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THE FIELD ARTILLERY JOURNAL

EDITED BY

MARLBOROUGH CHURCHILL

CAPTAIN FIELD ARTILLERY, UNITED STATES ARMY

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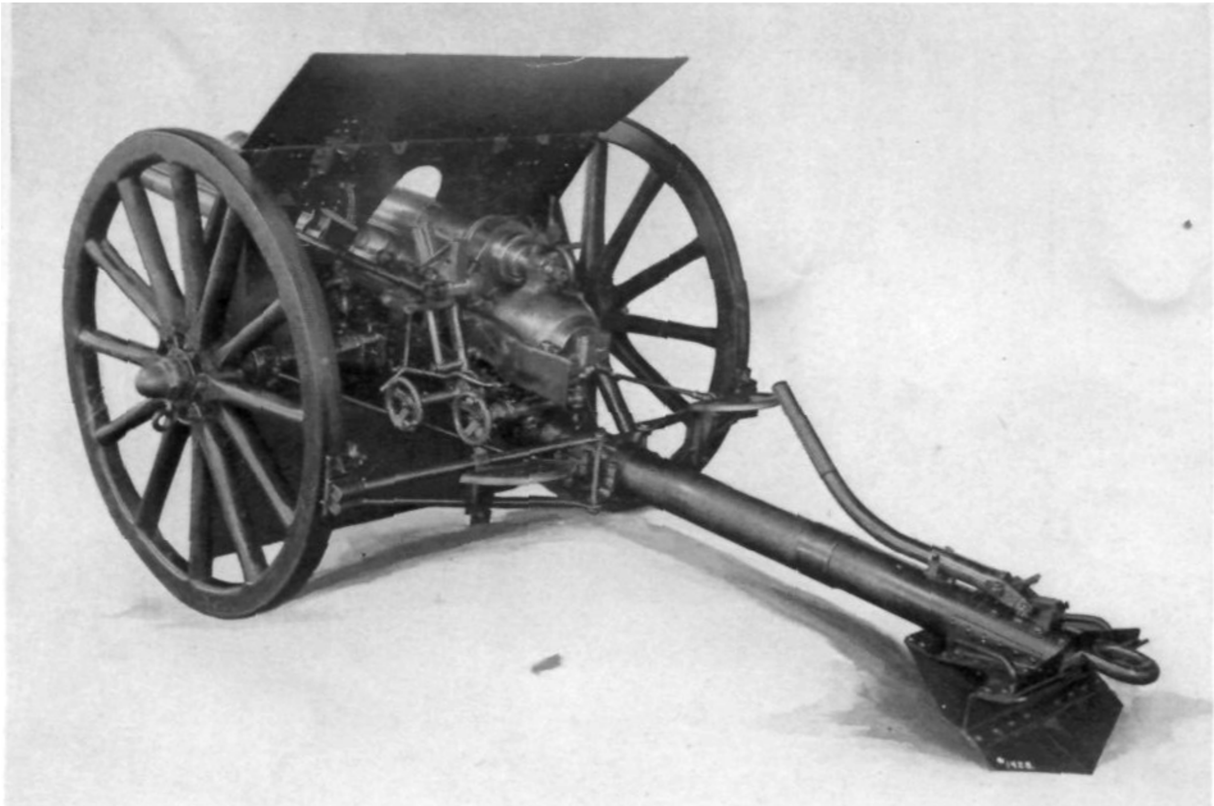

BRITISH 18-POUNDER FIELD GUN. MARK I.

THE FIELD ARTILLERY JOURNAL

VOL. V OCTOBER-DECEMBER, 1915 NO. 4

Our Baptism of Fire

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

(*Translated from the "Artilleristische Monatshefte," June, 1915, by First Lieut. Edmund L. Gruber, 5th F. A.*)

Here at last we have an artilleryman's story of his first fight, told in artillery language. Shortcomings, fears and anxieties are frankly admitted; and pride in accomplishment is delightfully expressed. We are indebted to author and translator alike for this account which, thus far, from an artillery point of view, seems unique in the literature of the war in Europe.

A few days after the orders for mobilization, the Cavalry Division[1] to which we belonged was assembled at Saarburg and awaited with impatience the order to advance in order to get in contact with the enemy. Pending the arrival and the detraining

[1] The register shows that the horse artillery battalion, 15th Field Artillery, was stationed at Saarburg with Headquarters and one battalion (light). The other battalion (light) was stationed at Merchingen. The 15th Field Artillery was brigaded with the 8th Field Artillery stationed at Saarbrücken forming the 42nd Field Artillery Brigade. This brigade belonged to the 42nd Division Organized in 1912) which with the 31st Division formed the 21st Army Corps.

The Cavalry Division mentioned in this report was probably composed of the 30th Cavalry Brigade (11th and 15th Uhlans) stationed at Saarburg and the 16th Cavalry Brigade (17th Dragoons and 7th Uhlans) stationed at Saarbrücken. The mention of the 26th Brigade in the report is evidently a typographical error; it should be 16th Brigade no doubt. Since the 15th Field Artillery is the only one of the four artillery regiments in the 21st Army Corps which has a horse artillery battalion, it is quite likely that this was the only artillery with the Cavalry Divisions, the other battalions (light) being held with the Army Corps.—TRANS.

of all the troops, the battalion had been designated as the main reserve for the troops protecting the frontier between the Vosges Mountains and the neighboring Corps at Metz, being required to be ready at all times to take the march in case the French should, as was generally expected, make a sudden advance with strong forces against our comparatively weak force protecting our frontier.

But the attack was not made, and the mobilization was able to be carried out to its successful completion as planned. As early as the second day of mobilization, the first troop trains, enthusiastically greeted by us, began to arrive from the Empire. They were Bavarians from Augsburg and Lindau, and were received with an interminable cheering by their people[2] who were rather fearful of their own safety. It was evident to all that at this point so close to the frontier, some real fighting would soon take place. The events of August 17–20, have substantiated these apprehensions only too forcibly and the houses and barracks shot up during the bloody battle of August 20, are to-day eloquent evidence of this. Without any more delay en route, the Bavarians at once marched to their positions near the frontier in order to release for other duty the troops regularly garrisoned at Saarburg, which were to be assembled in their divisional organization. Under the protection of the Bavarian lines, every one, both civilian and military, looked toward the future with confidence and calmness.

When the capture of Liege and the early glorious victories of our troops became known here, our longing also to be permitted to speak with our guns grew apace.

Mobilization was accomplished according to schedule. Every man and horse, ammunition, the readiness of the command to march, all were reported in order even before the appointed time.

On August 8, at noon, the "alarm" was suddenly sounded

[2] The inhabitants of Saarburg are Bavarians, being in the Bavarian Palatinate.—TRANS.

and orders were given to move out. In a half hour the battalion was ready to move and proceeded to the rendezvous fixed at Heming. On the previous days our Uhlan patrols had already reported that a strong hostile force of cavalry supported by artillery and cyclists was in movement in the country south of Lunéville. This was no doubt the Cavalry Division stationed at that place, supported by troops from Toul. Some prisoners were being brought to the rear. They were cavalry patrols which were simply nabbed and hustled away by our Uhlans as in 1870, and then made captive. These men were cavalry from the south of France, from Lyon, who in their full peace equipment had been hurriedly forwarded by rail. At noon, in the heat of a torrid sun, the advance to the frontier was begun on the road St. George-Foulcrey, the troops cheering as the boundary was crossed. A halt was made at Hill 351 near the frontier. The battalion was assembled in formation and then went into a position. The advance cavalry squadron had already advanced beyond Blamont-Domêvre-Verdenal and made its reconnaissance without having found the enemy.

To our left the Bavarians were engaged around Blamont, which was occupied by them that same evening. The inhabitants displayed great hostility even on this first day, and shortly after, their behavior led to a terrible summary punishment, which included also the neighboring villages where, in a treacherous manner, they had fired upon our troops. Bivouac was made a little farther back, our first bivouac in the enemy's country and under a clear star-lit sky. The next morning camp was broken and the advance into uncertainty was resumed. A position in readiness was again taken, pending the receipt of information concerning the enemy. We reconnoitered and searched the terrain with our splendid scissors observing telescope. In the far distance, fully over six kilometres away, heavy clouds of dust gradually became visible near Gondrexen-Reillon-Chazelles, beyond the extensive Bois de Grand Seille. The range was too great to warrant opening fire at the target which by its movement was gradually identified as cavalry. In keeping with the principle not to open fire at such a great range, I refused permission to my battery commanders to disclose our presence so early in the fight.

Finally at three P.M., the order came to move up closer and to advance under the support of a force composed of Bavarian cyclists and Jägers, via Autrepierre to Gondrexen. In the latter place strong hostile cavalry detachments and a lively commotion were again disclosed. I caused the battalion to go into position very near to and above Autrepierre, in order to support the Jägers with our fire from this commanding position. The battalion went into position as if engaged in peace maneuvers; suitable observing stations were reconnoitered and selected; telephone communications were established and sectors assigned. Nothing could be seen of the hostile artillery, and later this was the general rule. Suddenly there appeared at a distance still over 5000 metres an eskadron trotting along near Reillon enveloped in a thick cloud of dust. I ordered one battery to open up suddenly with a surprise fire, and the first shots, breaking our terrible suspense, reverberated over the sunny fields. The effect of these first shots though a little short, was startling. The enemy was plainly seen to hesitate being very much surprised by these first shots from German guns. He then suddenly turned about in order to get back behind the crest by constantly increasing the gallop, being followed by our fire of increasing rapidity which was undoubtedly producing losses as was plainly to be seen, so that he soon disappeared in an extended gallop. No other target worth while was to be seen. Through the neighboring village of Autrepierre which was already in the possession of our Jägers, the march was continued to Gondrexen, with the cavalry in front. Our patrols had reported the hostile cavalry as marching away toward the south, so the advance was continued without interruptions to Chazelles where a halt was made pending further information. This second advance, made at a rapid gait in the excessive heat of the afternoon, had put a considerable strain on our horses and they perspired quite freely. At Chazelles our patrols came rushing back in a headlong gallop calling out: "Strong force of hostile cavalry with cyclists and artillery along the road on the low ground between Frémenil and Ogéviller." I at once rode over to the Division Commander and requested permission to take up a position southwest of Chazelles on Ridge 297, about 1500 metres to our front, in order to take under fire as quickly as possible the target, which according to the map, could be done very advantageously.

Before leaving I saw for the first time, plainly visible to our right front, the outline of the Forts at Manonviller, about 8 kilometres distant. My attention was thus called to the fact that it was not impossible that we might come under the fire of the heavy guns located there, a circumstance which became of increasing importance, on account of the French network of telephone communications which was surely in existence and remained undamaged as further events also proved. After a rapid estimate of the situation and a short discussion with the general staff officer, who believed that the range to the French artillery was not over 6000 metres with which estimate I, however, disagreed, the advance to the ridge was made at a gallop, the batteries having been ordered to do their utmost to get into position quickly. In front of us our cavalry was deployed, being previously dismounted to fight on foot, and were firing upon hostile cavalry at St. Martin, who replied with a desultory fire at about 1500 metres range. Very soon after, our skirmishers withdrew, in order to make room for our batteries which were advancing at a gallop in double section column. Upon reaching the top of the hill, I saw before me a panorama most alluring for a field artilleryman, a picture such as is seldom seen either in maneuvers or during firing practice. At about 3800 metres a great highway (Frémenil-Ogéviller) and on it cyclists in columns of twos moving along leisurely; beyond the road some artillery halted in a meadow by the roadside; farther up the slope near the village, a strong force of cavalry in assembling formation. The neighboring village of St. Martin was occupied by hostile skirmishers, who now were delivering a livelier fire as my battalion headquarters showed itself and our cavalry skirmishers began to withdraw. In sizing up the situation I had immediately decided to move rapidly into an open position in order not to lose a single second. Riding along at a gallop, I roughly designated the positions of the batteries, two batteries to the right and one battery to the left of a sheep-pen, batteries to go in the order of march, move by the flank and execute action to the flank. As the battery commanders, not very far distant from their batteries, came up to me, the hostile small-arms fire became stronger but caused no losses. After galloping for 1000 metres and straining all efforts to the utmost the batteries came through a high field of corn up to Hill 297. Having first oriented every one, I quickly gave only the following orders: "Haste is urgent. Here's a chance to get a few Iron Crosses. Fire upon everything that is standing or moving down there. Right battery, Cyclists; Centre battery, Artillery; Left battery, Cavalry." The excitement and the tension of all the men had reached its highest limit, and every one realized that in this particular case the effect produced came before any consideration of cover. The battalion went into position as if it were on the drill ground where we had so frequently practised this same maneuver. Shortly after unlimbering, the first shots were fired, which although a little short, acted like fire heaped on a pile of ants. The cyclists energetically increased their pace, one could see how vehemently they were putting all possible power into the pedals, in order to get forward. The next shots followed quickly and already produced visible effect, empty bicycles, dead and wounded, a part dismounted and in proper manner sought cover in the ditch along the road; the other part was less wise and sought safety in flight, but by increasing their pace merely hastened to their destruction.

In the mean time the centre battery had unlimbered and fired on the artillery which was halted alongside the road. They at once mounted up in order to get away. But the shrapnel reached them easily, because the trees lining the road gave little protection while the ground beyond the road was very open and in plain view. The enemy's guns separated, moving away to both sides at a gallop. In a very short time two guns were put out by our fire and left standing unable to move. The others under the protection of the trees, attempted to escape on the road to Ogéviller whereby it was very plain to see the drivers cutting and slashing their horses with their whips and endeavoring to urge their horses to exert their greatest efforts. The cavalry, at a halt near a small stretch of woods, disappeared quickest of all. No sooner had the first shots fallen in their midst than all hurriedly mounted and rushed madly away, and as was plainly seen, without either order or command, every one being obsessed with the mad desire to get to safety.

The rapid fire of my batteries, had up to this time, called forth no reply from the French artillery. We were all intent on inflicting as much damage as possible upon our careless opponent down below, and all our attention was concentrated on this objective. It was like a scene taken from our firing practice. The few small-arms bullets which occasionally struck the ground were scarcely noticed. In this infernal noise of the gun fire, I directed the fire of the batteries as near as was possible under the circumstances. I passed along the different batteries making corrections in such cases where I thought the shots were not properly placed or adjusted. Then suddenly, the first hostile artillery shot from some concealed position came whizzing toward us, followed immediately by a second, third and fourth, all four being fired with the same range and height of burst, and about 150 metres in front of my battalion. The bursts of the shrapnel were rather high and therefore ineffective. "So that's it, at last!" said I to myself.

"Things are really first beginning," and I became curious over the probable outcome of the duel. For many years we had witnessed the firing of many rounds at our firing practice and at the School of Fire, had also observed the effect as seen from the firing point and from the range party near the targets and had obtained a distinct impression of the moral and actual effect produced by our German projectiles and the extent of the zone swept by their fire. But what I saw here did not come up to my expectations and this first impression remained unchanged during the whole course of the fight. My curiosity increased appreciably as I, after having taken cover with my staff behind our observation wagon, followed the fire for adjustment of our opponents. Being in an almost open position on the crest we presented an admirable target, something which we never did again. The second French salvo burst in the prescribed manner about 100 metres in rear of the battalion, the fragments and bullets whizzing down the reverse slope behind us and almost reaching the position of the limbers in the hollow, but at present without doing any damage. I had a very distinct impression, that the pattern of the French shrapnel, as was previously known to me, had a smaller density of hits than our German shrapnel, and that many bullets spent themselves in the air, not reaching the ground until too far distant from the point of burst. This impression also remained unchanged during the whole campaign. It seemed to me that the "shower of bullets" common to our German shrapnel was lacking. After about two minutes of ineffective firing with shrapnel, a change was made and the first shell came rushing along, and we saw instead of the shrapnel white smoke balls, the black smoke produced by impact shell burst accompanied by a violent and deafening detonation. Our opponent was constantly coming closer with his projectiles and the moment was not far distant when the shots would be striking right in the midst of the batteries. Again we felt a curiosity of what would come next. There seemed to be very little nervousness among the cannoneers. At last the expected rafale came right in the centre of the battalion, in fact right in the center battery. I looked in that direction and saw the projectiles bursting in front and in rear of the battery, and heard the clink of the fragments as they struck the shields. One shell struck about five metres from a trail, detonated and completely covered with earth a cannoneer who was engaged in bringing forward some ammunition baskets. He stopped for a moment, shook off the clumps of dirt, and then continued to carry his ammunition to the gun just as if nothing had happened. It was very noticeable how the men at the caissons got in closer and sought more cover of the shield, and that they then at once began to dig, in order to fill up the intervals with earth.

A part of the enemy's force below had disappeared, or was behind the cover offered by the road, seeking protection from our overwhelming fire. Of the cyclists we could see only the tail end as they entered the village, the entrance to which I had immediately taken under fire with shell in order to compel them to halt and thus cut them off. Later on it was seen that the greatest effect was produced here, not only against the cyclists but also against the fleeing cavalrymen who tried to escape. Our advanced cavalry patrols, who had gotten a point of vantage very close to the village confirmed our observations of the effect and the panic which our fire had produced. These became still greater when the buildings at the entrance to the village began to burn as the result of our shell fire. In the mean time the hail of hostile shell around my battalion became also more dense, but the relatively small effect produced raised the assurance and self confidence of our cannoneers; they were loading, laying and firing more calmly. After our batteries had now been firing for about fifteen minutes, it was still impossible for us to locate the hostile batteries. We searched the whole terrain with our scissors observing telescope, examining all the crests, woods and edges of villages. I thought that I could see something moving in a church steeple and some indications of smoke behind a certain roof which showed up brightly. The fire of the nearest battery was at once directed upon this target. The instrument sergeant, a young aspirant for ensign, had quickly measured the offset in deflection and the angle of site, going about his duties just as calmly as if he were on the drill ground. Almost immediately the first shots were falling in the village, where the barns which were full with the harvested crops were soon bursting into flames due to the intense heat of the summer. After this the hostile fire seemed to diminish somewhat.

It was now necessary again to pick up any target which might still be visible and to make a re-assignment of these targets. At this moment a new and very strange sound was heard like the buzzing sound made by a heavy gun projectile. This was immediately followed by a second, third and fourth and they all struck in the immediate vicinity of our right or exposed flank. Shortly after this there came a terrific detonation with the bursts directly in front of our guns. Enormous clouds of dust were produced and fragments were projected in all directions. A glance to our right and the riddle was solved. There was no doubt about it, we had gotten within the range of the guns of the Forts of Manonviller, which were subjecting us to an enfilading fire. There we were, a beautiful target for the enemy, caught in the nicest cross fire. In a low voice, I communicated my fears and estimate of the situation to the battery commander of the battery nearest to me, a proceeding which under such critical circumstances is always advisable. I then counseled with him. Under the circumstances, there was just one thing to do, to get out of this cross fire and to withdraw behind the crest. I gave the order to withdraw the guns by hand, no mean job in the heavy plowed ground and the considerable distance over which the guns had to be moved. To our good luck, all the hostile heavy gun projectiles struck in front of the batteries. They were not quite correct for deflection. A hit would have done great damage. I do not believe that I am far wrong in making the assumption that the position of my battalion was communicated to Fort Manonviller by telephone from one of the neighboring villages, perhaps from Chazelles, being probably sent in by one of their patrols or by the inhabitants, a fact which we later observed quite frequently.

"On Hill 297, north-west of St. Martin, hostile artillery." The artillerymen in the fort which fourteen days later was blown to pieces by our 42 centimetre howitzers, needed only to set off the proper azimuth in their revolving turrets, and fire could at once be opened at a range which had been previously accurately determined. And this is no doubt the way it also happened. The enemy was completely successful in his attempt to lure us by his voluntary withdrawal, within the range of his fortifications, but his guns which no doubt were 15.5 centimetre guns, should have done better shooting.

Two of our batteries had already withdrawn their guns to a position behind the crest and had relaid them. Some time later, one of the battery commanders assured me that his men had never in time of peace moved the guns quite so quickly, nor the ammunition wagons which were almost full. Due to the hurried withdrawal, a considerable number of ammunition baskets were left in front, nearly all of which were later carried back. The third battery which was not within sight of the fort held its position for the present and continued to fire alone on its opposite target.

In the mean time the fire of the hostile artillery from the fort had reached the position of the limbers some appreciable distance in our rear, whereupon the limbers moved away at a slow walk, going obliquely to the rear, not however without suffering some losses in men and horses. The French, in keeping with their methods of fire, had also shifted their fire laterally and now systematically searched the whole terrain. In doing so, a few shrapnel burst among our cavalry which had moved out of the fire-swept zone by going to the right rear. Here also some damage was done and as was to be expected disorder was also created because the horses who of their own accord immediately turned about in this shower of bullets. The regiment was however shortly afterwards again assembled in good order. It was still impossible to fix definitely the position of the French light batteries. I continued to have constant observations made, and especially had the terrain searched in the direction of the furrows made by the projectiles which clearly gave us two different directions of hostile fire. I also had some French shrapnel fuses picked up in order to determine the ranges therefrom. But since these were graduated in seconds and not in meters and a range table was not at hand (later on they were furnished to us) a determination of the range was not possible.

From Fort Manonviller about 20 shots in all were fired, of which number a few struck among the machine guns to the left of our line without doing any damage.

About this time, after the firing had been going on for about a half hour, the Division Adjutant came riding up and called me from a distance: "The Division will withdraw in the direction of Chazelles. Your battalion will follow under the protection of the 26th Brigade." I transmitted the order through the batteries and had the limbers brought forward in order to limber up under cover. This took considerable time on account of the losses in horses and men which had just been suffered and also on account of the long way which they had to travel. It took even longer to bring up the horses of battalion headquarters which were hidden in a fold in the terrain. Finally everything was ready for marching and the battalion left the position at a walk. All individual attempts to take up the trot without command and before the proper time, were suppressed by the battery commanders and thus two of the batteries got out of the fire-swept zone well closed up and in good order. The hostile fire had already died down considerably when the guns were withdrawn behind the crest. In the hollow in rear there lay an ammunition wagon of the 3rd horse battery with the lead horses killed, also a limber, the team of which had also to be changed. Just as the batteries in their retirement had passed through the village, I heard behind me a lively fire coming from the direction of our former position, a circumstance which I was unable to explain. Not until we had reached a point about 3 kilometres from the former position, an agent from the second battery came toward us at a gallop and requested that ammunition from the light ammunition column (combat train) be sent forward because there was some danger of the ammunition running short. To my surprised inquiry whether the battery had not limbered up and followed the others I received the reply that it had not and that the battery had received no orders to withdraw.

In spite of the fact that the batteries were emplaced quite close to each other and that the limbering up of an adjacent battery would immediately have been noticed in time of peace, the battery on the left flank of the battalion was still so busily engaged with the enemy, that no one had observed the departure of the others thus leaving this battery all alone under the fire of the enemy, where under the circumstances it might have suffered capture by a more energetic opponent. The order simply did not sift through. Visual communication was impossible due to the nature of the terrain in the position. In the haste made in this fight, where everything depended upon rapidity since the duration of the fight promised to be short, the telephone was not laid, notwithstanding that the regulations prescribe that telephone communications shall be established also when in open positions. The fight was a combat of surprise or pursuit from which later I immediately drew the proper warning and lesson. I felt great anxiety about getting the battery back again and at once sent back for it. Beyond the village, a halt was made. In passing along the two batteries which had now dismounted, I received the reports of the losses. In this connection the junior officer of the third battery reported that the captain and the 1st lieutenant of his battery were missing and were probably left behind wounded, a report, which as later information proved, was incorrect. As a matter of fact both had remained behind in order to rescue a caisson which had been abandoned and which they did not wish to leave in the territory of the enemy under any circumstances. At this moment, his Excellency, the Division Commander, came back and inquired concerning our casualties, which I was able to report as being very slight. At the same time I informed him of the reported wounding of the two afore-mentioned officers which report immediately spread throughout the entire division.

The second battery which was engaged with the enemy for a half hour longer, at last also rejoined the battalion. I was glad to have it again and, as it turned out, without having suffered hardly any losses. This first day of our baptism of fire did not impress upon us a very high opinion of the firing of the hostile artillery and this opinion remained the same concerning the firing of the heavy artillery. Where real success is not attained, the moral effect will also soon vanish. Every one in the battalion took courage in the feeling: "Well, if this is the worst we may expect, and if the French do not shoot any better than this, especially when they have us in an open position, then we can look forward to the coming battles with full confidence." Later on there were days when the French did shoot better, and made a greater impression upon us in their methods of fire and in the rapidity of their adjustment, than in that day at St. Martin.

On the way back to the place where we were to be quartered, I received a message from our regimental commander who from the heights at Igney had observed our fight through his glasses and who, basing his judgment upon the heavy fire of our opponents, was more or less resigned to an expectation of heavy losses in the horse artillery battalion and therefore wished to express his appreciation and thanks for our brave resistance. The concluding sentence of his message pleased us most: "The hostile cavalry division fled in a mad rush on the road to Lunéville, showing unmistakable signs of panic and noticeable losses."

In addition to this very pleasing message, it was also gratifying to hear the thanks and the ungrudging appreciation of our friends of the Cavalry with whom we later on fought shoulder to shoulder for several weeks.

This then was our baptism of fire. Only on rare occasions did we later gain a success which was any way near so pretty or so distinetly fruitful in results.

Adjustment of Height of Burst by Variation of Site

BY LIEUTENANT COLONEL EDWARD F. McGLACHLIN, 5th FIELD ARTILLERY
AND
CAPTAIN LESLEY J. McNAIR, 4th FIELD ARTILLERY

1. A scheme for adjustment, in indirect laying, of height of burst suitable for observation of range has been taught and used in one of our regiments, according to an article in THE FIELD ARTILLERY JOURNAL of July-September, 1915. The method appears to be as follows: In opening fire for adjustment use the calculated data, adding arithmetically to the site determined the greatest absolute error of the observer. On the basis of observation bring the mean point of burst into the plane of site by changes of site.

2. There are certain assumptions that are either definitely stated in the article or are possible of inference from it.

The principal assumptions are: (1) that there is a "corrector for the day" which (2) may be established; (3) that the use of the range finder will ordinarily give ranges within 200 yards of the range to the target; (4) that the site determined is the least accurate of all the firing data and (5) will frequently be as much as 8 mils in error.

Subordinate assumptions are: (6) that the range finder will be accurate and expertly used; (7) that the site may vary from 280 to 320 mils; (8) that the matériel, ammunition and gun service are perfect; (9) that the ordinary country is difficult and will make determination of site inaccurate.

3. While some of these assumptions have no weight in consideration of the subject, it seems best to examine them. In this examination, and throughout this paper, all data used are taken from voluminous records at the School of Fire for Field Artillery.

(1) THERE IS A CORRECTOR FOR THE DAY

It is admitted in the article that the trajectory and rate of burning of the fuze are affected by the range and by the density, humidity, velocity and direction of the air and differ between the lots of ammunition.

At points near the sea daily variations of atmospheric conditions, although they occur, are not as great as they are in the interior. The daily effect upon the corrector of variations of atmospheric conditions is shown by the facts that although the average maximum variations of range are but 1000 yards daily, the mean maximum variations of corrector are 6 points daily, the effect of site errors having been eliminated.

(2) A CORRECTOR FOR THE DAY MAY BE ESTABLISHED

This requires actual firing with a correct site. It would amount to registration of fire and would have to precede the day's action. Registration of fire is forbidden by our drill regulations when it will disclose the position of artillery not previously discovered.

(3) EXPERT USE OF THE RANGE FINDER WILL ORDINARILY GIVE RANGES WITHIN 200 YARDS OF THE CORRECT RANGE

Actually the range finder, skilfully used, gives a probable error of 94 yards in the measurement of distance from the guns. Thus practically all errors will be within 376 yards of the true range. The average probable error in estimation of range is about 400 yards.

(4) THE SITE DETERMINED IS THE LEAST ACCURATE OF THE FIRING DATA

At 3000 yards, the probable error in site, 2.5 mils, is equivalent to an error in range of 57 yards; the probable error in range, based on the use of the range finder is 94 yards, based on estimation, 380 yards; the probable error of the first corrector used is about 3.6 points, corresponding to an error in range to point of burst of 62 yards.

(5) THE SITE DETERMINED WILL FREQUENTLY BE AS MUCH AS 8 MILS IN ERROR

From numerous problems, the site reduced to the guns, computed by indifferent as well as good observers and by many methods, on varied terrain, has a probable error of only 2.5 mils. Thus practically all sites will be within 10 mils of the true site. The probability of exceeding an 8 mil error is .093, less than one per cent.

(6) THE RANGE FINDER WILL BE ACCURATE AND EXPERTLY USED

But it gets out of adjustment, will often not be available, and must frequently be operated under conditions involving estimation of distance and crude or inaccurate methods.

(7) THE SITE MAY VARY BETWEEN 280 AND 320 MILS

This is an unusual condition. Systems should be based on the common case.

(8) MATÉRIEL, AMMUNITION AND GUN SERVICE ARE PERFECT

They never are in peace. The condition cannot be hoped for in war.

(9) THE ORDINARY COUNTRY WILL BE SO DIFFICULT AS TO MAKE CALCULATION OF SITE INACCURATE

Admitting this to be true it carries with it the conclusion that modifications of the observed heights of burst must be made for application at the guns. The error will be the same for any given height whether the corrector or the site scale be used. As it is proposed to add to the calculated site the greatest personal error in its calculation by the observer, the mean point of burst so obtained will be at 10 mils in height and the bursts may be 20 mils high, leaving out of consideration errors of the corrector. These may happen to be such as to raise the height still more. A greater error is made in the measurement and correction of large angles than of small.

4. The purpose of the method given is to secure "the greatest chance of adjusting the fire in the smallest number of rounds . . . of sensing the shots and thus . . . to obtain most quickly and accurately the most effect;" to find bracketing trajectories "with the least expenditure of ammunition . . . in the best and quickest way;" to establish "zero to one mil high bursts on the plane containing the gun and target, and thus the correct range of burst . . . with as small an expenditure of ammunition as possible;" to fix quickly on a trajectory passing through the target, the point of burst which shall be at the right height and the right burst interval.

The purpose is plainly to save both ammunition and time in adjustment of time fire by indirect laying.

5. New methods should be tried when their analysis gives promise of greater simplicity or of increasing effect per round or per unit of time, and they should be adopted if they prove their worth to be materially greater than that of the old. But they should not be adopted, for general application, on the basis of special or unusual cases or unsound theories. For the United States, especially, methods must be simple and direct, easily described and understood.

6. An analysis of the suggested method follows. As understood, it differs from the method of adjustment of height of burst by variations of the corrector in that, for the purpose of ensuring air bursts, for the first salvo a site is used 8 mils higher than its determined value; on the observation of the burst height the site is changed with the object of bringing the burst centre of the second salvo to the plane of site; this accomplished, any further adjustment of height of burst is made by the corrector.

In the possible, but unusual, event that the first salvo bursts on graze, the site is raised for successive salvos until air bursts are obtained, after which the procedure is as above.

Whether or not range sensings obtained before a site change may be still utilized after the change of site depends on whether the sensing is short or over and whether the change of site is up or down.

7. If the method, without serious attendant disadvantages, is superior to the one in common use in saving ammunition and time, the fundamental measure of efficiency, it should be adopted for general use. From this view-point the question is studied.

8. Due to the wide variations in the elements which affect artillery fire, special conditions may occur which support one method while under other conditions another may seem preferable. By applying each method to all possible conditions, considering the relative frequency of each condition in the *long run*, definite and correct conclusions as to the merits of the methods may be reached.

In this investigation two ranges will be used, 2500 and 5000 yards, these being considered representative and indicative of what may be expected at other ranges.

9. A governing factor in the consumption of time and ammunition in adjustment is the proximity to the target of the first range used. The following elements affect this proximity:

(*a*) *The determination of the initial range*, generally by means of the range finder or by estimation. This determination, in either case, is subject to errors which follow the law of errors. The magnitude of the errors may then be expressed by a probable value. Such values have been determined to be as follows:

At range, yards	2500	5000
Probable error of range finding, yards	94	94
Probable error of range estimation, yards	310	670

(*b*) *The determination of the site*. This determination is subject to errors which follow the law of errors. The probable error of site determination has been found, under widely varying conditions, to be 2.5 mils. The corresponding errors in range are:

Range	Probable range error due to site determination
2500	62 yards
5000	40 yards

(*c*) *The variation of the range centre*. This may be defined as the difference between the range centre, or range of the centre of impact of a large number of shots fired under the same conditions, and the range at which they were fired. In other words, it is the amount by which the guns fail to shoot to range. This variation, through a complete cycle of seasons and other conditions which affect it, is found substantially to follow the law of errors. Its probable value increases with the range. For the ranges assumed, it is as follows:

Range	Probable variation of the range centre
2500	59 yards
5000	90 yards

The variation of the range centre does not affect the proximity to the target of the first range used in the case of the proposed, or site, method.

(*d*) *The variation of the range of burst centre*. This may be defined as the difference between the range of the burst centre of a large number of shots fired under the same conditions so as to burst in air and the range at which they should have burst considering the range and corrector setting of the fuze setter. This variation has been found substantially to follow the law of errors. The probable variation of the range of burst centre increases with the range. For the ranges assumed, it is as follows:

Range	Probable variation of range of burst centre
2500	44 yards
5000	73 yards

The variation of the range of burst centre does not affect the proximity to the target of the first range used in the case of the present service, or corrector, method.

Comparison of the last two tables shows that the fuze, under all conditions, bursts more nearly to range than the gun shoots to range.

10. In the present service, or corrector, method the proximity to the target of the first range used depends on:

The error of initial range determination,

The range error due to site determination,

The variation of the range centre.

As all of these elements follow the law of errors, their resultant probable value is the square root of the sum of the squares of their individual probable values. This resultant is the probable proximity to the target of the first range used, and for the ranges assumed is as follows:

CORRECTOR METHOD

Range	Probable proximity
2500, range finder	127 yards
2500, estimated	322 yards
5000, range finder	136 yards
5000, estimated	677 yards

11. In the proposed, or site, method the proximity to the target of the first range used depends on:

The error of the initial range determination,

The variation of the range of burst centre.

As these follow the law of errors, the probable proximity to the target of the first range used may be determined as in the case of the corrector method, and is as follows:

SITE METHOD

Range	Probable proximity
2500, range finder	104 yards
2500, estimated	313 yards
5000, range finder	119 yards
5000, estimated	671 yards

There is an additional error due to the fact that the burst centre would not, in general, be accurately adjusted at the adopted height of 1 mil by the use of the site scale because to do so would involve an unwarranted ammunition expenditure. This error would, however, be relatively small, and is neglected to the advantage of the method.

12. In calculating the probable proximity of the first range to the target by the site method it is assumed that the corrector used for the first salvo is the one which, in the greatest number of cases in the long run, gives a 1 mil height of burst. Under normal conditions this is Corrector 28.

The use of a "corrector for the day" determined by direct laying would result to the disadvantage of the method in the matter of the proximity to the target of the first range used. This fact is shown as follows: An examination of the records shows that if shots be fired at a certain range with a corrector which should, under normal conditions, give air bursts at 0 height at that range, the range of burst centre varies from this range and height, from day to day and from problem to problem, according to the law of errors. This variation of the range of burst centre from the range to point of fall in the plane of site is due to both the variation of the range centre and the variation of the range of burst centre. Its probable value is:

Range	Probable variation
2500	62 yards
5000	93 yards

Now, if a corrector be used which will, in direct laying, give bursts at a 0 height, the range of burst centre with this corrector will be in error with respect to the range used by just the above amounts. These values, in determining the proximity to the target of the first range used, must be substituted for the values previously given for the probable variation of the range of burst centre and would result in a greater value for the probable proximity to the target of the first range used, increasing, for example, in paragraph 11, the numbers 104, 313, 119 and 671 to 113, 319, 132 and 678, respectively. This would result in disadvantage to the site method and will not be further considered.

13. The values obtained in paragraphs 10 and 11 are repeated for comparison:

PROBABLE PROXIMITY TO THE TARGET OF THE RANGE USED

Range	Corrector method	Site Method
2500, range finder	127	104
2500, estimated	322	313
5000, range finder	136	119
5000, estimated	677	671

The comparison is obviously to the advantage of the site method. This advantage is of practical utility in that it reduces the number of ranges which must, in the long run, be used to obtain a given bracket. Of 100 cases where a 200-yard bracket is sought, the following table shows the number in which 2, 3 and 4 ranges must be used. Bracketing and mixed salvos are neglected for the sake of simplicity.

100 CASES OF A 200-YARD BRACKET

Range	2500		5000	
Ranges per case	Method		Method	
	Corrector cases	Site cases	Corrector cases	Site cases
2	71	81	68	74
3	26	18	28	24
4	3	1	4	2
	—	—	—	—
	100	100	100	100

It appears then that, as far as the number of ranges which must be used in the long run to obtain a given bracket is concerned, the site method is superior to the corrector method.

14. From this advantage alone, it does not necessarily follow

that the use of the site method will result in a saving of ammunition and time in ranging, because this method has certain disadvantages the general nature of which may be stated as follows:

(a) The addition of 8, or any other number, to the determined site has the effect of placing the bursts of the first salvo in many cases so high in air that they cannot possibly be sensed. This results in no disadvantage provided the first salvo is outside of the target in direction and could not have been sensed even if the height of burst had been suitable. But in those cases where the first salvo is sensable as far as direction is concerned, the site method obviously causes a loss of time and ammunition. The determination of the initial deflection or of a deflection shift has been given special attention with a view of reducing the error in this determination to the lowest possible amount. The probable error in an original deflection determination is 30 mils. The probable error in the determination of a deflection shift increases with the amount of the shift from 0 to 20 mils. In service, it may be expected that the number of shifts will be considerably greater than the number of original determinations; so that it seems fair to take 20 mils as a general value for the probable error in the first deflection used against a target.

With a view of reducing the disadvantages resulting from the error in the initial deflection determination, studies were recently made of the effect of the initial distribution on the probability of observing for range one or more of the shots of the first salvo as far as direction is concerned. The results of these studies were published in a form adapted to practical use in Principle 3 of Subject No. 34, School of Fire. According to this principle, the initial deflection difference should, in the ordinary case, be determined to open by 10 from parallel fire. If we assume, as a representative case, that the target has a front equal to that of the battery firing, the front of the target will be 24 mils at 2500 yards and 12 mils at 5000 yards. The initial distribution difference would be 8 + 10 = 18 mils at 2500 yards and 4 + 10 = 14 mils at 5000 yards.

