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EDITED BY
JOHN NESMITH GREELY
CAPTAIN, 7TH FIELD ARTILLERY, UNITED STATES ARMY
(No. 1)

DWIGHT E. AULTMAN
LIEUTENANT-COLONEL, FIELD ARTILLERY, UNITED STATES ARMY
(Nos. 2, 3, 4.)

THE UNITED STATES FIELD ARTILLERY ASSOCIATION
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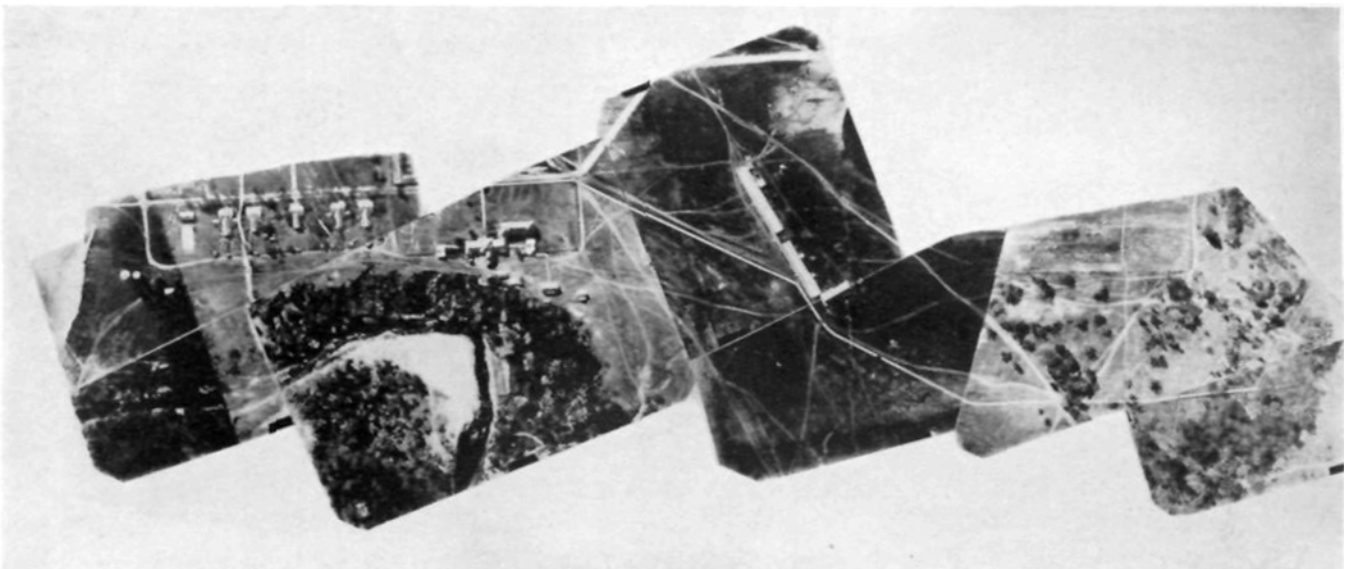

OLD FORT SILL FROM NEW ANGLE

THIS PHOTOGRAPHIC MAP OF THE OLD POST OF FORT SILL WAS MADE WITH THE BROCK AUTOMATIC AEROPLANE CAMERA DURING TESTS BY THE FIRST AERO SQUADRON IN THE FALL OF 1915. THE CAMERA HAS BEEN IMPROVED, AND IS NOW BEING FURTHER TESTED AT FORT SAM HOUSTON.

THE FIELD ARTILLERY JOURNAL

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The Combats in Pursuit Following the Great Battle in Lorraine, August, 1914

A FIELD ARTILLERYMAN'S RECOLLECTION OF THE EVENTS OF AUGUST 20, 1914

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

(*From "Artilleristische Monatshefte," September–October, 1915*)

TRANSLATOR'S NOTE: *The first article by this same author, entitled "Our Baptism of Fire," appeared in the "Artilleristische Monatshefte" for June, 1915. This article discussed the mobilization of the Cavalry Division, the first advance of the Germans from Saarburg to Lunéville, the resulting engagements and the subsequent order to retire, the movement being evidently a reconnaissance in force. In order to assist the reader to better understand the movements and engagements described in this former article, a map covering the events described therein, which was found after a tedious search, is here published. A translation of this former article appeared also in the "Cavalry Journal" for December, 1915, and later in* THE FIELD ARTILLERY JOURNAL *for October-December, 1915.*

In the present article, the writer takes up the operations of the Horse Artillery Battalion and the Cavalry Division, after the retirement to Saarburg, which followed the engagements described in the former article "Our Baptism of Fire." Maps accompany the present article.

This is a remarkable article, pregnant with lessons and of intense and absorbing interest to every field artilleryman. The author discusses with the same delightful frankness mistakes and deficiencies as well as successful accomplishment. His

unstinted praise of his opponent and the unbiased and strictly professional manner in which he discusses the events, makes this article of more than ordinary value not only from an artillery view point but also from the point of view of the other services.

On August 20, 1914, the great battle in Lorraine had begun, extending over an area from Metz to the heart of the Vosges Mountains. Many hundreds of thousands of combatants fought on both sides with dogged bitterness; we Germans to clear our land of our uninvited guests, who after all remained only four days on German soil; the French, in order to realize completely the redemption of Alsace and Lorraine. With the greatest confidence in victory, the French had entered, on August 17th, the city of Saarburg, without having to strike a blow, orders from Army Headquarters having directed the evacuation of the city, so that in the general battle with the whole Sixth Army, now fully concentrated, the enemy might be the more decisively defeated and expelled. Those were indeed sad days for us. Without being able to ascribe any reasons therefore, after our first victorious advance which took us almost to the River Meurthe, we found ourselves ordered to withdraw in an orderly retreat to the River Saar.

From the 14th of August on our cavalry had maintained constant contact with the enemy who, in endless columns and over a broad front, was advancing from the south and west. During their sojourn in Saarburg, French officers in triumphant glee had proclaimed to the populace: "In three days we will be in Strassburg, in two weeks in Berlin." It happened, however, quite otherwise. As an example of the overconfidence of a portion of the enemy, the following little occurrence is interesting. On the day of the battle there was found in the pockets of a dead French sergeant a letter addressed to his fiancée, in which he also expressed himself, as did the officers, to the effect that in three days they would be in Strassburg and in a couple of weeks in Berlin. The shoes worn by the sergeant

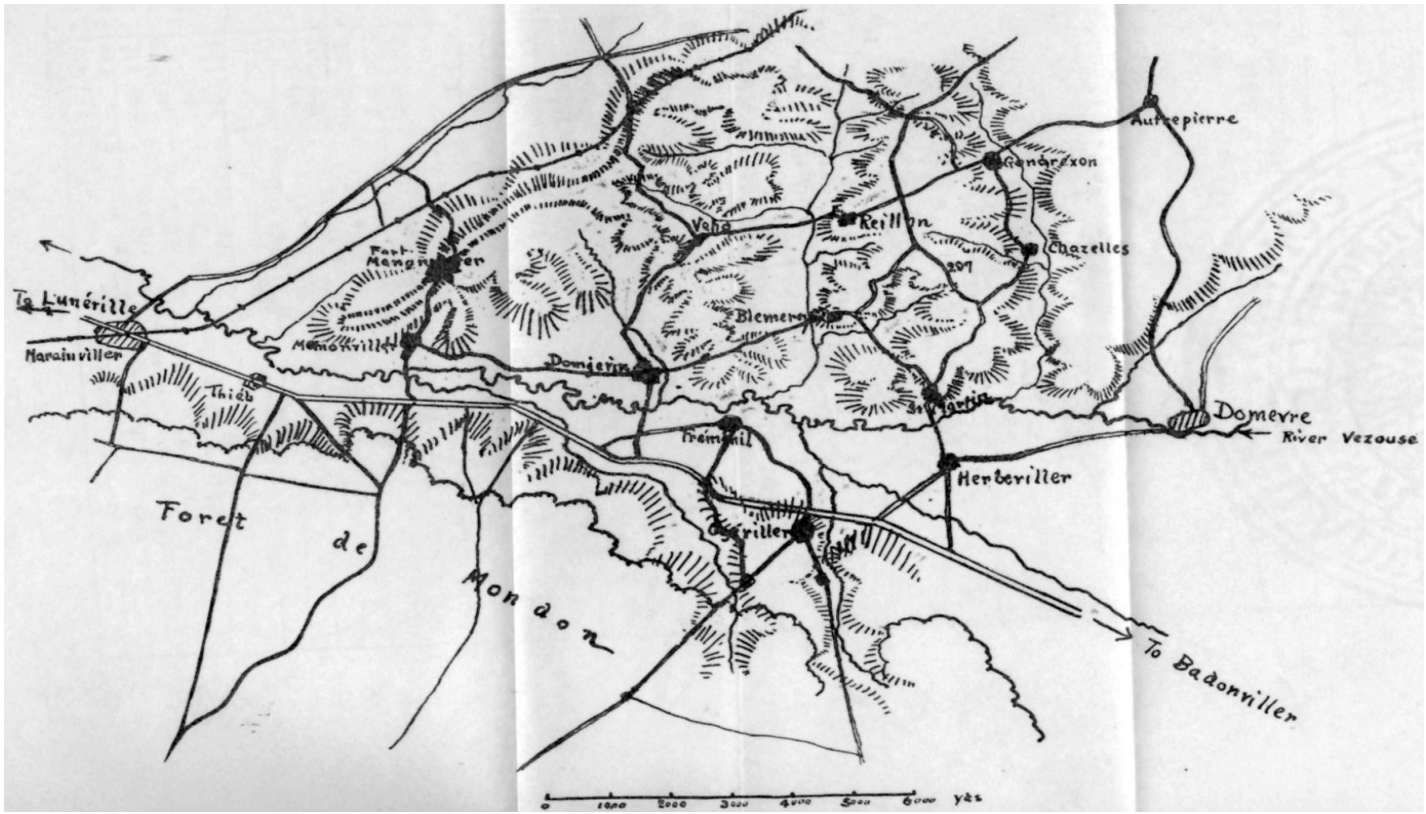


FIG. 1.—THIS MAP COVERS THE COUNTRY DESCRIBED IN "OUR BAPTISM OF FIRE." WHICH APPEARED IN "THE FIELD ARTILLERY JOURNAL." OCTOBER-DECEMBER, 1915.

were of the light civilian Parisian style. They were so completely worn out that the stockings showed through the soles. A former employee of the clothing depot at Strassburg could not resist the impulse to appropriate these shoes, sending them to the Supply Depot Headquarters with the following memorandum: "With these shoes, Sergeant Durand of the 87th Regiment of Infantry, intended to walk from Saarburg to Berlin in three weeks." This small token is being preserved in Strassburg to commemorate the poor footgear of the French soldier. When we retreated to Saarburg, anxious faces were seen among the people, for no one knew how the coming liberators would conduct themselves in the newly acquired territory. We comforted these poor people as much as possible and promised to return soon. Faithfully we kept our promise, only Saarburg looked different after the battle than it had before.

Our Cavalry Division had been deployed just west of Pfalzburg and in constant touch with the enemy, covering the final distribution of the troops for the coming battle. It received on August 18th the order to proceed to the east side of the Saar by passing in rear of the different corps already advancing for battle, and to march to the vicinity of Münster, between the railroad Bensdorf-Saaralben and Bensdorf-Saarburg, filling in here a vacant space in the line between the 21st Army Corps to the west and the 1st Bavarian Reserve Corps formed a little north of Lauterfingen. In another report I have already described our important successes in the battle at Lauterfingen. After heavy fighting on August 18th and 19th for possession of the canal crossings (the Saar Canal) at Mittersheim and points to the south, in which engagements the Cavalry Division did not participate, the great battle of August 20th began. As a part of the Army Reserve, we were able to follow the progress of the battle from the heights southwest of Insmingen (Eichelberg), at first from a distance and in rear of the line, being held here to await the moment when our cavalry should again be ordered into the fight. It was an indescribable moment for us

when the next day at 5 A.M., on the Eichelberg, the Division Commander greeted us with the words: "Gentlemen, this morning a momentous day has dawned for us! All the forces of the enemy which have invaded Lorraine, will this day be attacked in their entirety and along the whole front extending from Metz to the Vosges Mountains and must be crushed to a complete defeat." Upon a large map the situation was explained to the commanding officers present and our objectives pointed out to us, during which time the fire of the artillery opened simultaneously along the entire battlefront 100 kilometers in length, indicating the preliminary phase of this mighty battle. Far to the southeast, in the vicinity of our garrison, Saarburg, the thunder of the artillery seemed to be loudest and the battle fiercest. It was the day on which the French, in the early hours of the morning, were surprised in their bivouacs in and around Saarburg, to be completely driven out later in the day by the Bavarians. During the morning hours, the German artillery of our 14th Army Corps shot up our beautiful barracks, from which we could plainly see the smoke rising. We also felt anxiety—and as later events proved, justly so—when we thought of all our homes in the vicinity of barracks.

On the 20th of August there was as yet nothing for us to do. It was first necessary for the infantry to fight its way through the impenetrable woods and thickets of the forests at Mittersheim and Finstingen, which offered very unfavorable lateral communications. In spite of a victorious advance, heavy losses were suffered from hostile fire. The numerous graves of both friend and foe, which are found everywhere, are eloquent witnesses to confirm the severity of the fight. The French Field Artillery showed here as on every other occasion that it knew how, especially during a retreat, to cover and support in an admirable manner the movements of its infantry. The losses suffered by a certain battalion of Bavarian Jägers at Stranhof, west of Angweiler, were especially heavy. This battalion was advancing in column of march along the only

road debouching from the woods at this place and at 1200 meters came under an annihilating fire from which on account of the impassable condition of the woods, it could not escape even by deployment to both sides of the road. At some later day we passed this place and still saw traces of the heavy losses.

On the 21st of August we were assembled quite early at Insweiler and awaited with impatience the order to advance and take up the pursuit. It was evident that our infantry and with it all the corps must already have advanced a considerable distance, as was to be concluded from the thunder of the artillery which was constantly becoming more distant. And then came the order from Headquarters of our Sixth Army, which had previously been quartered at Helimer, to advance as quickly as possible, to hang on to the enemy's rear and by attacking to cause him as much loss as possible. Both corps to the right and left of us had already reached the Rhine-Marne Canal, and in order not to arrive too late, it was imperative to make haste.

In three columns our division advanced at a trot through the woods and the battlefield of the previous day, the main body going via Lauterfingen-Rohrbach-Germingen-Disselingen-Freiburg-Azoudange to Maizières. Frequent halts were necessary because the roads were not yet everywhere clear and were obstructed with vehicles of all sorts. We saw nothing to indicate the alleged mad flight of the French, at least not in our sector. We saw very little impedimenta and very few discarded or abandoned weapons. In Azoudange we saw a French field bakery which it had been impossible to knock down and withdraw. It had also left behind its numerous receptacles, all filled with freshly baked loaves of bread. With great relish did our men consume the delicious French white bread and it was quite plain now why our neighbors in the west have so little taste for the coarser German issue bread.

At Maizières, we received reports from our advanced eskadrons that the enemy was making a stand along the canal (Rhine-Marne Canal) at Moussey; that this place was blocked

with troops and that long march columns were striving to reach the heights of Avricourt. I quickly glanced at my map to select the probable position which would have to be occupied in the prospective fight. Then I rode over to his Excellency, the Division Commander, and requested authority to put my batteries into action. One of my batteries had been assigned to the advance guard, and by this time should have reached the southern exit of the woods north of Moussey.

At the same time I was ordered to put the other two batteries in a position north of Moussey and to open fire with the utmost dispatch upon all targets that might present themselves.

I galloped forward along the road finding it still occupied by our cavalry, which was being held up and just then making preparations to fight on foot, advancing in skirmish line against the ground at Porte St. Marie where hostile infantry was still reported. This forward movement of the dismounted cavalry seemed to take rather a long time. Not until later did our cavalry learn to fight on foot, a method not held in too much favor. So much the more thoroughly did they learn it later on. Anyway, my second battery which was already on the point of going into position along the edge of the woods, positively needed the support of some dismounted skirmishers to the front. It would have been a very easy matter for a resourceful and energetic hostile cavalry to have taken the battery, the advance of which to this advanced point had been rather risky. But here as well as on every other occasion the French cavalry, in contrast to the admirable French field artillery, showed itself absolutely deficient. Just as I emerged from the woods, I saw my advance guard battery slowly winding its way along the edge of the woods, much too slowly to suit me, so that I was compelled, in view of the situation which demanded rapidity of action, to urge them to make haste. In such cases as this it is no mistake for the artillery commander to be well to the front, say about near the reserve of the advance guard eskadron. This will enable him to make quick and timely dispositions for


METZ
MOSEL RIVER
Bolchen
Pange
Verny
Remilly
Nomeny
Dehne
Chateau Salins
Falkenberg
St Avold
Forbach
Gross Tänchen
Mörchingen
Dieuze
Bensdorf
Albesdorf
Insmingen
Helimer
Münster
Mittersheim
Finstingen
Angweiler
Strankof
Germingen
Puttlingen
Saaralben
SAARGEMUND
SAARBRUCKEN
SAAR RIVER
Saarunion
Rohrbach
Drulingen
CANAL

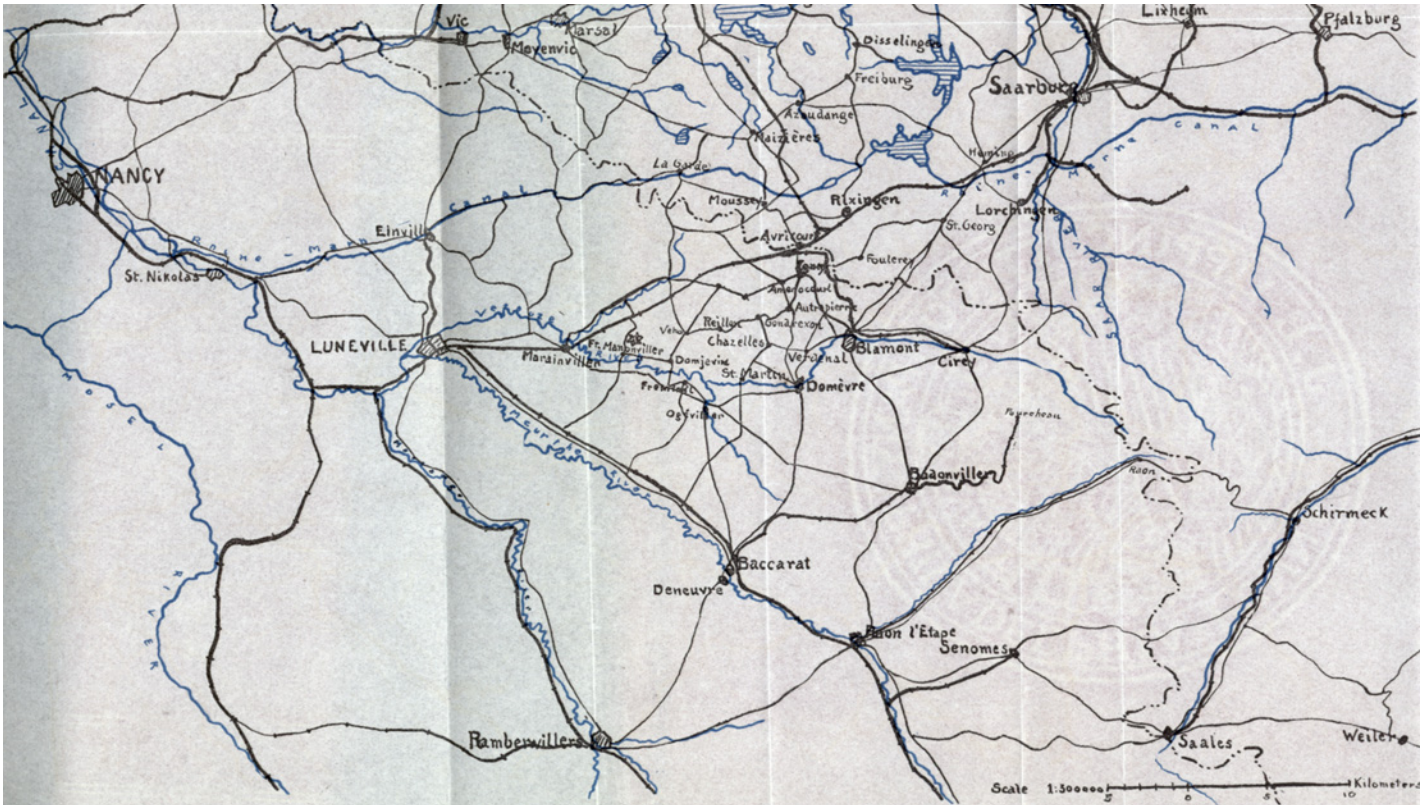


FIG. 2.—THIS IS A GENERAL MAP OF THE THEATRE OF OPERATIONS DESCRIBED IN MAJOR SEEGER'S ARTICLES.

his batteries. A rapid glance through my field glasses at the edge of the woods on the heights beyond, showed me that in fact it was necessary to act with all possible haste in order to yet catch the enemy, who in dense march columns at a range of about 5000 meters and plainly visible, was climbing up the slope on the road from Avricourt to Igney. In spite of the long range each and every battalion was plainly visible and could be easily picked out separately.

When, after my rapid advance, I turned about to have my battalion headquarters detail carry out the necessary orders, I found myself out in the open all alone. My battalion staff had become separated from me, my adjutant had been sent off, and the other members of my headquarters detail had simply failed to get past the narrow stretch of the road which was blocked by the halted cavalry troops; all of which put me in a mild rage. Fortunately the Division Commander's aide, Lieutenant Forst, who had just transmitted some orders to me, was with me at the time. I directed him to have the cavalry clear that part of the road passing through the woods as quickly as possible and to have the batteries move forward with the utmost speed, all of which was properly done.

I had the choice, either to take a position near the woods, east of the highway Maizières-Moussey, or to occupy another position at about the same elevation but 500 meters farther to the front. It was lucky for us that I decided upon the latter position, if for nothing more than to get farther away from the constricted roadway directly in our rear. I intercepted the second battery which was just then going to its assigned position and ordered it forward with me. Due to this change in plans, this battery did not get into position ahead of the other batteries. I rode rapidly along the position, tied my lone horse to a stack of straw, and on foot made a closer reconnaissance, in the meantime impatiently awaiting the arrival of the battery commanders. At last they came, and also a part of my battalion staff, so that I was now able to designate the location of my

observing station and have the scissors observing telescope set up. I cannot believe that all these movements of ours had entirely escaped the attentive observation of the hostile artillery, for, as we soon learned subsequently, the enemy was already in position with a part of his artillery in order to support the withdrawal of his own march columns then in a very dangerous situation. In about fifteen minutes the batteries were all in position. To the first battery emplaced, I assigned the only visible and at the same time appropriate target, namely, the hostile march columns on the road climbing up the steep slope to Igney, a target which it was necessary for us to take under fire before it disappeared behind this hill. But the extreme range (about 5600 meters) which made it necessary to dig holes for the trails and in very hard ground at that, delayed the opening of fire very much. How often have we bewailed this very circumstance, namely that the inadequate limit of elevation of the gun when on level ground compels us to resort to this unavoidable labor in such emergencies.

In continuing my observations with the scissors telescope and while sweeping the objective over the panorama for the purpose of directing the remaining two batteries upon some other targets which I felt positive were surely out there, I suddenly identified at a distance of about 4000 meters upon a flat ridge a little lower than the one we occupied and in the direction of what I believed to be the village of Rixingen a dark, worm-like object creeping along through the terrain, coming toward us and then halting. I looked a little closer and now recognized it as a battery in double section column moving into position with the drivers dismounted, and just about to unlimber. I could feel my heart beat distinctly! This battery was going into action with its front directed against an entirely different part of the battlefield. It was impossible for it to be aware of our position in observation. If it were a hostile battery, then it was up to us to surprise our unsuspecting enemy with an overwhelming fire and after that to finish up

the job with the support of our numerous cavalry. After the "worm" came to a halt, in spite of the greatest endeavor on my part to get a clearer view, I could not tell whether it was our neighboring Bavarian artillery, a part of which, we were told, had taken the field in the old blue uniform, or perhaps after all French artillery, which also has a very dark uniform. Judging from the color of the uniform and the whole line of conduct, it was positively not Prussian Artillery. At 4000 meters with field glasses, it is very easy to distinguish between field gray and either black or blue. The moment was now coming which would determine my decision. The column halted and unlimbered. If the battery unlimbered to the right that is to the north, then according to the tactical situation it was bound to be hostile artillery, but if the muzzles of the guns were pointed south, then it probably was a pursuing blue Bavarian reserve battery. Just as the movement was completed, I said aloud to myself and to the C. O. of the third battery who had just then hurriedly joined: "They are French; and I was not mistaken." The muzzles turned toward the north. Very distinctly did I see the familiar long tube of the French gun turn toward the north, from which direction our neighboring columns had to advance. To make sure I then counted the number of carriages. Five small heaps remained standing while the remainder with horses and limbers, wound its way down the valley to take cover, everything just as laid down in the French Drill Regulations. Again there was no doubt. There they were, four French gun sections and the observation wagon of the battery commander, and in rear of the centre of the battery stood another dark object. According to the familiar diagram showing the order in battery of the French artillery, I knew it to be the sixth caisson of the firing battery. And now the members of the hostile battery detail began running to their front just as ours do. It was absolutely impossible for them to be German troops. Both my adjutant and the C. O. of the third battery still had some doubts as to the correctness

FIG. 3.—Bhf=R. R. station; Schleuse (schl) = canal-lock; Weiher (W)=canal basin or pond; Wald = bois = forest or woods; Holz = grove of trees; Teich (T) = small lake or pond; – hof = farm estate; Bach (B) = creek or brook.

NOTE TO FIG. 3.—The black line leading south from Maizières to Porte St. Marie shows the route of advance of the battalion along the main road which about 1000 meters north of Porte St. Marie debouches from the Wald (Woods) of Maizières. The three German batteries went into position east of the main road just half way between the edge of the woods and the farm at Porte St. Marie as shown by the three conventional signs for guns. The initial R and the period just to the east of the batteries show the position of the battalion observation station. The initials IS and line show the position of the cavalry squadron assigned as artillery support. The dotted line which crosses the main road from Moussey to Avricourt and extends from the small pond just south of the word *Moussey* to the Grosswald Bach (Creek) just east of the railroad shows the line of infantry encountered by the scouts which were sent forward to secure the destroyed French battery. The position of the reserves for this infantry line is shown by two conventional signs one west of the road near the figures 270 and the other about 500 meters east of the road. About 600 meters south of this detachment and just north of the town of Deutsch Avricourt is the unfortunate battery marked *a*, with its direction of fire northeast, which was surprised and attacked in flank. The position of the other two batteries which attempted the rescue of the first battery is shown by the letters and conventional signs; one *b*, just south of the letters *Av* in Deutsch Avricourt, and the other *c*, just south of the letters *ri* in Avricourt and located near the Barrone (Grove) Holz. The line of retreat of the French infantry which was seen climbing the heights toward Igney is shown by the dotted line beginning at the R.R. station (Bhf d'Igney) just south of Avricourt, then south through Igney and from this point south-west through Amenoncourt.

The Rhine-Marne Canal winds across the map between Porte St. Marie and Moussey.

of my conclusions and recommended greater caution, that is, thought it best to wait for more positive proofs before opening fire. I admit that it is best not to open fire when there is any doubt, but I was positive in my belief and gave the definite order: "Fire will be opened; I assume responsibility." This dainty morsel, this battery with its flanks exposed to our fire, I assigned to the two batteries, the first and the third batteries, in position next to me, and gave as principal reference point what I took to be the church tower of Rixingen (directly in rear of the hostile battery). It was not until much later, after the battle, that this turned out to be the church tower of the village Deutsch-Avricourt. This error is made daily during active campaign in a hostile country and it can easily be the cause of fatal mistakes in the transmission and execution of orders. I mention this here because I believe that one cannot do too much of this reconnaissance of the hostile sector, nor practice too often the immediate and accurate location and identification of all visible reference points which may be needed in the direction and control of fire.

I must admit that I could scareely await the first shot from our batteries, especially since it was becoming constantly clearer from the conduct of the hostile battery that it was a rear guard battery evidently with the mission to delay the pursuit by the German troops coming from the extensive woods northeast of Rixingen. And such was the case on this day at almost all points along the battlefront. Everywhere march columns were suddenly attacked with a withering fire in order to break up and delay as much as possible the pursuit of the opponent.

I ordered the first battery to open suddenly on the target with échelon[1] (time) fire, in order to get in at least some effect

[1] TRANSLATOR'S NOTE.—In échelon fire, the three platoons, or the six guns, fire a simultaneous volley, the range for the different platoons or guns differing progressively by 100 meters. Only one range is given in the command, which range is taken by the centre platoon in échelon fire by platoon, or by the fourth gun in échelon fire by piece. Several volleys are usually fired in rapid succession, without waiting to observe effect. The height of burst is so chosen as to prevent grazes, but on the other hand very high bursts are not desired.

immediately. The adjacent third battery, by making use of the observations of this fire, was to begin at once to bracket the target with shell. The first method does not quite conform to the prescriptions of the Firing Regulations since such a hostile battery target cannot be considered to be an instantaneous target. But special conditions necessitate special methods. What commanding officer of any grade would in time of war have adhered scrupulously to the Regulations when circumstances required that some success be attained as quickly as possible? How ill adapted to entirely different and unexpected circumstances have our Regulations often proved themselves, and how quickly did we then have to learn over again because the targets which present themselves in war compelled us to change! This combined fire for adjustment and for effect of the two batteries, notwithstanding the rather long range, at once produced some results, as we could plainly see through the scissors observing telescope. The hostile battery, the movements of which we could follow very closely and which was still engaged in preparing the guns for fire in an entirely different direction, was visibly surprised by this sudden enfilading fire. At first the limbers which had taken position not sufficiently far behind the guns, took up the trot and wound their way completely down the slope, endeavoring to get out of the line of fire as quickly as possible, successfully doing so in a very short time. I should have assigned these limbers as a special target to one of my batteries from the very beginning in order to deprive the enemy from the very start of his only means of mobility. I would certainly do this if a similar case came up again, but we are all wiser after a thing is over. The first thing that I noticed about the hostile guns, was a part of the gun detachments running away to take cover in a fold of the ground in rear of the hostile position, a view of which was moreover obscured by the high standing grain. Only one gun, very probably commanded by a very energetic chief of section or platoon, took up the unequal contest and at once was faced to the left

with its muzzle turned toward us. The gun had probably not yet been anchored, for the rapid identification of our location and the quickness shown in laying the gun, thirty seconds after which the first shot was already on the way, was rather startling to me. I had always heard unfavorable comments concerning the deficiency of the French gun in preparing for action and its inability to make a rapid change of target. The flashes of our guns were no doubt quite clearly visible to our opponent, for we were not very far behind the crest and moreover almost all the guns of the battalion were firing simultaneously. The smoke which was thereby developed, especially on humid days, disclosed our position much sooner than we liked. And this point must also be considered and will compel us in the future to go back a little farther behind the crest rather than to take an open or partly defiladed position so much preferred in the past. Evidently the rapid manner in which the enemy picked us up can probably be explained by his use of a range finder which I am sorry to say we are still lacking.

We saw the long flash of the French gun, heard the projectile coming and shortly after that saw it burst on impact with a loud crash scarcely 20 paces in front of us, causing me to cry out aloud: "Confound it! But that's good." I now gave directions to increase the rapidity of fire, giving the battery commanders a free hand, whereupon the opposing gun was soon silenced in this unequal contest and the cannoneers also withdrew. I then gave the order to destroy the matériel and render it harmless by percussion fire, while the other battery with shrapnel time fire searched the area in the rear in order to keep the detachments away from the guns, in which we were successful for the present. It seemed that the battery was properly despatched and that the personnel was powerless to make an uninterrupted or successful attempt to recover it. At that moment the Division Commander was stopping in the nearby Porte St. Marie and I expressed to him my intention of capturing the hostile battery with my men. I therefore ordered my

adjutant with about 20 men, whose horses had in the meantime been brought forward, to ride by the shortest route to the ridge about 4 kilometers distant and to take possession of the guns. But in spite of the unconcealed retreat of the French army, we had made our plans without considering our not-to-be-despised enemy. My adjutant did not get any nearer than about 1500 meters to the hostile position at Avricourt and was there greeted from all directions with a heavy infantry fire, so that in spite of several attempts to make a detour, he was compelled to turn back. This decision he was compelled to make because these mounted men were absolutely without adequate weapons or arms.

While my batteries kept up a slow and easy continuous fire upon the deserted hostile battery in order to nip in the bud any attempt at renewing fire, our comrades of the hostile battery got busy themselves in order to save what remained to be saved, and right here I desire to state by way of introduction that they accomplished their task in a really masterful manner, and looking at it from an idealistic artillery point of view and as professional comrades, it could not have been done better. In fact it was a type example of how, in a retreat, the one should help the other out of a bad situation. Meanwhile, during the pause in the firing which now set in, our comrades in St. Barbara no doubt were considering and planning how to get this battery out of its precarious position. At least two if not more hostile batteries were directed to smother us, with an overwhelming and prolonged fire, our position being now pretty accurately located by the French; in other words to neutralize us by preventing us from firing. During this action the unlucky battery was to get its guns back over the crest as quickly as possible and in the best way it could, disappearing quickly and abandoning the position, for considering the great extent to which the retreat of the French Infantry had progressed, it was high time for the batteries to pull out or a few more batteries might also be left behind.

And now began the second and for us less pleasant phase of the duel. While the C. O. of the first battery and I kept the hostile battery under observation we both noticed that the little double heaps marking the sections in the firing battery, were becoming smaller, and we could plainly see at first only one gun setting itself in motion, being drawn by some unknown force. There was no doubt about it. Under the protection of the high grain in the fields and the adjacent covering crest, the French had crept unobserved up to the guns, had attached drag ropes or cables to them and were now slowly dragging them back over the crest. It was a damned good idea, and it caused me to immediately and energetically increase the rapidity of fire. I did not intend to let this prize once seized to get out of my hands again. During this time that we sped up our shrapnel and shell fire the enemy with his two other remaining batteries did not remain idle. They had remained silent up to this moment, and probably were even brought into action for this purpose by the anxious battalion commander. They now opened upon us from some completely masked positions which were never disclosed. Where these positions were neither I nor any of my subordinates were able to discover and unless they were within the zone searched by us in firing at the first battery, these hostile counter batteries never came under our fire. A sudden and very violent rafale fire, delivered with beautiful accuracy, was now directed upon my observing station and the batteries standing not far behind me. As was plainly to be seen, the fire was coming from two directions, from a point well off to the right and also from the left. A year later during the period of our protracted service in the vicinity of Avricourt, I had an opportunity to make a more thorough reconnaissance of the terrain, and came to the conclusion that one battery must have been in position west of Baronne, near the Baronne woods, and the other one stood near the railroad station at Deutsch-Avricourt, in both of which places there was good cover and from which in the further progress

of the retreat, they could withdraw unmolested to the west.

The suddenness with which the fire was opened and the great accuracy of the individual shots was surprising to us. To our good fortune, as already mentioned, the French had no doubt taken the range to the crest in our rear with their range finder, a fact which we could immediately observe from the first shots. In the beginning as well as in the later firing, most of the shots were over and in rear of my batteries, so that only a relatively small number of hits was obtained in the line of guns. Even later when, in accordance with their regulations and the character of the terrain, they began to search the ground also in front of the guns, the effect produced was relatively small. The first volley fired by the French was close to the edge of the woods, that is, about 300 meters in our rear, the bursts being in regular order and with uniform distribution so that a line could be drawn through them all; in other words the guns were laid parallel with normal intervals. I remember calling the attention of those in my vicinity to the accuracy of the fire. The fire of the other hostile battery was much too short at first, and was in front of my third battery. This interfered very much with the latter's fire. In front of the observing station of this battery, fragments were constantly striking and kicking up dirt so that, as the battery commander informed me, on various occasions his view was completely obstructed, which of course was to the advantage of the unfortunate first hostile battery and also diminished our fire. Right here I must also call attention to a piece of carelessness in one of my batteries which made use of the first pause in our previous firing to show its cannoneers the apparently destroyed hostile battery on the ridge to our front. In doing this, it undoubtedly disregarded the imperative precaution to keep covered which is always necessary and to which from that time on we all soon habituated ourselves. This gathering of a large group of men did not remain unnoticed by the French, and although for the greater part of this time they searched for us back near the edge of the

woods, they also sought us to some extent on the ridge in front due to the above circumstance. Another clew for the hostile artillery was also the main road from Maizières to Moussey. The point where this road emerges from the woods was plainly visible from the hostile position and very naturally was a very important locality for a rear guard battery to observe and register. In addition, the great amount of dust stirred up by our Cavalry Division on these hot days was also an admirable indication for our enemy, showing him where to direct his fire in order to be successful in delaying us. This concentration of troops near the woods in rear of the batteries, and the halting and dismounting of whole regiments of cavalry on the only main road leading to the front, were fatal mistakes for our cavalry. At the very first shots fired by us, they should have cleared out of the roads in the woods and as rapidly as possible deployed to the right and left of the defile. The second or third hostile volley sweeping, burst directly at the exit of the road from the woods and passed through the march columns of the cavalry, causing considerable losses there.

During the firing just mentioned, which produced more harm in rear of, than in the firing batteries, and in course of which the enemy must have fired several hundred projectiles, the French with commendable courage and great perseverance attempted to completely rescue their unlucky battery, in which attempt, however, they were not entirely successful. On one occasion when the hostile fire was also especially heavy, we saw a limber come galloping out in order to recover another gun. Our fire was immediately increased and with one shot the limber was brought to a halt, several horses being either killed or wounded. Anyway, from that moment all further attempts to recover any carriages ceased. It was now possible to observe through the telescope that only the caissons were still remaining and that the attempt to recover the guns had apparently been successful. Some days later we learned that, on the whole, such was also the case. The fire of the two defensive

rear guard batteries had lasted on and off, including pauses, about two hours, during which time I had directed my left flank battery to make a change of position to the low ground near the Rhine and Marne Canal in order to be able to cover more effectively the low foreground near Moussey. But on account of the heavy hostile fire on the crossing at Porte St. Marie, this battery never got a chance to unlimber, for in the meantime the French had also taken under fire the premises of Porte St. Marie, so that the Division Commander without apprising us of the fact, had to leave this place. Until way late in the afternoon, the canal was nowhere crossed by any strong force of cavalry, and thus the French were able to withdraw to the west and south quite unmolested. An eskadron of cavalry had been assigned for the protection of my left flank and took up a position along the woods. This eskadron was also unable to get cover against the hostile artillery fire and sought a more favorable position a little farther to the rear. Upon the complaint of the C. O. of the left flank battery, I was several times compelled to interfere in order to assure the absolutely necessary guarding of my flanks. Artillery which is already in position and firing has an absolute right to demand that the other arms of the service protect the front and flanks of its position, and, when such protection is once ordered the arms which it is supporting are not authorized or justified in abandoning this support of their own accord or without urgent cause which in this case did not exist. In other words, they have no right to leave the artillery in the lurch. We were very much relieved when toward evening a company of infantry was sent to our support. But later on toward dark when the hostile artillery fire again set in with great intensity, compelling us to seek the shelter of our shields, the infantry also withdrew to the protection of the woods. The task assigned to the hostile batteries, namely to prevent under all circumstances the pursuit by our strong cavalry forces across the Rhine-Marne Canal in the directions of Avricourt-Amenoncourt, was accomplished by them in a

masterful manner. Anyway we did not succeed in cutting off any rear guard battalions either in their retreat or while making a stand. Far better than any type or school example can show it, one fact stands out clearly and that is the extraordinary importance of our arm in a retreat, and this our Drill Regulations also emphasize. It was a day on which we all learned a great deal, and from our enemies at that.

Night now came upon us. The battalion, single handed and almost alone, without any support worth mentioning from the other arms, had held out to the end. In the glow of the setting sun we buried at the firing position our first dead comrade of the first battery, and removed our wounded and those unfit for mounted work or otherwise disabled to the rear.

