

VOLUME V

NUMBER 3

JULY-SEPTEMBER

**THE
FIELD ARTILLERY
JOURNAL**

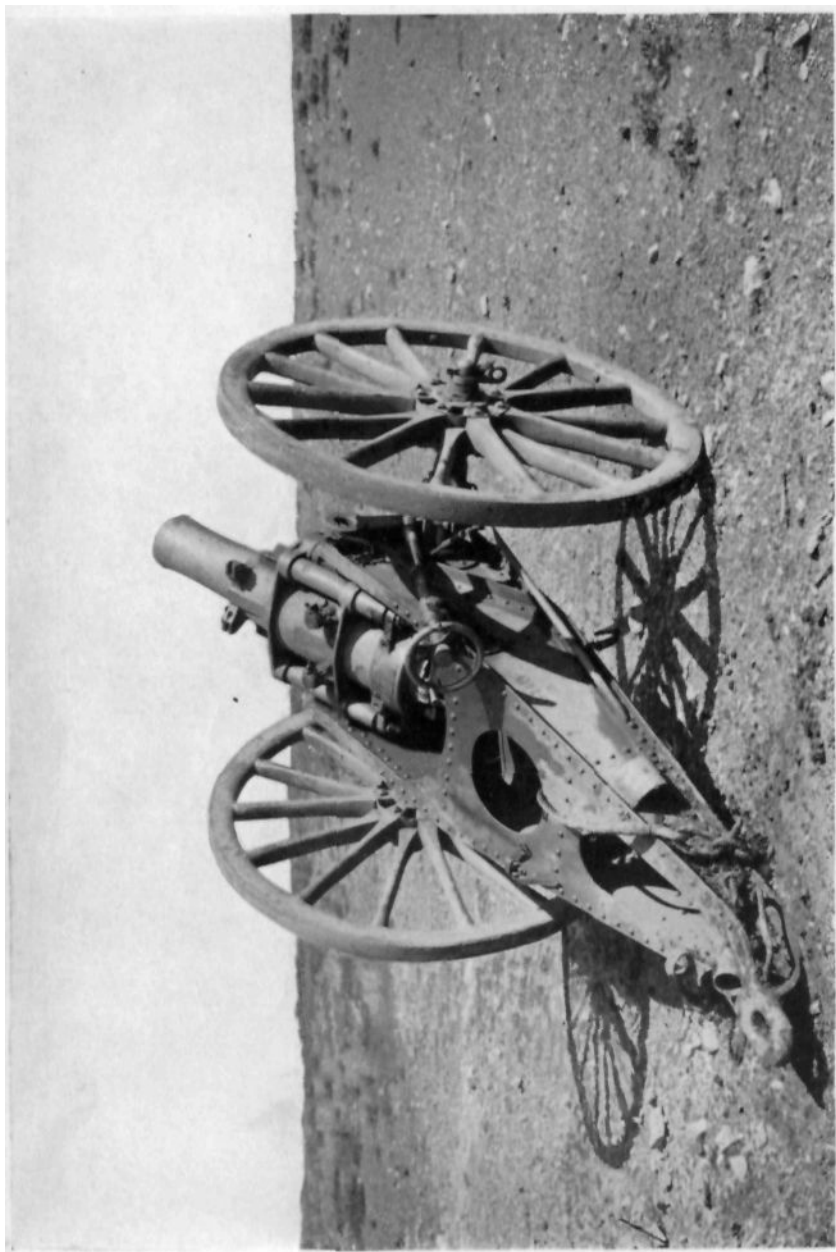
EDITED BY

MARLBOROUGH CHURCHILL

CAPTAIN FIELD ARTILLERY, UNITED STATES ARMY

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

COPYRIGHT, 1915. BY
THE UNITED STATES FIELD ARTILLERY ASSOCIATION



BRITISH 5-INCH HOWITZER

Contents, July-September

Common Faults in Conduct of Fire	487
Lieutenant Colonel Edward F. McGlachlin, 5th Field Artillery.	
Intensive Training for Volunteer Batteries	496
First Lieutenant George H. Paine, 3rd Field Artillery.	
The Fuze Setter Problem	506
First Lieutenant Cortlandt Parker, 2nd Field Artillery.	
The Adjustment of Shrapnel Fire	513
Regimental Sergeant Major Basil Conless, 6th Field Artillery.	
Aviation and Its Employment with Field Artillery	528
Notes on Lost Motion and Jump	531
Captain Fox Conner, Field Artillery.	
Battery Administration and the Duties of Lieutenants	550
Captain William Bryden, Field Artillery.	
The Firing Battery	578
First Lieutenant Harry Pfeil, 1st Field Artillery.	
Draft in Batteries of Heavy Field Artillery	593
Captain Francis W. Honeycutt, 2nd Field Artillery.	
In the Collar	596
Veterinarian Gerald E. Griffin, 3rd Field Artillery.	
Current Field Artillery Notes	611
Editorial Department:	
Plattsburg and the Field Artillery	623
Reorganization and Increase	623
An Obvious Comparison.....	624
The Need for Discussion.....	626
Target Practice	628
The Revision of the Drill Regulations.....	629
The School of Fire for Field Artillery and the School of Musketry	630
Field Artillery Songs.....	631
The J. B. Lippincott Company	631
Book Reviews	632
Index to Current Field Artillery Literature	642
Field Artillery Directory	647

THE UNITED STATES FIELD ARTILLERY ASSOCIATION

Organized June 7, 1910

OFFICERS

PRESIDENT: Brigadier General M. M. Macomb, U. S. Army.

VICE-PRESIDENT: Colonel Charles G. Treat (Field Artillery) General Staff, U. S. Army.