The probability of at least one shot of the initial battery salvo being in the direction of the front of the target at 2500 yards would be .81; of its not being in that direction, .19. At 5000 yards these figures are .56 and .44, respectively.

When a burst is in the direction of a target the probability of sensing it for range obviously varies with the burst height. This probability, determined by examination of the records of observation of numerous such rounds, is shown below. In the table also appears the probability of sensing for range at least one round of a battery salvo.

Height of burst, mils	Probability of observing for range-	
	a round in direction of the target	at least one round in a battery salvo
Air or graze.		
0 or below	.73	1.00
Air.		
1	.72	.99
2	.70	.99
3	.68	.99
4	.65	.98
5	.61	.98
6	.58	.97
7	.54	.95
8	.49	.93
9	.44	.90
10	.38	.85
11	.31	.77
12	.22	.63
13	.12	.40
14	.00	.00

It will thus be seen that part of the initial salvo is very frequently observable for range as far as direction is concerned, and that the higher the bursts the less the probability of observing at least one shot for range.

(b) In those cases where the direction is correct, and one or more of the shots of the first salvo are observed for range, the application of the site method results in a loss of ammunition in the following cases:

1. When the bursts observed are *over* and above 1 mil in height.

In this case, the site is lowered after the first salvo, and the range must be repeated because it is not known that the range with the lowered site will still be long. If it be said that the over range will be considered as the one first used plus the change due to the site decrement, then the range finder range is wholly or in part abandoned and loss of ammunition will result in the long run. Moreover, mental calculations of this kind lead to confusion, error and delay.

2. When the bursts are short and on graze.

In this case the site is raised after the first salvo, and the range must be repeated because it is not known that this range with the raised site will still be short.

15. It is thus seen that the site method has an advantage over the corrector method in the proximity to the target of the first range used, which results of itself in a saving of ammunition; but that the application of the site method results in a loss of ammunition in certain cases while such losses would not have resulted from the application of the corrector method. The relative merits of the two methods, then, depend upon the relative magnitude of the effect on ammunition consumption of the various sources of loss and gain in the application of the methods. Although it might appear that the deliberate introduction of an error of 8 mils in the site would inevitably waste ammunition it is best not to rely on mere inspection. So tabulations of the height of burst centre to be expected in the corrector and site methods of ammunition consumption are made on the following hypotheses:

(a) The range finder is used. This cannot be considered as the invariable, and perhaps not the typical, case; but it is taken because it is to the advantage of the site method for the following reason: The cases where the corrector method results in a loss of ammunition, aside from the number of ranges to be used in the long run to obtain a given bracket, are those in which the corrector is not adjusted when the adjustment of deflection and range is completed, causing additional salvos to be fired merely for the adjustment of the corrector. These cases are, of course, more numerous when the range finder is used. They do not occur with the site method.

(b) A 200-yard bracket is sought. This is to the advantage of the site method for the same reason as given under (a); that is, narrowing of the bracket would give an opportunity for refinement of height of burst by the corrector.

(c) In those cases where the first salvo is not observable on account of direction, the deflection is taken as correct for the second salvo. In other words, two is the maximum number of salvos required for adjustment of deflection. This is not, of course, strictly correct, but is to the advantage of the site method for the reason given under (a); that is, every additional salvo gives opportunity further to adjust height of burst by the corrector.

(d) When the burst centre of the first salvo is in air, it is adjusted by one change of site or corrector as the case may be.

(e) When the first salvo is on graze, the site or corrector is raised by bounds of 5 mils until the burst centre is in air.

(f) The dispersion of bursts in height about the burst centre is not considered, for they will be below the burst centre as frequently in the long run as they are above it and the mean results will be those indicated by the true position of the burst centre.

(g) A 0 height of burst centre will be taken as recognizable by the proportion of airs and grazes, while positions of the burst centre below 0 will be taken as wholly on graze and subject to the change stated in (e) above.

(h) All calculations are based on the values previously given.

(i) The surface of the ground is in the plane of site.

(k) At least one observation for range at each limit of the bracket is sufficient. This favors the site method because firing for more observations would give opportunity for refinement of the corrector setting.

16. The first step is the determination of the distribution in the long run of the height of burst centre of the first salvo.

The height of burst centre varies above and below the plane of site according to the variation of the range of burst centre from the range to point of fall in the plane of site, discussed in paragraph 12. This was given as 62 yards at 2500 yards and 93 yards at 5000 yards. A mil at 2500 yards corresponds to a range change of 25 yards, and a mil at 5000 yards to 16 yards. The probable variation of the height of burst centre from the plane of site is then 62/25 = 2.5 mils at 2500 yards, and 5.8 mils at 5000 yards.

The plane of site varies from the point for which the site was determined due to the error of site determination. The probable error of this has been stated as 2.5 mils.

The probable variation of the height of burst centre from the point for which the site was determined is then:

$$\text{For 2500 yards, } \sqrt{2.5^2 + 2.5^2} = 3.5 \text{ mils.}$$

$$\text{For 5000 yards, } \sqrt{5.8^2 + 2.5^2} = 6.3 \text{ mils.}$$

It is to be remembered that the site is determined for a point at 0 height or that of the target in the case of the corrector method, and for a point at a height of + 8 mils in the case of the site method.

The desired distribution of the height of burst centre may now be computed with the aid of the law of errors, and is tabulated as follows:

POSITION OF THE HEIGHT OF BURST CENTRE OF THE FIRST SALVO, 1000 CASES

Height mils	Range 2500		Range 5000	
	Corrector method cases	Site method cases	Corrector method cases	Site method cases
28	..	..	..	10
27	..	..	..	10
26	..	..	..	10
25	..	..	..	10
24	..	..	..	10
23	..	..	..	10
22	..	..	..	10
21	..	10	..	20
20	..	10	10	20
19	..	10	10	20
18	..	10	10	20
17	..	20	10	30
16	..	20	10	30
15	..	30	10	30
14	..	40	10	40
13	10	50	20	40
12	10	60	20	40
11	10	60	20	40
10	10	70	20	40
9	20	70	30	40
8	20	80	30	40
7	30	70	30	40
6	40	70	40	40
5	50	60	40	40
4	60	60	40	40
3	60	50	40	40
2	70	40	40	40
1	70	30	40	30
Target. 0	80	20	40	30
– 1	70	20	40	30
– 2	70	10	40	20
– 3	60	10	40	20
– 4	60	10	40	20
– 5	50	10	40	20
– 6	40	..	40	10
– 7	30	..	30	10
– 8	20	..	30	10
– 9	20	..	30	10
–10	10	..	20	10
–11	10	..	20	10
–12	10	..	20	10
–13	10	..	20	..
–14	..	..	10	..
–15	..	..	10	..
–16	..	..	10	..
–17	..	..	10	..
–18	..	..	10	..
–19	..	..	10	..
–20	..	..	10	..
	1000	1000	1000	1000

17. The method of employing the foregoing table and the data previously given to determine the ammunition consumption with the two methods will be illustrated by several examples:

(a) Corrector method, 2500 yards. Burst centre of first salvo 7 mils above the target.

There are 30 of these cases per 1000.

At least one round of the first salvo will be in the target direction in 30 × .81 = 24 cases. The probability of observing at least one of these 7 mil bursts for range is .95. The first range will be observed, then, on the first salvo in 24 × .95 = 22.8 of the 24 cases correct for deflection.

The remaining 1.2 cases of the 24 observable for deflection will require two salvos for the observation of the first range.

Of the 30 – 24 = 6 cases where no rounds of the first salvo are in the target direction, both the direction and the height of burst will be corrected for the second salvo, and the first range will be observed in all of these cases in two salvos each.

The salvos consumed in observing the first range for the entire 30 cases will be:

1 salvo in 22.8 cases	= 22.8 salvos
2 salvos in 1.2 cases	= 2.4 salvos
2 salvos in 6 cases	= 12.0 salvos
Total salvos for the first range	37.2

For all cases, the second range is begun with the deflection and corrector adjusted, and hence the second range will be observed in all cases with the firing of one salvo per case. As all cases require the observation of the second range, the ammunition required for the second range is 30 salvos.

.29 of the cases require the observation of a third range (last part of paragraph 13), or the number of cases requiring a third range is 30 × .29 = 8.7. One salvo will be required for the observation of the third range in each case, or 8.7 salvos will be consumed in observing the third range for the 30 cases.

A fourth range must be observed in .03 of the 30 cases, or .9 cases; and the ammunition consumed will be .9 salvos.

The total salvos consumed in obtaining the required bracket for the 30 cases will then be 37.2 + 30. + 8.7 + .9 = 76.8 salvos, the desired figure.

(b) Corrector method, 2500 yards. Burst centre of first salvo 11 mils below the ground.

There are 10 of these cases per 1000.

10 × .81 = 8 of them will give at least one round in the target direction on the first salvo, and since they are on graze the first range will be observed with one salvo per case.

The second range will also be on graze and observable with one salvo per case. But in 8 × .71 = 5.7 of these cases, the range adjustment is completed with the observation of the second range. Another salvo per case must be fired for corrector adjustment, which will place the height of burst at 1 mil below the ground. The next salvo may be used for fire for effect as it will be at a height of 4 mils.

8 × .29 = 2.3 cases will require fire at a third range, and since the bursts will be on graze the range observation will be obtained in one salvo per case. The next salvo will be at 4 mils height and may be used for fire for effect.

8 × .03 = .2 cases will require fire at a fourth range for which the height of burst will be at 4 mils. The desired observation will be obtained in .2 × .98 = .2 cases on the first salvo.

For the 8 cases, then, the salvos consumed are as follows:

1st range: For range	8 salvos
2nd range: For range	8 salvos
Additional for corrector	5.7 salvos
3rd range: For range	2.3 salvos
4th range: For range	.2 salvos
Total	24.2 salvos

Of the total of 10 cases, 10 × .19 = 2 cases are not in direction on the first salvo. Following the same reasoning, the ammunition consumption for these cases is as follows:

1st range: For range	4	salvos
2nd range: For range	2	salvos
3rd range: For range	.6	salvos
4th range: For range	.1	salvos
Total	6.7	salvos
Total for the 10 cases	30.9	salvos

(c) Site method, 2500 yards. Burst centre of the first salvo 10 mils above the target.

There are 70 of these cases per 1000.

At least one round of the first salvo will be in direction in 70 × .81 = 57 cases. 57 × .85 = 48.4 of the cases will yield an observation for range on the first salvo, one-half of the observations over and one-half short. The overs cannot be utilized for reasons already discussed, so that in 24.2 cases the first range will be disposed of in one salvo. In the 24.2 cases of overs, the range must be repeated with lowered site, requiring two salvos per case to dispose of the range.

The first salvo will not be observable for direction in 70 × .19 = 13 cases. In these cases, the first range will require two salvos per case.

In all cases, the second range will be undertaken with deflection and height of burst adjusted. The second range will then require 1 salvo per case.

In 70 × .19 = 13.3 cases a third range must be observed, requiring 1 salvo per case.

In 70 × .01 = .7 cases a fourth range must be observed, requiring 1 salvo per case.

The ammunition consumption for the 70 cases is then as follows:

First range: 24.2 + 2 (57 — 24.2 + 13) =	115.8 salvos
Second range:	70.0 salvos
Third range:	13.3 salvos
Fourth range:	.7 salvos
Total	199.8 salvos

18. Similarly both methods may be applied to various positions of the height of burst centre of the first salvo to determine the ammunition consumption in all possible cases, having proper regard for their relative frequencies in the long run. This has been done and the following tables show the results:

SALVOS CONSUMED TO OBTAIN A 200-YARD BRACKET BASED ON AT LEAST 1 OBSERVATION AT EACH LIMIT. 1000 CASES. 2500 YARDS

No. of cases	Height of burst centre mils		SALVOS CONSUMED									
			1st range		2nd range		3rd range		4th range		Totals	
	Corrector method	Site method	Corrector method	Site method	Corrector method	Site method	Corrector method	Site method	Corrector method	Site method	Corrector method	Site method
10	+13	+21	16.8	20.0	10.0	10.0	2.9	1.9	.3	.1	30.0	32.0
10	+12	+20	15.0	20.0	10.0	10.0	2.9	1.9	.3	.1	28.2	32.0
10	+11	+19	13.8	20.0	10.0	10.0	2.9	1.9	.3	.1	27.0	32.0
10	+10	+18	13.2	20.0	10.0	10.0	2.9	1.9	.3	.1	26.4	32.0
20	+ 9	+17	25.6	40.0	20.0	20.0	5.8	3.8	.6	.2	52.0	64.0
20	+ 8	+16	25.1	40.0	20.0	20.0	5.8	3.8	.6	.2	51.5	64.0
30	+ 7	+15	37.2	60.0	30.0	30.0	8.7	5.7	.9	.3	76.8	96.0
40	+ 6	+14	48.9	80.0	40.0	40.0	11.6	7.6	1.2	.4	101.7	128.0
50	+ 5	+13	60.8	92.0	50.0	50.0	14.5	9.5	1.5	.5	126.8	152.0
60	+ 4	+12	72.0	104.0	60.0	60.0	17.4	11.4	1.8	.6	151.2	176.0
60	+ 3	+11	71.5	101.0	60.0	60.0	17.4	11.4	1.8	.6	150.7	173.0
70	+ 2	+10	83.6	115.8	70.0	70.0	20.3	13.3	2.1	.7	176.0	199.8
70	+ 1	+ 9	83.6	114.3	70.0	70.0	20.3	13.3	2.1	.7	176.0	198.3
80	0	+ 8	95.0	129.8	80.0	80.0	24.6	15.2	2.4	.8	202.0	225.8
70	– 1	+ 7	83.3	112.9	71.2	70.0	20.3	13.3	2.1	.7	176.9	196.9
70	– 2	+ 6	83.1	112.3	70.6	70.0	20.3	13.3	2.1	.7	176.1	196.3
60	– 3	+ 5	71.1	96.0	60.5	60.0	17.4	11.4	1.8	.6	150.8	168.0
60	– 4	+ 4	71.1	96.0	60.5	60.0	17.4	11.4	1.8	.6	150.8	168.0
50	– 5	+ 3	60.0	80.1	50.0	50.0	14.5	9.5	1.5	.5	126.0	140.1
40	– 6	+ 2	48.0	64.2	40.2	40.0	11.8	7.6	1.2	.4	101.2	112.2
30	– 7	+ 1	36.0	36.2	30.1	30.0	8.8	5.7	.9	.3	75.8	72.2
20	– 8	0	24.0	24.0	20.0	20.0	5.8	3.8	.6	.2	50.4	48.0
20	– 9	– 1	24.0	32.3	20.0	20.2	5.8	3.8	.6	.2	50.4	56.5
10	–10	– 2	12.0	16.0	15.7	10.0	2.9	1.9	.3	.1	30.9	28.0
10	–11	– 3	12.0	16.0	15.7	10.0	2.9	1.9	.3	.1	30.9	28.0
10	–12	– 4	12.0	16.0	15.7	10.0	2.9	1.9	.3	.1	30.9	28.0
10	–13	– 5	12.0	16.0	15.7	10.0	2.9	1.9	.3	.1	30.9	28.0
	Totals		1210.7	1674.9	1025.9	1000.2	291.7	190.0	30.0	10.0	2558.3	2875.1

ADJUSTMENT OF HEIGHT OF BURST

SALVOS CONSUMED TO OBTAIN A 200-YARD BRACKET BASED ON AT LEAST 1 OBSERVATION AT EACH LIMIT. 1000 CASES. 5000 YARDS

No. of cases	Height of burst centre mils		SALVOS CONSUMED									
			1st range		2nd range		3rd range		4th range		Totals	
	Corrector method	Site method	Corrector method	Site method	Corrector method	Site method	Corrector method	Site method	Corrector method	Site method	Corrector method	Site method
10	+20	+28	20.0	20.0	10.0	10.0	3.2	2.6	.4	.2	33.6	32.8
10	+19	+27	20.0	20.0	10.0	10.0	3.2	2.6	.4	.2	33.6	32.8
10	+18	+26	20.0	20.0	10.0	10.0	3.2	2.6	.4	.2	33.6	32.8
10	+17	+25	20.0	20.0	10.0	10.0	3.2	2.6	.4	.2	33.6	32.8
10	+16	+24	20.0	20.0	10.0	10.0	3.2	2.6	.4	.2	33.6	32.8
10	+15	+23	20.0	20.0	10.0	10.0	3.2	2.6	.4	.2	33.6	32.8
10	+14	+22	20.0	20.0	10.0	10.0	3.2	2.6	.4	.2	33.6	32.8
20	+13	+21	35.5	40.0	20.0	20.0	6.4	5.2	.8	.4	62.7	65.6
20	+12	+20	32.9	40.0	20.0	20.0	6.4	5.2	.8	.4	60.1	65.6
20	+11	+19	31.4	40.0	20.0	20.0	6.4	5.2	.8	.4	58.6	65.6
20	+10	+18	30.5	40.0	20.0	20.0	6.4	5.2	.8	.4	57.7	65.6
30	+ 9	+17	44.9	60.0	30.0	30.0	9.6	7.8	1.2	.6	85.7	98.4
30	+ 8	+16	44.4	60.0	30.0	30.0	9.6	7.8	1.2	.6	85.2	98.4
30	+ 7	+15	44.0	60.0	30.0	30.0	9.6	7.8	1.2	.6	84.8	98.4
40	+ 6	+14	58.3	80.0	40.0	40.0	12.8	10.4	1.6	.8	112.7	131.2
40	+ 5	+13	58.0	75.5	40.0	40.0	12.8	10.4	1.6	.8	112.4	126.7
40	+ 4	+12	58.0	72.9	40.0	40.0	12.8	10.4	1.6	.8	112.4	124.1
40	+ 3	+11	57.8	71.4	40.0	40.0	12.8	10.4	1.6	.8	112.2	122.6
40	+ 2	+10	57.8	70.5	40.0	40.0	12.8	10.4	1.6	.8	112.2	121.7
40	+ 1	+ 9	57.8	69.9	40.0	40.0	12.8	10.4	1.6	.8	112.2	121.1
40	0	+ 8	57.6	69.6	40.0	40.0	12.8	10.4	1.6	.8	112.0	120.8
40	− 1	+ 7	57.9	69.3	40.0	40.0	12.8	10.4	1.6	.8	112.7	120.5
40	− 2	+ 6	57.8	69.1	40.2	40.0	12.8	10.4	1.6	.8	112.4	120.3
40	− 3	+ 5	57.8	69.0	40.2	40.0	12.8	10.4	1.6	.8	112.4	120.2
40	− 4	+ 4	57.8	69.0	40.2	40.0	12.8	10.4	1.6	.8	112.4	120.2
40	− 5	+ 3	57.6	68.9	40.0	40.0	12.8	10.4	1.6	.8	112.0	120.1
40	− 6	+ 2	57.6	68.9	40.3	40.0	12.9	10.4	1.6	.8	112.4	120.1
30	− 7	+ 1	43.2	43.4	30.1	30.0	9.7	7.8	1.2	.6	84.2	81.8
30	− 8	0	43.2	43.2	30.1	30.0	9.7	7.8	1.2	.6	84.2	81.6
30	− 9	− 1	43.2	52.0	30.1	30.2	9.7	7.8	1.2	.6	84.2	90.6
20	−10	− 2	28.8	34.6	27.6	20.1	6.5	5.2	.8	.4	63.7	60.3
20	−11	− 3	28.8	34.6	27.6	20.1	6.5	5.2	.8	.4	63.7	60.3
20	−12	− 4	28.8	34.6	27.6	20.1	6.4	5.2	.8	.4	63.6	60.3
20	−13	− 5	28.8	34.4	27.6	20.0	6.4	5.2	.8	.4	63.6	60.0
10	−14	− 6	14.4	22.3	13.8	12.9	3.2	2.6	.4	.2	31.8	38.0
10	−15	− 7	14.4	22.2	20.6	12.8	4.8	2.6	.4	.2	40.2	37.8
10	−16	− 8	14.4	22.2	20.6	12.8	4.8	2.6	.4	.2	40.2	37.8
10	−17	− 9	14.4	22.2	20.6	12.8	4.8	2.6	.4	.2	40.2	37.8
10	−18	−10	14.4	22.2	20.6	12.8	4.8	2.6	.4	.2	40.2	37.8
10	−19	−11	14.4	27.3	20.6	17.9	4.8	2.6	.4	.2	40.2	48.0
10	−20	−12	14.4	27.2	27.4	17.8	7.6	2.6	.6	.2	50.0	47.8
	Totals		1501.0	1846.4	1106.2	1030.3	333.0	260.0	40.2	20.0	2980.4	3156.7

19. The tables show that the salvos consumed by the site method in the long run are 12.4 per cent. greater at 2500 yards and 5.9 per cent. greater at 5000 yards than those consumed by the corrector method. Examination shows that the lack of ammunition economy by the site method is due entirely to the first range. The consumption at the second range is practically always less by the site method than by the corrector method. This is due to the more complete adjustment of height of burst

on the first range when the site method is used. The ammunition consumption for the third and fourth ranges is always less by the site method than by the corrector method. This is partly due to the more complete adjustment of height of burst on the first two ranges when the site method is used, but principally to the greater proximity to the target of the first range used in the case of the site method. The loss of ammunition at the first range by the site method is so great, however, that it is not entirely offset by the gains at subsequent ranges. It must be concluded, therefore, that the claim that the site method effects an economy of ammunition is not substantiated in the case considered.

But the case considered is favorable to the site method as compared with the corrector method because no assumption has been made and no consideration has been neglected to the advantage of the latter. On the contrary, as a re-reading of the last section in paragraph 11, of paragraph 12 and of sections (a), (b), (c) and (k) in paragraph 15, will show.

It is therefore concluded that for adjustment of time fire in indirect laying the site method will not save ammunition. In general, the time consumed in adjustment will be proportional to the rounds fired, but if, in the site method, the conductor of fire, after observing graze bursts, attempts mental calculation of reciprocal changes of site and range, considerable ultimate delay in giving data will frequently result. Also, in such case, No. 1 will have to make an additional change on the quadrant and the gun service will be slower. In short, the site method is not expected to prove the claims made for it.

But there are other objections. A particular advantage of careful preparation of fire and the use of an accurate range for the first salvo is that effect may be produced from the beginning. The site method deliberately raises the mean burst centre 8 or 10 mils above the plane of site and sacrifices considerable physical effect besides the moral effect of surprise losses.

Moreover, the method is admittedly not applicable in percussion fire or in direct laying. It is, therefore, not general.

20. Difficulty in the adjustment of height of burst is due to the scanty, often confusing, information which the firing affords as to the true position of the centre of the height of burst. While the site method will practically always give a group of bursts in air at the first salvo there is no reason to expect that on the second salvo much more information will be obtained in the general case than would result from the first salvo in the corrector method. So far as manipulation of the trajectory is concerned both methods are equally possible and equally accurate. The corrector method is the simpler and admits of simultaneous adjustments of range and height of burst.

21. An established method has the advantage that many are familiar with it. Now the established method in our service, and in all services provided with similar equipment, is to prepare the fire as accurately as possible, to use the data computed and to correct it by observation. The use of the site device to modify heights of burst is recognized as appropriate for particular cases but the corrector is used in the ordinary case. Misuse of either will lead into difficulties. Correct use of either will avoid them. A full knowledge of both and the correct application of them will leave nothing to be desired.

The Horse Supply of Austria-Hungary

BY CAPTAIN AUGUSTINE McINTYRE, 4TH FIELD ARTILLERY

In spite of the rapid development of the automobile, the modern army in the field still requires an enormous number of horses. It will probably be many years before horses are entirely superseded by the motor means of transportation. The transition will occur last in America, because in spite of the good-roads movement, it will be many a long year before auto trucks can go anywhere in our country under all weather conditions.

This paper is not submitted as anything in the nature of a suggestion as to how we should provide for our horse supply, but merely as a study for those who are interested in the different armies now in campaign. The reasons why this is not submitted as a suggestion, I think will be obvious to the reader by the time he has finished this article.

In the Austro-Hungarian Empire there were at the outbreak of the present war about 4,000,000 horses. Of these, 1,500,000 were in Austria, and 2,500,000 in Hungary.

Of the horses of Austria, that is, of the entire monarchy, excepting Hungary, the majority are small, mere ponies under 14 hands, so that from Hungary come the greater number of the horses for the army.

For war they considered that 600,000 horses would be required; but there is little doubt that this, like all other estimates, has proven too small for this war.

The government has for many years been spending much attention and money for the improvement of its horses, not only for military but also for economic reasons. All racing is government-controlled. Large purses are given by the government for the classic races, in which only mares and stallions are allowed to run. The government reserves the right to purchase

AUSTRO-HUNGARIAN ARTILLERY HORSE

AMMUNITION TRAIN HORSE, SWING, NEAR SIDE. THIS HORSE HAD HAD NEARLY A YEAR'S WAR SERVICE WITH BATTERY AND WITH AMMUNITION TRAIN

AUSTRO-HUNGARIAN CAVALRY HORSE

AN AVERAGE TYPE. THIS PICTURE WAS TAKEN AT THE FRONT. THIS HORSE HAD HAD AT THAT TIME ABOUT EIGHT MONTHS IN THE FIELD. NOTE ENTRENCHING TOOLS AND BAYONET OF CAVALRYMAN for use on the government breeding farms for fair prices any of the horses in these races.

There are two breeding farms pertaining to the court and seven breeding farms of a more public character.

These latter contain about 5000 horses, mares with the requisite number of stallions, and form the principal means of improving the type of horse throughout the monarchy. The English thoroughbred, Arabian and the Spanish bloods are represented.

From these breeding farms come the stallions which are used throughout the country. There are about 5000 stallions distributed in about 1500 stations and any mare suitable may be bred without cost to the owner.

It is perfectly apparent how in a very few years such a breeding method would improve the average. And when it is considered that the Hungarian horse, from which most of the horses are obtained, was at the beginning a very sturdy animal, the general excellence of their horses is explained.

They have no breeding farm for the army alone. The method of obtaining horses for the army is as follows:

In time of peace they need about 14,000 horses a year. These horses are bought by nine remount commissions. The prices vary from about $120 for pack horses to $240 for heavy Artillery horses. Their specifications are about the same as ours, but there is a very strong and newly acquired sentiment among the cavalry officers for smaller but well-bred horses. Of this 14,000 forty per cent. are colts from 3 to 4 years of age which are given a year's training at seven regularly established training camps or schools. The remaining sixty per cent. are grown horses, 4 to 7 years old, and are issued directly to troops.

The military service of a saddle horse with the colors is eight years and for draft and pack horses ten years. Under these conditions, the cavalry receive twelve per cent. remounts a year and the artillery and train ten per cent. After a horse has completed his service he is given to a farmer in the district for use under condition that he take good care of him. Once a year during maneuvres the horse must be returned for four weeks' service. After five years he becomes the property of the caretaker. Of course by that time he is an old horse, but still useful. At the beginning of this war there were about 30,000 such horses called into service.

The above account gives roughly the Austro-Hungarian method of obtaining horses for the army on a peace footing. To obtain horses promptly in case of a mobilization, they use the following method. Assuming for war they need about 500,000 horses at once, of which about thirty-three per cent. are saddle, thirty-three per cent. artillery and heavy train, and thirty-three per cent. supply train horses and pack horses, they make the following arrangements:

The entire monarchy is divided into seventy-six districts, each in charge of a retired or reserve officer with necessary assistants. A horse census is taken every ten years at the same time as the ordinary census. Every two years there is an inspection of horses in the districts.

Every horse owner must on a certain day bring all his horses to the place of inspection. Each horse is examined. From all the horses examined the requisite number for the district is selected, due consideration being given to avoid inflicting too great hardship on individuals. A record is kept of each horse, and the owner is given a copy which gives him all the necessary instructions. The penalty for non-compliance is severe. The essential feature is that upon an announcement of mobilization all horses selected must be delivered within twenty-four hours at the place designated. Of course there are certain exemptions from these inspections, such as mares in foal and the like, but the general method is all that this article is intended to cover. There is a stipulation that deaths, injuries and the like must be reported by the owner. The price paid for horses procured in this way is ten per cent. more than the last peace price. They are paid for upon delivery. The number of horses required from each district is fixed by the proper bureau of the War ministry.

The small horses or ponies referred to at the beginning of this article are used in the small peasant wagons of the country in the rear trains, but, on account of their efficiency, many have crept well up to the front. In the inspection for these horses is also included an inspection of the wagons and harness pertaining to them and in case of mobilization these too must be brought in within twenty-four hours. The prices to be paid for the wagons are fixed at the time of the inspection. There are also thousands of these teams which have not been bought, but are hired. A wagon with two ponies and driver costs about $2.00 a day. Rations for driver and forage for horses are furnished by the government.

This is merely an outline of the horse-supply system in Austria-Hungary. Their scheme of "Preparedness" is based upon the sound principle that no plan of action can be formulated unless it is based upon their actual resources and not upon vague possibilities. And their scheme of "Preparedness," of which this particular subject is a very small part, includes all their resources.

The Scout's Note Book

EXTRACTS FROM *Mon Carnet d'Eclaireur*, THE DIARY OF A YOUNG FRENCH CORPORAL, TRANSLATED FROM THE *Revue des Deux Mondes*, AUGUST, 1915, BY GEORGE NESTLER TRICOCHE, LATE LIEUTENANT, FRENCH FOOT ARTILLERY.

The value of these personal impressions of an artillery scout is enhanced by the comments of the translator who is familiar with the details of our own service as well as those of the French Field Artillery. We are also indebted to him for the synopsis of the diary which it was not practicable to quote in full.

The diary begins with an account of the mobilization of the battery, from the standpoint of a corporal; it completes to some extent the interesting *Contemporaneous Notes* published in THE FIELD ARTILLERY JOURNAL for July-September 1914.

When the war broke out, this particular battery was stationed at Troyes, Champagne.

The batteries, which had gone away in order to test a new "75" matériel, came back to the barracks during the night of July 28. . . . That night, I hardly slept. The drivers who had remained at the depot were already receiving the first requisition horses, and going for the others. Guard duty was much more heavy than it generally is, and I had to attend to it. . . . Mobilization began early in the morning (28th). From the first, one could surmise, on account of the following signs, that it was, this time, a serious affair: issuing of the identification discs, of real war bread loaves, of genuine first aid packages, which, hitherto in the drills, had been represented by slips of paper, etc., etc. Then the fatigue parties sent out to get, from the stores, loaded caissons, war uniforms and accoutrements, young remount horses, forage, oats and war rations, etc.[1]

[1] In the French Army, at the mobilization, the men receive new uniforms, which are always ready in the battery stores, and gathered in bundles labelled with the men's names. In each regiment of field artillery, a certain proportion of young horses, sent out from the regular remount depots, form a regimental remount, which is under the direct supervision of the regimental commander. At the mobilization, these horses are, as a rule, allotted to the different batteries, even if they are not absolutely "broken." They are eagerly sought for by the sergeants and corporals. In this particular case, the fact that our corporal obtained a fine mare from the regimental remount enabled him later, to be detailed as a scout, a very much coveted situation, almost a "berth"!

During the day, the armorers sharpened the sabres, which caused some excitement among the youngest men; the litter bearers practised their art on privates detailed as "wounded"; and reservists turned in. On the night of Thursday and very early on Friday, the remainder of requisition horses arrived. The battery forges were placed in the open air ring of the riding yard; and horses were shod and numbered as they were brought in. The officers did not leave the barracks:

The captain could not make up his mind to go to bed, as he was worried by the thought that he might forget something. The lieutenant had the greatest pains in prevailing upon him to lie down for a little while on a noncommissioned officer's bed.

At noon, on the 29th, the batteries walked their horses around the ring, to try them:

It was truly beautiful: brand new uniforms, harnesses fresh from the harness store room. . . .[2]

The firing battery was about ready. It consisted of the first *six* sections, without any reservists, since the three year service law had left enough men under the colors to complete these six sections with *active* privates and noncommissioned officers.[3]

The *échelon's* formation began in the afternoon, as well as that of the regimental train. The former consisted of the 7th and 8th sections, the latter of the 9th section. When night came, very little had been accomplished.

The firing batteries left, separately, on Saturday the 80th, from 7 A.M. until 3 P.M. When a battery filed out of the barracks,

[2] Artillery draft horses are provided, at the mobilization, with entirely new sets of harnesses. This improvement was made, among other "thankless jobs," early in the eighties, by the Chief of the Artillery Bureau at the War Department.

[3] The fact that no reservists are placed in the firing battery seems gratifying to our corporal. This, however, would not be particularly desirable in the event of a war breaking out soon after the arrival of recruits. The only real advantage of the proceeding appears to be that the firing battery could be ready sooner; yet from what we know of the mobilization work of the artillery, it seems established that the reservists were all in at the time the firing batteries left for the front. It takes less than an hour to equip the reservists of a battery from the moment they report at the office.

the regimental standard, with an escort of two men, was displayed in front of the guard house. There was no flourish of trumpets; but officers and noncommissioned officers saluted as they passed:

The *échelons* started only on Monday, the 3rd of August, in the evening.[4]

The corporal, who was not yet a scout, had left with the échelon, in charge of twenty-seven horses.[5]

The different elements of the battery were not brought together before 2 P.M., Tuesday, the 4th of August, after the échelon had travelled about nineteen hours by rail. The battery was not far from the frontier. For some days, the daily routine remained the same: reveille at 2 A.M.; battery ready to start soon after, before the men have had a chance to cook any breakfast; then a long, tedious, useless wait. Either the battery did not start at all, or else the order for marching was given several hours afterward. Owing to the uncertainty of the battalion's movements, men could not cook their rations, and horses remained harnessed and hitched. Later on, as battery officers became more familiar with the situation, it was taken for granted that the morning wait was to be long, men were allowed to eat, and horses were unharnessed.[6]

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[4] Theoretically, the battery is divided into three "échelons": firing battery, battery combat train, regimental train. Usually, the term "échelon" applies only to the 6th, 7th, and 8th sections, consisting of six caissons, the forge, the battery wagon and the led teams. But it seems that, in the regiment in question, the 6th section had been united with the firing battery, at least during the mobilization work, for the corporal's diary specifies that the "échelon" had only the 7th and 8th sections. It is possible that, as it was not practicable to send ahead, to the frontier, the complete battery on the 30th of July, and the échelon properly speaking could not join the firing battery until three days later, it was deemed advisable to give the captains three caissons more (those of the 6th section). We see no other reason for this departure from the established rules.

[5] This particular battery must have been sadly depleted as far as noncommissioned officers are concerned: a single corporal is not supposed to be in charge of so many teams or saddle horses.

[6] From this, one is led to infer that, in regards to useless fatigue caused to man and beasts, there has been little improvement since 1871. These long waits—or *drogues*, as they are called in army slang—have always been conspicuous in the military operation, or even in the ordinary routine of French troops. Efforts have been continually made, however, to put an end to such practices. Not very long ago, in Paris, a cavalry lieutenant, who had to bring an escort platoon to the Presidential Mansion, was punished for arriving there 45 minutes ahead of time.

The battalion remained quartered for a few days in the same village. So the major ordered some battery drills, mounted. This did not seem to please the men, who would prefer to fight. The scouts, etc., were organized and began their work:

On the 9th of August, a swift reconnaissance as far as the frontier to reconnoiter some battery positions, at the trot or at the gallop all the time along the crests. I shall always remember the words of the lieutenant who was guiding us: "It may be," he said to us, "that we should be disturbed by hostile cavalrymen. In that case, we'll rush down upon them!"

The scouts were delighted at the idea, and made sure that sabers could easily be drawn, and revolvers taken out of their holsters. But the Uhlans did not put in an appearance. The scouting party covered thus about thirty kilometres in three hours. Reconnaissances of that kind were made every day. At last the order was given to start. Troops of all arms were seen in all directions.

On the 14th, early in the morning, we came across the Cavalry Division from Lunéville (minus the Hussars) and its artillery with the "75" short, new model.[7]

This day, the battery was under fire for the first time. Their work done, the scouts took shelter behind the talus of a road:

We must be pretty safe there, for three wounded men come to join us. And so, we remain in that hole. How hot it is! Suddenly: zee . . . zee . . . We jump up, our hearts begin to beat faster. But it is not meant for us: two *fusans*[8] aimed at the firing battery, too short and too high. They burst almost timidly: pee-oo . . pee-oo . . . The velocity of their bullets is much inferior to that of ours. Our first emotion subsides pretty soon; as we know that we are in the dead angle, we feel safe. But the firing batteries are more exposed and we are worried about them. . . .

[7] This artillery was a battalion of horse batteries. Most of these units had been supplied with a new gun of the calibre 75, lighter than that of field batteries.

[8] Shells provided with a time fuse.

During this engagement, some infantrymen, made uneasy by shells against which they had no protection, left—without orders, it seems—a wood which they had been occupying; and came to the sheltered position of the scouts, and soon became reassured at hearing the booming of the "75".[9]

Then, very easily, their (infantry) officers led them back to their old position. Indeed, we artillerymen had explained to them in such a masterly way the reasons of the inefficiency of the German shells (wasting of the cone of dispersion in an upward direction); and we had, on the other hand, extolled so tremendously our own matériel that their morale had entirely re-asserted itself . . . and so did ours, too . . .[10]

German spies were at work everywhere. Within the French lines, at Arracourt, one of them had stationed himself in the steeple of the village church, moving the hands of the clock back and forth according to a code arranged beforehand, so as to assist the German artillerymen in adjusting their fire against the French batteries.[11]

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[9] In many newspaper reports, private letters, etc., we find similar statements in regards to the moral support afforded to the infantry by the "good 75." The confidence of the *fantassin* in his comrade of the artillery manifests itself in many ways, and sometimes in a touching manner. In this phase of the campaign, the appearance of a battery was often greeted with shouts of joy; and infantrymen, not infrequently, rushed towards the artillery column proffering their canteens full of water to the tired and dusty cannoneers. Usually, on such occasions, the thankful artillerymen, in turn, promise to their brothers of the "foot" the hearty and mighty help of the "75."

