualified men in the locality where a battery can be supported are not very great. The same is true of the other source of supply, the colleges and universities where military training is a part of the curriculum. Even the best of the products of these places would hardly make more than junior officers; while experience with some of them indicates that a cadet commission is not an evidence of either mental brilliance or ability to lead. Time and increasing stiffening of these courses may produce the class of men we need; but to date they are few and far between, and the captaincy of a Guard field battery is something of a man's job. In the commercial world we do not trust a recent college graduate to operate even a small department, no matter what his record. The owner or manager who did so would be courting bankruptcy. Why, then, should we entrust the management of a whole plant, the size and value of a battery of field artillery, to an inexperienced youth? It is fatal to contemplate it, and we must therefore select as our officers, particularly the battery commander, men of maturer years and experience, even though they have little or no military experience. This condition will exist as long as we maintain the present system of voluntary service and with such a very small percentage of the population having any military training whatsoever. When the head of the engineering department of a plant employing 3000 men tells you, after you have described the workings of a battery, that he felt capable of taking the job as chief mechanic if he were allowed to study up on it for a month, one receives a jar which sets you to thinking very seriously.

We must therefore so arrange and fit any system of examinations which we may devise as to insure the highest possible standard and yet not discourage and prevent capable men of affairs from taking the commissions. For this reason it is advocated that all commissions be given after a reasonable

preliminary examination covering the elementary subjects, the same to be subject to an efficiency examination at the end of one or two years, except in cases of promotion in existing organizations, unless the candidate be an officer brought into the same from the outside and without experience in the work of the Field Artillery.

It has been suggested that valuable officers could be found who would be available for any locality from among the older and more experienced sergeants of the regular army. This plan would be ideal were it not for the almost absolute necessity of having as officers men of some position in their respective localities, and the further difficulty of providing a living for the ex-sergeant commensurate with his expenses. To leave or have him dependent on the possibly fluctuating fortunes of the organization would be neither fair nor practical.

The problem is a large one and it will require considerably more experience than we now possess to solve it satisfactorily. The foregoing must not be regarded as in any way a solution or even an attempt at one. They are merely some ideas jotted down and given for what they are worth. The experience of the next year may change the writer's view-point very materially.

It is important for us all to bear in mind that we have a duty to perform, and it can only be performed in a manner commensurate with its importance and magnitude by the most cordial coöperation between the Guard and the Army. If we have disagreements, let us work them out manfully and honestly between ourselves. The past has been full of misunderstandings and suspicions, from which we have been happily very free in the Field Artillery, but which have been allowed to grow and fester in other quarters until they have threatened to engulf us all.

Whatever solution is worked out by the officers of the Army will and must be accepted in good faith by the Guard. If it be faulty, unworkable or productive of hardship, we may be sure the troubles will be sooner straightened out if we have each other's respect and confidence.

OHIO FIELD ARTILLERY SCHEDULE OF EXAMINATIONS FOR OFFICERS AND NONCOMMISSIONED OFFICERS, MAY, 1916

The following examination schedules will govern all promotions in the Ohio Field Artillery:

1. *Corporal*.—Physical examination. To be a second-class gunner. Matériel, written or oral, 20 questions. The Horse, written or oral, including a practical test of harnessing; stable duty. Passing grade, 75 per cent.

2. *Sergeant*.—Physical examination. To be first-class gunner. Matériel, written or oral, 20 questions. Hippology, practical knowledge of the horse, stable duty, harnessing and saddling. Practical test in harnessing, hitching, riding and driving. Passing grade, 80 per cent.

3. *Second Lieutenants*.—(a) General efficiency and service record to be satisfactory. Physical examination and such additional physical tests as the Board of Examiners may consider advisable. To hold a Gunner's certificate. Value 100.

(b) Mathematics: Arithmetic, Algebra and Elementary Trigonometry; with practical problems relating to Field Artillery work. A high school diploma or graduation from a college or university to pass at the required grade on subjects covered in the course. Value 10.

(c) Hippology: Army Horse in Accident and Disease; Marshall's Hippology, The Army Horseshoer, Farrier's Manual, Part VII, Field Artillery Drill Regulations. Value 15.

(d) Topography: Tests as prescribed for Specialist Gunner in Map Measuring, Range Finding, Reconnaissance, Road Sketch, Panoramic Sketching. A certificate as a Specialist Gunner will be accepted in lieu, provided the same be not over two years old. The grades obtained will be the grades given for credit. Value 10.

(e) Military Hygiene and First Aid: To include the examination of a recruit such as would be made by a recruiting officer in advance of the surgeon's examination. Ashburne and Circular No. 5, War Department, Division of Militia Affairs, 1916. Value 10.

(f) Field Artillery Drill Regulations, except Parts VI, VII, VIII, IX and Horse Artillery. To include the Specialist Tests on use of the Battery Commander's Telescope, Computation of Firing Data, and Agent's Test. Value 20.

(g) Field Service Regulations, Parts II and III. Value 10.

(h) Handbook of Three-inch Field Artillery Matériel, except parts relating to reel and cart. Value 15.

(i) Signaling: To pass the Specialist Test. Value 10.

Grades to pass in any one subject 70 per cent., with a general average of 80 per cent.

Candidates giving satisfactory evidence of proficiency (80 per cent.) in some subjects and failing in others will be allowed sixty days to prepare for another examination.

Candidates without any previous Field Artillery experience, as in case of new batteries, may be commissioned with a deficiency in one or more subjects, provided they give a written undertaking to resign, if after one year they fail to pass the subject or subjects with a grade sufficient to make the required general average. In the discretion of the Board, approved by the commanding officer and higher authority, this rule may be applied to candidates having previous Field Artillery service.

The Board may require the candidate to take the Gunner's Test, even though he shall have passed the same as an enlisted man; provided that if he passed this test with the rating of Expert First-class he shall be exempt.

Not less than three days should be taken in giving this examination.

4. *First Lieutenants*.—(a) General efficiency and service record to be satisfactory. Physical examination and such additional physical tests as the Board may consider advisable. To hold a Gunner's certificate.

War Department Certificate of Proficiency to count on all subjects covered by same as follows: Basic 50 per cent.; "A" 60 per cent.; "B" 75 per cent.; "C" 90 per cent. Course to be passed within one year of date of examination. Certificate on all courses, last one within one year of date of examination, to entitle to promotion without examination on all subjects covered. Physical examination cannot be passed over, but must be taken in every case. Value 100.

(b) Mathematics: Application of mathematical principles to practical problems. Value 10.

(c) Hippology: Same as Second Lieutenants, but with a passing grade of 80 per cent. Value 15.

(d) Topography: First-class Specialist Rating in Map Measuring, Range Finding, Reconaissance, Road Sketch, Panoramic Sketching. Certificate as First-class Gunner Specialist or better, within two years, to pass with grade obtained. Value 15.

(e) Field Service Regulations, whole book and Tables of Organization. Value 10.

(f) Manual of Courts Martial, whole book. Value 10.

(g) Field Artillery Drill Regulations: All except Horse Artillery and Part VI, also including Specialist Tests on Battery Commander's Telescope, Computation of Firing Data, Agent, to make First-class rating. If this rating has been made within one year, grades thus

obtained to count with relative weight as if made in the examination. Value 20.

(h) Matériel, Three-inch Gun: Whole book except as far as relates to different model gun or strictly battalion equipment; unless candidate be up for appointment on the staff. Value 10.

(i) Signaling: First-class Gunner Specialist rating. If made within one year at annual test, same to pass with grade obtained. Value 10.

Grades to pass, except as noted, 75 per cent. with an average of 85 per cent.

Same notes apply as to Second Lieutenants. Proficiency to be rated at 85 per cent. instead of 80 per cent.

5. *Captains.*—(a) Same as for First Lieutenants. Value 100.

(b) Matériel: Whole book. Value 15.

(c) Hippology: Same as for Second Lieutenants, with a passing grade of 90 per cent. Value 15.

(d) Administration: Correspondence, forms and returns. Value 20.

(e) Field Service Regulations. Value 15.

(f) Manual of Courts Martial. Value 5.

(g) Field Artillery Drill Regulations: All except Horse Artillery. Value 20.

(h) Military Hygiene: Same as for Second Lieutenants. To pass 90 per cent. Value 5.

(i) Signaling: First-class Gunner Specialist. Value 5.

Grades to pass 80 per cent., except where noted otherwise, general average of all 85 per cent.

Under Field Artillery Drill Regulations a part of the examination will consist of the practical handling of a Battery Commander's Detail who will not be allowed to help by any act of their own knowledge or training.

In cases where the candidates have not passed through the preceding grades, taking the examinations therefor, the Board will determine the extent of further examination, notifying the candidate in advance to permit of his preparing himself.

The notes under the schedule for Second Lieutenants apply to this schedule.

In all cases the possession of a certificate of Volunteer Commission in the Field Artillery, and which is still in effect, will be accepted in lieu of all examination but the physical and the requirements under subheading (a) in so far as they apply to availability and adaptability.

By order of Major Bush.

QUIDO A. KULISH,
Captain and Adjutant.

CURRENT FIELD ARTILLERY NOTES

Manufacture and Consumption of Ammunition in France

ARTICLE PUBLISHED IN THE "FREMDENBLATT" OF APRIL 1, 1916

WHEN Albert Thomas was appointed Under State Secretary and Minister of Ammunition, it became his duty to produce as quickly as possible the enormous quantities of war matériel required by the general headquarters. Factories were closed, raw material was in a great measure lacking and 50 per cent. of the workmen were mobilized. Four of the departments occupied by the Germans contained 77 per cent. of the French metal industry. The output of the coal mines occupied by the Germans amounted to 68 per cent. of the total production of coal in France. The enemy had seized territory which supplied 78 per cent. of the coke production, 86 per cent. of the iron production, 70 per cent. of the steel production, and 34 per cent. of the steam horsepower existing in France before the war.

It was, therefore, no easy task for M. Thomas under such circumstances to build up an ammunition industry, to double its output and to find the necessary number of workmen. With regard to the workmen, in August, 1915, nearly 42 per cent. of them were at the front; 2 months later, in October, the factories were again employing 68 per cent. of their normal number of hands. People in France had learned that ammunition made up the nerve life of the war; in consequence, by a decree of the War Office, a great number of workmen were withdrawn from the front and sent back to the factories.

The vast quantities of matériel and ammunition demanded by this war is scarcely credible. In 1870-1871 the German artillery was superior to the French, nevertheless there was not a single battle in which German guns fired more than 200 shots. During the Russo-Japanese War the consumption of ammunition had already doubled; in the battle of Tashitshao a Russian battery fired on an average 522 shots per gun. During the war of 1870-1871 the Germans fired a total of 817,000 shells, of which 479,000 were employed against French fortresses and the remainder in field engagements. In the battle of St. Privat, which was the greatest artillery battle of the Franco-Prussian War, 39,000 shells were fired. During the entire Russo-Japanese War 954,000 shots were fired.

The following figures should be compared with the above: During the present war on a single day the Germans fired 100,000 shells on a front of eight kilometres. During the struggle in Galicia the consumption

was even greater. The French communiqué of June 17th states that within twenty-four hours the French fired at the German rifle trenches and fortifications north of Arras 300,000 shells; that is about as much as the entire German Field Artillery fired during the war of 1870-1871. The weight of these 300,000 projectiles was about 4½ million kilograms. For their transportation 300 large railroad goods-vans and 4000 six-horse caissons were necessary. The cannonade during these twenty-four hours cost France 9,375,000 francs.

In the course of the last three to four months M. Thomas has not only set most of the factories of arms and ammunition going again, but he has established a number of new arsenals and military workshops. He has also been compelled to create a number of new factories for raw material, iron and steel works, foundries, metal workshops, etc. During the last three months France has spent 2 milliards for the manufacture of guns and ammunition.

Heavy Field Artillery

BY GENERAL BOURELLY, IN "LA FRANCE MILITAIRE," MARCH 18, 1916

To crush our artillery while themselves remaining beyond our range, as they did in 1870, and thus to open the way for their infantry and light artillery, such was the rôle that the Germans had prepared to play with their heavy field artillery, especially with their 15-centimetre howitzers and their 21-centimetre mortars or howitzers.

The conclusion to which they had come that their own light Field Artillery was distinctly inferior to ours contributed not a little to exalt the savage energy with which they expected to attack us.

We knew their tactics, but we never suspected the enormous amount of ammunition which the application of these tactics involved, and, above all, we were insufficiently informed of their means of observation at great distances; hence, what was our surprise when, at the beginning of operations, we saw ourselves swept, as soon as we were in position, by the fire of distant batteries of large calibre, against which we were powerless. Under these circumstances our artillery risked being paralyzed almost upon its entry into action, either because the cannoneers were driven off by an unexpected deluge of heavy shells, or because a part of the matériel was quickly put out of action.

The heavy artillery of the Germans was then at its best in every particular of its powerful organization, from its viewpoint of the mission which they had assigned to it. They utilized at the same time both its material and its moral effect upon the troops. The rule was not only to combat the opposing artillery, but to open the fire of the heavy guns

upon the supporting points, and especially upon inhabited places. Although the systematic destruction of villages, pushed even to the point of bombarding the deserted ruins which they thus produced, had nothing in common with war, yet they have not ceased to practise it. They also swept all the roads, all the avenues of approach, up to the limit of range of their guns; due to this our first lines of artillery and infantry fought under a hail of heavy shells which burst up to two or three kilometres behind them.

The action of the heavy artillery and zone fire were the two characteristic features of our first contact with the German artillery. For lack of other means, we tried to reply by the use of long range zone fire, firing by the map. This method was held in honor for some time, but was soon abandoned on account of the consumption of ammunition and slight fire effect. Such fire had not, like that of the heavy artillery, even a serious moral effect.