It was some days later, after a long seemingly endless and fatiguing night march back to Azoudange, where we bivouacked, that we had an opportunity to fetch our trophies. I ordered two teams from our light ammunition column (combat train) to be unhitched and to start out early in the morning in order to gather up all the caissons left behind by the unlucky hostile battery, and to turn them over to the trains, which was done. I also instructed them to look for any guns that might have been abandoned. Our detachment from the combat train found twelve caissons on the heights just north of the railroad station at Avricourt, all of them loaded full up with shrapnel and shell excepting for a few rounds which had been fired from the position on the afternoon of the 20th. After a further search of the battlefield it was learned that the French did abandon three guns in Avricourt after all, and as our investigation showed from the same regiment. But I am sorry to say that this derelict prize, which was left standing only a few hundred meters from the place of combat, was in the meantime confiscated by the Bavarians and by the time our men arrived, they were already on the road to Munich. These guns which I would rather see at the entrance to my barracks at Saarburg, now decorate the Hall of Trophies in Munich.

Motor Transport for Field Artillery

BY MAJOR LUCIAN B. MOODY, ORDNANCE DEPARTMENT

THE FIELD ARTILLERY JOURNAL *is indebted to Major Moody for this comprehensive article on the development of motor traction for Field Artillery in this country. Major Moody has been working on this matter for some years at the Rock Island Arsenal and was present at the tests conducted by the Field Artillery Board at Fort Sill.*

THE first serious official attempt at motor transportation for field artillery in this country that the writer is aware of is illustrated in Fig. 1, which shows a combined battery and store wagon for light batteries constructed under the supervision of the Ordnance Department at Jersey City in 1903.

In addition to the usual tools, supplies and spare parts it contained a power-operated lathe, grindstone and emery-wheel. The contents were carried in conveniently arranged special compartments. At the front end of the truck there was a winch for use, with 200 feet of rope and a snatch block, in pulling the truck out of difficulties. The total weight was about 12,000 pounds.

In the fall of 1903, this truck was run from Jersey City to Washington over 160 miles of macadamized, and 100 miles of dirt roads in more or less bad condition. Much of the way was hilly with grades up to twenty per cent. and about fifteen per cent. was sandy. The average speed of the whole run was 7¼ miles per hour and the truck was in good condition at the end of the trip.

In May and June, 1904, a trial run was made to Gettysburg and in August the truck was taken with a battalion of field artillery from Fort Myer to maneuvers near Thoroughfare Gap Va. The report on this trip stated that "The wagon, which weighs about 12,000 pounds loaded, is to heavy, and the outfit could not be relied upon to keep up with the battery,

whereas it is absolutely necessary that the battery wagon and forge limber be up with the battery at all times." The truck was finally dismantled at Rock Island Arsenal.

The principal criticism in the light of later developments is that the project attempted was too ambitious, as with the great improvements made during the intervening twelve years it is now thought that for light batteries two trucks will be required to do what was attempted then with one truck and that the total weight of each should not exceed about 8000 pounds.

Comparatively little was done by the Ordnance Department after this test until about two years ago due to the fact that the Quartermaster's and other corps were making an effort to discover a suitable truck for replacing ordinary wagon transport, and that until this had been satisfactorily accomplished there was little hope of applying motor power to the movement of such important units as field batteries. The whole subject was of course given an impetus by the unexpected demand for transportation in the present war which called into service motor vehicles of every description, many of which would probably have been found totally unsuited for military use except for the superior roads of France. It is believed that Russia is now much more particular about the vehicles for use on her poor roads than the nations operating vehicles in France.

Practical tests by the Ordnance Department were again undertaken at Rock Island Arsenal early in 1915, with a view of determining what types of motor vehicles would probably be suited for field artillery and for armored car service. About the same time practical tests were undertaken at Fort Sill under the direction of the Field Artillery Board, which are referred to in the July-September, 1915, number of the Journal and more fully in the article by Captain Wm. Bryden in this issue.

Most of the photographs and data upon which this article is based were procured during the Rock Island tests, and are used by courtesy of the Ordnance Department. Any conclusions

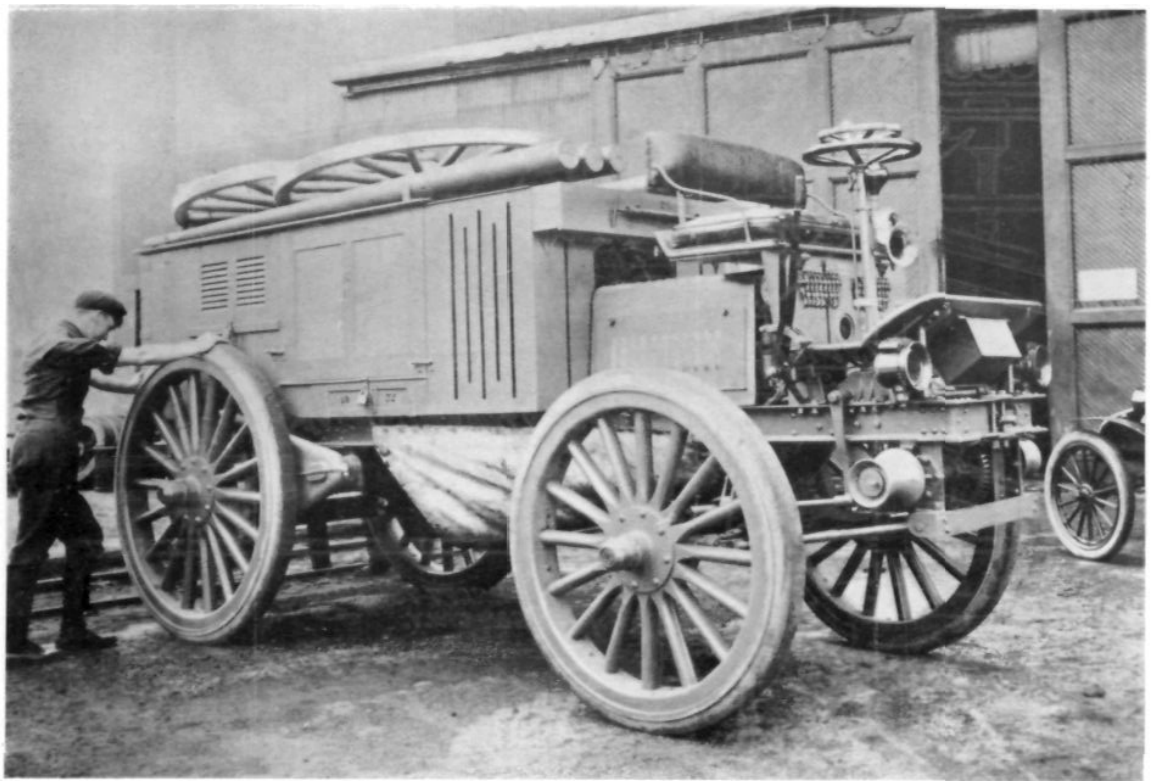
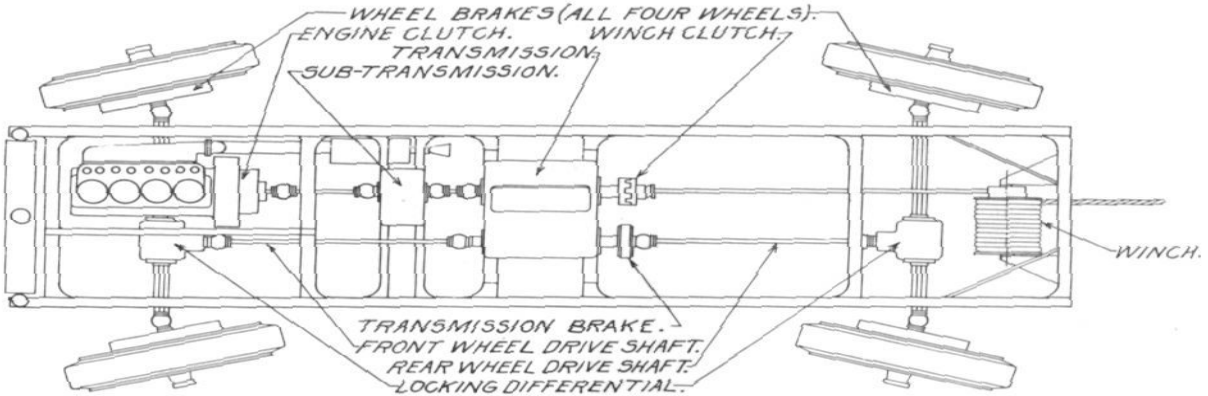
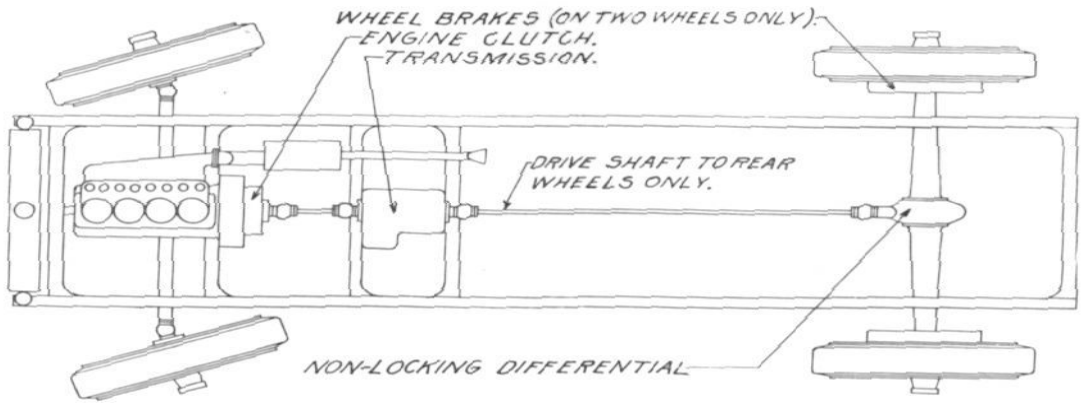


FIG. 1.—COMBINED BATTERY AND STORE WAGON CONSTRUCTED IN 1903. THIS VEHICLE WAS INTENDED FOR SERVICE WITH LIGHT BATTERIES. BUT WAS FOUND UNSUITABLE ON ACCOUNT OF ITS WEIGHT OF 12,000 POUNDS BEING TOO GREAT TO ENABLE IT TO MANEUVER WITH LIGHT BATTERIES.



TYPICAL "FOUR WHEEL DRIVE" TRUCK.

STEERS ON ALL FOUR WHEELS.



ORDINARY COMMERCIAL "TWO WHEEL DRIVE" TRUCK.

STEERS ON FRONT WHEELS ONLY

or opinions expressed are purely personal and have no official sanction.

Macadam, dirt and soft-cinder roads as well as the rock testing road, shown in Fig. 8, were available on the Arsenal grounds, also sodded ground, plowed fields, deep gumbo and wet bog such as shown in Figs. 16 and 17. Hills with almost any desired grade were within a few minutes run of the reservation, and in general the difficulties likely to be encountered in field service were better simulated than might be expected on a small reservation practically within city limits. Trucks used for commercial hauling, farm tractors of the wheeled type, such as shown in Fig. 13, and tractors of the caterpillar type shown in Fig. 15, are the three commercial types possessing probable usefulness for artillery purposes and one or more representatives of each class were tested.

The general appearance of all trucks is about the same, and barring size and technical details the principal features of construction of most of them are similar. There is, however, a growing minority designed especially for country delivery, desert hauling, ore transportation, etc., and these are naturally the ones that may be best expected to keep moving in field service when good roads are not available. Fig 2 shows schematically the principal mechanical features of each type.

The arrangement of the ordinary truck shown at the bottom is essentially the same as that of the ordinary pleasure car. Power is delivered to the rear wheels only, and the reductions in speed and increase in torque of the moving parts made in the transmission case (containing the change speed gears) and in the axle differential (which takes care of difference of speed of wheels in turning corners) are moderate. In other words the torque at the wheels is sufficient for all ordinary cases but not for extraordinary ones. None of the weight carried on the front wheels adds to the grip of the power wheels on the ground. Brakes are on two wheels only and good, but hardly good enough, for extreme conditions unless carefully adjusted.

The differential is of a type which does not use judgment in controlling the relative movement of the rear wheels, and should one get into soft mud it will spin and nicely bury itself while the other one stands still.

The arrangement of the other class, covered by the general name of four-wheel drive is shown at the top. Power is transmitted to all wheels and the increase in grip on the ground over the first class is the same as that of the light railway switch engine with all its weight on the drivers, which can pull as long a string of cars as a heavier road engine with part of the weight on a front truck. When extraordinary power is required the normal turns of the engine at each speed to one turn of the wheels may be doubled by throwing in mesh extra gearing in a subtransmission and the power at the wheels becomes so great that it is practically impossible to stall the engine although the truck may fail by slipping of the wheels on the ground. All the weight is useful in increasing friction on the ground and the differentials are so constructed that while they will permit relative motion of the wheels on corners they will not permit any wheel to spin while the others stand still.

At the rear of the truck there is a drum or winch such as shown in Fig. 3 with a long length of wire rope. The rope can be wound up by power to pull a tow or another machine out of difficulties, or it can be attached to a tree or other anchor to help the truck out of trouble. All four wheels are steering wheels giving about half the usual turning radius. Brakes are provided on all four wheels and in addition a transmission brake, the power of which is multiplied by the transmission gearing through which it acts on the wheels.

Fig. 4 shows graphically the relative merits of the two classes for military purposes. The truck at the left is an ordinary commercial 3½-ton truck, loaded to capacity, and the other is a two-ton truck of the four wheel drive type with subtransmission, loaded to capacity. The two-ton truck without use of the subtransmission is having no difficulty in pulling the

FIG. 3.—POWER-OPERATED WINCH WITH 500 FEET OF STEEL CABLE FOR USE WITH TRUCK INTENDED FOR FIELD SERVICE.

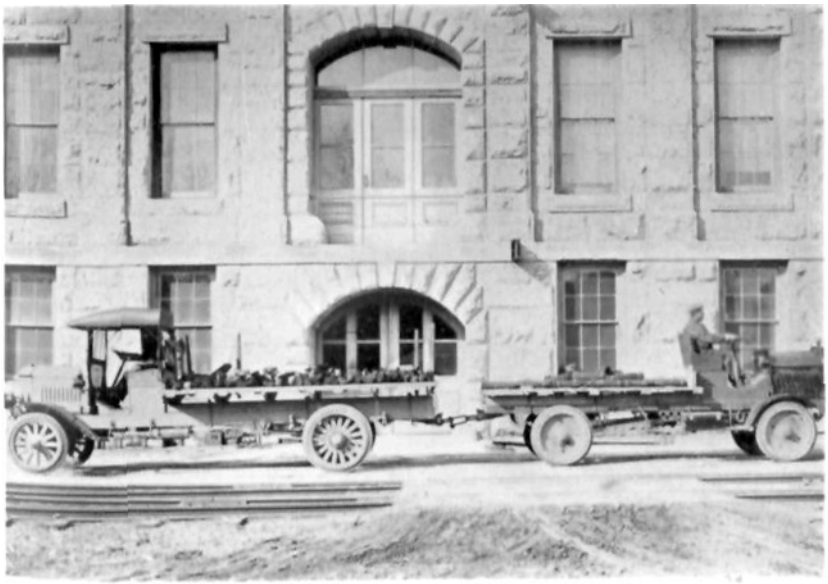


FIG. 4.—FOUR-WHEEL DRIVE TYPE OF TWO-TON TRUCK (ON RIGHT) PULLING WITH EASE A THREE AND ONE-HALF TON TWO-WHEEL DRIVE TRUCK. BOTH TRUCKS LOADED TO CAPACITY. BY USING ITS SUB-TRANSMISSION THE TWO-TON TRUCK COULD HAVE EXERTED A MUCH GREATER PULL.

FIG. 5.—A THREE-TON FOUR-WHEEL DRIVE TRUCK WITH FULL LOAD RUNNING ON PLOWED GROUND WET BENEATH THE SURFACE. WHEELS ARE CUTTING ABOUT THE INCHES.

FIG. 6.—THREE-TON FOUR-WHEEL DRIVE TYPE OF TRUCK CROSSING DITCH. UNDER SUCH CIRCUMSTANCES A TWO-WHEEL DRIVE TRUCK WOULD MERELY PUSH ITS FRONT WHEELS AGAINST THE SIDE OF THE DITCH. THE FRONT WHEELS OF THE FOUR-WHEEL DRIVE BEING POWER WHEELS CLIMB OUT.

3½-ton truck. In Appendix are listed points of more or less importance that should be investigated in selecting motor vehicles for field use, although no one commercial vehicle is liable to be found having all the features listed as desirable.

Trucks were tested at Rock Island with a view of determining their probable suitability under field conditions for towing ammunition vehicles of light field batteries, for towing guns and ammunition vehicles of heavy batteries, for carrying ammunition as a load, for use as battery and store wagons and for use as armored automobiles. Practically the tests narrowed down to determining how much if any load could be towed under field conditions with or without load on the truck, and how much could be carried without a tow.

Two makes of two-ton four-wheel drive chassis were purchased. The bare chassis averaged 5700 pounds and were guaranteed to carry a body allowance of 1200 pounds, 4000 pounds load and an overload of 1000 pounds if necessary. As a suitable body weighs about 700 pounds one of these trucks would normally carry 4500 pounds of net load and 5500 pounds without danger. Recently advertisements have been issued for trucks with body, weighing not to exceed 6500 pounds, guaranteed to carry a load of 5000 pounds for truck equipment of one heavy field battery for test at Fort Sill. These trucks are intended to replace six caissons and the battery and store wagon.

The fifty-six rounds of 4.7-inch gun ammunition, now carried in a limber and caisson, weigh in original boxes about 5200 pounds and twenty-eight rounds of 6-inch howitzer ammunition 4700 pounds. This total load of 11,000 to 12,000 pounds seems rather heavy, but it is to be presumed that some sort of roads and bridges will exist for any extensive movement of heavy field artillery. If not, loads will have to be reduced to suit conditions, especially bridges. Figs. 5 and 6 give an idea of the capabilities of this style of truck and compared with the behavior of the ordinary truck performances are remarkable.

However, it is not thought that absolute dependence can be placed on any truck to deliver ammunition to places that can be reached by light field artillery drawn by horses. The worst case is that of very soft water soaked ground in which the truck sinks under its own weight up to the axles as in Fig. 7. In this case the weight of the truck rests on the axles and the wheels turn without securing traction, no matter what the power of the engine. Horses cannot move indefinitely in such ground but can for considerable distances, possibly with the assistance of extra teams and cannoneers. Trucks not too heavily loaded would perhaps be suitable for replacing the store and battery wagons and a portion of the ammunition vehicles in light batteries, bearing in mind their superiority in replenishing ammunition and towing ability except under extremely bad conditions.

It is hard to condemn for towing purposes a truck that will pull an entire section of heavy field artillery on fairly bad road as in Fig. 8 and half a section on plowed ground as in Fig. 9, but the condemnation is based on sound reasoning. A 4.7-inch gun and carriage limber weigh about 8000 pounds and a pull of about 2000 pounds is required to move the same through bad mud. A truck loaded heavily enough to secure traction will weigh another 8000 pounds, although there seems to be no definite best weight of truck to give maximum tractive effort, probably because the conditions of the ground are continually changing. The force to move the truck is about the same as that to move the gun making a total reaction at the truck wheels of 4000 pounds to be developed by the friction caused by a weight of 8000 pounds, *i.e.,* a coëfficient of friction of 50 per cent. which is impossible of development on a slippery surface even with the best of chains.

The towing of light field artillery by trucks except under special conditions does not seem exceptionally promising. Aside from the failing case in which the truck cannot get there at all, light vehicles are very liable to be towed at a rate that

FIG. 7.—ABOUT THE ONLY KIND OF GROUND THAT WILL STOP A FOUR-WHEEL DRIVE TYPE—MUD SO DEEP THAT THE WHEELS SINK UNDER THEIR OWN WEIGHT UNTIL AXLES REST ON GROUND.

FIG. 8.—A TWO-TON FOUR-WHEEL DRIVE TYPE TRUCK PULLING SECTION OF SIX-INCH HOWITZER MATERIEL ON THE ROCK TESTING ROAD AT ROCK ISLAND ARSENAL.

FIG. 9.—TWO-TON FOUR-WHEEL DRIVE TRUCK TOWING LIMBER AND CAISSON OVER CORN FIELD WITH DEEP FURROWS.

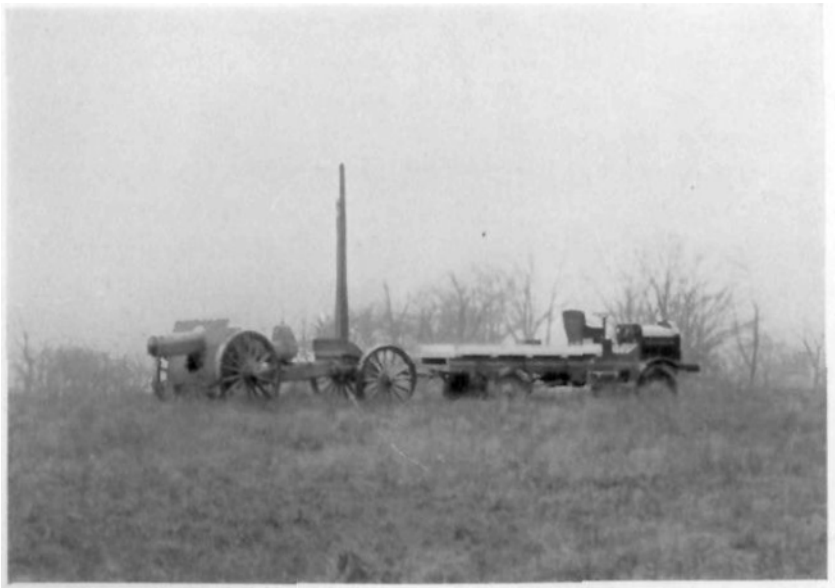


FIG. 10.—ABOUT THE LIMIT OF TOWING CAPACITY OF A TWO-TON FOUR-WHEEL DRIVE TYPE TRUCK. EIGHT PER CENT, GRADE. WET, SLIGHTLY FROZEN SOD. SIX-INCH HOWITZER WHEELS SUNK FIVE TO NINE INCHES. TRUCK WHEELS EQUIPPED WITH CHAINS AND AMPLE POWER DELIVERED TO WHEELS TO KEEP THEM TURNING. FAILED ACCOUNT WHEELS DIGGING IN GROUND. SUCCEEDED WITH EIGHT MEN PUSHING. TOTAL WEIGHT OF TRUCK AND LOAD 7500 POUNDS.

is damaging to vehicles of rigid construction. Fig. 11 shows a horse-drawn caisson striking a crossing projecting about two inches from a smooth road. At fifteen or twenty miles per hour the jolt would have been worse. This is not a plea for nursing matériel but the fact that our vehicles are rigid must be considered and tractor companies whose product is not so rigid, will not guarantee over six miles per hour and normally provide a maximum speed of about 4 miles.

For rapid movements over good roads of guns assigned to anti-aircraft service, to resist landing parties or to other special rôles of minor tactics, would it not be better to place the gun on the truck and run it off at the destination? Fig. 12 shows a German gun so carried and it is understood that the French have done the same thing quite extensively.

Figs. 13 and 14 show an excellent type of 50-horse power wheeled farm tractor tested. This machine weighed 8500 pounds and at first appeared very attractive for heavy towing, but the drawbar pull in bad mud before the wheels began to spin was only 1500 pounds and it takes 2000 to move a 4.7-inch gun in bad mud. When good footing could be secured the pull was 4000 pounds without effort and 5000 in low gear. The following table gives an idea of the capabilities of such a machine on fair roads.

Grade per cent.	Pounds pull per ton	Effective drawbar pull (4000 lbs. less component of weight acting paralled to road)	Tons which can be hauled	Tons which can be hauled assuming matimum pull of 5000 lbs. less component of weight parallel to road
0	175	4000	23	27
5	225	3600	17	21
10	300	3200	11	14
15	410	2700	6	8.5
20	575	2300	4	6
25	800	1800	2	3.5

It will be seen that the power is ample for handling a section of heavy artillery under normal conditions and a gun or ammunition limber and caisson on grades running up to 25 per cent., always assuming that the hold on the ground is sufficient

to enable the power to be delivered at the drawbar. The pulley at the rear end may be replaced by a winch.

Farm tractors are usually intended to have the drawbar low down for the attachment of plows and placing a heavy pull at the height of the artillery pintle may raise the front end of the tractor off the ground. This is not of serious moment except that it interferes with steering. The construction is generally better than that of trucks from a military standpoint, as they are expected to stand up under hard service without counting on a garage or service station around the corner. Parts are usually simpler and more accessible.

Figs. 15, 16, 17 and 18 show a 25,000 pound, 75-horsepower tractor of the caterpillar type. This machine could exert a drawbar pull of approximately 11,000 pounds and the pull was practically independent of the condition of the ground. It could handle two sections of heavy field artillery under any conditions at the Arsenal and certainly one section under almost any conceivable conditions. This machine is doubtless too heavy for regular service with batteries of present calibres, but the great power was valuable in enabling good tractograph records to be obtained of the pull required to move various combinations of vehicles under severe conditions. Fig. 19 shows typical records made while pulling a section of 6-inch howitzer matériel.

Aside from the weight the power is greater than can be well utilized with our regular matériel as the latter was not designed with the idea of habitually hauling long strings of vehicles with a single source of power, although pintles were provided for emergency coupling up. The exact difference in effect between hauling as at present and with a section or more in tandem has not been determined, but a probably fair guess is that continuous hauling of more than a section with one tractor will produce a noticeable increase in breakages and that one section can be hauled without an undue increase. It would also seem that a battery division of one section per tractor

FIG. 11.—RAPID TOWING WITH AN AUTO TRUCK WILL BREAK UP RIGID VEHICLES MUCH MORE QUICKLY THAN HORSES CAN DO AT THEIR WORST. THE CROSSING THE LIMBER HAS JUST STRUCK DOES NOT PROJECT MORE THAN TWO INCHES ABOVE THE ROADWAY. IT IS A BARELY NOTICEABLE OBSTRUCTION.

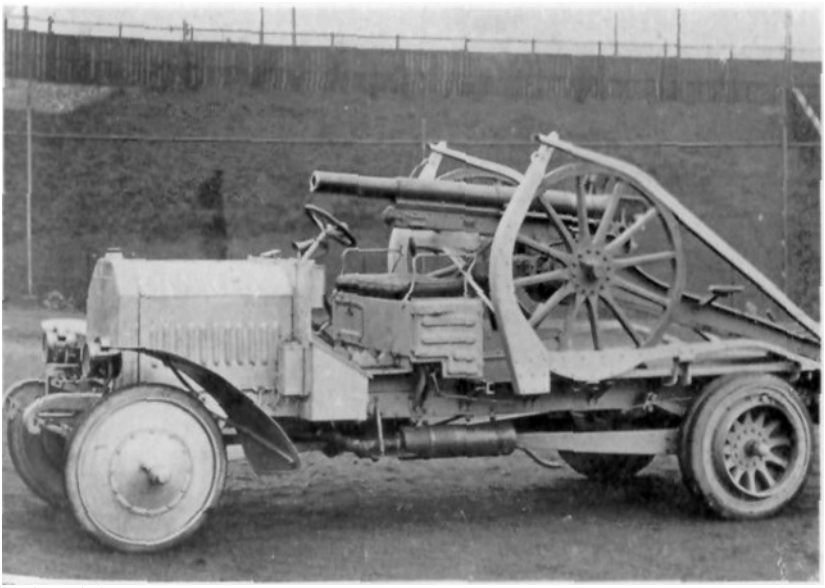


Photo by Paul Thompson

FIG. 12.—ANTI-AIRCRAFT GUN ON FIELD CARRIAGE BEING TRANSPORTED BY TRUCK. NOTE THAT THE RAILS HOLDING DOWN THE WHEELS SUPPLY A TRACK TO RUN THE GUN ON AND OFF THE TRUCK.

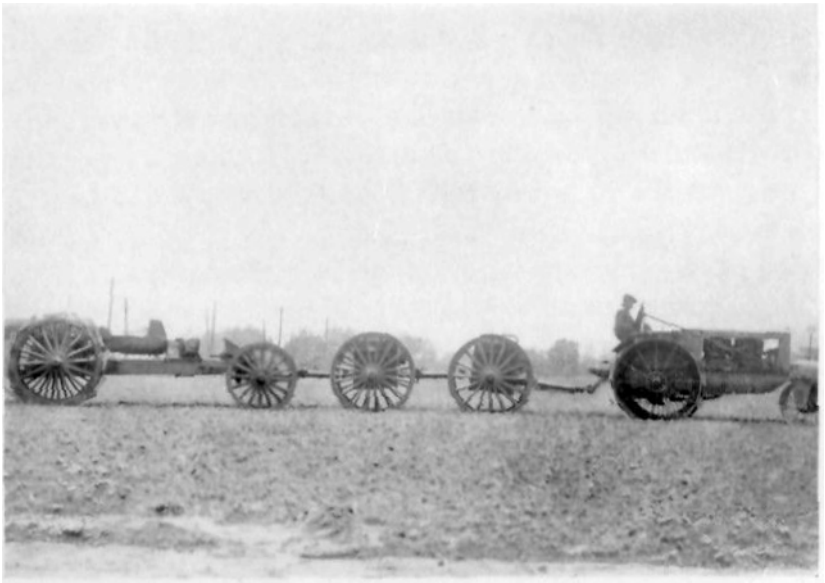


FIG. 13.—FIFTY-HORSEPOWER WHEELED TRACTOR PULLING SECTION OF SIX-INCH HOWITZER MATERIEL ON DRY PLOWED GROUND WITHOUT DIFFICULTY. EXPERIMENTAL WHEEL SHOES ON CARRIAGE.

FIG. 14.—FIFTY-HORSEPOWER WHEELED TRACTOR STALLED WHILE ATTEMPTING TO PULL A 4.7-INCH GUN. THE POWERFUL ENGINE KEPT TURNING THE WHEELS WHICH SPUN AND DUG IN UNTIL THE BODY OF THE TRACTOR WAS RESTING ON THE GROUND.

would give a convenient arrangement from a tactical standpoint.

As a result of the tests of the two tractors referred to above, Rock Island Arsenal arrived at the conclusion that the most promising tractor for heavy field artillery was a caterpillar of about 50-horsepower. Such a machine would weigh about 13,000 pounds, but due to the great surface over which the load is distributed would not be more severe on bridges than a considerably lighter tractor of the wheeled type. Test of such a machine was not made at the Arsenal as in the meantime one had been loaned the Field Artillery Board for a service test at Fort Sill, and the tests at that place have apparently confirmed the opinion as to the suitability of the type for pulling heavy field artillery.

It is rather hazardous to attempt to predict the future of Motor Traction for Field Artillery in our service, but the following would seem to be possible, subject of course, to service tests:

For light batteries, replace the battery and store wagons and a portion of the caissons by an equal number of lightly loaded motor trucks, carrying the present contents of the battery and store wagons in convenient chests and the ammunition in original packing boxes.

Horse-drawn transportation would then be available for the guns and a considerable portion of the ammunition and in the event that the trucks could not get to the actual firing position, there would be teams available for bringing up ammunition in empty caissons from the position of the trucks.

On fair roads not in the presence of the enemy, the trucks would have a good capacity for towing in addition to carrying their normal load and the teams could be saved by unlimbering the guns and caissons, and towing them behind the trucks, thus leaving only the limbers to be pulled by the teams on a march

of such a nature that there would be no tactical objection to such an arrangement.

There are doubtless objections to the above but the trucks would give a means of transportation under the immediate control of artillery commanders that would be far more expeditious in bringing up ammunition from the ammunition column, or the advance supply depot, than any horse drawn vehicles, provided there were any sort of a road whatever. The trucks can do such work both day and night if necessary.

For special service on fair roads where high speed is valuable, batteries could be equipped entirely with motor traction, both guns and ammunition being carried on trucks. The trucks would of course have pintles and if desired, the guns could be rolled off their trucks and limbered behind the same, on approaching the probable position.

The retention of horses for certain portions of light batteries seems essential for the present, for the reason that there is no known motor vehicle which can move with certainty over the worst ground that can be covered by horses and at the same time move on good ground with the speed that is sometimes required with light batteries.

For heavy batteries up to and including the 7.6-inch howitzer, the units of which do not greatly exceed in weight those of the 6-inch howitzer, it is thought that the same principles apply except that the necessity for high speed is not as great with these batteries as with light batteries and that where horses are used with light batteries, caterpillar tractors should be used with heavy batteries. Auto trucks should carry the ammunition not hauled by tractors, as with the light batteries, but the loads should be heavier.

The tractors insure getting in position with the guns and a certain amount of ammunition over ground where even horses cannot pass and are a certain means of bringing up in emptied caissons the truck carried ammunition, should the trucks not be able to reach the firing point. It is thought that at least

five sections should be pulled by tractors which would insure one spare tractor for pulling gun sections. The trucks will usually be able to tow the vehicles assigned to a disabled tractor, but if not, four tractors can probably handle the load assigned normally to five.

For heavier pieces than the 7.6-inch howitzer, it would seem that tractors should be used for hauling the entire batteries, as the number of rounds of ammunition that could be carried in a truck would be very limited. Fig. 20 indicates this to be the idea of the English Government which purchased a large number of ammunition vehicles equipped with caterpillar tracks instead of wheels. These vehicles are towed by 75-to 100-horsepower tractors.

In considering such radical changes as are now being discussed, the question of cost must be considered and in this case preliminary figures are fortunately very favorable to motor transport so that the objection of 'increased cost' will not be raised to oppose in their early stages such trials as may be proposed by the Field Artillery.

It is understood that the first motor battery will be a 4.7-inch gun or 6-inch howitzer battery now in service and one of this weight will be taken as an example, considering initial cost first. The Field Artillery Board estimate a saving in cost of horses of about $40,000. If six caissons are replaced by trucks there will be a saving of $23,000. Also $11,000 for harness and $2000 for personal and horse equipments, making a total gross saving in round numbers of $75,000. The auto store and battery wagons will cost about as much as the present so no saving is estimated. Against this there must be charged five tractors at about $3500 each and six trucks at about $2500, a total of $32,500. Adding 20 per cent. for extra equipment, spare parts, etc., brings this cost to $40,000, making a net saving in initial cost of $35,000 per battery.

The saving in Ordnance Department matériel alone would

be sufficient to provide practically complete motor transport for militia batteries and thus satisfactorily solve the problem of transportation which is understood to have been the insurmountable barrier to the organization of militia heavy field batteries and has kept the majority of our small stock of heavy matériel locked up in arsenal storehouses.

Annual maintenance is a more complicated problem as the life of a horse is normally measured in years and that of a vehicle in miles. The Field Artillery Board has computed an annual saving in pay, clothing and rations of about $11,000, in forage of $15,000, in horse, harness and personal equipment depreciation of $5000 (service life of ten years which it believes too long), making a gross annual saving in these items of $31,000. Against this must be set the cost of maintaining the motor transport and all that the writer will attempt is an estimate of the cost per thousand miles of travel and each reader whose patience has led him this far can make his own estimate as to how many miles a heavy field battery should travel per annum.

The average gasoline consumption per ton mile (including weight of vehicle) with more than half the distance on very bad roads was found during the Rock Island Arsenal tests to be .057 gallons. With war allowance of ammunition a motor battery will weigh about 125 tons and the gasoline consumption for 125,000 ton miles be about 7125 gallons, costing at sixteen cents a gallon $1141.

Similarly oil consumption is about .002 gallons per ton mile and to take a battery one thousand miles will cost at thirty cents per gallon $75.00. Other greases will add $75.00 more.

A new outfit of tires for the eight trucks will cost about $2000. These are guaranteed for 7000 miles, but cross country work and the use of chains will greatly reduce this mileage. Assuming 3000 miles the cost is $666.

No depreciation is assumed for the trucks as no saving in depreciation has been assumed for the replaced caissons and

FIG. 19.—TYPICAL TRACTOGRAPH RECORDS SHOWING PULL REQUIRED TO MOVE A SECTION OF 4.7-INCH GUN OR 6-INCH HOWITZER MATERIEL UNDER VARIOUS BAD CONDITIONS.

FIG. 20.—AN UP-TO-DATE CAISSON. THE TRACTOR IS 100 HORSEPOWER. EACH VEHICLE OF THE TOW WEIGHS 11,600 POUNDS AND CARRIES 22,000 POUNDS NET OF AMMUNITION. THE TRAIN SHOWN WOULD HANDLE ABOUT 550 ROUNDS OF SIX-INCH HOWITZER AMMUNITION IN ORIGINAL PACKING BOXES. A LIGHTER TYPE OF WAGON WEIGHS 7000 POUNDS AND CARRIES 11,000 POUNDS.

battery and store wagons. If used for the same purposes only it is thought that the truck will outwear the replaced vehicles and if used for miscellaneous purposes they will be replacing something else and credit should be given accordingly. There is just being generally overhauled at Rock Island Arsenal for the first time a truck that has been in daily use for four years working eight hours per day. The mileage made is not known but the truck has pulled dozens of road tests of artillery vehicles running from a few miles to a thousand or more, and in more than one the vehicle was ready to discontinue the test before the finish. When not used in road tests the truck has been hauling material about the shops and store houses.

There is doubtless reliable data in existence regarding the life of tractors in farm service that would hold for batteries; but it is not at hand. They are known to last for several years and assuming a farm life of five years at forty miles per day for one hundred days each year gives 20,000 miles and a depreciation of $875.00 per thousand miles for the five in the battery.

The total of the above is $2832.00 per thousand miles and the battery would have to travel about 11,000 miles per year to eat up the estimated saving of $31,000 per annum. Various contingencies may increase the 1000 mile cost estimate, but there are many savings that have not been counted, such as "recruiting men and shoeing animals, overhead at remount depots, quartermaster equipment of personnel, reduction of stable and barrack space, reduced cost of transportation by rail, etc."

APPENDIX

DESIRABLE FEATURES OR POINTS THAT SHOULD BE REMEMBERED IN SELECTING TRUCKS OR TRACTORS FOR MILITARY SERVICE

Carburettor.—Should be set high enough so that water cannot enter it in crossing streams of reasonable depth, and adjustments and connections should be readily accessible without removing other parts.

Gasoline Tank.—Should, if practicable, have a capacity for 24 hours' running. Connections should be exposed so that leaks will be evident and easily corrected. Should have drain cock and strainers. Connections should lead away from tank so that approximately the last gasoline will be drained irrespective of angle of machine longitudinally or crosswise. A small reserve supply of gasoline that cannot be used without action on the part of the driver should be habitually carried. The best way to provide this is a partition in the tank extending up far enough to leave about five gallons on each side of the partition. Pipes lead from each side to the feed pipe through a three-way cock so connected that the gasoline trapped on one side of the partition after all the rest is drained cannot be used without turning the cock.

Radiator.—The tubular type of radiator is preferable to the cellular type, as emergency repairs are simpler. Should be mounted on suitable springs or buffers. Drain cock should be provided. Radiating efficiency should be tested by running ten miles in reasonably heavy pulling without boiling. A radiator which boils on each half mile stretch of poor road will cause endless trouble for military purposes. Cover should be provided for winter use.

Pump.—A small key or other easily replaced part should break in preference to the pump, in the event of freezing or stoppage. Drain cock should be provided.

Magneto.—This should be of the high tension, waterproof

type and high enough to escape water when fording streams. An impulse attachment is desirable, which will enable the magneto to give a satisfactory spark on a quarter-turn of the engine without spinning.

Engine Fan.—Should be considered in connection with radiator. The fan will act more efficiently if there is a housing attached to the radiator which forces all air moved by the fan to actually pass through the radiator.

Brakes.—Should be powerful enough to hold the loaded machine on a 20 per cent. grade. To accomplish this with reasonable certainty under all conditions a transmission brake in addition to the ordinary wheel brake is desirable. Chances for grease to work under the brake bands should be small, as a little grease greatly reduces the efficiency.

Lubrication System.—There should be a sight feed of some sort so that the driver will know at once if anything serious has happened to the oil supply, and gauge to show how much oil is in the reservoir. Grease cups and oil plugs that are not in reasonably plain sight are objectionable.

Clutch.—Any standard clutch is satisfactory but adjustment should be easily made.

Lighting System.—Kerosene or other simple system for night use should be provided even though there may be an electrical system on the machine. The latter is usually dependent on a storage battery that may fail under service conditions.

Clearance.—Good road clearance is desirable and, especially if the clearance is low, it is desirable that some strong part, such as the axle, be the first thing to strike rather than some relatively delicate part, such as a steering rod.

Tools and Equipment.—The tools usually furnished with a machine are insufficient and care should be taken that enough are provided to make all adjustments that can reasonably be made in the field. The outfit should include a first-class 12-inch monkey-wrench, a 2-pound hammer, a jack sufficiently strong to lift any wheel of the loaded machine and a chisel bar about three feet long.