SECRETARY-EDITOR AND TREASURER:

Captain Marlborough Churchill, Field Artillery, U. S. Army.

EXECUTIVE COUNCIL

Brigadier General M. M. Macomb, U. S. Army.

Lieutenant Colonel Peyton C. March (Field Artillery), Adjutant-General, U. S. Army.

Lieutenant Colonel Charles T. Menoher, 3rd Field Artillery.

Major Roy C. Vandercook, Field Artillery, National Guard, State of Michigan.

Major John H. Sherbourne, Field Artillery, Massachusetts Volunteer Militia.

THE FIELD ARTILLERY JOURNAL

Edited by

Marlborough Churchill

Captain, Field Artillery, United States Army.

PUBLISHED QUARTERLY

Under the supervision of the U. S. Field Artillery Association.

Subscriptions should be sent to

The United States Field Artillery Association,

230 First St., N. W., Washington, D. C.

Price, \$3.00 per annum.

Clubbing arrangements with The U. S. Field Artillery Association, The U. S. Cavalry Association, and The U. S. Infantry Association give to the members of each Association the privilege of subscribing for the Journal of either or both of the other Associations at reduced rates.

THE FIELD ARTILLERY JOURNAL

TO MEMBERS OF THE CAVALRY ASSOCIATION OR THE INFANTRY ASSOCIATION AT \$2 PER ANNUM. THE REGULAR PRICE IS \$3 PER ANNUM.

THE CAVALRY JOURNAL

TO MEMBERS OF THE FIELD ARTILLERY ASSOCIATION AT \$1 PER ANNUM.

THE REGULAR PRICE IS \$2.50 PER ANNUM.

THE INFANTRY JOURNAL

TO MEMBERS OF THE FIELD ARTILLERY ASSOCIATION AT \$1 PER ANNUM.

THE REGULAR PRICE FOR ORIGINAL SUBSCRIPTIONS IS \$3 AND FOR RENEWALS \$2 PER ANNUM.

PUBLISHED QUARTERLY BY

The United States Field Artillery Association

PHILADELPHIA OFFICE: J. B. LIPPINCOTT COMPANY, 227 South Sixth Street.

LONDON OFFICE: J. B. LIPPINCOTT COMPANY, Durham House, 16 John St. Adelphi. WASHINGTON

OFFICE: 230 First Street, N. W., Washington, D. C.

Application for entry as second-class matter at the Post Office at Philadelphia pending.

THE FIELD ARTILLERY JOURNAL

VOL. V

JULY-SEPTEMBER, 1915

NO. 3

Common Faults in Conduct of Fire

BY LIEUTENANT COLONEL EDWARD F. McGLACHLIN, 5TH FIELD ARTILLERY

THE following is designed to be helpful in avoiding some of the common errors in conduct of fire of a 3-inch battery. Numbers in parentheses refer to paragraphs of the Field Artillery Drill Regulations, as changed.

SLOWNESS. LACK OF CONCENTRATION, INITIATIVE, AND DECISION. THE DEMAND FOR RULES OF FIRE

Field artillery firing being an art, there are no fixed formulæ or rules of invariable application. "An infinite variety" of problems will be encountered, for each of which there will be a "best solution" which cannot be reached by "adherence to any fixed rule." Simple principles have been developed. They are difficult of application. Only by the cultivation of prompt good judgment, the welcoming of responsibility, the development of self-reliance, the absorption of correct principles, can the conductor of fire become the artist. It is better to fire by rule than to fire by whim or caprice. To those who recognize their personal weaknesses, or who, through inexperience, are undecided and doubtful as to the measures appropriate under varying conditions, good rules under recognized principles will be acceptable and useful. Principles are enunciated throughout the drill regulations; a few rules of fire are given. But a higher state of efficiency than that indicated by their blind application must be the goal of those who would "exercise constant and unremitting care to economize ammunition."

THE FIELD ARTILLERY JOURNAL

TARGET NOT CORRECTLY AND SURELY IDENTIFIED

One of the duties of the higher artillery commanders is "to formulate clearly in their minds the terms or methods which they will employ in the designation of objectives (targets, aiming points, registration marks, etc.)" (315,-4).

This frequently also becomes the duty of a battery commander, particularly as to the designation of aiming points. The subject of the designation of objectives is discussed in Field Artillery Drill Regulations 449-453.

Many objectives properly designated and once seen are momentarily lost sight of and not again identified. The method of designation or some of the terms and qualities used are forgotten. It is not necessary to remember them if the battery commander will "examine the target assigned and endeavor to determine clearly its nature, its extent, and its relation to surrounding objects" (316,-1), and in the necessary cases, few in number, fix the direction by reference to some prominent feature of the skyline or by using his headgear, a handkerchief, a glove or some other handy object to establish the line. The use of an extemporized mount for field glasses helps toward certain and continued identification. The assignment of one of the battery detail to the target is also helpful.

The error or fault is critical. "Due to the extensive use of cover . . . the targets of artillery are apt to be concealed from view a great part of the time, and, when visible, to remain so but a short time" (314).

FAILURE TO CONSIDER TACTICAL SITUATION

"The time available for the performance of the foregoing duties (of higher artillery and battery commanders) depends entirely upon the nature of the action. In some cases they must be performed with the utmost celerity; in others the opportunity is afforded for deliberate and complete preparation before opening fire" (317). "In service the fire of field artillery must be adapted to meet the requirements of

COMMON FAULTS IN CONDUCT OF FIRE

many and ever-varying conditions. An infinite variety of concrete problems is afforded, and each problem will have its own best solution. . . . By constant practice in peace in employing fire (simulated or otherwise) to meet the requirements of a great variety of tactical situations, officers may prepare themselves to use their guns to the best advantage in war" (408).