The impossibility of observing fire beyond 5000 to 6000 metres was admitted to such a point before the war that our artillerymen rarely fired at ranges greater than 5000 metres; that they did so occasionally was merely for the purpose of proving its futility. It cannot be doubted, however, that, if the observation of shots of small calibre at long range is difficult, that of shots of large calibre is sensibly less so. It was therefore a question of perfecting the means of observation, as had been done by the Germans; their observers, connected by telephone and provided with excellent glasses, were pushed well to the front.

The opinion that before the war, they counted on their dirigibles to assist in this observation, has been recently expressed by one of our artillery officers; it must be recognized, moreover, that they have not been behindhand in utilizing their aeroplanes and in improving their apparatus.

We can understand without difficulty the astonishment of our artillerymen on finding themselves under fire when they thought themselves defiladed from all sides; they had not foreseen that they could be visible from their flanks to an observer posted in such a church tower or such a wood from which they were not defiladed; have not some of these lateral observers been captured on their infantry skirmish line? Great also was their surprise at the sight of the *Drachen* balloons of which they had never even heard. It may be said in passing that, if the 105-millimetre gun, which we have wanted to oppose the German 105-millimetre light howitzer, had been in service before the war, it would have promptly led us to employ observers thrown far to the front.

The lessons of experience, as outlined in the preceding paragraphs,

have not been lost on the artillery in general, and especially on the heavy artillery. Methods of observation have been perfected; it can no longer be said of the French army that it is the poorest in telephones and in optical instruments; that "flying observatory," the aeroplane, has entered into a close and constant bond with the fighting battery; in a word, our artillery is operating on the same principles as that of the Germans: counter batteries, destruction of obstacles, bombardment at long range.

The importance of heavy artillery increases, so to speak, from day to day. The fact that the Germans owe to it an important part of their success is not to be denied; but the statement recently made by one of the directors of the Krupp works to the effect that the light field artillery is constantly losing its importance can be applied only to that of our adversaries.

The last operations to the north of Verdun on both banks of the Meuse have given rise to the following opinion, expressed by Lord Northcliffe after his visit to that region; it may serve as a conclusion to our sketch, for it expresses clearly, from a practical point of view, the rôle of heavy artillery in battle, as it has resulted from the tactics adopted in the present war: "Given the necessary concentration of heavy artillery, either side can drive the other from its first and even from its second position; but, unless each successive infantry attack be even more vigorous and more persistent than the preceding ones, and unless the advance of the artillery be in concert with that of the infantry, the defending forces will have time to make their third line impregnable."

Radio Communication For Field Artillery

BY FIRST LIEUTENANT HAROLD G. FERGUSON, BATTERY A. FIRST BATTALION, NATIONAL GUARD OF CALIFORNIA

MEANS of communication for Field Artillery are not only important, they are absolutely indispensable. Therefore, the more certain such means in any battery, battalion or regiment, the more efficient is that unit. But there is always danger of destruction of such communication and if permanently disabled there must be other means of communication to continue an effective fire.

Realizing this fact, Battery A, First Battalion, Field Artillery, National Guard of California, is experimenting with other methods of communication than telephone and semaphore. These experiments have resulted in Battery A adopting the most modern and advanced of all methods of communication, namely that of wireless telegraphy. Through the individual efforts of the officers and men of Battery A a

complete wireless station with modern equipment has been established at their Armory in the City of Los Angeles, capable of sending to wireless stations within a radius of approximately five hundred miles and of receiving messages from an unlimited distance. This makes the reception of messages from the Hawaiian Islands, San Francisco and many other stations upon the Pacific Coast possible, not to mention communications that may be sent and received to and from the numerous vessels plying this coast.

Through the courtesy and interest of the Southern California Edison Company in the efforts of the National Guard, Battery A was enabled to secure two pressed steel towers, sixty-five feet in height, weighing approximately 6500 pounds. These were placed in position upon steel plates eighteen inches square, imbedded in concrete in the roof of the Armory. The roof is forty-five feet above the ground, thus placing the tops of the towers one hundred and ten feet above the ground. Each tower is held in place by ten one-quarter inch guys, which are fastened to the concrete roof of the Armory by eyebolts set eight inches in the concrete. Each guy wire is insulated with two porcelain ball insulators, thoroughly protecting against all short circuits, while a turn-buckle on each guy is used to take up all slack in the wire. A concrete base about the tower was also built to protect against rain and misplacement, eighteen inches in width by twenty inches high. The towers are one hundred and fifty-five feet apart, thus allowing approximately that distance for the aerial between the towers. Two truss type spreaders, thirty-five feet in length, are used for the aerials; they are cigar-shaped, four inches in diameter at the ends and fifteen inches in diameter in the middle. The eight wires are suspended five feet apart from a cable running through the middle of each spreader, each wire being spliced into the cable and soldered in place. This forms a specially constructed, unique system of spreading and securing the aerials, and is insurance against ordinary accidents. With one flagpole made of three-quarter inch pipe upon the top of each tower rising twenty feet above same, the above apparatus constitutes the outside construction of the station.

The station is of the Marconi type and to those interested in improved communication the following description will show that the most modern of equipment is being used in an experiment that will develop into the use of a portable wireless station for communication purposes. The present station is intended for the education of the Battery in the fundamentals of wireless telegraphy, from which the portable system will develop.

A transformer has been installed to raise the feeding current of one hundred and ten volts to forty-two thousand, the transformer used being of the closed cove type.

The sending mechanism is a complete Marconi set, consisting of the ordinary oscillating transformer rotary gap, with a speed of from eighteen hundred to two thousand revolutions per minute, induction coil, helix, plate-glass condenser, key and apparatus for installation. The set is governed by a one kilowatt transformer and although the station is controlled by the Federal Statutes which forbid the use of more than one thousand, it is capable of using fifteen hundred watts. In sending a two hundred metre wave length to comply with the same statutes, which allow the use of a two hundred metre wave length or below, or a fifteen hundred metre wave length or above, we are now complying with the lower limit of two hundred metre wave lengths.

Atmospheric conditions will, of course, limit the possibilities of the sending capacity, but with the above sending apparatus, a radius of from four to five hundred miles can be obtained. As there are amateur and commercial stations at San Luis Obispo, San Diego, Catalina Island, Santa Barbara, San Francisco and upon all vessels plying to and from Port Los Angeles, there will be abundant opportunity for communicating with other stations. The Seventh, Eighth and Ninth Divisions of the Naval Militia of the National Guard of California have had assigned for their use the *U. S. S. Farragut*, which is, of course, equipped with a wireless station. Battery A contemplates communication with this station.

The receiving apparatus of Battery A station is a slight variation from the Marconi type, although the usual detector (cat whisker type), two pair of two thousand ohm receivers, and variable condenser, are used. A special loose coupler, Navy type, is used to vary the wave length used in receiving messages. The coupler was constructed and installed by Sergeant J. V. Wagoner of Battery A, who is a licensed operator, having passed his examinations before United States Inspector Wolverton, inspector, State of California. The coupler will allow any station to be cut out of a communication held with any other station and regulates the wave length. The receiving wave length is variable and it is possible to receive from any station.

As a result of the installation of the station, the signal detail is a coveted duty. Fourteen men are now assigned to this detail under the supervision of one officer and Sergeant Wagoner. These men attend schools to perfect themselves in the use of the Continental Morse Code and in the general use of wireless telegraphy.

Before any man can attend such school he is drilled and has become proficient in the work of the "Battery Detail," in the handling of the telephone and semaphore. Such men as do become so proficient can then be graduated to the work with the wireless, thereby creating some incentive for a geater efficiency in the present methods of communication. Among such men as have obtained the privilege of work with the wireless there are five men who are now studying with the intention of at some future time taking the required examinations to become licensed wireless operators. Although the station has been installed but a few weeks, the effect upon recruiting, the *bête noir* of every militia battery commander, has already been observed. Efficiency and progressive features in a battery are the best recruiting sergeants, and Battery A expects to secure such results as will compensate for the expense, time and work required in installing this station. Development of this feature will follow, and we of Battery A hope to evolve some practical, timely suggestions in progressive communication, which we most respectfully will submit as suggestions and notes for use to those who have the power to test their value and to develop into practical value.

Influence of Forts and Fortified Cities as Distinguished From Entrenched Areas, Upon Operations on Land

PREPARED BY WAR COLLEGE DIVISION, GENERAL STAFF

FORTIFICATIONS OF LIEGE

AT the outbreak of the present European war the Germans, in their march through Belgium, were, on the evening of August 4, 1914, closing in on Liege, which lies astride the Meuse River near the eastern boundary of Belgium. The fortifications of Liege had been constructed by Brialmont, a Belgian officer, who also designed the fortifications of Namur and Antwerp. They were completed in 1892, and consisted of a circle of forts commanding the main approaches to the city and about 4 miles therefrom. There were six main forts of the pentagonal type and six smaller, triangular in shape; the greatest distance between forts was 7000 yards, and the average less than 4000 yards. Each fort had a garrison of about 80 men and an armament of two 6-inch guns, four 4.7-inch guns, two 8-inch mortars, and three or four quick-fire guns, the total number of guns in the 12 forts being about 400. It was intended to construct between the forts lines of trenches and redoubts for infantry and gun pits for artillery, but this had not been done.

The fort itself consisted of a low mound of concrete or masonry,

roofed with concrete and covered with earth; a deep ditch surrounded the mound, the top of the latter barely showing above the margin of the ditch. The top was pierced with circular pits, in which "cupolas" or gun turrets moved up and down. Within the mound there were quarters, machinery, stores, etc.

When the Germans appeared the Belgian mobilization was still in progress, and it is probable that the garrison, instead of being 30,000 as was intended, was only 20,000. The Germans, numbering about 30,000, concentrated the attack on the four forts at the southeast sector and opened up with field guns on the night of August 4-5. One of the forts was silenced by this fire on the 5th and on the 6th the Germans brought up their 8.4-inch howitzers and probably some 11-inch mortars, outranging the Belgian guns. Shells are said to have gone through 12 feet of concrete. The accurate firing of the Germans showed that the forts could not long withstand, and in the afternoon of the 6th the Belgian field force was withdrawn from the city and all the forts abandoned except the northern ones. The Germans left the remaining forts in peace until the 13th, when the 11-inch mortars opened on them, and by the 15th all had been captured. The cupolas had been smashed and shells had penetrated the roofs and exploded the magazines.

FORTIFICATIONS OF NAMUR AND ALONG THE FRENCH FRONTIER

Namur was defended by a ring of nine forts, 2½ miles from the city, with an armament similar to that in the Liege forts. The garrison of 26,000 had prepared the defense of the intervals by entrenchments and wire entanglements, and a vigorous defense was intended, as French help was expected. The Germans brought up 32 modern siege pieces, including the 42-centimetre howitzer, its first appearance, and the Austrian 12-inch mortar, and placed them 3 miles from the Belgian lines. The attack began August 20. On the next day the Belgians had to withdraw from the advanced trenches owing to their inability to reply to the German fire; two forts fell; three others were silenced after an attack of two hours. On the 23rd Namur was occupied, and on the 25th the last fort had fallen. One fort had fired only 10 times and was itself struck by 1,200 shells fired at the rate of 20 per minute. The speedy fall of Namur came near playing havoc with the allies' plans, as with the delay caused by its resistance they had intended to complete the concentration along the Belgian frontier.

Other fortified places such as Lille, Laon, La Fere, and Rheims,

along the northeastern French boundary fell before the advancing Germans without striking a blow. The advance was on such a broad front that an attempt at defense would have endangered the safety of the garrisons, and it was imperative that the garrisons join the field army. By August 28th Maubeuge of all the northern strongholds alone held out. The defenses had been brought to a high state of efficiency, the intervals well prepared, with an armored train running on a track encircling the main line of defenses. The German infantry invested the place August 27th, but the siege guns did not go into action until September 3rd. The place fell September 8th with a loss of 40,000 men.

ANTWERP

Antwerp, said to be the second most strongly fortified city of Europe, encircled by a girdle of 20 permanent forts and 12 earthen redoubts, was in similar manner quickly reduced by the heavy siege guns. The garrison, beginning to profit by the lessons learned at Liege and Namur, attempted to keep the enemy's big howitzers beyond range of the forts, but were driven back by the superior numbers of the Germans, whose siege guns were then brought up and quickly demolished the masonry forts. Thus the garrison was deprived of any further assistance from its larger guns and, being but poorly entrenched and unable to withstand the overwhelming artillery fire, was forced back to the inner line, thereby permitting the siege guns to come within range of the city, which had therefore to be abandoned promptly in order to prevent its destruction by bombardment.

VERDUN

Verdun, however, on the eastern French frontier, with a ring of forts 5 miles from the city, is still in the hands of the French, because with a field army employing earthworks the fortified zone has been largely extended and the German howitzers have been kept 6 miles from the forts. The unfortified city of Nancy has withstood several heavy attacks, being protected by a field army on the hills forming the "Grand Crown."

PRZEMYSL AND THE RUSSIAN FORTIFICATIONS

The Russians invested the fortress of Przemysl on September 22, 1914, but later the siege was raised and on November 12th it was invested a second time As the Russians had no heavy siege guns, the siege resulted in an attempt to starve out the garrison, which succeeded

March 22, 1915. With the return of the Teutonic allies in May, 20 days was sufficient to recapture the place. The Russians stated that their ammunition supply was low, but it is safe to assume that the presence of the heavy siege guns with the Germans had a great deal to do with the recapture.