The following, while not complete, indicates probably desirable equipment:

Tools for clearing roads, etc., such as axe, pick, shovel and hatchet;
Extra wheel and chains where cross chains are provided;
Extra parts for continuous chains, such as those of the Weed type where these are provided;
Assortment of cotter pins;
Assortment of bolts, nuts and lock washers applicable to the machine;
Set of extra spark plugs; Set of extra dry cells (if required);
Extra magneto or parts where ignition is entirely dependent on the magneto;
Supply of flexible insulated copper wire which will carry the highest tension current about the machine;
Extra fan belt;
Chamois lined funnel for straining gasoline;
Extra bolts and clips for springs;
Small oil can with cap for use with gasoline in priming cylinders;
Outfit for repairing tires, including a small vuleanizer;
Small supply of sulphuric acid and clean water for storage batteries;
Storage battery hydrometer;
Cup grease; Transmission grease; Graphite; Valve grinding paste;
Strong towing rope, preferably 50 to 100 feet long;
Denatured alcohol for use in radiator during cold weather;
Grease gun if not included in regular tool equipment;
Sufficient reserve gasoline, engine oil and water to last between opportunities for resupply;
Extra engine valves;
Kerosene, which in connection with denatured alcohol is required for cleaning carbon from cylinders;
Water bucket;
Set of carbon scrapers;
Material for patching radiator in emergency;
Gaskets and diaphragms for valve caps, hand holes, etc.;
Extra ignition switch key when the latter is detachable;
Extra electric bulbs, gas tips or kerosene lamp wicks;
Suitable extra connections for gasoline and oil piping, particularly those which are liable to be injured by disassembling;
Stiff steel wire for removing obstacles from tubing, etc.;
Assortment of electrical connections;
Waste, emery paper and similar cleaning material.

Muffler and Cutout.—Muffler to reduce noise and cutout to enable operator to note action of his engine.

Protection.—Waterproof cover should be provided for magneto and preferably some sort of canvas cover or paulin for the more important parts of the machine when not running.

Drive.—Four-wheel drive is far preferable to two-wheel drive for trucks. Should one end of a four-wheel drive truck be damaged, a two-wheel truck still remains.

Steer.—Four-wheel steer gives a small turning radius and usually increases interchangeability of parts.

Flexibility.—Should be tested by running machine over very irregular ground or rocks.

Buffer springs should be provided to prevent parts liable to damage coming in violent contact when passing over obstacles.

Speeds.—The gearing should be so arranged by use of a subtransmission or otherwise that on extreme low gear the power will be sufficient to slip the wheels on fairly dry ground without stalling the engine. This requirement means that the parts of the transmission must be of first-class material, or otherwise breakages may result.

Pintle.—Pintle at suitable height and of a type that will accommodate the artillery lunette should be provided. If a special pintle is put on much higher than the regular pintle, tests should be made to see that the towed load will not raise the floor end of the machine off the ground. In addition to the regular pintle, a second pintle or hook of some sort should be on the other end of the machine.

Draft spring is desirable to lessen shocks on towed matériel.

Differentials.—The locking type is preferable. Should be tested by jacking all driving wheels but one off the ground and seeing that truck will move forward off the jacks with the remaining wheel.

Batteries.—Care should be taken that the ignition system is such that the engine can be easily started with all batteries entirely disconnected. Storage batteries should be very firmly secured in a box, which may or may not be spring supported.

If the battery is not tightly held it will become shaken to pieces under service conditions.

Governor.—Is required by some engines and not by others. Necessity therefor should be decided by circumstances.

Speedometer.—One should be provided. Desirable for use in travelling by map.

Horn.—This or other warning signal is desirable.

Chains.—Particular attention should be paid to this point. Those ordinarily furnished with trucks are not good enough for maneuvering over bad ground. Suitable grouters should be provided for tractors.

Winch.—Should be provided. A machine not ordinarily equipped with a winch can be so provided without much trouble if a machine shop is available by making a winch body that can be attached to one of driving wheels by removing hub cap.

Speeds.—Specifications for speed depend on circumstances. The speed control should be satisfactory at all speeds and truck should run for long distances on low speed without excessive heating of engine or radiator.

Tool Box.—Suitable box with lock should be provided.

View.—The driver should be able to see sufficiently well for maneuvering without moving from his seat.

Springs.—Should be tested by running machine over rocks several inches high, or otherwise subjecting machine to shock for testing.

Bolts, Nuts and Screws.—All except those of negligible importance should be secured by lock washers, cotter pins or other means. It is worth while testing this feature by running for a day over cobblestone pavement or similar road, if available.

Engine.—Should be of sufficient power for the purpose required and should not be assumed to be sufficient merely because the truck is given a high rating. As an approximation, anything less than four cylinder, 4¼-inch bore, should not be considered for a truck rated at two tons. For hauling a section of heavy field artillery a 50-horsepower engine is about right for a tractor.

Concealment and Protection of Artillery from Artillery Fire

BY MAJOR WILLIAM S. McNAIR, INSPECTOR GENERAL'S DEPARTMENT

AFTER the Russo-Japanese War of 1905-06, our service dropped the historical old designation of Corps and substituted therefor the term Field Army, thereby illustrating how prone we are in our service to adopt *some* of the new things which the latest war has brought to our notice. The tendency seems to be to copy from the successful side. It is to be noted that the Corps designation is still retained by the great military nations of Europe.

In the conflict now going on there have been many new developments which are real changes in methods due to immense expansion of the use of mechanical appliances. Sooner or later the official reports of observers will be published but at present they cannot be made the basis of a magazine article without violating the hospitality of the nations that have permitted our observers to accompany their operations in the field. There is, however, enough published in various journals to suggest to us new lines of work in our peace time training.

Operations on the Western front where the Germans are facing the French, English and Belgians have assumed a phase now popularly known as trench warfare and popularly believed to be a new condition. Professional soldiers, however, recognize in these operations the old familiar things that have been done for centuries, modified by improvements in the character of weapons, explosives and means of observation and of communication.

Great increase in ranges for the artillery has made it possible to deliver the fire of guns against very distant targets while it has also become possible to deliver such fire accurately because of the panoramic sights and efficient telephone service.

Guns and howitzers are now able to work from positions which are well concealed either by cover or by distance.

A great improvement in optical instruments has on the other hand tended to make it easier to locate targets from a distance, so that more concealment for the guns must be sought. Then too another dimension has been Introduced into warfare by the wonderful development of aeroplanes, dirigibles and balloons.

The introduction of the third dimension has necessitated the screening of batteries against overhead observation. It has not brought out much in the way of actual overhead protection, since projectiles dropped from swiftly moving aeroplanes have trajectories not unlike those of howitzers, but with a little steeper angle of fall.

If a battery can be brought (during fire for adjustment by its opponent), under the observation of an observer provided with means of communicating his observations to the adjusting battery, a definite and limited area to be battered will soon be determined and the target will be in great danger of annihilation. It therefore becomes of greatest importance to conceal a battery against observation from the enemy's most advanced trenches, from high observing points or from overhead. As a corollary to this it becomes the duty of artillery observers to seek advance observing stations and coöperation of the flying corps.

In order to provide intelligently against being observed from aeroplanes we should consider the point of view of the aerial observer.

It should be remembered that the anti-aircraft guns have now forced such observers up to a height of from 5000 to 7000 feet, so that the things they must depend upon seeing are such as are visible to them at a distance of one mile or more. For example, four gun sections exactly aligned mark out on the ground a straight line from sixty to one hundred yards long which at once attracts attention on ordinary terrain, where natural straight lines are usually wanting. It would then seem advisable

for a battery in the open to avoid exact alignment, having due regard to its own field of fire. Similarly exact intervals should be avoided. Experienced observers know how visible are even the straight tops of the shields of a gun and caisson at ranges of 3000 or 4000 yards. These straight lines can be broken up by fastening small branches with leaves on them to the wheels and tops of shields.

Brilliant points on the matériel should be avoided—to permit them would be to give information to the enemy.

The flashes of guns especially at dawn or twilight would disclose the presence of a battery. As the flashes cannot be avoided it would be well to use discretion about firing at those hours if the guns are under observation by hostile aircraft or from advanced trenches.

In dry weather the dust raised by the blast of discharge is often conspicuous. Pains should be taken to suppress it by wetting the ground, by use of paulins or by other suitable means. Where a battery is in one position for a prolonged period it may be practicable to use crude oil for this purpose. If water is scarce it will sometimes be possible to construct brush mats to cover the ground under the muzzles. The mats will themselves suppress the dust for awhile but if water is obtainable the ground under the mats should be wet also, the mats helping to retain the moisture. The color of the mats should blend with that of the ground or they should not be used.

Motion of the cannoneers as they serve the guns and of other personnel about the battery readily attracts attention. It may be necessary on approach of a hostile aeroplane to suspend firing and require everyone to remain immobile. Occasionally it will be possible to get a position in the edge of a wood, thus concealing the battery from overhead observation. Such a position has disadvantages, however, due to other considerations.

An appliance for getting artificial overhead screening is used in the Royal Field Artillery of England. It consists of

a net, 20 by 30 feet, with two-inch mesh strengthened by a five-foot mesh of small rope. It is provided with bamboo poles to support it above the section. Grass, leaves, brush or whatever blends with the surrounding ground is scattered over the net.

Two small nets, 10 by 15 feet, are provided for use as a screen in front when there is no parapet.

It has been proposed that dummy batteries be used to draw hostile artillery fire away from the real position. An instance has been cited in newspaper accounts of fire having been kept up for two days against a dummy battery observed by an aeroplane.

This is not always a practicable scheme. With 15 to 30 men per yard of front the terrain in rear of the first line is pretty well occupied back to extreme artillery ranges so that the loss and annoyance to our own forces would hardly be compensated for by the small waste of ammunition occasioned the enemy by such a ruse.

Aside from the assistance given by the flying corps the fire of artillery will be directed by observers in front line trenches or in elevated positions further in rear, such as high ground, towers, trees or captive balloons. The latter have become much more serviceable since the beginning of the European conflict. Spherical balloons having given place to sausage-shaped ones with smaller ones attached as air anchors so that they are now quite steady and furnish excellent observing stations. Concealment from such observers is often if not generally practicable by taking advantage of natural features of the terrain. Long range batteries may be placed behind hedges, embankments or woods; in the midst of brush or high corn. But guns must always be placed first with a view to fulfilling their mission and in being so placed it will frequently be necessary to provide artificial means for concealment. Some of the methods already mentioned for concealment from aircraft also apply here. Regular intervals should be avoided. The tops of shields and

wheels should be concealed. Movements within the battery should not be within view of the enemy observers. Nothing about the battery must be allowed to reflect the sunlight. Sky lines must be avoided. Dust must be suppressed. The shields must be painted according to the background. These things are mentioned in the drill regulations and have been long practiced in our service.

While concealment is of first importance it now has become necessary to provide for actual protection again shell fire. In trench warfare protection against shrapnel fire is soon obtained. The shields alone are excellent protection against shrapnel bullets. For various reasons shrapnel is not much used in modern trench warfare, some of which reasons are as follows:

The combatants burrow into the ground out of reach of shrapnel bullets so that there are no shrapnel targets.

Shell are cheaper and more quickly made and require less skill to handle by new batteries.

Artillery fire is used in such volume that shell cover the ground as well as shrapnel against troops in the open and serve better for attack of trenches and matériel.

Calibres and hence shell power have been greatly increased.

If the position of a battery becomes known to the enemy there can be very little protection for it when it comes under shell fire. The cannoneers must retire to bomb proofs and await with what patience they can the destruction of their matériel.

On the other hand they can secure much immunity from accidental shell bursts in the position or from a general beating of the terrain by an enemy who has been unable to observe their exact position. This is accomplished by digging deep pits for howitzers or by building up for each section a parapet which covers it in front and on both flanks.

Protection from a burst just in rear of the section may be secured by a low parados or sometimes by placing caissons in rear of the gun.

Bombs proofs outside the emplacement should be provided for the men to occupy while not actually serving the guns.

If material is available light overhead cover may be constructed over the gun emplacement to serve as concealment from aeroplanes and to keep out shrapnel bullets and shell fragments. The utility of light overhead cover as protection is very doubtful and heavy cover is generally not practicable.

The preparation of some positions on the French-German lines has been going on for months so that it is to be expected that the protection of gun emplacements will be the result of days of labor and the adaptation of available means and material to the needs of the case.

Observing stations, especially those in advanced trenches, must be carefully concealed and have protection for the personnel. It is astonishing what a distinctive object a scissors observing telescope is and to what a distance it can be seen. It should therefore be disguised by such means as fastening a small piece of brush to the top of the binoculars.

If it is necessary to seek such careful concealment for the battery it is evident that a battery not concealed will at once become the target for one or more hostile batteries and unless favored by circumstances which will enable it to withdraw from the position, such a battery will be doomed to destruction.

It follows that batteries will usually be in concealed positions unfavorable to the conduct of fire from a point near the emplacement, and that the usual thing will be advanced observing stations. First line trenches and wire entanglements will generally be visible from our own trenches. These will be the most usual first targets in an attack, since all hostile batteries are concealed and the artillery duel preceding an attack is no longer possible.

The attack will begin by concentrated fire of the artillery on a section of the enemy's first line trench for the double purpose of inflicting loss on him and of destroying his entanglements to such an extent as will enable the infantry to find passages

through them. At a prearranged moment this artillery fire will be shifted to a new range, two or three hundred yards greater, as the infantry advances to the first line. If the assault succeeds artillery observers will move forward and may find in their new stations that they are able to locate hostile batteries, reserves, combat trains or other good targets. They will then need good lines of communication in order to take full advantage of their opportunities, and must be prepared to carry forward their telephones. It will rarely be possible to communicate to the rear by visual signals. Aeroplanes equipped with wireless may be able to help during this stage of the combat.

It is evident that concealment has devolved upon the artillery a difficult duty, namely that of extending its communication system far to the front and using it under hard conditions. Wires must be protected by burying them or by stringing them up in trees or on light poles. Lines must be duplicated. Our present simple system of telephones, reel carts and buzzer wire needs to be greatly improved upon for trench warfare as a direct result of concealment.

Trench warfare is due to the employment of immense armies, about evenly matched. The defensive has gained so much advantage that at the first lull both sides entrench and the game becomes a draw. It is only on the flanks that advantage can be gained by maneuver. If, as on the Western battle lines of Europe, both flanks are secured a deadlock ensues.

But if either side is forced out of its trenches and pushed back vigorously without time to reëstablish its trench lines the character of the fighting will change. Elaborate protection will have to be abandoned and concealment will be sought by using the features of the terrain. Changes of position will be frequent and permanent lines of communication will not be practicable. The work of the artillery will then be more like that described in the drill regulations, which are based largely

upon the idea of an advance from a distance to the attack of an enemy recently arrived on the scene.

The writer realizes that this is in no sense a technical paper. It is intended rather to point out some things to which we might turn our attention to good advantage in the summer's work.

It is recommended that every battery or battalion commander take advantage of the presence of aeroplanes near its instruction ground by arranging one or more concealment problems, putting to actual test his ideas on the subject and bringing the matter to the attention of those who have not thought of it.

It is further recommended that during the summer's firing many problems be practiced in which the conditions of trench warfare are simulated and difficult problems of communication are involved.

It is hoped that officers will report freely on their experiences in such practice with a view to bringing to light any deficiencies in our present equipment.

Notes on the Recent Tractor Test at Fort Sill, Oklahoma

BY CAPTAIN WILLIAM BRYDEN, FIELD ARTILLERY

LAST November the Holt Manufacturing Company of Peoria, Illinois, sent one of its 45-horsepower caterpillar tractors to Fort Sill for test by the Field Artillery Board in the traction of heavy field artillery.

For the first few days of the test the tractor attended the ordinary drills and road marches of the heavy batteries in order that the civilian operator might become accustomed to towing the matériel, and that the Board might get an idea of the capabilities of the tractor. The work of these days showed that the caterpillar could handle with ease a complete section with filled chests of either 4.7-inch gun or 6-inch howitzer matériel over ordinary ground both on and off the roads.

The later tests were, therefore, undertaken with the idea of determining to what extent a tractor of this type could be used to replace the sixteen horses that make up the two teams of a section of a heavy battery; consequently, the tow in each case consisted of a 4.7-inch gun caisson and limber with filled chests weighing about 8,200 pounds, and a 4.7-inch gun and limber weighing about 8,800 pounds, a total weight of about 17,000 pounds.

The accompanying photographs show the nature of some of these tests, and, to persons who may be familiar with the particular points of the Fort Sill Reservation described, they will also give an idea of the efficiency of the machine as a tractor.

Photograph No. 1 shows the section at the Cache Creek crossing about one and one-eighth miles north of the Old Post. The rather difficult road up the east bank was easily traversed in spite of its sharp turn and its grade, at one point, of about 30 per cent. The compact business-like appearance of the section

and the fact that no cannoneers are required to walk are points that are noticed at once. The saving of road space of this section over one equipped with animal traction is about twenty-four yards.

About one-half mile southeast of this point is the difficult V-shaped crossing of Beef Creek, shown in Nos. 2 and 3. In No. 2 the tractor is at the steepest part of the east bank, a grade of about 40 per cent. No. 3 shows the piece at this point. In making this ascent, the tractor was obliged to stop two or three times in order to speed up the motor. No trouble was experienced in starting after these slight delays.

No. 4 shows the section in Cache Creek just below the iron bridge east of the Old Post. This crossing was easily made.

In No. 5 is depicted one distinct advantage that motor traction has over animal traction; an advantage that might under certain conditions become of great value. The tractor is hauling its tow over a stream on a railroad bridge, the vehicles running directly on the ties without the intervention of planks or other covering. The rate of crossing was slow to avoid bumping the bridge and the matériel too severely; as far as the tractor itself was concerned, no better roadway than the level ties could have been desired. At one point in the bridge one tie was missing and the gun wheels sank down into this space with a thud, only to be pulled out slowly and easily.

No. 6 shows the tractor passing over a cattle guard which proved to be a close fit for the caterpillar track. This photograph also shows how the vehicles straddled one rail in crossing the bridge and in moving along the ties.

The last test was held in a mud hole. Up to this time the caterpillar had successfully overcome all obstacles that had been presented to it. The weather had been dry for some time and mud had not figured greatly in any of the trials. After a search, however, a gully of thick, black, sticky mud was found. The section was ordered to proceed down through this, to turn around and to come back up the gully keeping in the track

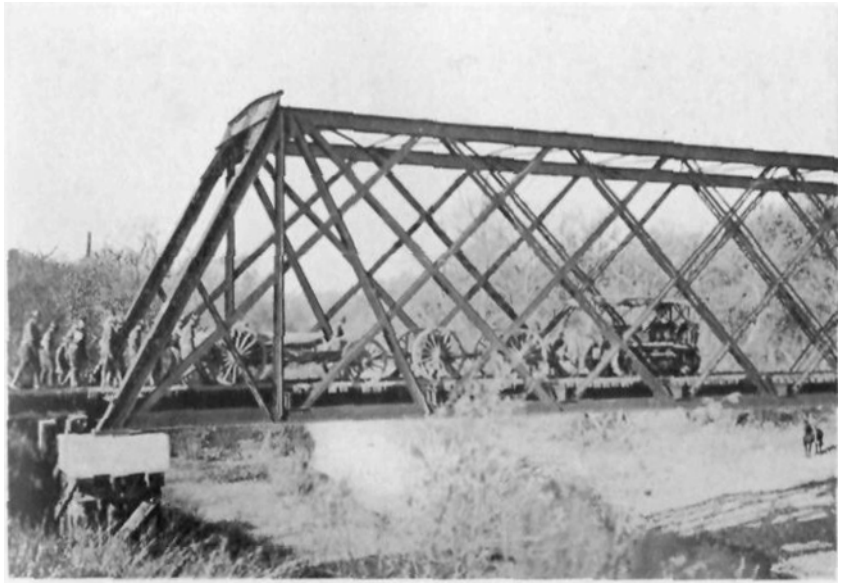


FIG. 5

FIG. 6

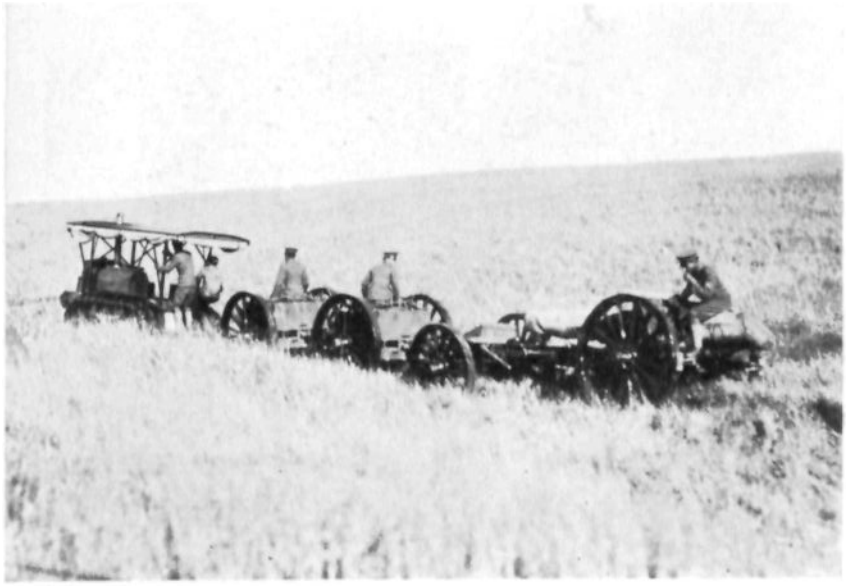


FIG. 7

FIG. 8

FIG. 9

FIG. 10

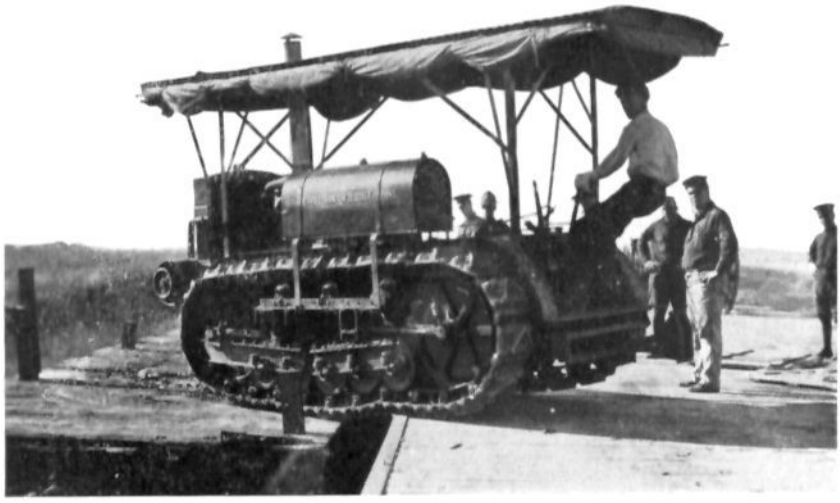


FIG. 11

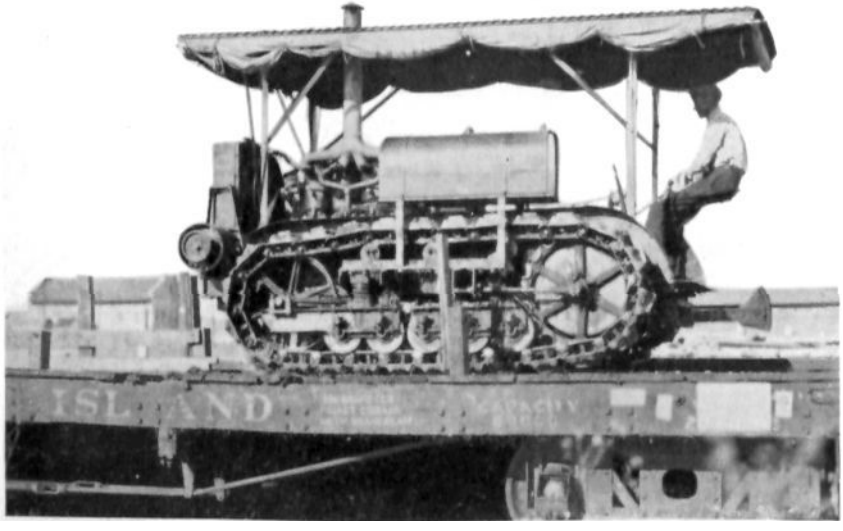


FIG. 12

previously made. The down trip (No. 7) was easily made, and the return trip was proceeding very well until the wheels of the piece unearthed the large rock shown in No. 9. That stopped the tractor, and once stopped it was unable to budge the section. The carriages were separated (No. 8) and the caterpillar easily pulled the caisson out of the mud and then went back for the piece. The 13,000 pound tractor with its bearing surface of 2080 square inches maneuvred over the soft mud with never a thought of becoming mired. But meanwhile the gun was slowly settling until by the time the tractor had backed up and was limbered to the piece the gun carriage was resting in the mud on its trail and apron (No. 9). In vain did the disgruntled operator make the caterpillar snort and puff. The tracks turned and tore large holes in the mud but without a firmer footing the tractor could not free the gun from its sticky resting place. The necessity for a stout rope or chain as part of the equipment of a tractor engaged in this kind of work was very apparent. Two new picket ropes were attached between the tractor and the piece to allow the former to pull upon more solid ground, but at the first strain the ropes snapped. Then a chain was used, and that went the way of the ropes. By this time it was getting late, and an order for horses and men was deemed advisable and was reluctantly given. Before they could arrive, however, one more attempt was made (No. 10), using a short tow line composed of the several pieces of rope and chain. This time the tractor won, and while the order for horses and men was being countermanded, it hauled the gun to *terra firma*.

Nos. 11 and 12 show the ease with which the tractor loaded itself on a flat car in preparation for its departure.

All who witnessed these demonstrations were greatly impressed by the ease and efficiency with which the caterpillar handled its heavy trailers. The requirements of these tests were probably as severe as any that would be demanded by war service, but through them all the tractor showed itself

capable of doing the work of two eight-horse teams, not only over all terrain practicable for animal traction, but also in places where such traction could not be used.

It would seem that the time is ripe for extensive tests of heavy field batteries equipped with all-motor traction, the firing batteries being hauled by tractor, the remaining caissons being replaced by trucks, the officers and the battery commander's detail being transported in motor cars or on motorcycles equipped, when necessary, with side cars for persons or instruments.

In the Field

BY GERALD E. GRIFFIN, VETERINARIAN, 3RD FIELD ARTILLERY

BEFORE a light battery takes the field, even for a short march, it is necessary that it should be fully and properly equipped with artillery horses; these horses should be in hard, working condition and they should be trained to the work expected of them.

The conformation of a light battery horse is, it is hoped, familiar to the field artillery officer and for this reason it is not deemed necessary to discus it here.

Those officers of militia field artillery who have attended the camp of instruction at Tobyhanna, Pa., for the past three years will probably remember the stress placed upon light draft conformation. If they have given due consideration to this subject, they undoubtedly realize that any marked deviation from the type continually brought to their notice will have a strong tendency to minimize the efficiency of an otherwise good organization.

The familiar statement "You must reach the firing position before you can do effective firing," should not be lost sight of for a moment while in the field. At present the firing position must be reached by means of horse power.

In some states when a militia battery is about to take the field, arrangements for its horse supply are usually made by some one whose knowledge of field artillery horses is, to say the least, no better than it ought to be. Horses with which to equip such a battery are procured by contract from some individual who, as a rule, collects a number of nondescript jades, whose worn frames barely fill the harness, at a given point and there turns them over to a more or less disgusted organization that must accept them for a stated period of time. During such a period these animals are entitled to full rations of forage,

which to many of them is no doubt often in the nature of a Godsend, and the contractor to a remuneration of about two dollars per day per head.

In the course of many years of service the writer has met with militia batteries in the field which were handicapped with equine specimens of the above character. The influence of such horses on the personnel was depressing, the pride of the men in their organization and arm was hurt, and their muscles were made to ache too frequently when the inability of such miserable teams to properly handle the carriages forced them to put their shoulders to the wheels when a fairly heavy piece of road was encountered.

The furnishing of nondescript horses, for field services, to batteries of militia is to be regretted—to the writer it is unpardonable. The battery commander should have a strong voice in the selection of horses to be used by his battery in the field for quite frequently the supreme military state authority is unfamiliar with the conformation of field artillery draft animals.

The proper kind of conditioned horse being on hand it follows that he should be correctly fitted with the harness furnished.

The fitting and adjusting of artillery harness are important matters well worthy the study of field artillery officers. They should not be passed over in a perfunctory manner but should be given the closest personal attention and supervision.

So important is the fitting of harness considered in the regular service that even the battalion commander does not disdain to personally verify the fitting of each animal of his command, but closely examines, calls attention to and directs adjustments when deemed necessary. The more experience possessed by a field artillery officer the more concerned is he with the harness proposition, knowing as he does that harness galls will soon place an animal in the rear of the column and that a few galled horses there is an advertisement to the observer that those

responsible are either ignorant of their duties in this connection or remiss in their discharge. An experienced field officer once remarked to the writer "Permit me to sean the tail end of a battery after it has been on the road a few days and I can tell you all about it."

It has been remarked that men pay for their experience in money, anguish or physical pain. Experience in the field with a battery on the march is usually paid for, by the careless officer, in loss of horse power.

There being no doubt as to the correct fit of the harness and its comfort, the next question that presents itself for consideration so far as the horses are concerned is the number of shoes to be transported. This will of course depend upon the number of animals and the distance to be travelled. If the animals have been shod all round a few days before starting it is fair to assume that on average roads a set of shoes will last for two hundred miles. Allowing for casts, a full set of extra shoes and nails for each horse will be needed, when this distance is exceeded to any unreasonable extent. It will be found of much value both as a time and labor saver to have a set of shoes fitted and numbered for each horse before starting. In addition to extra shoes and nails there should be five per cent. of extra halters and ten per cent. of extra halter ropes provided.

Animals in the field are subject to accident and disease but to a less extent than when in garrison, due of course to the fact that when worked hard they are less given to mischief, and when well fed, watered, and cared for they are more resistent to infection and unfavorable weather conditions. It is not to be expected that a lean horse, to begin with, will put on flesh while on the march but it may be expected that an animal in good, hard condition of flesh will maintain this condition for two or three weeks of reasonable marching if properly looked after. No matter how thorough the management of horses may be in the field many ailments peculiar to the march are bound to

make their appearance and some of them inside of twenty-four hours.

The ailments most frequently met with are as follows:

Contusions, lacerations, sprains, abrasions, nail pricks, bruised sole, harness galls, saddle injuries, cinch sores, neck galls, wither bruises, eye injuries, poll injuries, colic, respiratory troubles, laminitis (founder), lameness of various kinds, bit injuries, punctured wounds, rope burns, thrush, forage poisoning.

To prepare for these and other ailments the battery should be equipped with a supply of dressings, disinfectants and simple drugs.

The following equipment for the farrier or stable sergeant has proved to be ample for a march of ten days under ordinary conditions:

1 farrier's case complete.
1 hoof knife.
1 leg strap (a stirrup strap makes a good leg strap).
1 drenching bottle (leather covered).
1 bottle, pint capacity, for mixing.
1 bottle, 4-oz. capacity, for measuring.
1 syringe, metal, 2 oz.
6 bandages, flannel.
6 bandages, cotton.
4 ounces absorbent cotton.
1 package oakum.
1 package antiseptic gauze.
1 pound castile soap.
15 feet lash rope for control when used as a war bridle.
1 twitch.
4 ounces cosmoline.
4 ounces creolin.
1 ounce bichloride of mercury tablets.
1 ounce boracic acid.
4 ounces ammonia liniment.
8 ounces iodine solution.
8 ounces aromatic spirits of ammonia.

4 ounces sweet spirits of nitre.
4 ounces alcohol.
2 ounces cannabis indica.
3 cathartic capsules.
2 ounces sulphate of copper, powdered.
½ ounce lunar caustic.
Weight, exclusive of chest, 15½ pounds.

In addition to these some reliable gall wash or ointment should be taken along for the treatment of galls and other skin abrasions. A solution of two drachms of aniline violet in one pint of alcohol has given good results when lightly applied to collar and other galls.

Some time previous to the battery taking the field it is necessary that an itinerary be established taking into consideration exact distances, water supply and facilities for procuring fuel, forage, subsistence, mail, etc.

The distance from camp to camp cannot be accurately judged when large cities are selected for camping places on account of the difficulty of securing grounds close to the line of march. For this reason cities of considerable size should be avoided, as well as for the reason that the amusements offered are apt to attract the men from the camp and cause them to lose needed sleep and rest.

In time of peace there is seldom a necessity for marching over twenty miles a day. Therefore, for the welfare and good condition of the horses it is considered good policy not to exceed this distance.

The battery having started it is the duty of the quartermaster to be at the intended camp site at least three hours before its expected arrival so that grounds may be engaged, good watering place located, fuel purchased and provision made for the proper handling of supplies. If forage is to be purchased en route the quartermaster should be a good judge of same and should be familiar with the current prices of hay by the ton and oats by the bushel. He should also inform himself as to the

condition of the roads to be travelled and the watering places to be met with on the following day.

The battery takes the road, say at six A.M., and at a walk, including hourly halts, it should cover about three and one-half miles per hour. For a march of twenty miles about six hours would be consumed at this gait. This length of time is too great for such a distance; horses are required to sustain the weight of harness, rider and pack for too long a period. Under these conditions young, unseasoned horses soon begin to lose flesh, interfere in front and stumble. It has been demonstrated that when a battery is marched as fast as five miles per hour on fair roads the horses hold their condition better and there is less trouble from galls if the distance of twenty miles is not exceeded.

The method of march is laid down in regulations and is the result of experience. The gait of course must depend upon the condition of the roads.

In some organizations of the regular service it is customary at the halts to unsnap the collars, place them on the saddles and then massage and dry the shoulders. There is no good reason to be advanced from a veterinary or a military point of view for such a procedure. On the one hand the shoulders are not subject, like the back beneath the saddle, to constant pressure, for in draft the collar oscillates to such an extent that when the traces are of equal length practically but one shoulder bears the strain at each stride depending on which fore limb is advanced at the moment. This being evident it follows that a given shoulder is practically subject to collar pressure but half of the time except at the moment of starting, in traversing heavy roads or in climbing hills when the animals step short, hold the shoulders practically rigid and pull upon both traces equally. If these statements are accepted as true it will be admitted that there is little interference with the blood circulation of the skin of the shoulders beneath the collar and that the necessity for massaging is not apparent. It may be

argued that the removal of the collar relieves whatever little pressure there may be and permits the air to quickly dry the skin beneath, now moist from sweat. The answer to this must be that the shoulders in this instance are receiving the treatment condemned for the back, for if the instant removal of the collar and the quick but temporary drying of the shoulders are beneficial why advocate the retaining of the saddle in place for some time after the rider dismounts and the slow drying of the skin beneath it afterward.

Furthermore from a military point of view the teams are practically unhitched and when in this situation they are very apt to become unmanageable if frightened. In a hostile country the placing of teams out of the collar while on the road would not be considered for a moment by the good artillerist for he has an idea of what might happen should a fairly well ranged shrapnel burst in his vicinity.

While the battery is at the halt it is considered sufficient, so far as the collars are concerned, to slack the traces, examine the shoulders, shift the collar a little to relieve the pressure on the neck and wet the sponge which should be attached to the top of the collar itself in warm, sunny weather so that evaporation may keep the parts immediately beneath the pad cool and free from tenderness.

The writer believes that the entire mane of the artillery horse should be clipped close (roached) with the objects of eliminating its engagement with front and crown piece when bridling, entanglement with collar pad and top of collar when snapping collars in place and restoring the clean and snappy appearance of the necks which is lost when the mane is rubbed and scuffed off on the picket line.

Nature undoubtedly provided the mane as a protection for the neck and forehead against the attacks of flies and other insects, as the panniculus carnosus muscle (the fly shaker), terminates at the shoulders. In the natural state, where the mane falls equally on each side of the neck, such protection

is ample; but a scuffed, scraggy mane trained to fall for two or three inches on one side is of little avail in this connection. It cannot now be maintained that the mane is needed to assist the rider in mounting, for recent regulations ignore it completely for use in this respect. On the march the dirty halter, unprovided with a brow band, falling one-third way back on the neck possessing a scraggy mane does not present either a joyous or beauteous appearance. It is irritating to the artistic temperament with which some of us are cursed.

Throughout the march the battery commander should frequently review his organization from some favorable position with the object of ascertaining the condition of the horses, the stretch of the traces, the set of the martingales and breeching, the seats of the drivers, the handling of the reins—especially those of the off-horse—the position of the packs, the position of the saddle blankets, the adjustment of slickers on pommels, the dangling of loose straps, the play of the poles, the position of cannoneers when mounted and the score of other matters that go from bad to worse unless constantly watched and corrected.

Contrivances of chains, rings and ropes not laid down in regulations are frequently made use of in some organizations for the support of the poles while carriages are in traction. These contrivances are expensive and often much in the way. They are undoubtedly of value in taking weight off the neck of the wheel horses but it is believed the same thing could be accomplished by equipping each limber with a strap backrest for the cannoneers who ride thereon.

When the watering place on the road is reached—the good quartermaster who is in advance should have left a signal near it—there should be no confusion when the animals are lead to the stream. Watering there should be done by section or platoon and with strict discipline. It is as true in our new army as it was in the old or old, old, that one of the most reliable tests of discipline in a mounted organization is the manner

in which its watering is conducted. Confusion and violent language at the watering place means that a mob in uniform is abusing the animals. One of the most annoying happenings when watering in streams is the dropping down and trailing of traces. It would seem to be an enough easy matter to properly secure these traces before riding or leading off but the frequency with which they become detached would suggest that the proper manner of securing them has not been given sufficient thought.

Some regular organizations make it a practice to remove bridles before allowing the horses to drink. This is considered a dangerous practice as a pair is apt to get beyond control. A horse bitted with a snaffle bit only has little difficulty in drinking comfortably.

Should the day be quite warm, the animals sweating freely and the water of the stream cold they should be watered promptly and immediately moved out so that the blood circulation may not be interfered with. The walking of a heated horse into a cold stream of water of which he is permitted to drink freely and then allowed to stand in place for from fifteen to twenty minutes is dangerous practice. Congestion of the veins of the feet may take place with a—sometimes—resultant attack of laminitis (founder). Muddy water is poor refreshment and horses will not partake of it unless very thirsty. It is believed that watering by bucket, though slower, is the better way in very warm weather where streams are very cold. The good horseman will take advantage of convenient watering places at reasonable intervals, knowing as he does that thirst is an enemy of good condition.

When the vicinity of the camp site is reached, its location having been indicated early by the quartermaster or his representative, the battery commander should ride ahead with ample time to spare so that he may properly establish the lines definitely and thus avoid the unmilitary indecision and telescoping so frequently in evidence when poorly disciplined batteries and

trains make camp. The organization and its train should march smartly and without hesitation to designated places, promptly line up, halt and melt away on the lines.

The girths of all saddles should be loosened slightly on reaching camp and the saddles themselves allowed to remain in place for at least ten minutes with the object of gradually restoring the circulation of the skin of back which has been interfered with by pressure. When the saddles are at length removed a dry fold of the blanket should be placed on the saddle bed of the back and retained there by means of a surcingle so that the sweat may be absorbed and the skin protected until it has regained its lost tone. When saddle blankets are removed the side intended to be placed next the skin on the following morning should not be exposed to the sun for drying purposes as when thus exposed and dried it takes up a number of particles of clay and sand, becomes hard and may irritate the back. Should the blanket appear to be hard and stiff it should be well shaken out and switched.

The shoulders of all horses in draft should be washed off so that dust, sand and dandruff may be removed and in addition to this it is a good plan to bathe the shoulders of young, soft horses with salted water with the object of toning the skin; salt solution being a refrigerent, tonic and disinfectant. Collars should be cleaned thoroughly by means of water and sponge and all harness cleaned and softened. All animals should now be inspected closely for abrasions, galls and shoe replacements.

If camp is made before the noon hour, and as a rule it should be if the start was made early, the animals should be watered and the mid-day feed of oats and about three pounds of hay for each animal offered. If the men's dinner is ready before it is time for the horse to have finished the grain it may be that nose bags are allowed to remain attached to the horses' heads long after the oats have been consumed. Horses become impatient with this state of things, their impatience being made manifest by pawing at, trampling on and wasting the hay that

may be in front of them. This neglect of the nose bags is still another evidence of the carelessness of those whose duty it is to inject discipline into non-military minds.