[10] This plain instance of moral support given by the artillery to the infantry is particularly interesting, it seems, if one refers to a recent statement by the French infantry colonel Baron d'André, who appears to be somewhat jealous of the fame of the "75," and of artillerymen in general. He goes as far as to say that in the present war, at least on the French side, infantry is self-supporting in the attack as well as on the defensive. From personal experience, he quotes a number of instances in which his regiment did not rely at all on the field batteries for the preparation of the attack or for the support of the retreat. While no one should deny that the infantry is "the queen of the battlefield," it is hardly possible to agree with Colonel d'André when he asserts that artillery is no more useful to the infantry than the commissary department. All official and unofficial reports of the operations since the beginning of the war have recognized the material as well as the moral support given to the infantry, not only by the "75," but also by the heavy guns. In as far as the present phase of the campaign is concerned, an attack on hostile trenches seems to be always prepared by a violent artillery fire. On the other hand, notwithstanding the colonel's assertion that "good shots behind a breast work make it impregnable," infantry was absolutely helpless in every fortified place attacked by the large German or Austrian guns.

[11] To our knowledge, there is at least another instance of that method of observation, mentioned in a private letter as having been used against French heavy batteries near Reims. Another proceeding has been described by us in the October-December, 1914 number of THE FIELD ARTILLERY JOURNAL. Especially at the beginning of the war, French batteries were much better defiladed than the German ones, and the latter had to use many expedients in order to adjust their fire; French guns were so cleverly hidden that hostile aeroplanes were often unable to locate them.

The battery remained unlimbered for many hours on the same position, and the scouts, on the rear, did not know how to kill time. Finally the corporal went down to the village to water his horse and get some victuals for his fellow scouts, the telephone men and himself.[12]

In the evening, as fire had ceased altogether, the limbers and all the horses were brought back to the battery's position. The men laid down in the wheat fields and tried to sleep. But soon the order came to repair to some village to quarter for the night. But as the roads were crowded with trains the battery did not reach its *cantonnement*[13] before 1.30 A.M. As reveille was at 2 A.M., it was not worth while quartering men and horses. The battery halted and waited.

On August 15, the battery suffered some losses:

An accursed aeroplane marked the location of the batteries' limbers; and three "big blacks"—as they had been nicknamed—fell upon them. One limber exploded and we had some men killed and wounded. As for the horses, there were about twenty-five of them disabled in the two batteries. Some stampede occurred. A few men tried to stop the maddened animals. Finally, the calm of most corporals and of the first sergeant put an end to the trouble. The teams were speedily completed or replaced with the horses of the échelon. This accident

[12] The lack of rolling kitchens has been severely felt by the French. In Germany, Russia, and even Switzerland, men of the *échelon*, and even those with the limbers, are easily supplied with rations; and, during the lulls that occur in the firing, cooked food can be carried from the sheltered position of the limbers to the personnel on the firing line. With the present system in use in the French army, meals are extremely irregular, unless batteries have become almost stationary, and have established regular kitchens. In what could be termed the "semi-stationary condition," there is, as a rule, time enough to cook rations at the *échelon*; but there are many difficulties, because part of the cooking outfit remains with the men's kits on the limbers of the firing battery.

[13] In the *cantonnement*, houses and barns, etc., are taxed to their utmost capacity. On the march, farther from the front, men are only billetted, (*logés*), two or three together, in the different houses.

The practice of quartering (*cantonner*) troops for the night seems to be carried a little too far by the French, especially in warm weather. In this particular case, it would have afforded the men and horses a better rest to allow them to remain over night in their position, even if they had no shelter tents—so much the more so because the position was to be occupied again next morning. Men could have cooked their rations in the late evening, instead of 1.30 A.M.; and they could have slept instead of waiting in column on impassable roads. The French took the *cantonnement* habit—which is indeed a very good one in ordinary circumstances—from the Germans, after the war of 1870–1871. During that war, even in midwinter, when close to villages offering plenty of shelter for men and horses, the French slept under shelter tents.

was a good lesson for us; henceforth, the limbers were sent sufficiently to the rear and well sheltered.

The battery changed position; but, finally, came back to the old one, which was satisfactory, since the German percussion shells did not do any harm, although falling near the guns. The want of heavy artillery was felt from the first, for the corporal writes:

On the morning of the 16th (Sunday), the Germans remained quiet. . . . One of their heavy batteries had been silenced by our 120-millimetre guns, which had arrived at last. Ah! the heavy artillery. . . . How we had deplored its penury at the beginning of the war! Fortunately this was remedied, and we are able to fight successfully their "130," "150" and "210," which outrange our "75."

On the 16th, the batteries started on a hollow road which soon proved almost impassable on account of mud and ruts; and a culvert sank under the weight of a gun.

Already, the batteries had become more stationary. Guns remained in position even during the night. In that case, the *échelon*, pretty far in the rear, had all its horses unhitched. Food was prepared there for the men of the firing battery as well as for those of the combat train.

One night, the guns were almost surprised by the Germans. But the two infantry companies detailed as artillery support repulsed the attacking party in a bayonet charge:

A moment afterwards, the Bavarians try to storm us again. Our search-lights had discovered, on the rear of the first hostile line, some important reinforcements—about a regiment—advancing in close formation, by fours, in two columns. What a target for our captain!. "Range: 1500 metres; by ten; zone fire; three rounds!" To comprehend the intensity of such a fire, one must remember that our four pieces were firing, as quickly as possible, ten projectiles each, searching an area of 150 metres by 600.

The attacking forces wavered, then scattered in all directions. The French gunners were jubilant:

The captain shouts: "Same as before! Fire at will! Empty the chests!"

Each gun fired twenty shots more, at full speed. The din was deafening. The cannoneers went crazy with excitement.

The captain was shouting, getting hoarse: "Faster, faster!" It was awful; one could not see anything; one could not hear any more. The horses, maddened, could hardly be kept in their place. This was indeed a terrible moment, enervating to the extreme.

Then suddenly: silence. The overheated guns are limbered up; and the battery goes on at a fast trot. It is useless now, since ammunition is exhausted. The battalion places itself on the road side, where the replenishment of ammunition takes place. When caissons and limbers are filled up again, everybody is soon laying down near the guns and falling asleep, the ears still full with the noise of the terrific cannonade.

Later on, at Flainval, the battalion occupied part of an extremely good artillery position. But the observing stations were 1800 metres from the batteries—which is somewhat hard on the telephone operators. These stations were much exposed; scouts, while on their way between the stations and the firing batteries, were good targets for the enemy, who could not see the guns. The battery remained there two weeks. It was the scouts' duty to carry to officers, signalmen, and other men detailed at the observing station the rations cooked in the rear—presumably at the *échelon*. Finally, as there was no use for him in the capacity of a scout, the corporal was ordered to alternate with the trumpeter in holding the observers' horses. So, every morning, he went up to the observing station with the detail, and brought back the latter's horses to a sheltered position in the rear.[14]

Already, shelters of some kind were built for the firing battery:

We dug a trench long enough to contain eight men in a row, and as little wide as possible (we could hardly sit in it); and about one and

[14] According to the regulations, such horses are to be led "to the vicinity of the limbers." It seems that, in this battalion, they were kept as far as practicable between the firing battery and the position of the limbers; and sometimes near the former. The corporal reports that on several occasions these animals, and himself, had a narrow escape from shells aimed at the firing battery. It is not easy to understand why the horses of the observers, etc., were not sent much farther to the rear, close to the limbers for instance, since the battery was to remain for days on the same spot.

a half metres deep. Above: strong branches and limbs, covered with straw, support a layer of earth fifty centimetres thick. This makes a cover affording a good protection against small fragments of shell, etc.

Then they "dressed up" the battery; that is to say, the men cut off large limbs of trees, having plenty of leaves. These limbs were planted in front of and at about four metres from the guns, on several rows. Other branches were placed on or close to the shields, and between the wheels and the body of the caissons. Thus "dressed up," a gun and its caisson could not be seen, sometimes, *at one hundred meters*. The only trouble was that these limbs had to be replaced often, because the leaves fell off and everything became more or less shattered after a few salvos, by the vibration and other causes.[15]

Ammunition was lavishly expended: it was not unfrequent to empty *two* caissons—144 shots—*per piece*, in a single morning.

The corporal did not relish his new duties, which compelled him to remain with the horses in some bottom, where he could not see what was going on. So he formed the habit of tying his charges securely to trees or fences, and going up to the firing battery, "just to look on."

I remember, one fine afternoon, just as I was reaching the battery, the latter was doing some rapid firing. These men, bare breasted, red, sweating, surrounded by flames and smoke gave me the impression of a band of devils, busy with some hellish cooking!

It is a fact that the personnel of the firing battery, even though it worked harder, was calmer than on the battlefields of the previous wars. Unable to see, not only the enemy, but—often—anything else than the crest in front of the guns, cannoneers acted like mere machines as long as the hostile fire was not perfectly adjusted. And the latter seldom was, so far as

[15] It must not be forgotten that this refers to the first two or three months of the war. Since then, the science of hiding the guns and their crews has made great progress. Some officers have gone so far as to paint images of branches or leaves upon the shields of the larger guns, such as the "105" and the "155."

this particular battery was concerned. For *three* days (in the same position), the German shells fell at least 500 metres short. On the fourth and following day, thanks to the observations of one of their aeroplanes, the Germans got a better range. Yet, in this particular battery, the only damage done was one cannoneer wounded and a gun brake perforated. During the fifteen days' fight in the same position, besides what we have just mentioned, the two battalions had only to report:

At the 6th battery, one empty caisson broken to bits by a *marmite*.[16]

At the 2nd battery, 1.: one caisson exploded (some men wounded). 2.: one *marmite* falling upon the limbers' station (some men and horses killed).

The scout was right when he said:

This comparatively scant damage during a fifteen days' bombardment demonstrates clearly that the big German shells are little to be feared. We received, in fact, only shells of the 105 calibre and above, including the "210." Fired at a very long range, they came slowly; and their prolonged whistling warned us generously to hide in our shelters.[17]

Hostile aeroplanes were, naturally enough, the bane of a cannoneer's existence. Whenever one of these aircrafts came within reasonable range, the guns were immediately aimed at it. Not infrequently, the two battalions fired together at a single aeroplane.[18]

In this phase of the campaign, at least in the engagements witnessed by the writer of the diary, the Germans did not try to keep their batteries of 77-millimetres within the range of the French "75" (7500 metres). Once, the captain, "just for fun," opened fire against a German battery which was at about 8000 metres, and which, of course, he did not expect to hit. When the Germans saw the shells bursting nearer and nearer to their guns, they limbered up and withdrew.

[16] "Kettle": nickname given to the heavy German projectiles, generally the 210-millimetre.

[17] The men use often as shelters, in such case, the craters made previously by the German *marmites*.

[18] We do not see, in the diary, one single case when a French aeroplane helped the battery to get rid of these troublesome visitors.

Sometime afterward, the corporal, being unwell, was sent to the regimental train to recuperate. His life there is devoided of interest. The diary contains a picturesque sketch of the battery commander's character. This officer, a typical French soldier, is represented as nervous, quick to anger, but very just and extremely fond of his men. We see him summoning his chiefs of section to find out how many men were too poor to buy sweaters, and purchasing these articles with his own money; all this in his gruff, businesslike manner, which hides a very kind heart. Excitable as he was, this battery commander was known, nevertheless, as one of the best "fire adjusters" of the Field Artillery. He was destined to fall on the battlefield, where he died stoically.

After the battle of the Marne, the Army Corps to which the battery belonged was shifted from the Eastern frontier to Normandy. It was a long trip by rail, on a line crowded with military trains. The men were glad to pass through their old garrison town, Troyes, even if they did not stop. At Versailles, and other cities, they were welcomed and entertained by the populace which almost mobbed the railroad cars. Finally, the battery detrained and went by easy stages towards the northern frontier.

> On Sunday, 27th (of September),—a fine day—we have the pleasure of seeing, on their way to the rear, the field batteries taken from the Germans. I was able, by manipulating the German gun of 77-millimetres, to realize how inferior it is to our "75." It is a *thrashy* matériel, poorly devised, and badly constructed. . . .[19]

[19] The diary stops here. From an editorial note in the August 1915 number of the *Revue des Deux Mondes*, we infer that the corporal, who had been commended for bravery in a General Order of the Army Corps, was wounded, and left his battery.

Breaking Artillery Horses

BY CAPTAIN WILLIAM P. ENNIS, FIELD ARTILLERY

No matter what conditions may bring about the organization of additional batteries of field artillery, each new battery will present to its commander a definite and exceedingly difficult problem in horse-breaking and horse-training.

Some batteries will receive partially trained horses, accustomed to draft on the farm or on the city street. Others will receive unbroken range horses.

The presentation of a detailed method of dealing with unbroken artillery horses is considered especially timely. Captain Ennis tested his method for three years at the Fort Reno Remount Depot. He put it into practice successfully when Battery A, 1st Field Artillery, received an entire remount in 1912.

It is probable that in the event of a sudden increase in the Field Artillery, many of the horses would come from the range, a large number of them not being even halter-broken. Under these conditions, the entire training would devolve upon the battery commanders.

PRELIMINARY STEPS

Before beginning the breaking, it is necessary to equip the horse with a halter- and neck-rope, the latter of one-inch rope, with a length of about fifteen feet, in addition to the neck-loop, the end of the rope to pass through the chin-strap of the halter. (See Fig. 1.) These can be adjusted by driving the horses singly into a chute. The operation being completed, the animals should be turned loose in a corral for about twenty-four hours, where, by constantly stepping on one another's neck-ropes, they do much towards halter-breaking themselves.

The following day, by quiet work, the trainer can get hold of the halter-rope, and with the assistance of another man in rear of the animal, tie it securely to an unyielding object, the horse not being allowed more than three feet of rope. (See Fig. 2.) A large rope is necessary in order to prevent all possibility of its being broken. The use of the rope for two months, or until the horse is thoroughly broken, eliminates all chance of a pull-back; indeed, it is wise to use it on all new horses, whether broken or unbroken, as there are always halter-pullers in every new consignment.

The horse being tied, the trainer, by very slow and careful movements, works up to the animal, at first feeding from the hand with a little hay or grass. Unless absolutely necessary for self-protection, no sudden movement should be executed while anywhere near the horse. In a short time, the man should be able to place his hand on the animal's head, then on his neck, and so on. After each step accomplished, the horse should be given something to eat, as a reward and as a means of gaining his confidence.

TEACHING TO LEAD

As soon as the horse allows his back to be rubbed, he should be taught to lead with the halter-rope. This not only gentles him, but is a great convenience in moving him about. It can be done in a few minutes by dropping a loop over the croup, the man carrying the end of the rope to the front and standing there, as shown in Fig. 3. The trainer now pulls on the halter-rope. If the horse refuses to move, a jerk of the rope leading to the croup-loop will move him forward a step or two. This is repeated until the horse responds readily, which will generally be within five minutes.

HANDLING THE FEET

The gentling is now continued until all four feet can be easily handled. During this handling, the horse should always

FIG. 1

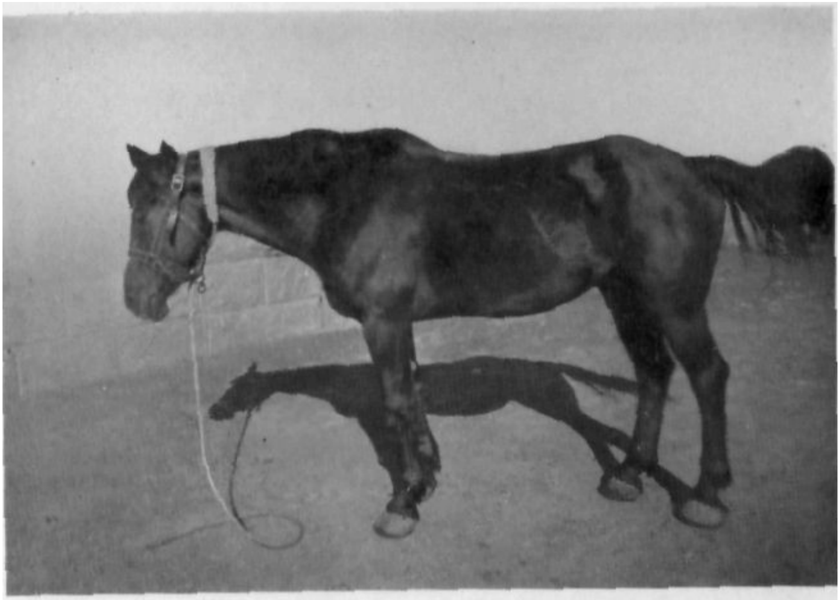


FIG. 2

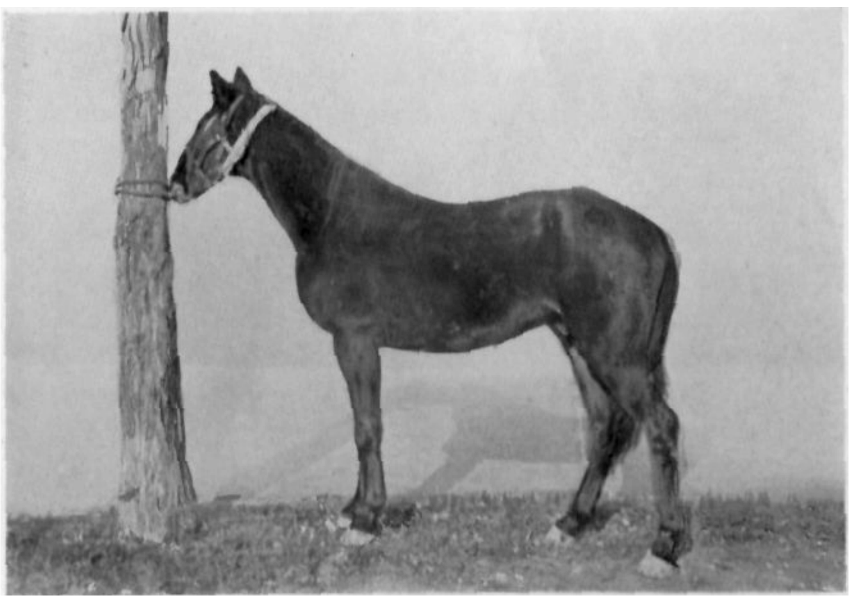


FIG. 3

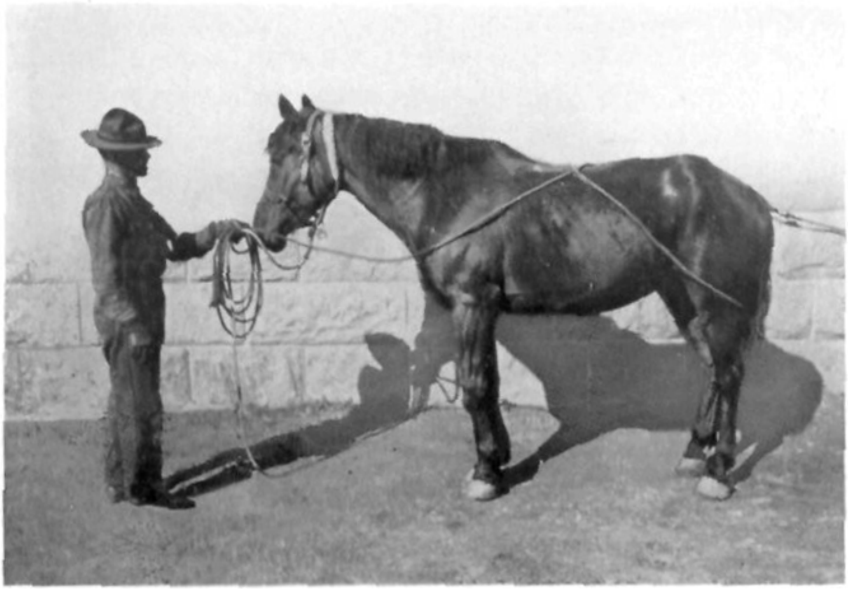
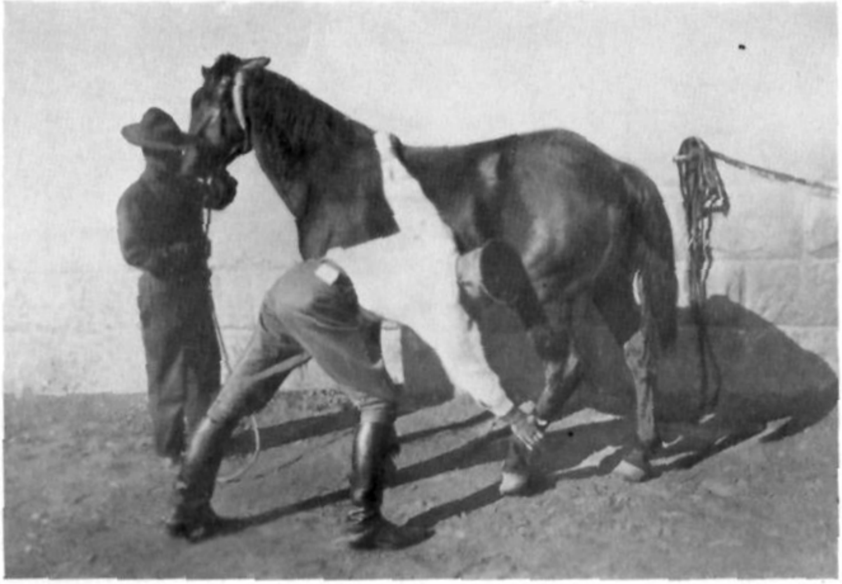


FIG. 4



be securely tied with a short halter-rope, thereby avoiding much danger to the trainer. The safest method of working with the feet is to grasp a lock of the mane with the hand nearest the horse, using the other hand for the feet. (See Fig. 4.) This does away with all chance of the trainer's being thrown to the ground by a quick move of the horse.

MOUNTING AND BITTING

The horse, having become accustomed to the handling of his feet, must be taught to allow the man on his back. For this, the animal must be snubbed very close to an immovable object about five feet high. Under these conditions, it is impossible for him to buck. The trainer begins by getting a good grip of the mane, with his left hand, places the right elbow across the horse's back, and leans on the horse. While gradually increasing the time of leaning, he also gradually gets a little farther up on the horse's back. When the horse quietly submits to this treatment, the trainer leaps entirely up and mounts. If the horse jumps at all, the rider must remain on the animal's back until the latter becomes quiet. The horse should be petted on neck and back and the rider's feet moved along his flanks, these motions being continued until the animal ceases to show fear. This being accomplished, the trainer mounts and dismounts from both sides, repeating the action until the horse no longer objects to it. These steps, with the handling of the feet, grooming, hand-feeding, etc., should be continued until the horse accepts them quietly. During the last period of this period, a snaffle bridle without reins should be placed in the horse's mouth. The bit should never be forced into the animal's mouth, nor should the ears ever be handled roughly, as either of these things will produce head shyness which cannot be overcome for a long time. A little grain in the hand holding the bit will induce the horse to open his mouth, when the bit can be easily slipped into place.

At this point the horse can be mounted bareback, and the reins attached to the bit. An assistant next grasps the halter-rope and gradually starts the horse, then leads him about, starting and stopping him frequently. When the horse loses all fear, the rider alone can take him, always remembering that the least roughness in handling will probably lead to trouble.

SADDLING

As soon as the horse goes well at a walk, he can be saddled. To do this, snub him as before; very carefully put the blanket on and off several times; put on the saddle; fasten the girth loosely; rub the stirrups lightly against the sides of the animal, repeating each separate movement until the animal no longer shows fear. When the horse accepts all this without protest, the trainer should mount and move the stirrups freely with his feet, in order to accustom the animal to them. This result being achieved, the horse may be ridden with the saddle as in bareback. By gentle handling, he soon becomes bridle-wise.

HARNESSING

The next step is to harness. Snub the horse again and, if necessary, adjust a Scotch hobble, as shown in Fig. 10, and fully described farther on in this article. Place the blanket and saddle quietly on the horse's back; raise the tail and place the croupper in position several times. Always fasten the girth lightly as soon as the saddle is in place, to prevent the latter falling off and frightening the horse.

The collar is the next part of the harness to be put on, and this requires more care than any other piece. A little carelessness or roughness may cause months of trouble, and even make it impossible ever to use a collar on this particular animal. The horse should be allowed to smell the collar, and the collar should be moved gradually close to the horse's neck and rubbed against him until it no longer alarms him. Then the collar should be placed around the neck (Fig. 5). With the aid of an assistant,

FIG. 5

FIG. 6

FIG. 7

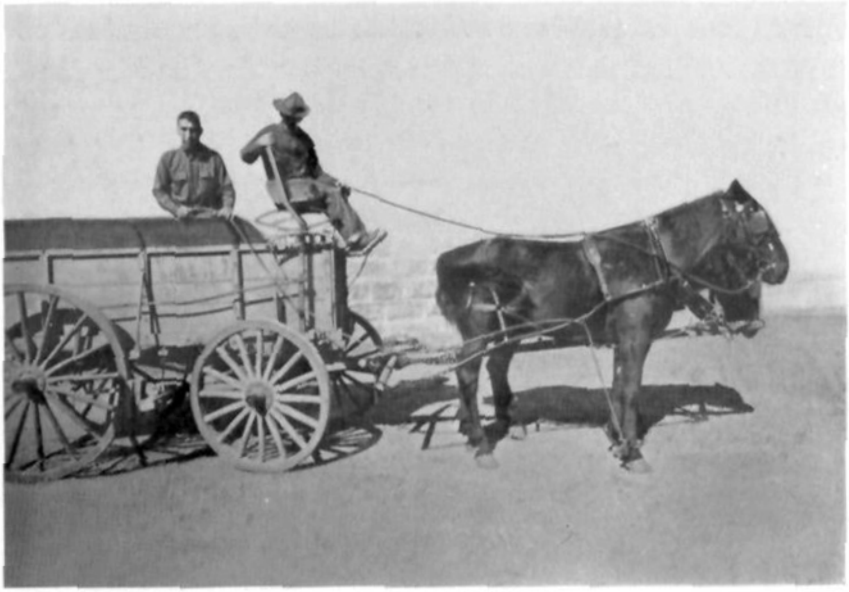
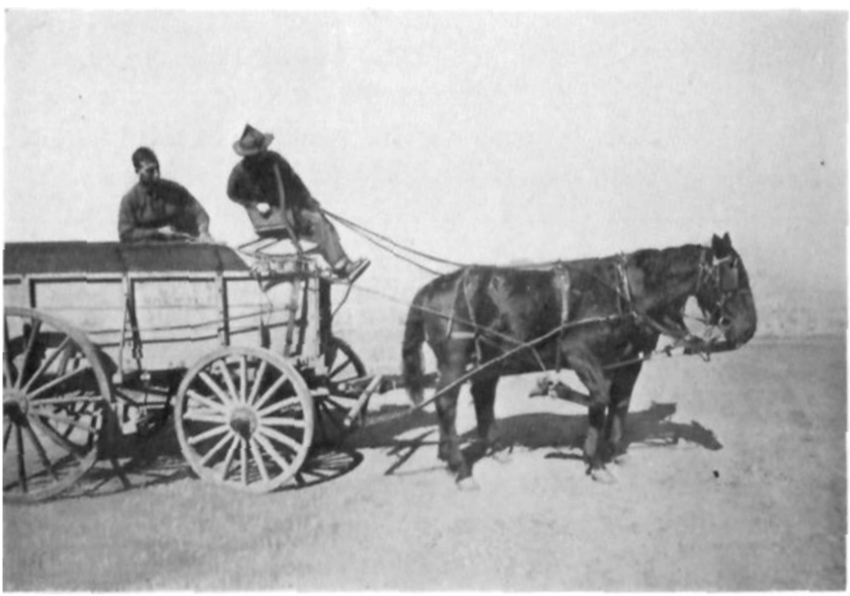


FIG. 8



the trainer gradually closes and buckles the collar (Fig. 6) and fastens the collar-strap to the saddle. It is most important that neither man should release his hold on the collar until it is latched and the strap is fastened, for if the hold is loosened and the horse jumps, the sharp part of the buckle will gouge the shoulders; and if the collar is latched, but the strap not fastened, the collar will hit the horse behind the ears and badly frighten him.

Next, remove the Scotch hobble, if used, and the neck-rope and lead the horse about. If he goes quietly, he should be unharnessed and harnessed several times. The neck-rope always being securely fastened to a secure object, and the same care exercised in unharnessing as in harnessing. If this can be accomplished without frightening the horse, there will be no further trouble in harnessing him.

Never leave the collar on a new horse without fastening the collar-strap to the saddle; therefore, never place the collar on the horse until the saddle has been put on and fastened.

The traces next being put on the animal, he is ready to put in a team.

THE TEAM

The first horses to be hitched should be the two wheel horses which, up to this point, have shown the quietest dispositions. A field wagon with regular driving harness is the best vehicle to hitch to, but if this is not available, any of the carriages can be used, with driving reins of rope. A half-inch rope should run from the wagon, through a ring on the trace about two feet from the collar, to a strap around the fetlock of the outside foreleg of each horse. (See Fig. 7.) Each of these ropes should be held by a man on the wagon. If a horse misbehaves, the man holding his leg-rope should pull hard on it, thereby raising the outer foot. (See Fig. 8.) Deprived of the use of one leg, the most unruly horse cannot go far. As soon as the horse becomes quiet again, the tension is released and he is allowed to use the leg unless he again misbehaves. When one horse becomes tractable, he should be used under the saddle to break the off horses and the new near horses.

The lead horses should now be broken, the gentlest ones being tried first in the off wheel and then in the near lead. When the near leader works satisfactorily, the off leader can be easily broken in the off lead position.

If some of the horses refuse to move when first hitched, men should be ordered to lead them, getting them to move by gentle handling and, if necessary, the carriage should be moved by hand until the horses are well started. *Whipping, or any kind of roughness, should not be tolerated*. Never forget that, if properly handled, about ninety-nine per cent. of horses will willingly obey as soon as they understand what is desired.

Never let a horse lunge into the collar, as this bruises his shoulder and will probably make him fear the collar. Do not expect the young horse to pull immediately; if he will walk along quietly, it is all that can be expected. At the end of a week, the average horse will come to the collar nicely, a little encouragement being all that is required. Bear in mind that it is always easy to make a horse pull, but that it is very difficult to prevent a too free horse from working too hard.

When the wheelers and leaders are working quietly, the swing animals can be hitched in the team, a near leader being used for a near swing until the near swing has been tried out in the off swing position and is working quietly. The most difficult horse should be the last one hitched, and should then be placed in the off swing with five reliable horses in the other positions. If he is a very fractious animal, the leg-rope should be used on him and the rope handled by a man on the carriage. A halter-rope from the halter of the off horse, fastened around the pommel of the near saddle, was found to be advantageous, in that it prevented the breaking of coupling reins, and avoided injury to the mouths of obstreperous horses.

DRAFT

After all the horses are working well in the teams, they should be taught to pull by gradually applying the brakes. In the first part of draft training, care should be taken to avoid stalling the team, or tiring it by excessive pulling. If a team shows signs of stopping, the drivers should stop it immediately, so that the horses will not get the idea that the load stopped them. In the early stages of draft training, it is important, also, to avoid overloading, as at this point it is likely to produce balkers.

NECK-REINING

The horse can be trained to neck-rein by the following method: He should be taught first to turn on the forehand to right and to left, a light tap of a switch being used to augment the pressure of the heel. When the horse will move his haunches by the application of the heel, the neck-reining proper should begin. Turning to the right is accomplished by carrying the left rein against the neck, the right rein being opened wide, the right heel tapping the right flank of the horse. If the horse fails to turn to the right, a slight jerk should be given to the right rein, and the action repeated until the horse obeys. Turning to the left is taught in the reverse manner.

BACKING

In teaching a horse to back, the trainer mounts and takes a rein in each hand, the hands being placed on the withers. While always keeping a light pressure on the bit, the pressure should be varied by rapid oscillations of the hands, the hands moving in unison so that there is no sawing of the mouth. The legs also should be closed on the horse, and slight taps of the heel will be necessary if the animal fails to take a step backward by the end of a minute.

In all training, as soon as the horse makes any required movement, the application of the aids should be stopped at once, and the animal rewarded. Then try it again.

RECRUITS

Recruits can be taught to ride by mounting them on the gentlest horses, and fastening the reins in the halter-squares instead of the bits. In this way, the horses' mouths will not be injured, and the animals will not resent so much having the recruits on their backs. The riding should take place in a corral, which may be improvised with carriages. I believe that with a few experienced men to form a nucleus for the enlisted force, the horse part of a battery can be put in shape to travel on the ordinary road in a month.

In addition to the foregoing method of breaking ordinary horses, there are others that have been found greatly to expedite the work in difficult cases, and still others which my experience has shown to be decidedly harmful.

COLD-SHOULDERED HORSES

If a horse is just a little cold-shouldered, but will pull when once started, place a rope or strap around the knees, as shown in Fig. 9, and pull straight to the front. This will cause the horse to move one of his forelegs and, consequently, bring all the tension of the rope on the rear one, which he will then move, and so on. This is generally sufficient for a horse of this kind.

BALKEY HORSES

If the horse is a confirmed balker and throws himself, he should be hitched with a good pulling animal, and when down should be held down by putting two men on his head and neck. Get a bucket of water and pour a very small stream on his nose, occasionally allowing a little to fall into a nostril. He

FIG. 9

FIG. 10

FIG. 11

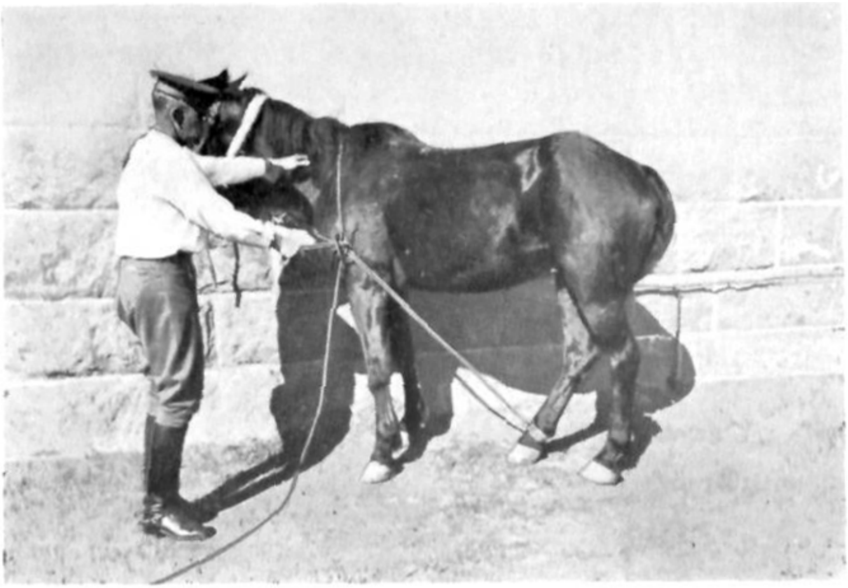


FIG. 12

will struggle to rise, but should be held down for about two minutes, with water trickling on the muzzle all the time, and then allowed to get on his feet. If he goes down a second time, which he probably will do, repeat the treatment. I have never known a horse to throw himself a third time. If he still refuses to move forward, a loop should be dropped over the croup, as in teaching to lead (Fig. 3), and the end of the rope fastened to a good pulling animal. The horses should be started, the wagon being pulled by the mate of the balky horse, and the balky horse being pulled by the horse at the end of the rope. As soon as the balky horse shows an inclination to move by himself, the tension of the rope should be released, and tightened again only when the balker hesitates or stops. A very few lessons of this kind will cure a balky horse. *No punishment by whip should be used*.

SCOTCH HOBBLE

To put a Scotch hobble (Figs. 10 and 11) on a fractious horse, place a fixed loop of one-inch rope around the horse's shoulders.

Take about forty feet of half-inch rope and make a loop of it by fastening one end to one ring of a leather anklet and allowing the other end to run freely through the other ring. Throw this loop on the ground beside the horse, as shown in Fig. 12. Move the horse sidewise until the desired foot is inside the loop. (Fig. 12.) Grasping the loop firmly to retain its size and keep it from slipping, suddenly jerk it upward so that it will go above the horse's hock. Pull the part of the rope marked 1 in Fig. 12 towards the right hand, paying out with the left hand until the anklet is near the right hand in the position shown in Fig. 13. Untie the fastened end of the rope, still keeping it through the ring, but running freely like the other end. You are now holding four lengths of rope, two in each hand, a loop passing through each ring.

The two inner lengths are our original loop, and the two outer lengths are the two ends of the rope. (Fig. 13.) Pull on the ropes in the left hand (marked 2 in Fig. 13) until the anklet is in the position shown in Fig. 14. Release the two inner ropes (our original loop) and pull quickly on the two outer or end parts. We now have a single rope running from the right hand through both rings of the anklet to the left hand. Allow the anklet to drop into place as shown in Fig. 15. Fasten both ends of the rope to the shoulder-rope, and adjust the tension of the anklet-rope until the foot takes the position shown in Fig. 10. The hobbled foot should not be lifted more than enough to allow the toe just to touch the ground. This is most useful in harnessing new horses that kick, and in doctoring the hind legs. Except in shoeing, it should always be placed on the leg opposite the side on which you intend to work.

A large neck-rope should always be placed on the horse before the Scotch hobble is put on.

LONG REINS

Hayes's method of long reins as modified by Major Hardeman and formerly used at the Fort Reno Remount Depot, I consider the best means of teaching a horse to be bridle-wise, to move to the front, to back, and so forth. In addition, it does more to gentle a horse than any other method known to me. A horse handled with the long reins will never object to being saddled or harnessed, nor will the traces ever frighten him. This method requires a special saddle which is not a commercial article (Fig. 16). In beginning, the reins are fastened to the halter or cavesson and are not attached to the bit until the horse understands their application. The secret of success with this method lies in gentleness and playing the reins, *never in roughness or whipping*. In this way, the horse's spirit of opposition is never aroused.