The fortresses guarding Warsaw and the Russian frontier on the west were quickly taken during the advance of the Teutonic allies in the summer of 1915, either by maneuvering the defenders out of them or by bringing up the heavy guns and shattering the fortifications, as at Novo Georgievsk. The fortress of Ossowetz on the line Niemen-Bobr-Narew had a different history. In February, 1915, the Russians fell back across the Bobr River to the protection of Ossowetz, which stood on the east bank along a long ridge covered with woods, affording good artillery positions and commanding the opposite bank where artillery positions were poor. There were extensive marshes along the river, but at this time of the year they were frozen. The Germans at first tried to turn the position, but failing, brought up their heavy mortars, even the 42-centimetre howitzer. The Russian batteries were so well concealed that the Germans could not locate them and their big guns did no damage. The Russians silenced several batteries without suffering from their fire. As the warm weather advanced, the marshes made it difficult to emplace the heavy guns. Ossowetz did not fall until August 22nd in the general Russian retreat after the capture of Warsaw.

THE FORTIFIED CITY OF THE FUTURE

The failure of the forts in the present war is due to several causes:

First.—Being built some years before the war, their position was accurately known to the enemy, thus losing the advantage of concealment; also, the details of their construction leaked out and guns were especially designed to destroy them.

Second.—Their armament had not been kept up to date and was entirely overpowered by guns of recent construction and of a type unknown to the defense.

Third.—The garrisons permitted the enemy to emplace his guns within their effective range, but beyond range of the forts' guns.

The favorable effect of concealment, as a defensive measure, is illustrated by the operations against Ossowetz, and that of keeping the enemy at a distance by the operations against Verdun.

The experiences of this war confirm the conclusion reached during the siege of Port Arthur in 1904, "that the mounting of large-calibre

guns in a fort for use against the siege guns of the enemy is a fatal error." It would therefore seem preferable to place the fixed heavy guns in emplacements located in rear of the line of forts, depending for protection upon concealment rather than masonry or other cover. The forts themselves, whether permanent or improvised after the outbreak of war, should be designed for an infantry garrison only, and the main line of defense should consist of a continuous system of infantry entrenchments (including machine-gun emplacements), located in advance of the line of forts. These latter would serve mainly as supporting points for organizing a counter attack in case the front were penetrated.

To check the enemy's advance before his heaviest guns have reached points within effective range of the city, naval base, or other vital object to be protected, a garrison sufficiently strong to operate well in advance of the forts, is indispensable, and its action should be assisted by long-range fire from the fixed armament, which should be superior in calibre and range to the guns usually supplied to an army in the field.

The guns of the fortress, both fixed and mobile, should be distributed over a large area and advantage taken of the terrain to secure concealment, which must be had at any price. It is important to bear in mind that the number of guns permanently emplaced should be comparatively small compared with the total heavy armament of the fortress, or in other words, the main reliance will be placed on the mobile guns, some of which should be at least as powerful as any the enemy can bring against them.

The fortress of the future should consist of a large area so organized as to insure extreme mobility both to troops and guns. There will be no conspicuous forts of masonry and armor. Permanent gun emplacements should be constructed only at important points with the primary intention of compelling the enemy to lose time in bringing up his heaviest siege guns. The mobile guns would be located in earthen emplacements well concealed from the enemy's observers who might endeavor to direct fire on them. The point to be emphasized is that unless the garrison be strong enough in both mobile troops and mobile guns to keep the enemy from breaking through the line or coming within effective range of the city proper or other vital point or object to be protected, then there is no hope of offering a prolonged resistance.

In view of the foregoing it is apparent that entrenched areas with mobile troops and guns are a more dependable protection than a stereotyped system of permanent forts

BOOK REVIEWS

AWAKE, U. S. A. By William Freeman. George H. Doran Co., New York.

The author starts out with strong convictions on the present state of unpreparedness of the United States and of the consequent dangers to the future of the country, and carries his readers along with him to an equally strong feeling of the correctness of his views. He begins by showing that Germany, Japan, and Great Britain are the "three hungry nations," the two first-named being said to be starving. He proves his point by diagrams showing the density of population, the comparative areal resources as a whole and per inhabitant, the debts of all nations at war, of the three hungry nations, and of all neutral nations, the per capita burden of national debt to national wealth, and the nations which hold the resources to pay these gigantic debts. These and many other startling facts are shown graphically. He then proceeds to give the reasons why he believes that each of the hungry nations may fight us in preference to seeking relief in other directions, which, briefly stated, is principally because of the quick and easy realization of our resources to countries which cannot wait on the slow process of development elsewhere.

In the chapter on "The Good Faith of Nations" we are asked whether we would agree or would have agreed to submit to arbitration the questions which have caused our national wars. Some quotations from authentic official sources are given to show what the hungry nations think of the United States. The facilities for transportation of an expedition to our shores by our probable enemies are clearly stated, which concludes part one of the book.

Part two asks the question, "Are We Prepared?", and then proceeds to answer it in detail under the title of, "The Guards Without." Our naval strength is analyzed and compared with the naval strengths of our possible enemies, by means of numerous diagrams, the quotation references being given at the end of the chapter here, as in other parts of the book.

Chapter two, "The Guards at the Door," deals with our coast fortifications, and the next chapter, under the title of "The Guards

Within," treats of our general land forces, with diagrams clearly showing the ridiculous proportion of our preparedness to our requirements.

In part three we are asked, "What are Our Chances?", and the answer is given for the time when the spiked helmet, the brown man, and the Lion shall come. We are clearly not prepared for any of these attacks, and the reason why is set forth in part four. The first reason is found in our policy of pacific militarism for politics, and a strong arraignment of this unfortunate state of affairs is made in chapter one. Our inefficiency, negligence, and suppression of facts, our wasting of billions of money, are the remaining causes of our lack of preparedness, and are shown by graphic methods in the remaining chapters of part four.

In part five the failure of political militarism is shown under the headings of "The Minute Men," "The Price We Have Paid," and "The Tragic Comedy," the tragedy of our waste of men and money and the comedy of our military blunders from the foundations of the government to the present day.

"Will the Proposed Plans Protect Us?" is the title of part six, the navy plans in chapter one and the army in chapter two being severely criticized, while chapter three makes a striking comparison of Belgium with a similar extent of territory in our New England states.

Part seven tells us what each citizen can do. A strong plea is made for expert military and naval men in charge of their respective branches, for adequate appropriations from Congress. "If our present Congress should appropriate one billion dollars for defense and authorize twenty-year bonds it would impose on the people of the United States a debt (*i.e.*, interest) of only fifty-two cents per person each year for twenty years. Every person in England is burdened with a debt of $200 and the war is not over yet." The remaining chapters are devoted to the obligations of citizenship, national fitness, the ideal of the Christ. There are 453 pages in the book and 70 diagrams which bring home most vividly the startling and disturbing facts. The book should be read by every thinking citizen of the United States, and a copy should be sent to every member of Congress, and of each member of our various state legislatures, as well as to all other public officials. The book takes its place alongside The Valor of Ignorance, with the added advantage of graphic illustrations.

USE OF THE BATTALION AND BATTERY DETAILS IN THE RECONNAISSANCE AND OCCUPATION OF A BATTALION POSITION. Reprint of Circular No. 19a, School of Fire for Field Artillery, Fort Sill, Okla., July, 1915. Published by Second Field Artillery, National Guard of New York, 171 Clermont Avenue, Brooklyn, N. Y. Price, 15 cents.

This circular has been found of great value in the training of militia batteries, and has been reprinted by the Second Field Artillery, National Guard of New York. Extra copies are available on application to the adjutant of the regiment.

Index to Current Field Artillery Literature

Compiled from monthly list of military information carded from books, periodicals and other sources furnished by the War College Division, General Staff.

Officers requesting information will please give the number of the entry and the date of the list. For officers on duty in Washington, D. C., a formal call is not necessary; a telephone call will be sufficient. When a book is called for, the title and author will be given in the language in which it is printed. The material here listed is not available for general loan outside of the U. S. Army.

Aerial guns—France—European war. Photo of a French rapid-fire airship gun. (Scientific American, December 4, 1915, p. 495.)

Ammunition allowance—artillery—Allowance for field and mounted artillery in Germany, France and Chile. (Memorial del Ejército de Chile, December, 1915, pp. 933-936.)

Ammunition supply—Great Britain artillery.—Supply of artillery ammunition per gun of different types in the field. Components and weight. (Ordnance Manual (War) 1914, p. 40. Filed UF 555 G7 A44.)

Ammunition supply—Great Britain—machine gun.—Supply of machine gun ammunition. Field allowance, weight and other data. (Ordnance Manual (War) 1914, pp. 38 and 41.)

Ammunition supply—Great Britain—small arms.—Field allowance of small arms ammunition. Rounds per man armed with rifle. Also machine guns transportation of. Weight and other data. (Ordnance Manual (War) 1914, p. 41. Filed UF 555 G7 A44.)

Ammunition supply artillery—France.—Ammunition allowance and supply for field artillery in 1914. Estimates of consumption before the war. (Memorial del E. M. del Ejército de Colombia, October, 1915, p. 556.)

Ammunition supply—artillery—U. S.—Shortage of ammunition for seacoast artillery. Insufficiency of policy to provide 2 hours' allowance for half the armament in U. S. (Report, Chief of Coast Artillery, 1915, p. 14.)

Anti-aircraft gun—Great Britain.—Illustration showing British type mounted on a motor. (The Illustrated London News, November 13, 1915, p. 617.)

Anti-balloon guns.—Armament of aircraft. Sketch showing automatic gun in place on an aeroplane and method of operation. (The Illustrated London News, November 13, 1915, p. 613.)

Anti-balloon gunfire.—Artillery against aircraft. The problem of hitting a Zeppelin. The difficulties of. (Clipping from Arms and Explosives, December 1, 1915. Filed Envelope Case, Anti-balloon gunfire.)

Anti-balloon guns—European war.—Illustration showing a field gun arranged for high angle fire. (Scientific American Supplement, January 8, 1916, p. 17.)

Anti-balloon guns—Germany—European war.—Pictures showing type of German anti-aircraft gun. (Filed Envelope Case, Anti-balloon gun, Germany, European War.)

Artillery.—Range finders and instruments for measuring angles to be used by artillery officers. Illustrated. (Artilleristische Monatshefte, Sept.-Oct., 1915, pp. 154-164.)

Artillery.—Modern heavy high elevation artillery. New structural designs that have resulted from new methods of use. Illustrated. (Scientific American Supplement, December 11, 1915, p. 376.)

Artillery—Chile.—Organization and field ammunition allowance of field and horse artillery. (Memorial del Ejército de Chile, December, 1915, pp. 934-936.)

Artillery—European war.—The proportionate number of pieces of light field artillery to 1000 rifles is for: France, 4.6; Germany, 5.76. For light and heavy field artillery: France, 5.0; Germany, 6.4. (Boletin Mensal Do Estado Maior Do Exercito, Brazil, November, 1915, p. 381.)

Artillery—France.—Organization and field ammunition allowance of field and horse artillery (Memorial del Ejército de Chile, December, 1915, p. 933.)

Artillery—France—European war.—Battle of Champagne. Steadily increasing supperiority of French artillery over German. Forecast of methods to be employed in decisive action. (Clipping from Gazette de Lausanne, December 16, 1915. Filed Pocket Card—Artillery—France—European war.)

Artillery—Germany.—Organization and field ammunition allowance of field and horse artillery. (Memorial del Ejército de Chile, December, 1915, p. 933.)

Artillery.—Data with description of principal types of field and siege artillery equipment in 1912. (Britannica Year Book, 1913, p. 369. AY2 B86, 1913.)

Artillery—Germany.—Artillery emplacements in German trenches. Picture showing a gun placed in a revolving steel cupola. (L'Illustration, October 16, 1915, p. 410.)

Artillery—Italy.—Composition and armament of the artillery. (International Military Digest, November, 1915, p. 332.)

Artillery fire.—Maximum range of high angle fire. A table giving compilation and means for obtaining published in Journal Royal Artillery, August, 1915. (International Military Digest, November, 1915, p. 325.)

Artillery matériel.—Patent description of a sighting apparatus automatically correcting angle of tangent elevation. Patent No. 14,222/14. With cuts. (Engineering, November 26, 1915, p. 558.)

Artillery matériel.—Platforms for heavy pieces, Krupp pattern. Description and cuts. (Clipping from Le Génie Civil, December 11, 1915. Filed Env. Case—Artillery Matériel.)

Balloons—Great Britain.—Employment of captive balloons in the British navy for "spotter" work. Pictures of a "sausage" balloon for observing artillery fire, and its special ship. (Illustrated London News, November 13, 1915, p. 637.)

Bomb throwers—European war—Great Britain.—British type of catapults used for picture. (The Illustrated War News, November 17, 1915, p. 39.)

Field artillery—European war.—Serial articles on the field artillery matériel of the belligerents. Illustrated. (La Science et La Vie, January, 1915, pp. 305-319.)

Field artillery—European war.—The personal arm of the field artilleryman. Notes on different methods of providing support for field artillery units. (Field Artillery Journal, October-December, 1915, p. 785.)

Field artillery—European war.—The new developments in field artillery. Heavy field artillery the future mainstay. Note on light guns. Organization. (International Military Digest, December, 1915, p. 386.)

Field artillery fire—Spain.—The use of percussion shells in the field artillery fire. (Memorial De Artilleria, November, 1915, pp. 845-866.) (To be continued.)

Field artillery matériel—U. S.—Equipment of 323 batteries of field artillery required for mobile army; 228 made or now on way. Harness not provided for. (Report of the Chief of Ordnance, 1915, p. 20.)