LOSS OF TIME THROUGH FAILURE TO TRANSMIT AVAILABLE DATA AS SOON AS OBTAINED

Paragraph 278 states that firing data will "habitually" be communicated in a certain order. This order is not required to be invariably followed, but the order is common, usual, customary, ordinary. Time may be saved sometimes by early giving the range and kind of projectile; occasionally, at least, the method of fire may be postponed to advantage. The other data need not be delayed to await the finding of the range.

USE OF ORDERS SUCH AS "STEADY" OR "AS YOU WERE"

If data go to the battery which, because they were in error or because of changes in the situation, should be changed, the proper method and the one best calculated not to upset fire-discipline or not to reduce confidence in the conductor of fire is to give new data. It may even be wiser in some cases to fire with wrong data than to unload, reset fuzes and re-lay, particularly when communication is not by voice.

ATTEMPTING TOO NARROW A BRACKET. APPROPRIATELY NARROW BRACKET NOT ATTEMPTED

"Against stationary targets . . . a bracket of 100 yards should ordinarily be sought. Against targets moving slowly . . . a bracket of 200 yards should be attempted. Against transient targets . . . a bracket of 200 yards is usually the narrowest that should be attempted. Against troops moving . . . rapidly in the direction of the range . . . bracket by changes of 600 yards in range and . . . attempt no narrowing of the bracket

thus obtained. . . . Against instantaneous targets . . . no bracket is sought" (402).

Note the distinct differences in language above and the latitude permitted by Field Artillery Drill Regulations 408. These stationary, mobile, transient, rapid, or instantaneous targets grade into one another. Occasionally the conditions of observation or the pressing needs of the tactical situation may warrant contentment with a wider bracket than normal, although it is wasteful ordinarily to assume that the normal bracket cannot be obtained. Against some opponents or under some conditions, narrower than normal brackets may appropriately be sought. The narrower the certain bracket the greater will be the effect for the ammunition expended. But it is believed that early effect in a bracket described as appropriate by the Drill Regulations is the best insurance of damage to the enemy and that, if ammunition shall be furnished to warrant considerable practice fire for effect, methods will be developed for narrowing the bracket during such fire.

UNNECESSARILY REPEATING SALVOS SENSED FOR RANGE,
BASING LIMIT OF A BRACKET ON A SINGLE ROUND

During adjustment a single round sensed for range, for example, is sufficient basis for a change of range up to the moment when observations have been obtained both short and over, at ranges limiting the appropriate bracket.

For, suppose that in the next salvo one or more rounds are observed in the same sense as before; then the first range is more or less verified and may most likely be eliminated. If, on the other hand, that next salvo is observed for range in the opposite sense from the single round, nothing is lost because one can fire again to check the single observation.

To change the range on a single observation is quite different from basing a limit of a bracket on a single round. Probability shows that three correct sensings for range at each limit of a 100-yard bracket are necessary to make the bracket certain within 10 per cent.

COMMON FAULTS IN CONDUCT OF FIRE

USE OF INAPPROPRIATE BOUNDS IN BRACKETING FOR RANGE. ATTEMPTING TO SENSE AMOUNTS OF SHORTS OR OVERS

Familiarity with the theory of field gunnery alone will correct the first fault. "The initial range may be determined by a range-finding instrument," by other means, "or by estimation. . . . Upon its correct predetermination success in producing prompt effect depends" (335). The first bracket sought is usually 400 yards (396),—not always but usually. Analysis of firing records shows that the use of a good range-finder by a good operator working rapidly, in connection with fair determination of the angle of site, warrants 200-yard bounds. A range-finder in excellent condition operated by an expert without haste and in connection with an expert instrument sergeant or very reliable maps may warrant bounds of 100 yards or even the assumption of a bracket based on the observation of sufficient bursts at the first range used.

"It is rarely possible from a position near the guns to estimate with any accuracy the amount of the error in range" (370). Perhaps it would have been better to say "from a position near the line of fire." But it is sometimes possible at such a location and it is often possible at locations off the line to estimate that the range used was much too great or much too small and to make the next bound accordingly, not by a rule but by judgment. Constant study of ground forms will make observation on terrain much easier.

IMMATERIAL CORRECTIONS FOR DIRECTION, FOR DISTRIBUTION, FOR HEIGHT OF BURST. BASING CHANGES OF DATA ON TOO FEW OBSERVATIONS. TIMIDITY IN MAKING CORRECTIONS

"Dispersion is to be normally expected, and minor changes in firing data should not be based on the observation of a single shot" (384). A minor change may perhaps be well defined as one less than the width of the probable zone. At ranges about 3000 yards a minor change in deflection would

THE FIELD ARTILLERY JOURNAL

then be anything less than 10.5 yards or 3.5 mils, in height of burst anything less than 12 yards or 4 mils. Practically, then, changes of less than 5 mils are inadvisable based on single observations. Two observations form a fairly dependable basis and three are very reliable. When they are obtained the changes should be bold. Bracketing for height of burst and direction are quite as practical and valuable as bracketing for range, and bold changes mark self-reliance and initiative, characteristics indispensable in the accomplished soldier.

"To procure a close adjustment changes should be based on the observation of two or more shots fired with the same data" (385).

USE OF ERRONEOUS ANGLE OF SITE

The determination of the correct angle of site is discussed in Field Artillery Drill Regulations 333 and 395. But "erroneous" is used in the sense of large errors. The probable error in determination of the angle of site is 2.5 mils. If, instead of taking the measured or calculated angle the nearest angle which is a multiple of 5 is used, the probable error is increased to only 2.66 mils. When time is no object and there is opportunity for the accurate predetermination of data and their leisurely application at the guns, the calculated angle of site should be used, but otherwise simplicity and accuracy of service, fire-discipline and rapidity of adjustment will be enhanced by using the nearest division that is a multiple of 5. The probable error in range due to this method is only 10 or 12 yards.