FIG. 13

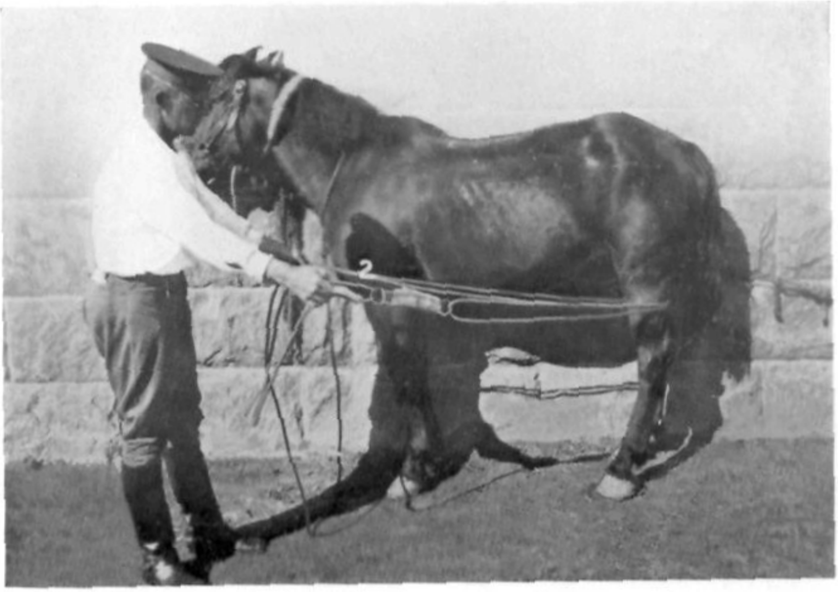


FIG. 14

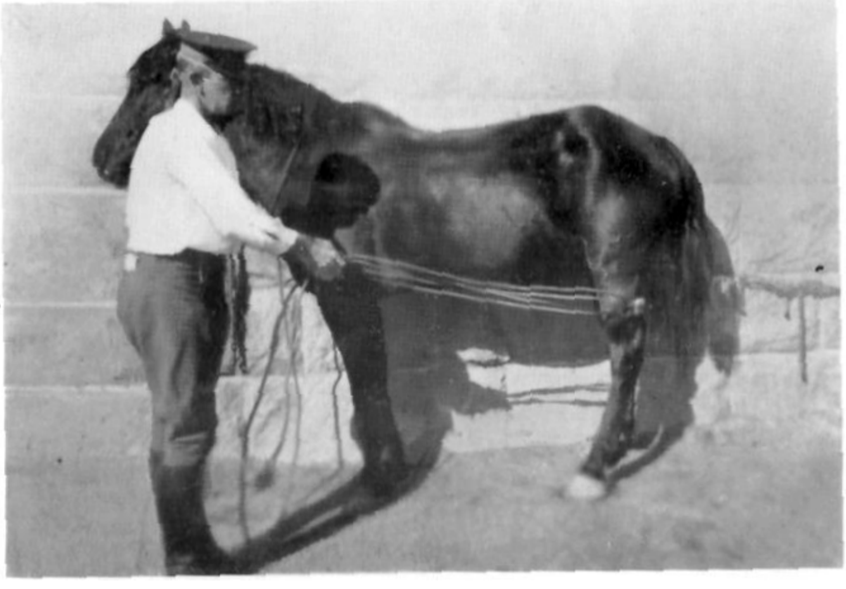
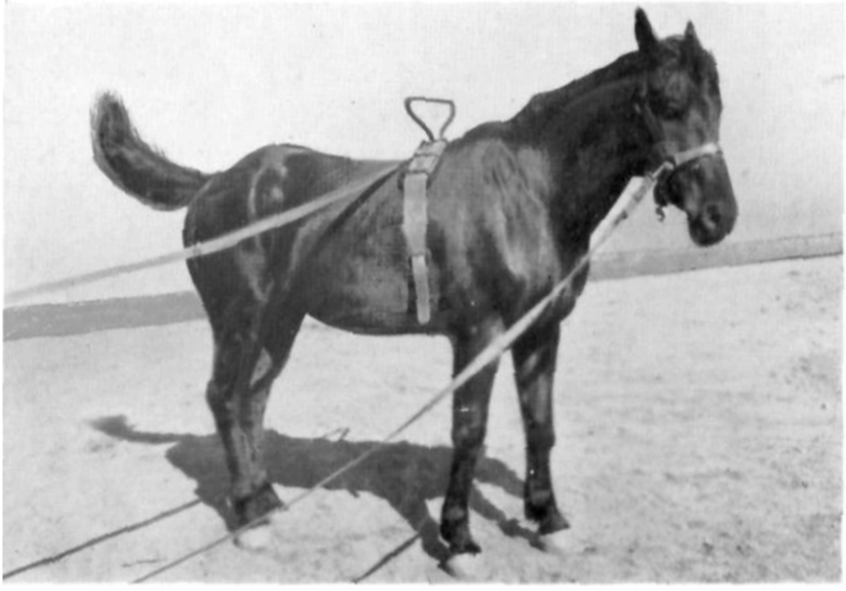


Fig. 15

Fig. 16



STALLED TEAMS

To make a stalled team pull, back up all the horses until the traces are as slack as possible, and pass the pairs well to the right or left. Start the leaders quietly, gradually moving them to the front at the same time. The swing driver should watch the lead traces, and when they begin to tighten he should move his team forward as the lead driver did. The wheel driver should move his team so that it will get in draft when the swing traces tighten. The instant the traces tighten, the horses should be required to give their maximum effort.

The advantages of this method can be briefly summarized:

Every horse moves one or more steps to the front before the traces tighten, thus giving him the idea that everything is all right. By moving sidewise at the same time, the tension in the traces is taken up gradually, without shock to the shoulders. It is much easier of accomplishment than is the moving of the whole team at once.

HARMFUL METHODS

Twitches.—Never allow a twitch to be used. It is absolutely unnecessary, brutal and ineffectual, and produces more headshyness than any other cause. I have had more than fifty range horses clipped without difficulty after having had them a month, and no twitches were used. Animals that had been considered too unmanageable to clip without a twitch, have been successfully clipped without one, and have stood more quietly than ever before. The next time you think you need a twitch, do without it, trying instead very quiet and gentle handling and, if necessary, placing your finger in the animal's mouth and holding it there. This will distract his attention sufficiently in all ordinary cases.

Stocks.—Never allow stocks to be used for shoeing, or for any except veterinary purposes. It never gentles a horse nor, in itself, teaches him to stand for shoeing. You cannot have it in the field and, after all, efficiency in the field is the goal of all our training.

Tails, Manes, and Forelocks.—Never cut tails, manes or forelocks. The horse may not look so smart, but in the field these are his only protection against flies. If your animals lose flesh, you may consider it all due to work and scant forage, but the flies have done their share.

Whips, Spurs.—Do not allow whips or spurs to be used on new horses. Ignorant application of either will ruin more good horses than any other cause. If punishment is necessary, give it or supervise it yourself. About ninety-nine per cent. of all horses will do their best for you if properly handled.

Drivers.—On a long, hard pull, if you are careful not to make your horses walk fast, they will not be winded or exhausted when they reach the top. Let them have their heads, as they know, better than you do, the most comfortable position for them. Never allow a team horse's head to be held to the side, as so many drivers do hold them through careless handling of the reins.

Finally, you must concede that your first duty is to get your battery to the required place at the required time. If, through neglect or ignorance in the care and training of your horses and drivers, you fail to accomplish this, your usefulness as a battery commander is negligible.

Competitive Figure of Merit for Field Artillery

A SUGGESTED MEANS OF COMPARISON BETWEEN BATTERIES IN ORDER TO SECURE A MEASURE OF THEIR RELATIVE BATTLE EFFICIENCY

BY CAPTAIN CLARENCE DEEMS, Jr., 6th FIELD ARTILLERY

(*Extracts from a lecture delivered at the School of Fire for Field Artillery, Fort Sill, Oklahoma*)

This discussion is intended only as a guide for the purpose of inviting better ideas on the part of others with a view to securing a rational method for grading batteries. Certain assumptions had to be made—for instance, in regard to the relative number of salvos and volleys in a test problem—and it was attempted to have these conditions taken as nearly as normal as could be judged, simply for an analysis of the subject. The general ideas offered would not be materially changed by the substitution of more nearly correct numerical values than those accepted. As our Drill Regulations change from time to time in their details, the application of the methods suggested will, to some extent, be required to be altered to meet the changing conditions.

A partial reason for the importance of suggesting such a subject for discussion in the School is given in the opening page of our Field Artillery Drill Regulations for Light Artillery, which states: "The sole reason for the existence of Field Artillery is its ability to assist the other arms, especially the Infantry, upon the field of battle. The degree to which the Field Artillery prepares itself to render this assistance is, then, the only measure of its training.

"2. To enable it to render effective assistance upon the battlefield artillery must be able, first, to march rapidly and in good order and to establish itself, promptly and without confusion in such positions as will best utilize the available terrain; second, to deliver an effective and overpowering fire upon any designated part of the enemy's position."

Based upon these statements of authority, and strengthened by the advice and judgment of many other authorities, all of which opinions are in the most perfect accord, we may rightly say that the value of a battery, or any other field artillery battle unit, is primarily based upon (1), its marching capacity, and (2), its shooting ability.

REGARDING A SYSTEM OF GRADING FIELD ARTILLERY UNITS

The real value of competition between military organizations is that it develops (if kept within proper bounds) both efficiency and *esprit de corps*. Up to the present time we have had certain reports made by our Field Artillery inspectors in which, to some extent, an attempt was made to grade the various battalions upon the results obtained in the rate of fire reached by the batteries in each battalion. While this has been a step in the right direction, it is believed that this initial step can be improved upon.

One of the first queries is naturally, "What is the matter with the present system?" The answer seems to be that it is not comprehensive enough. Battalions are not the only units that should be graded. Batteries should be graded, and so should regiments. The efficiency of a battalion should largely be based upon the separate efficiency values of the respective batteries in it; and, likewise, the efficiency of a regiment should, to a high degree, be determined by the efficiency of the two battalions of which it is composed. Mountain and heavy regiments should be compared with their own kind. Light and horse regiments could probably be considered in the same class. The direct comparison only should be made between units armed with the same type and calibre of gun and those which are mounted in an identical manner, excepting, perhaps, the light and horse regiments.

To-day we recognize the battalion as a basic battle unit, but an objection to grading by battalion alone is that the credit or discredit does not apply sufficiently directly to the cause of the efficiency or inefficiency. It is quite possible that an unenthusiastic major or one devoted entirely to the cause of petty trifles, instead of the ability to march and fight well, may have exceptionally good captains under his command, who, through their individual efforts alone, will place the rating of the major's battalion above that place which his personal unaided efforts would have normally secured for it. The captains, in that case, secure no recognition, when they really deserve all. The reverse, in this case, is not true to such a great extent, because it is entirely within the power of an ambitious major by drill, instruction, example and application to bring up a relatively poor battalion to a very good standing, as he is in a position where he can to a large degree actually command and enforce all that is desired.

A further objection to battalion grading alone is that the *esprit* of a certain battalion is, probably, as a rule, not so strong as that in a battery. The battery is a unit that daily compares itself with other units of the same kind, and, therefore, the most should be made of this evidence of *esprit*, instead of smothering its identity. Then, too, in our pitifully small army, it happens that but a single battalion may regularly serve in one post. In such cases, particularly, the fostering of the spirit of battery competition is what really makes the battery as well as the battalion.

For these reasons, then, a system of comparative merit is suggested in which (in the same branch of the Field Artillery) batteries may be compared with batteries, battalions with battalions, and regiments with regiments, with a view to securing by the annual publication of the results the greatest *esprit*, as well as efficiency.

The grading should be effected by bearing in mind that the fire efficiency is based, (a) on the offensive value of its fire, and (b) on its defensive ability; and, also, that marching capacity must be combined in some reasonable manner with (a) and (b).

The subjects will be discussed in this order.

CONCERNING THE OFFENSIVE VALUE OF A BATTERY

At present the most important thing to investigate will be how to obtain some fair means of determining the offensive value of field batteries in fire action, and to rate them accordingly. But, while the offensive value is all-important, in this discussion the defensive value at close quarters should not be entirely forgotten.

Should the offensive value of a field battery be determined on the rate of fire alone? It seems not, as, on that unit of comparison alone there would be a decided incentive to waste ammunition by shooting it in the air, regardless of effect. The desire to excel in speed should, of course, be admitted and urged, but it should be entirely subordinated to effect. Hohenlohe's first rule of his epitome of the duties of artillery will ever remain true. But hitting is not the only duty put upon us. We must be able to "get the drop" on the other fellow, and then hit him faster and harder than he can hit us.

The *rate of hitting* then becomes an all-important element. The number of hits (not the number of shots) that a battery can deliver in a unit of time is most likely to be the determining factor of its success in battle. Upon this belief are based these suggestions for the possible grading of batteries in the future.

GRADING IN OTHER BRANCHES

In the Coast Artillery a system of grading by relative efficiency, using a certain figure of merit, has been advantageously used. In the Infantry not quite the same system has been employed, but the organizations have been placed in relative grades as a result of their test firing. Can we not adopt to our advantage some such means of comparison?

When this has been suggested heretofore many objections have been offered, the principal one being that the terrain and weather conditions cannot be made the same at all places and therefore there is no true standard of comparison. The force of this objection is recognized as being but partially true. Some chance element is bound to enter, and it must be accepted. An examination into this part of the problem will show that the difficulty is not so great as it may seem at first, for the same objections apply to the test firing of the Infantry, yet they seem to think that the system is of value, for they still retain it. The same is true to a large extent in the Coast Artillery; for, while their practice is conducted over a level plane variations in light, tide, wind, barometer, thermometer, etc., together with the relative positions of observing stations, battery, and target, afford a variety of conditions which they take into accurate account and which differ materially at the various posts where target practice is held. So, in the Field Artillery, with the problem divulged only to the umpire with the approximate ranges, kind of target, relative visibility, number of figures exposed, the kind of communication to be maintained, all stated in confidential instructions, he should be able (with the proper description furnished) to make the problem one of the relative difficulty intended.

Objections Offered

When this scheme was suggested some time ago to an officer of considerable experience an objection was offered to the effect that it would make the nature of the instruction and competition so strenuous that everything else would be subordinated to it, and there would be no peace for anyone. The reply to this objection seems to be that we can only justify our existence by being able to "deliver the goods" in a crisis, and everything should be subordinated to the extreme instruction in its minuteness of detail, which will enable us to deliver exactly what is wanted and just when it is needed.

Another objection has been that too much difficulty will ensue in trying to make the scheme a fair one to all concerned. Unfortunately, all theoretical and practical tests or examinations have their faults, and, for one reason or another, fail to present exactly the same degree of fairness to all the participants. But, in general, fairness can be obtained by necessary precautions. For instance, where practicable, the same umpire should give the same problem to all the batteries of the same post on the same day, in order to make all conditions nearly similar and equal. In the battery test, any field officer not belonging to the battalion could properly be detailed as an umpire. Each year the character of the test problem should be changed, both for the purpose of extending the instruction and equalizing the tests.

FIRING FOR EFFECT

At present we do practically no firing for effect. What little opportunity we may have in that direction comes at the time of annual inspection, when as many as 36 rounds may be authorized in a simple problem. Ordinarily this is hardly enough to secure any material degree of effect, unless the organization which is doing the firing is provided with a reliable range finder. Were this amount increased by 12 rounds, making a total of 48 rounds, all to be fired in one problem at the same target, it would probably permit effect to be more reasonably gauged. Enough rounds would then be fired to eliminate largely the element of luck.

It is believed, therefore, for the purpose of comparison, batteries should have one test problem annually in which 48 rounds are fired; and, if the appropriation for ammunition is insufficient, then the additional 12 rounds needed per battery could well be taken from the usual battery allowance. But, as at present only 36 rounds seem to be authorized with which to make this test, this number can always be available for this distinct purpose, and a start could be made in the development of this scheme.

CONDUCT OF FIRE BY UNIT COMMANDERS

It is considered important that every unit commander should conduct annually a certain amount of this test firing. As each lieutenant and each captain gets a problem or more to fire each year, the presumption is, that by the time one reaches the field officer's grade he has become reasonably proficient in handling a battery, and that a single extended problem each year should be sufficient to "keep his hand in." Accordingly, the major's single problem should be his yearly test. If each of his batteries is allowed, say 24 rounds, for his battalion problem, the total, if fired at one appropriate target, should give a reasonable measure of effect upon which to judge his ability to conduct and direct the fire in a battalion. Well might he be required to conduct the fire of a ranging battery until adjustment is secured, and then turn it over to its captain to fire for effect, after which time the other batteries, profiting by the data obtained, can open at an early moment with relatively small changes in adjustment, and fire for effect with a considerable amount of ammunition. It might be assumed that one particular captain cannot see the target, that the battalion commander can, that the fire of this battery is needed upon the target being attacked, and hence the battalion commander finds it actually necessary in this particular phase to conduct the fire personally.

The same, or similar suggestions can properly be carried out in the problems of the other field officers.

VALUE OF A YEARLY TEST

Every true field artilleryman should love to shoot with his own organization, and should be encouraged to make the most of his ability in that direction. Those who are keen in their work will desire to transmit their knowledge obtained by experience to their subordinates. They will be ambitious to promote team work, and by the personal active handling of their personnel and matériel in their yearly tests, retain that familiarity of detail which is so essential for the development of the expert.

Again, the method of yearly tests will have an entirely proper prodding effect. It will prevent the growth of that type of man who might try to hide his ignorance by attempting to pass responsibility to his subordinates, or who deems that the privileges of his rank are a sufficient excuse ... to permit him to become lax regarding the study of up-to-date methods.

Another value of this proposed test method is that if we have in the service any field officers who have, by force of circumstances, lacked opportunity to fire batteries while captains, and acquire the degree of confidence and skill expected, then, at this time they are given the chance actually to conduct fire and perfect themselves in the confidence and knowledge that they must have in order to really be practical, thorough masters of instruction.

HIGHER UNITS

The test is intended to cover not only the battery, but higher units. In determining the figure of merit for a battalion, it should be obtained by taking the average figure of merit for the three batteries (as determined by their prior tests) and adding it to the figure of merit as obtained by the battalion commander in the battalion test, and dividing the result by two. This then makes the battalion figure of merit partly dependent on the separate battery figures of merit, which is as it should be, since firing in the battalion in action may be conducted either by the battery or battalion commander. (See Field Artillery Drill Regulations, 1911. Paragraph 810 states: "Conduct of fire is ordinarily the province of battery commanders," but paragraph 808 states: "In exceptional cases the battalion commander may have to conduct the fire of his unit.") It hardly seems exactly proper tactically that the regimental problem should require conduct of fire by any but the battery commanders ordinarily, since we consider the battalion more strictly the battle unit than any other unit. Of course, in a regimental problem the case is likely to arise in a battalion where the major may be forced to conduct the fire of one of his batteries. Whether or not, for the purpose of continuing training only, and keeping that facility in the actual handling of details so necessary to make a good instructor, it will be desired to have officers higher in rank than that of major conduct fire is simply a matter to be adjusted by proper authority; but it is believed that the regimental figure of merit in any case should be obtained by taking the average of the separate battalion figures of merit, adding them to the figure of merit obtained on the regimental problem and dividing by two. The above-suggested system necessitates team work throughout and personal active supervision from the top, and also admits of a comparison of each subordinate unit.

It is admitted that it is a rather delicate subject to mention, but it is believed to be of high importance in improving our field artillery methods that criticism to be of value should be constructive, not destructive, as is so frequently the case. Far more loyal support and far better team work is given to a commander who knows how, whose officers and men know that he knows how, than one who fails to command, instruct and supervise actually. This system is intended to promote a feeling of confidence on the part of all; and it is believed that if officers of higher rank are required actually to perform their duties as instructors and are required really to exercise great personal supervision, then not only will their units improve in efficiency, but a feeling of *esprit* will arise, which will demand that every assistance will be given to the weaker units to bring them up to normal, rather than caustic words of comment or even abuse, which can hardly be considered as improving either morale or instruction.

In the discussion following, the battery will be the only unit considered, but, with simple modifications, the method can be applied also to the higher units.

BATTLE CONDITIONS

While there are many elements encountered on the battlefield which tend to make the firing of a battery more erratic than working under peace conditions, these disturbing events (such as the destruction of matériel, loss of personnel, errors due to nervousness, and so on) will not be considered at all in the accuracy of fire, as their resultant effect is extremely variable, and cannot be arbitrarily reduced to a system of measurement or computation. The peace condition of the battery concerned probably reflects well its war ability. Experience in one organization at least has shown that it speedily settles down to business even under a most annoying fire, and that as the campaign progresses experience teaches men that most of the missiles do no harm and the service of the guns then quickly approaches that of garrison training. Every one, too, rapidly acquires in a few days of action knowledge that many years of garrison teaching will never provide. Many rounds are fired in active service and the experiences and impressions of the working of the battery are kept fresh in the minds of all participants. So that a battery which has been in one or two engagements, will speedily settle down to work in action and reflect with great credit its peace training, provided it is not hampered by the loss of its personnel.

RANGING METHODS

As war conditions should be approached as nearly as possible in the test, it is assumed that probably most frequently battery salvos with time shrapnel will be preferred for ranging, and no prohibition under the plea of saving ammunition should be imposed upon the battery commander which will prevent his using battery salvos if he so desires.

Where the character of the target may demand it (such as a visible battery at irregular intervals) at least one additional battery salvo may be desired thoroughly to adjust distribution and to obtain a proper corrector for killing effect at all the guns; or, where few observations have been obtained from previous fire, if the tactical conditions permit, it will be desired absolutely to verify the short limit of the bracket in immobile targets. Due to unfavorable terrain possibly a second extra salvo may be needed. For the sake of simplicity this discussion will be generally limited to the action of a battery against troops in trenches, or some other immobilized target such as a battery, this being the stage assumed in a modern battle, next succeeding that of movements of troops exposed in the open. It is assumed for analysis that the test problem is of such a nature demanding an absolutely certain range adjustment.

NUMBER OF SALVOS

The question next to consider is, "How many salvos should be allowed for ranging?" In the case of an infantry target advancing under artillery fire, Spaulding, in his recent article in the *Infantry Journal*, assumes that it will take three to four. Generally speaking it should require more than that to obtain proper adjustment upon intrenched infantry where it will be necessary to get a considerably smaller bracket to insure effect and where the target is immobilized and therefore time is not such a valuable element. Then it would seem that five or even six adjusting salvos would be quite proper. While against an immobilized target of this kind the rough adjustment by platoon might be obtained to insure saving of ammunition, it will frequently happen that skill evidenced in the concealment of trenches will make it necessary to use our entire battery in order to get enough sure observations.

To approach this same question from another angle, if we refer to our subject No. 20-G Range Adjustment (School of Fire for Field Artillery, March, 1915) in paragraph 1, when it is assumed that a range finder is used (a condition that we hope soon to become normal in the service at large) it is possible, with the initial probable range error of 120 yards to secure, before firing, a range adjusted only within limits separated by 960 yards. This initial probable error of 120 yards has been adopted as a result of extensive tabulation and can reasonably be accepted. That being true, the 50 per cent. zone for the positions of the target then would be 240 yards wide, or there would be a number of cases, where by making 200-yard bounds we would fail to bracket the target, at the long bracket, in the first two salvos, or we must fire at least three salvos to get a 200-yard bracket, and four to get a 100-yard bracket, assuming that we get observations every time. But we will not be able to get observations in range in many cases due to lost salvos in woods and gulches or those that may be wide in deflection, and we are more liable to get this state of affairs in the first salvo than any other; so, in a large number of cases five salvos, none of which can be called verifying, will be required.

Numerous observations at the School of Fire show that about 53 per cent. of shots fired are either correctly or incorrectly observed. (See Subject 8d, February, 1915) and that of all rounds fired during adjustment about 5 per cent. were incorrectly observed. As an approximation probably 50 per cent. of shots then will be correctly and positively observed during adjustment; or, in a salvo of four shots, roughly, two will be observed. This is approximately verified by the table in Subject No. 8d for February, 1915, which shows that, in ranging by battery in order to get two (2) observations; (*i.e.*, 50 per cent. of the four shots fired) an average of about 5 rounds must be fired. As has been noted, a relatively small number of shots are observed incorrectly. Failure due to loss of the shot and inability to sense it when seen account almost entirely for those which were not observed correctly.

Salvos will be fired which must be repeated because no range sensings are obtained. Uncertainty to a considerable degree rests upon a battery salvo affording but one shot for range sensing. Two similar range sensings in the same salvo indicate much information; while in those where good fortune permits us to observe three or four we may settle the matter. So, we are not far wrong if we consider two range sensings as an average case.

Unfortunately together with heights of burst awry on the opening salvo, deflection out in adjustment, mirage and light conditions which make observation unfavorable, there are some cases where the range sensings may be correct, but the bracket will be incorrect for range. Suppose the original error to be one of about 480 yards. If the salvo now be fired at say 3000 yards range, the far limit of the target may be as much as 480 yards beyond, or at a range of 3480 yards. The near limit (2 shots short) is 3000 — 75 yards or 2925 yards. Hence after a single salvo is fired (2 rounds) and is observed short the target is positively adjusted within 555-yard limits. If a salvo (the second) be fired at 3200 and is observed over (2 shots), then the range is adjusted within the limits of 3200 + 75 = 3275, and 2925 yards — or between 350 yards. The third salvo gives an adjustment (when fired at 3100) within the limits of 2925 and 3175 or 250 yards, although it now seems to be the 100-yard bracket and will be so accepted by the battery commander, and later firing may fail to prove his bracket, thus requiring at least an additional salvo, or 4 salvos to bracket his target, and, which added to the two salvos already suggested, to verify all adjustments and prove the same, will permit him properly six salvos, or 24 shots which are not fired strictly for effect. Under the assumed present allowance of 36 rounds he would then have left 36 — 24 or 12 rounds, or three volleys to be fired for effect as a reasonable assumption, eliminating very unusual conditions. While Subject No. 8e (published by the School of Fire in February) shows that ranging by battery it will take 5.2 rounds in order to observe two rounds, either correctly or otherwise, and that it would then take probably at least 31 rounds to get two observations in each of the six salvos fired, the probability would seem that the six salvos suggested (24 shots) as a reasonable amount for the adjustment of fire, will in the normal case be sufficient; this is because changes in range, corrector, or deflection may be ordered on the result of one positively observed short (particularly in the long bracket), and frequently more than two rounds will be observed in a single salvo. The officer conducting the fire may also be fortunate in requiring no proving salvos and his gun range may closely approximate the range finder range in many cases of early observation, saving him one or more salvos in the bracketing process. So the number of battery salvos considered as amply sufficient for normal ranging at battle ranges will be accepted as *six* in this discussion for an infantry intrenched line, or similar immobilized target, and the number of battery volleys fired solely for effect as *three*, 36 rounds being the authorized allowance.

It is not intended to imply that there are necessarily two distinct phases always in the problem; for, depending upon the target and tactical conditions, it is difficult to give a general rule as to just when fire for adjustment strictly ceases and when fire for effect really begins. As a matter of fact, both adjustment and effect, as far as practicable, are desired in every volley or salvo fired. In the case assumed, however, as the target is immobilized and the time element is not of great importance, there is decidedly more of a line of demarcation existing between fire for adjustment and fire for effect than will be presented in the large number of other cases.

The idea of settling upon the number of volleys and salvos that may be reasonably fired in this case is for the purpose of, first, giving some clue as to the time it should take to solve a problem, and second, as to determining then how many volleys alone should be reckoned upon for effect produced.

CONCERNING THE NORMAL TIME ALLOWANCE

Referring again to Captain McNair's tabulations given in Subject No. 8e (School of Fire for Field Artillery, February, 1915) it is seen that .62 minutes is the normal time per salvo. This time is of course increased if in ranging by battery a definite number of observations is assumed to have been obtained in each case. But as six salvos have been taken to insure the bracket, it would seem that the average time per salvo can properly be used regardless of the number of observations, without very material error. But, as it will be impracticable in all tests to have the guns fired at the same exact ranges for the same problem at different posts, a system of comparison should be employed which involves the working time of a battery, and that is a time value which is independent of the time of flight; so, the normal time for ranging should be diminished by the time of flight for the gun range (to the nearest 100 yards) of the target.[1]

Following this idea, and assuming that the value of .62 minutes per salvo includes the time of flight and that this time applies to the average, regardless of range, and that 3000 is a normal mean battle range for the targets from which this data has been obtained; then, for a basis of comparison, the .62 minutes or 37.2 seconds should be reduced by the time of flight corresponding to 3000 yards, or 37.2 – 7.83 = 29.37 seconds as a working time per salvo under average conditions. This, it is to be noted, is not so fast as the arbitrary 30 seconds per salvo, which, at one time, was laid down by the School as practically a necessity for a "solution," since to this value the time of flight to the target must be added. For school conditions, with a view alone to improving the standard, it is better that the time limit should be pressing; but, with the object of obtaining

[1] It is not known whether this time given per salvo (.62 minutes) includes the average time of flight, or not. That is of no very material importance, and the assumptions made can be corrected, if need be, as this paper is intended to suggest a method, rather than absolute values.

a measure of comparison between service batteries, it is desired to assume a reasonable standard and to work the batteries in the test in such a manner that if they exceed the normal time limit they will be duly penalized, and that if they beat it, then they should receive the credit accruing.

Based on the supposition that 6 salvos are fired and that a normal working time is 29.37 seconds per salvo, then as there are but five intervals between the six salvos, the total working time allowed should be 5 × 29.37 = 147 seconds (about), for ranging alone.

Regarding the use of the volley there seemed to be few data obtainable. Volleys will be fired at different rates at the different kinds of target. To quote from Rouquerol, "As a matter of fact, we *must not exaggerate the importance of maximum rates of fire. . . . If the fire is accurate and effective, it will disorganize the enemy at once*, whether at the rate of 8, 10, or 12 rounds a minute." *If it is inaccurate*, or for some reason or other ineffective, *the rate is of little account;* on the contrary, the greater the disadvantage from the point of view of wasting ammunition."

Bethell, the English writer, says, regarding the rate of fire, "This depends principally on the fuze setting. But, so far as the breech action is concerned, a field gun with the ordinary quick fire action can fire 20 aimed rounds per minute, while with the semi-automatic action it can fire 30.

"A full automatic ... made by ... Krupp ... is capable of 40 rounds a minute; but ... if fired continually it would soon get red hot."

In another place he says: "A quick firing battery engaging an *easy* target expects to get its range in one minute, and is then able to fire 60 rounds a minute, or 100 rounds a minute after the fuzes have been set."[2] Lest the exponents of the cult of instantaneous attack without most careful adjustment

[2] This is of course for a battery of 6 guns.

on all classes of targets should feel that by this latter quotation they are justified in their stand, a further quotation from this same author is most worthy of digestion. He says: "The proper tactical rate of fire is a matter which does not directly depend on the rate of fire of the gun, but rather on the vulnerability of the target. Thus it might be hastily assumed that because an enemy has been located in a certain spot, therefore the battery should fire, and continue to fire, at its highest rate in order to destroy him. The practical result would be that the enemy would lie low till the storm was over and the ammunition exhausted, and would then renew the combat. In most cases artillery fire is not so much destructive as *neutralizing*. That is, the object is to prevent the enemy from exposing himself in order to fire, and from shifting his position. Therefore a steady rate of fire is kept up, increasing if the enemy is still observed to be firing, and decreasing if he remains silent; while if any movement can be observed, it is checked by a burst of rapid fire. *It is impossible to lay down any fixed rate;* but, at a very rough estimate it may be said that, when the troops are not closely engaged, a rate of fire of 10 rounds a minute is sufficient to keep down the fire of a line of infantry 100 yards long behind a bank or in a trench. This estimate is arrived at as follows: Taking the effective spread of the shrapnel bullets at 20 yards, each rifle-man will be liable to be shot twice a minute if he puts up his head to fire. After each shrapnel bursts over him, he will have only 30 seconds to make up his mind, to get up, pick up his rifle, and then aim and fire. If the rate of artillery fire were absolutely regular, the rifle-man would soon get accustomed to firing between shrapnel bursts. But, if, while maintaining the average steady rate, the rate per minute and the distribution be judiciously varied, the rifle-man will never know when a shell is coming, and will be nervous about getting up to fire."

Considering the above, it seems reasonable to assume an ordinary rate of 10 shots per minute as being somewhere near the normal condition for one type of target that we have elected to consider in the discussion—that is, intrenched infantry, who are to be neutralized by our shrapnel fire. Ten shots a minute is at a rate of 2½ volleys a minute; or, for steady firing, at the rate of 24 seconds a volley.

This time may be also arrived at in another way, and for the purpose of verifying the assumption, will also be presented. Our Drill Regulations (see page 111) state: "When the mean height of burst of shrapnel is well adjusted, each gun is expected to cover effectively a front of 20 yards if one round is fired, 25 if two are fired." If more than two are fired, the front of 25 yards is increased slightly; but, as it is at the overlap of the spread of the shrapnel bullets from one center to the next one, it simply tends to keep the pattern density on these overlaps (where for any single shot the density is somewhat low) more nearly at the average density. So we are justified in saying that for a hundred-yard-line of infantry (or perhaps even for a battery with flank caissons which roughly approximate the same in length), we can probably neutralize the fire, or nearly do so with eight accurately placed shots a minute. So far as a hostile battery is concerned, this will surely interrupt good artillery laying. It will break up infantry aiming from behind cover. So, in order to insure good work being even better done, it is justifiable to say that the rate of fire for neutralizing a target in position, upon which a relatively small bracket may be taken, should be increased slightly and brought up to the 2½ volleys a minute in order to be in accord with such an authority as Rouquerol.

Then, for three volleys we must add their time to the time already obtained for the six salvos. Now as the salvos are followed immediately by volleys, the spacing of the salvos must be taken as the whole number, or six, and the volleys diminished by one (in counting the time spaces) since time is taken from the first to last discharge.

The expression then for the total time to fire six salvos which are followed immediately by three volleys is: (29.37 × 6) = 176.22 seconds, plus the total time allowed in which to fire the three volleys. If T equal time of flight in seconds, then (2 × 24) – (2 × 7.83) = 32.34 as the working time for the 3 volleys, assuming again 3000 to be a normal battle range, with observations permitted on the volleys. Or, the salvo time (176.22 seconds) plus the volley time (32.34 seconds) equal total normal working time, or 208.56 seconds, say 209 seconds. Now it is to be noted that in this case that during the volley fire, time of flight is considered and deducted, since it is assumed that on an immobile target, and one that must have most accurate adjustment in order to secure any effect beyond neutralization, the battery commander will most surely be justified in waiting to observe the effect of each round before firing the next, unless the tactical situation is pressing. Later on in his firing, in order to keep the enemy guessing, he should use quick bursts of fire, followed by intervals of silence; but, at the first he must be careful, so far as practicable, to observe every round and know at what range it was fired in order to clearly ascertain actually what exact range is giving him effect. It is believed that more ammunition will be saved and more effect produced and more of the enemy silenced in the field by procedure by this method than by indiscriminately covering all kinds of targets at once in the early stage of volley fire with a rapid unobserved fire at different ranges simply in order to get some effect. The tendency in recent years has been to shoot up quickly *any kind of target* by successive volleys, and thereby, so far as actual effect produced, really to waste ammunition upon immobilized targets, which permit accurate ranging and a reasonable time for observation even on the preliminary volleys.

We are now prepared to assume that 209 seconds or 3 minutes and 29 seconds is the normal working time for a problem of 36 rounds fired at a target representing intrenched infantry, or perhaps, even, a battery in position whose personnel is being attacked. This time is independent of the gun range. To it should be added the time of flight of 8 salvos or volleys for the range considered, which time will give some guide as to a reasonable rate that should be maintained, and, faster than which, on this kind of a target a certain credit should accrue to the organization making it, and, similarly a certain penalty should be imposed when the time becomes slower.

It is recognized that a difference in time exists between the time required to fire a battery salvo and a battery volley, the former taking properly some 9 seconds and the latter usually being gotten off in 1 or 2 seconds, or practically as a simultaneous discharge. But in this discussion a normal number of salvos and volleys having been assumed, this relative number continues constant and the working times are not thereby influenced. If the battery commander is fortunate and gets his target at once he puts himself in the position where he can fire more for effect and more rapidly. This is as it should be, since his ability to get an early bracket depends highly on close estimation of ranges, accurate work of his range finder, accurate calculation of firing data, accurate laying of his pieces, accurate adjusting of his pieces and accurate observation. A premium on these essential requisites is therefore offered by permitting the battery commander, under favorable conditions, to beat out the normal time limits suggested. Of course bad luck, due to an unusual dispersion of shots in range may occasionally be looked for, but the battery commander always lives in fervent hope that the inequalities of hard luck will be offset by extraordinarily good luck the very next time that he fires.

It may happen that it will be desirable to fire for effect, purely, without waiting for an observation between volleys, in which case the problem should be drawn up clearly as representing a crisis on the battlefield that will demand such a rapid expenditure of ammunition.

But as the particular problem that we desire to trace is the ordinary case of an attack of infantry in trenches, probably representing the phase of our infantry offensive in the early stages, we are concerned only in the class of fire and the rapidity of fire which accompanies it.

For the case representing a battle crisis entirely different times for the volleys must be assumed. Tabulating, then, what we consider to be the normal times for the different ranges, we obtain the following table:

Range	Time (secs) 209 + 8 T	8 T	Range	Time 209 + 8 T	8 T
1500	236	26.72	3600	288	78.56
1600	238	28.88	3700	290	81.36
1700	240	31.12	3800	293	84.24
1800	242	33.36	3900	296	87.12
1900	245	35.68	4000	299	90.00
2000	247	38.00	4100	302	92.96
2100	249	40.40	4200	305	95.92
2200	252	42.80	4300	308	98.96
2300	254	45.20	4400	311	102.00
2400	257	47.60	4500	314	105.04
2500	259	50.08	4600	317	108.16
2600	262	53.56	4700	320	111.36
2700	264	55.04	4800	323	114.56
2800	267	57.52	4900	326	117.76
2900	269	60.08	5000	330	120.96
3000	272	62.64	5100	333	124.16
3100	274	65.20	5200	336	127.36
3200	277	67.76	5300	340	130.56
3300	279	70.40	5400	343	133.84
3400	282	73.04	5500	346	137.12
3500	285	75.76	5600	349	140.48
			5700	353	144.00
			5800	356	147.32
			5900	360	151.12
			6000	364	154.88

These times will permit observations between volleys at reasonable ranges.

A glance at these times will show the unfairness in making an arbitrary rule, that, regardless of ranges, the battery should be fired at the rate of, say, two (2) salvos a minute, because the time of flight at a minimum ordinary range (say 1500 yards) is about one-sixth of that at the extreme ordinary range (say 6000 yards). In other words, at 1500 yards where 27 seconds is added to the normal working time, at 6000 yards, 155 seconds, or about 2 1/7 more minutes is consumed in the time of flight alone, over which the quick and smooth working of the battery as a machine (regardless to the extent that training is carried) has no control whatever.

At targets of another character (such as, for instance, mounted targets in rapid motion) entirely different suppositions are necessitated both in respect to the number of salvos or volleys to be fired and the proper time allowance; but, if the subject be closely examined in each case an appropriate analysis can be made along the way which has been outlined herein.