Field guns—Germany.—Picture showing revolver type of field gun used by the Germans. Gun captured by the French. (The Illustrated war News, December 22, 1915, p. 40.)

Field artillery fire.—Maximum range of high angle fire. A table giving means for obtaining, published in Journal Royal Artillery, August, 1915. (International Military Digest, November, 1915, p. 325.)

Fortresses—France—Verdun.—Verdun and the Argonne. Articles on the difficulties encountered in the siege of the fortress, and a summary of the location of the forts and surrounding terrain. By Captain W. Stavenhagen. With plate. (Mitteilungen, Artillerie & Geniewesens, (M. A. & G.), Copy 10, pp. 947-953.)

Fuzes.—Description and illustrations of different types of fuzes. (Machinery, December, 1915, p. 265.)

Fuzes.—Specification of a British patent combination time and percussion fuze. No. 20,892/14. Illustrated. (Engineering, November 26, 1915, p. 558.)

Fuzes—France.—Illustrations and description of Schneider percussion and double action fuzes. How they act. (L'Illustration, December 4, 1915, p. 600.)

Heavy artillery.—Report by F. A. Board, U. S. A., on advantage of mechanical traction for heavy artillery. (Field Artillery Journal, October-December, 1915, p. 794.)

Heavy artillery.—Modern heavy high elevation artillery. New structural designs that have resulted from new methods of use. Illustrated. (Scientific American Supplement, December 11, 1915, p. 376.)

Heavy artillery—European war.—Steady increase in caliber of heavy artillery. How Great Britain is meeting demands. (United Service Gazette, December 23, 1915, p. 410.)

Heavy artillery—France.—Illustration of a French mobile howitzer with revolving platform and constructed to move on railway trucks. (Illustrated War News, October 14, 1914, p. 40.)

Heavy artillery—Italy—European war.—How the Italians transport their heavy artillery up the Alps; guns in sections on miniature caterpillar wheels. Illustrated. (Illustrated War News, December 1, 1915, p. 5.)

Heavy artillery—France.—Data relative to a 20-centimetre Creusot gun mounted on and fired from a railroad car. (German source.) (Memorial de Artilleria, July, 1915, p. 145.)

Heavy artillery—France—European war.—Picture of a heavy battery of guns mounted on railway trucks from which they are fired. (Clipping from Japan Advertiser, Tokyo, October 13, 1915. Filed Pocket Card—Heavy artillery—France—European war.)

Heavy artillery—Italy.—Heavy artillery, Italian army. Photograph showing the breech block of a gun on the Austrian front. 1915. (Filed Envelope Case—Heavy artillery—Italy.)

Helmets—France.—Illustrations showing French "Adrian helmet." Pictures of helmets which had been struck by shell splinters which they deflected. (The Illustrated London News, November 13, 1915, p. 624.)

Helmets—France.—"Manufacture of steel helmets for the French soldiers. Why and how two million of these head protectors were made in two months." (Scientific American, November 27, 1915, p. 468.)

Helmets—France—European war.—Illustrations of the French type of helmet. The protection given by it with examples of such which have saved the lives of their wearers. (L'Illustration, October 30, 1915, p. 462.)

Howitzers—Austria-Hungary.—The Austrian 30.5-centimetre siege mortar, Skoda type. Description and illustration. (Clipping from Oesterreichs Illustrirte Zeitung, August 15, 1915. Filed Envelope Case—Howitzers—Austria.)

Howitzers—France.—Illustration of a French mobile howitzer with revolving platform and constructed to move on railway trucks. (Illustrated War News, October 14, 1914, p. 40.)

Howitzers—France.—Illustration showing a French howitzer on a railroad truck from which it can be fired. (The Times History of the War, Part 70, vol. 6, December 21, 1915, p. 179.)

Howitzers—Italy.—Type of howitzers used on the Isonzo front by Italians. (Clipping from Berliner Illustrirte Zeitung, December 5, 1915. Filed Envelope Case—Howitzers—Italy.)

Intrenchments—European war.—Perspective and diagrams of German trenches. (Clipping from L'Illustration, October 31, 1914. Filed Envelope Case—Intrenchments—European war.)

Losses—European war.—Casualties by artillery and infantry fire. Observation giving the ratio of wounded as result of various causes. (Artilleristische Monatshefte, November, 1915, p. 266.)

Losses—European war.—Statement that 90 per cent. of the losses are due to machine guns and artillery. 5 per cent. to rifles. (United Service Gazette, December 23, 1915, p. 412.) (Data probably for British forces.)

Mechanical transportation.—Cost of motor transportation compared with that of a mule drawn ambulance company. Advantage in favor of motors. Transportation of Ambulance Companies. By Captain E. C. Jones, Medical Corps. (The Military Surgeon, November, 1915, p. 429.)

Mechanical transportation.—Mechanical traction for heavy field artillery. Reports of U. S. F. A. Board on advantage over horses. (Field Artillery Journal, October-December, 1915, p. 794.)

Mechanical transportation—U. S.—Development in commercial vehicle design. Prominent features and tendencies in present-day motor truck design. (Scientific American, January 1, 1916, p. 16.)

Militia—United States.—Preservation of the arms provided for the militia. Policy of the government. (American State Papers, Military Affairs, vol. 2. 2, p. 671.)

Militia—U. S.—Extracts from inspections of field artillery organizations showing armories, drill and instruction, horses, and other data. (Report of the Chief, Division of Militia Affairs, 1915, p. 296.)

Ordnance—U. S.—Equipment of 323 batteries of field artillery required for mobile army; 228 made or now on way. Harness not provided for. (Report of the Chief of Ordnance, 1915, p. 20.)

Ordnance—U. S.—Letter from Secretary of War transmitting statement submitted by the chief of ordnance, U. S. A., of the cost of type and experimental manufacture of guns and other articles, and the average cost of the several classes of guns and other articles manufactured by the government at the several arsenals during the fiscal year ended June 30, 1915. (Document No. 105, 64th Congress, 1st Session, H. R. UF533 A6 1915.)

Range finders.—Field artillery and infantry range finders. Outline of simple form devised by Prof. J. A. Fleming, Great Britain, 1915, and submitted to the ministry of munitions. (Scientific American Supplement, November 27, 1915, p. 338.)

Shells. Illustrated description of types of high-explosive and armor-piercing shells used by American, British, French and Russian governments. (Machinery, December, 1915, p. 267.)

Shells European war. Metallographic examination of shell fragments. Result of tests with the component parts. (Tr. 2851, Sundry articles appearing in French Journals.)

Shells—France. Illustrations and description of machinery and tools for the manufacture of shells. (Clipping from Le Genie Civil, December 11, 1915. Filed Envelope Case—Shells—France.)

Shells. A shell with a base cap that precludes premature explosion. Illustrations. (Scientific American, November 27, 1915, p. 469.)

Shells—France.—Advantage of making shells from east iron. French, British and German practice given. (Engineering, October 29, 1915, p. 453.)

Shells—Germany.—Report on German shell that can give five different actions. Shrapnel shell time and delay. (Filed Envelope Case Shells Germany. July 10, 1915.)

Transportation—Guns.—Motor transportation for field and heavy artillery. European war. Methods (Pictures). (The Illustrated War News, January 20, 1915, p. 15.)

Transportation Guns.—Illustration showing a traction engine drawing a heavy British gun. (The Illustrated War News, January 20, 1915, p. 15.)

Transportation Guns—European war.—Heavy mobile artillery. Illustration showing a French howitzer on a railroad truck from which it can be fired. (The Times History of the War, Part 70, vol. 6. December 21, 1915, p. 179.)

Transportation—heavy artillery.—Illustration showing French heavy mobile artillery on a truck from which it can be fired. (The Illustrated War News, January 20, 1915, p. 30.)

Wire cutters—Russia.—Wire cutters. Illustration showing a Russian device attached to a bayonet. (Clipping from Oester. Illus. Zeitung, October 17, 1915. Filed Envelope Case.)

Wire entanglements—European war.—Pictures of German soldiers making portable barbed wire obstructions and being drilled in setting up wire fences. (Scientific American, December 4, 1915, p. 495.)

Wire entanglements.—The manufacture, use and destruction of barbed wire entanglements. Illustrated. (La Science et La Vie, July, 1915, pp. 167-170.)

Wire entanglements—European war.—French type of wire entanglement more or less indestructible by shell fire. (Army & Navy Journal, December 25, 1915, p. 535.)

Exchanges

LOANED TO MEMBERS ON REQUEST

* Archives Militaires, Paris, France.
Arms and The Man, Washington, D. C.
Army and Navy Journal, New York City.
Army and Navy Register, Washington, D. C.
Artilleritidskrift, Stockholm, Sweden.
Artilleristische Monatshefte, Berlin, Germany.
Cavalry Journal, Fort Leavenworth, Kansas.
Circular Militar Argentio, Buenos Aires, Argentine Republic
Dansk Artileri-Tidsskrift, Copenhagen, Denmark.
Flight, London, England.
Flying, New York City.
Forest and Stream, New York City.
Infantry Journal, Washington, D. C.
Informacion Militar del Extranjero, Madrid, Spain.
* Journal des Sciences Militaires, Paris, France.
Journal of the Military Service Institution, Governor's Island.
Journal of the Royal Artillery, Woolwich, England.
Journal of the U. S. Artillery, Fort Monroe, Virginia.
Memorial de Artilleria, Madrid, Spain.
Memorial del Ejército de Chile, Santiago, Chile.
Memorial del Estade Mayor de Ejército de Colombia, Bogota, Colombia.
Militär Wochenblatt, Berlin, Germany.
Military Historian and Economist, Cambridge, Mass.
National Guard Magazine.
National Guardsman, Washington, D. C.
New York Evening Sun.
Norsk Artileritidsskrift, Kristiania, Norway.
Our Dumb Animals, Boston, Massachusetts.
Professional Memoirs, Corps of Engineers, Washington, D. C.
Revista de Artilharia, Lisbon, Portugal.
Revista del Circulo Militar, Buenos Aires, Argentine Republic.
Revista di Artigleria e Genio, Rome, Italy.
Revista Militar, Buenos Aires, Argentine Republic.
* Revue d'Artillerie, Paris, France.
* Revue d'Infantrie, Paris, France.
Scabbard and Blade, Fond du Lac, Wisconsin.
Yale Review, New Haven, Connecticut.

* Publication suspended during the war.

Field Artillery Directory

REGULAR ARMY

Name.	Batteries.
FIRST FIELD ARTILLERY. (Light.)	
Schofield Barracks, H. T.	
Colonel.	
Berry, Lucien G.	
Lieutenant Colonel.	
McMahon, John E.	
Majors.	
Horn, Tiemann N.	2 Battn.
Guignard, William S.	1 Battn.
Chaplain.	
Fealy, Ignatius (1 lieut.)	
Captains.	
Lloyd, Charles R.	B
Kilbreth, John W., Jr.	C
McIntyre, Augustine	A
Browning, William S.	Adjt.
Currie, Dennis H.	E
Pratt, Raymond S	D
Corey, John B. W.	Adjt.
	2 Battn.
Frankenberger, Samuel	Unass'd
Ferris, Charles J.	Unass'd
Kilbourne, Henry S., Jr	F
Glassford, Pelham D	Qm.
First Lieutenants.	
Hoyle, René E. De R.	C
Paine, George H.	A
Lyerly, Ballard	Qm. and Comy.
	2 Battn.
Pfeil, Harry	D
McCleave, William	E
Martin, Truby C	E
Rogers, Wilbur	F
Daly, Charles D.	B
Palmer, Albert K. C	B
Stewart, Frederick, W	A
Ahern, Leo J.	D
Erlenkotter, Herman	F
Second Lieutenants.	
Gay, George S.	Qm. and Comy.
	1 Battn.
Selleck, Clyde A	Unass'd
Beard, Louie A.	B
Goetz, Robert C. F	Unass'd
Hatch, John E.	E
Simpson, Bethel W	Unass'd
Andrews, Joseph	D
Deshon, Percy	F
Vanderveer, Harold C	F
Andrus, Clift	B

Name.	Batteries.
Second Lieutenants—Continued.	
Hauser, John N.	E
Frankenberger, Bertram	C
Daly, Joseph O	C
Veterinarians.	
Stokes, Wilfred J.	
Haynes, James R.	
SECOND FIELD ARTILLERY. (Mountain.)	
Philippine Islands.	
Colonel.	
Van Deusen, George W.	
Lieutenant Colonel.	
Lassiter, William	
Majors.	
Snow, William J.	1 Battn.
Fleming, Adrian S	2 Battn.
Chaplain.	
Houlihan, James F. (1 lieut.)	
Captains.	
Spaulding, Oliver L., Jr	F
Austin, Fred T	Qm.
Boiseau, Louis T.	D
Stuart, Edward A.	B
Hennessy, Frederick B.	Unass'd
Barnes, Joseph F.	C
Fuger, Albert S	Unass'd
Myers, Joseph E	E
Baker, Scott	A
Allin, George R	Adjt.
	1 Battn.
Honeycutt, Francis W.	Adjt.
	2 Battn.
First Lieutenants.	
Cubbison, Donald C.	A
Pennell, Ralph McT.	C
Hall, Albert L	F
Randol, Marshall G	E
Mort, John E.	Unass'd
Smith, Thomas J.	B
Higley, Harvey D.	C
King, Edward P., Jr	A
McBride, Allan C	D
Sparks, Leonard C	E
Magruder, Marshall	F
Hopkins, Samuel R.	B
Hayden, Herbert B.	Qm. and Comy.
	1 Battn.
Second Lieutenants.	
Wallace, Fred C.	B
Beatty, John C	Qm. and Comy.
	2 Battn.
Finch, Neil G	B
Oliphant, Thomas G. M.	F
Wrons, William J	F