MISAPPLICATION OF THE PRINCIPLE OF THE DROP-BACK

The phrase, "Drop-back and walk through," is catchy but it makes a poor rule. "To bracket" is rather the rule in firing at visible targets—to "drop back" is the exception.

"The range for the first salvo or volley is usually that corresponding to the short limit of the bracket" (404). "If he

COMMON FAULTS IN CONDUCT OF FIRE

is not convinced that the short limit of the bracket corresponds to a short range, the captain, in covering the area inclosed by the limits of the bracket, should insure himself against overshooting by opening fire for effect at a range short of the short limit. Every target attacked will present its own problem, which must be solved according to existing conditions and not by adherence to any fixed rule" (353). The principle of the drop-back is nothing but the assumption of a bracket wider than an uncertain one observed.

"The first consideration is to determine that fire at a certain range is surely short of the target, and that fire at another and longer range is surely over the target" (397).

Tactical considerations, conditions of observation, uncertainty as to the forward limits of the target—warrant the drop-back. For example, infantry or machine guns firing effectively on our troops call for early or immediate effect with decreased regard for ammunition expended; the meteorological or terrain conditions or the indistinct outline of parts of the target may make certain establishment of a short limit so difficult and slow as to warrant abandonment of the effort; an irregular or inclined crest or a scattered or uncertain front line of a target may call for a widened bracket. In such cases the drop-back is called for. Similarly a step-forward may rarely be appropriate. Resort to the drop-back is a confession of defeat, often excusable, in the attempt to obtain a secure and appropriate bracket which alone ensures large effect proportionate to the ammunition expenditure.

"It is the duty of every field artillery commander to exercise constant and unremitting care to economize ammunition. . . . Methods of fire that involve great expenditure of ammunition will not be permitted except when vitally necessary" (804).

USE OF WRONG METHODS IN FIRE FOR EFFECT

The first range "is usually that corresponding to the short limit of the bracket" (404). "The adjustment should be

continued during fire for effect" (403). "Fire for effect should be opened at an appropriate range. . . . Bold changes . . . should be made, . . . the rate of fire for effect being reduced, if necessary" (398) to permit continued adjustment of distribution and height of burst.

Against a moving target the appropriate initial range is that limit of a bracket toward which the enemy is moving. This may be the long limit.

On a still day or against targets on dusty ground a volley at the short limit may utterly prevent any subsequent observation at longer ranges. On the other hand a bank of smoke and dust short of the target may be of greater relative importance than effect throughout a bracket. To open at a short range is manifestly inappropriate in the first case,—at a long range in the last.

If a bracketed target is to be fired at for effect only, the mid-range of the bracket is most likely to give the effect, but it cannot ordinarily be relied upon alone. This range is the most probable one to the target. Because it gives the best chance of an appropriate reduction of the bracket and because a proper height of burst established there gives the best corrector for the whole bracket if the target is on not too great a slope, it will often be the most appropriate first range for effect or for the verification or modification of firing data.

If doubt as to the bracket arises during fire for effect, ranges outside the bracket may often be used, sometimes with a lowered corrector.

(a) If two rounds are observed as bracketing; (b) if four rounds are observed as bracketing; (c) if three rounds are observed as mixed over or (d) mixed short; (e) if four rounds are observed mixed over or (f) mixed short—indications of a range close to the part of the target ranged on are obtained. If the bursts were above the plane of site the range indicated is somewhat long except in the cases of mixed shorts, and in those it may be. If time is an urgent consideration a step-forward

COMMON FAULTS IN CONDUCT OF FIRE

and a drop-back may both be appropriately assumed as the limits of a bracket to be attacked. If time is a subordinate factor of the problem, more accurate adjustment of range should be sought before going to effect.

USE OF AN INAPPROPRIATE UNIT

"In deciding upon the unit to be employed in adjustment, the captain should consider the nature, size, importance and range of the target to be attacked, the conditions of observation, the firing data already determined by previous fire, the supply of ammunition, the tactical situation" (350).

Adjustment of distribution is three times surer by battery than by platoon. The height of bursts in air based on the observation of 4 bursts is five times as reliable as though based on 1 burst, three times as reliable as when based on 2 bursts.

The securing of a reliable bracket by battery salvos takes less than one-half as long as by piece, less than two-thirds as long as by platoon. It costs 25 per cent. more ammunition than by piece, 14 per cent. more than by platoon.

The deflection is much more easily established by battery than by any sub-unit because an original sheaf may be used that will practically ensure one shot at least in the direction of the target. The accuracy of calculation of deflections varies with the size of the angle, the instruments and methods used, the time available, the relative positions of guns and battery commander's station. Ordinarily the least distribution desirable for the first salvo is that for parallel fire. Under difficult conditions the sheaf may be widely opened. If there is great doubt as to deflection, the first salvo may appropriately be by piece with a high corrector or angle of site.

The more accurate the methods of range finding the more desirable is the use of the battery; the greater the necessity for early effect, the more useful is the battery.

Intensive Training for Volunteer Batteries

SUGGESTIONS FOR REGULAR OFFICERS ASSIGNED TO COMMAND NEWLY ORGANIZED VOLUNTEER BATTERIES IN TIME OF WAR

BY FIRST LIEUTENANT GEORGE H. PAINE, 3RD FIELD ARTILLERY

IN the following outline of a course of instruction for batteries of Field Artillery organized in time of war, it is assumed that a competent regular officer has been assigned to command the battery, that he has been given about 5 per cent. of men with previous service in the regular Field Artillery, and that the time available for training is limited to two months.