HITS

It is now desired to consider the matter of hits. In a test problem it is assumed that the shrapnel projectile will normally be used because it demands the manipulation of a greater number of elements than the shell, both by the officer conducting the fire and his gun squads. The discussion is limited to the common shrapnel with which we have been firing, as too little is known regarding the actual pattern and the field results of using high explosive shrapnel. Several different kinds of hits may be obtained in the use of the common shrapnel. Pellet hits are the most numerous, and are the particular kind of hits of which we generally think in shrapnel fire. But there are other hits that in some cases probably have a special significance where they can be identified. The fuze most likely follows fairly nearly the trajectory of the center of mass of the projectile, as its center starts in the prolongation of the line of motion of the center of mass at the moment of explosion; it is rotating rapidly with its point on the line along which it starts, which should compel accuracy; it is of considerable mass itself, of fairly regular construction and therefore, in most cases, should indicate the prolongation of the trajectory, unless, as there is some reason to believe, the nose of the shrapnel is inclined relatively upward, and the axis of the projectile is not tangent to the trajectory upon which it is travelling. Even in this latter case, the fuze probably travels very close to the mean trajectory of the shrapnel pellets and fragments, and, if so, it measures not only the accuracy for deflection and distribution, but also for effective range. A hit by the fuze, when surely identified as such, should therefore have considerably more value attached to it in some cases than a single hit by a mere pellet—particularly in fire upon an artillery target. If experimental firing shows the course of the fuze to be erratic, then it should be considered only as a fragment hit.

Considering specially the shrapnel case, the experiments held at Fort Riley in 1906 showed that the mass was relatively so great that its point of fall was not materially affected by its recoil to the rear due to the discharge of its contents to the front; and, that, for all practical purposes (as it was presumed to have sufficient velocity of rotation to continue to travel point in front after the burst) it indicated very nearly the mean trajectory of the pattern, and, therefore, a hit by it would be most indicative of the accuracy of fire and should receive relatively great credit upon an artillery target. During the last target season several hits of both fuzes and cases were noted on board targets and the perforations made were circular and clean cut, indicating the likelihood that these parts were travelling true when they struck the target.

Aside from the indications of accuracy given by the shrapnel case and its fuze, there is another thing to be considered in connection with these particular parts, and that is, that the material effect of a shrapnel case or a fuze is manifestly greater than that of a pellet, as both the former and latter have mass enough with their remaining velocity to give them sufficient striking energy to perforate or smash the shield and injure both matériel and personnel. A little more in regard to this will be mentioned later.

Fragment hits will be generally of about the same destructive effect on living tissue and matériel as the pellet—sometimes more, and sometimes less, depending how these irregularly-shaped and oftentimes rather flat pieces strike their part of the target. It is thought proper to class fragment hits, therefore, with pellet hits, except where the hits can be clearly identified, as by a case or fuze, in which case, depending upon the target, particular values will be assigned to these case or fuze hits.

Assuming that, depending upon hits alone, a "factor of efficiency," E, is to be determined, we have

$$E=H+h+h_1$$

in which

H = the number of case hits made.
h = the number of fuze hits made, and
h_1 = the number of pellet and fragment hits made.

A material difficulty presents itself in attempting to make a comparison between the relative values of H, h, and h_1. As has been noted above great value should be attached to fuze and case hits upon artillery targets, since they indicate accuracy of fire usually; they indicate therefore (except possibly for a small central void in the shrapnel cone) that the greatest density of shrapnel bullets has been put on the target at this point; or, in any case, they indicate that the greatest density is little removed from the point of contact with the target. So much for the indication of accuracy. So far as effect is concerned, there are two items particularly important; the first is, *material effect*, and the second is, *psychological effect*. A shrapnel case smashing into a shield will materially injure it, and probably some parts of the gun, as well as the personnel behind it. Those who escape uninjured will be partially unnerved, and will carry in their minds a dread of the repetition of the same experience. The service of the enemy's piece is impaired thereby, and the feeling of more or less security previously enjoyed by the gun crew by noting the action of the shield in resisting shrapnel and infantry bullets, is largely dissipated, and the ragged hole left in the shield in itself offers an uninterrupted way for the searching of the small missiles which heretofore had been ineffective. Actual insecurity is magnified in the minds of those affected by the result of previous experience. So, it seems, the real value of a case hit is great. How great, in reference to the shrapnel pellet, would be highly interesting to positively determine. Since the remaining velocity of case hit, fuze and pellets for a normal burst (particularly those pellets near the center of the cone and therefore which strike near the case and fuze and at the approximate place of greatest density) is about the same at the moment of impact of any of them, on the same vertical target, it would seem that the proportionate effect would be indicated by their relative masses.[3]

But the probability of getting a hit with a shrapnel bullet at any given range, with normal burst, is much greater than that of getting a case or fuze hit at that range, since the spread of the sheaf permits considerable variation in deflection and range of the mean bullet of the sheaf and still allowing pellet hits to be obtained. So, as in a large number of shots fired, the effect seems to depend, first, on the number of hits obtained; and second, on the value of each hit, it is correct also to say that the value of a hit or the credit to be assigned for making it, should be recorded by dividing the number of such hits made

[3] This is not strictly true since the nose and pellets have an accelerated velocity over that of the case on the moment of leaving it; but, as they are smaller, and have less mass, the resistance of the atmosphere rapidly overcomes their momentum, and, for a burst at normal, the actual difference in velocity by the time they strike their target is probably not so very great.

by the probability of making such a hit for the range considered. Let us consider our expression:

$$E=H+h+h_1$$

Again

Let P equal the probability of making a case hit at the range considered.

Let p equal the probability of making a fuze hit, and

Let p_1 equal the probability of making a pellet hit.

Our expression now becomes:

$$E=\frac{H}{P}+\frac{h}{p}+\frac{h_1}{p_1}$$

or, basing efficiency on material effect (disregarding the effect of the psychological element of fear) and assuming that material effect on both animate and inanimate objects may be gauged by the mass where the velocities are about equal, we have, assuming the mass of the pellet as unity and M equal the relative mass of the case, and m equals relative mass of the fuze.

$$E=\frac{MH}{P}+\frac{mh}{p}+\frac{h_1}{p_1}$$

which more particularly applies to an artillery target.

The principal objection to such a value is that even if the exact range be found and a relatively small number of shots be fired, the effect, except perhaps as may be partially shown by the number of pellet hits, will not approach that to be obtained in the long run, for the reason that in the few shots fired we are liable to strike conditions which are not average ones. When the conditions are not average ones, then the results fail to show their comparative values. Hence, for service problems in which but few shots are fired, perhaps the most just comparison would be that of pellet hits alone. On the other hand is the claim of the battery commander who says, "I did hit my opposing guns with my cases, smashing in their shields and demoralizing the personnel as well. I should have credit for what I have actually shown the ability of my command to effect." The case certainly should have a just hearing. One way to adjust this difference would be to consider carefully the kind of target in assigning values to the hits obtained each year in the test problem. As shown above, in firing at a battery, a case hit is of serious importance; but, if the target were infantry, the value of the case hit could be vastly diminished, since in all probability it would kill or disable ordinarily not more than one or two men when used against deployed units. So, strictly speaking, it would appear that in firing at a battery as a target the high value to case hits should be assigned; but, where the target is infantry, or of some target not of matériel, then, without any very great error we may assume the value of case, pellet, fuze or fragment hit to be about the same, the probability of a hit from any one roughly the same and, our expression then, referring to an animate target becomes,

$$E=\frac{H+h+h_1}{p_1},$$

without material error.

But, the time element, heretofore discussed, is most important, and it would be more correct to say (assuming for simplicity the expression just suggested in reference to animate targets),

$$E=\frac{H+h+h_1}{Tp_1}$$

in which T equals the total time in seconds from the discharge of the first to the last shot in the problem.

Again, as mentioned heretofore, the element of range should be considered, as it will be impossible to have all problems fired at the same range, and the time of flight therefore will differ. If then the total time be diminished by the time of flight (corresponding to the gun range to the target) multiplied by the number of salvos or volleys fired, less one, the resulting value then would indicate the working time of the battery, or the time necessary to observe, give commands, load and fire, assuming that the number of rounds and salvos were the same in each case.

Assuming then that

t=time of flight in seconds.

n=the total number of volleys and salvos fired.

$$E=\frac{(H+h+h_1)}{(T-t(n-1))p_1}$$

Also, as hits per minute is perhaps a more convenient form to use than hits per second, and, as the value of the above expression is based upon hits per second together with the relative probability for the range to the target, the expression

$$E=\frac{60(H+h+h_1)}{(T-t(n-1))p_1},$$

becomes a more convenient measure of efficiency to handle, and it is therefore suggested.

As ranging salvos are in general, by their nature, more or less ineffective, the more used the greater should be the penalty, since both failure to observe the ranging shots and bad estimates in range, coupled with poor fire discipline, are the usual causes.

As the total time element (T) is running all the time, and the time of flight (t) will always be less than the time to fire and observe each salvo or volley, the term T — t(n — 1) will be constantly diminishing the value of E as a greater number of ranging salvos are fired, particularly as salvos are usually fired more slowly than volleys. Hence the denominator of this expression, as compared with the assumed correct value, is the term, which, in regard to time, either penalizes or gives credit.

The expression:

$$E=\frac{60(H+h+h_1)}{(T-t(n-1))p_1},$$

is complete only if the target consists of but a single figure. But the target usually consists of a group of figures, and very frequently these figures are of the same kind; for instance, a line of kneeling, lying down or standing figures, or a battery in position represented by ten silhouettes of the same size (6 caissons and 4 guns). Since the number of figures hit gives a measure of distribution, the above-assumed efficiency factor becomes:

$$E=\frac{60\times(H+h+h_1)}{(T-t(n-1))p_1}\times\frac{f}{F}$$

in which, F equals the total number of figures in the target, and f equal the number of figures hit.

It is considered quite necessary too, to introduce the term ($\frac{f}{F}$) as the case is likely to arise where one figure is hit by a number of pellets from the same projectile. The efficiency factor, or figure of merit being directly dependent on the proportion of figures hit (due to the introduction of the term ($\frac{f}{F}$) prevents, therefore, the case of the single shrapnel which puts a large number of pellets into a single figure, carrying too much weight.

For the purpose of exact comparison, the number of square feet in one kind of target as compared with another, should be considered; but, as in the test, the same kind of target should be given to all batteries the same season, we can, without error, assume *relative values* of the value of p_1 as it appears in the denominator of the above expression, for the ranges within which the limits of the target are properly set.

It not being desired to restrict a battery commander in any way in his ranging or fire for effect, he is at liberty then to range by platoon or battery as he may see fit and then having adjusted his range, deflection, distribution and corrector, he may fire his remaining volleys as rapidly as he desires at the ranges he deems to be most effective. But, as for each different case, depending on what kind of salvos and their number, as compared with the normal case assumed in the early part of this paper, it would necessitate figuring the time element exactly, it is considered sufficiently accurate to compare the time he actually took with the computed time that should have been taken in the normal case. But as the normal case assumes 9 salvos and volleys of 4 rounds each, his actual time (in order to reduce it to the working time) should be diminished by 8 times the time of flight for the gun range, provided he observes every volley and salvo.

But we have prepared a table of times for convenience. These tabular times will be designated by the expression T_1 and the total time from the first to the last shot will be denoted by T, then our efficiency expression, for convenience, can be taken as:

$$E = \frac{60 \times (H + h + h_1)}{\frac{T}{T_t} \times p_1} \times \frac{f}{F}$$

$$E = \frac{60 \times (H + h + h_1) \times T_t \times f}{T \times p_1 \times F}$$

(It is not necessary that the value of E should be recorded in hits per unit of time, but it should bear some relative value to that measure. The coefficient, 60, is left in as a convenient factor.)

The above makes an easy value to handle practically. The time is taken from the first to the last shot; the number of hits recorded upon the target is obtained by inspection; the gun range to the target (within a hundred yards) obtained by the range observations; the tabular value of T_t taken from a table corresponding to the range; and the relative value of p_1 taken also from a table depending on the range, and the value of E quickly computed.

For the sake of convenience alone in gauging efficiency (particularly in reference to values mentioned later on) it might be deemed advisable to introduce a constant, by which when the expression for E is multiplied, the resulting value in the basic case would become, say, one thousand (1000), or some other convenient number.

A similar expression can be used in the case where an artillery (instead of a strictly animate target is fired at). The value then is

$$E = \frac{60\left(\frac{MH}{P} + \frac{mh}{p} + \frac{h_1}{p_1}\right)}{\frac{T}{T_t^1}} \times \frac{f}{F}$$

If the target be one assigned that should be attacked by quick volleys without waiting for observation after each volley then particular tabular values for T_t may be computed. It seems fair in that case to compute the value of time for the six salvos in the manner heretofore given; or, to make an allowance of 6 times the time of flight (since each salvo certainly should be observed) and consider that each volley, regardless of range, should be delivered at the rate of 10 seconds for each one.

In preparing a figure of merit for a higher unit than that of the battery, there are certain additional considerations that enter. In the battery it is assumed that 36 rounds and 4 guns are used. As the number of hits is dependent upon the amount of ammunition used, it is to be remembered that where all guns of a battalion are firing on a single target, a different proportion as to rounds expended and the number of guns in action will enter. For instance, in the battery it is assumed that in the usual case nine rounds will be fired from each gun. In a battalion problem of, say, 24 rounds per battery, or a total of 72 rounds, there will be 12 guns present to do the firing, or an average of but six rounds per gun. Therefore, a totally different value of E_b for the battalion will be obtained, than that for the battery. Also, the relative sizes of the targets must be considered. So the value of E_b for the battalion should be multiplied by a ratio, R, in order to bring the normal value to that of the battery, for the purpose of combination, in order to form an ultimate idea of the real value of the battalion, together with its battery units, as outlined earlier in this paper.

Similarly, figures of efficiency for the regiment may be determined.

CONCERNING THE DEFENSIVE VALUE OF A BATTERY

The Pistol.—All of the above is suggested as a method of determining the *offensive* value of a battery. Its defensive value is dependent upon its offensive value plus its ability to use the pistol. This statement is made because of the following quotation, to be found in paragraph 855, Drill Regulations, "at the last, officers and men should take shelter among the carriages, and with their pistols force the enemy to pay the dearest price for the possession of the guns." The pistol is then supplied for a definite artillery purpose, and the ability of the men in a battery to use a pistol, affects materially its battle efficiency.

While in any system of grading some more or less arbitrary method must be assumed which frequently introduces artificial conditions, it is believed that a system can, however, be used in which both the pistol efficiency and artillery fire efficiency of a battery may be properly combined without being unfair relatively to any organizations concerned. In connection therewith the following is suggested:

Let us assume that at the time of firing the battery field artillery problem for determining the figure of merit, that a figure of merit of pistol efficiency is also added to the value of E, and thus a total figure of merit (so far), M_t, is obtained; or, M_t equal E + P, in which P = pistol efficiency of a battery. As, in close quarters, one qualified man would be very probably as good as another (since ability to shoot and hit rapidly is desired, rather than fine work at a long range, such as is demanded of an expert pistol shot), the value of P should depend upon the total number of qualified men compared with the total number of men in the battery, at the time of firing the battery field artillery test, who have had the regular pistol course,—or, if,

Q=the sum of the number of first- and second-class men and experts in the battery, and U = the number of men in the battery who have failed for qualification, then

$$P \text{ equal } \frac{Q}{Q+U}$$

Those men who have never fired the pistol course, being unknown quantities, should, therefore, be disregarded.

The general value of P with respect to E must be adjusted.

Let us take what may be considered a basic case: Suppose a battery to fire upon a line of infantry at 3000 yards, these men being entrenched, showing only the upper part of their bodies and at one yard intervals. Since in our normal case we have assumed 3 battery volleys for effect, after the range has been well established, we will consider the same in this case.

Referring to paragraph 61, *Gunnery and Explosives for Field Artillery Officers*, it will be noted that for the 3 mil height of burst, the density on a vertical target is given as one pellet per square yard, or $\frac{1}{9}$ of a hit for each square foot. On page 26 of Rouquerol's *Tactical Employment of Quick-Firing Field Artillery*, it is noted that the vertical surface of a man lying down is 1.3 square feet. This may be reasonably assumed as the amount exposed by a man in a trench. Also, since more than two rounds are considered for each gun, it is also reasonable to assume that the swept section due to the burst from the shrapnel from each gun will be 25 yards in width. As there are 100 men then under fire, each presenting a surface of 1.3 square feet. There are 130 square feet exposed to a density from each round of $\frac{1}{9}$ of a pellet per square foot, or there should be, theoretically, $\frac{1}{9} \times 130 = 14$ men hit out of the 100 in the first volley.

In the second volley there would be

$$\frac{(100-14)\times 1.3}{9} = 12 \text{ men hit.}$$

In the third volley there would be

$$\frac{(100-26)\times 1.3}{9} = 11 \text{ men hit.}$$

Or there would be 14 + 12 + 11 = 37 men hit out of a total of 100, with 42 hits on these 37 men.

Assume also that the time of firing is exactly normal.

Since we have assumed an exact condition (in fact a perfect one) the probability of hitting may be disregarded, and we may see:

$$E=(60\times 42)\times \frac{37}{100}$$

$$E=932$$

Assuming a calculated value of E in round numbers as 900, what relation should the pistol efficiency bear to it? It seems that approximately 10 per cent. should be somewhere near correct. These two quantities are not capable of being mathematically expressed in fixed relation to each other, hence some arbitrary relative values must be assigned in accordance with our judgment. In this case a maximum value of 100 (or every man who had taken the pistol course being reported as qualified) would be approximately a proper value and the *percentage* of qualified men added to the total number of points obtained in the artillery problem could give a figure of merit, or M_t, for all firing.

So far, the test outlined includes the firing of a test problem, and the value of the annual pistol results. A test of the character suggested would have its value in stimulating interest throughout the arm, and, even if not an absolute measure of comparative efficiency, would probably be a close estimate and would serve to keep up constant competition and develop firing methods. In some organizations pistol practice would probably receive more attention than it has in the past. Regulations require this instruction. Our rules for combat call for its knowledge. We are armed with the weapon. If we are not required to use it reasonably well, it should be taken from us as an arm. We have it, so we must make the most out of it that training will give.

GENERAL REMARKS REGARDING FIRING

Everything should be done to make the annual field test interesting, to approach war conditions, and to eliminate the artificial elements, such as, for instance, the recording of the shots by a battery commander. The Ordnance Department and other offices will get enough data to keep them busy if all problems, other than the test problems, are recorded.

In this suggested method of comparison, the ability of an organization to secure hits per unit of time is recorded with some degree of accuracy and this should be its real test of efficiency as a fire unit.

It is not at all a complete test to grade batteries on their rate of fire alone, and their method of handling ranging problems. It is not unusual in the present artificial method of firing ranging problems alone to have a solution, practically perfect as to methods, but with not a single hit recorded. The problem is incomplete. The information acquired by ranging has not been proved. The cannoneer, too, should have confidence in his weapon, and that is best given him by an object lesson, obtained by firing in a few problems a fair number of rounds for effect, so that he may see the results. It is necessary that the battery commander, too, should have the practice, so that he can unhesitatingly deliver the kind of fire most effective at the earliest practicable moment. The battery commander should have experience in observation of effect which he gets only by accident in ranging problems. The number of rounds suggested is the very minimum. Enough should be authorized to show what the weapon can do and be sufficiently great to be reasonably sure of eliminating largely the element of pure luck.

The present tendency is to get in a groove and to solve all similar problems in practically the same way, particularly in many cases just to be in accord with regimental orders and thereby avoid trouble. Is this for the best? Is not the best measure of success, success itself? Getting in a groove kills initiative. Initiative produces development, and lack of it mediocrity. If an artillery commander sees a chance to depart from the established rules to secure results, in the form of hits on his target, he should do so. The method of working suggested herein will either verify or condemn his judgment if he departs from established methods which are generally referred to as "good practice." The mark he makes appears against him either as a credit or otherwise, and reflects both the value of his organization as a team (as the result of the training he has given it) and his own ability and judgment in conducting fire.

MARCHING

So far there is one very important element in the grading of batteries that we have not considered, and that is their ability to march. A battery unable to "deliver the goods" by its fire effect because it is unable to make long, hard and rapid marches, is of little value. The ability to deliver crushing fire effect at the psychological moment at the place most needed is dependent upon superior marching ability. The annual test should therefore include a real marching test of considerable difficulty. Preferably a long march of several days should be exacted, under field service conditions, at the end of which a rapid long day's march, or a night march requiring the battery to be in position at dawn should be required. The problem should then be fired at the termination of the march. Grading upon marching ability, seems at first to present considerable difficulty, but upon an analysis of the question it does not seem so difficult after all. A system similar to the long distance motor car efficiency runs is suggested.

Let it be assumed that some given value proportionate in our judgment to the relative value of marching ability, compared with shooting ability, be assigned as the maximum value of the test. It was seen that the standard of hitting ability was assumed in one case as being about 900. The standard expression for E can be multiplied by some constant, C, which will give this basic value always. Assume it as being 900, the pistol efficiency might add another hundred, bringing up the value to one thousand. Now suppose we assign a value to the maximum marching ability of, say, 500 points. If an organization marched perfectly and shot perfectly, too, under the conditions assumed it might properly make a total of 1500 points. To arrive at the value assumed for marching ability in each case, it would be necessary to have a scale of points determined upon beforehand.

For example only:

The march to be timed, distance known beforehand, rate of marching required, say 6 miles an hour for 18 miles.

Deductions:

	Points.
For every minute late at the appointed rendezvous	10
For every man absent	5
For every animal absent	5
For every caisson absent	25
For every piece absent	50
For every strap broken	1
For every trace broken	3
For every sore back, sore shoulder or gall caused by the marching test	3

and so on to cover most of the ordinary failures.

The value assigned to an organization for its total efficiency would then be a sum consisting of the points made in artillery firing, those in pistol practice and those in the marching test.

Closing Remarks

These explanations have been long, but the working out of the system should be easy. The particular improvement needed in it is the opportunity to use once a year more than 36 rounds allowed each battery for inspection purposes. This had far better be increased to 48. As previously stated, confidence in our weapon so far as the enlisted man is concerned is not only desirable, but really is an essential element. If you can show him once a year what his weapon can really do, he will exhibit more interest and acquire that confidence which he must honestly possess in order to return the best service himself.

There has perhaps been a factor disregarded in determining the value of E, which should be considered, and which depends upon the relative visibility of the target. It should not extend over too wide a range or its governing features might at times be abused. This is a quantity more liable than any other to suffer a departure from its true value, as it will become a matter, principally, of judgment for the umpire. For his guidance alone, rather complete rules could be properly formulated to give him the necessary information in preparing himself. If, for instance, a value of unity were given for the visibility factor in the case when observation was excellent, the following remaining values might well obtain:

Very good	1.05
Good	1.10
Fair	1.15
Poor	1.20
Bad	1.25

The value for E should be multiplied by the visibility factor most applicable at the time of the problem for the target concerned.

While not directly connected with this subject, but in order to show that a system of the kind suggested would have a further application, it seems pertinent to remark that to-day, in the promotion examination, a limited amount of ammunition is given a captain, and he is supposed to fire a service problem. The idea is all right in some respects but lacking in others. To begin with, in many cases the officer goes to a strange post for his examination and works with an organization with which he is unfamiliar. The enlisted men are not even interested in the results, probably, as the officer is a stranger and they feel bound to him by no particular ties of loyalty and *esprit*. He does not get the snap and ginger his own battery delivers. He is given a machine to use, the operation of which in no way depends upon his adjustment of and familiarity with it. It is much like handing a skillful surgeon an assortment of instruments and calling upon him to perform a major operation—his first demand would be, "Give me my own"—for, to meet with greatest success he needs those that he uses every day and of which, in consequence, he knows their balance, their cutting powers, their limitations. An officer's practical work should be judged by the results he achieves from the use of the tools constantly in his hands, and not with strange instruments. An officer's ability to command should be judged by the degree of development to which he can bring a tactical unit which has been under his constant instruction. Yearly test problems could be arranged to be fired under conditions closely approximating those of war service. The results of these annual tests, aside from giving a relative standing to the organization, could well be entered on the individual service report of each battery, battalion and regimental commander, and expressed in some graded form of an efficiency mark converted into actual figures, as suggested in this paper. Is not the ability to cause a command to acquire a valuable degree of training and fighting efficiency a better measure of a man's value to the service in time of war, than his ability to put up a pretty recitation upon the First Bull Run? Rather, too, than judge an officer's value upon the result of a single test, where luck has an opportunity to figure to an unwholesome degree, it would seem far fairer to him and the military establishment, too, to take the yearly reports of his work, as shown by the figures of merit of the organizations under his command, through a series of years, and then average all the results. A bit of misfortune, or unusually good luck, would be eventually compensated, and a fair average determined in the number of years ordinarily spent in any one grade.

Pertaining to the computations in this paper, it is regretted that the limited time permitted the student at this school for the preparation of original matter has not made it practicable to compute the values of P, p, and p_1, for each 100 yards between usual ranges, say from 1500 to 6000 yards. The values of P and p can be taken as being the same as for a direct hit, as they will be practically upon the mean trajectory. Values for p_1 for the target considered will require considerable computation. It will be necessary first to consider the effective shrapnel bullets, then to compute the density of hits and their relation to the width of the zone dispersion in a large number of cases. Hence this paper is necessarily submitted as being incomplete, but with, however, what is intended as a reasonable outline upon which to work.

The Service Buzzer Code

BY FIRST LIEUTENANT WEBSTER A. CAPRON, FIELD ARTILLERY

The Service Buzzer, brought out by the Signal Corps and used by that corps exclusively until 1914, has been issued as a part of the Field Artillery equipment.

The recommendation of the Field Artillery Board which led to the adoption of this instrument was based upon the desirability of uniformity of type which tends to economy and quick repair, and upon the inherent efficiency of the Service Buzzer as a telephone.

There was no idea of extending the scope of field artillery signallers to include any of the functions of signal troops nor of supplementing the field communication of the army. The telephone is as much an integral part of the Field Artillery as its guns, and is furnished for the sole purpose of facilitating the conduct of fire and fire direction.

It seems apparent from the present European War that buzzer communication must frequently be used in lieu of the telephone for field artillery fire control. Noise and, more frequently, line troubles make this imperative. Fortunately the high secondary voltage of our buzzer can be detected in our telephone receiver even when the line is completely parted, and ordinary grounds on the system scarcely diminish it.

The Field Artillery already having a letter code for the rapid transmission of firing data with the semaphore and being equipped with an instrument embodying both the telephone and buzzer elements in a high state of efficiency, it was logical that the same code should be employed with both.

The question at once presented itself as to whether the Continental or American Morse code should be adopted. The answer is obvious, the Continental Morse code; *i.e.*, the general service code. Each battery is required by Army Regulations to maintain two of its enlisted personnel at a high state of proficiency in this code. These men are members of the battery signal detail and are familiar with the letter combinations for firing data transmitted via semaphore, and can at once take up the buzzer. This does not imply that many hours of hard and conscientious practice will not be necessary before actual efficiency can be attained; but it is obvious that if the code and the letter combinations are known, a good working basis has been established. Suppose we attempted to employ the American Morse, the best signal men available would be found in the battery detail and the thought of taking up a third and new code would at once dishearten the most enthusiastic of them. They would be entirely discouraged when they discovered that five elements composed the new code as against two in the old. Let us consider this comparison: the elements of the Continental or general service code are the dot and the dash, not difficult to distinguish in sound, those of the American Morse are the dot, dash, long dash, longer dash and space, very difficult of differentiation. By glancing at the two codes when printed, one does not appreciate this vast difference, but let the reader actually attempt to sound or hear them on a buzzer and he will be convinced.

The beginner erroneously devotes all his time to receiving, not realizing that sending has an almost equal importance, but let him attempt to receive a poor sender even though he has mastered the listening end of the line, and he is not only greatly confused but loses faith in his own ability; on the other hand let both receiver and sender be new, inexperienced and inefficient, communication will be nearly impossible. If we bear in mind the above and also the fact that the field artillery operator has little time to become proficient in this one small part of his many and various duties, it is readily seen that simplicity must be the paramount consideration in the choice of a code.

The great difficulty with the American Morse is differentiating between the space element in a letter and the space separating two letters. Good operators will have difficulty during the stress and noise of cannon fire to understand correctly, while the less efficient will be constantly "breaking" the sender and making grave errors. A good illustration of the confusion of spaces is seen in the word "rice." By American Morse, this would be transmitted by .... It is readily seen that the least error in spacing on the part of the sender or receiver will give a great number of interpretations, which, in an ordinary message might be eliminated by virtue of the context, but when the use of a code in which letter combinations follow each other without sequence, will invariably result in a repetition of the message or serious mistakes, the former sacrificing valuable time, the latter intolerable.

The American Morse is prescribed for use on all field lines, and this is readily applicable to the Signal Corps whose operators have ample schooling in telegraphy and which expects to gain recruits from the great force of civilian operators in case of war. The Field Artillery, on the other hand, not only establishes purely local lines for the sole purpose of intra-artillery communication, but also is dependent upon operators who cannot specialize to the extent possible for Signal Corps operators. It is also highly improbable that experienced civilian telegraph operators will be available for the Field Artillery in time of war. Such men will undoubtedly be assigned to the Signal Corps.

There is little possibility of confusion between the Signal Corps and the Field Artillery if different codes are used. If a Signal Corps line is laid it will be manned by Signal Corps personnel; and if it becomes necessary to extend a field artillery line its stations will be in charge of field artillerymen. Interference on the two lines caused by induction will be greatly reduced if the codes are different.

Though little has yet been done in our service to develop aeroplane control of field artillery fire, there is no doubt that the European War has demonstrated the necessity of developing such control, and our failure to attempt it seriously is greatly regretted. It will, of course, be taken up eventually, and the question of the best means of communication will then have to be determined. Leaving out of consideration arbitrary methods of signalling such as the Very pistol, smoke-puffs, banking, turning, and other uncertain expedients, we arrive at the application of radio communication.

The principal obstacle encountered in radio communication from aeroplanes is the difficulty of equipping the plane with a satisfactory receiving apparatus. The ordinary devices are not satisfactory because of the noise and vibration; but it is reported that amplifiers have been constructed which will either record the signals visually or else make them sufficiently strong so that they will be audible. Even though this is possible, it is not essential that the observer should receive; and his ability to send is of far greater importance. For this purpose a sending apparatus embodying high-frequency generators driven from the main shaft, with transformer, capacity and inductance has been constructed which combines lightness, compactness and efficient sending radius. Trailing antennæ are used; and the power plant, with all metal parts, is utilized as a counterpoise.

Observers for such work should certainly not be drawn from the Flying Corps. This branch will be fully occupied with training aviators, and will have no time or opportunity to train field artillery observers. Aerial observers must be taken from the personnel of the Field Artillery; and the data transmitted by radio from the aeroplane must be received by field artillerymen at the batteries. As the Continental Code is used in radio transmission it is all the more important that field artillerymen should not be burdened with the American Code for normal fire control.

THE LETTER CODE

When the semaphore system became a means of fire control communication, it was found expedient to use single letters or combinations thereof to indicate commands and firing data. At first only a few abbreviations were employed, but as the needs became greater others were adopted to fulfill necessary requirements. Signal men, through healthy rivalry, attempted all manner of abbreviation and short cuts in order to reduce the all-important time factor, but the very existence of these caused them to be purely local in each battery. It was seen, therefore, that if no regular code were prescribed, each battery unit, working out its own salvation, would simply produce failure when numerous units combined. In making up this prescribed list of abbreviations, or letter code, no attention whatever was paid to seeking conformity with commands applicable to other arms of the service, nor was communication with the Navy considered, the one great object being to secure rapidity and accuracy of fire.

It is preposterous to suppose that the fact of other arms having certain signals peculiar to themselves, would interfere in the slightest degree with the use by the Field Artillery of its special code. No such idea, at least, existed so long as fire control communication depended upon the semaphore and telephone, but when the use of the buzzer element of the telephone was found necessary, a strenuous objection arose, based, apparently, upon the fact that the service buzzer would probably be used throughout the Army.

Though it is advantageous to draw up a letter code involving, as far as practicable, signals whose meanings conform to all arms of the service and contain nothing which conflicts with them, to distort the code necessary for Field Artillery use so as to fill all the requirements of other arms, will render it anything but efficient. If such a procedure be followed it would be well to retain the recently prepared code for semaphore transmission and attempt to burden the signal detail with an entirely different system when recourse to the buzzer becomes necessary. It is hoped, however, that realization of the entire local and self-contained character of Field Artillery fire control communication, will prevent the existence of any such condition.

In the following letter code an attempt has been made to employ those signals whose meaning, though very necessary to other arms, should be known by Field Artillery as well.

A	Error (Ardois and Semaphore only).
*	Error (Ardois and Semaphore excepted).
AD	Add.
AP	Aiming Point.
B (numerals)	Battery (so many) rounds.
BS (numeral)	(Such) Batallion station.
BL	Battery from the left.
BR	Battery from the right.
CCC	Charge (mandatory at all times). Am about to charge if not instructed to the contrary.
CF	Cease firing.
D	Down.
DF	Deflection.
DT	Double time. Rush. Hurry.
FCL (numerals)	On first piece close by (so much).
FL	Artillery fire is causing us losses.
FOP (numerals)	On first piece open by (so much).
G	Move forward. Preparing to move forward.
HHH	Action suspended. Halt.
IX	Commence firing. Fire. Execute. Go ahead. Transmit.
K	Negative. No.
KR	Corrector.
KF (numerals)	Continuous fire(interval).
KS (numerals)	Continuous fire. Sweeping (interval).
L	Preparatory. Attention.
LCL (numerals)	On fourth piece close by (so much).
LOP (numerals)	On fourth piece open by (so much).
LT	Left.
LL	Left from the left.
LR	Left from the right.
LE (numerals)	Less (so much).
MR	Move to your right.
ML	Move to your left.
MU	Move up.
MD	Move down.
MO (numerals)	More (so much).
N	Annul. Cancel.
O	Interrogatory. Question. (Ardois and Semaphore only).
* .. - ..	Interrogatory. Question. (Ardois and Semaphore excepted.)
P	Affirmative. Yes.
PS	Percussion shrapnel.
QRQ	Send faster.
QRS	Send slower.
QRT	Cease sending.
R	Acknowledgement. Received.
RS	Regimental station.
RL	Right from the left.
RR	Right from the right.
RN	Range.
RT	Right.
S	Subtract.
SCL (numerals)	On second piece close by (so much).
SOP (numerals)	On second piece open by (so much).
SH	Shell.
SI	Site.
SSS	Support needed.
TCL (numerals)	On third piece close by (so much).
TOP (numerals)	On third piece open by (so much).
U	Up.
Y (letter)	(Such) Battery station.
*—Interval	End of word.
*—Double Interval	End of sentence.
*—Triple Interval	End of message.
*— -...-	Signal separating text from signature.
*—Double interval SIG interval	Signal separating text from signature. (Ardois and Semaphore only).
*—Interrogatory A (word)	Repeat after (word).
*—Interrogatory twice	Repeat last word.
*—Interrogatory thrice	Repeat last message.
*—.-...	Wait a moment. (Ardois and Semaphore excepted).
*—...-.-	Finished. End of work. (Ardois and Semaphore excepted).

* Those marked *, if incorporated in the new Signal Book, should not appear in the Manual for Field Artillery.

The following additional abbreviations should be prescribed and will be memorized for communication by buzzer only:

AA	Numerals follow. Numerals end.	. . . .	Four.
		. . . . .	Five.
FONE	Use of telephone.	– .	Six.
MCM	Emergency. All operators attention.	– . .	Seven.
		– . . .	Eight.
.	One.	–	Nine.
. .	Two.	—	Zero.
. . .	Three.		

The following abbreviations are authorized and will not be altered, but need not be memorized:

AKT	Draw ammunition from combat train.	AMC	At my command.
AL	Draw ammunition from limbers.	CS	Close station.
		CT	Change target.

F (S, T, or L)— {AD, D, S, U} .... 1st (2nd, 3rd or 4th) piece— {Add, Down, Subtract, Up}

MO	March order.	OV	Over.
MIN	Report minimum range, site 300.	PA	Limber.
JI	Report firing data.	T	Target.
MDF	Measure the deflection.	Z	Short.
MPF	Mark a platoon front.	ZO	Zone.

The following conventional signals will be used with the buzzer:

Attention (or call)	When there is but one other station on the line repeat L until acknowledged by R. When there are several stations on the line signal L followed twice by the call letters of the station called and once by the call letters of the station sending; repeat, if necessary, until acknowledged.
Acknowledgement of call	Letters of the station called, followed by R.
Here is a message	HR to precede each message as distinguished from data.
Numerals follow (end)	Used only in messages, not in firing data, RN precedes the range.

Recoil Brake Pressure

AN EXACT METHOD OF COMPUTATION

BY CORPORAL JOHN F. PELLY, BATTERY A. NATIONAL GUARD OF PENNSYLVANIA

This article is based upon the law of expansion of the powder gases evolved by Professor Franklin of Lehigh University, which assumes that the muzzle pressure continues to act on the gun with a constant value during the total time of after effects, and then drops to atmospheric pressure.

The author has made some interesting deductions which merit careful consideration. THE FIELD ARTILLERY JOURNAL *is confident that officers of the Ordnance Department will welcome the opportunity to discuss the subject fully in later issues. We are indebted to First Lieutenant Burton O. Lewis, Ordnance Department, for the following brief comment: "A method is proposed for the analytical determination, at the instant of maximum velocity of free recoil, of the velocity of the powder gases, which value has previously been obtained by computation based upon the experimentally determined value of the maximum velocity of retarded recoil of the gun.*

This particular feature of the problem has been investigated by the Ordnance Department, although the experimentally determined value of the velocity of the powder gascs has given satisfactory results for use in carriage design.

It will also be noted that the time during which the powder gases would act upon the gun after the projectile has left the bore would be considerably reduced by this law of the expansion of the gases.

The fact that recoil throttling areas computed from these equations check with the present design gives the method additional weight. No further comments on these deductions are made at this time, as the idea is a new one which must necessarily be traced from the source."

THE recoil of a gun is made up of two parts: (a) The Acceleration Period, extending from the beginning of motion to the ceasing of the after-effects of the powder gases, and, (b) The Retardation Period, extending from the ceasing of the after-effects of the powder gases to the end of the recoil.