FIELD ARTILLERY DIRECTORY—Continued

Name.	Batteries.
Second Lieutenants—Continued.	
Bloom, Frank	Unass'd
Jones, Lloyd E	Unass'd
Polk, Newton N	C
Anderson, Jonathan W	D
Browne, Charles J	E
Bailey, Wesley M	D
von Holtzendorff, John D	E
Austin, Raymond B	A
Veterinarians.	
Gage, Fred B	
Gould, John H	
THIRD FIELD ARTILLERY. (Light.)	
Permanent Stations: Hdqrs. and 1 Battn., Ft. Sam Houston, Tex. 2 Battn., Ft. Myer, Va.	
Present Station: 2 Battn., Ft. Sam Houston, Tex.	
Colonel.	
Millar, Edward A	
Lieutenant Colonel.	
Menoher, Charles T	
Majors.	
Gatley, George G.	1 Battn.
McCloskey, Manus	2 Battn.
Chaplain.	
Perry, Barton W. (maj.)	
Captains.	
Stephens, John E	Unass'd
Gallup, Fred H	F
Farrar, Henry B	Adj't.
Bunker, Charles M	A
Jones, Clarence N	Adj't.
	2 Battn.
Locke, Morris E	Unass'd
Michel, William N	C
Mortimer, Charles G	D
Margetts, Nelson E	E
First Lieutenants.	
McKinlay, Louis H.	C
Riley, James W	Qm. and Comy.
	2 Battn.
Huntley, Harold W	D
Smith, Edwin De L	B
Miles, Sherman	F
Burleson, Richard C	E
Lewis, Robert H	B
Downer, John W	Unass'd
Bailey, Benjamin M	C
Dunn, William E	E
Parrott, Roger S	A
Kirkwood, Robert G	Unass'd
Brabson, Joe R	F

Name.	Batteries.
Second Lieutenants.	
Bateman, Harold H	A
Odell, Herbert R	B
Peyton, Bernard R	C
Magruder, John	Qm. and Comy.
	1 Battn.
Cain, David E	Unass'd
McMahon, John E., Jr.	C
Kilburn, Charles L	F
Thurber, Philip L	D
Harris, Arthur R	A
Beukema, Herman	E
Waldron, Albert W	D
Wallace, John H	B
Veterinarians.	
Griffin, Gerald E	
Mitchell, Aquilla	
FOURTH FIELD ARTILLERY. (Mountain.)	
Permanent stations: Hdqrs. and 1 Battn., Ft. D. A. Russell, Wyo. 2 Battn., Carozal, Canal Zone	
Present Stations: Hdqrs. and 1 Battn., Columbus, N. M. Battery D, Brownsville, Tex.	
Colonel.	
Lieutenant Colonel.	
Irwin, George Le R	
Majors.	
Lyon, LeRoy S	2 Battn.
McMaster, Richard H	1 Battn.
Chaplain.	
Joyce, Francis P. (capt.)	
Captains.	
Merrill, Thomas E	Adj't.
	1 Battn.
Newbold, Henry L	B
Lambdin, William McK	E
Faulkner, Albert U	F
Apple, George M	A
Craig, Daniel F	Unass'd
Lawson, Laurin L	C
Mason, Roger O	Qm.
Brewster, Alden F	D
Wheeler, Ernest S	Unass'd
McNair, Lesley J	Unass'd
First Lieutenants.	
Quinn, Leo P	Unass'd
Osborne, Thomas D	E
Maul, John C	E
Collins, Leroy P	F
Cruse, Fred T	D
Merrill, Walter W	F
Sands, Alfred L. P.	D
Harlow, Charles W	B
Barrows, Frederick M	Qm. and Comy.
	2 Battn.

FIELD ARTILLERY DIRECTORY—Continued

Name.	Batteries.
First Lieutenants—Continued.	
Hughes, Everett S	C
Rumbough, Joseph W	Unass'd
Second Lieutenants.	
Hobbs, Harvey M	Unass'd
Morrow, Norman P	Qm. and Comy. 1 Battn.
Anderson, Richard E	Unass'd
Parker, Edwin P., Jr	E
Eager, John M	D
Scott, Richard C	A
Eager, Howard	F
Young, William C.	E
Crane, William C., Jr	D
Brewer, Carlos	F
Dunigan, Francis J	C
Howard, Clinton W	C
Busbee, Charles M	A
Swing, Joseph M. (addl.)	A
Veterinarians.	
Le May, Daniel	
Sproule, William A	
FIFTH FIELD ARTILLERY. (Light.)	
Permanent station: Ft. Sill, Okla. Present station: Batty. A, Camp Ft. Bliss, Tex.	
Colonel.	
Adams, Granger	
Lieutenant Colonel.	
McGlachlin, Edward F., Jr	
Majors.	
Bowley, Albert J	Unass'd
Bishop, Harry G	Unass'd
Chaplain.	
Clemens, Joseph (capt.)	
Captains.	
Smith, Wright	E
Starbird, Alfred A	C
Lanza, Conrad H	Unass'd
Donnelly, Edward T	Unass'd
Williams, Harry C	F
Greene, George R	Unass'd
Briggs, Raymond W	A
Wood, Norton E	Adj't.
Hand, Daniel W	Unass'd
Rehkopf, Ned B	B
Blakely, Charles S.	Unass'd
First Lieutenants.	
Smith, Emery T	Unass'd
Danford, Robert M	Unass'd
Gruber, Edmund L	Unass'd
Sturgil, Walter S	E

Name.	Batteries.
First Lieutenants—Continued.	
Davis, Joseph R	C
Booker, Phillip W	D
Capron, Webster A	Unass'd
Perkins, Kenneth S	A
Marr, Harold E	B
Crane, John A	A
Prince, Frederick A	Unass'd
Hollingsworth, Charles P	Unass'd
Second Lieutenants.	
Seaman, George G	Qm. and Comy. 1 Battn.
Reynolds, Charles C	Unass'd
Jones, Ivens	Unass'd
Riggs, E. Francis	B
Meyer, Vincent	E
Barnes, Julian F	A
Greenwald, Karl C	Unass'd
Gillespie, James A	B
Winton, Walter F.	A
Wyeth, John C	D
Burr, John G	F
Burr, William E	C
Lester, James A. (att.)	Unass'd
Struble, Herbert S	Unass'd
Veterinarian.	
Williams, Herbert S	
Power, Richard H.	
SIXTH FIELD ARTILLERY. (Horse.)	
Permanent station: Ft. Riley, Kans. Present stations: Hdqrs. and Batty. A. Douglas, Ariz. Battys. B and C, Columbus, N. Mex. Batty. D, Nogales, Ariz. Batty. E, Laredo, Tex. Batty. F, Eagle Pass, Tex.	
Colonel.	
Greble, Edwin St. J	
Lieutenant Colonel.	
Kenly, William L.	
Majors.	
Aultman, Dwight E	1 Battn.
Payne, Brooke	2 Battn.
Chaplain.	
Dickson, Thomas J. (maj.)	
Captains.	
Butner, Henry W	Unass'd
Cassels, Arthur F	F
Pulis, Charles C	Unass'd
Yule, Edgar H	B
Birnie, Upton, Jr	A
Deems, Clarence, Jr	Unass'd
Griffin, Francis W	E
Campbell, Tilman	C

FIELD ARTILLERY DIRECTORY—Continued

Name.	Batteries.
Captains—Continued.	
Wood, William S	D
Morrison, William F	Adj't.
First Lieutenants.	
Neal, Carroll W	Unass'd
Dodds, William H., Jr	B
Bishop, Albert T	E
Starkey, John R	A
Marley, James P	Unass'd
Potter, Waldo C	E
Tyndall, John G	F
George, Charles P., Jr	B
Shepherd, William H	D
Gottschalk, Telesphor G	C
Beere, Donald M	Unass'd
Miner, Harold E	Unass'd

Name.	Batteries.
Second Lieutenants.	
Taliaferro, Lucien H	F
Turner, Frank A	B
Dawley, Ernest J	B
Nance, Curtis H	D
Proctor, Mert	D
Erwin, Vincent P	Unass'd
Hicks, Edward H	Unass'd
Clarkson, Herbert S	C
Helmick, Charles G	A
Sedlacek, Ernst	F
Houghton, William C	C
Anderson, John B	A
Zundel, Edwin A	E
Marsh, Raymond (addl.)	B
Veterinarians.	
Hill, William P	
Mason, Alfred L. (att.)	

LINEAL RANK*

No.	Name, rank, and date of rank.	Reg't
	Colonels.	
1	*a* Adams, G 11 mar. 11	5
2	Greble, E. St. J 11 mar.	6
3	Treat, C. G 6 may,	.....
4	Van Deusen, G. W 7 sept.	2
5	Millar, E. A 1 dec.	3
6	Sturgis, S. D 27 dec. 12	.....
7	Berry, L. G 16 mar. 13	1
	Lieutenant Colonels.	
1	McMahon, J. E 3 may, 11	1
2	Menoher, C. T 26 may,	3
3	*Hinds, E* 1 dec.	.....
4	*March, P. C* 8 feb. 12	.....
5	Kenly, W. L 26 aug.	6
6	McGlachlin, E. F., Jr 27 dec.	5
7	Lassiter, W 16 mar. 13	2
8	Irwin, G. Le R 18 nov. 14	4
	Majors.	
1	*McNair, W. S* 15 nov. 10	.....
2	Snow, W. J 3 mar. 11	2
3	Gatley, G. G 11 mar.	3
4	Lyon, Le R. S 11 mar.	4
5	Horn, T. N 11 mar.	1
6	*Summerall, C. P* 11 mar.	.....
7	*Cruikshank, W. M* 11 mar.	.....
8	*Farr, O. W. B* 13 apr.	.....
9	Aultman, D. E 3 may,	6
10	Fleming, A. S 26 may,	2
11	Payne, B 7 sept.	6
12	Guignard, W. S 1 dec.	1
13	Bowley, A. J 9 feb. 12	5
14	Bishop, H. G 26 aug.	5
15	*Newbill, W. D* 27 dec.	.....
16	McCloskey, M 16 mar. 13	3
17	McMaster, R. H 18 nov. 14	4
	Captains.	
1	Stephens, J. E 23 sept. 01	3
2	Merrill, T. E 23 sept.	4
3	Conner, F 23 sept.	.....
4	Butner, H. W 23 sept.	6
5	Newbold, H. L 23 sept.	4
6	*Scott, E. D* 23 sept.	.....
7	Smith, W 20 sept. 02	5
8	Starbird, A. A 31 july, 03	5
9	Lloyd, C. R 14 aug.	1
10	Spaulding, O. L., Jr 27 aug.	2
11	Lanza, C. H 1 nov.	5
12	Cassels, A. F 23 nov.	6
13	Gallup, F. H 7 july, 04	3
14	Farrar, H. B 27 sept.	3
15	*Granger, R. S* 2 feb. 05	.....
16	*Moore, D. T* 14 apr.	.....
17	*Hopkins, F. E* 24 feb. 06	.....
18	Austin, F. T 14 apr.	2
19	Pulis, C. C 9 june,	6
20	Boiseau, L. T 25 jan. 07	2
21	Lambdin, W. McK 25 jan.	4
22	Stuart, E. A 25 jan.	2
23	Donnelly, E. T 25 jan.	5
24	Brooke, G. M 25 jan.	.....
25	Williams, H. C 25 jan.	5
26	Faulkner, A. U 25 jan.	4
27	Apple, G. M 25 jan.	4
28	Yule, E. H 25 jan.	6
29	*Westervelt, W. I* 25 jan.	.....
30	Birnie, U., Jr 25 jan.	6
31	Deems, C., Jr 25 jan.	6
32	*Doyle, F. C* 25 jan.	.....
33	McIntyre, A 25 jan.	1
34	Greene, G. R 25 jan.	5
35	Briggs, R. W 25 jan.	5
36	Bunker, C. M 25 jan.	3
37	Griffin, F. W 25 jan.	6
38	*Welsh, R. S* 25 jan.	.....
39	Campbell, T 25 jan.	6
40	Craig, D. F 25 jan.	4
41	*Warfield, A. B* 25 jan.	.....
42	*Burt, W. H* 12 june.	.....
43	Jones, C. N 25 feb. 08	3
44	Hennessy, F. B 26 july, 07	2
45	Lawson, L. L 12 aug.	4
46	Locke, M. E 25 aug.	3
47	Kilbreth, J. W., Jr 1 apr. 04	1
48	*Bryson, J. H* 10 sept. 09	.....
49	Mason, R. O 30 sept.	4
50	Browning, W. S 15 nov. 10	1
51	Barnes, J. F 3 mar. 11	2
52	*Ennis, W. P* 11 mar.	.....
53	Currie, D. H 11 mar.	1

* NOTE.—The names of officers detailed from the line for service in the staff departments, and of officers detached from their proper commands under the Acts of March 3, 1911, or July 18, 1914, are printed in *italics*.

a Additional in grade.