It is further assumed that the four lieutenants have already been appointed and given volunteer commissions, and that when the regular officer takes command of the battery the entire commissioned and enlisted personnel with the necessary matériel and horses are already on hand at the United States mobilization camp.

PRELIMINARY DUTIES ON FIRST JOINING BATTERY

First Hour.—Interview officers, and by an informal inspection look over the general situation, condition of equipment, personnel, and other conditions.

Prepare list of personnel of battery with columns for remarks as follows:

Name	Previous Service	Occupation	Experience with Horses	What Ability	Prob. Position in Battery
Smith, J.	No. of years position held as noncommissioned officer, etc.	Cook Horseshoer Mechanic Clerk Electrician Laborer Farmer Veterinarian, etc.	What experience and how much: Teamster Hostler Barn boss Cowboy Jockey, etc.	Bright Medium Dull	Noncommissioned officer Driver Cannoneer Cook Mechanic Scout Signal detail, etc.

INTENSIVE TRAINING FOR VOLUNTEER BATTERIES

Next Three Hours.—Divide battery into five sections, and cause each officer to interview and examine one section, man by man, noting appropriate remarks in columns, as above. (This will give an average of about five minutes to each man.)

Next Hour.—Look over results of examination and receive recommendations from officers of the qualifications of any men they know of in the battery for positions above that of private.

Next Hour.—Call up and interview all men who have had previous service, also men who have special qualifications for quartermaster sergeant, stable sergeant, mess sergeant and cooks (such as shipping and property clerks, veterinarians and barn bosses, chefs and cooks).

Next.—After weighing all possibilities issue an order appointing first lot of noncommissioned officers as follows:

First sergeant: From previous service man who has been first sergeant or has had the most service and has, in battery commander's opinion, the best qualifications for a first sergeant.

Quartermaster sergeant: A man with previous service or not, who has the best qualifications for the position. If a man can be found who has had no previous service, but has held similar positions of responsibility in civil life, it will be best to appoint him, as the chances are he will make a better quartermaster sergeant than a former service man who has had no experience as such. (Assume nonservice man.)

Stable sergeant: Man most suitable for position, preferably a man who has been a veterinarian or barn boss for a big firm in civil life. The chances are in favor of such a man being in the organization. (Assume such a man.)

Mess sergeant: Man most suited. If none of the previous service men have had experience as mess sergeants or cooks it will be best to appoint man with most experience as chef or cook in civil life. (Assume nonservice man.)

Cooks: Men with most experience with cooking. It is assumed that these men are not previous service men, as it would hardly be probable that more than one previous service

THE FIELD ARTILLERY JOURNAL

man would have been a cook and he would likely have been appointed mess sergeant.

This will leave eight previous service men for appointment as follows, according to their length of service and previous positions as noncommissioned officers:

Six men as sergeants.

Two men as corporals and acting chiefs of sections. Make no further appointments at this time.

Next.—Call up noncommissioned officers appointed and give them short talk on their duties, responsibilities, privileges and the like, impressing on them the short length of time available for preparing for field service and the fact that they will act as instructors as much as possible.

Next.—With assistance of officers and noncommissioned officers pick out sixty men who have had experience with horses and will make the most likely drivers and assign them as *permanent drivers*. Assign all other privates as cannoneers for the time being.

The battery should now be divided into sections. This preliminary work of the captain will have taken about seven hours and should be completed on the first day he joins the organization.

Next Day (First Working Day) 7 to 9 A.M.:

Drivers: Under direction of one lieutenant and stable sergeant stretch picket line and prepare, as far as possible, a place of stabling for the horses. Draw forage if possible.

Cannoneers—one half, under one lieutenant and 1st sergeant: general police of camp, adjustment of tents, ditching tents and general permanent arrangement of camp.

One half under one lieutenant and quartermaster sergeant and other noncommissioned officers: General arrangement of property, arrangement of carriages in proper parks. Unpacking halters and halter ropes.

The captain with other officers will at this time make arrangements for drawing horses assigned to him and also generally make arrangements of supply. If the property has

INTENSIVE TRAINING FOR VOLUNTEER BATTERIES

not been issued to the battery the captain should arrange to draw it at once.

If the carriages have to be hauled any distance a few teams of horses can probably be borrowed from some regular organization or the quartermaster. If the harness has not been issued, the halters and halter ropes should be drawn at once.

9 to 12 A.M. (or as much time as necessary): Whole battery under direction of officers and noncommissioned officers—each man draw a halter and rope and proceed to the quartermaster corral, from which each man will lead a horse to picket line and tie on line. Water and feed hay at once.

Afternoon.—General work by battery, placing property in shape. Unpack nose bags. Whole battery water and feed at 4.00 P.M.

Next Day (Second Working Day).—Necessary care of horses. General work with property.

During this time all property and equipment should have been drawn and properly issued and arranged. From now on the battery should devote itself to instruction, and as few details as possible should be made from the actual instruction work.

From inquiry into and study of the qualifications of the men the mechanics and horseshoers should now be appointed.

The following schedule of work should thereafter be carried on with as little interruption as possible:

SCHEDULE OF INSTRUCTION

FIRST WEEK

Time	Section	Exercise	Instructors
Reveille 7 to 7.20 A.M.	Feed horses. Whole battery	Setting-up exercises	Noncommissioned officers, supervised by officers and 1st Sergeant.
7.25 to 7.50 A.M.		Dismounted drill. Right and Left face, marching and halting. About face; marching in section.	As above.