It is with the acceleration period that we are mostly concerned. The acceleration period is, of course, intimately connected with the gas pressures in the bore. This leads to the division of the acceleration period itself into the period during which the projectile is in the bore and the period from the time that the projectile leaves the muzzle to the ceasing of the after-effects of the powder gases. The rise and fall of the pressures along the bore and the corresponding change of velocity of the projectile may be readily and accurately computed.

With this data given, values of recoil velocity and distance recoiled may be obtained with considerable accuracy either by graphic methods or from pressure ratio constants, ending with the velocity of the gun as the projectile leaves the muzzle. Beyond this point all methods for determining velocity and distance travelled have been very crude, depending on the experience of the computer in estimating the probable maximum or on the results of tests when available.

In this article, the method as outlined by Professor F. Raussenberger in "Theory of the Recoil of Guns" (*"Theorie der Rohrrücklaufgeschütze"*) has been followed so far as form is concerned.

But for the period of the after-effects of the powder gases when the projectile has left the muzzle, his assumptions with regard to pressure changes are incorrect, and require the insertion of empirical constants into the formulæ. These constants being only approximations, unsatisfactory results are obtained. The following method takes care of the after-effects of the powder gases generally, thus avoiding the necessity for previous experimental data. Recoil throttling areas obtained by using this method were compared with the actual values used on guns varying in size from one pounder to 14 inches (pedestal, barbette, field guns and howitzers) with excellent results.

We will assume the following nomenclature:

Let d = diameter of bore of gun—inches

$\overline{w}$ = weight of powder —pounds

w = weight of projectile —pounds

Γ_o = muzzle velocity of projectile—feet per second

s = travel of projectile in bore—feet

W = weight of recoiling parts—pounds

p_e = muzzle pressure — pounds per square inch

$P_e = \frac{\pi d^2}{4} p_e$ = total muzzle pressure—pounds

$P'_e = 144 \times 32.16 \times p_e$ = muzzle pressure in poundals per square foot

$P_a = 144 \times 32.16 \times 14.7$ = atmospheric pressure in poundals per square foot

f_v = theoretical velocity of gases leaving the gun—feet per second

v' = volume of gases at muzzle—cubic feet

$\Gamma_e = v' \div \overline{w}$ volume of gases at muzzle—cubic feet per pound

V_o=free recoiling velocity of gun as projectile leaves the muzzle—feet per second

V_r = free maximum velocity of recoiling parts—feet per second

E=potential energy of gas at muzzle—foot-poundals

K = effective recoil brake resistance—pounds

t_o=time of travel of projectile in bore—seconds

t' = time of after-effects—seconds

R = recoil distance—feet

k = ratio of specific heats of gases = 1.28

The sum of the potential and kinetic energies of the gases when the shell is about to leave the muzzle is

$$E+\frac{1}{2}\left(\frac{1}{2}\,\overline{w}\,v_o\right)^2=\frac{1}{2}\,\overline{w}\int^2 v \qquad (A)$$

The value of E is obtained in the following manner. Referring to the condition existing as the projectile leaves the muzzle we have for adiabatic expansion

$$pv^k = C \text{ (a constant)}$$

This gives the relation between the volumes and pressures of the gases expanding after the projectile leaves the gun. The available work of expansion from P'_e to P_a is

$$E = \overline{w}\int_{P_a}^{P'_e} pdv \text{ foot-poundals}$$

Since $$pv^k = C, v = \left(\frac{C}{P}\right)^{\frac{1}{k}}$$

$$dv = \frac{1}{k}\left(\frac{C}{p}\right)^{\frac{1}{k}-1} \times \left(-\frac{C}{p2}\,\mathrm{dp}\right) = \frac{1}{k}\left(\frac{C}{p}\right)^{\frac{1-k}{k}} \times \frac{C}{p^2} \times dp$$

$$\therefore E = \overline{w}\,\frac{1}{k} \times C\frac{1}{k}\left[\frac{p^{-\frac{1}{k}+1}}{-\frac{1}{k}+1}\right]_{P_a}^{P'_e} = \frac{wC\frac{1}{k}}{k-1}\left[P'_{\acute{e}}{}^{\frac{k-1}{k}} - P_a{}^{\frac{k-1}{k}}\right]$$

But $$C=pv^k = P'^e v^k_e$$

$$\therefore E = \frac{wP'e^{\frac{1}{k}}v_e}{k-1}\left[P'_e{}^{\frac{k-1}{k}} - P_a{}^{\frac{k-1}{k}}\right]$$

$$= \frac{\overline{w}P'e^{\frac{1}{1.28}}}{.28}v_e\left[P'_e{}^{\frac{.28}{1.28}} - P_a{}^{\frac{.28}{1.28}}\right]$$

$$P_a{}^{\frac{.28}{1.28}} = (14.7 \times 144 \times 32.16)^{\frac{.28}{1.28}} = (68060)^{\frac{.28}{1.28}} = 11.407$$

and $$E = \frac{wP'e^{\frac{1}{1.28}}}{.28}v_e\left[P'_e{}^{\frac{.28}{1.28}} - 11.407\right]$$

A table of values for $\frac{P'_e{}^{\frac{1}{1.28}}}{28.}\left[P'_e{}^{\frac{.28}{1.28}} - 11.407\right]$

for different values of p_e is provided below.

Then $E = wv_e$ times a constant for a given pressure. $\overline{w}v_e = v'$ = volume of gases as projectile leaves muzzle and $E = v'$ times a constant. That is, the potential energy of the gases at the muzzle equals the product of the volume of the gases at the muzzle in cubic feet and a constant.

Muzzle pressure pounds per sq. inch	Log. of Constant	Muzzle pressure pounds per sq. inch	Log. of Constant
1500	7.19840	10000	8.09931
2000	7.33820	11000	8.14352
2500	7.44569	12000	8.18381
3000	7.53298	13000	8.22083
3500	7.60643	14000	8.25001
4000	7.66980	15000	8.28695
4500	7.72551	16000	8.31762
5000	7.77419	17000	8.34453
6000	7.86090	18000	8.37082
7000	7.93313	19000	8.39564
8000	7.99598	20000	8.41923
9000	8.05298		

Referring to equation (A) the only unknown quantity f_v is now readily obtained.

Taking once more the condition as the projectile leaves the muzzle, the momentum imparted to the gun equals the combined momenta of the projectile and the gases

or $$wv_e + wf_v = WV_r$$

from which is obtained the value of V_r, the maximum free velocity of the gun. The velocity imparted to the gun due to the after-effects is (V_r - V_o) where

$$V_o = \frac{v_o\left(w + \frac{1}{2}\bar{w}\right)}{W}$$

Since the total impulse equals the momentum imparted it follows that

$$t' = \frac{W}{g}\,\frac{(V_r - V_o)}{P_e} = \frac{M}{P_e}\,(V_r - V_o) \text{ in which } M = \frac{W}{g}$$

This equation of impulse versus momentum is based on the assumption that the muzzle pressure continues to act on the gun with a constant value during the total time t' of the after-effects, and at the end of this time it immediately drops to atmospheric pressure. An explanation of this phenomenon will be found in *The Journal of the Franklin Institute*, May, 1915, in which Professor W. S. Franklin, Professor of Physics at Lehigh University, discusses the result of the after-effects of the gases on the momentum of the gun. His article takes into account various refinements undoubtedly necessary to a complete discussion of the case. Omitting these complications and assuming the muzzle pressure constant during the after-effects, has not in any instance, detracted from the accuracy of the result.

To determine the brake pressure, let

$$Y = MV_o + P_e t'$$

and

$$Z = \frac{2w + \overline{w}}{g} \,.\, s + 2MV_o t' + P_e t'^2$$

It will be noted that these equations are slightly different from those given in "Recoil of Guns."

$$t_o = \frac{2s}{v_e} \times \text{a constant}$$

times a constant depending on the average pressure of powder gases. A table giving these values is found in "Recoil of Guns."

This value of t_o may also be found by plotting the reciprocal of the velocity of the projectile in the bore against travel of projectile in bore. The area under this curve will be t_o. This possibly gives a more exact value but is a tedious operation compared to the above equation and the difference has been found to be of very small importance in the whole calculation.

$$K = \frac{Y^2}{2MR - Z + 2Y(t_o + t')}$$

This equation is the same as Raussenberger's formula in form but not in value.

The recoiling velocity of the gun can now be obtained.

$$V'_o = V_o - \frac{K}{M} t_o$$

This gives the velocity of the gun as the projectile leaves the muzzle.

$$S'_o = \frac{w + .\overline{5}w}{W + w + w} \,.\, s - \frac{Kt_o^2}{2M}$$

This gives the distance in feet that the gun has travelled when the projectile leaves the muzzle.

$$V'_1 = V_o + \frac{P_e t'}{M} - \frac{K(t_o + t')}{M}$$

This gives the maximum velocity of the gun.

$$S'_1 = \frac{w + .5\overline{w}}{W + w + w} \;.\; s + V_o t' + \frac{P_e t'^2}{2M} - \frac{K(to + t')^2}{2M}$$

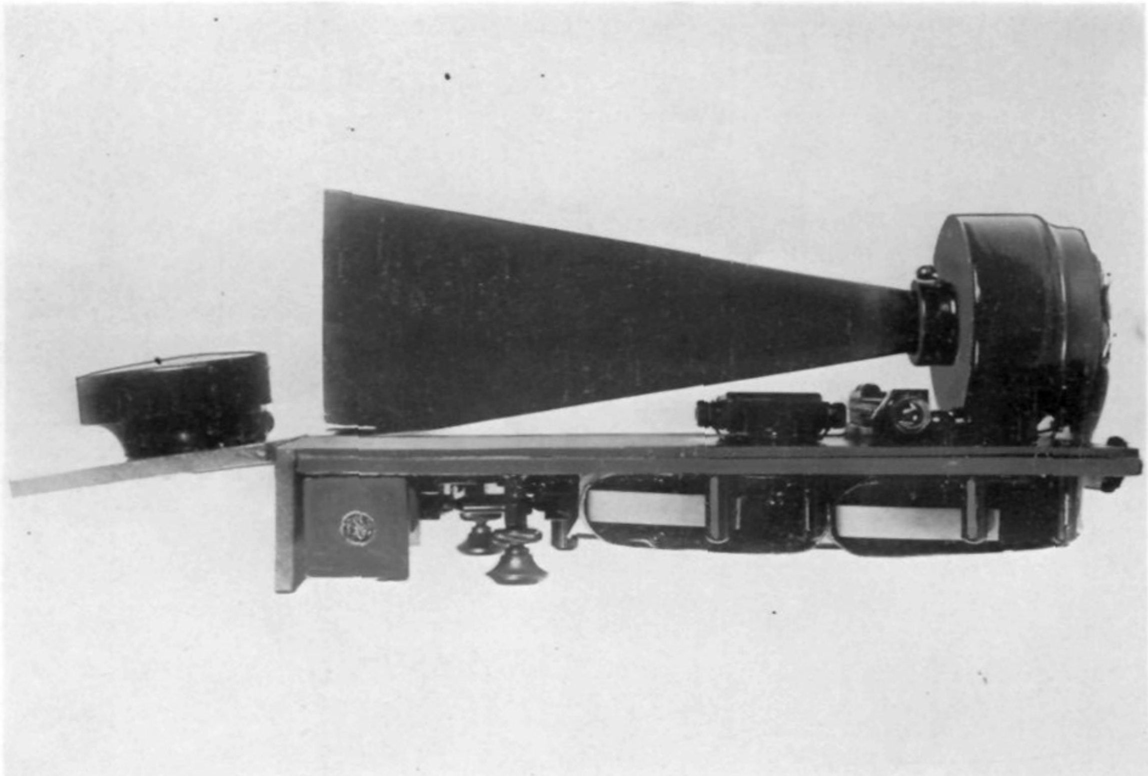
This gives the distance the gun has travelled when the maximum velocity has been attained.

For velocities during the retardation period we have

$$V_x = \sqrt{\frac{64.32\,K}{W}(R - X)}$$

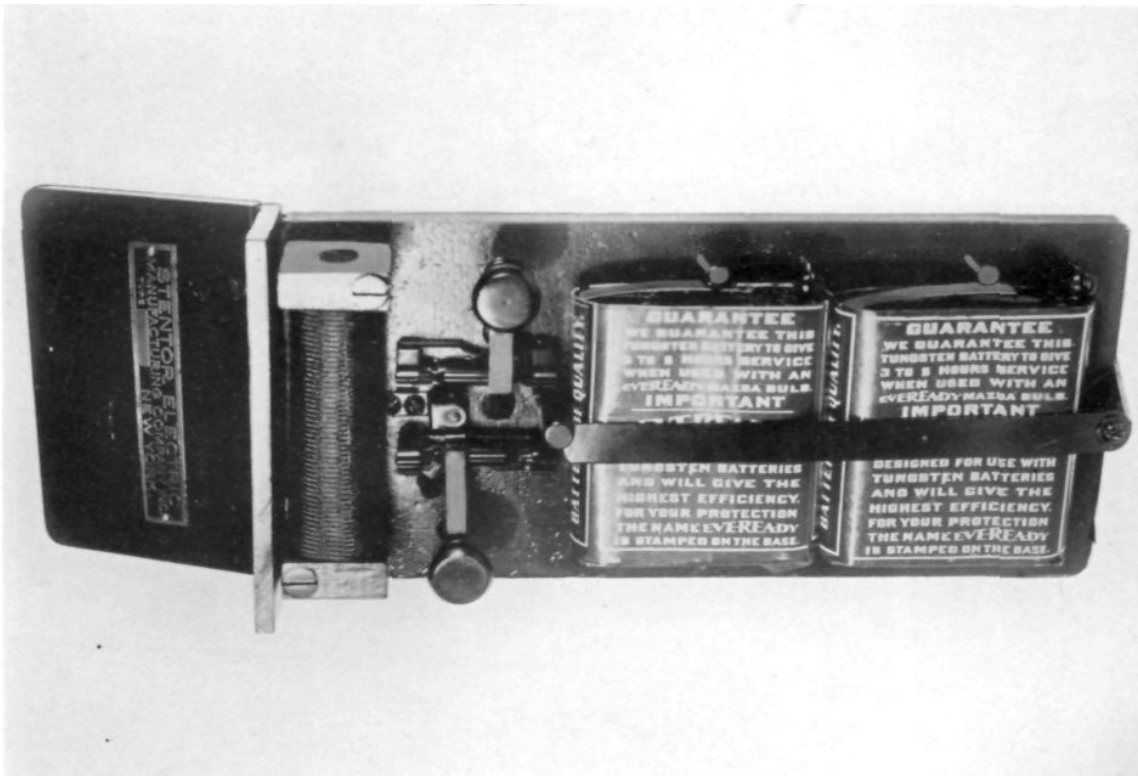
in which V_x is the velocity of the gun at any point X feet from the beginning of motion.

FIG. 1



LOUD SPEAKING TELEPHONE

FIG. 2



LOUD SPEAKING TELEPHONE

CURRENT FIELD ARTILLERY NOTES

Loud-Speaking Telephones

Contributed by First Lieutenant Dawion Olmstead, Field Artillery

The loud-speaking telephone has been the subject of experiment by telephone engineers for several years. The result sought after is an instrument that will throw out the sound loudly and clearly enough to be heard without holding a receiver to the ear.

In the United States this instrument was first perfected for commercial use and is now installed on several of the larger railroads of this country for train despatching in lieu of the telegraph. It has also been adapted to many other commercial uses.

The instrument to be described was developed at the instance of Colonel H. H. Rogers, 1st Field Artillery, New York National Guard, who believes the idea can be adapted to the needs of the Field Artillery.

For battery communication some field artillery officers now believe that the battery commander and the executive should operate the telephones at their respective stations. There are many objections to this, but certainly the chance for error in transmitting data is diminished by eliminating the operators. Should a satisfactory loud-speaking telephone be provided these officers could operate their respective instruments without the embarrassment of head receivers.

The instrument shown in Figs. 1 and 2 is a local battery telephone of six cells. The principal parts consist of: transmitter, receiver, horn, induction coil, buzzer, key, battery, jack and wiring, all mounted on a composition base plate; the whole contained in an aluminum case covered with fair leather. A small bag containing a jointed ground-rod, plug, cord and line and ground connection clamps, fits in the horn. The instrument complete weighs about 3½ pounds. Binding posts are provided in case plug and connections are lost. In this event the instrument can be connected directly to line and ground.

The buzzer is not mounted on the induction coil but is separate and capable of ready adjustment.

The receiver with horn, constituting the loud-speaking element of the telephone, is adjusted for maximum efficiency and sealed by the manufacturer so that further adjustment should be unnecessary.

The instrument contains no flexible wires and is easily withdrawn from its case for inspection.

Figs. 3 and 4 show an experimental set in use by Battery F, 3rd Field Artillery, Fort Myer, Va., Captain E. T. Donnelly, commanding.

The loud-speaking telephone has been adapted to military uses by the Germans and it is understood adopted for their siege artillery. So far as is known the other nations have not yet made use of it in a military way.

The idea of attaching a receiver and horn to each gun of a battery in addition to the instruments provided for the battery commander and executive has been considered, the object being to permit the several cannoneers to set the gun instruments directly from the battery commander's commands without passing the data through operators. This scheme has the very serious objection that it increases the number of instruments in the plant. Such an arrangement would, if practicable, on the other hand, be especially valuable where the several guns of the battery were located in emplacements at considerable intervals such as we are advised is often the case in the present war.

The cuts give a very good idea of the experimental loud-speaking telephone as designed for military use. It is believed the War Department will be requested to have an experimental set tested out by the Signal Corps, U. S. Army, and by the Field Artillery Board with a view to ascertaining what practical value, if any, the instruments may possess for field artillery purposes.

22-Calibre Subcalibre Tube for Militia Batteries

In the July-September, 1914, number of THE FIELD ARTILLERY JOURNAL, there appeared a description of a 22-calibre subcalibre tube designed for the use of "spot-light" cartridges. It was contributed by Francis T. Colby, now an officer in the Belgian Army.

The following adaptation of the idea has been devised by Captain Arthur J. Elliott, Battery B, Field Artillery, Organized Militia of Missouri. The entire outfit, including the rifle barrel can be improvised at a cost of $2.25.

A small 22-calibre rifle is placed longitudinally between two pieces of yellow pine wood, 2 in. by 4 in., 15 in. long, each piece being groved to fit the rifle barrel. Wood screws are used to fasten these pieces around the barrel of the rifle, thus making a solid wood block. The stock, trigger guard and breech of the rifle are left protruding from one end of the block. The muzzle and part of the barrel are left protruding at the other end of the block. The block is then placed in a wood turning machine and centred upon the exact centre of the bore of the rifle.

TEST OF LOUD SPEAKING TELEPHONE AT FORT MYER, VA.

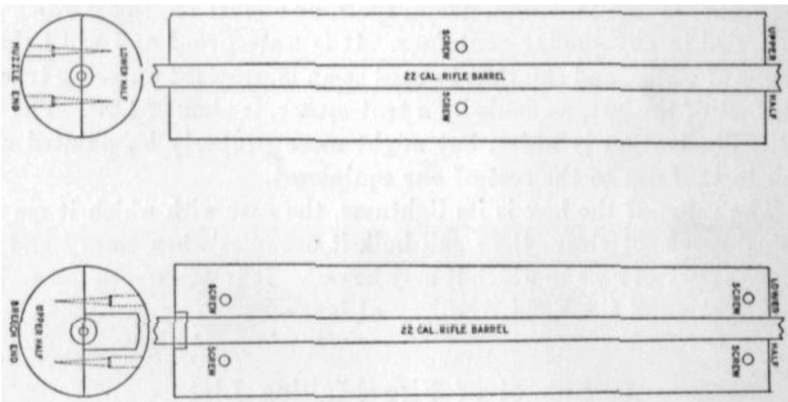
THE ILLUSTRATION SHOWS THE USE OF THE TELEPHONE BY THE BATTERY COMMANDER WITHOUT INTERVENTION OF OPERATORS

TEST OF LOUD SPEAKING TELEPHONES AT FORT MYER, VA.

THE ILLUSTRATION SHOWS THE USE OF THE TELEPHONE BY THE EXECUTIVE OFFICER WITHOUT INTERVENTION OF OPERATORS OR THE USE OF HEAD RECEIVERS.

The machine is started and the block is turned down so that the wood is taken off and the block turned perfectly round having a diameter, over all, of 3 inches. The outfit is then complete and ready to be placed in the gun. The breech-block can be taken off, although this is not necessary for the use of the outfit.

The design of the subcalibre tube is shown in the diagrams below. The general appearance is shown in illustration on top of insert opposite page 780.



Canvas Box for Field Artillery

Contributed by Captain Guido F. Verbeck, 1st New York Field Artillery

The problem of a suitable container for the various articles of equipment which have to be carried in field wagons and on journeys by rail and water is a difficult one. Adaptability to the size and nature of the articles to be carried, lightness, durability, cost, ease of repair and of storage when not in use are some of the requirements of the ideal container. Many of these have been met by a canvas box designed and made by Quartermaster Sergeant G. C. Reals, Battery A, 1st New York Field Artillery.

The box is made of 12-oz. white duck which is very heavy. It is 20 × 22 × 32 inches, and is strongly sewed together in the shape of a box. When properly packed, is very rigid. Carrying handles of half-inch rope are provided for both ends. There are flaps on each side which form a very tight cover when folded over and tied by means of ends of marlin sewed on the bag opposite rings on the flaps. The edges to which the rings are attached are reënforced with double canvas, as are also the ends and gromets through which the carrying handles are passed. In addition to the flaps there is an inside cover of 8-oz. duck which covers the entire contents. The box is shown in the illustration on the opposite page.

The box alone weighs 7.5 pounds. It will contain a volume of 14,080 inches, and when empty it can be rolled into a very small bundle. The box has a variety of uses. It may be used to carry 125 heavy blankets and can transport overcoats, clothing, horse-covers, horse equipment, cooking utensils, grain, tools, or almost anything which can be carried in any similar container. It is waterproof and will hold 61 gallons of water, and can thus be used as an improvised watering trough. The cost of the box, as made by a tent-maker, is about $4.00. The box in the illustration is white, but might more properly be painted olive drab to conform to the rest of our equipment.

The value of the box is its lightness, the ease with which it may be washed and kept clean, the small bulk it occupies when empty and the great variety of uses to which it may be put. It is well worth the serious consideration of the Field Artillery at large.

School of Fire Mailing List

The School of Fire issues from time to time to persons desiring them printed and mimeographed copies of technical pamphlets, translations, school records, etc., of interest to the Field Artillery Service.

Subscribers bear only the cost of material. The former subscription of $2.00 is no longer required. Bills for the actual cost are rendered annually during the month of October.

Application for these papers should be made to the Secretary, School of Fire for Field Artillery, Fort Sill, Oklahoma.

Field Artillery Evolutions.

The attention of officers who are interested in the organization or instruction of newly-formed batteries is invited to the revised edition of his *Field Artillery Evolutions* which Captain Chester B. McCormick, Michigan Field Artillery, has recently published.

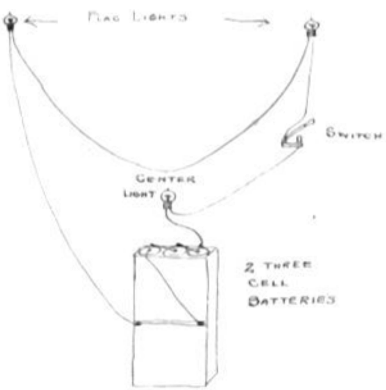
In its present form the set is completely up to date in every respect; and to officers and men not familiar with field artillery drill it should prove invaluable. Any formation or evolution is seen at a glance. The

22-CALIBRE SUBCALIBRE TUBE FOR MILITIA BATTERIES

CANVAS BOX FOR FIELD ARTILLERY

NIGHT AND DAY RIGID SEMAPHORE

SHOWING DETAILS OF FLAGS AND NIGHT CONNECTIONS, NOTICE SWITCH BUTTON ON FLAG HANDLE IN RIGHT HAND OF OPERATOR



SERIES WIRING FOR NIGHT AND DAY RIGID SEMAPHORE blocks which accompany the set of plates furnish an excellent method of testing the knowledge of those who have been studying drill regulations and yet, from lack of horses or other facilities for mounted drill, have no opportunity of demonstrating the progress they have made.

Night and Day Rigid Semaphore

Contributed by Captain Guido F. Verbeck, 1st New York Field Artillery

It is well known that the range of visibility of the present semaphore flag is greatly diminished in a strong wind. The greater the wind, the less the range at which the flag can be distinguished. Furthermore, the present flag is as visible from the rear of the sender as from his front; and it goes without saying that it is invisible at night.

Sergeant H. A. Pierce, Battery A, 1st New York Field Artillery, has designed a rigid semaphore, invisible from the rear of the sender and fitted with an illuminating device for use at night. It is shown in the illustration on the opposite page. The wiring is shown in the lower diagram.

The kit consists of 2 flags, red and white, a canvas carrying case similar to the issue case of khaki canvas, a battery box and attachments, wire, plugs, three lamps, 2 white and 1 red, 2 spare lamps, and one extra battery.

The flags are round as shown in the illustration, 1 foot 3 inches in diameter. They are white with a red centre. This color was found the most universally visible under all conditions. Visibility in all cases was tested by several tests using seventy men as observers and taking average of these seventy pairs of eyes. Observations have been made under all conditions both night and day.

The construction of the flag is as follows: Into a wooden chisel handle, large size, is fitted a ¼-inch brass tube 2 feet 3 inches long. At the top of the brass tube is attached a small steel block to which are hinged two spring steel wires. The wires are hinged to another steel block which slides over the tube. The sliding block is fitted with a snap catch which engages in a slot in two positions, one when the flag is stretched and one when the flag is lowered. There are twenty small brass rings sliding over the wires, ten on each side. To these rings is sowed the round cloth flag. There is a hole in the centre of the red centre of the flag fitted with a brass gromet through which the electric lamp passes when used for night signalling. There are plug sockets in the butt of each flag handle for electric connections, a small socket is attached to the brass tube at a point just below the centre of the flag. The wiring is described below. The back of the flag is olive drab cloth.

To use the flag for day, release the catch and slide the lower slide up the tube until the catch engages in the upper slot. This stretches the cloth tight and makes the flag rigid and ready for use. In the highest wind the size of the flag is not diminished. It is practically invisible from the rear owing to the olive drab back. The clear visible range of this flag under ordinary conditions of observation is 1800 yards. That of the Field Artillery orange and red flag is only about half this. In a wind the standard flag is reduced in range greatly. The speed and accuracy of operation of the rigid flap is greater than the standard flag as it never becomes entangled on the staff.

For night use electric lights are attached to the regular day flag. A small battery box is hung from the operator's neck and falling at about the second button of the blouse. This box is made of copper or aluminum and securely attached to the operator at the top and bottom in such a way as to give him absolute freedom of movement in any position mounted or dismounted. In the top of the battery box, which has a hinged lip, is carried the wire to connect the flags, plugs, lamps and small pliers. To use at night, draw out the wire and plug into the bottom of each flag handle. Screw the two white lamps into each flag and the red lamp into the socket on the front of the battery box. There is a button switch on the handle of the right flag. To signal take the position of the letter and press the button which lights all three lights at once flashing the letter to the receiving station. After sending one letter the lights are extinguished and the next letter flashed. The red light on the battery box furnishes a reference point for the white flag lights. This night flag has an average visible range of 1200 yards. Varying night conditions make this range as short as 1000 yards on some occasions and on others as long as 1500. All statements as to visibility of this flag for both night and day are for the unaided eye. With a field glass the range is easily cubed.

The following are the weights of the kit:

2 flags, 1 lb. each	2 lbs.
Battery box, aluminum, complete	2 lbs. 8 oz.
Canvas carrying case, for flags	5 oz.
Total weight:	4 lbs. 18 oz.

The original outfit cost as follows:

2 Eveready Tungsten batteries, @ 18 c.	$ .36
3 Lamps, 3 volt tungsten, 6 C.P., @ 8 c.	.24
Electric wire, about 8 feet	.12
3 Sockets for lamps, made from reflectors of flash lights cut off and turned upside down, @ 10 c.	.30
2 Auto light plugs, for flag buts, @ 25 c.	.50
1 Button switch	.95
2 Chisel handles, large, @ 5 c.	.10
2 Brass tubes, ¼ inch, @ 11 c.	.22
Spring steel wire for bows, about	.08
Fittings and time of expert mechanic	$1.00
40 Brass rings, 20 each flag	.10
2 Cloth flags, ¼ yard red and ½ yard white and ½ yard O.D. cotton and time for sewing, about	.67
Aluminum and time for expert mechanic to make battery box	2.50
Khaki canvas carrying case for flags, materials and time for sewing	.50
Straps for battery box made by battery saddler	
Total cost	$6.74

These flags as described above have been in constant use since November, 1913. They are the same ones shown in the photographs. They have been exposed to long rains, freezing, and heat without damage or even need of repair.

Leaves from a Line Officer's Note Book.

Alert officers and noncommissioned officers on duty with batteries come into daily contact with many of the intimate details of the profession from which the authors of regulations and text-books are unfortunately often far removed.

The following notes, contributed by First Lieutenant R. C. Burleson, 3rd Field Artillery, are representative of the kind of details referred to. If the service will coöperate with the editor it will be possible to enlarge this column and make it the repository of much useful information which might otherwise be lost, or at least not properly disseminated.

An Improvised Fireless Cooker.—While on maneuvres during the summer of 1914, the battery was cut down to the limit on our transportation, and we were not able to carry our improvised fireless cookers on account of weight and bulk. The question of supplying hot food to the troops was solved by wrapping securely the 10-gallon milk cans which had been used as receptacles for the food in the cookers, with the bedding of the kitchen detail. This worked very well, but was rather hard on the bedding.

One day while passing a milk station, it was noted that the cans then being unloaded were protected by a canvas and felt cover. As soon as possible four of these covers were purchased from a dairy furnishings supply house. They were a success from the start, and have now been in use more than a year and during that time the organization spent five months in the field. They have never failed to supply steaming hot food and coffee. In this connection, it is thought that a pack outfit could very easily be devised and used to supply all troops while on the march or in position.

A Hint for the Infantry.—While on the 1915 maneuvres at Plattsburg it was noted that a great many infantry soldiers carried their rifles with the butt above the shoulder, sometimes pointed to the front and sometimes to the rear. As the butts had been worn bright they represented just that many mirrors and easily disclosed the position of the troops. One one occasion, in very close country, while searching with field glasses for a body of troops, the first thing that attracted my attention to what afterwards proved to be the main body was the bright shafts of light. From an examination of the equipment I was firmly convinced that the bright butts of the rifles were the things seen. It would seem that when we are taking such pains to obtain a neutral color for our uniforms and to eradicate all bright parts of the equipment that such points should not be overlooked.

How No. 3 Can Speed Up.—A few days ago while at firing battery drill, I noticed that the No. 3 of the second section was so much more rapid than the others that, at first, I suspected that he was not setting off the data given. Repeated checks, however, disclosed the fact that his settings were always correct. The cause was this: This No. 3 had placed the palm of his right hand against the milled head of the corrector worm screw, instead of grasping it with the thumb and forefinger as is usually done. Any change in the corrector by the command *Up* was set off by moving the right hand up and turning the milled head in this manner. Changes in the opposite direction were set off by moving the hand down. After a thorough test, this method was adopted and has now been in use several months. As a result the speed and accuracy of the Nos. 3 have been greatly increased.

How to Load a Balky Horse—While loading the horses of Battery "D," 3rd Field Artillery, at Plattsburg, New York, last fall, the following interesting point was noted: A balky horse had been started up toward the loading ramp, but he refused to move on to the ramp, planted his forefeet against the edge of the ramp, and immediately put a stop to any further loading. I cautioned the man on the halter rope to look straight ahead and to keep a tight pull on it. Two strong men were detailed to take a position by the hind-quarters, one on each side, the man on the right to grasp with his left hand the right hand of the man on the left, and to try to pull the horse on to the ramp in this manner. This is a method which has been found to be successful in most cases.

However, the horse was very large and obstinate, and had his forefeet so firmly planted that it was impossible to move him. Then I saw the sergeant in charge of the loading detail walk up alongside the near foreleg of the horse, placing his opened hand against the rear of the knee-joint, he pushed the joint forward. This caused the horse to go down in front and before he could recover his balance he was safely inside the car. This method was tried successfully in several cases.

The Personal Arm of the Field Artilleryman

THE arming of the personnel of Field Artillery appears to have come about through its weakness in opposing attack while it is on the march or in camp, and in resisting hostile troops that approach or have penetrated the artillery positions.

Even small enemy parties, if they reach the guns in position or if they can come to close quarters with horsed or limbered carriages, are very dangerous. And such small parties, it has been feared, may get through the forward lines and reach artillery units in masked positions considerably withdrawn from other troops.

Heavy artillery, by reason of its usual greater separation from the advanced lines; ammunition columns, by reason of their depth and isolation; and pack artillery, because of its peculiar adaptability to work in rough and close country, seemed to be particularly open to these dangers.

It is possible that in some armies the practice of arming generally the personnel of Field Artillery grew out of the extensive use of small expeditionary bodies in the operations of irregular or savage warfare. In one, at least, the practice has been carried along, perhaps through conservatism mainly, from the time when drivers were civilians and the cannoneers marched independently until the guns came up.

In our service the use of firearms other than the revolver or pistol has been frowned upon. The theory has been that, in the excitement of a threatened close attack upon guns in position, the cannoneers might succumb to a temptation to use the carbine or rifle rather than defend themselves, as is quite practicable, with artillery fire; or that the drivers might abandon their teams. This is purely a question of discipline. The argument, resorted to in other armies also, is more nearly appropriate in considering an army mostly composed of volunteers, but it has little value under any circumstances because it is a matter of consequence only that a marauding party be driven off, not how it shall be repelled. The necessity for using small arms in the firing battery is probably a remote possibility.

On the march the situation is different. Thorough reconnaissance and the support of other arms should provide protection against attack. If any small arm for the artillery personnel is necessary, it should have greater practicability than the pistol or revolver, which, however excellent their ballistic properties, do not give great effect at considerable ranges. The purpose of resisting small parties will be to keep them at such a distance that they cannot kill or wound animals and drivers. Large bodies could not be effectually opposed by the artillery personnel except by the fire of the guns.

It is thought that in camps the principal danger arises from hostile individuals or very small parties whose objectives would be the matériel or ammunition. Suitable interior guards should provide the proper protection against them and the personal arm has no importance at all. Against large bodies, only other troops would be effective.

Independently of all other considerations, the possession of a hand arm doubtless adds somewhat to the morale of the individual, will be useful to scouts, observers, couriers and other men separated from their units in the field, and is required in guarding prisoners.

Nowhere, except in our own service, has the suggestion been discovered that machine guns be attached to artillery units, but it is believed that there has been a French discussion of the question. If our method, prescribed in various manuals, of providing artillery support from other arms is objected to on the ground that such support may not be actually furnished, then the furnishing of machine guns may be objected to, it is believed with much more reason, on the ground that those guns and their personnel would be detached by superior commanders for use on the infantry firing lines, their appropriate place.

So far as can be learned, the principal nations now engaged in the European war entered it with the following arms in the hands of the artillery personnel:

Austria:	horse artillery, except drivers,—revolvers;
	other artillery,—rifles;
	ammunition columns,—rifles,
England:	ammunition columns,—carbines;
	other artillery,—drivers, revolvers; cannoneers, carbines.
France:	horse artillery,—revolvers;
	other artillery,—cannoneers, carbines with bayonets.
Germany:	heavy artillery,—rifles;
	other artillery,—mounted men, automatic pistols; cannoneers, short-range carbines.

Italy:	mountain artillery,—carbines;
	ammunition columns,—carbines;
	other artillery,—no hand arms.
Russia:	ammunition columns,—carbines;
	other artillery,—revolvers and sabres or knives.

From Official Bulletin No. 3, Office of the Chief of Staff, the following extracts show the practice with respect to protection of artillery during the Balkan Wars, 1912-1913.

BULGARIAN ARMY

By S. The protection of the artillery on the march or during the fight devolved on the nearest infantry troops. When the position of certain batteries was such that surprises might be effected, a special guard was assigned them. During the last wars, our artillerymen had absolutely no weapon for personal defense. But sudden attacks while advancing, either on the part of the hostile infantry or cavalry, did not occur.

By X. Unless the guns were assigned to very small advanced units their defense was more or less intimately connected with that of the whole position. This applies also to artillery on the march. A small escort was as a rule told off for the guns, but it was entirely nominal, and seldom large enough to be taken into account.

GREEK ARMY

No escort was assigned to us. We called on the infantry for support when necessary. I believe it is a good thing to arm the gunners with carbines (as ours are armed). They are taught, of course, to regard the field gun as their means of defense and to serve it up to the last moment; but still the men are often sent on foraging or scouting expeditions, and the carbine is the best weapon for them to have.

In view of the foregoing and of the fact that very different methods of providing support for Field Artillery units are now undergoing the supreme test in Europe it is believed that any radical change in the type of hand arms of our Field Artillery personnel would be premature and that inquiry should be made of our attachés and observers abroad as to what modifications in this respect, if any, have already been made in foreign artilleries, and as to what occasion there has been for the use of small arms by field artillery personnel.

THE UNITED STATES FIELD ARTILLERY ASSOCIATION

Annual Meeting

THE fourth annual meeting and the first annual dinner of the U. S. Field Artillery Association was held at the Army and Navy Club, Washington, D. C., on the night of December 17, 1915. Twenty-nine members were present and one hundred and eight-nine represented by proxy. This number constituted a quorum for the transaction of business as required by the constitution of the Association.

The dinner was productive of good-fellowship, and furnished an excellent opportunity for the discussion of matters of vital interest to the Field Artillery.

At the election Lieutenant-Colonels Peyton C. March and Charles T. Menoher were re-elected members of the Executive Council.