FIELD ARTILLERY DIRECTORY—Continued

No.	Name, rank, and date of rank,	Reg't
	Captains—Continued.	
54	*Browne, B. F* ..... 11 mar. 11	.....
55	Pratt, R. S ..... 11 mar.	1
56	Brewster, A. F ..... 11 mar.	4
57	*De Armond, E. H* ..... 11 mar.	.....
58	Wood, N. E ..... 11 mar.	5
59	Fuger, A. S ..... 11 mar.	2
60	Michel, W. N ..... 11 mar.	3
61	Wheeler, E. S ..... 11 mar.	4
62	*Hollyday, T. W* ..... 11 mar.	.....
63	Corey, J. B. W ..... 13 apr.	1
64	*Churchill, M* ..... 13 apr.	.....
65	*Jones, W. F* ..... 13 apr.	.....
66	Mortimer, C. G ..... 26 may,	3
67	Margetts, N. E ..... 26 may,	3
68	*Davis, R* ..... 7 june,	.....
69	Myers, J. E ..... 7 sept.	2
70	Wood, W. S ..... 8 sept.	6
71	Frankenberger, S ..... 18 oct.	1
72	Morrison, W. F ..... 9 feb. 12	6
73	Ferris, C. J ..... 26 aug.	1
74	Rehkopf, N. B ..... 11 july, 13	5
75	Baker, S ..... 9 oct.	2
76	*Howze, M. W* ..... 24 oct.	.....
77	Kilbourne, H. S., Jr ..... 22 nov.	1
78	McNair, L. J ..... 19 apr. 14	4
79	Allin, G. R ..... 13 june,	2
80	Glassford, P. D ..... 18 nov.	1
81	Bryden, W ..... 10 jan. 15	.....
82	Honeycutt, F. W ..... 27 june,	2
83	Hand, D. W ..... 25 jan. 07	5
84	Blakely, C. S ..... 4 nov. 15	5
	First Lieutenants.	
1	Smith, E. T ..... 25 jan. 07	5
2	Danford, R. M ..... 25 jan.	5
3	Quinn, L. P ..... 25 jan.	4
4	Gruber, E. L ..... 25 jan.	5
5	Neal, C. W ..... 25 jan.	6
6	Cubbison, D. C ..... 25 jan.	2
7	McKinlay, L. H ..... 25 jan.	3
8	Osborne, T. D ..... 25 jan.	4
9	Dodds, W. H., Jr ..... 25 jan.	6
10	*Hammond, J. S* ..... 25 jan.	.....
11	Bishop, A. T ..... 25 jan.	6
12	*Prosser, W. E* ..... 25 jan.	.....
13	Riley, J. W ..... 25 jan.	3
14	Huntley, H. W ..... 25 jan.	3
15	Smith, E. De L ..... 25 jan.	3
16	Pennell, R. McT ..... 6 july,	2
17	Sturgill, W. S ..... 7 july,	5
18	Miles, S ..... 8 july,	3
19	*Parker, C* ..... 8 july,	.....
20	Burleson, R. C ..... 9 july,	3
21	Davis, J. R ..... 10 july,	5
22	Starkey, J. R ..... 11 july,	6
23	Hoyle, R. E. DeR ..... 11 july,	1
24	Olmstead, D ..... 12 july,	.....
25	Maul, J. C ..... 12 july,	4
26	Hall, A. L ..... 13 july,	2
27	Paine, G. H ..... 13 july,	1
28	Collins, L. P ..... 16 july,	4
29	Lyerly, B ..... 19 july,	1
30	Lewis, R. H ..... 26 july,	3
31	Booker, P. W ..... 12 aug.	5
32	Cruse, F. T ..... 1 july, 08	4
33	Marley, J. P ..... 20 july,	6
34	Potter, W. C ..... 25 aug.	6
35	Pfeil, H ..... 17 sept.	1
36	Merrill, W. W ..... 16 june, 09	4
37	Downer, J. W ..... 10 sept.	3
38	Bailey, B. M ..... 29 sept.	3
39	*Sharp, W. F* ..... 30 sept.	.....

No.	Name, rank, and date of rank.	Reg't
	First Lieutenants—Continued.	
40	Thorp, F., Jr ..... 14 jan. 10	.....
41	Tyndall, J. G ..... 3 mar. 11	6
42	Sands, A. L. P ..... 11 mar.	4
43	George, C. P ..... 11 mar.	6
44	Harlow, C. W ..... 11 mar.	4
45	*Rucker, W. H* ..... 11 mar.	.....
46	Shepherd, W. H ..... 11 mar.	6
47	Randol, M. G ..... 11 mar.	2
48	*Greely, J. N* ..... 11 mar.	.....
49	Capron, W. A ..... 11 mar.	5
50	Mort, J. E ..... 11 mar.	2
51	Barrows, F. M ..... 11 mar.	4
52	Dunn, W. E ..... 11 mar.	3
53	*Burns, J. H* ..... 11 mar.	.....
54	Hughes, E. S ..... 11 mar.	4
55	Smith, T. J ..... 11 mar.	2
56	Parrott, R. S ..... 11 mar.	3
57	Gottschalk, T. G ..... 11 mar.	6
58	Higley, H. D ..... 11 mar.	2
59	King, E. P., Jr ..... 13 apr.	2
60	Perkins, K. S ..... 13 apr.	5
61	Kirkwood, R. G ..... 13 apr.	3
62	Marr, H. E ..... 26 may,	5
63	Rumbough, J. W ..... 7 june,	4
64	McCleave, W ..... 13 june,	1
65	McBride, M. C ..... 20 june,	2
66	Brabson, J. R ..... 20 june,	3
67	Sparks, L. C ..... 1 july,	2
68	Crane, J. A ..... 1 july,	5
69	Prince, F. A ..... 1 apr. 12	5
70	Magruder, M ..... 28 may,	2
71	Martin, T. C ..... 31 may,	1
72	Rogers, W ..... 31 july,	1
73	*Dougherty, L. R* ..... 22 aug.	.....
74	Hopkins, S. R ..... 26 aug.	2
75	Hollingsworth, C. P ..... 6 sept.	5
76	Daly, C. D ..... 5 mar. 13	1
77	Palmer, A. K. C ..... 22 nov.	1
78	Stewart, F. W ..... 13 june, 14	1
79	Hayden, H. B ..... 18 nov.	2
80	Ahern, L. J ..... 10 jan. 15	1
81	Beere, D. M ..... 10 jan.	1
82	Erlenkotter, H ..... 12 may,	1
83	*Thummel, C. B* ..... 15 may,	.....
84	Miner, H. E ..... 4 nov.	1
85	Devers, J. L ..... 1 apr. 16	.....
	Second Lieutenants.	
1	Taliaferro, L. H ..... 14 july, 09	6
2	Bateman, H. H ..... 14 july,	3
3	Turner, F. A ..... 13 nov.	6
4	Seaman, G. G ..... 13 nov.	5
5	Reynolds, C. C ..... 13 nov.	5
6	Gay, G. S ..... 18 jan. 10	1
7	Wallace, F. C ..... 15 june,	2
8	*Lewis, B. O* ..... 15 june,	.....
9	Odell, H. R ..... 15 june,	3
10	Selleck, C. A ..... 15 june,	1
11	Dawley, E. J ..... 15 june,	6
12	Beard, L. A ..... 15 june,	1
13	Jones, I ..... 15 june,	5
14	Goetz, R. C. F ..... 17 aug.	1
15	Peyton, B. R ..... 8 sept.	3
16	Magruder, J ..... 9 sept.	3
17	Riggs, E. F ..... 11 feb. 11	5
18	Nance, C. H ..... 13 june,	6
19	*Bowley, F. W* ..... 13 june,	.....
20	Beatty, J. C ..... 13 june,	2
21	Hatch, J. E ..... 13 june,	1
22	*Walker, C. A., Jr* ..... 13 june,	.....
23	Simpson, B. W ..... 13 june,	1
24	Finch, N. G ..... 13 june,	2

FIELD ARTILLERY DIRECTORY—Continued.

No.	Name, rank, and date of rank.	Reg't
	Second Lieutenants—Continued.	
25	Hobbs, H. M. 14 june, 11	4
26	Andrews, J. 15 june,	1
27	Oliphant, T. G. M. 20 july,	2
28	Proctor, M. 20 july,	6
29	Wrona, W. J. 20 july,	2
30	Erwin, V. P. 19 aug.	6
31	Bloom, F. 27 sept.	2
32	Meyer, V. 28 sept.	5
33	Hicks, E. H. 28 sept.	6
34	Morrow, N. P. 7 oct.	4
35	Jones, L. E. 7 oct.	2
36	Polk, N. N. 7 oct.	2
37	*Bradley, F.* 2 dec.	.....
38	Anderson, J. W. 3 dec.	2
39	Deshon, P. 24 apr. 12	1
40	Barnes, J. F. 24 apr.	5
41	Vanderveer, H. C. 24 apr.	1
42	Andrus, C. 24 apr.	1
43	*Maxwell, R. L.* 12 june,	.....
44	Browne, C. J. 12 june,	2
45	Hauser, J. N. 12 june,	1
46	Greenwald, K. C. 12 june,	5
47	Anderson, R. E. 12 june,	4
48	Gillespie, J. A. 12 june,	5
49	Bailey, W. M. 12 june,	2
50	von Holtzendorff, J. D. 22 july,	2
51	Winton, W. F. 23 july,	5
52	Frankenberger, B. 30 nov.	1
53	Austin, R. B. 30 nov.	2
54	Daly, J. O. 30 nov.	1
55	Parker, E. P., Jr. 30 nov.	4
56	Eager, J. M. 30 nov.	4
57	Scott, R. C. 15 jan. 13	4
	Second Lieutenants—Continued.	
58	Eager, H. 25 mar. 13	4
59	Young, W. C. 12 june,	4
60	Crane, W. C., Jr. 12 june,	4
61	Brewer, C. 12 june,	4
62	Cain, D. E. 12 june,	3
63	McMahon, J. E., Jr. 12 june,	3
64	Clarkson, H. S. 26 june,	6
65	Kilburn, C. L. 14 july,	3
66	Helmick, C. G. 18 july,	6
67	Sedlacek, E. 30 aug.	6
68	Thurber, P. L. 12 june, 14	3
69	Houghton, W. C. 12 june,	6
70	Wyeth, J. C. 12 june,	5
71	Harris, A. R. 12 june,	3
72	Burr, J. G. 12 june,	5
73	Anderson, J. B. 12 june,	6
74	Burr, W. E. 12 june,	5
75	Lester, J. A. 12 june, 15	.....
76	Beukema, H. 12 june,	3
77	Struble, H. S. 12 june,	5
78	Dunigan, F. J. 12 june,	4
79	Zundel, E. A. 12 june,	6
80	Howard, C. W. 12 june,	4
81	Busbee, C. M. 12 june,	4
82	Waldron, A. W. 12 june,	3
83	Wallace, J. H. 12 june,	3
	Additional Second Lieutenants.	
1	Marsh, R. 12 june, 15	6
2	Swing, J. M. 12 june,	4

MILITIA

FIRST INSPECTION DISTRICT

Capt. Robert Davis and Lieut. Cortlandt Parker, Inspectors, Boston, Mass.

New Hampshire

BATTERY A, MANCHESTER

Capt. Edward L. Toule.
1st Lieut. Frank J. Abbott.
1st Lieut. Henry A. Worthen.
2nd Lieut. Lucius E. Hill.
2nd Lieut. George W. Upton.

Massachusetts

FIRST REGIMENT

Headquarters, Boston

Col. John H. Sherburne.
Capt. Roger D. Swaim, Adjutant.
Capt. Robert E. Goodwin, Quartermaster
Capt. Arthur W. Green, Commissary.
Chaplain Murray W. Dewart.

FIRST BATTALION

Headquarters, Boston

Maj. Richard K. Hale.
Capt. Norton Wigglesworth, Battalion Adjutant.
1st Lieut. Winthrop Miller, Battalion Quartermaster and Commissary.
Veterinarian Wm. T. White.

BATTERY A, BOSTON

Capt. E. B. Richardson.
1st Lieut. H. S. Allen.
1st Lieut. Geo. A. Parker.
2nd Lieut. James F. Clarke.
2nd Lieut. Erland F. Fish.

BATTERY B, WORCESTER

Capt. John F. J. Herbert.
1st Lieut. Arthur P. Trombly.
1st Lieut. John B. Haliburton.
2nd Lieut. Milton J. Haynes.
2nd Lieut. Edward J. Gulley.

BATTERY C, LAWRENCE

Capt. Watkins W. Roberts.
1st Lieut. George McLane.
1st Lieut. R. A. Daniels.
2nd Lieut. Sumner H. Needham.
2nd Lieut. Wesley L. Whelpley.

SECOND BATTALION

Salem.

Maj. Thorndike D. Howe.
1st Lieut. John A. O'Keefe, Jr., Battalion Adjutant.
2nd Lieut. Stuart McLeod, Battalion Quartermaster and Commissary.
Veterinarian John H. Searle.

BATTERY D

Capt. Frank S. Perkins.
1st Lieut. Arthur E. Johnson, Jr.
1st Lieut. Willis G. C. Kimball, Jr.
2nd Lieut. Carroll M. Wheeler.
2nd Lieut. Roland H. Choate.

BATTERY E

Capt. Ernest R. Redmond.
1st Lieut. Harry E. Mitton.
1st Lieut. George E. Burke.
2nd Lieut. Harry E. Cahoon.
2nd Lieut. Edward H. Calhoun.

It is requested that all errors be reported to the Secretary, United States Field Artillery Association. Army War College, Washington, D. C.

FIELD ARTILLERY DIRECTORY—Continued

BATTERY F

Capt. William B. Morgan.
1st Lieut. Clyde W. Johnson.
1st Lieut. Willis G. Dockum.
2nd Lieut. Herman A. MacDonald.
2nd Lieut. James O. Safford.