THE FIELD ARTILLERY JOURNAL

Time	Section	Exercise	Instructors
8.00 to 11.00 A.M.	Cannoneers Drivers Note:—Cannoneers above No. 6 will on alternate days work with the drivers.	Individual duties in service of piece. (At least two-thirds of time devoted to service of piece.) Standing gun drill. Watering of horses. Work gentling horses. Each driver two horses to work with. Extra horses assigned to best men. Horses to be saddled and mounted as fast as possible and taught to move straight to front at walk. Stables and general work around picket line and park.	4 noncommissioned officers, supervised by 2 lieutenants. Remaining noncommissioned officers, supervised by 2 lieutenants. Note:—Captain and 1st Sergeant will divide time between drivers and cannoneers Captain going where his services are most necessary. All noncommissioned officers and all officers.
11.00 A.M. to 12.00 M.	Whole battery	Stables and general work around picket line and park.	All noncommissioned officers and all officers.

Afternoon

2.00 P.M. to 2.30 P.M.	Whole battery	Manual of pistol.	Officers and noncommissioned officers.
2.30 P.M. to 3.30 P.M.	Drivers	Nomenclature of harness. Arrangement of harness on poles. Care of harness and equipment.	Officers and noncommissioned officers. Note:—Half of chiefs of sections will one day be with drivers and next with cannoneers.
	Cannoneers.	Nomenclature of piece. Care of piece and equipment.	
3.30 P.M. to 4.00 P.M.	Whole battery	Instruction in military discipline, military courtesy, guard duty, etc.	Noncommissioned officers.
3.30 P.M. to 4.30 P.M.	Officers	Field Artillery Drill Regulations.	Captain.
4.30 P.M.	Drivers	Watering horses and feeding.	Officer and 1st Sergeant and chiefs of section.

Saturday: Same work as mornings.

Sunday: Stables 8 to 9 A.M. 9.30 to 10.30 A.M., lecture by captain on first aid.

At this time remaining noncommissioned officers and special detail men should be appointed.

INTENSIVE TRAINING FOR VOLUNTEER BATTERIES

SECOND WEEK

Time	Section	Exercise	Instructors
7.00 to 8.00 A.M. 8.00 to 11.00 A.M.	Same as first week. Cannoneers.	Standing gun drill. Service of piece by gun squad (at least two-thirds of time devoted to service of piece).	Same.
	Drivers	By this time most of the horses should be saddled and move forward at walk. Instruct in school of soldier mounted, to train men in proper seat and use of hands and legs and to train horses to go forward at walk and trot and to change direction. At end of this week horses should be permanently matched up in pairs and teams.	Same.
11 A.M. to 12.00 M.	Same as first week.		

Afternoon

2.00 to 2.30 P.M. 2.30 to 3.30 P.M.		Same as first week. Same as first week with the exception that drivers and cannoneers change duties on alternate days.	Battery officer of day and noncommissioned officer.
3.30 to 4.00 P.M. 2.30 to 3.30 P.M.		Same as first week. Captain and all officers except Officer of the Day instruct special details.	
3.30 to 4.30 P.M.		Same as first week for officers.	
4.30 P.M.		Same as first week.	

Saturday and Sunday same as first week.

THE FIELD ARTILLERY JOURNAL

THIRD WEEK

Time	Section	Exercise	Instructors
7.00 to 8.00 A.M.		Same as first week with exception that semaphore drill is substituted for calisthenics.	
8.00 to 11.00 A.M.	Cannoneers.	One-third time standing gun drill and service of piece. Two-thirds time battery fire-discipline.	Same.
	Drivers.	8 to 10, mounted instruction, one-half time on each horse. 10 to 11, by detail harness. Gradually put on all harness except collars and traces, which are to be put on the last day.	Same.
11 A.M. to 12 M.		Same as second.	
<i>Afternoon</i>			
		Same as second week with exception that in the hour 2.30 to 3.30 the drivers receive instruction in standing gun drill and the cannoneers receive riding instruction, using the off horses for this work.	

Saturday and Sunday same as second week.

INTENSIVE TRAINING FOR VOLUNTEER BATTERIES

FOURTH WEEK

Time	Section	Exercise	Instructors
7.00 to 8.00 A.M.	Cannoneers. Drivers	Same as third week with exception that specialists and 10 men who have shown most proficiency in signalling spend whole hour at that.	Same. Same
8.00 to 11.00 A.M.		Same as third week. 8 to 9, driving by pair. 9 to 10, harness and unharness by detail. Last two days spend as much time as necessary to refitting collars and harness. 10 to 11, driving by teams and simple movements in drill. (Right by section, section column, double section column, flank column, front into line, right and left flanks and abouts.)	
11.00 A.M. to 12.00 M. and afternoons		Same as third week.	

Saturday and Sunday same as third week.

THE FIELD ARTILLERY JOURNAL

FIFTH WEEK

Time	Section	Exercise	Instructors
7.00 to 8.00 A.M. 8.00 to 11.00 A.M.	Cannoneers. Drivers	Same as fourth week. Same as fourth week. 8 to 9.30, harness and hitch to limbers. Drill at walk with limbers. 9.30 to 11.00, draft exercise with spare caissons.	
11.00 A.M. to 12.00 M. and after noons		Same as third week.	

Saturday: Mounted inspection and refitting collars and harness.

Sunday: Same as third week.