Should camp be made in fair grounds or on race tracks the great temptation offered for housing animals in vacant stalls should be resisted for who can tell with what equine disease any of these stalls may be infected. In this connection it might be well to suggest that all public watering troughs and hitching posts should be avoided. On the road the presence of a full water trough seems to have a fascination for individual riders. The strictest orders do not deter these men from riding up to and watering at every roadside trough met with.

From what has been written it may be learned that the duties of the officers and men of a battery in the field are incessant and that it is the eternally-working-at-it that keeps things moving smoothly.

The command of a battery or a battalion is not a position offering a soft couch on which to repose when camp is made; on the contrary there is no chance to use a couch until darkness has settled over things for the night, for outside of the proper care of the animals there are scores of other things pressing for personal attention. Uneasy lies the head of a commanding officer in the field unless he has disciplined and trained his officers and men to a point where the neglect of a duty rasps upon their military conscience.

It has been said that an infantryman in the field should never stand when he may sit or lie down. It should be said of the artilleryman in the field that he must not sit or lie down, while able to do his duty, until he is satisfied that he can do no more to keep his part of the organization in perfect working order.

Between the hours of two and four P.M., there may be time for considerable leisure, if camp has been made before noon, and then comes the grooming, watering and feeding for the night. In warm weather the animals would do better if they

were given a last drink about 6:30 or 7 P.M., but as this is very inconvenient they must get along without water from about 5 P.M. until some time the following morning. In the mean time each will masticate and insalivate eight pounds of dry oats and about twelve pounds of hay. It takes about fifty pounds of saliva to do this properly.

Horses will not drink well early in the morning unless the night has been a sultry one or they are feverish, therefore it would be wise to water as soon as practicable on the road.

The routine work of a march does not vary much from day to day but the condition of roads does and so does the condition of the horses if the length of the march is misjudged and they are kept too long in harness. In this case they soon begin to lose flesh in the regions of the abdomen, neck, shoulders, croup and back and for this reason the adjustment of harness, more especially the collar, must be constantly borne in mind.

A march of fifteen days' duration, at a rate of twenty-five miles per day, on average roads, when done at the rate of three and one-half miles per hour including halts, etc., will cut the flesh of the average battery horse to the bone unless the forage is increased twenty per cent. and water is given late in the evening. It has been frequently noticed that when commands are homeward bound commanding officers, whose horsemanship may be questioned, force the marching to from twenty-five to as high as thirty miles per day so that they may the more quickly enter the much reviled garrison routine. So determined are they to reach their destination on a given date, that the usual and necessary Sunday halt is ignored, the standard excuse being that a stopover would stiffen the horses. It is needless to remark that a horseman would not give an excuse of this character.

While on the subject of Sunday halts it might not be out of place to suggest that there is seldom, in time of peace, a good excuse for marching on a Sunday. The reputation of the Army for supposed unrighteousness seems to be fairly well established

in the minds of our people. Why continue to advertise it by marching in the face of the church-going, God-fearing, peaceful communities of the country side who usually devote this day to the practice of their religion?

Some commanding officers appear to be satisfied if the average day's march of the itinerary is from twenty-one to twenty-two miles; they evidently forget that on the days when long marches of from twenty-five to twenty-eight miles are made weary horses become much exhausted on the last six miles.

It is well known to horsemen that the endurance of the horses of a battery as a whole must be judged by the strength of its weakest team. The weakest team should be capable of doing twenty-five miles per day for a period of four or five days without showing undue exhaustion under fair conditions of roads, water and forage. No horse should be taken along with a battery if it is at all doubtful that he is fit to do his full share of the work.

From time to time severe tests have been made with the object of determining the endurance of military animals in the field. The result of these tests from any point of view proves nothing except that at their conclusion the majority of the animals are practically exhausted and do not fully recover from the strain for several days. In time of need animals must be forced to the very limit of their endurance and that limit is as dependent upon the horse sense and horsemanship of the officer in command as it is upon the condition of the animals themselves. It is probably true that one officer may be capable of doing fifty miles a day for three days and still have his battery in fighting shape while another handling the same battery under similar conditions would go to pieces on the road before one hundred and twenty miles had been accomplished. From this it may be gleaned that endurance of battery horses is as dependent upon the officer as it is upon grade, condition and conformation of the animals themselves.

To be ready to move out of camp at 6 A.M., experience has shown that reveille should be sounded as early as 4:45 A.M. After roll call oats should be offered and the men should then eat breakfast. It takes a horse from twenty-five to thirty minutes to consume four pounds of oats and if he is not allowed all of this time the oats which are left in the nose bag are lost, as a rule thrown on the ground by the driver. The end of the feed will bring the time to 5:20 A.M. and by this time shelter tents and bedding should be in shape for stowing. After the nose bags have been placed in their proper places it will be 5:35. No equipment of any kind should be placed on the animals until 5:40; at this time boots and saddles is sounded when all working animals should have their equipment placed upon them and themselves placed in their appointed positions. The harnessing and hitching should take about fifteen minutes; this will leave five minutes to spare for final adjustment. At 6 A.M. every wheel should be ready to turn, even those of the junk wagon which carries the rakes, forks and implements of war.

In some militia batteries and in some regular batteries for that matter nervous men, who cannot sleep after daylight may be observed prowling around the picket lines long before first call. These men will often harness and saddle their horses long before the appointed time and frequently in militia camps, individually mounted men may be seen charging on horseback from one point to another without any object in view. Such things as these show how affairs are managed in slip-shod organizations.

Quite frequently the batteries of a battalion compete with one another in the matter of being prepared to "hit the trail" at the designated hour. This kind of competition is injurious to the horses as frequently the harnessing is done before daylight, the uproar occasioned is unseemly and the horses have to carry the load of harness until the next camp is reached.

When this kind of soldiering is in evidence there is as a rule a screw loose somewhere in the assemblage of the battalion commander.

It might be of value to make a few remarks about the feeding of hay on wet and on windy days. Neglect of the conservation of hay at any time is soon made evident by the tucked up flanks of the animals but neglect of its management in wet or in windy weather causes them to really suffer.

Horses will not lie down in wet weather unless very tired but will stand persistently and sleep in the standing position. Therefore they are not sufficiently rested for the following day's march and if a portion of the hay ration is lost to them they suffer from hunger as well as from the fatigue of continuous standing. On wet days the hay ration should be offered in small quantities in order to save it from being trampled underfoot. The detailing of men armed with rakes to keep the hay on the line in place is of little avail for it must be remembered that horses will refuse wet hay unless they are very hungry. This part of the forage should be offered by the drivers in bundles of two or three pounds at intervals of about one hour—it takes about twenty minutes for a horse to consume one pound of hay—and it should all be consumed before dark so that little of it is lost.

On windy days much of the hay is blown away. Here again it should be offered in small bundles. Some careful drivers have been observed to place the hay in open sacks and hang these in front of the pair; this is a good scheme but the holding of it in wide meshed nets would be still better. There is a tendency among a certain class of men to rob the picket line of hay for use as bedding for themselves. It would be well to bear this in mind when untrained men are taken on the march for the first time.

In the field animals should have plenty of water and all of their forage. By getting all of their forage is meant that there should be strict supervision over the morning feeding of

oats. At this hour men come running with their nose bags, the vicinity of the forage place is crowded and there is more or less confusion. Some men will walk off with one nose bag filled and to save time will make this do for two horses; others will take the full feed and empty a third of it on the ground; while still others will, when time presses, take off the feed bags before the oats are all consumed and waste what is left therein which is usually from one to one and one-half pounds.

The writer is convinced that the morning feeding, when it is done hurriedly, is responsible among other things for the alarming loss of flesh so often noticed on marches where officers and men are under hack by the commanding officer. An uncoördinated management of affairs may cause the animals to lose quite a lot of their oats at the morning feed, where as a rule an officer is not present on each line to see to it that each animal partakes of his full allowance and that he is not harnessed before the appointed time.

It may be noticed that these horse articles, into the composition of which the writer has been cajoled, are mainly intended for his militia friends with whom he is in sincere sympathy. No one knows better than he the difficulties they will have to encounter when it comes to taking the field with their own horses, if they ever get them, but he believes that they will have as much success along this line as they are having along the lines of gunnery, handling of men and camp sanitation.

The organized militia is about to come into its own and it is hoped that when they get everything that is coming to them the supply of *serviceable* horses will not be lacking.

A Belgian Battalion of Field Artillery on the Yser

EXTRACTS FROM *Les Pages de Gloire de l'Armée Belge* (BY COMMANDANT WILLY BRETON) AND *Les Opérations de l'Armée Belge en 1914* (BY LIEUTENANT COLONEL H. LECOMTE, SWISS ARMY, *Revue Militaire Suisse*, DEC., 1915). TRANSLATION AND COMMENTARY BY GEORGE NESTLER TRICOCHE, LATE LIEUTENANT, FRENCH FOOT ARTILLERY.

The following notes do not refer to a baptism of fire, like the German and French diaries, published in the December, 1915, issue of THE FIELD ARTILLERY JOURNAL. *Here we have a Belgian battalion of field artillery which has been in the field, and many times under fire, from the 18th of August until the middle of October, 1914. These artillerymen fought desperately at Antwerp and endured much hardship during the retreat towards the Yser. However, batteries 28 and 29, of the 5th Composite Brigade,*[1] *were still undaunted, when they reached the new lines of defense*.

[1] At first this battalion, on the Yser, had only three batteries. On the 18th of October battery 44 from the Third Division, joined the battalion headquarters; but it had only three pieces left.

The 'Composite Brigade,' of the Belgian Army, consists of two infantry regiments, one battalion of field artillery (3 batteries), one machine gun company, one platoon of mounted *gendarmes*. There are three or four such brigades in each Army Division. Besides the brigade artillery above mentioned, each division has one divisional regiment (corresponding to the Corps Artillery of the French Army) of three battalions. But it must be remembered that six out of the nine divisional batteries were to be 'heavy artillery;' and, as no howitzer batteries had yet been organized when the war broke out, a Belgian division had only, as divisional artillery, one single battalion of 75 mms.

In short, the Belgian Field Artillery consisted of 20 Brigade battalions, and 7 divisional battalions: 324 guns of 75 mms.

The men had recovered their gaiety, and their full confidence in the final success; they were getting ready, in a spirited manner, to step again "into the furnace" and bent on knocking down as many Germans as possible.

Taking advantage of the terrain, the two batteries had worked laboriously to organize a very strong position. Pits were dug for the guns; and the latter protected with parapets six metres thick. Shelters were also made for the cannoneers, near the guns. . . .

The battalion, under Major Van Bever, opened fire on the 18th, through the 20th; although they fired repeatedly at the hostile artillery, the batteries did not bring upon themselves any reply from the German guns. They were so well hidden, that their position was not marked by the enemy before the 21st. Then suddenly,

A German battery of 210 mms., with its terrible shrapnel, searched the whole area occupied by us, while the battalion was constantly subjected to the fire of light and field howitzer batteries.[2] Our losses were severe. Major Peteau was killed; one piece was destroyed by a direct shot. But the personnel did not evince any sign of excitement. It only took shelter temporarily in the dugouts, when the hostile fire became too violent; then it resumed its own firing, and so on, with intermissions, between the German rafales. There was not the slightest hesitation; on the contrary, the batteries vied with one another in showing courage and endurance.

On the next day, in order to assert its vitality, the battalion replied vigorously to a new German battery which, during the night, had taken position near the road to Westende. . . .

The battalion, on the 22d and on the next day, fired almost continually at different farmhouses and small hamlets, and succeeded in compelling the hostile infantry to abandon these strongholds. But, although the position of the German guns of 210 mms. had been discovered, the Belgium artillery, being outranged by this heavy battery, was unable to answer its fire.

[2] In French, the term field howitzer (*obusier de campagne*) is often used when speaking of *easily movable* field guns of the heavier type, in opposition to the very large guns like the Austrian 305, the German 420 or even 210.

The situation of the batteries became critical, so much the more so because the German Infantry was steadily advancing and extending its wings right and left of the Yser. Fortunately, on the 24th, some French batteries opened up at good range against the 210-mm. guns. Relieved from that quarter, the Van Bever battalion could devote its fire to the support of the Belgian infantry which needed it badly.

> In a single day (the 24th), the three batteries shot no less than 2,000 to 3,000 rounds. Their fire, besides, was admirably adjusted. . . .[3]

Late in the afternoon of the same day, the infantry was obliged to fall back. At this juncture, the artillery was called upon to perform a deed that was nothing short of heroic:

> In a moment, the pieces of batteries 28, 29 and 44 were moved forward by hand, out of their sheltered pits, placed boldly on an open position, and begun to deliver, at short range, and with high explosive shells, a rapid fire against the village of St. George, where the enemy had gained a foothold; also against the bridge of Union, near which the Germans were massing their troops. During 25 minutes our guns poured out their destructive shots at full speed. They were manned by the cannoneers with more energy than ever. The assailants were mown down; it was in vain for them to try to come out of St. George, where their dead piled up high among the ruins. Our 14th Infantry Regiment was thus enabled to resume its retreat in good order. . . .

At night, the battalion retreated to another position, from which it immediately opened fire again to prevent the hostile infantry's advance from St. George. The fight lasted all night. Thus the battalion had been in action, practically without any rest, *for nearly 48 hours*. The batteries remained in action until the 28th, playing a prominent part in the famous defense of Ramseapelle.

[3] It must be noticed that, while the infantry regiments relieved one another, during this two days' fight, the artillery had no rest. Such a condition of things, which has been quite common in this war, has led some European officers to advocate an increase in the number of cannoneers, sufficient to enable the latter, in each battery, to work in two shifts.

> One may get an idea of their tremendous activity in the ten days' fight, . . . by considering the fact that, during this time, they spent about 13,000 rounds of shrapnel or high explosive shell. . . .

It is to be regretted that the author of this narrative should have omitted to supply us with data concerning the losses of the battalion during these ten days. The reader remains under the impression that, in spite of the enormuos amount of projectiles fired on both sides, the effect produced was relatively small. As stated above, in as far as this battalion is concerned, a major was reported killed on the 21st of October. The *Pages de Gloire* mention, also, on the 25th, a rafale that struck the position of the limbers, killing about twenty horses and wounding some drivers. But no other figures are given out. On the other hand, Lieutenant Colonel Lecomte, in the *Revue Militaire Suisse*, states that, after the official lists of losses during the battle of the Yser, only four artillery officers were reported killed in the whole Belgian army.

If we are in the dark as regards losses in personnel, we are better posted in respect to the matériel. Towards the end of the fight, the three batteries had ten guns left. But the battalion never had more than eleven, since battery 44 had only three pieces when it joined the battalion headquarters, on the 18th. Therefore the only gun put out of commission by the German fire was the one mentioned in the narrative as damaged on the 21st. However, we are not likely to go far wrong in making the assumption that, on the 31st of October, when the battle of the Yser ended, several guns of the battalion must have been temporarily useless on account of the excessive number of shots fired. Statistics given out recently show that, on the fourth of November, the 2nd Division could use only fifteen out of its forty-eight field guns, for that reason.

It is almost needless to point out that the Belgian army was considerably handicapped by its lack of heavy field artillery. This defect in organization not only reduced to a great extent,

on the defensive, the efficiency of the light batteries, but it prevented the Belgians from taking any advantage of their successes by an offensive movement. In spite of the excellent qualities of its matériel, Belgian field artillery, in order to partially make up for its inferiority as regards range and power, was compelled to spend its ammunition in an almost extravagant manner, and, by so doing, impaired the working of its guns.

War surprised the Belgians in the midst of a military reorganization. If France was late in creating its heavy field batteries, at least, early in 1914, five heavy regiments were formed. In Belgium, the law of 1913, which decided to provide each division (except the Cavalry Division), with six howitzer batteries, was not put into operation at the time of the mobilization, on July 31st 1914. Indeed, as late as May in that year, the matériel for these batteries had not been decided upon[4]. It seems that, at the end of 1914,—if not as late as the end of 1915—the Belgian heavy field artillery consisted of one single 105-mm. howitzer which is said to have been attached to the Divisional Artillery of the 1st Division.[5]

It is interesting to notice that Switzerland, which has the same number of divisions as Belgium, is far ahead of the latter in respect to heavy field artillery. The Swiss have been wise enough to organize howitzer batteries several years ago, thus following closely in the wake of the Germans.[6]

[4] The fact is mentioned in the Chronique Belge of the *Revue Militaire Suisse* for May, 1914.

[5] *Pages de Gloire*.

[6] The 2nd and 4th Divisions of the Swiss army received each two howitzer battalions of two batteries of 120 mms., and an ammunition column for howitzers.

Supplemental Notes on Lost Motion

BY CAPTAIN R. R. NIX, ORDNANCE DEPARTMENT

1. In the last January-March number of the FIELD ARTILLERY JOURNAL an artillery officer submitted his opinions concerning "The Effect of Lost Motion on Accuracy," predicated upon experience with 3-inch matériel gained in the Ordnance Department. The July-September number of the JOURNAL contained a most interesting attack by a field artilleryman upon carefully chosen extracts from this paper under the caption, "Notes on Lost Motion and Jump." The field artilleryman could scarcely be accused of treating the views of the coast artilleryman with sympathy and appreciation.

2. With a purpose primarily to straighten distorted meanings which may result from reading the criticism by refreshing the memory sufficiently on the first article, these supplemental notes are prepared. Where the subject is viewed from a very narrow and imperfect angle the fault lies—certainly not with the Coast Artillery or with the Ordnance Department—but with the writer, as he does not assume to present any but his own convictions. The whole tenor of his first paper differs materially from the impression conveyed by "Notes on Lost Motion and Jump."

3. Where a reasonable difference of opinion exists, the true point of view can best be attained by a careful consideration of both sides of a question. It is difficult for an opponent in a discussion to render a correct interpretation of the other man's opinion; extracts and partial quotations, moreover, fail in many cases to express a belief or a fact in its entirety: for these reasons the criticism of, "The Effect of Lost Motion on Accuracy" contains several misconceptions. Acknowledgment is made to the author of "Notes on Lost Motion and Jump" for the prominence given in his paper to the faulty diction used in

places by the writer. It is believed if as careful analysis had been given to the ideas as to the words, some of the criticism would have been omitted altogether or would otherwise appear manifestly not well taken.

4. Subjects such as this one, bearing upon the technical development of matériel, are confined in a large measure to official communications. A freedom of expression from the service at large of different phases and view points of professional subjects is of prime value to broaden our understanding; and there is no better medium for obtaining a reliable consensus of opinion on these debatable questions than through our military journals.[1] Officers who control the design of matériel and those who recommend changes therein may, by this means, have all the more data available to constitute a permanent basis for decision.

5. It follows that this supplement is desirable to the extent that it elucidates "The Effect of Lost Motion on Accuracy." Reference is made to the pages of the article, "Notes on Lost Motion and Jump" in the July-September number of the JOURNAL.

Page 533. "The present writer, for one, has never heard it stated that erratic results were due solely to lost motion or to personnel, or to a combination of the two." Neither has the writer of this supplement. This superficial construction of the general tenor of the original article would hardly pass unchallenged even by a casually interested reader. "The Effect on Accuracy of Lost Motion in the elevating and traversing gears of 3-inch field gun carriages," was the first title; for obvious reasons it was finally put in the form, "The Effect of Lost Motion on Accuracy." The subject did not comprehend all causes of erratic results in artillery fire or all lost motion, but dealt with the effect on the accuracy of the service 3-inch field guns of only that lost motion occurring in the elevating and

[1] Statements of facts, and opinions confirmed by these facts, are of real importance, whereas quibbles and mere verbal controversies accomplish nothing.

traversing gears. The subject was clearly defined in the opening sentences. It was at once pointed out that errors due to personnel and other components of the matériel, as lost motion in sights and quadrants, should not be confused with minor errors due to lost motion in the gears.

6. Page 534. "Clearly the author of these extracts has not considered, if he has heard of it, the method of 'volley fire sweeping.'" The original discussion did not consider methods of fire which preclude high accuracy, as sweeping fire or fire at will. From Par. 249 of Field Artillery Drill Regulations, "Sweeping is employed only with time shrapnel and during fire for effect. Its purpose is to distribute the fire over a wide front." Quoting again from Par. 255 of the Drill Regulations, "Before firing each of the succeeding rounds of the volley the gunner traverses the piece to the left by a full turn of the traversing handwheel, and for these rounds disregards accurate laying in direction." Certainly in firing with our 3-inch carriages, the trail spade may fail to hold, the wheels may creep sideways and the brakes may slip, allowing the carriage as a whole to give perceptibly. Each and all of such factors contribute to derangements more or less considerable, in the longitudinal axis of the piece, independent of any amount of lost motion in the gears. Is it fair to hold lost motion alone responsible for this cumulative and more or less formidable displacement?

7. On the other hand if volley sweeping is to be considered under this subject, it is necessary to limit the extent to which accurate laying in traverse may be disregarded by a much lower figure than 4 or 5 mils. Those who expect a degree of accuracy less than 3 mils in sweeping fire as effected by lost motion in the bearings may fully realize this result if a reasonable measure of care be exercised at proper intervals by their gun crews to "check back" on the laying of the piece. The bubble of the quadrant and the azimuth scale on the carriage, in plain view, offer at a glance a positive means of checking back on

the laying. The author of the criticism on page 534 holds up with levity a partial quotation, "the idea of checking sweeping fire by the panoramic sight and quadrant," but he overlooks the very next sentence, "the gunner, moreover, has a ready check under his eye on the azimuth scale of the carriage——." The azimuth scale might be used to advantage by those who strive for the highest accuracy and most even distribution in sweeping fire, even though the panoramic sight be of no avail. Our ammunition allowance is perhaps too low to qualify many of us in the technique of volley sweeping; still experience indicates, page 534, that lost motion precludes "any possibility of regularity between the first and second rounds of volley fire sweeping." Would it be worth while then for the gunners to make sure that the pointer of the scale clears about 8 mils in traverse, one turn of the handwheel, and that the bubble of the quadrant is approximately central for the second round only of volley sweeping? It might be pointed out also that the tabulated statement referred to on page 539 gave displacements of the piece in the operations of loading only when "as much force as possible" was exercised by hand. The maximum derangement in these extreme circumstances was 2 mils in elevation and 7½ mils in deflection. The table of itself has no intrinsic value; during a few minutes' recess at drill similar experiments in the usual operations of loading, as performed by service gun squads, would convince anyone that the greatest derangements to be expected are far less than those tabulated. Analyzing the loading operations it will be noted that the only material derangement occurs in traverse alone and then only in opening the breech; if the gunner be practiced in bearing his shoulder against the shoulder guard, this displacement is taken care of with no loss of time. This practice is important because in effect it serves almost the same purpose as checking back on the azimuth scale. It may be said on behalf of the opponents of the "check back" that it is considered an unnecessary refinement in sweeping fire; the practice, however, of the gunner

pressing his right shoulder against the piece is more or less general throughout our service. The facts in the case are positively convincing that vertical lost motion does not in any circumstances materially affect accuracy. The reduction of lost motion in the gears may be obtained by replacing worn parts; still the fact must be faced that if very old pieces are laid and then loaded and fired without verifying the laying or without previously taking up the play by applying the shoulder to the gun, errors, 3 or perhaps 4 mils in traverse, may result due to lost motion; whereas if loading is performed first, the laying will remain the same for slow or rapid fire, and the accuracy in such case will be unimpaired as far as lost motion in the gears is concerned.

8. It is evident that it was assumed beyond contradiction that the underlying principle of *accurate* firing is based upon the fact that the aim is taken, as it were, immediately before the trigger is pulled, or during the trigger pull. Whether the operator uses a rifle, a machine gun, a field or seige piece, or a seacoast cannon, the operations of loading are invariably performed first; the operations of sighting and firing should be as nearly simultaneous as possible. This natural process becomes more necessary as greater accuracy is required even though bull's eye shooting is not attempted with the 3-inch. Our coast artillery employs an excellent "check back" system throughout its fire control and gun sections to search out and check operations preliminary to firing with a view of determining that the cannon is accurately laid before the firing signal is given. Even with cannon weighing 30 tons or more this exact procedure is resorted to in order to attain accuracy. Surely it is not going too far to say that where *high* accuracy is demanded, the laying of field pieces should be verified by panoramic sight and quadrant or checked by azimuth scale and quadrant immediately before firing; or, as is necessarily the rule in very accurate shooting, loading should precede laying. It is indeed questionable whether this degree of precaution will

not in the long run prove both a time and ammunition saver. In special methods of fire which disregard accuracy to a limited extent, or where rapidity of fire is the paramount consideration, such precautions are not the rule; neither are they necessary or advisable.[2]

9. Page 535. "These ideas, however simple, now seem to be in danger of being forgotten." From a commercial standpoint perpetual motion is desirable; from a mechanical standpoint it is impracticable. To be specific, lost motion and wear are undesirable, but they are concomitant variables in practically all mechanical parts. There is of necessity a certain amount of play in gears, worms, and bearings taken directly from the machine shop, otherwise they will not work smoothly together; tolerances are allowed on all sets of drawings; interchangeability demands variations within prescribed limits; commercial variations always occur in parts manufactured by different establisments. An increase in the original play in gears due to wear is anticipated. There are no less than nine or ten distinct places on the components of both the elevating and the traversing mechanisms of the 3-inch carriage where wear augments the play. The necessary tolerances at these contact surfaces are such that a 3-inch carriage just from the shops has three or even four mils' play in traverse and in elevation. Matériel will never be absolutely perfect although improvements therein are the subject of constant investigation. It would be a decidedly backward step to condemn our 3-inch carriages, all of which have lost motion in the gears, on the grounds of only sweeping *generalizations* (with apologies to our critic and his creed): "Lost motion is inherently disadvantageous

[2] We do not, of course, disregard accuracy to any extent because we want to, but we must make some concessions, knowing the limitations of our matériel and personnel, understanding that nature does not always provide fixed and rigid emplacements for our carriages, and duly appreciating the value of an effective volume or burst of fire over rigid accuracy. A studiously balanced proportion of speed and accuracy is desirable. In this connection we should first settle in our minds the extent to which lost motion affects accuracy, as only then can we determine properly by experiment the extent to which it affects rapidity of fire.

wherever it occurs; it prohibits the effective use of a method of fire included in our drill regulations; it reduces the rapidity of fire; it affects the accuracy of fire."

10. Extraneous devices and appliances or spring components which take up this play have the objection that they increase the wear and reduce the rapidity of operation. A radical change in design should certainly not be resorted to until evidence amounting to proof is at hand that it is worth while. Troubles in interchangeability and large additional costs occasioned by a change in design are especially to be avoided.

11. Pages 537 and 539. "If Captain Campana classes carriages which fail to suppress the jump as only entitled to the term accelerated fire, what should the classification be when the operation of loading materially disturbes the laying?" Apropos of the subject of the Deport type of carriage certain experiments at Rock Island Arsenal in 1912 are pertinent. A comparative road test of 300 miles was given a service 3-inch carriage and a Deport carriage purchased by the Ordnance Department, U. S. A. After the test the lost motion in elevating traversing parts of the foreign carriage was more than twice as much as that in ours; but more important still was the fact that lost motion in the foreign carriage materially affected its accuracy, as comparatively slight jolts of the gun would derange the setting eight or ten mils, in both elevation and traverse; such jolts as would have no measurable effect on ours. Even before the road test a proof officer from his experience at the Sandy Hook Proving Ground stated to the writer that it was very difficult for him to obtain any regularity in the firing of this Deport carriage owing to the lost motion in the elevating and traversing mechanisms. These remarks are inserted with no view of decrying acknowledged merits of the Deport construction with regard to the facilities offered for rapid fire,—the stability of the carriage itself, the independent line of sight, the wide field of traverse and elevation, and the semi-automatic

breech mechanism. They go to show, however, the presence of lost motion in designs other than our own; they indicate that lost motion does affect the accuracy with certain types of carriages. In view of the marvelous results attributed to the "Soixante quinze" in the present war where such enthusiastic references include this Deport type, we may feel assured that the design has been considerably improved in this respect or that the gunners have learned how to control lost motion.[3]

[3] The following is taken from a memorandum on the subject of lost motion in the Deport carriage, prepared at the Rock Island Arsenal, June 5, 1914.

"1. Before Road Test, measured May 4, 1914.

"In elevation, Gun at -7.5 degrees depression, lost motion was 13.9 mils
" " 0. " " " " 18.4 "
" " 15. " elevation " " " 18.0 "
" " 25. " " " " " 4.74 "

"2. After Road Test, measured June 3, 1914.

"In elevation, Gun at -7.5 degrees depression, lost motion was 18.95 "
" " 0. " " " " 23.7 "
" " 15. " elevation, " " " 23.1 "
" " 25. " " " " " 10.95 "

"3. Before and after Road Test, on dates above.

	Mils before	Mils after
"In traverse, Gun at zero azimuth	10.	13.
Guns at 250 mils (pointing right)	10.	13.
" " 250 " (" left)	9.	11.
" " 400 " (" ")	6.	8.
" " 400 " (" right)	7.	10.

"4. From the above figures it is seen that the lost motion in elevation was increased by 5 mils and in traverse by 3 mils, due to the road test, for practically all positions in elevation and traverse.

"5. It should be noted that the construction of the Deport carriage is such as to permit the gun to be thrown considerably off the target beyond the position where all lost motion in the gears is taken up by force exerted at the breech in firing, maneuvering, etc. The elevating cranks on the trails turn if the gun is jolted up and down and the traversing handwheel runs around readily when force is exterted on the breech in the direction of azimuth. After the road test, this derangement was much more easily obtained especially in azimuth, by forcing the piece around with one hand on the operating lever of the breech block through 250 mils or more. This additional derangement does not occur in the service 3-inch field gun, as after the lost motion is taken up the piece comes practically to a positive stop. Moreover, the connection of the trail and axle of the Deport carriage is such that if the brake is

"The result was the now famous 'Soixante quinze;' the prototype of all modern light field guns; a gun which has proved its worth in the greatest war of all ages; a field piece which has not yet been equalled, let alone surpassed, unless it be by Colonel Deport's latest model." In spite of this effervescence the fact remains that the "Sioxante quinze" has not the split trail construction and that the French have not adopted this construction. The French carriages in general receive the praise which they, no doubt, deserve; but it is believed that comparatively few split trails are in use in the present European War. It was reported about three or four years ago that Colonel Deport had a contract for 1000 of his carriages for the Italian government, but it was learned recently that the only one ever built was the one mentioned above.[4] It is understood that Colonel Deport has redesigned his carriage and brought in the features of the Pilot 3-inch Model of 1913 built at the Rock Island Arsenal.

12. Pages 541, 542 and 543 and page 532. "We are fully justified in rejecting as unworthy of credence any mathematical discussion the results of which tend to show that the sum of two and two is one and one half," and once again, "He therefore concludes that the jump of the projectile might measure 14 minutes;" the critic might at least have added (as stated specifically on page 185 of the original), "with the gun in free motion actuated by the maximum powder pressure." Quoting once more from page 544, "even with a single gun there is no reason to believe that the jump will always be constant when a great deal of lost motion is present."

In the theoretical discussion cited the *maximum* powder pressure was considered acting during the full time of flight of

not rigidly set the wheels of the vehicle will turn and the axle will pivot about the trail when force in the direction of azimuth is exterted at the breech, causing a large derangement in the line of sight."

[4] Reports are still current that the active Italian organizations are now equipped with Deport guns, but it appears that all nations at war, Italy as well, are using every gun and carriage available regardless of type.

the projectile in the bore; this extreme condition was emphasized in the words, "even under the extreme assumption of maximum powder pressure acting during the entire period." The test with subcalibre ammunition gave one extreme where no "jump" of the gun occurred, and by way of comparison the theoretical discussion treated the other extreme, the gun in free motion actuated to the time the projectile cleared the muzzle by the maximum pressure given in the powder specifications, 33,000 lbs. per square inch. The futility of a mathematical treatise of the hair-splitting variety on the subject of jump was well appreciated, and owing to the fact that no authentic firing data were available at the time the original computations were made, a precise calculation of the jump to be expected under normal conditions was not attempted. The trend of thought expressed mathematically was offered only as a guide or compass to indicate the proper direction when regulated by common sense and experience. Powder pressures are not static but dynamic, in which we deal with the duration of the greatest measured pressure or a period of time infinitesimal. The element of time changes the effect of a given force, producing in the case of a given powder pressure less strain in the metal and consequently less displacement of the mass of metal than would result from a static pressure as hydraulic pressure which is comparatively much longer sustained. The case is analogous to that of the small arms rifle where the hydraulic tests of barrels in past records show an elastic limit of about 40,000 lbs. per square inch interior pressure. Nevertheless, the same barrel has been fired as many as 100 rounds with excessive pressure charges of 100,000 lbs. per square inch without bursting. Surely the average effective pressure down the bore for the entire period that the projectile is in flight in the 3-inch gun is far less than the maximum and instantaneous pressure recorded by our gauges, some 30,000 lbs. per square inch. Were we to imagine the average effective pressure producing acceleration of the gun to be 33,000 lbs. per square inch, and the gun free to

rotate unrestrained, then we might fancy a jump of the projectile of 14 minutes; but as is normally the case, with old or new carriages, the jump is small and practically *constant*, 5.7 minutes to 7.7 minutes.[5] Quoting from the Special Report of Work Undertaken by the Ordnance Board for the months of July-August, 1914, as referred to on page 178 of the first article, "Jump of 3-inch field gun,—sensably unaffected by presence or absence of elevating and traversing mechanisms."[6]

[5] The average powder pressure while the projectile is in the bore is about 15,500 pounds per square inch. This value substituted in the equation page 184, gives a jump of projectile of 6.5 minutes. Theory and proof firings point to the same conclusion that whether old or new carriages are used the jump is sensably the same and practically constant.

[6] More recently still, a test was conducted at the U. S. Military Academy, which consisted of firing 11 rounds from a new 3-inch field gun and 11 rounds from an old gun that had considerable lost motion both at the cradle pintle and at the traversing and elevating mechanisms. In some of the rounds the gun with lost motion was pulled to one side or the other so as to place all the lost motion on one side. The ground from which the guns were fired was uneven and rocky, and the positions of the two guns were interchanged after 5 rounds from each. There was practically no difference in the dispersion of the rounds from the two guns. With no intent to involve others involuntarily into this discussion, but more especially with a desire to present various view points, the writer submits the reply to his inquiry from the officer who conducted the test at West Point.

"In firing in June of this year the guns of the battery would cross fire as much as 10 mils without any apparent reason, except the lost motion in the pintle surfaces and traversing mechanism. I placed fairly strong springs on the front of cradle and attached by a rope the other end of the springs to the left ammunition tube (as you face the muzzle). This stopped all the 'erratic' firing with the old battery. The lost horizontal motion in this old battery varied from 12 to 18 mils.

"I received a new battery in August and it shot beautifully. This led me to fire 22 rounds as a small personal test to find out if this lost motion was the cause of the erratic shooting.

"The conditions of the test were as follows:

"One new gun, no horizontal or vertical lost motion. One old gun, 14 mils lost motion horizontally; 6 mils lost motion vertically. Each gun fired 5 rounds in one position and then were interchanged and fired 6 more rounds. The muzzle of the gun with lost motion was pushed several times to the right and several times to the left and the other times no attempt was made to push it in any direction. The shots were fired about 1½ seconds apart so that the wind effect would be equal. All data was the same throughout the firing. All laying was accurately checked by officers just before the guns were fired. The range was 3800 yards.

13. Page 542. "The entirely practical mind is more at sea than ever when it notes on page 148 of the same JOURNAL another officer of ordnance state that far from being the distance from the axis of the bore to the axis of the piston-rod, the responsible lever arm is the distance between the axis of the bore and the centre of gravity of recoiling parts." As the moment of a force by definition equals the product of a force by its lever arm, it is evident that two moments may be equal even though the two lever arms chosen differ in length. The moment produces rotation and it is not the force itself, or the lever arm that is responsible. The powder pressure acting down the bore over its lever arm gives the same moment as the sum of the moments of acceleration of eccentrically disposed masses; in other words, if all recoiling parts were symmetrically disposed about the longitudinal axis of the bore of the gun the centre of gravity of these parts would lie in this axis and

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"The following results were recorded:

Maximum change in range, new gun	100	yards
" " " " old gun	140	yards
Maximum change in deflection, new gun	1	mil
" " " " old gun	12	mils
Mean deviation in range, new gun	33.83	yards
" " " " old gun	41.87	yards
Mean deviation in distribution, new gun	1/6	mil
" " " " old gun	2	mils

"There was no bad jump in deflection after the second shot of the old gun.

"From this result and my former experience with these old guns, I believe the following to be the facts:

"That in a gun, with lost motion, either changing the range laying or the deflection laying, is very liable to throw the deflection or range laying out. That opening and closing the breechblock will throw out the range and deflection laying. That if the firing handle is pulled with a quick jerk it will also change the range and deflection laying. That all play except in the pintle surfaces can be eliminated by training the gun detachments. That when the lost motion is taken up by the gun squads, the guns shoot approximately as well as guns without play. That the lost motion necessitates the relaying of the gun after each shot even when carriage is firmly seated. That the gunner and No. 1 cannot lay until after the gun has been loaded as the closing of the breechblock moves the gun. That these last two results cause the gun with lost motion to be a very slow firing weapon, decreasing the rapidity of fire by more than half."

there would be practically no tendency for the gun to rotate on firing.[7]

14. Pages 544 and 545. The criticism refers to a report of the Chief of Ordnance for 1902, which concerned only the jump of the carriage and had nothing whatever to do with the effect of such movement of the carriage on the trajectory. Exact data are available on this question as referred to on page 178 of the first paper. The Ordnance Board determined in February-March, 1914, that the jump of the projectile is uninfluenced by the nature of the platform used for the carriage. Whether the trail spade holds securely or does not hold at all; whether the wheels rise from the ground normally or excessively; whether the carriage is new or has considerable lost motion, the trajectory is constant to all intents and purposes as long as the initial laying remains the same. The adherents of the view that the predominating cause of such irregular results as are possible in sweeping fire originates largely in the lack of stability of the carriage itself have some consolation, however, in the quotation given, "Spade 18 inches in ground at end of test, causing excessive jump of wheels."

"It is at once seen that the rotation of parts about the spade edge or the failure of the trail to hold have infinitely less effects than the propositions investigated." Even were no firing data available the entirely practical mind might reason out this sentence without reference to interpolated pages of abstruse formulæ. If "the jump of the projectile is proportional to the total jump of the carriage," then with the 2.95-inch V. M. mountain gun there would be a large jump indeed, when the

[7] (The initial moments due to friction and even to the pull on the piston rod are comparatively small.) In the howitzer type of carriage, with cylinders above the howitzer, we have a negative jump; whereas with the gun the cylinders are below, giving a positive jump. As a common example a revolver may be fired in the normal position and shoot high, but if inverted the tendency is to shoot low. The principle of jump may be stated still in another way: The inertia of the recoiling parts being unbalanced with respect to the direction of application of the powder pressure causes rotation along the lines of least resistance. Each particular type of carriage, of course, presents a separate problem for the calculation of the jump.

carriage turns over completely. Returning to the quotation, 233,264 pounds was assumed to be the powder pressure acting on the 3-inch gun and recoiling parts, weighing 895 pounds. This large force acting directly on the recoiling parts produces a longitudinal displacement of 1.3 inches and a rotation of the gun of 14 minutes while the projectile is in the bore. This force is taken up gradually by the carriage through the pull on the piston rod, etc., some 4923 pounds, or less than one-fortieth of that acting on the gun. Moreover, the carriage weighs about twice as much as the gun and recoiling parts. The time element also deserves special consideration as the application of the force, 4923 pounds, is not direct or simultaneous on all parts of the carriage. When all the oil is banked in a solid column behind the piston head (see page 181 of the first article) the total force of about 4923 pounds is transmitted to the cradle head front and cradle rear end, and then to the female pintle, and then to the axle bushings of the rocker, and so on. There is more or less play at these bearing surfaces; there is also elasticity and flexibility even in metal parts and relative give and take of the parts among themselves. No matter how fast an engine, for instance, starts off with a train of cars, some appreciable time elapses before the last car takes up the acceleration. The time limit we are considering for the force of 4923 pounds to pass from the cradle head front to the spade is just about one-half of one hundredth of one second. Movement of the whole carriage, therefore, is very slow as compared to the velocity of the gun, and does not take place until after the projectile has left the bore.