Rhode Island

BATTERY A, PROVIDENCE

Capt. Everitte S. Chaffee.
1st Lieut. Wm. Gammell, Jr.
1st Lieut. Gerald T. Hanley.
2nd Lieut. Donald S. Babcock.
2nd Lieut. Harold R. Barker.

STATE OF CONNECTICUT

TENTH MILITIA FIELD ARTILLERY

Maj. Robert M. Danford, (1st Lieut., U. S. A.)
2nd Lieut. Morris Hadley, Acting Adjutant.
2nd Lieut. Melbert B. Cary, Battalion Quartermaster and Commissary.

BATTERY A, YALE UNIVERSITY

Capt. Carl F. Bollmann.
2nd Lieut. Paul F. Slocum.
2nd Lieut. Julien T. Davies.
2nd Lieut. Paul Schulze.
2nd Lieut. Marcus Morton, Jr.

BATTERY B, YALE UNIVERSITY

Capt. Henry H. Townshend.
2nd Lieut. James P. Kelly.
2nd Lieut. Charles F. Neave.
2nd Lieut. Henry W. Farnam, Jr.
2nd Lieut. Irving K. Fearn.

BATTERY C, YALE UNIVERSITY

Capt. John H. H. Alden.
2nd Lieut. Stuart Bullivant.
2nd Lieut. Calvin G. Littlefield.
2nd Lieut. Reginald Field.
2nd Lieut. Kenneth L. Holmes-Brown.

BATTERY D, YALE UNIVERSITY

Capt. Carroll C. Hincks.
2nd Lieut. Morris Hadley.
2nd Lieut. Clark O. Kimberly.
2nd Lieut. Ernest H. Burt.
2nd Lieut. Bennett Sanderson.

BATTERY E, BRANFORD

Capt. Chas. S. Yeomans.
1st Lieut. John J. Ahern.
1st Lieut.
2nd Lieut. John W. Newton.
2nd Lieut. Ernest L. Averill.

BATTERY F, STAMFORD

Capt. Wm. M. Wilson.
1st Lieut.
1st Lieut.
2nd Lieut. John Baker.
2nd Lieut. William E. Wesson.

SECOND INSPECTION DISTRICT

Capt. D. W. Hand and Lieut. John S. Hammond, Inspectors, New York City

New Jersey

BATTERY A, EAST ORANGE

Capt. Claude E. Lanterman
1st Lieut. Edward C. James.
1st Lieut. Henry Bennet.
2nd Lieut. W. F. Rothenburger.
2nd Lieut. C. A. Nordine.

BATTERY B, CAMDEN

Capt. Samuel G. Barnard.
1st Lieut.
1st Lieut. Samuel R. English.
2nd Lieut. Charles C. Dickinson.
2nd Lieut. John H. Dittess.

New York

FIRST FIELD ARTILLERY

Headquarters, New York City

Col. Henry H. Rogers.
Lieut. Col. Merritt H. Smith.
Maj. Charles R. Seymour.
Maj. James E. Austin.
Capt. Dawson Olmstead, Adjt. (1st Lieut., U.S.A.).
Capt. Francis D. Bowne, Quartermaster.
Capt. Alvin W. Perry, Commissary.
Capt. Leonard B. Smith, Battalion Adjutant.
Capt. Benjamin Van Raden, Battalion Adjutant.
1st Lieut. Matthew S. Weir, Battn. Qm. and Comy.
1st Lieut. Clarence G. Michalis, Battn. Qm. and Comy.
Veterinarian Eugene Combs.

BATTERY A, SYRACUSE

Capt. Guido F. Verbeck.
1st Lieut. George G. Bailey.
1st Lieut. Thomas E. Hitchcock.
2nd Lieut. William H. Thomas.
2nd Lieut. Edward R. Granger.

BATTERY B, NEW YORK CITY

Capt. Walter C. McClure.
1st Lieut. Channing R. Toy.
1st Lieut. James H. Giles.
2nd Lieut. William P. Welsh.
2nd Lieut. Heyworth Campbell.

BATTERY C, BINGHAMTON

Capt. Charles G. Blakeslee.
1st Lieut. Arthur E. Kaeppel.
1st Lieut.
2nd Lieut. Albert J. Sinnock.
2nd Lieut.

BATTERY D, NEW YORK CITY

Capt. Sylvester Simpson.
1st Lieut. Frederick J. Koch.
1st Lieut. George S. Gibbons.
2nd Lieut. Clinton M. Lucas.
2nd Lieut.

It is requested that all errors be reported to the Secretary, United States Field Artillery Association, Army War College, Washington, D. C.

FIELD ARTILLERY DIRECTORY—Continued

BATTERY E, NEW YORK CITY

Capt. John T. Delaney.
1st Lieut. Joseph H. De Rivers.
1st Lieut. Frederick H. Ryan.
2nd Lieut. Robert L. Russell.
2nd Lieut.

BATTERY F, NEW YORK CITY

Capt. Raymond M. Reid.
1st Lieut. James S. Larkin.
1st Lieut.
2nd Lieut. Robert L. Bacon.
2nd Lieut.

SECOND FIELD ARTILLERY

Headquarters, Brooklyn

Col. George A. Wingate.
Lieut. Col. Frank H. Hines.
Maj. Chauncey Matlock.
Maj. James B. Richardson.
Capt. DeWitt C. Weld, Adjutant.
Capt. Louis F. Kuntz, Quartermaster.
Capt. Albert D. Washington, Commissary.
Capt. Eugene F. Lohr, Battalion Adjutant.
Capt. Alphonse W. Werner Battalion Adjutant.
1st Lieut. Edward I. Brennan, Battalion Quartermaster and Commissary.
Veterinarian Harry F. Nimphius.
Veterinarian Robt. A. McAuslin.

BATTERY A, BROOKLYN

Capt. Walter P. Fox.
1st Lieut. John D. Butt.
1st Lieut. Roger P. Clark.
2nd Lieut. Henry P. Bristol.
2nd Lieut. Thomas H. S. Andrews.

BATTERY B, BROOKLYN

Capt. Lester C. Fox.
1st Lieut. Horst A. C. Albrecht.
1st Lieut. Harry C. Miller.
2nd Lieut.
2nd Lieut.

BATTERY C, BROOKLYN

Capt. Albert S. Hamilton.
1st Lieut. Eugene A. Holmes.
1st Lieut. Edward O. Gilmore.
2nd Lieut. James H. McSweeney.
2nd Lieut. Arthur M. Floor.

BATTERY D, NEW YORK CITY

Capt. Howard E. Sullivan.
1st Lieut. Charles J. McGronan.
1st Lieut. Henry G. W. Cox.
2nd Lieut. Charles C. Warren.
2nd Lieut.

BATTERY E, NEW YORK CITY

Capt. Wilbur T. Wright.
1st Lieut. Robert W. Marshall.
1st Lieut. Dean Nelson.
2nd Lieut. Hawthorne C. Greer.
2nd Lieut. Frank A. Spencer, Jr.

BATTERY F, NEW YORK CITY

Capt. William O. Richardson.
1st Lieut. Samuel E. McRickard.
1st Lieut. Charles H. King.
2nd Lieut. Raymond L. Hoffman.
2nd Lieut. Francis V. Hayes.

THIRD INSPECTION DISTRICT

Capt. W. F. Morrison, Inspector, Washington, D. C.

District of Columbia

BATTERY A, WASHINGTON, D. C.

Capt. Louis C. Vogt.
1st Lieut. George A. Bonnet.
1st Lieut. Harry E. Shilling.
2nd Lieut. Homer M. Mohr.
2nd Lieut. Milton. T. Noyes.

BATTERY B, WASHINGTON, D. C.

Capt. George G. Wilson.
1st Lieut. Ellwood S. Moorhead, Jr.
1st Lieut.
2nd Lieut.
2nd Lieut.

Pennsylvania

FIRST FIELD ARTILLERY

Headquarters, Pittsburgh

Col. William S. McKee.
Lieut. Col. Albert V. Crookston.
Maj. Theodore R. McLain.
Maj. Thomas O. Cole.
Capt. Josial L. Reese, Adjutant.
Capt. George B. Shields, Quartermaster.
Capt. Robert W. Cooper, Commissary.
Capt. James B. McCalley, Battalion Adjutant.
Capt. Elmer G. Tice, Battalion Adjutant.
1st Lieut. Carter L. Wright, Battalion Quartermaster.
1st Lieut. Edward A. Ohotincky, Battalion Quartermaster.
Capt. Charles M. Miller, Chaplain.

BATTERY A, SOUTH BETHLEHEM

Capt. Herbert M. Paul.
1st Lieut. George W. Edwards.
1st Lieut.
2nd Lieut. James F. Kratzer
2nd Lieut. Benjamin E. Cole.

BATTERY B, PITTSBURGH

Capt. William T. Rees.
1st Lieut. Clinton T. Bundy.
1st Lieut. John S. Purucker.
2nd Lieut. Chas. C. Williams.
2nd Lieut. Samuel D. Hollis.

BATTERY C, PHOENIXVILLE

Capt. Samuel A. Whitaker.
1st Lieut. Frederick S. Swier.
1st Lieut. Augustine S. Janeway.
2nd Lieut. John G. Failor.
2nd Lieut.

BATTERY D, WILLIAMSPORT

Capt. William B. Reilly.
1st Lieut. John D. Andrews.
1st Lieut. Garret Cochran.
2nd Lieut. John H. Ball.
2nd Lieut. Clyde R. Shelly.

BATTERY E, PITTSBURGH

Capt. Robert G. Snyder.
1st Lieut. William G. Fullman.
1st Lieut. Harry Howe.
2nd Lieut. Harry F. Plank.
2nd Lieut. William J. Miller.

It is requested that all errors be reported to the Secretary, United States Field Artillery Association, Army War College, Washington, D. C.

FIELD ARTILLERY DIRECTORY—Continued

BATTERY F, PITTSBURGH

Capt. Samuel R. McKamish.
1st Lieut. Harry L. Probst.
1st Lieut. William K. Weaver, Jr.
2nd Lieut. Ralph C. Robinson.
2nd Lieut. Charlie B. Reed.

Maryland

BATTERY A, BALTIMORE

Capt. William F. Johnson, Jr.
1st Lieut. James C. McLanahan.
1st Lieut. Gustavus Ober, Jr.
2nd Lieut. John Ridgely, Jr.
2nd Lieut. A. Hunter Boyd, Jr.

Virginia

FIRST BATTALION

Headquarters, Richmond

Major Thomas M. Wortham.
Capt. William W. LaPrade, Adjutant.
1st Lieut. John B. Harvie, Quartermaster.

BATTERY A, RICHMOND

Capt. William M. Myers.
1st Lieut. Edward C. Rees.
1st Lieut. James C. Pollard.
2nd Lieut. John T. Wood.
2nd Lieut. George H. Myers.

BATTERY B, NORFOLK

Capt. Paul W. Kear.
1st Lieut. McChesney H. Jeffries.
1st Lieut. W. Carleton Jones.
2nd Lieut. John D. Thomas.
2nd Lieut. Cary A. Willcox.

BATTERY C, PORTSMOUTH

Capt. Robert B. MacDonald.
1st Lieut. Walter J. Tennent.
1st Lieut.
2nd Lieut. Mason B. Lee.
2nd Lieut.

BATTERY D, HAMPTON

Capt. Frank H. Couch.
1st Lieut. Thornton F. Jones.
1st Lieut. Robert G. Sugden.
2nd Lieut. Charles B. Powell.
2nd Lieut. Robert F. Taylor.

FOURTH INSPECTION DISTRICT

Lieut. Charles S. Blakely, Inspector, New Orleans, La.

Alabama.

BATTERY A, BIRMINGHAM

Capt. Leon S. Dorrance.
1st Lieut. Alpha Brumage.
1st Lieut. Robert L. Pittman.
2nd Lieut. Fred N. Feld.
2nd Lieut. Laurence S. Morgan.

BATTERY C, BIRMINGHAM

Capt. C. P. Noland.
1st Lieut. J. M. Fray.
1st Lieut. H. J. Porter.
2nd Lieut. E. S. Jemison.
2nd Lieut. A. A. Adams.

Georgia

FIRST BATTALION

Headquarters, Savannah

Maj. Edward D. Wells.
Capt. William W. Douglas, Adjutant.
2nd Lieut. Alan M. MacDonell, Quartermaster and Commissary.

BATTERY A, SAVANNAH

Capt. Edward G. Thomson.
1st Lieut. Alexander R. MacDonell.
1st Lieut.
2nd Lieut. Mathias M. Ray.
2nd Lieut.

BATTERY B, ATLANTA

Capt. Andrew J. McBride, Jr.
1st Lieut. Robert G. Mangum.
1st Lieut.
2nd Lieut. Frank Boynton Tidwell.
2nd Lieut.

BATTERY C, SAVANNAH

Capt. Edward G. Butler.
1st Lieut. Joseph H. Thompson.
1st Lieut. Joseph E. Inglesby.
2nd Lieut. R. F. Rumph.
2nd Lieut.

Louisiana

FIRST BATTALION

Headquarters, New Orleans

Maj. Allison Owen.
Capt. Stanley M. Lamarie, Adjutant.
2nd Lieut. Guy Molony, Quartermaster and Commissary.
Veterinarian, Edward F. Karstendick.

BATTERY A, NEW ORLEANS

Capt. Schaumburg McGehee.
1st Lieut. Willis W. Hobson.
1st Lieut.
2nd Lieut. Cyril W. Bassich.

BATTERY B, NEW ORLEANS

Capt. James E. Edmonds.
1st Lieut. Harold P. Nathan.
1st Lieut. Peter Hamilton.
2nd Lieut.
2nd Lieut.