SIXTH, SEVENTH, EIGHTH AND NINTH WEEKS

Time	Section	Exercise	Instructors.
7.00 to 8.00 A.M. 8.00 to 11.00 A.M.	Same as third week. Whole battery	Mounted drill, devoting at least two-thirds of time to selection and occupation of positions, calculation of firing data and fire-discipline.	Captain.
11.00 A.M. to 12.00 M.	Whole battery	Cleaning harness by drivers, watering and feeding horses. Cleaning matériel by cannoneers.	Officers and noncommissioned officers.
2.00 to 3.00 P.M.	Whole battery	Tent pitching and individual duties of men, including packs, etc., and caring for selves in field.	Battery officer of the day, noncommissioned officers and 1st sergeant.
3.00 to 4.00 P.M.	Drivers	Stables.	Officer of the day
2.00 to 4.00 P.M.	Cannoneers Special detail	Fire-discipline Training in special duties.	Executive officer. Captain and remaining officers.
4.00 to 5.00 P.M.	Officers	Methods of fire an calculation of firing data, etc. Clear up any parts of Drill Regulations not understood.	Captain.

Saturday and Sunday: Same as fifth week.

INTENSIVE TRAINING FOR VOLUNTEER BATTERIES

NOTE.—If pistol range is available the time from 2 to 3 P.M. may be utilized several times a week in pistol practice.

In sixth week take battery on road march of 10 miles.

In seventh week take battery on two road marches of 10 miles each.

In eighth week take road march of 15 miles, pitching camp and bivouacking at end.

In ninth week take road march of 20 miles, pitching camp, and bivouacking at end.

During this time occasion should be taken to dismount pieces, springs, cylinders, etc., and see that they are properly assembled again.

Every possible effort should be made to obtain ammunition and facilities for service target practice.

It is not contemplated that the above will provide for every necessity which might arise, but it is thought that, by adhering to this system in general, and making necessary minor changes which local conditions enforce, it would be possible in two months' time to turn out a volunteer battery which would be capable of:

1. Caring for itself in the field.
2. Making the average marches required of artillery with the main body of a division.
3. Placing the guns in position to fire.
4. Delivering an effective fire from well-concealed positions.

The above results, however, have to do entirely with technic, which requires nothing more than the adaptability and the capacity for hard work.

Having then mastered the technic we must not delude ourselves into thinking that we are capable of everything, for the fact remains, and we must look it fairly in the face, that in any action against a first class power we would have to stand heavy losses and terrific reverses, with the most gruelling kind of field service. Troops which could not stand such service day after day and still maintain their morale would be of very little value. It would be impossible, in a month or two, to create such troops, for the basis of their morale is long training and discipline, which is a matter of years and not months.

The Fuze Setter Problem

A PROPOSED SOLUTION

BY FIRST LIEUTENANT CORTLANDT PARKER, 2ND FIELD ARTILLERY

THERE is a great desire in the Field Artillery at present to obtain a fuze setter of more efficiency and rapidity of function than the present fuze setter possesses. The work of the Ordnance Department in this direction is set forth as follows:

"In view of the desire of the Field Artillery that a better fuze setter be developed, a great deal of thought has been given to that article of equipment within the last couple of years. It has resulted in various samples being forwarded to the Field Artillery Board for test, and in other suggested changes not yet developed to the point justifying their consideration by the board. The types forwarded for test and not yet reported upon include one in which the fuze setter is rotated while the projectile is held fast; one in which a latch is provided to prevent the projectile from being withdrawn until accurately set, and the Greble fuze setter, involving a number of new principles. There has been very recently forwarded for test by the Field Artillery Board a bracket fuze setter procured from the Erhardt Co., presumably having all the latest and best features developed by that company. This fuze setter embodies the principle of setting the fuze by turning a crank. An attempt was made to purchase a Krupp fuze setter and a French fuze setter, but the manufacturers declined to sell samples. Drawings of the Krupp fuze setter indicate that it differs from the Erhardt type chiefly in that only one turn of the crank is required to set the fuze, whereas two turns are required with the Erhardt type. In the Erhardt type the first turn of the crank in effect rotates the entire round until the pin in the fixed part of the round comes against a stop in the fuze setter. The

THE FUZE SETTER PROBLEM

second turn of the crank moves the time train ring the proper amount, depending upon the setting. In the Krupp fuze setter one or more extra sets of bevelled gears are used, in order that the two parts of the system may turn in opposite directions; thus performing both the above functions with one turn of the operating crank.

"One of the proposed changes in the bracket fuze setter as now being tested at Frankford Arsenal is an arrangement to make the corrector scale more plainly visible than at present. This is accomplished by making that scale a complete circle as on the hand fuze setters of the latest type. This avoids the necessity for a celluloid cover to protect the internal parts of the fuze setter, the corrector scale being wide enough to cover the slot for the pointer arm. The graduations on the corrector scale are on a circle of larger diameter than on the present bracket fuze setter, and will be much more easily read.

"Another feature being tested out is the addition of a spring plunger to the operating handle of the corrector scale, so that a distinct click will be given for each turn of the handle. As each turn will correspond to one mil change in corrector setting, it will only be necessary for the operator to turn the handle five times at the command 'Up 5' or 'Down 5,' counting the clicks to indicate when the proper change in setting has been made. This is a simple device and it is thought will facilitate quick changes in the corrector."

The duties of cannoneers in fuze setting and loading at the service of the 3-inch field gun, model 1902, are too complex, and the less the degree of training of the personnel the more does fuze setting lag behind gun laying. The field gun, model 1913, will require a fuze setter of great efficiency and rapidity to keep up with the gun, and with such a fuze setter the cannoneers will have to be highly trained in the handling of the ammunition. In fact the mere handling of ammunition is performed by inexperienced men in such a gingerly fashion that, given our field gun, model 1913, and a fuze setter which

is a fit companion for it, men unaccustomed to handle real ammunition will not be able to take advantage of the high quality of the machine in their hands.