15. Page 546. "Investigation of the sources of errors which might be attributed off-hand to lost motion should be encouraged by battery commanders." At the risk of redundancy it might have been clearer to state in this case, "lost motion in the elevating and traversing gears" instead of simply "lost motion." In being too ready to attribute wide dispersions to lost motion in the gears some battery commanders have

failed to give proper analysis to the real contributing causes. There rests an easy process of reasoning in such statements as: "the play of the gun permitted an error of 17 mils . . . making in all a cumulative error of 21 mils. . . . Errors as large as 375 yards in range have been found to exist," or again, "the lost motion in the traversing and elevating mechanisms of the 3-inch carriages is such that it is impracticable to obtain accurate firing with carriages in this condition." It is claimed that an intimate understanding of the matériel is not essential—a reasonable knowledge of the design and functioning of parts of the 3-inch carriage reveals such statements on their face as false impressions of the effect of lost motion in the carriage on accuracy. Attention is invited in this connection to page 176 of the first paper. It would be particularly interesting and instructive to those who make these claims if they would analyze the separate causes which produce errors in the trajectory, such causes as lost motion in quadrants, and panoramic sights, slipping of range discs and angle of site scales of quadrants, etc., in an effort to determine as precisely as possible the amount of error in mils for which lost motion in the gears alone is responsible. A similar analysis would prove of value to those who attribute all sweeping fire irregularities solely to lost motion in the gears.

16. In conclusion it is gratifying to know that the status of lost motion in the gears and jump of the projectile is most satisfactory, first because with the service 3-inch carriages the lost motion in traverse will be greatly reduced as new traversing shafts and nuts with taper pins designed for this purpose are now being manufactured, and second because our new field artillery arm, the 3-inch carriage, Model of 1913, is designed so that the jump should be even less than that of our present matériel.

17. Dissecting this technical subject we are brought face to face with the limitations both of our matériel and personnel. Our duties are not properly performed if, knowing the precise

extent and conditions under which this lost motion may measurably affect accuracy, and knowing that the process of precluding these errors becomes automatic and natural with training, we do not practice our gunners to take care of this lost motion where necessary. In reality from an identical point of view, as is well stated on page 508 in the same number of the JOURNAL, "The United States must, more than any other country, devise machinery to take the place of training." With this perfect understanding our duties are not fully performed unless our designers meet our line officers surely half way. Only upon such common ground can our policies and precedents develop our general efficiency along the right lines.

Transportation by Motor Truck

BY FIRST LIEUTENANT HAROLD G. FERGUSON, BATTERY A. FIRST BATTALION, NATIONAL GUARD OF CALIFORNIA

THE Field Artillery Drill Regulations describe the efficiency of field artillery in Paragraph 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."

Although the above will always remain a fundamental axiom, the method of executing the same will change with the advance in the science of warfare and with the advance in the field of mechanical improvements and military machinery. Such changes are not made without trials as to the practicability of such improvements, and trials are not complete without experiments and pioneer work extending over a period of time.

Motor transportation has been introduced permanently both for civil and for military purposes and will remain to be developed to that point where it will become the principal method of transportation. In the issue of THE FIELD ARTILLERY JOURNAL for the months October-December, 1915, a very interesting contribution makes the assertion that it will probably be many years before horses are entirely superseded by motor means of transportation and that the transition will occur last in America in spite of the good roads movement that is prevalent throughout the various states of the Union. Conceding the same to be a fact, the years preceding such transition must be used to such advantage that when that method of transportation is adopted the most practical and economic solution of such traction will not only have been thoroughly tested and used, but special equipment will have been developed for various branches of the service.

It is the purpose of this article to give in summary the result of a contribution to the general problem of solving such a question as motor transportation for a firing battery. This contribution is made by Battery A, First Battalion, Field Artillery, National Guard of California, in the form of a practical experiment with a firing battery.

On December 18, 1915, at ten o'clock in the morning, Battery A, Captain Jesse McComas commanding, left their armory in the city of Los Angeles by motor trucks for the city of San Diego, a distance of one hundred and thirty miles. Four 2½-ton trucks and one 1½-ton truck were used in making the trip, all being trucks made in the city of Los Angeles, and all being stock ears used for the first time by the battery. One three-inch piece and one caisson were trailed behind each of the 2½ ton trucks, while the full complement of men for each section rode upon the truck trailing their particular piece and caisson. One of the four trucks last mentioned also carried upon its bed the battery and store wagons securely kept in place by cleats properly adjusted upon the bed of the truck. Blank ammunition was carried in the caissons while each truck had much available space for equipment, kitchen material, tentage, knapsacks, spare parts, or any baggage necessary.

The route taken to San Diego was over the State Highway, a concrete road twenty feet in width running from Los Angeles to San Diego, which was at that time in excellent condition. The trucks were run at an average speed of from fifteen to eighteen miles per hour. Every hour each wheel of every piece and every caisson was closely inspected by the officers accompanying the battery, for possible heating or dryness, but at no time was any wheel or axle found to be dry or even unduly warm. Each wheel after such inspection was oiled.

The one 1½-ton truck was used as a scout car carrying the signal detail and all equipment from the fire-control limber, which matériel was packed in a wooden box and carried on the bed of the truck. This truck maintained a greater speed than

any of the other trucks, never running at a speed less than twenty miles per hour, this rate being possible on account of the pneumatic tires with which it was equipped.

Battery A reached San Diego at eight-thirty that night, where hotel accommodations were provided for the men. The entire running time therefore, including stops for inspections, one meal, and once for maneuvers was ten and one-half hours. The return trip was made over the same route, the battery leaving San Diego at one o'clock on December 19th, reaching their armory at one-thirty the next morning.

The following is a resumé of the effects of the trip upon parts of the matériel liable to be injured or jarred by a rapid rate of speed over a hard concrete road. For reference, the same will be tabulated under headings:

GUNS.—The four three-inch field pieces with all bearings, elevating and traversing devices were found in perfect condition after the trip.

GUN-CARRIAGES.—The shields, brake, apron, sight-boxes, axle seats, arm-guards, tool box lids, ammunition carrier covers on the piece have too much play when fastened to their respective parts and become worn by fast travelling.

WHEELS.—The steel tires upon the wheels caused much shaking of shields, aprons, sight-boxes, while the noise caused by such tires passing over a concrete road could be heard for great distances. One wheel became badly dished (outward) as a result of taking turns in the road at a fast rate of speed; this caused the carriage to sway considerably from side to side and in consequence broke one pintle-latch spring.

WHEEL-FASTENINGS.—The inside wheel-fastenings allowed too much play and with much marching would wear out in a short space of time; they were noticeably worn as a result of this trip.

LUNETTE.—Lunettes and pintles were too large, allowing the carriage to swing from side to side under speed and caused

them to track poorly. This caused in part the breaking of the above-mentioned pintle-latch spring.

PINTLE.—The pintles constructed on the rear of the trucks for the purpose of trailing the pieces were too large; they should be of strong material, with springs to adjust the jar and jerking of the piece and caisson trailed behind the truck.

SIGHTS.—The sights were removed from their travelling cases and carried upon the trucks packed in waste in wooden boxes. The jar of the travelling cases for panoramic sight and range quadrant would cause such sights to come unscrewed, break the lenses and render them useless.

CAISSON-PROP.—The fastening for the caisson-prop is not strong enough to retain the same in place when the caisson is travelling at a rate of speed attained during the above trip. The props became unfastened from the jarring and fell to the ground, thereby breaking them; two props were broken in this manner.

SPARE POLE.—When the piece is limbered behind its caisson, the spare pole is so long that it will not permit the free action of the trail spade and, if the same is not removed from the caisson, the spade will split and wear the pole.

BATTERY AND STORE WAGONS.—These wagons are so high that when placed upon the bed of a 2½-ton truck, it is dangerous to travel at any great speed. The height makes the truck top-heavy and at speed greater than usual there is liability of turning the truck over.

AMMUNITION.—The blank ammunition carried in the caissons was ruined by the jarring of the caissons. The wads in the same were jarred loose, thus causing the powder to run out. The drill cartridge will unscrew at the base because of the jar and constant vibration. All oil-cans were intact and were not affected by the jar of the caisson. Service ammunition could be carried with bases down upon the truck.

In the above description I have merely outlined the breakages and faults discovered upon our return from San Diego.

The other parts of the equipment were intact and unharmed in every particular. As will be observed by a survey of the damage done, the majority of the imperfections could be remedied by a battery mechanic at the end of each day's travel. Other changes in the matériel suggest themselves as one reads the list of imperfections that appear, and each particular part of the matériel mentioned can be changed to remedy the evil that now appears to attend motor transportation. Such suggestions as roller bearings (Timken) and solid rubber tires for the wheels of the carriages are matters of simple experiment as to the amount of rough usage they would endure. I will not expand upon the changes necessary as the same appear to be self-evident and also apparently simple in adjustment.

A careful log was kept of all data relating to the care, use and expense of the trucks with the following results: each truck covered 268 miles in two days or in hours of actual time spent upon the road not excluding stops, twenty-three hours; total tonnage hauled 16 tons; distillate used by four trucks 133½ gallons at $.079 per gallon, $10.60; oil used by four trucks 4½ gallons at $.373 per gallon, $1.68; grease used by four trucks 9 pounds at $.06 per pound, $.54; kerosene used 5 quarts by four trucks at $.024 per quart $.12; making a total operating expense of $12.94, for four distillate using Moreland trucks. The total mileage per truck per gallon of distillate was 8.03. The total mileage per truck per gallon of oil was 236. Traction as efficient as the transportation rendered Battery A at the above figures is one of the strong arguments in favor of this form of traction.

If space allowed me I would set out the features in field artillery that motor transportation would eliminate, but as this article is merely to inform this branch of the service as to the results of such an experiment, I will only mention in passing the absence of horses, harness, horse drill, the difference between twenty-five miles per day and one hundred and thirty miles per day, forage, blacksmith, limbers, mules, drivers, etc.,

all of which mean additional training, time, less speed and delay. The condition of the personnel is excellent at the end of a trip by motor, ready for any service, while a day's march in the saddle with the attendant grooming, feeding, watering, harnessing, and unharnessing does not render the personnel as fit for strenuous duties as they would be had they made the trip by motor.

Colonel J. C. Gresham, U. S. Army (retired), accompanied Battery A upon its trip to San Diego as an observer.

With the formation of a motor truck reserve corps, of which the above trucks form a part, Battery A is now and will continue in the future to conduct experiments of the character above described in an endeavor to work out some definite solution of the problem mentioned in the first part of this report. Such trials will be had from time to time in the hope that some valuable suggestions or improvements may be made.

Reconnaissance and Occupation of Battalion Position

USE OF THE BATTERY AND BATTALION DETAILS

SUBJECT 19A. SCHOOL OF FIRE FOR FIELD ARTILLERY, JULY, 1915

(Extract)

1. Two principles are accepted as fundamental:
   (A) Battalion agents must be used only by the specific orders of the major or by his express authority in each case.
   (B) Battery details must be left at the disposal of their captains, the only exception being their rarely occasional use in supplementing the battalion detail in marking the route or as connecting files.

2. The method of using the battalion and battery details in the reconnaissance and occupation of a battalion position must be sufficiently flexible to be adapted to varied conditions and circumstances. However, for the coöperative training of the details, and in order to secure the maximum degree of efficient team work in that part of the field artillery tactical unit which renders the whole effective or ineffective, a carefully planned "model method" can profitably be employed. Confusion, indecision, misunderstanding and annoying and demoralizing delays are the natural results of training in which plan, system and method play no part. A "model method" for employing the details in battalion work is outlined below. Its application to concrete problems will greatly vary.

3. Each captain sends the agent to the major as soon as his battery is in order. When contact with the enemy is expected, or in battalion problems simulating such contact, the battery reconnaissance officers are likewise sent to report to the major.

The group of combat trains also sends an officer, with the necessary mounted men, to the commander of the unit to which the group belongs. (F.A.D.R. 831.) There should be usually four mounted men; one as horseholder, three as agents of communication with the batteries.

4. As regards the use of the details, two general cases will arise; first, those in which battalion reconnaissance to the hostile front must be made, in order to gain contact with the enemy, or to determine his location and dispositions; second, those in which such reconnaissance is unnecessary, the major having been ordered to take up a position already reconnoitered and selected by a higher commander. In either case the major will usually precede his battalion. He will ordinarily have his captains with him. Sometimes they will join him en route to his reconnaissance. In exceptional cases he will have to send for them after the position has been selected.

5. It is desirable that the major reach the position in ample time for complete and careful reconnaissance, for formulation of orders and instructions for the captains, for study of terms to be used in the designation of objectives, so that the position may be occupied and effective fire opened with a minimum of confusion and delay.

6. From the time that a captain dismounts to reconnoiter his station to the time that telephone communication has been established with the position of his guns 200 yards away there should, with a well instructed battery detail, be less than 10 minutes. He should, therefore, reach the position at least 10 minutes ahead of his battery.

7. The battalion detail is formed by the battalion sergeant major and is reported by him to the adjutant, for example, "Sir, the detail is present," or "Scout private No. 1 is absent, Sir."

8. Ordinarily just before or just after the battalion is formed the major assembles all officers of the battalion as well as the details for the purpose of giving information and instructions.

By conventional signals or the use of messengers he sends for the battalion detail, the captains with their details and the combat train commander with his agents, or such of these as he desires.

9. Battery details are formed as prescribed in Subject 19. Captains verify their officers and details and report same to the major. The officers and the details having been assembled, the major gives information, instructions and orders covering such of the following points as may be necessary:

1. Information of the enemy and of our supporting troops.
2. Plans and orders of the higher commander.
3. Plan of the major for the execution of these orders:
   (a) Approximate distance to and general location of the position to be occupied.
   (b) General description of route to be followed; whether under cover or exposed.
   (c) The point, if any, at which the battalion shall await further orders.
   (d) Special instructions to the individual batteries, including:
      1. Whether or not the batteries march together. If they proceed over separate and independent routes, a clear description of these routes.
      2. Order of march. Unless otherwise directed, in the absence of the major, the leading captain, or the leading executive officer conducts the march.
      3. Rate of march in miles per hour. Total periods of walk, trot and rest, in 60 minutes for different rates of march are:

Miles.	Walk.	Trot.	Rest.
3	45	0	15
4	40	10	10
5	25	25	10
6	10	40	10

The rate of march will often be beyond the control of the major on account of the movement of other troops.

(e) Special instructions for the combat train, including:
1. To march with or separate from the battalion, with a clear description of any independent route directed.
2. Probable location with respect to the selected position.
3. Whether the major or the combat train commander will select and reconnoiter the position. (F.A.D.R. 847.)
4. What is known concerning the location and orders of the ammunition train.
5. Special instructions, if any, regarding communications with the individual batteries.

(f) Special instructions to adjutant with reference to reconnaissance or marking the route or connecting, including any special signals to be employed.

(g) Any other necessary instructions, according to circumstances, including:
1. Whether or not the captains with their details will march at the head of the column.
2. Whether or not the major is going ahead at once.
3. Whether the battery details will assist to mark the route or to connect.

The command "Posts" is given when all orders and instructions have been announced.

10. When marching at the head of the column, the battalion detail and those attached are formed as follows:

Formation.			Order from Left to Right.
II	II	II	Combat train agent, adjutant, major.
II	II	II	Orderlies.
II	II	II	Battalion agents to batteries C, B, A.
II	II	II	Reconnaissance officers of batteries C, B, A.

Formation.			Order from Left to Right.
II	II	II	Orderlies.
	II	II	Musician, sergeant major.
II	II	II	Scout corporals, Nos. 1, 2 and 3.
II	II	II	Scout privates, Nos. 1, 2 and 3.
II	II	II	Combat train agents to batteries C, B, A.

11. If the adjutant desires to verify the detail when it reports he commands, "Call off." The detail calls off in the following order from rear to front: Scout private No. 1; Scout private No. 2; Scout private No. 3; Scout Corporal No. 1; Scout Corporal No. 2; Scout Corporal No. 3; Agent "C" Battery; Agent "B" Battery; Agent "A" Battery; Musician; Sergeant Major.

12. If the battery details are directed to march at the head of the column, the captains and their orderlies follow the orderlies of the major and the adjutant; and their details, in the order of their batteries in column of route, follow the battalion detachment as formed in paragraph 10. The battalion signal detail and reel cart follow the last battery detail.

13. Whenever the major is to leave the battalion without taking the captains, he either assembles and informs them or he informs the senior captain or the commanding officer of the leading battery as to:

1. Any later developments or orders regarding the situation or problem (par. 9).
2. Whether captains will come forward at once or wait until sent for.
3. Route to be followed:
   (a) "Bring the battalion on and halt at _____" (designating place and route of approach, or indicating same on a map), or
   (b) "I will mark the route," or
   (c) "Battery details will assist by connecting." (Exceptional.) Or

(d) "Battery details will assist by marking the route." (Exceptional.)

4. Rate of march in miles per hour.
5. Any other important orders or information, according to circumstances, including, if necessary, time and place for subdivision.

14. As soon as these instructions are given, the major, in order to save time, may at once go on ahead. The battalion sergeant major marks the route for the batteries to follow. To do this he calls "Marker" at each point where he desires one placed and the enlisted personnel of the detachment, except the battalion agents, drop off at that command in the order from left to right and from rear to front of the column as formed under paragraph 10. If the battalion sergeant major is in doubt on any point in connection with the marking of the route he asks the adjutant or the major. At a suitable point not far from the position, the adjutant, at the direction of the major, may call out "Last marker." At that command the next marker in order takes post at that point. The information "Last marker" is transmitted to each marker in turn as he reaches this point. When the battalion arrives, the leading executive is warned, "Last marker." On receiving this warning that officer causes the battalion to take the most compact formation permitted by the terrain while at the same time affording sufficient cover. (Line of batteries in double section column is a desirable formation.) The batteries remain in this position until they receive orders from their captains or until further orders are received from the major.

15. The senior captain, or the commanding officer of the leading battery, as soon as he receives the instructions of the Major, sends or signals, if necessary, for the captains with their details and also, if desirable, for their battery officers. In any case the executive officer of the leading battery reports. The orders and instructions of the major are then transmitted to them.

16. If the details have been ordered to connect, they move out at once at a gait designed to overtake the major, the leading instrument sergeant following the route marked by the battalion detail. The instrument sergeant of the rear detail causes his detail to drop off in the order in which they call off, Operator No. 1 being placed when he is from 100 to 500 yards in front of the leading element of the battalion, Operator No. 2 when he is from 100 to 500 yards in front of Operator No. 1, and so on, each man being careful not to lose touch with the man next in rear. The battalion is always the guide of this connecting column; that is, each man guides on and does not lose touch with the man next nearer the battalion. The signals "Halt" and "Forward" are relayed through these connecting files from the battalion to the major, or from the major to the battalion. The signal "Enemy in sight" (both arms extended, vertically overhead) is similarly relayed from the major to the battalion and means "Battery commanders report, details mark the route." When the details are used as connecting files the captains, unless otherwise directed, and the first sergeants always, remain with the battalion. Written but not oral messages may be relayed from front to rear or from rear to front. Oral messages are sent by agents.

17. If, while the battery details are acting as connecting files, the signal, "Battery commanders report, details mark the route," is received, the senior (or leading) captain instructs the leading executive to follow the route marked and the captains with their first sergeants ride forward to report to the major. The first sergeant of the rear battery in the column, as he rides forward, gathers in his detail from acting as connecting files, and places them as route markers, the instrument sergeant falling out of the column and accompanying his captain. As soon as the members of the rear battery detail are placed as route markers, the first sergeant of the centre battery continues the marking with his detail, and he in turn is followed by the first sergeant of the leading battery. It is thus

seen that if the route is long or lies through difficult country the captains may reach the major with their orderlies, instrument sergeants and first sergeants only. If the major, on leaving the battalion, has directed that the route be marked by battery details, it is first done by the rear battery detail, then continued by the centre battery detail, and then by the leading battery detail in the manner above described.

18. Whenever the route is marked the leading executive officer notifies the battalion signal corporal, who then takes the reel cart ahead at a trot to report to the major. In guiding the reel cart over the route marked, the markers are careful not to move on after signalling to and receiving the counter signal from the signal corporal.

19. On approaching an observing station the adjutant and sergeant major exercise particular care to keep the detail under cover, provided cover is available. Ordinarily it will be possible for the detail to halt together under cover, while the major and the adjutant ride forward to observe or to report to a higher commander. As a usual thing the major and the adjutant dismount and turn over their horses to their orderlies before they become exposed.

20. On completing his preliminary reconnaissance, or having received his orders from a higher commander, the major or the adjutant calls "Detail" or signals by three blasts of the whistle. At that command the officer from the combat train, the reconnaissance officers, scout corporals and the sergeant major dismount and turn over their horses, the officers to their orderlies, the scout corporals to the scout privates or to reconnaissance officers' horseholders and the sergeant major to the battalion musician. If the major desires only the officers and the sergeant major to report he calls "Officers." These officers and men in reporting to the major are careful not to expose themselves.

21. The major then gives information, instructions and orders covering such of the following points as may be necessary:

1. Any later information regarding the situation or problem.
2. The general front and limits of the battalion position.
3. The limits of the target sector with the location of the enemy and friendly troops.
4. The major's station.
5. The locality, in general, where the horses of the detail are to be held or linked and watched.
6. The rendezvous point for the captains with their details (usually a well concealed point in close proximity to the battalion station, but always the point at which the major wishes the captains to report to him).
7. The special reconnaissance of the position which the major desires made by certain designated reconnaissance officers or scouts.
8. Other special tasks for the reconnaissance officers and scouts (the adjutant in charge), such as:
   (a) Designation of flank or auxiliary observers.
   (b) Communication with the higher commander.
   (c) Communication with the troops supported by the battalion.
   (d) Panoramic or position sketches required.
   (e) Reconnaissance or maps of routes to front or rear.

Note to Sub-paragraph 7: As an example the major might order: "Lieutenant A reconnoiter that (pointing or otherwise designating) position for a battery; Lieutenant B reconnoiter that position for the combat train; Lieutenant C takes the agents and reconnoiter the most practicable route or routes for advance (or withdrawal) to ———— (such road or point)." When the officers or scouts designated have obtained the information called for they report back to the major at the rendezvous ordered for the captains. An officer or scout ordered to reconnoiter a battery position, notes and reports on the following points:

(a) Size (whether large enough for the battery).
(b) Cover (what defilade can be secured).
(c) Field of fire (whether or not designated sector can be covered).
(d) Observing stations (whether or not good field of view can be obtained).
(e) Kind of communication (whether or not necessary to employ other than voice).
(f) Approaches and exits (whether covered or exposed).
(g) Protection of flanks (whether afforded by friendly troops or by natural features of the terrain).
(h) Aiming points.
(i) Presence of friendly troops if known.
(j) Indication of the enemy.
(k) Position for the limbers.

22. As a usual thing the major, as soon as these instructions are given, rides over and thoroughly familiarizes himself with the position to be occupied. If he has sufficient time he locates the battery positions within narrow limits. He may find it advisable, unless his captains are present, to leave an agent to mark the position of each battery. Each agent rejoins the major as soon as he has given the necessary information to the captain concerned. His adjutant, if not already there, goes to the battalion station where he executes the orders of the major and keeps in touch with the tactical situation. If the adjutant has been given a task which takes him from the station (which should be rare) the major himself goes or remains there.

23. The major may send the combat train agent and the combat train battery agents to reconnoiter the position for the combat train. The other agents remain at his sole disposal and are to be used by others only by his specific authority in each case. The battalion musician accompanies the sergeant major to the rendezvous point for captains. As soon as the reel-cart arrives the sergeant major removes the necessary instruments and has them carried to the station.

24. The captains on arrival at their rendezvous point receive such of the following information and instructions as may be necessary:

1. Any later information or orders regarding the situation or problem.
2. The mission of the battalion.
3. The limits of the target sector for each battery, including:
   (a) Location of the enemy and friendly troops.
   (b) The reference point or points.
   (c) The target or targets if known.
   (d) The kind of communication that has been established with the friendly troops.
   (e) Posts of auxiliary observers.
4. Concerning the position.
   (a) The general front and limits.
   (b) The battalion station.
   (c) If desirable or necessary, the general location of the battery commander's station.
   (d) Communication between batteries and battalion.
   (e) Limits for each battery.
   (f) Degree of cover or amount of concealment required.
   (g) If desirable or necessary, the general location of the limbers.
   (h) General location of the battalion combat train.
5. Any special instructions regarding the occupation of the position.
6. Opening of fire: Whether immediately or when ordered, or whether batteries shall report "Ready to fire."
7. Special precaution for security required of captains, especially those of the flank batteries.

25. The captains having received their instructions at once proceed to reconnoiter and occupy their positions, according to the principles outlined in Subject No. 19.

26. The reconnoissance officers perform the duties ordered, each assisted, unless otherwise directed, by a scout corporal and

a scout private, the latter as a general practice being used as agent to, or signaller with, the sergeant major or adjutant. Whenever necessary, reconnaissance officers use their orderlies as agents for carrying information or messages to or from the adjutant.

27. The battalion sergeant major, assisted by the signal corporal and the signal private, establish communication with the batteries. The sergeant major then assists the adjutant or major by taking charge of all the details in connection with sending and receiving messages by flag or courier. He assists the scouts in sending or receiving flag messages to or from reconnaissance officers, auxiliary observers, agents with friendly troops, and so forth.

28. The signal corporal, assisted by the signal private or recorder, acts as operator at the battalion station. These two men learn from the adjutant what artificial cover if any is necessary at the battalion station, and, assisted by the agents and the battalion musician, construct the same at the first opportunity. The Major or Adjutant may direct one of the batteries to furnish a caisson for the purpose of affording cover. When wire communication is established between the higher commander and the major, the signal private is the operator on the wire.

29. One of the agents, acting in turn, remains in an unexposed position within range of the voice from the station. The other agents remain with and are giving their attention to their horses at the post of the horses belonging to the detail. These men, as indeed all members of the battalion detail, must be well mounted. All members of the detail must be made to understand that their efficiency depends to a very great extent upon their ability as horsemen. Equitation, care of the horse, how to condition him, and how to ride him so as best to save his strength, are very important parts of the training of the detail.

30. At the position selected the battalion musician is in general charge of the horses of the detail. He locates their

exact post under cover and sees that the orderlies properly hold and watch them there. He assists the sergant major. He gets, or orders up any officer's horse that may be called for, and he sees that any horse brought in is taken to the post selected for the horses and there properly held or watched.

31. In the advance to a position, if reconnaissance to the hostile front is directed, it is conducted by the adjutant, in charge, with the three battery reconnaissance officers, and the six battalion scouts. The battalion sergeant major assists the adjutant by superintending the details of sending and receiving messages. The adjutant should exercise the greatest care to see that these officers and men, before going out, are suitably mounted and equipped and thoroughly understand their duties. Available maps should be consulted and the territory to be covered should, if practicable, be divided into sectors, an officer and two scouts being assigned to each. Before going out these men should be able to answer the following questions:

1. Where is the enemy or where is he supposed to be?
2. Where are our troops and, are friendly scouts, or patrols, or troops liable to be encountered?
3. What information is desired; what is my exact mission?
4. What features are of especial importance?
5. What general direction is to be followed?
6. Where and to whom are messages and reports to be sent?
7. Are negative reports to be sent in; if so, how often, or from what places?
8. When am I to return, or at what place am I finally to report? When reconnaissance to the hostile front is under way the major and the adjutant are usually well to the front of the battalion, the major conducting the march of the same through the battery details, acting as connecting files. Written messages and reports sent to the rear by the reconnaissance officers and their scouts may be relayed to the major or the adjutant by the connecting files.

32. When reconnaissance to the hostile front is made before a position is selected or decided upon it will usually be unnecessary, perhaps impossible, to assemble the battalion detail for the purpose of making a careful reconnaissance of the exact position finally selected. In such cases the captains with their details, or the captains alone, are ordered up at a time best suited to be of greatest assistance to the major.

33. In general, and as a summary, duties are assigned as follows:

BATTALION SERGEANT MAJOR

1. In general charge of the instruments and equipment used by the detail.

2. Forms and commands the detail.

3. Marks the route for the batteries or for the battery details to follow.

4. Keeps the detail under cover when approaching or in the vicinity of an observing position.

5. Accompanies and assists the adjutant in sending and receiving messages when the detail is reconnoitering to the hostile front.

6. Learns from the adjutant or major:

(a) The rendezvous point at which to assemble the captains, their details, and the reel cart, and instructs an agent or agents to watch for and guide them to it.

(b) The general location of an unexposed post suitable for the horses of officers and detail, and instructs the battalion musician to reconnoiter it and properly secure the horses at that place.

(c) The location of the battalion and battery stations and orders relative to establishing communication between them.

7. Assisted by the signal corporal removes from the reel cart all necessary instruments; sets up the battalion commander's telescope.

8. Superintends the work of the signal corporal and signal private in establishing communication with the batteries.

9. In general charge of all messages received or sent by flag or agent from the battalion station.

(a) Keeps chronological record of all important messages received or sent.

(b) Assists the scouts in sending or receiving flag messages (to or from reconnaissance officers, auxiliary observers, combat train, and so forth).

(c) Superintends the work of the agents in carrying messages.

SIGNAL CORPORAL

1. Under general supervision of the battalion sergeant major has charge of and is responsible for all the signal equipment of the battalion. He makes such tests and repairs as he is authorized to make and reports all trouble which he cannot remedy to the adjutant personally at the first opportunity.

2. In charge of the reel cart on the march.

3. Learns from the leading executive officer whenever the route is ordered marked and at once takes the reel cart forward at a collected trot to report to the major.

4. Under the direction of the battalion sergeant major lays the wire and establishes kind of communication ordered.

5. Sees that the reel cart, after the instruments are removed and the wire laid, is taken to a place of safety, or that the horses are unhitched and taken to a place of safety and properly cared for by the drivers.

6. Acts as operator at the battalion station, reporting to the adjutant or major when communication with the various batteries is established or broken.

7. Learns from the adjutant or major what artificial cover, musician, the signal private and the agents, constructs same at if any, is required for the station, and, assisted by the battalion the first opportunity.

8. After the completion of the problem reels up the wire and sees that the instruments are collected and properly packed.

SIGNAL PRIVATE

1. Assists the signal corporal in caring for the reel cart and its accessories.
2. Assists the signal corporal in establishing the communication ordered.
3. Assists in constructing artificial cover for the station.
4. Acts as recorder for the signal corporal at the battalion station.
5. In case of communication with the regimental commander by wire acts as operator on the regimental wire at the battalion station.

AGENTS

1. Until all elements of the command are in position agents are especially careful, without definite instructions, to watch for and render information to reel cart, captains, officers, men of the various battery details, or anyone else who may properly need such information.
2. Under the direction or orders of the major, maintain communication between the various elements of the command.
3. Each agent must:
   (a) Keep himself informed as to the location of all the different elements of the command so that he can furnish this information if necessary to any person who may properly need it.
   (b) Study and look for the best routes for approaching the various elements of the command.
   (c) Study the ground occupied by, and neighboring to, the command, so that he will be able to guide elements into new positions over the best routes and, also be able to transmit information between the commander and neighboring troops of other arms.
4. Agents must keep in mind the following:

(a) Before starting with a message, ask the following questions if not clear:
   1. What is the official designation of the one to whom message is to be delivered?
   2. Where is the person to whom it is to be delivered?
   3. What is the best and shortest way there, or can I be given a map of the route?
   4. Am I to report back as soon as the message is delivered; if not, to whom shall I report?

(b) Important messages in writing should have their purport understood by the bearer so that, if necessary, they may be destroyed to prevent their falling into the hands of the enemy.

(c) On the envelope containing a written message is written:
   1. Name of messenger.
   2. Date and hour of departure, as 22 Feb.-15, 9.40 A.M.
   3. Rate of speed.

(d) Agents must thoroughly understand the different rates of speed and how to ride them, as follows:

Ordinary (approximately 5 miles per hour):

Walk,	5	minutes
Slow trot,	10	"
Walk,	5	"
Slow trot,	10	"
Walk,	5	"
Slow trot,	10	"
Walk,	5	"
Rest,	10	"

Riding at this gait and time, the number of minutes of actual travel gives a very close approximation to the tenths of miles traveled. Thus, after riding 18 minutes, the messenger has travelled 1.8 miles.

Rapid (7 to 8 miles per hour):

Walk, leading horse	5	minutes	
Slow canter,	10	"	
Walk, leading horse	5	"	
Canter,	10	"	=7¼ mi. per hr.
Walk, leading horse	5	"	
Canter,	10	"	
Walk, leading horse	5	"	
Rest,	10	"	

Urgent (highest speed consistent with safety and certainty of arrival at destination). *Never urge a horse at highest speed, if distance is greater than one mile*.

The condition of the horse, the weather and the state of the roads may make it necessary to diverge considerably from the instructions given regarding speed. The messenger has got to help get his horse through. In peace time, the horse is more important than the message. In war, it may be the other way.

(e) If mounted, and ordered to deliver a written message, and speed is not indicated, ask for it. Oral messages usually suggest the speed; if there is any uncertainty, however, always ask.

(f) At all times keep informed as to location of his own subdivision.

(g) Note carefully country traversed.

(h) Move promptly when on an errand. All military persons are required to render assistance in expediting movements of agents.

(i) On reaching designation, call out designation of person sought.

(j) Having delivered message:

(a) Ask if there is any reply.

(b) If receiver forgets to do so, ask that he initial the envelope and record hour and date thereon.

(k) If aware of the nature of the message carried, after delivering same, report any circumstances affecting the situation which have arisen since you left the sender.

(l) Always repeat a verbal message, word for word, in the presence of sender, *making certain you understand the meaning of the message*. This is most important; it is better to permit the sending officer to think you are stupid, than to render your errand fruitless or perhaps even disastrous.

(m) After diligent search, if person to whom message is sent cannot be found, endeavor to find some other person who can take full advantage of the information conveyed. Whether or not this can be done, always report back to the sender, with full facts in the case.

(n) Unless otherwise directed, always report back to the sender, whether or not the message was delivered.

(o) When a messenger carries a message unsealed, or not marked "confidential," he will permit commanders along the route to read same. He sees that they initial envelope and record hour and date when they read the contents. When it is desirable that neighboring troops get information from a message sent to a superior, that fact is noted on the envelope, and it is then the duty of the messenger to see that they get it. He must see that they also:

(a) Initial the envelope.

(b) Record the hour and date thereon.

SCOUTS

1. Act as route markers.

2. Usually operate in pairs, a scout corporal and scout private with each reconnaissance officer.

3. Understand the points in carrying information, as outlined under "Agents."

4. Regarding reports, scouts must keep in mind the following:

(a) Word a report as you would a telegram, brief and clear, but omit nothing that is important.

(b) Write legibly. The person receiving it should have no difficulty in making it out.

(c) Names of persons and places should be in block letters.

(d) Avoid vagueness; be accurate; report facts, not fancies.

(e) Report hearsay information as such. In every case state the source of your information.

(f) Always give the reason for your surmises.

(g) In reporting about the enemy, report should be so worded as to answer the following questions:

1. By whom seen?
2. How many?
3. What arm?
4. Where?
5. What doing?
6. At what time seen?

(h) A report is of no value unless it gives:

1. Designation of sender or sending detachment. (Such as "centre scout.")
2. Place.
3. Date and hour, as 4 Feb.-08, 2.45 P.M.
4. Signature. (Writer's surname and rank.)

(i) When more than one report may be sent by the same scout to the same recipient, reports should be numbered consecutively.

(j) Copies should be kept of important messages or reports.

(k) Remember that "negative" reports are often of the very greatest importance. Negative reports show "where the enemy is not." They also show where the scout or patrol is, and let the commanding officer know that the patrol is still working or is not captured.

(l) Always use compass bearings in reports, never "right" or "left," except with regard to the banks of a river.

(m) Avoid indefinite expressions, such as "in front of," "behind," "on this side," "beyond," etc.

(n) Roads are designated by connecting two or more names of places on the road with dashes, as: NATCHES GATE—CONCRETE FORD ROAD.

(o) A message or report should always state what the scout or patrol is going to do next.

(p) Use common sense in reporting. Remember that useless reports hamper a commander and waste his time.

(q) In making a verbal report, think out beforehand what you are going to say; give your report coolly, and take care that you are not misunderstood.

BATTALION MUSICIAN

1. At the firing position learns from the sergeant major where the horses belonging to the detail will be held or concealed, carefully reconnoiters designated place, and directs all orderlies and horseholders to that point.

2. In general charge of the horses held or watched by the orderlies and horseholders, and sees that they are properly linked or otherwise secured and watched; brings up or orders up any horse called for by an officer or noncommissioned officer at the battalion station.

3. Takes post near and assists the battalion sergeant major.

MAJOR'S ORDERLY

1. Acts as horseholder for the battalion commander.

2. When not being used by the battalion commander, watches or assists in holding horses belonging to any member of the detail.

ADJUTANT'S ORDERLY

1. Acts as horseholder for the adjutant.

2. When not being used by the adjutant, watches or assists in holding horses belonging to any member of the detail.

EQUIPMENT CARRIED BY MEMBERS OF THE DETAIL

Members.	Field Glasses.	Combination Flag Kits.	Wooden B. C. Ruler.	Note Book and Pencil.	Wrist Watch.	Buzzer Record Book.	Message Book.	Pocket Compass.	Megaphone.
Battalion Sergeant Major	X	X		X			X		
Scout Corporal No. 1	X	X	X	X	X		X	X	
Scout Corporal No. 2	X	X	X	X	X		X	X	
Scout Corporal No. 3	X	X	X	X	X		X	X	
Scout Private No. 1	X	X	X	X	X		X	X	
Scout Private No. 2	X	X	X	X	X		X	X	
Scout Private No. 3	X	X	X	X	X		X	X	
Signal Corporal		X		X		X	X		
Signal Private		X		X		X	X		X
Battalion Musician		X		X					
Battalion Commander's Orderly		X		X					
Adjutant's Orderly		X		X					
Horse holders, reconnaissance officers		X	Should be authorized.					Should be authorized.	

CURRENT FIELD ARTILLERY NOTES

English Artillery Harness

BY CAPTAIN ROGER D. SWAIN. ADJUTANT FIRST BATTALION FIELD ARTILLERY. MASSACHUSETTS VOLUNTEER MILITIA

RECENTLY opportunity was given to examine a war order of English artillery harness. Unfortunately no notes were made at the time and only the photographs are now available. These are particularly interesting at this time in view of the discussion as to the value of the breast collar and this article is submitted in the hope that someone who has seen the harness in use will be able to furnish further information.

Figs. 1 and 2 show the near wheel and near lead harnesses complete on wooden models. The pole yoke as shown is probably higher than in actual use. It was explained that the neck piece (*c*) passes through the large rings (*a*) on the side of the breast collar into the neck piece tug (*b*) to which it is attached by quick-detachable device similar to that in use in our service.

The leather used was the very best backs and bends available. No bellies or sides were used. The breast collar was made up of a wide piece-cut, folded and shaped so as to present a surface nearly five inches wide against the horse. The strap to which the traces were attached was sewed and riveted to the outside fold leaving the inside fold smooth so as not to chafe the horse. The sewing was done on a "lock-stitch machine" with six stitches to the inch, thread being thoroughly lubricated and waxed with black wax.

A metal pad, somewhat similar to our steel collar pad over which the neck piece (*c*) and neck strap (*i*) pass, carries the weight of the collar and pole at the top of the neck.