The Secretary-Editor-Treasurer submitted the following report, which was approved:

The total cash income of the Association, including the amount on hand at the beginning of the year, was $4,030.67, and the total of its expenditures was $3,789.90, leaving a balance in the treasury at the end of the year of $240.77. Following is a detailed statement of receipts and expenditures:

RECEIPTS

Balance on hand December 1, 1914	$ 504.21	
Subscriptions to The Field Artillery Journal, and copies of The Journal and books and pamphlets sold	1997.98	
Advertisements	326.98	
Donation	1200.00	
Miscellaneous receipts	1.50	$4030.67

EXPENDITURES

Printing, engraving, postage, stationery, etc.	$2391.62	
Office equipment	74.53	
Clerk hire and other personal services	235.75	
Telegrams, express, freight, and travelling expenses	37.94	
Solicitation of advertisements	1042.00	
Books for members, refunds, and miscellaneous expenses	8.06	3789.90

Balance on hand November 30th	$ 240.77
Advertising contracts due after January 1, 1916	789.00
To be collected from subscriptions in arrears, estimated	150.00
Total assets	$1179.77

Although the expenditures of the Association slightly exceeded its receipts inclusive of the amount on hand at the beginning of the year, the difference should not be understood as representing a loss but rather as a permanent investment. This has been a year of construction. During the year there has been a large increase in the paid circulation of THE FIELD ARTILLERY JOURNAL, and this increase constitutes a very important asset, which, with the very considerable increase in advertising patronage, insures a larger income in the future. THE JOURNAL has become much more widely known than formerly, and there are good reasons for believing that its increased circulation and advertising patronage will continue as permanent sources of income. There has been a gain of over thirteen per cent. in the number of regular army active members, a gain of over eighty per cent. in the number of militia active members, and a gain of over fifty per cent. in the number of associate members and other subscribers. The total paid subscription list of THE JOURNAL has increased over forty per cent., and the value of the advertising has increased three hundred and forty-six per cent.

Thirty-nine officers of the field artillery of the regular army are not members of the Association; but the number of such non-members at the beginning of the year has been reduced about forty per cent., and it is confidently hoped that during the coming year most of the others will express, by joining the Association, their willingness to bear a share of the burden of maintaining THE FIELD ARTILLERY JOURNAL.

During the year negotiations were entered into and carried to completion for transferring the printing of THE JOURNAL to the J. B. Lippincott Company, of Philadelphia, by which firm the work is now done. The improved appearance of the magazine will, it is believed, convince the members of the wisdom of the change.

First Lieutenant John N. Greely, Signal Corps, (Field Artillery) was designated to audit the accounts of the Treasurer.

The thanks of the Association were voted to the Secretary-Editor and to Mr. C. S. West for their services during the year, and to Colonel H. H. Rogers, 1st New York Field Artillery, for the generous donation made by him for the purpose of increasing the advertising of THE FIELD ARTILLERY JOURNAL.

EDITORIAL DEPARTMENT

Legislation Toward Field Artillery Efficiency

ADEQUATE comment on such general and far-reaching features of present-day legislation as Compulsory Service, the Reserve Army, the Continental Army, Pay for the Organized Militia, Cadet Companies, and the Provisional Appointment of Second Lieutenants, is neither possible nor desirable at this time.

Such subjects are too general and too closely connected with the evolution of a new military policy. We are necessarily confined to brief comment upon such salient points of proposed legislation now actually before the public as are intimately connected with the future and the efficiency of Field Artillery.

Of the many plans for Army increase the greater number have rested upon a foundation of expediency or selfishness rather than upon a desire for efficiency. But it is a pleasure to record that Mr. James Hay, of Virginia, Chairman of the House Committee on Military Affairs, has approached Field Artillery legislation with virility and courage.

Mr. Hay's bill is not flawless. It is designedly a draft prepared as a basis for discussion. But it is strong and progressive; and it is reasonable to look upon Mr. Hay's provisions as at least the framework of the legislation to be expected of the 64th Congress.

Briefly, Mr. Hay proposes to double the Field Artillery, to maintain it and the other arms at war strength, to leave the command of Field Artillery troops in the hands of Field Artillery officers, and to provide in the list of extra officers a legitimate opportunity for the advancement of officers of other arms which are not themselves increased.

Thus with a single stroke of the pen Mr. Hay disposes of the bugbear of the Single List for Promotion, the pitiful makeshift involved in a peace-strength Army and all justification for the opposition of any arm to the proper balancing of our military forces.

Apparently the time has not yet come for the serious consideration by Congress of an entire recasting of our military policy. Mr. Hay's bill, however, can at least be taken as a concrete proposal for legislation based upon efficiency which considers expediency sufficiently to insure success.

A Year of Editorials

IN DECEMBER, 1914, THE FIELD ARTILLERY JOURNAL announced the establishment of an Editorial Department. In common with all changes this decision of the Executive Council was not unanimously welcomed. But the deliberations which led to the decision were based on a high motive—the desire to help the Field Artillery by the creation at a critical time of a medium for the expression of Field Artillery views and a record of Field Artillery sentiment. The Executive Council was sincere in the conviction that an Editorial Department could do good work for our arm of the service in a hitherto undeveloped field, if it were kept free from pettiness, partisanship and selfishness.

Some faith was placed in the willingness of the various regiments to assist in the work. On the record of past performance, however, some doubt was voiced as to the foundation of this confidence. It is regretted that the doubt had more basis in fact than the faith. The results were discouraging. One conscientious effort was made to obtain the consensus of Field Artillery on vital points. Two regiments responded promptly and well. The response from two others was delayed to such an extent that it could not be used at a time when it would have been most valuable. The remaining regiments have preserved a silence unexplained and disheartening. However appreciative we were of the valuable assistance which was received from a small percentage of our members, it was soon evident that the attempt to interpret the wishes and views of the Field Artillery would have to be made practically unassisted. Such were the conditions under which we worked.

Our stand on the question of a Single List for Promotion was on a high ground and received favorable comment from unbiased sources and from all who place efficiency before selfishness. Our contention that the service of heavy field and siege artillery should be assigned to our branch of the service was made frankly and firmly, although we realized that it smacked of the self-interest which did not exist. Our warning to the Regular Army, that the readiness to assume new duties and responsibilities and an ability to measure up to a new and higher standard were more important than promotion, is still pertinent. It was the first note of its kind to be sounded.

In the main, such is the record of our year's work. Conscious of its shortcomings in execution, we are willing to stand behind the motives which underlie it. We hope that those of our own number who differed with us at the inception of the Editorial Department are now convinced that the past year has not been a year in which it was advisable for any arm of the service, much less the Field Artillery, to stand silent or inarticulate.

Competitive Grading of Batteries

THE military mind is often inelastic, often blindly bound to precedent. For this reason it can be assumed that any proposition differing radically from the existing order of things will be bitterly opposed.

A new field for discussion has been opened up by Captain Deems in this issue of THE FIELD ARTILLERY JOURNAL. Whether we agree with the method he proposes or not, his article will bring into prominence the entire question of Field Artillery competition.

The War Department has recently inaugurated a competitive system amongst militia batteries which has already been the subject of much discussion. Leaving all details out of consideration for the present, it appears to be likely that the system will stir the militia batteries to greater effort, and that there is reason to believe that the best batteries will be able to score the highest number of credits. It will undoubtedly brand the weak batteries as ineffective. Individuals may suffer; but the Militia Field Artillery has been set a new and higher standard.

The question which now confronts us is whether the regular batteries are to be allowed to proceed along their various ways undisturbed by healthy competition, or whether it is not possible to test some system more or less like the one proposed by Captain Deems. Such a course should appeal to the sporting spirit of officers and men, and permit the efficient batteries to make their efficiency a matter of record and put the lukewarm and the indifferent on the defensive.

A thousand protests on grounds of artificiality, dissimilarity of conditions and other bugbears will be heard. But we must remember that it is a human failing to work harder finding reasons why a thing cannot be done than to try honestly to do it. If half the efforts now made to find flaws in orders from higher authority were loyally devoted to carrying out those orders we should be on a fair road to efficiency.

The Navy works at fever-heat for the pennant or for the Efficiency "E" on funnel or turret. In the Army, zeal and efficiency are matters of personality. Some officers electrify their men by their own enthusiasm or through an inborn ability to make men give them their best. Other equally able officers fail to get the same response. Nearly everything is left to the individual. There is practically no system which in itself is designed to stimulate effort and produce good results.

Our goal is a combination of economy in administration, speed and accuracy of fire and mobility. Should we not reach it oftener and by a more direct road if results were made matters of record and rewards given for success? There is nothing now in our service to compel officers and men to do more than is required. Only the enthusiasts rise above this level. The efficient cannot be advanced. The inefficient cannot be eliminated. The drone and the zealot alike are supported by an indulgent nation.

At a time when the eyes of the country, long averted from military questions, are slowly but surely turning toward the Services, are we willing to have it said that in naval gunnery is a reward and an incentive for success, but that in the Field Artillery success is not even recorded?

We shoot. We hold a critique. We are sometimes inspected. It is all academic. Where is the tangible result? Is it not possible that in a comprehensive system of grading we can find for the Field Artillery an incentive for greatly increased efforts?

Motor Traction for Heavy Artillery

THE FIELD ARTILLERY BOARD has recently made a favorable report on mechanical traction for heavy field artillery, and has submitted a detailed statement showing not only that motor traction is more efficient than animal traction for this type of artillery, but also that, on a war-strength basis, it involves an initial saving of $40,000, and annual saving in up-keep of $25,000 per battery.

These figures, multiplied by the number of heavy batteries required to prepare the Army for war, are astounding. In addition to increased efficiency and diminished cost, tactical requirements such as saving in road-spaces, ability to maneuver at night and similar considerations are all in favor of the motor transport.

Horse-lovers will note that there is no mention of replacing the six-horse team for the first echelon of light batteries; but even in these batteries there will be a tremendous gain in efficiency and saving in cost and road-space due to the mechanical transport in ammunition columns and combat trains.

The conditions governing the test at Fort Sill were severe. They were enumerated in the July-September, 1915, issue of THE FIELD ARTILLERY JOURNAL. The report of the Board shows that the results surpassed all expectations. The action of the War Department is not known; but such an emphatic and unanimous recommendation from the Field Artillery Board can hardly be overlooked. It is not too much to say that the test and its results are epochal, and are likely to change not only our equipment, but also our training, our traditions and our Field Artillery life.

Duplication of Effort

FROM time to time there is a demand for Gunners' Instruction and other pamphlets of a similar nature which are required to supplement the manuals and drill regulations issued by the War Department. In the past it has been the custom for progressive organizations in the Army and the Organized Militia to prepare and publish such pamphlets without great regard for the possibility of the existence of similar pamphlets published by other organizations.

Recently the Field Artillery Association received an excellent pamphlet for the instruction of candidates for 1st and 2nd Class Gunners. It had been published at the Military Academy but was not available for general issue. Tentative preparations were made to publish the pamphlet for the entire Field Artillery service. It was then found that at least three other equally good pamphlets had been prepared elsewhere, and the project was dropped to avoid unnecessary duplication of effort.

It is evident that the different regiments and States are suffering from lack of coördination in such matters. The expenditure of much unnecessary money and effort is the result. The Association was formed for the good of all the Field

Artillery. It is supported in part by nearly every regular and militia organization. It stands ready to coördinate and assist. The Executive Council suggests that, before publishing any book or pamphlet relating to field artillery instruction, the officers in charge confer with the Secretary with a view to ascertaining whether or not a similar pamphlet is procurable and, if not, whether or not it could not advantageously be published by the Association and thus prevent confusion and unnecessary effort.

The Special Relief Society

THE SPECIAL RELIEF SOCIETY which has already accomplished much toward alleviating the suffering caused by the European War has recently organized an American Army Division. The public-spirited women who are in charge of the work declare that they do not expect war, and that they hope that there never will be war. But they have been convinced that any country is liable to be plunged into war overnight. If war comes, it is the intention of this society to have the women of this country prepared to care for the sick and wounded.

To this end the American Army Division of the Special Relief Society is compiling information concerning the names of volunteer nurses, homes that might be used as emergency hospitals, sewing clubs, field workers, and possible contributors of materials and funds. In addition the Society is urging the women of the country to do their part in encouraging Congressional action in favor of an adequate defense, and in arousing on the part of manufacturers and employers a proper attitude toward the Army and the National Guard.

It is believed that the work of the Society is a patriotic one which deserves the support of the military service as well as that of public-spirited citizens. Information concerning the society may be obtained by addressing the Special Relief Society, 597 Fifth Avenue, New York City.

BOOK REVIEWS

THE LONG ARM OF LEE, by Jennings C. Wise. The J. P. Bell Co., Lynchburg, Va., 1915. 2 vols. in red silk, 6 × 9 inches. Price, postpaid, $4.50.

The *Long Arm of Lee* is a most valuable addition to field artillery literature. The author has approached his work in a spirit of enthusiasm and with a rare ability to appreciate and interpret the field artillery history of the Civil War.

Too often the references to the work of the Field Artillery found in official reports and in the most carefully written histories either pass over essential points or else are so lacking in technical detail as to be disappointing and sometimes worthless to the field artilleryman in search of the record of the achievements of the gunners of the past.

Colonel Wise has exhausted contemporaneous authorities for his information and has been greatly helped by the testimony of the few survivors of the Field Artillery of the Army of Northern Virginia. The result is a work well calculated to fill the field artilleryman with added pride in his profession and with admiration for the gallant gunners who so admirably supported the infantry of Lee.

Part I contains a brief and clear outline of wonderful work done by the Bureau of Ordnance of the Confederacy. It is evident that remarkable results were obtained chiefly because remarkable men were given the task of producing something out of almost nothing. To officers of the present Army it is interesting to learn that to General Gorgas, father of the present Surgeon-General, is due the credit for creating the Bureau of Ordnance and for carrying on its stupendous work under almost unbelievable difficulties. He was ably assisted by such competent and devoted men as St. John, Jackson, Pendleton and Alexander.

There is a prevalent opinion that much of the ordnance of the Confederacy was obtained by more or less treacherous seizure of United States property in Southern arsenals before the outbreak of war. Colonel Wise shows conclusively that little of value was obtained in this way; and that, in the case of at least one lot of stores, the State of Virginia even reimbursed the United States for the amount paid an ordnance contractor on an unfulfilled contract.

In view of the present discussion of "Preparedness," it is enlightening to learn to what an extent the State of Virginia made adequate and timely preparation for the coming conflict even at a time when actual hostilities did not seem probable. A commission was appointed, large sums of money appropriated, and the most able men in the commonwealth were employed on the problem. To their ability and foresight is due the comparatively excellent equipment of the Confederate Field Artillery at the beginning of the war. Stonewall Jackson's experiments with rifled guns at the Virginia Military Institute formed a part of this movement; and his conviction concerning the superiority of rifled cannon had great influence on his contemporaries.

At the opening of the war, there were three sources of supply—manufacture, foreign purchase, and capture from the enemy. In each of these three fields General Gorgas and his able assistants demonstrated their efficiency, their loyalty to their cause, and an ingenuity almost unparalleled in the history of war. They had to contend with a scarcity of metals and chemicals which at this date we can barely comprehend. To overcome this it was necessary to establish a bureau of mining and to utilize every mechanical and chemical expedient which alert and well-trained brains could devise. The blockade and the failing finances of the Confederacy were both serious obstacles to foreign purchase, both of which were to a great extent overcome by the courage and daring of the blockade-runners whose history is a romance in itself. Captures from the enemy were absolutely necessary to augment the supply of arms and ammunition; and this fact explains many of the Confederate raids for which there was apparently no tactical or strategical justification.

Yet the results accomplished by the genius and devotion of men like Gorgas and Alexander should not blind us to the changed conditions of our own time. Modern guns and carriages are complicated machines and cannot be improvised in wayside blacksmith shops. The consumption of ammunition is almost beyond belief. Captured guns cannot be used unless ammunition expressly designed for them is also captured in adequate amounts. The combined wealth and manufacturing capacity of England, France and America seem all but unable to supply a modern army when pitted against a well-equipped enemy. Impressed as we are by the accomplishments of the Confederate Bureau of Ordnance, we must not forget that its work was carried on in an era which, when compared to the mechanical age in which we live, must be called almost primitive. We are proud to think that American ingenuity and ability worked the wonders which are rightly credited to Gorgas and his Bureau, but we can never again expect to see an army supplied by improvisation.

In Part II Colonel Wise vividly portrays the character and training of the peerless gunners of the Confederacy. He makes very clear the importance of the trained officer and the part he played in the artillery of Lee. Stonewall Jackson had instructed six hundred of the best young men in the South in the rudiments of artillery tactics and gunnery. These graduates of the Virginia Military Institute, added to the graduates of the United States Military Academy who had resigned from the United States Army, gave the South a corps of officers with which to officer her batteries.

Colonel Wise then shows us to what extent was justified the reliance placed in these young men who added careful military training to courage, loyalty and breeding. It would be well for every demagogue who dreams of creating soldiers over night to read these pages and obtain some knowledge of the firm foundation upon which was built the Field Artillery of the Army of Northern Virginia. We are accustomed to believe that in the early days of the Civil War untrained men were pitted against other men without training, and that the veteran armies of the later years of the conflict were the result of experience alone. *The Long Arm of Lee* contains ample explanation of the initial Confederate success—the adoption of a logical military policy, the centralization of authority and the dependence upon officers of high character and considerable military training.

Field Artillery organization is carefully gone into. It is shown that there were not less than twenty-five batteries in the South at the outbreak of the war.

Colonel Wise then goes on carefully to trace the development and use of Field Artillery in every important engagement of the war.

He shows us that, at the first Bull Run, the Confederate Field Artillery did glorious work on the left and lost many golden opportunities on the right. The *Long Arm of Lee* is a Southern story written by an admiring son of the South; but no writer ever paid a more generous tribute to a heroic foe than does Colonel Wise when he portrays the splendid work of the Federal batteries under Griffin and Ricketts.

Turning to the Valley campaigns of Jackson we are shown the growth of the Horse Artillery under Chew. The exploits of these galloping gunners and their unparalleled dash appeal to every romantic ideal of the field artilleryman. This was largely due to the extremely high-class personnel which overcame by courage and ingenuity defects in equipment and disparity in numbers. They attained a miraculous mobility which was not then and never can be the result of mechanical development, but of well-trained officers, drivers and teams. What was required of Chew's men and horses will never again *so often* be required of the Horse Artillery of the future; but until that distant day when the motor shall entirely replace the horse no light or horse battery can be truly worthy of the name unless it is ready, at critical times, to move as Chew moved, and to fight as Chew fought.

But the story of the Confederate Field Artillery is not all glorious. At Seven Pines the failure to use the idle batteries which choked the roads while two Federal batteries were playing havoc with the Confederate Infantry shows us conclusively that batteries alone are not sufficient, and that there must be organization and enough centralized control to employ them in right numbers at the right time.

Although no one would willingly be so narrow-minded as to believe that the fate of battles ever hung on the use of Field Artillery alone, and although we know that no matter how good the Artillery, no decisive result can be obtained without the Infantry, a careful reading of Colonel Wise's book will go far to show the disaster which so often overcame the general who failed to use his Artillery properly. The prevailing fault of the early organization of the Confederate Field Artillery was the failure to make the batteries divisional units. They were at first distributed singly among the brigades, thus leaving their intelligent use to chance and seldom making possible the massing so essential to success. In strong contrast to this faulty employment of the Confederate Artillery were the masterful tactics of General Hunt, the Chief of Artillery of the Army of the Potomac. To him Colonel Wise pays admiring tribute, and with the pen of the enthusiast portrays the skill with which Hunt massed his guns at Malvern Hill and Antietam.

Space does not permit us to follow Colonel Wise through all the battles of the war; but it is impossible to leave his narrative without commenting upon the marvellous marching of Jackson's batteries. On one occasion this master of men marched twenty-one batteries fifty-five miles in forty-eight hours with only four-horse teams. Such exploits on the part of Americans of another generation should spur on the artillerymen of this generation to greater efforts in the direction of mobility.

Colonel Wise has shown himself throughout his work to be not only a painstaking historian, but a just and non-partisan critic and a most skilful word-painter. In make-up and typography the book is a credit to author and publisher alike. No one who has ever, with joy in his heart, followed the red guidon and heard the rumble of wheels through the night can fail to become absorbed and enthusiastic over *The Long Arm of Lee*.

The book cannot be laid down without paying a tribute to the care with which the illustrations have been selected and the skill with which they have been reproduced. They consist entirely of portraits of the men who made the history with which the book is concerned. They look out at us from the printed page with youth, breeding and determination delineated in every feature, and are in themselves almost as much of an inspiration to the field artilleryman as the words with which their deeds are described.

Let us hope that some field artilleryman will find in Colonel Wise's story of the Confederate batteries an incentive to give us a similar history of the gunners who opposed them so nobly and so well.

M. C.

GERMANY OF TO-DAY, by George Stuart Fullerton. The Bobbs-Merrill Co., Chicago, Ill. 1 Vol., 5 × 7½ inches. Price $1.50.

Professor Fullerton's American parentage, his ability, and his evident desire to be fair-minded cannot be doubted; but it is feared that his convincing exposition of Germany of to-day will fail to influence the growing numbers of Americans who refuse to believe anything good of Germany and who are deaf to history, and blind to the fact that most information to-day has its source in countries hostile to Germany.

In the interest of a better understanding amongst nations Professor Fullerton has succeeded in tracing many points of similarity between German political institutions and our own, and in dispelling many erroneous ideas about German autocracy and German militarism. He shows us that the excellent educational system of Germany offers many lessons for this country. The genuine democracy which underlies universal military service is brought out in a way which, it is hoped, may appeal to Anglo-Saxon minds to whom the idea has formerly been abhorrent.

In his attempt to show how free from menace to the United States is the growth of German imperialism, Professor Fullerton will not meet with a very cordial reception from any but the most open-minded of his readers. The motive underlying international hate is largely commercial; and it is on commercial grounds in South America that many of our people fear that the ultimate clash with Germany will come.

In *Germany of To-day* no attempt has been made to take the time and space necessary to demonstrate the accuracy of the premises upon which the author bases his conclusions; and it is here that Professor Fullerton will part company with many an American reader. But if we admit the excellent opportunity which he has had to inform himself, and his sincere desire to be non-partisan and fair-minded, we cannot help but go a long way toward being convinced that there is much in comman between America and Germany, and that any attempt to arouse hostility between the two nations is not only wicked but also senseless.

Unfortunately a large proportion of otherwise well-informed Americans have temporarily put aside considerations of fair play. In a contest in which they can have but little part they have taken a violently partisan attitude which, after the bitterness engendered by war has died down, will be a source not only of personal regret, but also possibly of national embarrassment.

If, as we hope, Professor Fullerton has made any progress toward establishing in the minds of his American readers a better understanding of German government, education, military system and imperialism, the time will not be far distant when, as a nation, we shall be deeply grateful to him for his effort to protect his countrymen from the partisanship which, under the circumstances, is anything but creditable to them.

UNDER THE RED CROSS FLAG AT HOME AND ABROAD, by Mabel T. Boardman. The J. B. Lippincott Co., Philadelphia, Pa. 1 vol. Svo. Price, $1.50.

This very vivid story of a society which has probably done more to alleviate human suffering than any other organization in the world has been written to supply a demand for a history of its origin and to add to the interest in its work.

Miss Barton requires no introduction to American readers; and the foreword by the President of the United States, who is himself also President of the American Red Cross, lends not only high official indorsement but also dignity to the work.

Miss Boardman touches upon ancient history sufficiently to show us that the idea of mercy and of pity has grown slowly with the development of civilization. In ancient times, there was practically no consideration for the wounded. As wars were all wars of extermination the enemy had no wounded, because battle involved literally victory or death. It was not until the beginning of the Christian era that the alleviation of suffering seemed to have any place in the world. From that time on, man, although periodically lapsing into cruelty, has always had some definite idea of merciful treatment of the wounded, including those of the enemy.

Having slight and unorganized beginnings amongst the women of the American colonies in the Revolutionary War, the great work of caring for the sick and wounded first received some definite standing and organization when Florence Nightingale went out to Scutari in the Crimean War. But it was the horror and suffering which Henri Dunant saw and tried to alleviate after the battle of Solferino which really resulted in his effort to *organize* relief work and to carry it on *without regard for nationality*. Thus Neutrality and Humanity, the two underlying motives of the Red Cross, were made the foundation of all the wonderful work which later generations have accomplished.

In this country the precursor of the Red Cross was the Sanitary Commission which was formed at the outbreak of the Civil War as soon as it was seen that the Government was totally unable to provide for the sanitation of camps and for the care of the sick and wounded.

It is almost inconceivable that the United States Government should have been so tardy in joining with other nations in the provisions of the Geneva Convention. It was not until 1882 that Miss Clara Barton obtained through President Arthur the adoption of the treaty and the ratification by Congress.

Since then, the American Red Cross has been prominent and efficient under every and all circumstances which entail human suffering. It is not war alone which brings forth the efforts of this society. Famine, pestilence, fire and flood alike create conditions which call for its activities; and whatever may be the cause of the suffering, the Red Cross is equally diligent and resourceful in relieving it.

The book contains not only an account of the growth of the Red Cross idea and the Red Cross organization, but also a most stirring story of deeds done for humanity from the time of the inception of the Society to the present work which it is doing in the European War.

It is understood that the author will donate her royalties to the Red Cross Endowment Fund for the carrying on of the work of the Society.

QUAINT AND HISTORIC FORTS OF NORTH AMERICA, by John Martin Hammond. The J. B. Lippincott Co., Philadelphia, 1915. 1 vol. 65 illustrations. $5.00.

At a time when more than half the world is giving its attention to war, and when the mechanical horror of war is everywhere being emphasized, Mr. Hammond's beautiful book, *Quaint and Historic Forts of North America*, takes the reader most pleasantly back to the days when war, always terrible, was at least clothed in romance and staged in beauty.

So little is done in this country to preserve historic ruins, that it will not be long before books like Mr. Hammond's will be the only source of information as to the physical aspect of the fortifications of Colonial times and of the period of the Civil War.

In addition to its very real historical and military value the exquisite beauty of the work will make it a most appropriate gift for those interested in military affairs.

THE BALKAN WARS, by Major Clyde Sinclair Ford, Medical Corps, U. S. Army. The Army Service Schools, Fort Leavenworth, Kansas, 1915. Pamphlet. $0.75.

This is a most interesting series of lectures well worth studying at a time when the Balkans are again playing such a prominent part in world history. Major Ford's opportunity for first-hand observation was unexcelled; and his deductions explain many matters essential to a complete understanding of present conditions.

The general public is believed to be much interested in the narratives of military observers; and there seems to be no good reason why this pamphlet should not be more widely distributed, and not restricted to officers of the service. It is doubtful if many civilians have any idea of the general interest and value of many of the publications of the Army Service Schools.

LECTURES ON CAVALRY, by Captain P. T. Hayne, Jr., 12th Cavalry. The Army Service Schools, Fort Leavenworth, Kansas, 1915. Pamphlet.

It would be difficult to excell Captain Hayne's modest, straightforward, professional exposition of his own arm. Its great value, true rôle and proper relation to the other arms are admirably brought out. It is a credit to the Army Service Schools and an indication of the excellent work now being done at Fort Leavenworth.

Otherwise well presented, it is difficult to explain why the school press permitted the pamphlet to go out into general circulation containing abbreviations which are, of course, familiar to officers of our own service, but which will be so much Greek to civilians or to officers of other armies.

ARTILLERY NOTES (Chapters I and II), by Captain E. D. Scott, Field Artillery. The Army Service Schools, Fort Leavenworth, Kansas, 1915. Uncovered pamphlet. Price not known.

These preliminary chapters just issued, and the mimeographed sheets of the later chapters, indicate that in the near future the Army Service Schools will publish a most enlightening and comprehensive compilation on the general subject of Field Artillery.

There has long been a demand for the statistical data included in Chapters I and II. Scattered as it has been in various books and manuals, most officers of Field Artillery knew where to find it, and were more or less vaguely able to answer the inquiries of officers of other arms of the service, and of the increasing number of civilians who have become interested in Field Artillery since the beginning of the present war. But there was left to Captain Scott the painstaking labor necessary for the compilation and orderly arrangement of this great mass of valuable material. He deserves great credit for the able way in which he has done his work.

It is to be hoped that nothing will delay the completion and publication of the entire pamphlet.

THE FIELD ARTILLERY JOURNAL has had occasion from time to time to comment on the duplication of labor involved in officers on duty at various schools and in various departments working independently and without the coördination so essential to success. It is possible that Captain Scott's work might have been undertaken simultaneously at the War College, the School of Fire for Field Artillery and the Army Service Schools. Are we not in need of some central direction of literary work in the Army?

CRITICISMS UPON SOLUTIONS OF MAP PROBLEMS, by Captain Charles T. Boyd, 10th Cavalry. The Army Service Schools, Fort Leavenworth, Kansas, 1915. 1 vol. Cloth. Price, $2.00.

The military student interested in map problems and the officer who contemplates attending the School of the Line will find this work of great value. It contains the original criticisms of the instructors upon some eighteen different solutions of each one of the sixteen map problems given out at the School of the Line. When differences of opinion existed, both sides of the controversy are presented.

The book will be eagerly sought after by officers who are forced to carry on their studies alone.

The possession of the Gettysburg maps is assumed. Those who do not have them can obtain them at the rate of 20 cents for a set unmounted, 35 cents for mounted sets.

Index to Current Field Artillery Literature

Compiled from weekly lists furnished by the War College Division, General Staff.

Officers requesting information will please quote fully, giving the subject matter carded. When a book is designated, the title will be given in the same language in which it is printed.

Ammunition—artillery—France.—Account and illustrations of the making of shells at the Creusot works. (P. 70–72, L'Illustration, July 17, 1915.)

Ammunition—artillery—manufacture of.—Manufacture of artillery ammunition during the Civil War. Methods of inspection of artillery ammunition. (American Machinist, September 16, 1915, p. 509.)

Ammunition—expended in battle.—Statement of shots fired per piece in certain engagements in 1807 to the Balkan wars. (P. 548, Revista Militar, Argentine, July, 1915. No. 270.)

Ammunition supply—Small arms and artillery ammunition allowed in the principal armies of the world. (Les Armées des Principales Puissances, 1913. Paris, 1913. UA15 A71 1913.)

Ammunition supply—Australia.—Ammunition Park and a Divisional supply column (mechanical transport). How composed. (Australian Military Journal, April, 1915, p. 230.)

Ammunition supply—France—field artillery.—Organization and methods of field artillery supply in French army. (From "L'Illustration," Paris, June, 5, 1915.) (P. 546, Revista Militar, Argentine, July, 1915. No. 270.)

Ammunition supply—France.—Ammunition allowance recommended for French artillery was 2000–3000 for each gun before war of 1914. Increase of shells necessary—P. 63. (Les Armées Française et Allemande. By General Maitrot. Paris, 1914. UA702, M23.)

Artillery.—The ordnance of the field and heavy artillery in the principal armies of the world. (Les Armées des Principales Puissance, 1913, Paris, 1913. UA15 A71 1913.)

Artillery.—Strength and organization of the field and foot artillery in the principal armies of the world. The auxiliary services with war strength. (Les Armées des Principales Puissances. 1913. Paris, 1913. UA15 A71 1913.)

Artillery—Italy.—Deport gun furnished to Italy by French firm. Its advantages over French matériel. Danger in permitting Italy to have it, but after 2 years the Italian manufacturers have produced only 4 guns. P. 25. (Les Armées Francaise et Allemande. By General Maitrot. Paris, 1914. UA702 M23.)

Artillery—Sweden.—Composition and armament of the artillery in the Swedish army—pp. 1125–1128. (Revista Militare Italiana, June 10, 1915.)

Auto trucks—United States.—Motor trucks for the army. Results of experiments and recommendations. By Capt. A. E. Williams, Q.M.C., U.S.A. (P. 284, Army and Navy Register, August 28, 1915.)

Automobiles—France—European war.—Automobile service with the armies. Methods of employment with a force of 40,000 men driving in the military zone, (P. 145, L'Illustration, August 7, 1915.)

Field artillery—Austria-Hungary.—Field artillery of all classes in an army corps—p. 515. (Revue Militaire des Armées Etrangères, July–December, 1912, vol. 80, U3 R8.)

Field artillery—European war.—Outline of field artillery organization, and data on strength, ammunition supply and guns per 1000 rifles, of Germany, Austria, France, Russia, Italy, and England. By Capt. D. T. Moore, U. S. F. A., General Staff. (P. 273, Army and Navy Register, August 28, 1915.)

Field artillery—France—European War.—In the field with the armies of France; the results of Freuch field artillery methods. (P. 261, Scribner's Magazine, September, 1915.)

Howitzers—Austria-Hungary.—Article on the the 42-cm. Skoda type howitzers—pp. 106–109. (Internationale Revue, Armeen and Flotten, July, 1915.)

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Range-finder.—Patent specifications that relate to improvements in range-finders and like instruments of the type in which the adjusting element to be deflected to sight the object, the range of which it is desired to ascertain, is directly moved by displacement of a cam. With cuts. (P. 230, Engineering, August 27, 1915.

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Field Artillery Directory

REGULAR ARMY

Name.	Batteries.
FIRST FIELD ARTILLERY. (Light.)	
Schofield Barracks, H. T.	
Colonel.	
Sturgis, Samuel D.	
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
Cassels, Arthur F.	A
Kilbreth, John W.	Adj't. 1 Battn.
Williams, Harry C.	E
Mason, Roger O.	C
Browning, William S.	Adjt.
Frankenberger, Samuel	Unass'd
Ferris, Charles J.	D
Rehkoph, Ned B.	Adjt. 2 Battn.
Kilbourne, Henry S., Jr.	F
Glassford, Pelham D.	Qm.
First Lieutenants.	
McKinlay, Louis H.	A
Dodds, William H., Jr.	C
Huntley, Harold W.	C
Lyerly, Ballard	D
Pfeil, Harry	Unass'd
McCleave, William	D
Martin, Truby C.	E
Rogers, Wilbur	F
Daly, Charles D.	Unass'd
Palmer, Albert K. C.	B
Steward, Frederick, W.	A
Erlenkotter, Herman	Unass'd
Second Lieutenants.	
Gay, George S.	Qm. and Comy. 1 Battn.
Selleck, Clyde A.	Unass'd
Beard, Louie A.	B
Jones, Ivens.	A
Goetz, Robert C. F.	Unass'd
Hatch, John E.	E
Andrews, Joseph	D
Deshon, Percy	F
Vanderveer, Harold C.	F
Andrus, Clift	B
Second Lieutenants—Continued.	
Hauser, John N.	E
Daly, Joseph O.	C
Veterinarians.	
Donovan, Andrew E.	
Haynes, James R.	
SECOND FIELD ARTILLERY. (Mountain.)	
Philippine Islands.	
Colonel.	
Millar, Edward A.	
Lieutenant Colonel.	
Lassiter, William.	
Majors.	
Snow, William J.	1 Battn.
Fleming, Adrian S.	Unass'd
Chaplain.	
Houlihan, James F. (1 lieut.)	
Captains.	
Spaulding, Oliver L., Jr.	Unass'd
Austin, Fred T.	Unass'd
Boiseau, Louis T.	D
Stuart, Edward A.	B
Warfield, Augustus B.	Qm.
Barnes, Joseph F.	C
De Armond, Edward H.	Adj't.
Myers, Joseph E.	E
Baker, Scott	Unass'd
Allin, George R.	Adjt. 1 Battn.
Honeycutt, Francis W.	Unass'd
First Lieutenants.	
Cubbison, Donald C.	A
Pennell, Ralph McT.	C
Hall, Albert L.	Unass'd
Shepherd, William H.	B
Randol, Marshall G.	Unass'd
Gottschalk, Telesphor G.	Qm. and Comy. 1 Battn.
Higley, Harvey D.	Unass'd
King, Edward P., Jr.	A
Rumbough, Joseph W.	D
Sparks, Leonard C.	E
Magruder, Marshall	F
Hopkins, Samuel R.	Unass'd
Hayden, Herbert B.	Unass'd
Second Lieutenants.	
Wallace, Fred C.	B
Nance, Curtis H.	A
Beatty, John C.	E
Finch, Neil C.	Unass'd
Oliphant, Thomas G. M.	Unass'd
Wrons, William J.	Unass'd

FIELD ARTILLERY DIRECTORY—Continued

Name.	Batteries.
Second Lieutenants—Continued.	
Bloom, Frank	Unass'd
Jones, Lloyd E.	Unass'd
Polk, Newton N.	Unass'd
Anderson, Jonathan W.	Unass'd
Browne, Charles J.	Unass'd
Bailey, Wesley M.	Unass'd
von Holtzendorff, John D.	Unass'd
Veterinarians.	
Gage, Fred B.	....
Gould, John H.	....
THIRD FIELD ARTILLERY. (Light.)	
Hdqrs. and Battys. A, B, and C, Ft. Sam Houston, Tex.	
Battys. D, E, and F, Ft. Myer, Va.	
Colonel.	
Van Deusen, George W.	....
Lieutenant Colonel.	
Menoher, Charles T.	....
Majora.	
Lyon, Le Roy 8.	1 Battn.
McCloskey, Manus	2 Battn.
Chaplain.	
Perry, Barton W. (maj.)	....
Captains.	
Stephens, John E.	A
Gallup, Fred H.	Unass'd
Farrar, Henry B.	Adj't.
Jones, Clarence N.	Adj't. 2 Battn.
Bunker, Charles M.	Adj't. 1 Battn.
Hennessy, Frederick B.	B
Locke, Morris E.	Unass'd
Michel, William N.	C
Hollyday, Thomas W.	Qm.
Mortimer, Charles G.	D
Margetts, Nelson E.	E
First Lieutenants.	
Hammond, John S.	B
Riley, James W.	F
Smith, Edwin De L.	B
Burleson, Richard C.	D
Olmstead, Dawson	F
Paine, George H.	E
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.	D
Second Lieutenants.	
Greble, Edwin St. J., Jr.	Qm. and Comy. 2 Battn.
Second Lieutenants—Continued.	
Bateman, Harold H.	Qm. and Comy. 1 Battn.
Odell, Herbert R.	Unass'd
Magruder, John.	B
Simpson, Bethel W.	F
Parker, Edwin P., Jr.	D
Eager, John M.	F
Brewer, Carlos	A
Cain, David E.	C
McMahon, John E., Jr.	C
Kilburn, Charles L.	E
Thurber, Philip L.	D
Beukema, Herman	E
Wallace, John H. (addl.)	B
Veterinarians.	
Griffin, Gerald E.	....
Mitchell, Aquilla	....
FOURTH FIELD ARTILLERY. (Mountain.)	
Permanent station: Ft. D. A. Russell, Wyo.	
Present stations: Regt. (less Batty, D), El Paso, Tex.	
Batty. D, Progresso, Tex.	
Colonel.	
Berry, Lucien G.	....
Lieutenant Colonel.	
Irwin, George Le R.	....
Majors.	
Gatley, George G.	2 Battn.
McMaster, Richard H.	1 Battn.
Chaplain.	
Joyee, Francis P. (capt.)	....
Captains.	
Merrill, Thomas E.	Adj't. 2 Battn.
Newbold, Henry L.	B
McIntyre, Augustine	Unass'd
Faulkner, Albert U.	C
Apple, George M.	F
Craig, Daniel F.	Unass'd
Lawson, Laurin L.	Adj't.
Brewster, Alden F.	Qm.
McNair, Lesley J.	Unass'd
First Lieutenants.	
Quinn, Leo P.	Qm. and Comy. 2 Battn.
Prosser, Walter E.	A
Parker, Cortlandt	Unass'd
Collins, Leroy P.	F
Harlow, Charles W.	B
Mort, John E.	D
Barrows, Frederick M.	E

FIELD ARTILLERY DIRECTORY—Continued

Name.	Batteries.
First Lieutenants—Continued.	
Hughes, Everett S.	C
Smith, Thomas J.	F
McBride, Allan C.	Qm. and Comy. 1 Battn.
Hollingsworth, Charles P.	Unass'd
Second Lieutenants.	
Devers, Jacob L.	Unass'd
Peyton, Bernard R.	D
Hobbs, Harvey M.	Unass'd
Morrow, Norman P.	B
Anderson, Richard E.	B
Winton, Walter F.	E
Scott, Richard C.	A
Eager, Howard	F
Harris, Arthur R.	E
Dunigan, Francis J.	C
Zundel, Edwin A.	Unass'd
Howard, Clinton W.	Unass'd
Waldron, Albert W. (addl.)	D
Swing, Joseph M. (addl.)	A
Veterinurians.	
Le May, Daniel	
Power, Richard H.	
FIFTH FIELD ARTILLERY. (Light.)	
Permanent station: Ft. Sill, Okla. Present stations: Batty. A, El Paso, Tex. Battys, B and E, Brownsville, Tex.	
Colonel.	
Adams, Granger	
Lieutenant Colonel.	
McGlachlin, Edward F., Jr.	
Majors.	
Bowley, Albert J.	Unass'd
Bishop, Harry G.	Unass'd
Chaplain.	
Sutherland, Alexander D. (1 lt.)	
Captains.	
Smith, Wright	E
Starbird, Alfred A.	C
Lanza, Conrad H.	Unass'd
Donnelly, Edward T.	Unass'd
Greene, George R.	Unass'd
Briggs, Raymond W.	A
Currie, Dennis H.	B
Wood, Norton E.	Adj't.
Hand, Daniel W.	Unass'd
First Lieutenants.	
Smith, Emery T.	Unass'd
Danford, Robert M.	Unass'd
Gruber, Edmund L.	Unass'd
Osborne, Thomas D.	Unass'd
First Lieutenants—Continued.	
Sturgil, Walter S.	E
Davis, Joseph R.	C
Booker, Phillip W.	D
Cruse, Fred T.	B
Naylor, Harold S.	F
Perkins, Kenneth S.	A
Marr, Harold E.	F
Crane, John A.	Unass'd
Prince, Frederick A.	Unass'd
Second Lieutenants.	
Seaman, George G.	D
Reynolds, Charles C.	Unass'd
Riggs, E. Francis	B
Meyer, Vincent	A
Barnes, Julian F.	E
Greenwald, Karl C.	Unass'd
Gillespie, James A.	B
Frankenberger, Bertram	E
Young, William C.	A
Wyeth, John C.	D
Burr, John G.	F
Burr, William E.	C
Lester, James A. (att.)	Unass'd
Struble, Herbert S.	Unass'd
Veterinarians.	
Jewell, Charles H.	
Sproule, William A.	
SIXTH FIELD ARTILLERY. (Horse.)	
Permanent stations: Ft. Riley, Kans. Present stations: Hdqrs. and Battys. A and B, Douglas, Aria. Battys. C and D, Nogales, Aris. Batty. E, Laredo, Tex. Batty. F, Eagle Pass, Tex.	
Colonel.	
Greble, Edwin St. J.	
Lieutenant Colonel.	
Kenley, William L.	
Majors.	
Aultman, Dwight E.	1 Battn.
Payne, Brooke	2 Battn.
Chaplain.	
Dickson, Thomas J. (msj.)	
Captains.	
Butner, Henry W.	Unass'd
Pulis, Charles C.	Unass'd
Lambdin, William McK.	D
Yule, Edgar H.	B
Birnie, Upton, Jr.	A
Deems, Clarence, Jr.	Unass'd
Griffin, Francis W.	E
Campbell, Tilman	C
Corey, John B. W.	F

FIELD ARTILLERY DIRECTORY—Continued

Name.	Batteries.	Name.	Batteries.
Captains—Continued.		*Second Lieutenants.*	
Wood, William S.	Unass'd	Taliaferro, Lueien H.	F
Morrison, William F.	Unass'd	Turner, Frank A.	B
		Dawley, Ernest J.	B
First Lieutenants.		Proctor, Mert.	D
		Erwin, Vincent P.	Unass'd
Blakeley, Charles S.	C	Hicks, Edward H.	D
Neal, Carroll W.	B	Austin, Raymond B.	E
Bishop, Albert T.	E	Crane, William C., Jr.	E
Starkey, John R.	A	Sedlacek, Ernst	F
Hoyle, Rene E. De R.	Unass'd	Houghton, William C.	C
Maul, John C.	C	Anderson, John B.	A
Marley, James P.	Unass'd	Busbee, Charles M. (addl.)	A
Potter, Waldo C.	E	Marsh, Raymond (addl.)	H
Merrill, Walter W.	D		
Tyndall, John G.	F	*Veterinarians.*	
Sands, Alfred L. P.	A		
George, Charles P.	B	Hill, William P.	....
Ahern, Leo J.	F	Stokes, Wilfred J.	....