BATTERY C, NEW ORLEANS

Capt. Bryan Black.
1st Lieut. Walter Stauffer.
1st Lieut.
2nd Lieut. Louis S. Goldstein.
2nd Lieut. George S. Clark.

FIFTH INSPECTION DISTRICT

Capt. Clarence Deems, Jr., Inspector, Indianapolis, Indiana

Indiana

FIRST BATTALION

Headquarters, Indianapolis

Major Robert H. Tyndall.
Capt. Thomas S. Wilson, Adjutant.
1st Lieut. Frank W. Buschmann, Quartermaster.
Veterinarian Roy C. Whitesell.

It is requested that all errors be reported to the Secretary, United States Field Artillery Association, Army War College, Washington, D. C.

FIELD ARTILLERY DIRECTORY—Continued

BATTERY A, INDIANAPOLIS

1st Lieut. Marlin A. Prather.
2nd Lieut. Sidney S. Miller.
2nd Lieut. Daniel I. Glossbrenner.

BATTERY B, PURDUE UNIVERSITY, LAFAYETTE

Capt. Harry E. McIvor.
1st Lieut. Harris C. Mahon.
1st Lieut. Frank D. Dexter.
2nd Lieut. Frank W. Bryant.
2nd Lieut. Wm. H. E. Holmes.

BATTERY C, LAFAYETTE

Capt. Arthur O. Brokenbrough.
1st Lieut. Rosier W. Levering.
1st Lieut. John C. Doyle.
2nd Lieut. Frank Nisley.
2nd Lieut. Wilmer C. Kashner.

Michigan

BATTERY A, LANSING

Capt. Chester B. McCormick.
1st Lieut. Fred G. Fuller.
1st Lieut. F. G. Chaddock.
2nd Lieut. Earl H. Spencer.
2nd Lieut. Harold H. Beltz.

BATTERY B, LANSING

Capt. Frank P. Dunnebacke.
1st Lieut. Chester E. Boelio.
1st Lieut. Joseph H. Lewis.
2nd Lieut.
2nd Lieut.

Ohio

FIRST BATTALION

Headquarters, Briggsdale

Maj. H. M. Bush.
Capt. Quido A. Kulish, Adjutant.
2nd Lieut. John B. Morton, Battalion Quartermaster and Commissary.
Veterinarian, Frank R. Lunn.

BATTERY A, CLEVELAND

Capt. Fred T. Mudge.
1st Lieut. Everette C. Williams.
1st Lieut.
2nd Lieut. J. L. Sullivan.
2nd Lieut.

BATTERY B, AKRON

Capt. Hurl J. Albrecht.
1st Lieut. Joseph J. Johnston.
1st Lieut. John P. Colwell.
2nd Lieut. John F. Babbitt.
2nd Lieut. John R. Taylor.

BATTERY C, BRIGGSDALE (COLUMBUS)

Capt. Rodney E. Pierce.
1st Lieut. George H. Bartholomew.
1st Lieut. Lawrence S. Schlegel.
2nd Lieut. Alfred Shutt.
2nd Lieut. William D. Kinsell.

———

SIXTH INSPECTION DISTRICT

Lieut. Louis R. Dougherty, Inspector, Chicago, Illinois

Illinois

FIRST BATTALION

Headquarters, Waukegan

Maj. Ashbel V. Smith.
1st Lieut. Curtis G. Redden, Quartermaster and Commissary.

BATTERY B, CHICAGO

Capt. Frank M. Course.
1st Lieut. Max E. Payne.
1st Lieut. James P. Tyrrell.
2nd Lieut.
2nd Lieut.

BATTERY C, FORT SHERIDAN

Capt. Roy B. Staver.
1st Lieut. Noble B. Judah.
1st Lieut.
2nd Lieut. George Richardson.
2nd Lieut. Bruce Smith.

SECOND BATTALION

Headquarters, Chicago

Maj. Charles R. Vincent.
Capt. Hugh R. Montgomery, Adjutant.
2nd Lieut. Martin Foss, Quartermaster and Commissary.

BATTERY D, CHICAGO

Capt. Edgar A. Ewing.
1st Lieut. Thomas Kelly.
1st Lieut. Arthur W. de Revere
2nd Lieut.
2nd Lieut.

BATTERY E, CHICAGO

Capt. Henry J. Reilly.
1st Lieut. Horace R. Denton.
1st Lieut. Irving Odell.
2nd Lieut.
2nd Lieut.

BATTERY F, UNIVERSITY OF ILLINOIS, URBANA

Capt. Bruce W. Benedict.
1st Lieut. Albert W. Jamison.
1st Lieut. Percy Ash.
2nd Lieut. H. W. Miller.
2nd Lieut.

It is requested that all errors be reported to the Secretary, United States Field Artillery Association, Army War College, Washington, D. C.

FIELD ARTILLERY DIRECTORY—Continued

Wisconsin

BATTERY A, MILWAUKEE

Capt. Philip C. Westfahl.
1st Lieut. Alonzo J. Comstock.
1st Lieut. William F. Fraedrich.
2nd Lieut. Alvin A. Kuechenmeister.
2nd Lieut.

Iowa

FIRST BATTALION

Headquarters, Clinton

Maj. Roy S. Whitley.
Capt. James L. Oakes, Adjutant.

BATTERY A, CLINTON

Capt. Jacob E. Brandt.
1st Lieut. Martin W. Purcell.
1st Lieut. Loren R. Brooks.
2nd Lieut. Peter A. Hinrichsen.
2nd Lieut.

BATTERY B, DAVENPORT

Capt. Arthur M. Compton.
1st Lieut. harry H. Ward.
1st Lieut. Roland S. Truitt.
2nd Lieut. Edward McCoy.
2nd Lieut. Walter H. Peterson.

BATTERY C, MUSCATINE

Capt. Otto W. Mull.
1st Lieut. Horace L. Husted.
1st Lieut. Clark M. Barnard.
2nd Lieut. Edward A. Roach.
2nd Lieut. C. Robinson.

———

SEVENTH INSPECTION DISTRICT

Inspector, Kansas City, Mo.

Kansas

BATTERY A, TOPEKA

Capt. John M. Hite.
1st Lieut.
1st Lieut.
2nd Lieut. William P. MacLean.
2nd Lieut. James C. Hughes.

Missouri

FIRST BATTALION

Headquarters, Independence

Maj. Edward M. Stayton.
Capt. John H. Thacher, Adjutant.

BATTERY A, ST. LOUIS

Capt. Frank M. Rumbold.
1st Lieut. Walter J. Warner.
1st Lieut. Robert C. Rutledge.
2nd Lieut. Daniel F. Jones.
2nd Lieut. Leon R. Sanford.

BATTERY B, KANSAS CITY

Capt. Arthur J. Elliott.
1st Lieut. Roy T. Olney.
1st Lieut. Fielding L. D. Carr.
2nd Lieut. Thomas S. McGee.
2nd Lieut. Marvin H. Gates.

BATTERY C, INDEPENDENCE

Capt. John L. Miles.
1st Lieut. Spencer Salisbury.
1st Lieut.
2nd Lieut. Roger T. Sermon.
2nd Lieut. Keneth V. Bostian.

Texas.

BATTERY A, DALLAS

Capt. F. A. Logan.
1st Lieut. Fred M. Logan.
1st Lieut. Ward C. Goessling.
2nd Lieut. Arthur H. J. Dumke.
2nd Lieut. Willard J. Stanton.

———

EIGHTH INSPECTION DISTRICT

Lieut. W. F. Sharp, Inspector, Denver, Colorado

Colorado

BATTERY A, STATE AGRICULTURAL COLLEGE, FORT COLLINS

Capt. J. A. Rogers (1st Lieut. U. S. A.)
1st Lieut. Roy G. Coffin.
1st Lieut. Artur W. Whitehouse.
2nd Lieut. Floyd Cross.
2nd Lieut. Paul G. Putty.

BATTERY B, DENVER

Capt. Guylan A. Blanchard.
1st Lieut. Canton O'Donnell.
1st Lieut. W. H. H. Cranmer
2nd Lieut. Charles W. Comstock.
2nd Lieut. Richard S. Fillius.

New Mexico.

BATTERY A, ROSWELL

Capt. Charles M. de Bremond.
1st Lieut. James C. Hamilton.
1st Lieut. Willard F. Hird.
2nd Lieut. George M. Williams.
2nd Lieut. W. E. Buchly.

Utah

1ST BATTERY, SALT LAKE CITY

Capt. William C. Webb.
1st Lieut. Curtis Y. Clawson.
1st Lieut. Fred T. Gundry.
2nd Lieut. Harold C. Mandell.
2nd Lieut.

It is requested that all errors be reported to the Secretary, United States Field Artillery Association, Army War College, Washington, D. C.

FIELD ARTILLERY DIRECTORY—Continued

NINTH INSPECTION DISTRICT

Lieut. Emery T. Smith, Inspector, San Francisco, Cal.

California.

FIRST BATTALION

Headquarters, Oakland

Maj. Ralph J. Faneuf.
Capt. Frederick W. H. Peterson, Adjutant.
2nd Lieut. James Gleason, Quartermaster.

BATTERY A, LOS ANGELES

Capt. Jesse McComas.
1st Lieut. Harold G. Ferguson.
1st Lieut. Walter Luer.
2nd Lieut. Robert W. Yates.
2nd Lieut. Frederick H. Hover.

BATTERY B, OAKLAND

Capt. Harry F. Huber.
1st Lieut. Edward E. Vicary.
1st Lieut. John W. White.
2nd Lieut. Howard W. Enefer.
2nd Lieut. Clyde Alexander.

BATTERY C, STOCKTON

Capt. Edward Van Vranken.
1st Lieut. Otto E. Sandman.
1st Lieut. Charles H. Young.
2nd Lieut. Hunt A. Davidson.
2nd Lieut. Charles A. Reyner.

Oregon

BATTERY A, PORTLAND

Capt. Charles G. Helme.
1st Lieut. George B. Otterstedt.
1st Lieut. Bert V. Clayton.
2nd Lieut. Charles L. Johnson.
2nd Lieut. G. W. Stevens.

———

STATE OF MINNESOTA

Capt. Geo. R. Greene, Inspector, Fort Snelling, Minn.

FIRST FIELD ARTILLERY

Headquarters, St. Paul

Col. George C. Lambert.
Lieut. Col. William J. Murphy.
Maj. Gates A. Johnson, Jr., First Battalion.
Maj. George E. Leach, Second Battalion.
Capt. Charles A. Green, Adjutant.
Capt. Fred L. Baker, Quartermaster.
Capt. William H. Donahue, Commissary.
Capt. Erwin H. Sherman, Battalion Adjutant.
Capt. Frederick A. Tiffany, Battalion Adjutant.
1st Lieut. Theodore A. Kaldunski, Battalion Quartermaster and Commissary.
2nd Lieut. Holland C. Headley, Battalion Quartermaster and Commissary.
Veterinarian, Richard Price.
Veterinarian, Elmer W. Berg.

BATTERY A, ST. PAUL

Capt. Arthur G. Teuchert.
1st Lieut. John Hammerbacher.
1st Lieut. Henry A. Stempel.
2nd Lieut. Otto K. Seidel.
2nd Lieut. James W. Scott, Jr.

BATTERY B, ST. PAUL

Capt. Charles L. Ames.
1st Lieut. Wallace Cole.
1st Lieut. James K. Edsall.
2nd Lieut. William S. Jenkins, Jr.
2nd Lieut. John S. Nichols.

BATTERY C, ST. PAUL

Capt. Thomas J. O'Leary.
1st Lieut. John H. McDonald.
1st Lieut. Roger J. Finn.
2nd Lieut. Philip J. McCauley.
2nd Lieut.

BATTERY D, MINNEAPOLIS

Capt. George T. Gorham.
1st Lieut. Julius H. Pohlson.
1st Lieut.
2nd Lieut. Hugh H. Barber.
2nd Lieut. Robert W. Grow.

BATTERY E, MINNEAPOLIS

Capt. Jerome Jackman.
1st Lieut. Louis Baker.
1st Lieut. William R. Cross.
2nd Lieut. John C. Robins.
2nd Lieut.

BATTERY F, MINNEAPOLIS

Capt. Walter F. Rhinow.
1st Lieut. Edwin Rollmann.
1st Lieut. John L. Haskins.
2nd Lieut. Andres J. Carlsen.
2nd Lieut. Harold L. Goss.

Active Membership, Field Artillery Association.

REGULAR ARMY.

5th Field Artillery	100 per cent.
3rd Field Artillery	97 per cent.
Unassigned to regiments	96 per cent.
6th Field Artillery	95 per cent.
4th Field Artillery	90 per cent.
2nd Field Artillery	90 per cent.
1st Field Artillery	88 per cent.

MILITIA.

* New Mexico	100 per cent.
Rhode Island	100 per cent.
* Utah	100 per cent.
* Colorado	100 per cent.
Ohio	94 per cent.
Illinois	59 per cent.
District of Columbia	57 per cent.
Massachusetts	55 per cent.
New York	52 per cent.
Iowa	50 per cent.
Virginia	48 per cent.
Georgia	46 per cent.
Missouri	44 per cent.
Indiana	44 per cent.
Pennsylvania	41 per cent.
Oregon	40 per cent.
Maryland	40 per cent.
California	39 per cent.
Connecticut	38 per cent.
Minnesota	37 per cent.
New Jersey	33 per cent.
Michigan	25 per cent.
Wisconsin	25 per cent.
Texas	20 per cent.
Louisiana	15 per cent.
Kansas	0 per cent.
New Hampshire	0 per cent.
Alabama	0 per cent.

* Eighth Inspection District. 100 per cent.