The traces (*e*) which are the same in lead and wheel pairs are attached to the collar by quick-detachable device. A similar fastening at the rear end of the trace proper connects it in the case of the wheel trace by chain to the single tree and in the case of the lead or swing to the short section of trace (*d*) connecting with the chain (*k*) in the breast collar of the horse in rear. Allowance for adjusting length of traces is provided by the chain at the collar which allows an adjustment of from 2 to 10 inches and a chain (not shown) to which the rear ends of the wheel trace are attached. The short section of the trace proper acts to connect the breeching with the pole-yoke through the attachment

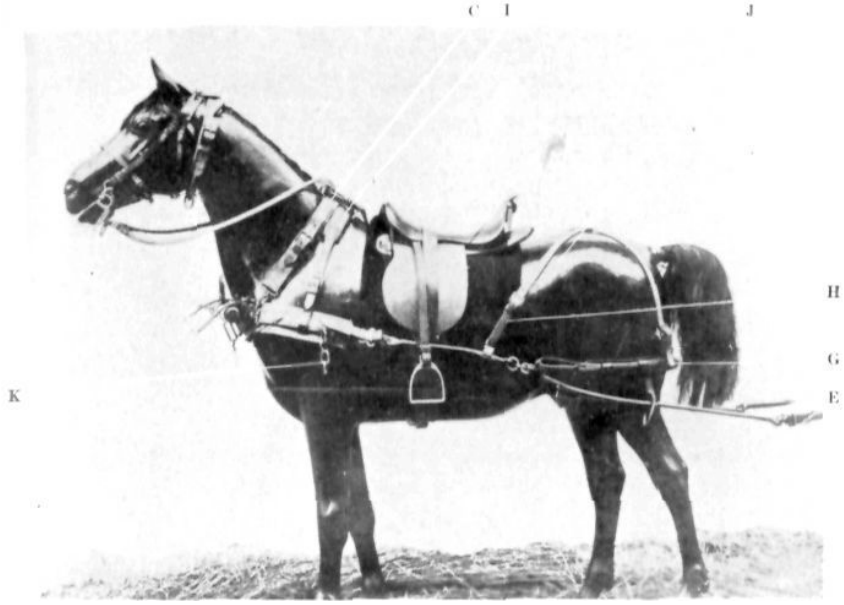


FIG. 1.—NEAR WHEEL HORSE

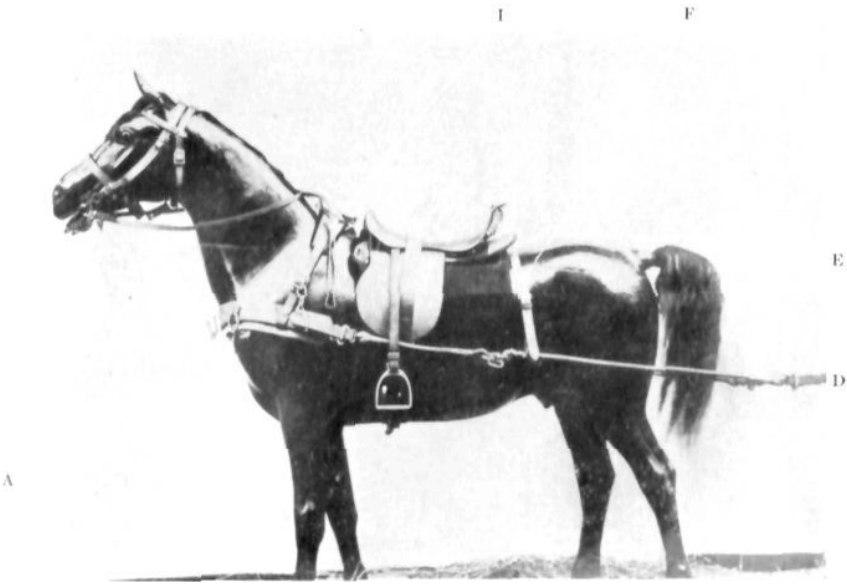
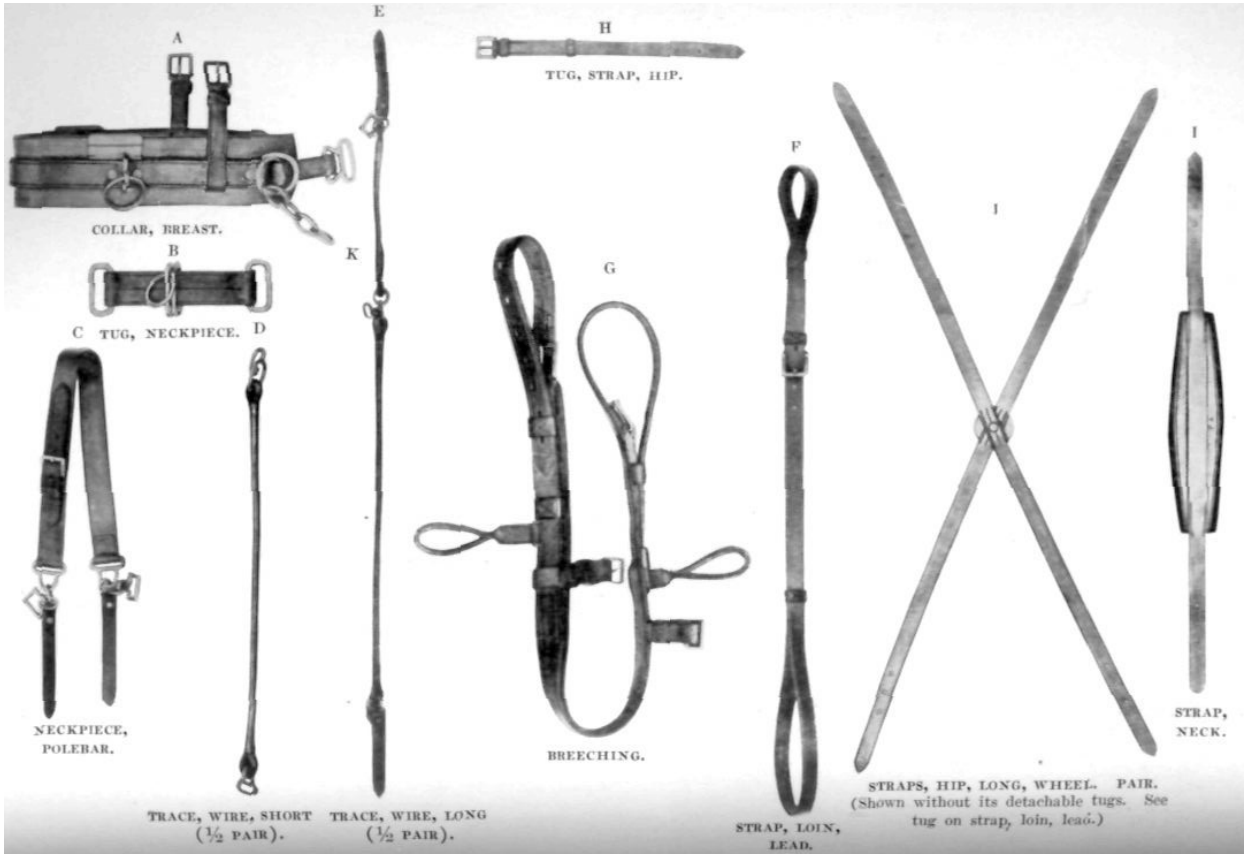


FIG. 2.—NEAR LEAD HORSE.


A
COLLAR, BREAST.
B
C TUG, NECKPIECE. D
NECKPIECE, POLEBAR.
E
K
TRACE, WIRE, SHORT (½ PAIR).
TRACE, WIRE, LONG (½ PAIR).
H
TUG, STRAP, HIP.
G
BREECHING.
F
STRAP, LOIN, LEAD.
I
STRAPS, HIP, LONG, WHEEL. PAIR. (Shown without its detachable tugs. See tug on strap, loin, lead.)
I
STRAP, NECK.

of the pole-yoke to the collar at the rings above referred to and the effect of the breeching it seems is aided by the crossed hip straps (*j*), which probably transfer part of the strain to the rump. The forward end of these hip straps (*h*) is held in place on the trace by passing through a small lug attached to the trace. In the lead harness the loin strap (*f*) is prevented from sliding back off the horse by passing through the same lug, but there appears to be nothing to prevent it from sliding from side to side.

The bridle is a combination bridle and halter. In the one seen a strap attached at one end to the bit passed over the crown following the check and crown pieces of the halter through the loop in the rear ends of the brow band and buckle to a short strap attached to the other side of the bit. This made a much lighter head gear than ours with a halter that stayed up on the head.

The general impression was of an extremely simple serviceable harness quickly put on and quickly removed. With no crupper, no attachment to the saddle, no side straps under the belly and the flexible breast collar it should be easy to strip a fallen horse. It may be that the pole-yoke would tend to ride up through absence of martingale. Possibly this may be counteracted by lower breeching through use of the crossed hip straps. An attachment at the rear of the saddle would prevent displacement of the loin strap in the lead harness.

No saddles were included in the war order seen.

Sitogoniometer, Model 1911, or French Angle of Site Measuring Instrument

TRANSLATED BY CAPTAIN NELSON E. MARGETTS 3RD FIELD ARTILLERY

1. This instrument permits:

(*a*) The measurement of angles of site, and the determination of the distance or position in rear of a mask or crest to place the guns of a battery, in order that the shots will clear the crest when laid on the target.

(*b*) The measurement of horizontal angles in mils.

In accordance with the above it permits the determination of the emplacement of a battery behind a crest in order to accomplish a determined mission.

The instrument consists of a boite d'appareil or small aluminum

box (Fig. 1) carrying on one of its faces a parallax table computed for a platoon front of 15 metres (Fig. 2).

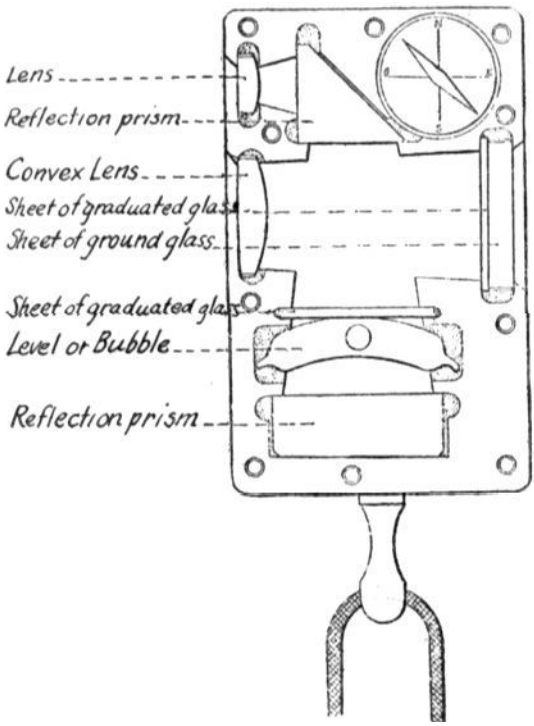


Fig. 1.—Sitogoniometer. Model 1911. (Aluminum Box—Interior Arrangement)

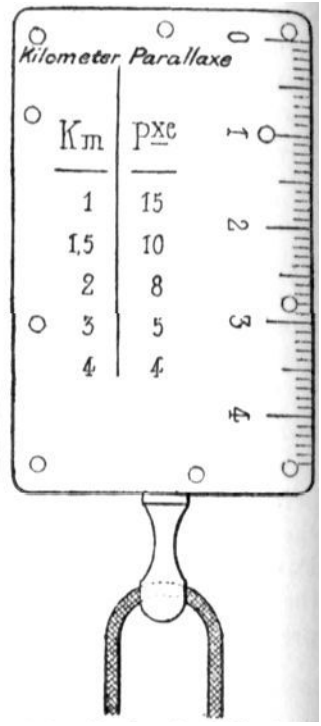


Fig. 2.—Aluminum Box—(Graduated Back)

A small button on the bottom facilitates the holding of the sitometer in the hand and a string may be attached to it to secure the instrument to the person when not in use.

(*a*) To measure the angle of site: Hold the instrument by the button in the right hand, place the edge with the two little windows vertically against the upper part of the right cheek in such manner that in looking into the smaller upper window the right eye will see the bubble and scale inside and the objectives to the right on the outside.

Bring the bubble between the two central lines by slowly inclining the head, and read the graduation that coincides with the object on the terrain of which you wish to find the angle of site.

The graduations are 5 mils apart.

(*b*) Determination of the distance or position in rear of the crest

to place the guns in order that the shots will clear the crest when laid at the range of the target:

Being at the selected position of the guns, the observer places the instrument before the eye as in measuring the angle of site. He marks a point on the terrain, *A* (see Fig. 3) having an angle of site equal to that of the target, displaces before the eye in such manner the instrument that the point *A* will be seen to the left of the instrument and brings the zero graduation on the left side (graduation in range) to the height of the point *A*, then reads on this left hand scale the distance to the summit of the crest (see Fig. 4).

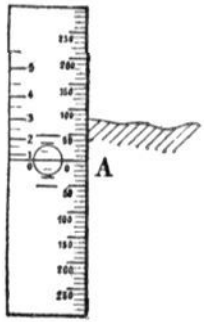


Fig. 3.

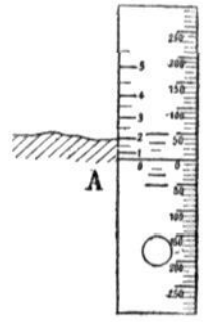


Fig. 4.

The graduations in range can be employed in all cases as explained above, where the crest is distant at least 300 yards.

(*c*) To measure deflections or angular deviations: Hold the instrument by the button in the right hand and place it horizontally before the right eye, supporting it against the cheek at the base of the nose in such a manner that by looking through the large central window the deflection scale can be read on the inside, and by looking over or under the instrument the required graduation of the scale can be brought into coincidence with the aiming point or target and the deflection in mils read to the required point.

The scale is graduated into 533 mils, conforming to the sight graduation on the French 75 mm. piece which is divided into four quadrants each numbered from 1 to 16 hundred.

Armory Plans for a National Guard Battery

BY R. T. OLNEY. FIRST LIEUTENANT. BATTERY B NATIONAL GUARD OF MISSOURI

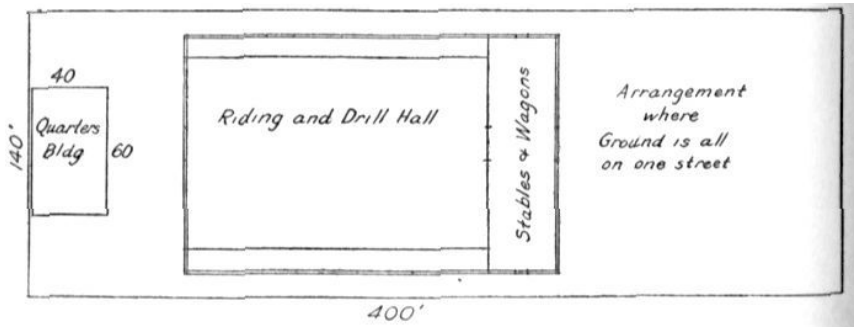
ONE of the first problems that is to be met by a National Guard battery is suitable quarters. In some of the states a large amount

of funds are available; but in most of the states, the battery officers must raise the money necessary; either personally or through public subscriptions.

The question is: What are the necessary buildings, and how much will they cost?

The following plan is submitted as one that will make a very workable plant. It is one that can easily be enlarged or reduced to suit the different conditions. It is built with the idea that it is necessary to provide the following:

A proper place to store the government property; a space for standing gun drill; a locker-room for men; officers' rooms and men's club-rooms; stables for thirty-two horses as government provides care for that number; if possible, a riding hall.



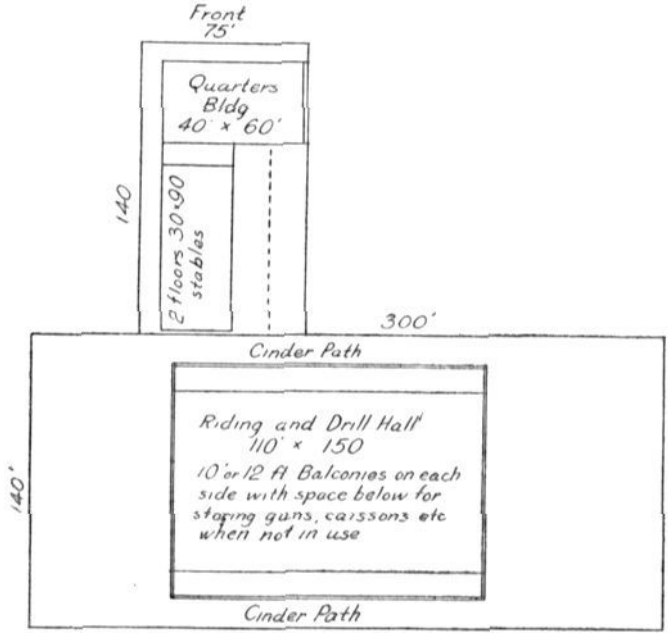
Besides this, gymnasium, swimming pool, etc., is, of course, a very fine addition; but can easily be arranged if funds permit.

Location: A site should be chosen in a convenient location. To save expense, a very nice arrangement can be worked out by securing a 60- or 75-foot lot facing on a first-class street, where 300 to 500 feet can be secured on the street in rear, where ground may be very cheap.

This arrangement provides for the battery office, club rooms, locker rooms and stables on one lot, with a riding- and drill-hall in the rear. The large hall to have a balcony about 10 feet wide along two sides with space below to store guns, caissons, wagons, etc., when not in use.

There is a cinder road-way all around the riding-hall, which gives an excellent exercise track. At one end, enough to make an easy turn, even with a carriage, is provided; the balance of the space is left at the other end to give room for a "Bull Ring"; also space to unlimber and limber.

The larger the riding-hall, the better. One with an open space, 90 by 200 feet, would be very good. In fact, a riding-hall with an open space 60 by 100 feet would be much better than many batteries now possess, and would give room for excellent instruction.



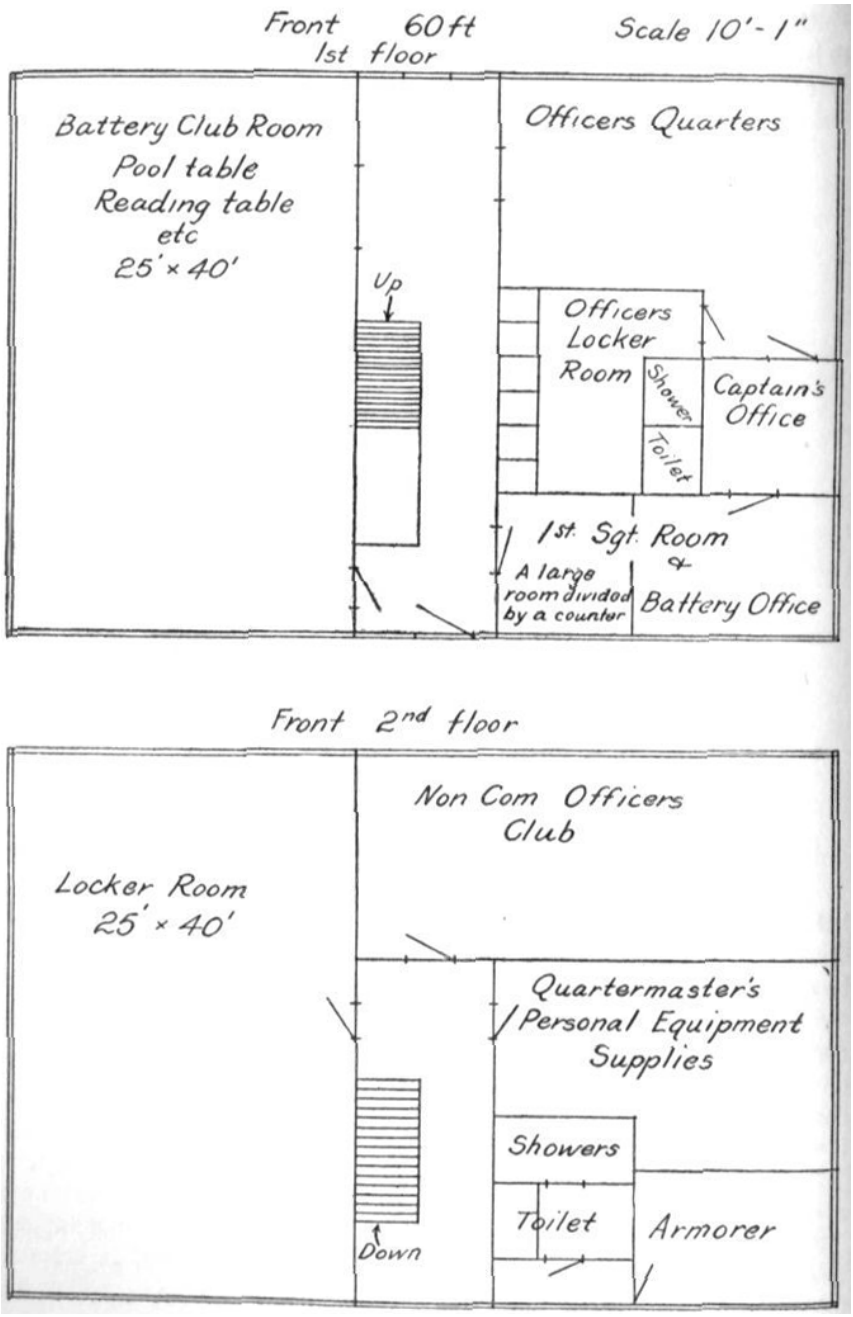
Space is left at one side of the stable for a picket line.

Most National Guard batteries are located in cities where very little use can be had of horses in bad weather, on account of paved streets. For this reason, the arrangement, of buildings, as shown, will be quite an advantage.

If all the property is on one street, the quarters, including locker room, Quartermaster's store room, club rooms, office, etc., may be built on one end of the riding-hall, and stables at the other end. In such cases, the "Track" may either go in front of "Quarters," or between it and the riding-hall.

The extra ground for drill, being left at the end next stables, will also provide open space to tie horses out.

The interior plans of buildings can be made to suit various conditions. Men's lockers will take a space 25 by 40 feet with a Quartermaster's uniform room, 20 by 25 feet, adjoining. A noncommissioned


Front 60ft
1st floor
Scale 10'-1"
Battery Club Room
Pool table
Reading table
etc
25' × 40'
Up
Officers Quarters
Officers Locker Room
Shower
Toilet
Captain's Office
1st Sgt. Room &
A large room divided by a counter
Battery Office
Front 2nd floor
Locker Room
25' × 40'
Non Com Officers Club
Quartermaster's / Personal Equipment Supplies
Showers
Toilet
Armorer
Down

officers' room should be provided, if possible, in addition to battery club rooms.

Harness should be near stables; part on heel posts; balance on second floor. It is well to provide a workshop with a room for tools and spare parts and supplies.

Buildings as indicated in this plan can be built at a cost of $20,000 to $30,000.

Of course, many times that amount may be expended; but this will provide an excellent plant.

The riding-hall, if built with only 80 feet in clear, can be built of cheap construction, 150 feet long, for $10,000, and may be added to when funds are available. A good dirt floor with cinders or tan bark will furnish a fine space for riding instruction and also be a fine place for standing gun-drill, subcalibre practice, pistol practice, etc.

Some place must be provided for standing gun drill and its development into even a very small riding-hall will serve both purposes better than to provide a room with floors to be used either for gymnasium or dancing, as is done in many infantry armories.

Every situation, of course, will call for a little different arrangement. The subject has been discussed with many officers, and an attempt has been made to incorporate the features which their experience has found most necessary, with the hope that these plans may contain a few suggestions of value.

Canvas Pockets in Battery and Store Wagons

BY SERGEANT GEO. A. WATSON. FIELD ARTILLERY. U. S. A.

THE packing and unpacking of the battery and store wagons is no small item in connection with our annual inspections. The necessity, which sometimes arises, of going to the bottom of one of them for some article taxes the patience of everybody. Why would it not be practicable to arrange canvas pockets along the sides for the smaller but heavy articles and have bags, built on the principle of baseball bat bags for articles like handles, etc.?

Improvements in Subcalibre Cartridge

BY COLONEL GEORGE A. WINGATE, SECOND FIELD ARTILLERY, NATIONAL GUARD OF NEW YORK

IN the October-December, 1915, number of THE FIELD ARTILLERY JOURNAL there was an article upon an inexpensive device for using 22-calibre cartridges for subcalibre work, in which is referred to the subcalibre cartridge devised by Lieutenant Colby.

In using the 30-calibre subcalibre cartridge with service ammunition indoors, two difficulties were experienced:

(*a*) The ammunition was so powerful that it cut away targets and backstops.

(*b*) Shots could only be spotted by having a man examine the target and point out the hit, which required a cessation in firing.

Lieutenant Colby's device overcame both of these difficulties.

There was a further defect in the subcalibre cartridge, in that having no fuse ring no drill could be given in setting the corrector, and cannoneers Nos. 3, 4 and 5, and to a large extent No. 2, received no instruction during subcalibre practice.

Lieutenant Colby's device has been modified and perfected to overcome the crudities of original construction and the objection in regard to the lack of fuse ring and inability to instruct cannoneers.

The device consists of assembling a United States Ordnance Department drill cartridge for three-inch gun and a United States Ordnance Department gallery practice rifle barrel, Model of 1903. The base of the drill cartridge was unscrewed and bored out in a special chuck to fit the thread on the rear end of the gallery practice rifle barrel. The shoulder on the rifle barrel was cut back and the rear end of the barrel faced to come flush with the base. A lock nut plate, cut out to conform to the shore of the rifle barrel, was attached to the inside face of the drill cartridge base by three screws to prevent movement of the rifle barrel. Three inches of the front end of the rifle barrel was cut off to conform to the length of the drill cartridge, and the front end of the rifle barrel was turned down for a distance slightly in excess of the distance between the point of the closing cap and the the front end of the drill cartridge to a diameter of ⅝ of an inch, and a hole bored in the cap to the same dimension, after which the gallery practice rifle barrel was screwed into the subcalibre cartridge base, fastened in place by the lock nut plate, the base screwed into the drill cartridge, and the cap of the drill cartridge screwed into place in the front end of the drill cartridge. All work was done from the axis of the bore of the subcalibre rifle, as it was found that the outside dimensions of the barrel were not always true to the axis of the bore.

This device has sufficient accuracy so that it will shoot true no matter how placed in the bore of the piece, and the fuse can be set to enable all the cannoneers to participate in the drill. The cartridge holder body provided with the gallery practice rifle is used as issued, the ammunition being the 22-calibre spotlight cartridges, manufactured

commercially, the bullet of which contains a small magnesium explosive charge, which, when used against a wooden target covered with sheet iron, gives an observable flash under conditions where artificial light is used, and a small puff of smoke under daylight conditions, enabling observation of fire to be made, and adjustments of fire to be based thereon. A sufficient number of cartridge holders are provided and are loaded by an extra cannoneer, who loads them with the spotlight cartridges and places them in the chamber of the rifle barrel after replacing the cartridges in the caisson. By the cannoneers using care to keep their hands on the base of the cartridge in handling it all of the members of the gun crew can perform their usual functions in the team.

By building the target in sections, those in the rear slightly higher than those in front and placed about two feet apart like the usual terrain boards, and painting a landscape on the target, overs and shorts may be sensed with good results. Targets of character proportions may be placed upon the landscape at any desired point by easily devised methods, so they will fall off when hit.

The mechanical work in making the change in the cartridges in which extra caps and extra bases purchased with the organization's funds were used, was done by a commercial house. The original cost, because of the necessity of making special chucks and tools was somewhat high, but at the present time the work can be done for the following sums:

Making alterations	$9.40
Extra cap	.24
Extra base	2.00
Gallery practice rifle barrel, Model 1903	1.67
Ramrod	.20
Cartridge holder body	.22
Total	$13.73

Two or possibly three cartridges are needed for each gun, and at least half a dozen cartridge body holders are required.

German Aviation

BY CAPTAIN NELSON E. MARGETTS, THIRD FIELD ARTILLERY

LE TEMPS, a popular Paris daily newspaper, published the following information about the German aviation service which was furnished by the mechanician of an Aviatik recently made prisoner by the French:

We have some excellent air-machines. My mechanician who has

been for six months in the same squadron has not seen a single apparatus changed on account of wear and tear nor has he seen a single breakdown of a motor. The Taubes, the invention of the engineer Rumpler or of the aviator Jeannin are in disfavor, and even before the war the military authorities had given preference to the biplane.

We have several sorts of aeroplanes of combat. One of them is immense and is propelled by two motors which give it a speed of a hundred and thirty-five kilometres an hour, or over eighty-five miles; it is armed with two machine guns, one in front and the other in rear. This type of apparatus has not given the results that were expected of it and has not been constructed on a large scale.

The aeroplane of combat which is most in favor at present is the Fokker, an aeroplane constructed by a Hollander who has been established for a long time at Johannisthal. It is a monoplane which may be compared to the Morane, propelled by a Gnome motor of eighty or one hundred horse-power and thanks to its lightness realizes a speed of one hundred and sixty kilometres an hour or one hundred miles. It does not carry any load and is armed with a machine gun which fires between the blades of the propeller. This apparatus is now constructed at Schwennigen, the Hollander Fokker having left Johannisthal for Schwennigen some months before the war. His first attempts were not successful and did not receive recognition by the Minister of War until recently. These new aeroplanes of combat are not grouped in squadrons but are sent to the front alone under the direction of the aviation corps.

Harnessing Green Horses

BY MAJOR H. M. BUSH, 1st BATTALION, OHIO FIELD ARTILLERY. BRIGGSDALE. OHIO

IN using horses gotten from everywhere for purposes of our work in the Militia it has been noticed that almost all of them when tied to the wheels for harnessing will drop their heads. If the collar is on and not held by the strap the result is painful to the horse and sometimes results in a lot of trouble. For the same reason that Captain Ennis gives in his article in THE FIELD ARTILLERY JOURNAL, October-December, 1915, an order was issued in this battalion two years ago directing that the collar be not put on until after the horse had been saddled. Then the strap was to be fastened immediately. The results have been very gratifying when we have had to harness green horses.

* * * * *

Why do the Allies' horse-buyers select horses with high withers and absolutely reject horses which conform more closely to our specifications?

They are buying about 100 a month here and we are picking up some mighty good bargains in their rejects.

Changes in Field Artillery Equipment

THE War Department has recently ordered some important changes in the equipment of various batteries of the regular establishment.

Battery A, Fifth Field Artillery, on its relief from El Paso, will turn over to the Fourth Field Artillery its animals and draft equipment. One battery of the Fourth Field Artillery will then be armed with the 3.8-inch howitzer. Battery A of the Fifth, on its return to Fort Sill, will be provided with motor traction, tractors for the gun sections and trucks instead of additional caissons. On arrival at Fort Sill of sufficient motor traction, one other battery of the Fifth will ship its animals and draft equipment to the Fourth Field Artillery, in which another 3.8-inch howitzer battery will be organized.

The battalion of the Fourth, already under orders for Panama, will take with it the youngest mules and newest equipment in this whole mountain regiment. It will have wholly pack transportation.

These changes will leave in the United States but one battery of mountain artillery. This battery will be maintained for experimental purposes. The surplus matériel will be turned in, and the spare mules will be utilized in the various activities of the Quartermaster Department.

The matériel to equip a battalion as a 4.7-gun battalion has been shipped to Honolulu for the supplementary use of the First Field Artillery which is armed with the 3-inch gun. Motor traction has also been provided by the Ordnance Department for this matériel.

Compilation of Schmid's Tactical Handbook

H. Schmid's Tactical Handbook (Taktisches Handbuch, H. Schmid) 15th Edition, Vienna, for the year 1916, has just appeared on the market and contains in its first pages a succinct compilation of the more important lessons of the present war. While perhaps somewhat premature these lessons are based on the actual experience of the Austrians against the Russians, Servians and Italians and are for this reason instructive. The following is a translation of the compilation which is given complete as having very general artillery interest:

COMBAT

Insignia of rank to be covered in combat.

Leaders not to differ conspicuously from subordinates in uniforms.

Orders clear and precise; clear statement of mission.

Strive to partially envelope the hostile supporting points by threats from flank and rear even with inferior forces of infantry and cavalry.

Be sparing of ammunition.

Take the greatest care against surprises in villages.

Optical signalmen to be well covered from hostile view.

Enemy has sought to deceive with white flags and cloths, therefore do not cease firing until weapons have been thrown away. Enemy also uses our uniform. Be careful.

Apply the regulations for the service of security on the march and at rest.

INFANTRY

Combat reconnaissance: at first by patrols; when the enemy is in position then by *very thin skirmish lines*, about 2 platoons per battalion with 10 paces interval between skirmishers.

Patrols to reconnoitre terrain, roads and bridges as well as enemy and to send back information at once.

Movements in hostile artillery fire: very *thin lines* with 500 to 600 paces distant.

Attack: After thorough reconnaissance, advance in *very loose* skirmish lines. Flanking positions in front or to one side of the frontal position, as well as weaker advanced lines must be thoroughly reconnoitred and taken from the flank if possible.

Detachments in front to *entrench at once*.

A slow and well considered advance, proper fire discipline, slow firing, not too hasty in fire surprises.

Reserves: Bring forward by collecting them to the front in *small groups and thin lines*.

CONTINUOUS SECURITY OF THE FLANKS also after occupation of the hostile position.

Keep up connection of units by telephone as far as possible. Keep oriented as to the situation of adjoining units.

Frequent reports of the situation. Trustworthy orderlies.

Defense: Sunken trenches to the depth of a man, covered by the minimum parapet, screened and on the slope toward the enemy.

Artillery support. Dummy works.

Every man to have an entrenching tool, longhandled preferable. Officers and noncommissioned officers must be instructed in the handling of explosives and means of ignition.

Combat in woods: Observation of the trees since hostile riflemen or machine-guns are frequently installed in them, security at audible distances, order, maintenance of *objective* and greatest *silence*.

High lying shrapnel fire clears out tall timber at the edge of the woods.

Repulsing cavalry attacks: Open fire as early as 800 paces. Retreat arranged in small units alongside one another. Security of flanks.

MACHINE GUN DETACHMENTS

Rapid occupation of the position, intrench, dummy works.

Digging tools for each man, always provide head and side cover. Sticking it out is better than a meaningless withdrawal. In case of final retreat one gun at a time.

Choice of fire position. Keep away from objects and corners of woods, also avoid setting up in small clumps of woods. Guns at least 50 paces apart and not the same distance to the front.

Fire and ammunition echelon, the latter to be in open ground at least 1000 paces *to the rear*.

Support at least one infantry platoon, which also furnishes connection to the rear echelons.

Tactical employment: In attack, first of all, on a *flank* with cover, single guns on a broad front, advance successively using the ground skillfully. Best results at 1000 paces, a closer advance brings too many casualties.

In consequence of their accuracy of fire and effectiveness it becomes in a measure the duty of machine guns to supervise the field of combat in front and on the flanks.

Where there is no field of fire and, finally, at night, machine guns with the reserve.

CAVALRY

Accustom the horses to camp in the open and to field forage.

Require fewer rapid gaits as compared with long quiet movements from place to place.

For the rider especially *training* in the use of *fire arms* is essential.

Horsemen must be drilled to *fight on foot* and, therefore, to *entrench rapidly*.

Charges are of no importance.

Be careful in pursuit of hostile horsemen on account of fire surprises.

ARTILLERY

Careful preparation and skillful use of ground. When possible concentric and flanking fire.

Field howitzers very useful against covers in spite of lesser ranges,

therefore employ the terrain for this purpose and strive for flanking fire.

Scanty observation and overhasty opening of fire has often resulted in our troops firing upon each other which must be avoided under all circumstances.

Shrapnel fire often too high a bursting point, consequently diminished effect.

Target reconnaissance and fire observation especially important, therefore send own reconnoitrers suitably far to the front (avoid observing stations too far to the rear as they are generally worthless).

Church towers draw artillery fire.

Hostile batteries are generally concealed, can be discovered only by creeping patrols and aviators.

A covered artillery position for yourself is the rule, but not too near to the cover, *guns with increased distances*, resulting in batteries being frequently employed singly in order better to utilize the ground.

A common, strict fire control in the unit prevents wastage of ammunition. Intrench, even in covered positions, and a free use of screens and dummy works.

The Russian heavy army artillery (10.6 cm. gun) is effective to about 10 km. and the 7.5 cm. field gun to about 6 km., therefore infantry must be prepared for a surprise fire at these distances. Consequently reconnoitring and security patrols to the front and side.

COMBAT IN STONY GROUND

Especially difficult because intrenching with the spade is impossible and the hostile fire effect, especially of the heavy artillery, is very much increased by the splinters.

Covers are set up in first order with sand bags and only where these are not obtainable will stone piles be erected; if the latter are suitably strong they will protect against infantry fire at least. Installation of traversers highly important.

When possible and explosives are available, dig down. Quarrying tools and explosives play a great rôle.

Utilize corrugated iron.

Cellars excavated in slopes at least 3 meters under the firm ground protect against artillery fire.

Make a free use of mine throwers.

War Department General Orders Issued in 1915 Relating to Field Artillery

COMPILED BY MAJOR WILLIAM M. CRUIKSHANK, ADJUTANT GENERAL'S DEPARTMENT

EDITORIAL DEPARTMENT

Appreciation

THIS issue is marked by the resignation of Captain Marlborough Churchill from the position of Secretary-Treasurer of THE FIELD ARTILLERY JOURNAL. Captain Churchill has filled that position for the past last year and a half, and under his management the Journal has increased enormously in circulation and influence. Part of this increase is fairly attributable to the growing interest in things military in this country, an interest that has shown itself in the Plattsburg camp, in pending legislation, in the tone of the press, as well as in THE FIELD ARTILLERY JOURNAL. A large part of this increase has been due to the personality and persevering labors of Captain Churchill. He has introduced the Field Artillery to many persons who hardly knew that such a thing existed, and an introduction is all that is necessary, for the Field Artillery has a personality itself that tends to make friends. Although saddled with a great deal of work and travel in his official duties as an Inspector-Instructor of a Militia district, he has given to the service of the Field Artillery much of the time that should belong to an officer personally for rest and recreation. Nobody who has played polo enjoys continual afternoons of office work; and nobody who has enjoyed life likes to devote his evenings exclusively to a mechanical typewriter.

Captain Churchill is recuperating as an observer with the French armies.

Field Artillery Legislation

IN its comments on prospective legislation this Journal has confined itself strictly to the provisions affecting the Field Artillery. Bills for the National Defense have been reported in both Houses of Congress. It is now possible to survey the

field with a definite understanding of the probable limits within which final legislation will lie.

The Senate Bill provides for twenty-one regiments of Field Artillery, comprising 126 batteries. These batteries are to be organized into two and three battery battalions, depending largely on whether they are armed with light or heavy guns.

The House Bill provides for a corps organization of the Field Artillery at large, comprising twelve colonels, and other officers proportionally, and 108 batteries. No regimental organization is fixed, and it is evident that should any provisional organization be adopted it must average three battalions of three batteries each to a regiment. Such a regiment is in reality a brigade. In fact, it would occupy more road space than a cavalry brigade; but the main objection to it must be that it is provisional. In this connection, Major General T. H. Bliss, Assistant Chief of Staff, stated before the House Military Committee:

> Temporary or provisional regiments—that is to say a more or less haphazard aggregation of batteries—lack the cohesion, morale, coordination, and efficiency which can only result from the individual responsibility and leadership that pertain to permanency of position in a commander and his staff. A corps organization might easily result in a lot of dispersed batallions in time of peace without any adequate head for the training and their combined action in war.

General Bliss advanced the theory that regimental organization may not have been provided for because of the difficulty in exactly prescribing two or three battery battalions on account of the varying calibres of field guns. It seems incredible that the House committee should have omitted the regimental organization except on the advice of some authority on field artillery. The only more incredible thing would be to discover that some authority on field artillery had advised the omission.

Both the House and Senate Bill provide for the retention of the present plan of promotion, by means of which each arm

retains the services of the trained specialists in that arm—for this principle the Journal has contended, in the interest of what it believes to be the efficiency of the army as a whole.

The Question of Traction

ONE of the developments of the Great War has been a very extensive use of motor traction in Field Artillery as in other arms. In the first great clash of the European powers every unit of motor traction that was available and could be used, was used. The same thing applies of course to steamers, railroads, and to animals. But the employment of automobiles of various types made its impression on professional as well as on civilian minds as the new thing in the transportation problem of a tremendous war.

The evolution of motor use during the ensuing months is interesting, and from it we can draw many lessons. But in a way the vital feature of the use of motor-traction insofar as it concerns this country is that first frenzied phase. What this country must now consider is the method of taking the first shock of an attack. The resourceful American mind can be trusted to figure out the later phases of almost any war.

In the event of war the regular Field Artillery as at present organized would be properly equipped with traction to fulfill its functions. It is to that end that batteries are kept at practically war strength, and that expensive animals are maintained. As a result of tests by the Ordnance Department and by the Field Artillery Board, elsewhere described in this number, the heavy field artillery is being equipped with efficient motor traction to improve its mobility.

But the regular army would furnish only a small proportion of the Field Artillery needed. Foreign nations are making effective use of every piece of ordnance that they can resurrect; and there is vastly more ordnance, old and new in the United States, than there is trained personnel to handle it. It would necessarily be used, by the Militia or by volunteer troops.

It must be moved into position, and very possibly out of position.