LINEAL RANK*

No.	Name, rank, and date of rank.	Reg't	No.	Name, rank, and date of rank.	Reg't
	Colonels.			*Captains*—Continued.	
1	*a* Adams, G. 11 mar. 11	5	8	Starbird, A. A. 31 july, 03	5
2	Greble, E. St. J. 11 mar.	6	9	Lloyd, C. R. 14 aug.	1
3	Treat, C. G. 6 may,	....	10	Spaulding, O. L., Jr. 27 aug.	2
4	Van Deusen, G. W. 7 sept.	3	11	Lansa, C. H. 1 nov.	5
5	Millar, E. A. 1 dec.	2	12	Casscls, A. F. 23 nov.	1
6	Sturgis, S. D. 27 dec. 12	1	13	Gallup, F. H. 7 july, 04	3
7	Berry, L. G. 16 mar. 13	4	14	Farrar, H. B. 27 sept.	3
			15	*Granger, R. S.* 2 feb. 05	....
	Lieutenant Colonels.		16	*Moore, D. T.* 14 apr.	....
1	McMahon, J. E. 3 may, 11	1	17	*Hopkins, P. E.* 24 feb. 06	....
2	Menoher, C. T. 26 may,	3	18	Austin, F. T. 14 apr.	2
3	*Hinds, E.* 1 dec.	....	19	Pulis, C. C. 9 june,	6
4	*March, P. C.* 8 feb. 12	....	20	Boiseau, L. T. 25 jan. 07	2
5	Kenly, W. L. 26 aug.	6	21	Lambdin, W. McK. 25 jan.	6
6	McGlachlin, E. F., Jr. 27 dec.	5	22	Stuart, E. A. 25 jan.	2
7	Lassiter, W. 16 mar. 13	2	23	Donnelly, E. T. 25 jan.	5
8	Irwin, G. Le R. 18 nov. 14	4	24	Brooke, G. M. 25 jan.	....
			25	Williams, H. C. 25 jan.	1
			26	Faulkner, A. U. 25 jan.	4
	Majors.		27	Apple, G. M. 25 jan.	4
1	*McNair, W. S.* 15 nov. 10	....	28	Yule, E. H. 25 jan.	6
2	Snow, W. J. 3 mar. 11	2	29	*Westervelt, W. I.* 25 jan.	....
3	Gatley, G. G. 11 mar.	4	30	Birnie, U., Jr. 25 jan.	6
4	Lyon, Le R. S. 11 mar.	3	31	Deems. C., Jr. 25 jan.	6
5	Horn, T. N. 11 mar.	1	32	*Doyle, F. C.* 25 jan.	....
6	*Summerall, C. P.* 11 mar.	....	33	Jones, C. N. 25 feb. 08	3
7	*Cruikshank, W. M.* 11 mar.	....	34	McIntyre, A. 25 jan. 07	4
8	*Farr, O. W. B.* 13 apr.	....	35	Greene, G. R. 25 jan.	5
9	Aultman, D. E. 3 may,	6	36	Briggs, R. W. 25 jan.	5
10	Fleming, A. S. 26 may,	2	37	Bunker, C. M. 25 jan.	3
11	Payne, B. 7 sept.	6	38	Griffin, F. W. 25 jan.	6
12	Guignard, W. S. 1 dec.	1	39	*Welsh, R. S.* 25 jan.	....
13	Bowley, A. J. 9 feb. 12	5	40	Campbell, T. 25 jan.	6
14	Bishop, H. G. 26 aug.	5	41	Craig, D. F. 25 jan.	4
15	*Newbill, W. D.* 27 dec.	....	42	Warfield, A. B. 25 jan.	2
16	McCloskey, M. 16 mar. 13	3	43	*Burt, W. H.* 12 june.	....
17	McMaster, R. H. 18 nov. 14	4	44	Hennessy, F. B. 26 july,	3
			45	Lawson, L. L. 12 aug.	4
	Captains.		46	Locke, M. E. 25 aug. 08	3
1	Stephens, J. E. 23 sept. 01	3	47	Kilbreth, J. W., Jr. 1 apr. 04	1
2	Merrill, T. E. 23 sept.	4	48	*Bryson, J. H.* 10 sept. 09	....
3	Conner, F. 23 sept.	....	49	Mason, R. O. 30 sept.	1
4	Butner, H. W. 23 sept.	6	50	Browning, W. S. 15 nov. 10	1
5	Newbold, H. L. 23 sept.	4	51	Barnes, J. F. 3 mar. 11	2
6	*Scott, E. D.* 23 sept.	....	52	*Ennis, W. P.* 11 mar.	5
7	Smith, W. 20 sept. 02	5	53	Currie, D. H. 11 mar.	....

* 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.	
56	Brewster, A. F. 11 mar.	4
57	De Armond, E. H. 11 mar.	2
58	Wood, N. E. 11 mar.	5
59	*Fuger, A. S.* 11 mar.	
60	Michel, W. N. 11 mar.	3
61	*Wheeler, E. S.* 11 mar.	
62	Hollyday, T. W. 11 mar.	3
63	Corey, J. B. W. 13 apr.	6
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	Rehkopt, N. B. 11 july, 13	1
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
	First Lieutenants.	
1	Blakely, C. S. 25 jan. 07	6
2	Smith, E. T. 25 jan.	5
3	Danford, R. M. 25 jan.	5
4	Quinn, L. P. 25 jan.	4
5	Gruber, E. L. 25 jan.	5
6	Neal, C. W. 25 jan.	6
7	Cubbison, D. C. 25 jan.	2
8	McKinlay, L. H. 25 jan.	1
9	Osborne, T. D. 25 jan.	5
10	Dodds, W. H., Jr. 25 jan.	1
11	Hammond, J. S. 25 jan.	3
12	Bishop, A. T. 25 jan.	6
13	Prosser, W. E. 25 jan.	4
14	Riley, J. W. 25 jan.	3
15	Huntley, H. W. 25 jan.	1
16	Smith, E. De L. 25 jan.	3
17	Pennell, R. McT. 6 july,	2
18	Sturgill, W. S. 7 july,	5
19	*Miles, S.* 8 july,	
20	Parker, C. 8 july,	4
21	Burleson, R. C. 9 july,	3
22	Davis, J. R. 10 july,	5
23	Starkey, J. R. 11 july,	6
24	Hoyle, R. E. DeR. 11 july,	6
25	Olmstead, D. 12 july,	3
26	Maul, J. C. 12 july,	6
27	Hall, A. L. 13 july,	2
28	Paine, G. H. 13 july,	3
29	Collins, L. P. 16 july,	4
30	Lyerly, B. 19 july,	1
31	Lewis, R. H. 26 july,	
32	Booker, P. W. 12 aug.	5
33	Pritchett, E. E. 5 mar. 08	
34	Cruse, F. T. 1 july,	5
35	Marley, J. P. 20 july,	6
36	Potter, W. C. 25 aug.	6
37	Pfeil, H. 17 sept.	1
38	Merrill, W. W. 16 june, 09	6
39	Downer, J. W. 10 sept.	3
40	Bailey, B. M. 29 sept.	3
41	*Sharp, W. F.* 30 sept.	
42	*Thorp, F., Jr.* 14 jan. 10	

No.	Name, rank, and date of rank.	Reg't
	First Lieutenants—Continued.	
43	Tyndall, J. G. 3 mar. 11	6
44	Sands, A. L. P. 11 mar.	6
45	George, C. P. 11 mar.	6
46	Harlow, C. W. 11 mar.	4
47	Naylor, H. S. 11 mar.	5
48	Rucker, W. H. 11 mar.	
49	Shepherd. W. H. 11 mar.	2
50	Randol, M. G. 11 mar.	2
51	*Greely, J. N.* 11 mar.	
52	*Capron, W. A.* 11 mar.	
53	Mort, J. E. 11 mar.	4
54	Barrows, F. M. 11 mar.	4
55	Dunn, W. E. 11 mar.	3
56	*Burns, J. H.* 11 mar	
57	Hughes, E. S. 11 mar.	4
58	Smith, T. J. 11 mar.	4
59	Parrott, R. S. 11 mar.	3
60	Gottschalk, T. G. 11 mar.	2
61	Higley, H. D. 11 mar.	2
62	King, E. P., Jr. 13 apr.	2
63	Perkins, K. S. 13 apr.	5
64	Kirkwood, R. G. 13 apr.	3
65	Marr, H. E. 26 may.	5
66	Rumbough, J. W. 7 june,	2
67	McCleave, W. 13 june,	1
68	McBride, M. C. 20 june,	4
69	Brabson, J. R. 20 june,	3
70	Sparks, L. C. 1 july,	2
71	Crane, J. A. 1 july,	5
72	Prince, F. A. 1 apr. 12	5
73	Magruder, M. 28 may,	2
74	Martin, T. C. 31 may,	1
75	Rogers, W. 31 july,	1
76	*Dougherty, L. R.* 22 aug.	
77	Hopkins, S. R. 26 aug.	2
78	Hollingsworth, C. P. 6 sept.	4
79	Daly, C. D. 5 mar. 13	1
80	Palmer, A. K. C. 22 nov.	1
81	Steward, F. W. 13 june, 14	1
82	Hayden, H. B. 18 nov.	2
83	Ahern, L. J. 10 jan. 15	6
84	Beere, D. M. 10 jan.	
85	Erlenkotter, H. 12 may.	1
86	*Thummel, C. B.* 15 may,	
	Second Lieutenants.	
1	Miner, H. E. 11 june, 09	
2	Greble, E. St. J., Jr. 11 june,	3
3	Devers, J. L. 11 june,	4
4	Taliaferro, L. H. 14 july,	6
5	Bateman, H. H. 14 july,	3
6	Turner, F. A. 13 nov.	6
7	Seaman, G. G. 13 nov.	5
8	Reynolds, C. C. 13 nov.	5
9	Gay, G. S. 18 jan. 10	1
10	Wallace, F. C. 15 june,	2
11	*Lewis, B. O.* 15 june,	
12	Odell, H. R. 15 june,	3
13	Selleck, C. A. 15 june,	1
14	Dawley, E. J. 15 june,	6
15	Beard, L. A. 15 june,	1
16	Jones, I. 15 june,	1
17	Goetz, R. C. F. 17 aug.	1
18	Peyton, B. R. 8 sept.	4
19	Magruder, J. 9 sept.	3
20	Riggs, E. F. 11 feb. 11	5
21	Nance, C. H. 13 june,	2
22	*Bowley, F. W.* 13 june,	
23	Beatty, J. C. 13 june,	2
24	Hatch, J. E. 13 june,	1
25	*Walker, C. A., Jr.* 13 june,	
26	Simpson, B. W. 13 june,	2
27	Finch, N. G. 13 june,	2

FIELD ARTILLERY DIRECTORY—Continued.

No.	Name, rank, and date of rank.	Reg't	No.	Name, rank and date of rank.	Reg't
	Second Lieutenants—Continued.			*Second Lieutenants*—Continued.	
28	Hobbs, H. M. .... 14 june, 11	4	61	Eager, H. .... 25 mar. 13	4
29	Andrews, J. .... 15 june,	1	62	Young, W. C. .... 12 june,	5
30	Oliphant, T. G. M. .... 20 july,	2	63	Crane, W. C., Jr. .... 12 june,	6
31	Proctor, M. .... 20 july,	6	64	Brewer, C. .... 12 june,	3
32	Wrona, W. J. .... 20 july,	2	65	Cain, D. E. .... 12 june,	3
33	Erwin, V. P. .... 19 aug.	6	66	McMahon, J. E., Jr. .... 12 june,	3
34	Bloom, F. .... 27 sept.	2	67	Clarkson, H. S. .... 26 june,	
35	Meyer, V. .... 28 sept.	5	68	Kilburn, C. L. .... 14 july,	3
36	Hicks, E. H. .... 28 sept.	6	69	Helmick, C. G. .... 18 july,	
37	Morrow, N. P. .... 7 oct.	4	70	Sedlacek, E. .... 30 aug.	6
38	Jones, L. E. .... 7 oct.	2	71	Thurber, P. L. .... 12 june, 14	3
39	Polk, N. N. .... 7 oct.	2	72	Houghton, W. C. .... 12 june,	6
40	*Bradley, F.* .... 2 dec.		73	Wyeth, J. C. .... 12 june,	5
41	Anderson, J. W. .... 3 dec.	2	74	Harris, A. R. .... 12 june,	4
42	Deshon, P. .... 24 apr. 12	1	75	Burr, J. G. .... 12 june,	5
43	Barnes, J. F. .... 24 apr.	5	76	Anderson, J. B. .... 12 june,	6
44	Vanderveer, H. C. .... 24 apr.	1	77	Burr, W. E. .... 12 june,	5
45	Andrus, C. .... 24 apr.	1	78	Lester, J. A. .... 12 june, 15	
46	*Maxwell, R. L.* .... 12 june,		79	Beukems, H. .... 12 june,	3
47	Browne, C. J. .... 12 june,	2	80	Struble, H. S. .... 12 june,	5
48	Hauser, J. N. .... 12 june,		81	Dunigan, F. J. .... 12 june,	4
59	Greenwald, K. C. .... 12 june,	5	82	Zundel, E. A. .... 12 june,	4
50	Anderson, R. E. .... 12 june,	4	83	Howard, C. W. .... 12 june,	4
51	Gillespie, J. A. .... 12 june,	2			
52	Bailey, W. M. .... 12 june,	2			
53	von Holtzendorff, J. D. .... 22 july,	2			
54	Winton, W. F. .... 23 july,	4		*Additional Second Lieutenants*.	
55	Frankenberger, B. .... 30 nov.	5			
56	Austin, R. B. .... 30 nov.	6	1	Busbee, C. M. .... 12 june, 15	6
57	Daly, J. O. .... 30 nov.	1	2	Waldron, A. W. .... 12 june,	4
58	Parker, E. P., Jr. .... 30 nov.	3	3	Wallace, J. H. .... 12 june,	3
59	Eager, J. M. .... 30 nov.	3	4	Marsh, R. .... 12 june,	6
60	Scott, R. C. .... 15 jan. 13	4	5	Swing, J. M. .... 12 june,	4

MILITIA

FIRST INSPECTION DISTRICT

Capt. Robert Davis, Inspector, 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 BATTALION

Headquarters, Boston

Maj. J. H. Sherburne.
Capt. Roger D. Swaim, Battalion Adjutant.
1st Lieut. Winthrop Miller, Battalion Quartermaster and Commissary.

BATTERY A, BOSTON

Capt. Richard K. Hale.
1st Lieut. E. B. Richardson.
1st Lieut. H. S. Allen.
2nd Lieut. R. C. Ware.
2nd Lieut. Geo. A. Parker.

BATTERY B, WORCESTER

Capt. John F. J. Herbert.
1st Lieut. Arthur P. Twombly.
1st Lieut.
2nd Lieut. George Bieberack.
2nd Lieut.

BATTERY C, LAWRENCE

Capt. Watkins W. Roberts.
1st Lieut. George McLain.
1st Lieut. R. A. Daniels.
2nd Lieut. Sumner H. Needham.
2nd Lieut. Wesley L. Whelpley.

SECOND CORPS GADETS

Headquarters, Salem

Maj. Thorndyke D. Howe
1st Lieut. Harry S. Perkins, Battalion Adjutant.
1st Lieut. Nathaniel T. Very, Battalion Quartermaster and Commissary.

FIRST BATTERY

Capt. Frank S. Perkins.
1st Lieut. Arthur E. Johnson.
1st Lieut.
2nd Lieut. Harold M. Wheeler.
2nd Lieut.

SECOND BATTERY

Capt. Ernest R. Redmond.
1st Lieut. John A. O'Keefe, Jr.
1st Lieut.
2nd Lieut. Arthur V. Wilson.
2nd Lieut. George A. Burke.

THIRD BATTERY

Capt. James R. Taylor.
1st Lieut. William B. Morgan.
1st Lieut. Harry E. Mitton.
2nd Lieut. Clyde W. Johnson.
2nd Lieut.

It is requested that all errors be reported to the Secretary, United States Field Artillery Association, 230 First St. N. W., Washington, D. C.

FIELD ARTILLERY DIRECTORY—Continued

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.)

BATTERY A, YALE UNIVERSITY

Capt. Carl F. Bollmann.
1st Lieut.
1st Lieut.
2nd Lieut.
2nd Lieut.

BATTERY B, YALE UNIVERSITY

Capt. Henry H. Townshend.
1st Lieut.
1st Lieut.
2nd Lieut.
2nd Lieut.

BATTERY C, YALE UNIVERSITY

Capt. John H. H. Alden.
1st Lieut.
1st Lieut.
2nd Lieut.
2nd Lieut.

BATTERY D, YALE UNIVERSITY

Capt. Osborne A. Day.
1st Lieut.
1st Lieut.
2nd Lieut.
2nd Lieut.

BATTERY E, BRANFORD

Capt. Chas. S. Yeomans.
1st Lieut. John J. Ahern.
1st Lieut.
2nd Lieut. John W. Newton.
2nd Lieut. Frank H. Stiles.

BATTERY F, STAMFORD

Capt. Wm. M. Wilson.
1st Lieut.
1st Lieut.
2nd Lieut.
2nd Lieut.

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. Charles M. Ferat, Jr.
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. Prentice Strong, Battalion Adjutant.
Capt. Leonard B. Smith, Battalion Adjutant.
1st Lieut. Arthur W. Copp, Battn. Qm. and Com
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. Robert D. Mills.
1st Lieut. Channing R. Toy.
1st Lieut.
2nd Lieut. James H. Giles.
2nd Lieut.

BATTERY C, BINGHAMTON

Capt.
1st Lieut. Arthur S. Douglass.
1st Lieut. John T. Shinners.
2nd Lieut. Chas. G. Blakeslee.
2nd Lieut. Arthur E. Kaeppel.

BATTERY D, NEW YORK CITY

Capt. Benjamin Van Raden.
1st Lieut. Sylvester Simpson.
1st Lieut.
2nd Lieut. Frederick J. Koch.
2nd Lieut. Clinton M. Lucas.

BATTERY E, NEW YORK CITY

Capt. John T. Delaney.
1st Lieut. Frederick H. Ryan.

1st Lieut. Joseph H. de Rivera.
2nd Lieut. George B. Gibbons.
2nd Lieut. Robert L. Russell.

BATTERY F, NEW YORK CITY

Capt. Raymond R. Reid.
1st Lieut. Walter C. McClure.
1st Lieut.
2nd Lieut. James S. Larkin.
2nd Lieut. Leonard Snider.

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FIELD ARTILLERY DIRECTORY—Continued

SECOND FIELD ARTILLERY

Headquarters, Brooklyn

Col. George A. Wingate.
Lieut. Col. Frank H. Hines.
Maj. Chauncey Matlock.
Maj. Joseph I. Berry.
Capt. DeWitt C. Weld, Adjutant.
Capt. Louis F. Kuntz, Quartermaster.
Capt. Wilbur T. Wright, Commissary.
Capt. Wm. B. Short, Battalion Adjutant.
Capt. Eugene F. Lohr, Battalion Adjutant.
1st Lieut. Albert D. Washington, Battalion Quartermaster and Commissary.
2nd Lieut. Herbert C. Dienst, 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.
2nd Lieut. Roger P. Clark.
2nd Lieut.

BATTERY B, BROOKLYN

Capt. Lester C. Fox.
1st Lieut. Horst A. C. Albrecht.
1st Lieut.
2nd Lieut. Harry C. Miller.
2nd Lieut. Edward L. Brennan.

BATTERY C, BROOKLYN

Capt. Albert S. Hamilton.
1st Lieut. Eugene A. Holmes.
1st Lieut.
2nd Lieut. Walter H. Simonson.
2nd Lieut.

BATTERY D, NEW YORK CITY

Capt. James B. Richardson.
1st Lieut. Howard E. Sullivan.
1st Lieut. Alphonse W. Weiner.
2nd Lieut. Charles J. McGronan.
2nd Lieut.

BATTERY E, NEW YORK CITY

Capt. John J. Stephens, Jr.
1st Lieut. Robert W. Marshall.
1st Lieut. James H. Davis.
2nd Lieut. Dean Nelson.
2nd Lieut.

BATTERY F, NEW YORK CITY

Capt. William O. Richardson.
1st Lieut. Samuel E. McRickard.
1st Lieut. Charles H. King.
2nd Lieut. Frederick W. Bergstein.
2nd Lieut. Raymond L. Hoffman.

THIRD INSPECTION DISTRICT

Capt. Marlborough Churchill, 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.
2nd Lieut.

BATTERY B, WASHINGTON, D. C.

Capt. George G. Wilson.
1st Lieut. Ellwood S. Moorhead, Jr.
1st Lieut.
2nd Lieut.
2nd Lieut.

Pennsylvania

BATTERY A, SOUTH BETHLEHEM

Capt. Thomas O. Cole.
1st Lieut. Elmer G. Tice.
1st Lieut. Carter L. Wright.
2nd Lieut. Ray R. Geary.
2nd Lieut. Herbert M. Paul.

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. Chas. H. Cox.
1st Lieut. Frederick S. Swier.
1st Lieut. Augustine S. Janeway.
2nd Lieut. Samuel A. Whitaker.
2nd Lieut. John G. Failor.

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. Shelley.

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. P. W. Kear.
1st Lieut. McChesney H. Jeffries.
1st Lieut. W. Carleton Jones.
2nd Lieut. Edmond L. Sylvester.
2nd Lieut. John D. Thomas.

BATTERY C, PORTSMOUTH

Capt. Robert B. MacDonald.
1st Lieut. Walter J. Tennent.
1st Lieut. Joe Clinton Dunford.
2nd Lieut. Stanley B. Houghton.
2nd Lieut. Mason Lee.

It is requested that all errors be reported to the Secretary, United States Field Artillery Association, 230 First St. N. W., Washington, D. C.

FIELD ARTILLERY DIRECTORY—Continued

FOURTH INSPECTION DISTRICT

Lieut. Charles S. Blakely, Inspector, New Orleans, La.

Alabama.

FIRST BATTALION

Headquarters, Birmingham

Maj. Leon S. Dorrance.
Capt. Hartley A. Moon, Adjutant.
1st Lieut. J. Alf. Luckie, Quartermaster and Commissary.

BATTERY A, BIRMINGHAM

Capt. Frank Flinn.
1st Lieut. Walter L. Furman.
1st Lieut.
2nd Lieut. Robert L. Pittman.
2nd Lieut.

BATTERY C, BIRMINGHAM

Capt.
1st Lieut. William S. Pritchard.
1st Lieut. Julian P. Smith.
2nd Lieut. Fred A. Feld.
2nd Lieut. Laurence S. Morgan.

Georgia

FIRST BATTALION

Headquarters, Savannah

Maj.
Capt. William W. Douglas, Adjutant.
1st Lieut. Wm. S. Connerat, Quartermaster and Commissary.

BATTERY A, SAVANNAH

Capt. Edward G. Thomson.
1st Lieut. Edward G. Butler.
1st Lieut. Valentine Seyden.
2nd Lieut. Alexander R. MacDonell.
2nd Lieut. Mathias M. Ray.

BATTERY B, ATLANTA

Capt. Andrew J. McBride, Jr.
1st Lieut. Robert G. Mangum.
1st Lieut. Leonard F. Wilson.
2nd Lieut. Frank Boynton Tidwell.
2nd Lieut.

BATTERY C, SAVANNAH

Capt. Edward D. Wells.
1st Lieut. Joseph H. Thompson.
1st Lieut.
2nd Lieut. Joseph E. Inglesby.
2nd Lieut.

Louisiana

FIRST BATTALION

Headquarters, New Orleans

Maj. Allison Owen.
Capt. Bryan Black, Adjutant.
1st Lieut. S. Ross Yancey, Quartermaster and Commissary.
Veterinarian, Edward F. Karstendick.

BATTERY A, NEW ORLEANS

Capt. Stanley M. Lamarie.
1st Lieut.
1st Lieut.
2nd Lieut. Guy R. Molony.
2nd Lieut. Maurice B. Lamarie.

BATTERY B, NEW ORLEANS

Capt. James E. Edmonds.
1st Lieut.
1st Lieut.
2nd Lieut. Harold P. Nathan.
2nd Lieut.

BATTERY C, NEW ORLEANS

Capt. Gabriel S. Adams.
1st Lieut.
1st Lieut.
2nd Lieut.
2nd Lieut.

FIFTH INSPECTION DISTRICT

Capt. Clarence Deems, Jr., Inspector, Indianapolis, Indiana

Indiana

FIRST BATTALION

Headquarters, Indianapolis

Major Robert H. Tyndall.
Capt. Thomas D. Wilson, Adjutant.

BATTERY A, INDIANAPOLIS

Capt. Gavin L. Payne.
1st Lieut. Frank W. Buschmann.
1st Lieut.
2nd Lieut. Chas. L. Watson.
2nd Lieut. Solon J. Carter.

BATTERY B, PURDUE UNIVERSITY, LAFAYETTE

Capt. Harry E. McIvor.
1st Lieut. Harris C. Mahin.
1st Lieut. Frank D. Dexter.
2nd Lieut. Allen H. Phillips.
2nd Lieut.

BATTERY C, LAFAYETTE

Capt.
1st Lieut. Joseph A. Andrews.
1st Lieut. Rosier W. Levering.
2nd Lieut. John C. Doyle.
2nd Lieut. Frank Nisley.

Michigan

FIRST BATTALION

Headquarters, Lansing

Maj. Roy C. Vandercook.
Capt. L. K. Caster, Adjutant.
1st Lieut. Robt. E. Marsh, Battalion Quartermaster and Commissary.

It is requested that all errors be reported to the Secretary, United States Field Artillery Association, 230 First St. N. W., Washington, D. C.

FIELD ARTILLERY DIRECTORY—Continued

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.
2nd Lieut. Joseph H. Lewis.
2nd Lieut.

Ohio

FIRST BATTALION

Headquarters, Briggsdale

Maj. H. M. Bush.
Capt. Quida 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, AERON

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.
Capt. Joseph R. Durkin, Adjutant.
1st Lieut. Curtis G. Redden, Quartermaster and Commissary.

BATTERY A, DANVILLE

Capt. Orvil F. Hopper.
1st Lieut. Leslie P. Livengood.
1st Lieut.
2nd Lieut. Fred G. Anderson.
2nd Lieut. John D. Cole.

BATTERY B, CHICAGO

Capt. Frank M. Course.
1st Lieut. Max E. Payne.
1st Lieut.
2nd Lieut. James P. Tyrell.
2nd Lieut.

BATTERY C, FORT SHERIDAN

Capt. Roy B. Staver.

SECOND BATTALION

Headquarters, Chicago

Maj. Charles R. Vincent.

BATTERY D, CHICAGO

Capt.
1st Lieut. L. T. Kelly.
1st Lieut. Horace R. Denton.
2nd Lieut. Hugh R. Montgomery.
2nd Lieut.

BATTERY E, CHICAGO

Capt. Henry J. Reilly.
1st Lieut.
1st Lieut.
2nd Lieut.
2nd Lieut.
2nd Lieut.

BATTERY F, URBANA

Capt. Bruce W. Benedict.
1st Lieut. Albert W. Jamison.
1st Lieut. George B. Rice.
2nd Lieut. Louis A. Harding.
2nd Lieut.

Wisconsin

BATTERY A, MILWAUKEE

Capt. Philip C. Westfahl.
1st Lieut. Alonzo J. Comstock.
1st Lieut. John G. Reed.
2nd Lieut. William F. Fraedrich.
2nd Lieut. Alvin A. Knechenmeister.

Iowa

FIRST BATTALION

Headquarters, Clinton

Maj. Roy S. Whitley.
Capt. James L. Oakes, Adjutant.
1st Lieut. Thomas McClelland, Quartermaster and Commissary.

BATTERY A, CLINTON

Capt. Jacob E. Brandt.
1st Lieut. Martin J. Purcell.
1st Lieut. Loren R. Brooks.
2nd Lieut. Frank G. Luth.
2nd Lieut. Peter A. Hinrichsen.

BATTERY B, DAVENPORT

Capt. Arthur M. Compton.
1st Lieut. Harry H. Ward.
1st Lieut. Roland S. Truitt.
2nd Lieut. Albert M. Parker.
2nd Lieut. F. H. Hinrichs.

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FIELD ARTILLERY DIRECTORY—Continued

BATTERY C, MUSCATINE

Capt. Henry F. Lange.
1st Lieut. Otto W. Mull.
1st Lieut. Horace L. Husted.
2nd Lieut. Clark M. Barnard.
2nd Lieut. Edward A. Roach.

SEVENTH INSPECTION DISTRICT

Lieut. Frank Thorp, Jr., Inspector, Kansas City, Mo

Kansas.

BATTERY A, TOPEKA

Capt. John M. Hite.
1st Lieut. Arthur J. Patterson.
1st Lieut. Richard J. Dorer.
2nd Lieut. William P. MacLean.
2nd Lieut. James C. Hughes.

Missouri

FIRST BATTALION

Headquarters, Independence

Maj. Edward M. Stayton.
Capt. John H. Thatcher, Adjutant.
1st Lieut. Harold D. Bell, Quartermaster and Commissary.

BATTERY A, ST, LOUIS

Capt. Frank M. Rumbold.
1st Lieut. Walter J. Warner.
1st Lieut. Robert C. Rutledge.
2nd Lieut. Edwin R. Nieheus.
2nd Lieut. Daniel F. Jones.

BATTERY B, KANSAS CITY

Capt. Arthur J. Elliott.
1st Lieut. Roy T. Oluey.
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. Harry B. Allen.
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.
2nd Lieut. Ward C. Goessling.
2nd Lieut.

EIGHTH INSPECTION DISTRICT

Lieut. W. F. Sharp, Inspector, Denver, Colorado
Colorado

BATTERY A, DENVER

Capt. James C. Exline.
1st Lieut.
1st Lieut.

BATTERY A—*Continued*

2nd Lieut. William H. Schade.
2nd Lieut. Harry O. Nichols.

BATTERY B, DESVER

Capt.
1st Lieut. Guylan A. Blanchard.
1st Lieut.
2nd Lieut.
2nd Lieut.

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.
2nd Lieut. Fred T. Gundry.
2nd Lieut.

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.

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. Walter Alexander.

BATTERY C, STOCKTON

Capt. Edward Van Vranken.
1st Lieut. Otto E. Sandman.
1st Lieut.
2nd Lieut. Charles H. Young.
2nd Lieut. Hunt A. Davidson.

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.

It is requested that all errors be reported to the Secretary, United States Field Artillery Association, 230 First St. N. W., Washington, D. C.

FIELD ARTILLERY DIRECTORY—Continued

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. Harry M. Boyer, Battalion Adjutant.
Capt. Frederick A. Tiffany, Battalion Adjutant.
1st Lieut. John H. Schoonmaker, Battalion Quartermaster and Commissary.

2nd Lieut. James K. Scott, Jr., 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. Charles Weiss.

BATTERY B, ST. PAUL

Capt. Charles L. Ames.
1st Lieut. Theodore A. Kaldunski.
1st Lieut.

BATTERY B—*Continued*

2nd Lieut. Horace S. Sorrells.
2nd Lieut. James K. Edsall.

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. Gorman.
1st Lieut. William J. Gilmour.
1st Lieut.

2nd Lieut. Julius H. Pohlson.
2nd Lieut.

BATTERY E, MINNEAPOLIS

Capt. Jerome Jackman.
1st Lieut. Louis Baker.
1st Lieut.
2nd Lieut. William R. Cross.
2nd Lieut. Thomas A. Hillary.

BATTERY F, MINNEAPOLIS

Capt. Walter F. Rhinow.
1st Lieut. Fletcher Rockwood.
1st Lieut. William H. Kennedy.
2nd Lieut. Edwin Rollmann.
2nd Lieut.

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Active Membership, Field Artillery Association.

REOULAR ARMY.

5th Field Artillery	98 per cent.
3rd Field Artillery	93 per cent.
Unassigned to regiments	90 per cent.
6th Field Artillery	88 per cent.
1st Field Artillery	85 per cent.
2nd Field Artillery	85 per cent.
4th Field Artillery	79 per cent.

MILITIA.

New Mexico	100 per cent.
Rhode Island	100 per cent.
Utah	100 per cent.
Pennsylvania	79 per cent.
Indiana	64 per cent.
Massachusetts	53 per cent.
Virginia	53 per cent.
New York	49 per cent.
Ohio	45 per cent.
District of Columbia	40 per cent.
Missouri	39 per cent.
Minnesota	31 per cent.
New Jersey	30 per cent.
Illinois	25 per cent.
Connecticut	22 per cent.
Louisiana	22 per cent.
Georgia	21 per cent.
Wisconsin	20 per cent.
California	19 per cent.
Michigan	18 per cent.
Iowa	17 per cent.
Alabama	10 per cent.
Colorado	0 per cent.
Kansas	0 per cent.
New Hampshire	0 per cent.
Oregon	0 per cent.
Texas	0 per cent.