The horse supply of the country is depleted and it would be difficult to equip a great number of batteries with suitable draft animals, trained to the peculiarities of artillery draft. The Militia Division realizes this, and the militia realizes it. There have been many informal tests of motor traction by militia batteries. An account of one appears in this number of the Journal and it is rather evident that it is the same test which elicited this official decision:

The following indorsement by the Chief of Ordnance upon a report of transportation of the 3-inch field artillery matériel by means of motor trucks is approved by the Secretary of War:

"This test appears to have been made for the purpose of determining whether the 3-inch field artillery matériel can be hauled over smooth roads by motor trucks. It is noted that the running time for 283 miles was about twenty-two hours, which is an average of about thirteen miles per hour, so that it is probable that part of the distance must have been traveled at eighteen or twenty miles per hour.

"In making this test, the practicability of maneuvering off of good roads and over all sorts of difficult terrain was evidently not considered, although failure of motor traction to meet this need is the principal reason it has not been adopted.

"This matériel was not designed for being hauled at these rates of speed, and the points shown by the test were already known to this Department.

"It is noted in paragraph 8 that the test was made with the approval of the Adjutant General of the State and that it involved no expense to the State or to the general Government. However, there was considerable wear and tear on the matériel due to the speed at which it was hauled, and it is thought that this was unnecessary, as no useful information was obtained. Tests of this character have been made by the Ordnance Department or the Field Artillery Board, or by organizations as directed by the War Department, and it is thought that they should be approved by the War Department before being undertaken."

The approval of the Secretary of War must be obtained before such tests are undertaken.

Certainly the Ordnance Department can approve no experiments which are deleterious to matériel. But it is hard to censure an enthusiastic organization for attempting to solve the eventual difficulties of the traction question. It is hoped that in view of extensive tests made and being made the War Department may soon be able to authorize traction for militia batteries by some simple variation of a commercial tractor or truck.

Cooperation

THE FIELD ARTILLERY JOURNAL is published under rather trying circumstances. Its office room is held by the courtesy of another Corps. Its office force consists of an editor and a clerk, both working after the regular War Department hours, and a most interested and willing publishing house cannot appreciably lighten the office routine.

It is not believed to be possible or desirable to secure the detail of an officer on the active list as editor. Such a detail would make the Journal a semi-governmental publication, instead of a medium of expressing the views of the field artillery arm of our organized forces. And the danger of employing a retired officer, or a militia officer as an editor would be the inevitable one of his losing the ever changing viewpoint of the arm he presents.

What the Field Artillery Journal should eventually be is a popular priced monthly magazine, financially on its feet, and able to maintain private offices, with properly paid clerical assistants who can take all work except the necessary supervision from the shoulders of an officer editor who has his official duties to perform.

To do this the Field Artillery Journal must have money.

The two normal channels through which money reaches a magazine are the subscription list and the advertisement list.

The subscription list is in a very healthy state. It has more than doubled in the last few years, and is constantly growing.

Its purely magazine appeal has brought in civilian subscribers, as has the wave of interest in military matters which has swept the country. The subscription list among militia officers is large, and several states boast an 100 per cent. membership in the Association. Only 24 field artillery officers of the regular army are not subscribers.

The income from advertising is not so satisfactory. An especial effort was made last year to establish advertising on a firm basis. But all advertisers are cautious about advertising in a new magazine unless they are persuaded that their advertising will pay. Purchasers are the proof they want, and they want to know who sends them their purchasers. All of our advertisers are patronized by field artillery officers. And an officer purchasing insurance or sporting goods, books, breeches or equipment, automobiles or typewriters or whatever he may purchase, can help his arm by the mere mention of THE FIELD ARTILLERY JOURNAL. There are moreover some officers so placed as to able to personally influence the placing of advertisements.

Some officers are energetic in this respect and some are not. Just so some officers are willing and regular contributors of articles and information, and others are as silent as the Sphynx. The greater number of contributors the Journal has to choose from, the better and more representative publication it will be.

The coöperation of all members of the Field Artillery Association in the business of publishing a Journal devoted to its interests, is of the first importance.

The Shoemaker and His Last

The January-February 1916 issue of the *Journal of the United States Artillery* contains an article, "The Use of Heavy Mobile Artillery in Connection with Our Seacoast Armament," which should be read by every field artilleryman. Its author advocates provision for the land defense of coast fortifications by means of heavy mobile artillery, adapted to the fire

control system of the coast artillery and manned by coast artillerymen.

The naval fiasco at the Dardanelles has magnificently justified the principle of the Coast Artillery Corps. A second class power there defeated the purposes of the greatest navy in the world. Before that dramatic clash between sea power and land fortifications there were those who openly doubted the value of coast artillery. Dead men and sunken ships was the vicious answer.

The necessity of mobile troops to resist the attack on seacoast fortifications by both land and sea was equally demonstrated by the second and bloodier phase of the Allies' Dardanelles campaign. Only a complete, properly organized mobile army could have held Gallipoli against such a desperate attack.

As the best defense of mobile artillery against infantry fire is infantry fire, so the best defense of coast artillery fortifications against an efficient mobile army is an efficient mobile army.

It is not the policy of this Journal in its editorial pages to take up in controversial spirit and answer an article in a sister Journal. But it is the duty of THE FIELD ARTILLERY JOURNAL to enunciate the principle that field artillery, light and heavy, both for coast defense and the defense of interior lines, is the proper type of artillery for operating with a mobile army.

Ensuing Publications

A NEW edition of the Drill Regulations for Field Artillery has been prepared by the Field Artillery Board, submitted to the General Staff, and will shortly be published. The draft was passed upon by the officers of the battalion of the 3rd Field Artillery stationed at Fort Myer, and is understood to have received enthusiastic approval. It is of course too early for any drill regulations to take advantage of the lessons of the European War, but this new edition contains radical changes. The dismounted instruction has been remodeled after the infantry

drill instruction which all recruits receive and the mounted instruction has been rewritten.

These regulations will probably be published in two volumes, under the head of Service Regulations for Field Artillery (Horse and Light). The first volume will consist of General Principles and Definitions, Dismounted Instruction, Mounted Instruction, Ceremonies and Care of Equipment. The second volume will contain Firing Instructions, and Artillery in the Field.

THERE has been in the past some misunderstanding as to the publication of a Gunners' Instruction Pamphlet. THE FIELD ARTILLERY JOURNAL undertook the publication of such a pamphlet, but withdrew on learning of an actual publication by the Second Field Artillery, N. G. N. Y., which reimbursed the Journal for its preliminary expense. This militia regiment now stands ready to supply all demands for such a pamphlet, and will issue a supplement covering the 1905 breech block if there appears to be sufficient demand for it.

DR. GERALD D. GRIFFIN, Veterinarian, 3rd Field Artillery, Fort Myer, Virginia, has published the words and music of "The Red Guidon." It is belived that another edition will soon be ensuing, and that Doctor Griffin will be led to publish certain of his other songs, already so well known throughout the Field Artillery, that comment on them is unnecessary.

BOOK REVIEWS

EMPIRE AND ARMAMENT. The Evolution of American Imperialism and the Problem of National Defense. By Jennings C. Wise. G. P. Putnam's Sons, New York, 1915. Price, $1.50.

In this timely volume Professor Wise traces from official documents the growth of American imperialism, and demonstrates that it is due to the enlargement of spheres of political control, dominated by the spirit of commercial expansion. The first naval force was for "the protection of . . . commerce . . . against the Algerine corsairs." Then in 1799 we looked "to the possession of the Floridas and Louisiana, and . . . squinted at South America." Despite the declaration in the Monroe manifesto we have interfered almost everywhere. The invasion of Florida, Louisiana, Japan, and Mexico, violations of the sovereignty of Costa Rica, Cuba, Guatemala, Honduras, Hayti, Nicaragua, and San Domingo, the Kossuth and Koszta episodes, the Ostend manifesto and the Venezuelan incident were all imperialistic acts. Meanwhile we have acquired territorially Louisiana, Florida, Texas, Mexican provinces, Alaska, Hawaii, Samoa, Philippines, Porto Rico, Guam, Marianne Islands and Panama. It is correct then to class the United States as "unmilitary and militant."

Professor Wise shows that adequate defense is not militarism, and considers the important question as to what defense is adequate. The regular army should be increased to 200,000, with surplus officers for detached duties and instruction, supervised by a Council of National Defense. Useless posts should be abandoned and troops so distributed as to defend important points and so stationed as to be able to have a maximum of drill throughout the year. He classes the organized militia as ineffective for lack of trained officers and of sufficient drill for men. It could not be kept to full strength in wartime and cannot be properly controlled by the Government.

Illuminating are the comments on militia in past wars.

Washington, after seven years' experience with nearly 400,000 men, declared: "If I was called upon to decide upon oath whether the militia had been most serviceable or hurtful, upon the whole I should subscribe to the latter."

In the War of 1812 the United States employed 527,654 troops whose incompetency as an army is known. In 1814 there were 235,839

men in the field, against 16,500 British troops defending Canada and operating in the United States. Although Jefferson declared that "mere marching" would carry the American army to Quebec, yet that year a detachment of British troops occupied and burned part of Washington City.

This volume merits general circulation and careful reading.

A. W. G.

THE AFTERMATH OF BATTLE. With the Red Cross in France. By Edward D. Toland. Introduction by Owen Wister. Macmillan Co., New York, 1916. Price, $1.00.

This volume relates the experiences of an American volunteer who served in hospitals in the early days of the war, both in Paris and on the battlefront. This business man found surprising the confusion and mal-administration attendant on these first days. He took them too seriously not considering that the call to arms of the flower of France, and the safety of the nation made countless urgent demands on the authorities.

Personal elements appeal directly to mind and heart, and as the story is told with frankness it is pathetic and painful by turns. Possibly too much stress is laid on hopelessly septic cases, brought to Paris after from three to five days of exposure where they fell, without food or water.

One is struck by the absence of despair, of discouragement or even of complaint on the part of the stricken men. Senegali and German, French and Briton offered in turn superb examples of calmness and courage. Now it was a Black Watch Scot who, with a bullet through his chest, folds up his kilts with one hand and says: "See that they are not mussed, will you?" A German youth kisses the hand that covers with a blanket his bare, freezing legs. A delirious old French captain cries: "Come on, boys, all together! Forward, forward!" Then a French priest beseeches care for neglected German wounded.

With the Harjes Ambulance Corps splendid work was done in the field, within zones of fire. Of 1,600 prostrate wounded in one day, 250 were handled by the Harjes ambulances. Altogether it is a record of helpful work of which America may be proud. Corroborative stories are told of German excesses, which one trusts are most exceptional.

Of artillery he says: "The artillery used to unlimber and hide under the trees during the day and do their marching by night, on account of the German aeroplanes. . . . The French batteries are splendidly placed. The guns are hidden by curtains of brushwood,

etc. They are pointed very high in the air, an angle of 40º giving them their maximum range. They are sighted by knowing the angle made by a fixed point on their flank, their own position and the enemy's battery. . . . From each gun runs quite an elaborate telephone system; it connects with everything, even wireless on the aeroplanes. This battery had seven scouts in their front, who telephone how their shells are going and correct their fire. . . . A battery of 120 mm. long was wonderfully hidden in a wooded swamp. You could stand within 50 yards of it and not know there was anything there. It had been in position three months without the Germans finding it."

Of German astuteness he says: "Lieutenant Kula told me that on three successive days, although they changed position twice, the Germans opened fire on them accurately. . . . One of the men noticed a dead German lying on the field some distance and thought that he saw him move. They investigated. He was not dead nor wounded, and underneath him was a telephone. There he had been lying three days correcting the fire of his friends." A.W.G.

STUDIES IN MINOR TACTICS, 1915. Press of the Army Service Schools, Fort Leavenworth, Kan., 1915. Price, postpaid, $0.50.

The authors of this book are to be congratulated on a very readable, interesting, and valuable addition to the literature of the profession. As far as possible the central idea of the work, namely, to make the situation continuous through a series of problems, has been carried out. This greatly increases the inexperienced student's interest in the work, without in any way impairing its tactical value.

The problems in artillery are as well-written and as well worked out as any problems can be under the system now in force at the service schools. As is however very clearly explained in the preface, there cannot really be any artillery minor tactics for non-artillery officers. The only minor tactics which affect artillery are those movements of the guns which are usually familiar only to officers of that arm. What is needed is a special course or sub-course in artillery tactics for non-artillery officers in which the subject would be developed to the exact extent useful to commanding officers of mixed troops, something analogous to the present engineering course at Leavenworth. Such a course would be in no sense minor tactics at all. By its very nature it would be a branch of the art of war utterly foreign to the duties of an infantry subaltern.

These remarks must not, however, be construed as any reflection

on the excellent text under review. As all that the ordinary officer knows of artillery is now learned from problems in minor tactics, the field artillery is to be congratulated on having the subject as well-discussed as it is in this little book. C. L. H.

MILITARY TOPOGRAPHY AND PHOTOGRAPHY. By Second Lieutenant F. L. Carlock, Seventeenth Infantry. George Banta Publishing Co., Menasha, Wis. Cloth binding, 310 pages. Price, postpaid, $2.50.

This book is a complete treatise on military map reading, topographical and photo-topographical surveying, military sketching, and elementary and aero-photography.

The whole book has been made simple and practical by giving the explanations of the theories and principles involved in clear descriptions: mathematical discussions have been reduced to a minimum. The text is copiously supplied with diagrams and illustrations.

Military map reading is presented in a new, precise, clear, and complete way. All modern control and sketching work for both limited and extended military topographical and photo-topographical surveys are thoroughly covered, while rapid military sketching is also presented to meet both instruction and field service conditions. The whole process involved in elementary photography is carefully explained as preliminary to practical work in photo-topography and aero-photography.

Military photography for topographical and tactical purposes has not yet been used to any great extent in our army and the subject may be said to be entirely new. No general textbook has heretofore treated of it in this country. The great use, however, to which it is being put in the present European wars, proves the great importance of military photography in future wars.

In a chapter on special problems full instructions are given for the running of levels and control traverses, base line measurements, angle measurement in triangulation work, the taking of Polaris and Sun azimuths, the rapid determinations of latitude, longitude, and azimuths, etc., etc. By placing these problems in a special chapter, the main text has been kept clear of technical discussions.

The conventional signs for U. S. Army maps are included in the book. The appendices contain tables of English and Metric weights and measures and their conversions, of trigonometric formulæ and functions, of stadia reductions, of logarithms, and of values of seconds in meters of latitude and longitude.

WEST POINT IN OUR NEXT WAR. By Maxwell Van Zandt Woodhull, A.M., late Lieutenant Colonel and Assistant Adjutant General 15th Army Corps and Army of the Tennessee, Brevet Brigadier General United States Volunteers. G. P. Putnam's Sons, New York. Price, $1.25.

This book draws its name from General Woodhull's proposition to enormously expand West Point, and to draw therefrom the officers to train a large army obtained by conscription.

His position is evidenced by the following quotation: "Let us give up the present fruitless method of recruitment of the Regular Army, and accept the necessary and the inevitable policy of conscription, which rests upon the principle of the natural obligation of every citizen to serve his country in peace or in war, for the creation and the maintenance of our armies and our reserve armies. Conscription is the most democratic, the fairest, the most equal, and the only logical method of raising and maintaining modern armies."

THE BOMBARDMENT OF FORT SUMTER, 1861. By Oliver Lyman Spaulding, Jr., Captain 4th Field Artillery, U. S. Army. Reprinted from the Annual Report of the American Historical Association for 1913, Volume I. Pamphlet. No price given.

Captain Spaulding was at one time editor of THE FIELD ARTILLERY JOURNAL, and is an officer who has written largely of the activities of his arm.

This short historical study of one of the most dramatic moments of our history is careful, complete, and yet eminently easy to read. It is a pleasure to find, among the enormous masses of publications which see the light in this age of the busy printing press, a modest pamphlet presenting a professional study by a real authority.

THE SERVICE OF INFORMATION, United States Army. By Brigadier General George P. Scriven, Chief Signal Officer of the Army. Government Printing Office, 1915. Government publication.

This circular, issued by the Signal Office, is a complete and timely compilation of the history, organization, and activities of the Signal Corps. At such a time as this, when the whole country is interested but uninstructed in military matters, the publication of such an authoritative document must be to the greatest interest of any arm or corps.

This book includes the most careful notes on the organization of the telegraph troops and the flying corps of all the principal foreign armies. These notes alone would establish its value. It is doubtful whether there has ever been published in this country such a complete study of the activities of any particular corps in foreign armies.

ROADSIDE GLIMPSES OF THE GREAT WAR. By Arthur Sweetser. The Macmillan Company, New York, 1916. Illustrated. Price, $1.50.

Here is a record of personal experiences during the great German drive on Paris. The author, in the first mad days of the war, worked his way north to the west of the battle line, and succeeded eventually in completing a bicycle trip from the Belgian border to Paris, passing through both hostile lines. He got out of this trip some very vivid impressions and a German pass to Paris, which may some day be a document of considerable historic interest.

Professional readers of this book will envy the author his opportunities for observation, opportunities which are perhaps inevitably denied them. It has been stated as a curious fact that the proportion of professional soldiers privileged to see a part of this great world war, is much smaller than the proportion of other American citizens who have at least glimpsed it.

SELF-HELPS FOR THE CITIZEN SOLDIER. By Captain James A. Moss, 29th U. S. Infantry, and Merch B. Stewart, 5th U. S. Infantry. Illustrated by Lieutenant W. E. Larner, 5th U. S. Infantry. George Banta Publishing Co., Menasha, Wis. Price, $1.25.

This is a valuable introduction to things military for the uninstructed citizen, free from the many shop expressions that mean much to the initiate but are puzzling to the novice. It should have a ready sale in these days when interest in military matters is sweeping the country.

For the regular officer it is not without interest, as many old subjects are presented in a new and readable light.

Index to Current Field Artillery Literature

Compiled from monthly list of military information carded from books, periodicals and other sources furnished by the War College Division, General Staff.

Officers requesting information will please give the number of the entry and the date of the list. For officers on duty in Washington, D. C., a formal call is not necessary; a telephone call will be sufficient. When a book is called for, the title and author will be given in the language in which it is printed. The material here listed is not available for general loan outside of the U. S. Army.

Aerial warfare.—Description of a device for finding the range of an airship in an attack. Illustrated. (Journal of the Royal Artillery, August, 1915, p. 269.)

Ammunition—artillery—Great Britain.—Official specifications of shell and shrapnel types authorized for the artillery. (List of Changes in War Matériel, Issued September 1, 1915, p. 325.)

Ammunition—artillery—manufacture of.—Machining and assembling shrapnel cases. (Engineering, October 1, 1915, p. 333.)

Ammunition—European war.—The deficiency in the supply of ammunition for the British and Russian armies and reasons for shortage. From Militär Wochenblatt. (Journal of the Royal Artillery, September, 1915, p. 334.)

Ammunition—France—European war.—Information on the making of ammunition by private concerns in France. (Memorial de Artilleria, September, 1915, pp. 463-471. With cuts.)

Ammunition—manufacture of.—Organizing and equipping for fuze manufacture. Making the British detonator, Mark 100, fuze. (American Machinist, October 28, 1915, pp. 749 and 771.)

Ammunition expended in battle—artillery—European war.—Expenditure of ammunition, English side. Regarding use of ammunition in the present war by English troops, the following is published in the English technical papers: Consumption of ammunition per battery, amount expended around Nieuport and Ostend. (Kriegstechnische Zeitschrift, Nos. 5 and 6, 1915, p. 135.)

Ammunition supply—European war.—"The belligerents' munitions. Growing problems of Germany and her opponents in supplying arms." (The New York Times Current History, August, 1915, p. 944.)

Ammunition supply—Germany.—Germany against waste of ammunition. An article giving the essential points of a short manual of instructions recently issued to German gunners and published in The Temps, against the waste of ammunition. "Never fire unless the mark is worth while," seems to be the basis. (In Army and Navy Journal, New York, 1915. Vol. LII, No. 18, January 2, 1915, p. 568. U1.U7 v. 52.)

Ammunition supply—Germany.—The German ammunition supply. An estimate of the rate of production and expenditure during the war 1914-15. Estimates that the German factories are capable of turning out 50,000 rounds of field gun ammunition, and that the expenditure is something like 20,000 rounds per day. On July 1, 1914, it is estimated that Germany had 2500 rounds of field gun ammunition for each gun. (In The Army and Navy Gazette, Vol. LVI, January 16, 1915, p. 42, U2.A7 v. 56.)

Anti-balloon guns.—"The gun and the aeroplane. The difficulties and principles of aiming." (Scientific American Supplement, No. 2078, October 30, 1915, p. 276.)

Artillery—European war.—Comparison of methods and results of German, French and British artillery. (The Fortnightly Review, July, 1915, p. 111.)

Artillery—France.—Condition of French artillery immediately prior to European War, 1914-15. (Behind the Scenes at the Front. By George Adam. Filed D 640 A19, p. 18.)

Artillery—France.—Law of July 24, 1909, modified by the law of April 15, 1914, relating to the composition of the cadres and effectives of the active and territorial armies, with regard to the artillery, followed by instructions of April 16th and June 8, 1914. (Filed Envelope case—Artillery—France.)

Artillery—Italy.—Summary notes concerning the Italian artillery. (Memorial de Artilleria, August, 1915, pp. 272-275.)

Artillery—Italy.—Composition of the Italian artillery with 1402 guns. (Journal of the Royal Artillery, September, 1915, pp. 330, 332.)

Artillery fire—Spain.—Preliminary data for preparation of the fire of a battery. (Memorial de Artilleria, September, 1915, pp. 375-388.)

Artillery fire.—Discussion of the maximum range of high angle fire. With tables. (Journal of the Royal Artillery, August, 1915, p. 266.)

Artillery material—Great Britain.—New patterns of ammunition wagon and limber caissons. Descriptive notes on dimensions, weights and capacity. (List of the Changes in War Matériel, issued September 1, 1915, p. 310.)

Auto trucks.—"The motor-driven commercial vehicle. Interesting forms of farm truck tractors." (Scientific American, October 16, 1915, p. 344.)

Auto trucks—European war—Germany.—Outline of means for return of used war trucks to the general public. (Scientific American, September 18, 1915, p. 245.)

Coast defense—France.—Mobile artillery for coast defense. A Schneider gun train with two guns and an observation tower running on railway trucks. (Clipping from Illustrated London News, October 17, 1914. Filed Envelope case, Coast defense, France.)

European war—ammunition expended in battle—artillery.—Expenditure of ammunition on the English side. Regarding the use of ammunition in the present war by English troops, the following is published in the English technical papers: At the battle of the Marne the consumption per battery for one day was between 600 and 1000 rounds. In the engagements around Nieuport and Ostend on the 23rd of October, 1914, it is noted one battery of six guns fired 1800 shots. (Kriegstechnische Zeitschrift, Nos. 5 and 6, 1915, p. 135.)

European war—ammunition supply.—Behind the fighting line in France. Germany went to war with her technical services fully developed. Means taken by France to bring hers to full development. (Clipping from "Gazette de Lausanne," September 12, 1915. Filed Envelope case—European war—Ammunition supply.)

Explosives.—Observations of the properties of high explosives. (Revue des Deux Mondes, October 1, 1915, pp. 686-696.)

Explosives.—European war.—Information on the manufacture of explosives in France and Italy. (Memorial de Artilleria, September, 1915, pp. 459-462.)

Explosives—Germany.—Notes on the employment of liquid air as an explosive. (Memorial de Artilleria, September, 1915, pp. 510-511.)

Explosives—Germany.—Report on the modern processes of obtaining nitrates in Germany. (Memorial de Artilleria, September, 1915, pp. 505-509.)

Explosives—manufacture of.—"The use of cotton for the production of explosives." (Scientific American Supplement, October 23, 1915, p. 271.)

Field artillery fire.—"Correction of the height of burst of shrapnel." Abridged translation from the Memorial de Artilleria, May, 1915. (Journal of the Royal Artillery, September, 1915, p. 324.)

Field artillery fire.—Coöperation of aircraft in artillery fire. Methods in various countries. How information is transmitted to the battery. (Memorial del Ejercito de Chile, October, 1915, pp. 805-829.)

Field artillery fire.—Scheme for a rapid solution of field artillery firing problems. (Memorial de Artilleria, August, 1915, pp. 253-261.)

Field fortifications—Germany.—Pictures showing armored trench casemates for artillery in German lines at Champagne. (The Illustrated London News, October 16, 1915, pp. 481, 493.)

Field guns—France.—Picture of a heavy French field gun showing caterpillar wheels. (The Illustrated War News, October 6, 1915, cover.)

Fuzes—United States.—Description and plates of combination fuzes. "Explosives," by Major Edward P. O'Hern. (Filed UF860.O37. Pp. 264-265.)

Guns—France.—The French heavy ordnance pieces with tables of numerical data. (Mitteilungen, Artillerie & Geniewesens (M. A. & G.), Copy 7, 1915, pp. 575-578.)

Guns—Japan.—Manufacture of heavy guns by private concerns initiated. (Clipping from "Japan Chronicle," November 29, 1912.)

Guns—European war.—Tables comparing the field pieces, howitzers, and mountain guns used by the belligerents. (Memorial del Ejercito de Chile, September, 1915, pp. 756-760.)

Guns—European war—Austria-Hungary.—Views showing methods of assembling and firing a 30.5-cm. siege gun. (Scientific American, September 18, 1915, p. 251.)

Guns—life of.—Number of shots which can be fired without destroying the accuracy of gun. "Explosives," by Major Edward P. O'Hern. (Filed UF860.O37, p. 258.)

Heavy artillery—France.—Data on French heavy artillery matériel and projectiles. (Memorial de Artilleria, August, 1915, p. 270.)

Heavy artillery—Germany.—Notes on the effect of the 42-cm. type howitzers. (Memorial del Ejercito de Chile, September, 1915, pp. 725-732.)

Heavy artillery—European war.—Pictures of heavy artillery. A Skoda howitzer ready for action, and the big guns of three belligerents. Mounted on trains. (The World's Work, November, 1915, p. 81.)

Howitzers—Haly.—Illustrations showing type of heavy howitzers used by the Italian army, 1915. (The Illustrated London News, October 30, 1915, p. 552.)

Howitzers—Switzerland.—Field artillery howitzers, Krupp type supplied to Switzerland and Turkey; Schneider type supplied to Greece and the Balkan States. Pictures of. (Illustrated London News, November 21, 1914, p. 714.)

Howitzers—Turkey.—Field artillery howitzers, Krupp type supplied to Switzerland and Turkey. Schneider type supplied to Greece and the Balkan States. Pictures of. (Illustrated London News, November 21, 1914, p. 714.)

Labor and labor organization—Russia.—Munition supply. An order of the Commander of the Military District of Petrograd concerning strikes in munition factories. (Field Envelope Case—Labor and labor organizations—Russia.)

Map making.—Map making by direct photography. The Scheimflug multiple camera. "Photographic Maps. Methods of Producing Correct Charts with the Camera." Illustrations. (Scientific American Supplement. September 25, 1915, p. 200.)

Mechanical transportation—European war, 1914-15.—"Motor trucks and modern warfare." Increase of American exports, subsidy systems of the warring nations. Illustrations. (Scientific American, November 6, 1915, p. 398.)

Night operations—European war.—Marching at night by means of the stars. Need for increased use of night marches to avoid observation by aircraft. (Land and Water, September 11, 1915, p. 15.)

Observation of fire.—Questions regarding siege artillery. A study on observation of artillery fire. Methods of aerial observation for directing artillery fire by aeroplane, kite and kite balloon. (Rivista di Artiglieria e Genio, June, 1915, pp. 307-340.)

Ordnance—France—European war.—Mortars of 370-mm. and other heavy pieces built after the beginning of the war. Clipping from "Gazette Lausanne," September 12, 1915. (Filed Envelope Case—European War—Ammunition Supply.)

Ordnance—Germany.—The use of aluminum for ordnance manufacture in Germany. (Memorial de Artilleria, August, 1915, p. 264.)

Powder—United States.—Powder for the United States Army and Navy. How made, tested and kept. "Explosives," by Major Edward P. O'Hern. (Filed UF860.O37, 1915.)

Projectiles.—Means of detecting buried shells on French battlefields, European war. (Scientific American, November 13, 1915, p. 425.)

Range finders.—Description of a patent sighting apparatus with panoramic telescope, especially for anti-balloon guns. With cuts. (Mitteilungen, Artillerie und Geniewesens (M. A. &. G.) Copy 8, 1915, p. 736-739.)

Shells—United States.—Characteristics of high explosive shells. "Explosives," by Major Edward P. O'Hern. (Filed UF860.O37, pp. 261-264.)

Shrapnel—United States.—Common and high explosive shrapnels. Description and plates. "Explosives," by Major Edward P. O'Hern. (Filed UF860.O37, pp. 261-264.)

Shrapnel—United States.—"The Adjustment of Shrapnel Fire." The problems met and their solution. Illustrations. (The Field Artillery Journal, July-September, 1915, p. 513.)

Shrapnel.—Machining and assembling shrapnel cases. (Engineering, October 1, 1915, p. 333.)

Shrapnel.—"The chain-shot principle in shrapnel." Description of a new shrapnel shell. (Scientific American, November 13, 1915, p. 423.)

Siege guns—Italy.—Heavy artillery—305-mm. siege gun used against Austrian forts. Picture of. (The Illustrated London News, October 23, 1915, p. 521.)

Siege guns—Italy.—Making a bed for a giant gun. How the Italians mount siegeartillery for use against the Austrian Alpine forts. (The Illustrated War News, October 27, 1915, p. 9.)

Siege artillery fire.—Questions regarding siege artillery. A study on observation of artillery fire. Methods of aerial observation for directing artillery fire by aeroplane, kite, and kite balloon. (Rivista di Artiglieria e Genio, June, 1915, pp. 307-340.)

Transportation—ammunition—France.—Status of auto service for transportation of artillery ammunition; twenty-five autotrucks can carry 7500 projectiles, the daily supply for fifteen pieces. Need of increase. (Les Armées Française et Allemande. By General Maitrot, Paris, 1914, p. 71.—UA702.M23.)

Trenches.—Effect of high explosives on trenches. Pictures showing German trenches after French advance in Champagne, September, 1915. (The Illustrated London News, October 16, 1915, pp. 481, 493.)

Trenches.—Sight of a section of trenches before and after heavy shell fire. (Illustrated London News, October 2, 1915, p. 435.)

Trucks—France.—Description of a test to which the trucks for war use are subjected. (Scientific American, September 18, 1915, p. 245.)

Wire entanglements.—Specification of projectile patented for removing wire entanglements. With cuts. (Mitteilungen Artillerie & Geniewesens (M. A. & G.),—Copy 7, 1915, p. 605.)

Wire entanglements—European war.—Pictures showing wire entanglements used in the European War and some means of attacking. (The World's Work, November, 1915, p. 84.)

Wounded—European war.—Brief notice stating percentage of wounds caused by shells, bayonet wounds, etc. (The United Service Magazine, October, 1915, p. 108.)

Exchanges

LOANED TO MEMBERS ON REQUEST

* Archives Militaires, Paris, France.
Arms and The Man, Washington, D. C.
Army and Navy Journal, New York City.
Army and Navy Register, Washington, D. C.
Artilleritidskrift, Stockholm, Sweden.
Artilleristische Monatshefte, Berlin, Germany.
Cavalry Journal, Fort Leavenworth, Kansas.
Circular Militar Argentio, Buenos Aires, Argentine Republic
Dansk Artileri-Tidsskrift, Copenhagen, Denmark.
Flight, London, England.
Flying, New York City.
Forest and Stream, New York City.
Infantry Journal, Washington, D. C.
Informacion Militar del Extranjero, Madrid, Spain.
* Journal des Sciences Militaires, Paris, France.
Journal of the Military Service Institution, Governor's Island.
Journal of the Royal Artillery, Woolwich, England.
Journal of the U. S. Artillery, Fort Monroe, Virginia.
Memorial de Artilleria, Madrid, Spain.
Memorial del Ejército de Chile, Santiago, Chile.
Memorial del Estade Mayor de Ejército de Colombia, Bogota, Colombia.
Militär Wochenblatt, Berlin, Germany.
Military Historian and Economist, Cambridge, Mass.
National Guard Magazine.
National Guardsman, Washington, D. C.
New York Evening Sun.
Norsk Artileritidsskrift, Kristiania, Norway.
Our Dumb Animals, Boston, Massachusetts.
Professional Memoirs, Corps of Engineers, Washington, D. C.
Revista de Artilharia, Lisbon, Portugal.
Revista del Circulo Militar, Buenos Aires, Argentine Republic.
Revista di Artigleria e Genio, Rome, Italy.
Revista Militar, Buenos Aires, Argentine Republic.
* Revue d'Artillerie, Paris, France.
* Revue d'Infantrie, Paris, France.
Scabbard and Blade, Fond du Lac, Wisconsin.
Yale Review, New Haven, Connecticut.

* Publication suspended during the war.

Field Artillery Directory

REGULAR ARMY

Name.	Batteries.
FIRST FIELD ARTILLERY. (Light.)	
Schofield Barracks, H. T.	
Colonel.	
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., Jr.	C
McIntyre, Augustine	Unass'd
Currie, Dennis H.	Unass'd
Pratt, Raymond S.	Unass'd
Browning, William S.	Adjt.
Frankenberger, Samuel	Unass'd
Ferris, Charles J.	D
Kilbourne, Henry S., Jr.	F
Glassford, Pelham D.	Qm.
First Lieutenants.	
Dodds, William H., Jr.	C
Huntley, Harold W.	C
Paine, George H.	A
Lyerly, Ballard	Qm. and Comy.
	2d Bttn.
Pfeil, Harry	D
McCleave, William	E
Martin, Truby C.	E
Rogers, Wilbur	F
Daly, Charles D.	B
Palmer, Albert K. C.	B
Stewart, Frederick, W.	A
Ahern, Leo J.	D
Erlenkotter, Herman	F
Second Lieutenants.	
Gay, George S.	Qm. and Comy.
	1 Battn.
Selleck, Clyde A.	Unass'd
Beard, Louie A.	B
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

Name.	Batteries.
Second Lieutenants—Continued.	
Hauser, John N.	E
Frankenberger, Bertram	Unass'd
Daly, Joseph O.	C
Veterinarians.	
Donovan, Andrew E.	
Haynes, James R.	
SECOND FIELD ARTILLERY. (Mountain.)	
Philippine Islands.	
Colonel.	
Van Deusen, George W.	
Lieutenant Colonel.	
Lassiter, William	
Majors.	
Snow, William J.	1 Battn.
Fleming, Adrian S.	2 Battn.
Chaplain.	
Houlihan, James F. (1 lieut.)	
Captains.	
Spaulding, Oliver L., Jr.	Unass'd
Austin, Fred T.	Unass'd
Boiseau, Louis T.	D
Stuart, Edward A.	B
Hennessy, Frederick B.	Unass'd
Barnes, Joseph F.	C
De Armond, Edward H.	Adjt.
Myers, Joseph E.	E
Baker, Scott	A
Allin, George R.	Adjt.
	1 Battn.
Honeycutt, Francis W.	Adjt.
	2 Battn.
First Lieutenants.	
Cubbison, Donald C.	A
Pennell, Ralph McT	C
Hall, Albert L.	F
Shepherd, William H.	Qm. and Comy.
	1 Battn.
Randol, Marshall G.	D
Gottschalk, Telesphor G.	B
Higley, Harvey D.	C
King, Edward P., Jr.	A
Rumbough, Joseph W.	Unass'd
Sparks, Leonard C.	E
Magruder, Marshall	F
Hopkins, Samuel R.	B
Hayden, Herbert B.	E
Second Lieutenants.	
Wallace, Fred C.	B
Nance, Curtis H.	A
Beatty, John C.	Qm. and Comy.
	2 Battn.
Finch, Neil G.	B
Oliphant, Thomas G. M.	Unass'd
Wrona, William J.	F

FIELD ARTILLERY DIRECTORY—Continued

Name.	Batteries.
Second Lieutenants—Continued.	
Bloom, Frank	Unass'd
Jones, Lloyd E.	Unass'd
Polk, Newton N.	C
Anderson, Jonathan W.	D
Browne, Charles J.	E
Bailey, Wesley M	D
von Holtzendorff, John D.	E
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.	
Millar, Edward A.	
Lieutenant Colonel.	
Menoher, Charles T.	
Majors.	
Gatley, George G.	1 Battn.
McCloskey, Manus	2 Battn.
Chaplain.	
Perry, Barton W. (maj.)	
Captains.	
Stephens, John E.	A
Gallup, Fred H.	Unass'd
Farrar, Henry B.	Adj't.
Bunker, Charles M.	C
Jones, Clarence N.	Adj't. 2 Battn.
Locke, Morris E.	Unass'd
Michel, William N.	Adj't. 1 Battn.
Mortimer, Charles G.	D
Margetts, Nelson E.	E
First Lieutenants.	
McKinlay, Louis H.	A
Riley, James W.	E
Smith, Edwin De L.	B
Burleson, Richard C.	D
Olmstead, Dawson	F
Lewis, Robert H.	B
Downer, John W.	Unass'd
Bailey, Benjamin M.	C
Dunn, William E.	E
Parrott, Roger S.	A
Kirkwood, Robert G.	Unass'd
Brabson, Joe R.	F
Miles, Sherman (Att.)	Unass'd
Second Lieutenants.	
Greble, Edwin St. J., Jr.	Qm. and Comy. 2 Battn.
Devers, Jacob L.	Unass'd
Bateman, Harold H.	A
Odell, Herbert R.	B
Peyton, Bernard R.	Unass'd
Magruder, John	Qm. and Comy. 1 Battn.
Simpson, Bethel W.	F
Cain, David E.	C
McMahon, John E., Jr.	C
Kilburn, Charles L.	F
Thurber, Philip L.	D
Harris, Arthur R.	A
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. Hdqrs, and Battys, A, B, and C, Ft. Bliss, Tex. Battys. D, E, and F, Canal Zone.	
Colonel.	
Berry, Lucien G.	
Lieutenant Colonel.	
Irwin, George Le R.	
Majors.	
Lyon, LeRoy S.	2 Battn.
McMaster, Richard H.	1 Battn.
Chaplain.	
Joyce, Francis P. (capt.)	
Captains.	
Merrill, Thomas E.	Adj't. 1 Battn.
Newbold, Henry L.	B
Lambdin, William McK.	E
Faulkner, Albert U.	F
Apple, George M.	A
Craig, Daniel F.	Unass'd
Lawson, Laurin L.	Adj't.
Mason, Roger O.	Qm.
Brewster, Alden F.	Adj't. 2 Battn.
Wheeler, Ernest S.	Unass'd
McNair, Lesley J.	Unass'd
First Lieutenants.	
Osborne, Thomas D.	Unass'd
Parker, Cortlandt	Unass'd
Maul, John C.	E
Collins, Leroy P.	F
Cruse, Fred T.	D
Merrill, Walter W.	F
Sands, Alfred L. P.	Unass'd
Harlow, Charles W.	B
Mort, John E.	Unass'd
Barrows, Frederick M.	Qm. and Comy. 2 Battn.

FIELD ARTILLERY DIRECTORY—Continued

Name.	Batteries.
First Lieutenants—Continued.	
Hughes, Everett S.	C
Smith, Thomas J.	B
McBride, Allan C.	Unass'd
Second Lieutenants.	
Hobbs, Harvey M.	Unass'd
Morrow, Norman P.	B
Anderson, Richard E.	Unass'd
Parker, Edwin P., Jr.	E
Eager, John M.	D
Scott, Richard C.	A
Eager, Howard	F
Young, William C.	E
Crane, William C., Jr.	D
Brewer, Carlos	F
Dunigan, Francis J.	C
Howard, Clinton W.	C
Busbee, Charles M.	A
Waldron, Albert W. (addl.)	B
Swing, Joseph M. (addl.)	A
Veterinarians.	
Le May, Daniel	
Sproule, William A.	A
FIFTH FIELD ARTILLERY. (Light.)	
Permanent station: Ft. Sill, Okla.	
Present stations: Batty. A, Camp Ft. Bliss, Tex.	
Colonel.	
Adams, Granger	
Lieutenant Colonel.	
McGlachlin, Edward F., Jr.	
Majors.	
Bowley, Albert J.	Unass'd
Bishop, Harry G.	Unass'd
Chaplain.	
Clemens, Joseph (capt.)	
Captains.	
Smith, Wright	E
Starbird, Alfred A.	C
Lanza, Conrad H.	Unass'd
Donnelly, Edward T.	F
Williams, Harry C.	Unass'd
Greene, George R.	Unass'd
Briggs, Raymond W.	A
Wood, Norton E.	Adj't.
Hand, Daniel W.	Unass'd
Rehkopf, Ned B.	Unass'd
Blakely, Charles S.	Unass'd
First Lieutenants.	
Smith, Emery T.	Unass'd
Danford, Robert M.	Unass'd
Gruber, Edmund L.	Unass'd
Sturgil, Walter S.	E

Name.	Batteries.
First Lieutenants—Continued.	
Davis, Joseph R.	C
Booker, Phillip W.	D
Pritchett, Edwin E.	Unass'd
Naylor, Harold S.	F
Perkins, Kenneth S.	A
Marr, Harold E.	B
Crane, John A.	Unass'd
Prince, Frederick A.	Unass'd
Hollingsworth, Charles P.	Unass'd
Second Lieutenants.	
Seaman, George G.	Qm. and Comy.
	1 Battn.
Reynolds, Charles C.	Unass'd
Riggs, E. Francis	B
Meyer, Vincent	E
Barnes, Julian F.	A
Greenwald, Karl C.	Unass'd
Gillespie, James A.	B
Winton, Walter F.	A
Wyeth, John C.	D
Burr, John G.	F
Burr, William E.	C
Lester, James A. (att.)	Unass'd
Struble, Herbert S.	Unass'd
Veterinarian.	
Power, Richard H.	
SIXTH FIELD ARTILLERY. (Horse.)	
Permanent station: Ft. Riley, Kans.	
Present stations: Hdqrs, and Battys, A and B, Douglas, Ariz.	
Battys, C and D, Nogales, Ariz.	
Batty, E. Laredo, Tex.	
Batty, F. Eagle Pass, Tex.	
Colonel.	
Greble, Edwin St. J.	
Lieutenant Colonel.	
Kenly, William L.	
Majors.	
Aultman, Dwight E.	1 Battn.
Payne, Brooke	2 Battn.
Chaplain.	
Dickson, Thomas J. (maj.)	
Captains.	
Butner, Henry W.	Unass'd
Pulis, Charles C.	Unass'd
Yule, Edgar H.	B
Birnie, Upton, Jr.	A
Deems, Clarence, Jr.	Unass'd
Griffin, Francis W.	E
Campbell, Tilman	C
Corey, John B. W.	F

FIELD ARTILLERY DIRECTORY—Continued

Name.	Batteries.
Captains—Continued.	
Wood, William S.	D
Morrison, William F.	Adj't.
First Lieutenants.	
Quinn, Leo P.	D
Neal, Carroll W.	B
Bishop, Albert T.	E
Starkey, John R.	A
Hoyle, Rene E. De R.	Unass'd
Marley, James P.	Unass'd
Potter, Waldo C.	E
Tyndall, John G.	F
George, Charles P., Jr.,	B
Rucker, William H.	F
Second Lieutenants.	
Taliaferro, Lucien H.	F
Turner, Frank A.	B

Name.	Batteries.
Second Lieutenants—Continued	
Dawley, Ernest J.	B
Proctor, Mert	D
Erwin, Vincent P.	Unass'd
Hicks, Edward H.	D
Austin, Raymond B.	E
Clarkson, Herbert S.	C
Helmick, Charles G.	A
Sedlscek, Ernst	F
Houghton, William C.	C
Anderson, John B.	A
Zundel, Edwin A.	E
Marsh, Raymond (addl.)	B
Veterinarians.	
Hill, William P.	
Stokes, Wilfred J.	
Mason, A. (att.)	

LINEAL RANK*

No.	Name, rank, and date of rank.	Reg't
	Colonels.	
1	*a* Adams, G. 11 mar. 11	5
2	Greble, E. St. J. 11 mar.	6
3	Treat, C. G. 6 may,	.....
4	Van Deusen, G. W. 7 sept.	2
5	Millar, E. A. 1 dec.	3
6	Sturgis, S. D. 27 dec. 12	1
7	Berry, L. G. 16 mar. 13	4
	Lieutenant Colonels.	
1	McMahon, J. E. 3 may, 11	1
2	Menoher, C. T. 26 may,	3
3	*Hinds, E.* 1 dec.	.....
4	*March, P. C.* 8 feb. 12	.....
5	Kenly, W. L. 26 aug.	6
6	McGlachlin, E. F., Jr. 27 dec.	5
7	Lassiter, W. 16 mar. 13	2
8	Irwin, G. Le R. 18 nov. 14	4
	Majors.	
1	*McNair, W. S.* 15 nov. 10	.....
2	Snow, W. J. 3 mar. 11	2
3	Gatley, G. G. 11 mar.	3
4	Lyon, Le R. S. 11 mar.	4
5	Horn, T. N. 11 mar.	1
6	*Summerall, C. P.* 11 mar.	.....
7	*Cruikshank, W. M.* 11 mar.	.....
8	*Farr, O. W. B.* 13 apr.	.....
9	Aultman, D. E. 3 may,	6
10	Fleming, A. S. 26 may,	2
11	Payne, B. 7 sept.	6
12	Guignard, W. S. 1 dec.	1
13	Bowley, A. J. 9 feb. 12	5
14	Bishop, H. G. 26 aug.	5
15	*Newbill, W. D.* 27 dec.	.....
16	McCloskey, M. 16 mar. 13	3
17	McMaster, R. H. 18 nov. 14	4
	Captains.	
1	Stephens, J. E. 23 sept. 01	3
2	Merrill, T. E. 23 sept.	4
3	Conner, F. 23 sept.	.....
4	Butner, H. W. 23 sept.	6
5	Newbold, H. L. 23 sept.	4
6	*Scott, E. D.* 23 sept.	.....
7	Smith, W. 20 sept. 02	5

No.	Name, rank, and date of rank.	Reg't
	Captains—Continued.	
8	Starbird, A. A. 31 july, 03	5
9	Lloyd, C. R. 14 aug.	1
10	Spaulding, O. L., Jr. 27 aug.	2
11	Lanza, C. H. 1 nov.	5
12	Cassels, A. F. 23 nov.	1
13	Gallup, F. H. 7 july, 04	3
14	Farrar, H. B. 27 sept.	3
15	*Granger, R. S.* 2 feb. 05	.....
16	*Moore, D. T.* 14 apr.	.....
17	*Hopkins, F. E.* 24 feb. 06	.....
18	Austin, F. T. 14 apr.	2
19	Pulis, C. C. 9 june,	6
20	Boiseau, L. T. 25 jan. 07	2
21	Lambdin, W. McK. 25 jan.	4
22	Stuart, E. A. 25 jan.	2
23	Donnelly, E. T. 25 jan.	5
24	Brooke, G. M. 25 jan.	.....
25	Williams, H. C. 25 jan.	5
26	Faulkner, A. U. 25 jan.	4
27	Apple, G. M. 25 jan.	4
28	Yule, E. H. 25 jan.	6
29	*Westervelt, W. I.* 25 jan.	.....
30	Birnie, U., Jr. 25 jan.	6
31	*Deems, C., Jr.* 25 jan.	.....
32	*Doyle, F. C.* 25 jan.	.....
33	McIntyre, A. 25 jan.	1
34	*Greene, G. R.* 25 jan.	.....
35	Briggs, R. W. 25 jan.	5
36	Bunker, C. M. 25 jan.	3
37	Griffin, F. W. 25 jan.	6
38	*Welsh, R. S.* 25 jan.	.....
39	Campbell, T. 25 jan.	6
40	Craig, D. F. 25 jan.	4
41	*Warfield, A. B.* 25 jan.	.....
42	*Burt, W. H.* 12 june.	.....
43	Jones, C. N. 25 feb. 08	3
44	Hennessy, F. B. 26 july, 07	2
45	Lawson, L. L. 12 aug.	4
46	Locke, M. E. 25 aug.	3
47	Kilbreth, J. W., Jr. 1 apr. 04	1
48	*Bryson, J. H.* 10 sept. 09	.....
49	Mason, R. O. 30 sept.	4
50	Browning, W. S. 15 nov. 10	1
51	Barnes, J. F. 3 mar. 11	2
52	*Ennis, W. P.* 11 mar.	5
53	Currie, D. H. 11 mar.	1

* NOTE.—The names of officers detailed from the line for service in the staff departments, and of officers detached from their proper commands under the Acts of March 3, 1911, or July 18, 1914, are printed in *italics*.

a Additional in grade.

FIELD ARTILLERY DIRECTORY—Continued

No.	Name, rank, and date of rank.	Reg't
	Captains—Continued.	
54	*Browne, B. F.* ..... 11 mar. 11	.....
55	Pratt, R. S. ..... 11 mar.	1
56	Brewster, A. F. ..... 11 mar.	4
57	De Armond, E. H. ..... 11 mar.	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.	4
62	*Hollyday, T. W.* ..... 11 mar.	.....
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	.....
73	Ferris, C. J. ..... 26 aug.	1
74	Rehkopf, N. B. ..... 11 July, 13	5
75	Baker, S. ..... 9 oct.	2
76	*Howze, M. W.* ..... 24 oct.	.....
77	Kilbourne, H. S., Jr. ..... 22 nov.	1
78	McNair, L. J. ..... 19 apr. 14	4
79	Allin, G. R. ..... 13 june,	2
80	Glassford, P. D. ..... 18 nov.	1
81	Bryden, W. ..... 10 jan. 15	.....
82	Honeycutt, F. W. ..... 27 june,	2
83	Hand, D. W. ..... 25 jan. 07	.....
84	*Blakely, C. S.* ..... 4 nov. 15	.....
	First Lieutenants.	
1	Smith, E. T. ..... 25 jan. 07	5
2	Danford, R. M. ..... 25 jan.	5
3	Quinn, L. P. ..... 25 jan.	6
4	Gruber, E. L. ..... 25 jan.	5
5	Neal, C. W. ..... 25 jan.	6
6	Cubbison, D. C. ..... 25 jan.	2
7	McKinlay, L. H. ..... 25 jan.	3
8	Osborne, T. D. ..... 25 jan.	4
9	Dodds, W. H., Jr. ..... 25 jan.	1
10	*Hammond, J. S.* ..... 25 jan.	.....
11	Bishop, A. T. ..... 25 jan.	6
12	*Prosser, W. E.* ..... 25 jan.	.....
13	Riley, J. W. ..... 25 jan.	3
14	Huntley, H. W. ..... 25 jan.	1
15	Smith, E. De L. ..... 25 jan.	3
16	Pennell, R. McT ..... 6 july,	2
17	Sturgill, W. S. ..... 7 july,	5
18	Miles, S. ..... 8 july,	3
19	*Parker, C.* ..... 8 july,	.....
20	Burleson, R. C. ..... 9 july,	3
21	Davis, J. R. ..... 10 july,	5
22	Starkey, J. R. ..... 11 july,	6
23	Hoyle, R. E. DeR ..... 11 july,	6
24	Olmstead, D. ..... 12 july,	3
25	Maul, J. C. ..... 12 july,	4
26	Hall, A. L. ..... 13 july,	2
27	Paine, G. H. ..... 13 july,	1
28	Collins, L. P. ..... 16 july,	4
29	Lyerly, B. ..... 19 july,	1
30	Lewis, R. H. ..... 26 july,	3
31	Booker, P. W. ..... 12 aug.	5
32	Pritchett, E. E. ..... 5 mar. 08	5
33	Cruse, F. T. ..... 1 july,	4
34	Marley, J. P. ..... 20 july,	6
35	Potter, W. C. ..... 25 aug.	6
36	Pfeil, H. ..... 17 sept.	1
37	Merrill, W. W. ..... 16 june, 09	4
38	Downer, J. W. ..... 10 sept.	3
39	Bailey, B. M. ..... 29 sept.	3
40	*Sharp, W. F.* ..... 30 sept.	.....
41	*Thorp, F., Jr.* ..... 14 jan. 10	.....
42	Tyndall, J. G. ..... 3 mar. 11	6
43	Sands, A. L. P. ..... 11 mar.	4
44	George, C. P. ..... 11 mar.	6
45	Harlow, C. W. ..... 11 mar.	4
46	Naylor, H. S. ..... 11 mar.	5
47	Rucker, W. H. ..... 11 mar.	6
48	Shepherd, W. H. ..... 11 mar.	2
49	Randol, M. G. ..... 11 mar.	2
50	*Greely, J. N.* ..... 11 mar.	.....
51	*Capron, W. A.* ..... 11 mar.	.....
52	Mort, J. E. ..... 11 mar.	4
53	Barrows, F. M. ..... 11 mar.	4
54	Dunn, W. E. ..... 11 mar.	3
55	*Burns, J. H.* ..... 11 mar.	.....
56	Hughes, E. S. ..... 11 mar.	4
57	Smith, T. J. ..... 11 mar.	4
58	Parrott, R. S. ..... 11 mar.	3
59	Gottschalk, T. G. ..... 11 mar.	2
60	Higley, H. D. ..... 11 mar.	2
61	King, E. P., Jr. ..... 13 apr.	2
62	Perkins, K. S. ..... 13 apr.	5
63	Kirkwood, R. G. ..... 13 apr.	3
64	Marr, H. E. ..... 26 may,	5
65	Rumbough, J. W. ..... 7 june,	2
66	McCleave, W. ..... 13 june,	1
67	McBride, M. C. ..... 20 june,	4
68	Brabson, J. R. ..... 20 june,	3
69	Sparks, L. C. ..... 1 july,	2
70	Crane, J. A. ..... 1 july,	5
71	Prince, F. A. ..... 1 apr. 12	5
72	Magruder, M. ..... 28 may,	2
73	Martin, T. C. ..... 31 may,	1
74	Rogers, W. ..... 31 july,	1
75	*Dougherty, L. R.* ..... 22 aug.	.....
76	Hopkins, S. R. ..... 26 aug.	2
77	Hollingsworth, C. P. ..... 6 sept.	5
78	Daly, C. D. ..... 5 mar. 13	1
79	Palmer, A. K. C. ..... 22 nov.	1
80	Stewart, F. W. ..... 13 june, 14	1
81	Hayden, H. B. ..... 18 nov.	2
82	Ahern, L. J. ..... 10 jan. 15	1
83	Beere, D. M. ..... 10 jan.	.....
84	Erlenkotter, H. ..... 12 may,	1
85	*Thummel, C. B.* ..... 15 may,	.....
86	Miner, H. E. ..... 4 nov.	.....
	Second Lieutenants.	
1	Greble, E. St. J., Jr. ..... 11 june, 09	3
2	Devers, J. L. ..... 11 june,	3
3	Taliaferro, L. H. ..... 14 july,	6
4	Bateman, H. H. ..... 14 july,	3
5	Turner, F. A. ..... 13 nov.	6
6	Seaman, G. G. ..... 13 nov.	5
7	Reynolds, C. C. ..... 13 nov.	5
8	Gay, G. S. ..... 18 jan. 10	1
9	Wallace, F. C. ..... 15 june,	2
10	*Lewis, B. O.* ..... 15 june,	.....
11	Odell, H. R. ..... 15 june,	3
12	Selleck, C. A. ..... 15 june,	1
13	Dawley, E. J. ..... 15 june,	6
14	Beard, L. A. ..... 15 june,	1
15	Jones, I. ..... 15 june,	1
16	Goetz, R. C. F. ..... 17 aug.	1
17	Peyton, B. R. ..... 8 sept.	3
18	Magruder, J. ..... 9 sept.	3
19	Riggs, E. F. ..... 11 feb. 11	5
20	Nance, C. H. ..... 13 june,	2
21	*Bowley, F. W.* ..... 13 june,	.....
22	Beatty, J. C. ..... 13 june,	2
23	Hatch, J. E. ..... 13 june,	1
24	*Walker, C. A., Jr.* ..... 13 june,	.....
25	Simpson, B. W. ..... 13 june,	2
26	Finch, N. G. ..... 13 june,	2

FIELD ARTILLERY DIRECTORY—Continued.

No.	Name, rank, and date of rank.	Reg't
	Second Lieutenants—Continued.	
27	Hobbs, H. M. ..... 14 june, 11	4
28	Andrews, J. ..... 15 june,	1
29	Oliphant, T. G. M. ..... 20 july,	2
30	Proctor, M. ..... 20 july,	6
31	Wrona, W. J. ..... 20 july,	2
32	Erwin, V. P. ..... 19 aug.	6
33	Bloom, F. ..... 27 sept.	2
34	Meyer, V. ..... 28 sept.	5
35	Hicks, E. H. ..... 28 sept.	6
36	Morrow, N. P. ..... 7 oct.	4
37	Jones, L. E. ..... 7 oct.	2
38	Polk, N. N. ..... 7 oct.	2
39	*Bradley, F.* ..... 2 dec.	.....
40	Anderson, J. W. ..... 3 dec.	2
41	Deshon, P. ..... 24 apr. 12	1
42	Barnes, J. F. ..... 24 apr.	5
43	Vanderveer, H. C. ..... 24 apr.	1
44	Andrus, C. ..... 24 apr.	1
45	*Maxwell, R. L.* ..... 12 june,	.....
46	Browne, C. J. ..... 12 june,	2
47	Hauser, J. N. ..... 12 june,	1
48	Greenwald, K. C. ..... 12 june,	5
49	Anderson, R. E. ..... 12 june,	4
50	Gillespie, J. A. ..... 12 june,	5
51	Bailey, W. M. ..... 12 june,	2
52	von Holtzendorff, J. D. ..... 22 july,	2
53	Winton, W. F. ..... 23 july,	5
54	Frankenberger, B. ..... 30 nov.	1
55	Austin, R. B. ..... 30 nov.	6
56	Daly, J. O. ..... 30 nov.	1
57	Parker, E. P., Jr. ..... 30 nov.	4
58	Eager, J. M. ..... 30 nov.	4
59	Scott, R. C. ..... 15 jan. 13	4

No.	Name, rank and date of rank.	Reg't
	Second Lieutenants—Continued.	
60	Eager, H. ..... 25 mar. 13	4
61	Young, W. C. ..... 12 june,	4
62	Crane, W. C., Jr. ..... 12 june,	4
63	Brewer, C. ..... 12 june,	4
64	Cain, D. E. ..... 12 june,	3
65	McMahon, J. E., Jr. ..... 12 june,	3
66	Clarkson, H. S. ..... 26 june,	6
67	Kilburn, C. L. ..... 14 july,	3
68	Helmick, C. G. ..... 18 july,	6
69	Sedlacek, E. ..... 30 aug.	6
70	Thurber, P. L. ..... 12 june, 14	3
71	Houghton, W. C. ..... 12 june,	6
72	Wyeth, J. C. ..... 12 june,	5
73	Harris, A. R. ..... 12 june,	3
74	Burr, J. G. ..... 12 june,	5
75	Anderson, J. B. ..... 12 june,	6
76	Burr, W. E. ..... 12 june,	5
77	Leater, J. A. ..... 12 june, 15	5
78	Beukema, H. ..... 12 june,	3
79	Struble, H. S. ..... 12 june,	5
80	Dunigan, F. J. ..... 12 june,	4
81	Zundel, E. A. ..... 12 june,	6
82	Howard, C. W. ..... 12 june,	4
83	Busbee, C. M. ..... 12 june,	4
	Additional Second Lieutenants.	
1	Waldron, A. W. ..... 12 june, 15	4
2	Wallace, J. H. ..... 12 june,	3
3	Marsh, R. ..... 12 june,	6
4	Swing, J. M. ..... 12 june,	4

MILITIA

FIRST INSPECTION DISTRICT

Capt. Robert Davis and Lieut. Cortlandt Parker, Inspectors, Boston, Mass.

New Hampshire

BATTERY A, MANCHESTER

Capt. Edward L. Toule.
1st Lieut. Frank J. Abbott.
1st Lieut. Henry A. Worthen.
2nd Lieut. Lucius E. Hill.
2nd Lieut. George W. Upton.

Massachusetts

FIRST REGIMENT

Headquarters, Boston

Col. John H. Sherburne.
Capt. Roger D. Swaim, Adjutant.
Capt. Robert E. Goodwin, Quartermaster and Commissary.

FIRST BATTALION

Headquarters, Boston

Maj. Richard K. Hale.
Capt. Norton Wigglesworth, Battalion Adjutant.
1st Lieut. Winthrop Miller, Battalion Quartermaster and Commissary.
Veterinarian Wm. T. White.

BATTERY A, BOSTON

Capt. E. B. Richardson.
1st Lieut. H. S. Allen.
1st Lieut. Geo. A. Parker.
2nd Lieut. James F. Clarke.
2nd Lieut. Erland F. Fish.

BATTERY B, WORCESTER

Capt. John F. J. Herbert.
1st Lieut. Arthur P. Twombly.
1st Lieut. Geo. Bieberbach.
2nd Lieut. John B. Haliburton.
2nd Lieut. Milton J. Haynes.

BATTERY C, LAWRENCE

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

SECOND BATTALLION

Headquarters, Salem

Maj. Thorndike D. Howe.
1st Lieut. John A. O'Keefe, Jr.
2nd Lieut. Arthur W. Green, Battalion Quartermaster and Commissary.
Veterinarian John H. Searle.

BATTERY D

Capt. Frank S. Perkins.
1st Lieut. Arthur E. Johnson, Jr.
1st Lieut. Willis G. C. Kimball, Jr.
2nd Lieut. Carroll M. Wheeler.
2nd Lieut. Roland H. Choate.

BATTERY E

Capt. Ernest R. Redmond.
1st Lieut. Harry E. Mitton.
1st Lieut. George E. Burke.
2nd Lieut. Harry E. Cahoon.
2nd Lieut. Edward H. Calhoun.

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FIELD ARTILLERY DIRECTORY—Continued

BATTERY F

Capt. James R. Taylor.
1st Lieut. William B. Morgan.
1st Lieut. Clyde W. Johnson.
2nd Lieut. Willis G. Dickum.
2nd Lieut. Herman A. MacDonald.

Rhode Island

BATTERY A, PROVIDENCE

Capt. Everitte S. Chaffee.
1st Lieut. Wm. Gammell, Jr.
1st Lieut. Gerald T. Hanley.
2nd Lieut. Donald S. Babcock.
2nd Lieut. Harold R. Barker.

———

STATE OF CONNECTICUT

TENTH MILITIA FIELD ARTILLERY

Maj. Robert M. Danford, (1st Lieut., U. S. A.)
2nd Lieut. Morris Hadley, Acting Adjutant.
2nd Lieut. Melbert B. Cary, Battalion Quartermaster and Commissary.

BATTERY A, YALE UNIVERSITY

Capt. Carl F. Bollmann.
2nd Lieut. Paul F. Slocum.
2nd Lieut. Edward C. Miller, Jr.
2nd Lieut. Julien T. Davies.
2nd Lieut. Paul Schulze.

BATTERY B, YALE UNIVERSITY

Capt. Henry H. Townshend.
2nd Lieut. James P. Kelly.
2nd Lieut. Charles F. Neave.
2nd Lieut. Henry W. Farnam, Jr.
2nd Lieut. Irving K. Fearn.

BATTERY C, YALE UNIVERSITY

Capt. John H. H. Alden.
2nd Lieut. Stuart Bullivant.
2nd Lieut. Calvin G. Littlefield.
2nd Lieut. Reginald Field.
2nd Lieut.

BATTERY D, YALE UNIVERSITY

Capt. Carroll C. Hincks.
2nd Lieut. Morris Hadley.
2nd Lieut. Clark O. Kimberly.
2nd Lieut. Ernest H. Burt.
2nd Lieut. Bennett Sanderson.

BATTERY E, BRANFORD

Capt. Chas. S. Yeomans.
1st Lieut. John J. Ahern.
1st Lieut.
2nd Lieut. John W. Newton.
2nd Lieut. Ernest L. Averill.

BATTERY F, STAMFORD

Capt. Wm. M. Wilson.
1st Lieut.
1st Lieut.
2nd Lieut. John Baker.
2nd Lieut. William E. Wesson.

SECOND INSPECTION DISTRICT

Capt. D. W. Hand and Lieut. John S. Hammond, Inspectors, New York City

New Jersey

BATTERY A, EAST ORANGE

Capt. Claude E. Lanterman
1st Lieut. Edward C. James.
1st Lieut. Henry Bennet.
2nd Lieut. W. F. Rothenburger.
2nd Lieut. C. A. Nordine.

BATTERY B, CAMDEN

Capt. Samuel G. Barnard.
1st Lieut. 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. Alvín W. Perry, Commissary.
Capt. Leonard B. Smith, Battalion Adjutant.
1st Lieut. Matthew S. Weir, Battn. Qm.
1st Lieut. Clarence G. Michalis, Battn. Qm.
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. Sylvester Simpson.
1st Lieut. Channing R. Toy.
1st Lieut.
2nd Lieut. James H. Giles.
2nd Lieut. William P. Welsh.

BATTERY C, BINGHAMTON

Capt. Charles G. Blakeslee.
1st Lieut. Arthur E. Kaeppel.
1st Lieut.
2nd Lieut.
2nd Lieut.

BATTERY D, NEW YORK CITY

Capt. Benjamin Van Raden.
1st Lieut. Frederick J. Koch.
1st Lieut. George S. Gibbons.
2nd Lieut. Clinton M. Lucas.
2nd Lieut.

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FIELD ARTILLERY DIRECTORY—Continued

BATTERY E, NEW YORK CITY

Capt. John T. Delaney.
1st Lieut. Frederick H. Ryan.
1st Lieut. Joseph H. de Rivera.
2nd Lieut. Robert L. Russell.
2nd Lieut.

BATTERY F, NEW YORK CITY

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

SECOND FIELD ARTILLERY

Headquarters, Brooklyn

Col. George A. Wingate.
Lieut. Col. Frank H. Hines.
Maj. Chauncey Matlock.
Maj. James B. Richardson.
Capt. DeWitt C. Weld, Adjutant.
Capt. Louis F. Kuntz, Quartermaster.
Capt. Albert D. Washington, Commissary.
Capt. Eugene F. Lohr, Battalion Adjutant.
1st Lieut. Edward I. Brennan, 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. Roger P. Clark.
2nd Lieut.
2nd Lieut.

BATTERY B, BROOKLYN

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

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. Howard E. Sullivan.
1st Lieut. Alphonse W. Weiner.
1st Lieut.
2nd Lieut. Charles J. McGronan.
2nd Lieut.

BATTERY E, NEW YORK CITY

Capt. Wilbur T. Wright.
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. Raymond L. Hoffman.
2nd Lieut. Henry W. Cox.

THIRD INSPECTION DISTRICT

Capt. W. F. Morrison, Inspector,
Washington, D. C.

District of Columbia

BATTERY A, WASHINGTON, D. C.

Capt. Louis C. Vogt.
1st Lieut. George A. Bonnet.
1st Lieut. Harry E. Shilling.
2nd Lieut.
2nd Lieut.

BATTERY B, WASHINGTON, D. C.

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

Pennsylvania

FIRST FIELD ARTILLERY

Headquarters, Pittsburgh

Col. William S. McKee.
Lieut. Col. Albert V. Crookston.
Maj. Theodore R. McLain.
Maj. Thomas O. Cole.

BATTERY A, SOUTH BETHLEHEM

Capt. Herbert M. Paul.
1st Lieut. Elmer G. Tice.
1st Lieut. Carter L. Wright.
2nd Lieut. Geo. W. Edwards.
2nd Lieut.

BATTERY B, PITTSBURGH

Capt. William T. Rees.
1st Lieut. Clinton T. Bundy.
1st Lieut. John S. Purucker.
2nd Lieut. Chas. C. Williams.
2nd Lieut. Samuel D. Hollis.

BATTERY C, PHOENIXVILLE

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

BATTERY D, WILLIAMSPORT

Capt. William B. Reilly.
1st Lieut. John D. Andrews.
1st Lieut. Garret Cochran.
2nd Lieut. John H. Ball.
2nd Lieut. Clyde R. Shelley.

BATTERY E, PITTSBURGH

Capt. Robert G. Snyder.
1st Lieut. William G. Fullman.
1st Lieut. Harry Howe.
2nd Lieut. Harry F. Plank.
2nd Lieut. William J. Miller.

BATTERY F, PITTSBURGH

Capt. Samuel R. McKamish.
1st Lieut. Harry L. Probst.
1st Lieut. William K. Weaver, Jr.
2nd Lieut. Ralph C. Robinson.
2nd Lieut. Charlie B. Reed.

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FIELD ARTILLERY DIRECTORY—Continued

Maryland

BATTERY A, BALTIMORE

Capt. William F. Johnson, Jr.
1st Lieut. James C. McLanahan.
1st Lieut. Gustavus Ober, Jr.
2nd Lieut. John Ridgely, Jr.
2nd Lieut. A. Hunter Boyd, Jr.

Virginia

FIRST BATTALION

Headquarters, Richmond

Major Thomas M. Wortham.
Capt. William W. LaPrade, Adjutant.
1st Lieut. John B. Harvie, Quartermaster.

BATTERY A, RICHMOND

Capt. William M. Myers.
1st Lieut. Edward C. Rees.
1st Lieut. James C. Pollard.
2nd Lieut. John T. Wood.
2nd Lieut. George H. Myers.

BATTERY B, NORFOLK

Capt. Paul W. Kear.
1st Lieut. McChesney H. Jeffries.
1st Lieut. W. Carleton Jones.
2nd Lieut. John D. Thomas.
2nd Lieut.

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 B. Lee.

BATTERY D, HAMPTON

Capt. Frank H. Couch.
1st Lieut. Thornton F. Jones.
1st Lieut. Robert G. Sugden.
2nd Lieut. Charles B. Powell.
2nd Lieut. Robert F. Taylor.

FOURTH INSPECTION DISTRICT

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

Alabama.

BATTERY A, BIRMINGHAM

Capt. Leon S. Dorrance.
1st Lieut.
1st Lieut.
2nd Lieut. Fred N. Feld.
2nd Lieut. Laurence S. Morgan.

BATTERY C, BIRMINGHAM

Capt. C. P. Noland.
1st Lieut. J. M. Fray.
1st Lieut. H. J. Porter.
2nd Lieut. E. S. Jemison.
2nd Lieut. A. A. Adams.

Georgia

FIRST BATTALION

Headquarters, Savannah

Maj. Edward D. Wells.
Capt. William W. Douglas, Adjutant.
2nd Lieut. Alan M. MacDonell, Quartermaster and Commissary.

BATTERY A, SAVANNAH

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

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 G. Butler.
1st Lieut. Joseph H. Thompson.
1st Lieut. Joseph E. Inglesby.
2nd Lieut. R. F. Rumph.
2nd Lieut.

Louisiana

FIRST BATTALION

Headquarters, New Orleans

Maj. Allison Owen.
Capt. Schaumburg McGehee, Adjutant.
2nd Lieut. Guy Molony, Quartermaster and Commissary.
Veterinarian, Edward F. Karstendick.

BATTERY A, NEW ORLEANS

Capt. Stanley M. Lamarie.
1st Lieut.
1st Lieut.
2nd Lieut. Maurice B. Lamarie.
2nd Lieut. Ernest J. Steward.

BATTERY B, NEW ORLEANS

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

BATTERY C, NEW ORLEANS

Capt. Bryan Black.
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 S. Wilson, Adjutant.
Veterinarian Roy C. Whitesell.

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FIELD ARTILLERY DIRECTORY—Continued

BATTERY A, INDIANAPOLIS

Capt. Gavin L. Payne.
1st Lieut. Frank W. Buschmann.
1st Lieut.
2nd Lieut. Solon J. Carter.
2nd Lieut. Marlin A. Prather.

BATTERY B, PURDUE UNIVERSITY, LAFAYETTI

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

BATTERY C, LAFAYETTE

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

Michigan

FIRST BATTALION

Headquarters, Lansing

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

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. Quido A. Kulish, Adjutant.
2nd Lieut. John B. Morton, Battalion Quartermaster and Commissary.
Veterinarian, Frank R. Lunn.

BATTERY A, CLEVELAND

Capt. Fred T. Mudge.
1st Lieut. Everette C. Williams.
1st Lieut.
2nd Lieut. J. L. Sullivan.
2nd Lieut.

BATTERY B, AKRON

Capt. Hurl J. Albrecht.
1st Lieut. Joseph J. Johnston.
1st Lieut. John P. Colwell.
2nd Lieut. John F. Babbitt.
2nd Lieut. John R. Taylor.

BATTERY C, BRIGGSDALE (COLUMBUS)

Capt. Rodney E. Pierce.
1st Lieut. George H. Bartholomew.
1st Lieut. Lawrence S. Schlegel.
2nd Lieut. Alfred Shutt.
2nd Lieut. William D. Kinsell.

SIXTH INSPECTION DISTRICT

Lieut. Louis R. Dougherty, Inspector, Chicago, Illinois

Illinois

FIRST BATTALION

Headquarters, Waukegan

Maj. Ashbel V. Smith.
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. F. J. Starkey.
2nd Lieut. Fred G. Anderson.
2nd Lieut. John D. Cole.

BATTERY B, CHICAGO

Capt. Frank M. Course.
1st Lieut. Max E. Payne.
1st Lieut. James P. Tyrell.
2nd Lieut. Ernest McCullough.
2nd Lieut. Chester H. Wright.

BATTERY C, FORT SHERIDAN

Capt. Roy B. Staver.

SECOND BATTALION

Headquarters, Chicago

Maj. Charles R. Vincent.
Capt. Hugh R. Montgomery, Adjutant.
2nd Lieut. Irving Odell, Quartermaster and Commissary.

BATTERY D, CHICAGO

Capt. E. A. Ewing.
1st Lieut. Thomas Kelly.
1st Lieut.
2nd Lieut.
2nd Lieut.

BATTERY E, CHICAGO

Capt. Henry J. Reilly.
1st Lieut. Horace R. Denton.
1st Lieut.
2nd Lieut.
2nd Lieut.

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FIELD ARTILLERY DIRECTORY—Continued

BATTERY F, URBANA

Capt. Bruce W. Benedict.
1st Lieut. George B. Rice.
1st Lieut. Albert W. Jamison.
2nd Lieut. Percy Ash.
2nd Lieut. W. L. Burlison.

Wisconsin

BATTERY A, MILWAUKEE

Capt. Philip C. Westfahl.
1st Lieut. Alonzo J. Comstock.
1st Lieut. William F. Fraedrich.
2nd Lieut. Alvin A. Kuechenmeister.
2nd Lieut.

Iowa

FIRST BATTALION

Headquarters, Clinton

Maj. Roy S. Whitley.
Capt. James L. Oakes, Adjutant.

BATTERY A, CLINTON

Capt. Jacob E. Brandt.
1st Lieut. Martin 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. F. H. Hinrichs.
2nd Lieut.

BATTERY C, MUSCATINE

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

SEVENTH INSPECTION DISTRICT

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

Kansas.

BATTERY A, TOPEKA

Capt. John M. Hite.
1st Lieut.
1st Lieut.
2nd Lieut. William P. MacLean.
2nd Lieut. James C. Hughes.

Missouri

FIRST BATTALION

Headquarters, Independence

Maj. Edward M. Stayton.
Capt. John H. 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. Daniel F. Jones.
2nd Lieut.

BATTERY B, KANSAS CITY

Capt. Arthur J. Elliott.
1st Lieut. Roy T. Olney.
1st Lieut. Fielding L. D. Carr.
2nd Lieut. Thomas S. McGee.
2nd Lieut. Marvin H. Gates.

BATTERY C, INDEPENDENCE

Capt. John L. Miles.
1st Lieut. Spencer Salisbury.
1st Lieut. 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, STATE AGRICULTURAL COLLEGE, FORT COLLINS

Capt. J. A. Rogers (1st Lieut., U. S. A.)
1st Lieut.
1st Lieut.
2nd Lieut.
2nd Lieut.

BATTERY B, DENVER

Capt. Guylan A. Blanchard.
1st Lieut.
1st Lieut.
2nd Lieut. W. H. H. Cranmer.
2nd Lieut. Canton O'Donnell.

New Mexico.

BATTERY A, ROSWELL

Capt. Charles M. de Bremond.
1st Lieut. James C. Hamilton.
1st Lieut. Willard F. Hird.
2nd Lieut. George M. Williams.
2nd Lieut. W. E. Buchly.

Utah

1ST BATTERY, SALT LAKE CITY

Capt. William C. Webb.
1st Lieut. Curtis Y. Clawson.
1st Lieut. Fred T. Gundry.
2nd Lieut. Harold C. Mandell.
2nd Lieut.

It is requested that all errors be reported to the Secretary, United States Field Artillery Association, Room 495, War Department, Washington, D. C.

FIELD ARTILLERY DIRECTORY—Continued

NINTH INSPECTION DISTRICT

Lieut. Emery T. Smith, Inspector, San Francisco, Cal.

California.

FIRST BATTALION

Headquarters, Oakland

Maj. Ralph J. Faneuf.
Capt. Frederick W. H. Peterson, Adjutant.

BATTERY A, LOS ANGELES

Capt. Jesse McComas.
1st Lieut. Harold G. Ferguson.
1st Lieut. Walter Luer.
2nd Lieut. Robert W. Yates.
2nd Lieut. Frederick H. Hover.

BATTERY B, OAKLAND

Capt. Harry F. Huber.
1st Lieut. Edward E. Vicary.
1st Lieut. John W. White.
2nd Lieut. Howard W. Enefer.
2nd Lieut. Clyde Alexander.

BATTERY C, STOCKTON

Capt. Edward Van Vranken.
1st Lieut. Otto E. Sandman.
1st Lieut.
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. G. W. Stevens.

STATE OF MINNESOTA

Capt. Geo. R. Greene, Inspector, Fort Shelling, Minn.

FIRST FIELD ARTILLERY

Headquarters, St. Paul

Col. George C. Lambert.
Lieut. Col. William J. Murphy.
Maj. Gates A. Johnson, Jr., First Battalion.
Maj. George E. Leach, Second Battalion.
Capt. Charles A. Green, Adjutant.
Capt. Fred L. Baker, Quartermaster.
Capt. William H. Donahue, Commissary.
Capt. Erwin H. Sherman, Battalion Adjutant.
Capt. Frederick A. Tiffany, Battalion Adjutant.
1st Lieut. Theodore A. Kaldunski, Battalion Quartermaster and Commissary.
2nd Lieut. Holland C. Headley, Battalion Quartermaster and Commissary.
Veterinarian, Richard Price.
Veterinarian, Elmer W. Berg.

BATTERY A, ST. PAUL

Capt. Arthur G. Teuchert.
1st Lieut. John Hammerbacher.
1st Lieut. Henry A. Stempel.
2nd Lieut. Otto K. Seidel.
2nd Lieut. James W. Scott, Jr.

BATTERY B, ST. PAUL

Capt. Charles L. Ames.
1st Lieut. Wallace Cole.
1st Lieut. James K. Edsall.
2nd Lieut. William S. Jenkins, Jr.
2nd Lieut. John S. Nichols.

BATTERY C, ST. PAUL

Capt. Thomas J. O'Leary.
1st Lieut. John H. McDonald.
1st Lieut. Roger J. Finn.
2nd Lieut. Philip J. McCauley.
2nd Lieut.

BATTERY D, MINNEAPOLIS

Capt. George T. Gorham.
1st Lieut. Julius H. Pohlson.
1st Lieut.
2nd Lieut. Hugh R. Barber.
2nd Lieut. Robert R. Grow.

BATTERY E, MINNEAPOLIS

Capt. Jerome Jackman.
1st Lieut. Louis Baker.
1st Lieut. William R. Cross.
2nd Lieut. John C. Robins.
2nd Lieut.

BATTERY F, MINNEAPOLIS

Capt. Walter F. Rhinow.
1st Lieut. Edwin Rollmann.
1st Lieut. John L. Haskins.
2nd Lieut. Andres J. Carlson.
2nd Lieut. Harold L. Goss.

Active Membership, Field Artillery Association.

REGULAR ARMY.

5th Field Artillery	100 per cent.
6th Field Artillery	95 per cent.
3rd Field Artillery	93 per cent.
Unassigned to regiments	93 per cent.
1st Field Artillery	90 per cent.
4th Field Artillery	88 per cent.
2nd Field Artillery	85 per cent.

MILITIA.

New Mexico	100 per cent.
Rhode Island	100 per cent.
Utah	100 per cent.
Ohio	63 per cent.
District of Columbia	60 per cent.
New York	52 per cent.
Indiana	50 per cent.
Pennsylvania	47 per cent.
Iowa	47 per cent.
Massachusetts	46 per cent.
Virginia	45 per cent.
Illinois	42 per cent.
Missouri	41 per cent.
New Jersey	30 per cent.
Louisiana	30 per cent.
Georgia	29 per cent.
Connecticut	26 per cent.
Wisconsin	25 per cent.
Minnesota	24 per cent.
Maryland	20 per cent.
California	19 per cent.
Michigan	18 per cent.
Alabama	0 per cent.
Colorado	0 per cent.
Kansas	0 per cent.
New Hampshire	0 per cent.
Oregon	0 per cent.
Texas	0 per cent.