The magazine rifle accomplishes by machinery what was formerly accomplished by hand by the rifleman—putting a cartridge in the chamber. In fact, there is a strong resemblance between our field gun and the old Springfield single shot in that both are single loaders and both are loaded by hand with cartridges taken from a source near at hand—for the field gun from the caisson and for the old Springfield from the web belt. Since the day of the Springfield single loader the magazine has been added to the small arms and so has it also to guns of field gun calibre. Krupp manufactures a 3.4-inch gun for naval torpedo defense, that is not only a magazine gun, but is automatic besides, and has a rate of fire of 40 aimed shots per minute. A photograph of this gun appears in the "Encyclopædia Britannica," under the head of "Ordnance." The magazine should now be applied to the field gun, first, because it will simplify the duties of the cannoneers, second, because it will reduce the number of cannoneers needed for the service of the gun, and third, because inexperienced or slightly trained men can deliver a rapid fire with a magazine field gun. The United States must, more than any other country, devise machinery to take the place of training.

If the magazine is applied to field guns the magazine must include a fuze setter. The breech mechanism should be designed to have the breech open automatically on recoil and be closed by hand by a cannoneer after the fuze projectile is ready for loading. The operation of one hand lever therefore should accomplish the following: (1) set the fuze on the projectile; (2) load the gun; (3) close the breech. The operation of a single hand lever on the 1902 field gun rotates the block and then gives it a motion of translation; the loading of the chamber of a small arms and closing of the breech is effected by a simple motion. It is not believed that the designing of a

THE FUZE SETTER PROBLEM

mechanism that will by a simple motion set a fuze, load the gun, and close the breech, is beyond the ordnance designers.

In the design of the field gun, model 1913, the Ordnance Department has given its sanction to the independent line of sight. It could probably be easily installed on the 1902 model gun, the cheapest way being very likely a copy of the arrangement on the 18-pounder British gun. The incidental value of the independent line of sight on a magazine field gun becomes at once apparent. The mechanism which gives the gun its range table elevation may be used to give simultaneously the range setting to the fuze setter. This results in a simplification of the duties of the cannoneers and in a reduction in the number of cannoneers necessary for the service of the piece. It may perhaps involve a rearrangement of the method of seating of the cannoneers at the gun to make room for a man to set the corrector scale on the fuze setter and to close the breech.

The duties of cannoneers at a magazine field gun would be about as follows:

- | | | |
|--------|---|--|
| Gunner | { | Lays for angle of site in direct laying only |
| | | Lays for direction in direct and indirect laying |
| | | Fires the piece |
| No. 1 | { | Lays for angle of site in indirect laying only |
| | | Lays for range in both direct and indirect laying, thereby setting the fuze setter apparatus for range |
| No. 2 | { | Sets off the corrector |
| | | Operates the breech operating lever, thereby setting the fuze, loading the piece, and closing the breech |
| No. 3 | { | Prepares projectiles and places them in automatic feed of the magazine at any time during the fire. If necessary moves the trail |

The writer of this article has had no experience in the design of ordnance matériel but in the hope that what follows may suggest ideas to a skilful designer, he submits it for what it is worth.

In discussing the nature of the fuze setter which must be a part of the magazine, it is necessary to call attention to the advantages offered by the Erhardt and Krupp fuze setters mentioned in the quotation at the beginning of this article. In these fuze setters there is nothing remarkable about the way in which the corrector and range are set off. The interesting point about them is that once the corrector and range are set off, the projectile is inserted at random in the fuze setter (the fuze of the projectile being put in snugly, of course), an operating handle is given two complete turns with the Erhardt, one with the Krupp, and the fuze is set. The projectile need not be held during the operation. Turning the operating handle twice on the Erhardt design turns one of the fuze setter rings around twice. Turning the handle once on the Krupp turns the range and corrector rings around once, but in opposite directions. The application of this fuze setter to a magazine such as appears on the Krupp design of automatic gun requires that the feed conduct the round where its fuze will fit snugly in the fuze setter attached to the magazine. The range elevating gear of the gun having set the fuze setter for range and the corrector ring having been set independently, the fuze setter would be ready for use. The breech operating lever must be geared into the fuze setter in such a way that the operation of the operating lever in the first movement of closing the breech sets the fuze in one of the ways shown above. A further movement of the hand lever sets in motion the loading device of the magazine, and the last of the movement closes the breech.

If it were possible to design an efficient cylindrical feed, such as the pump gun has, this kind of fuze setter is again appropriate. A cylindrical feed would probably have to be augmented by a vertical feed into which the rounds are placed first, due to the great length of a round compared to the length of the gun; and the magazine spring would have to be compressed by counter recoil after each shot, or better still by recoil if possible. The rear of the magazine spring, in such a design,

THE FUZE SETTER PROBLEM

would have to contain a fuze setter, which, while pushing the round rearwards towards the breech (just as in the case of a pump gun), sets the fuze, two complete turns being given to one of the rings of the fuze setter by means of a helical slot on the cylinder through which the round is pushed, a stud attached to one of the rings of the fuze setter working in this helical slot. The operation of such an arrangement would be about as follows: Recoil or counter recoil compresses the magazine spring which is held in its compressed position by a latch. A round then drops from the vertical feed into the magazine. While the magazine spring is compressed, the range for fuze is laid off by the gear which elevates the gun, this gear moving the cylinder containing the helical slot backward or forward along its axis. The corrector is laid off by an appropriate gearing moving the cylinder backward or forward without disturbing the elevating gear of the gun. The first movement of closing the breech trips the latch which holds the magazine spring compressed, the round is pushed to the rear and falls into the breech recess with its fuze set. Subsequent movements of the breech operating lever push the projectile into its chamber and close the breech.

The Krupp patent is 23,127 of 1908. It is illustrated by drawings in the *Journal of the Royal Artillery* for October, 1914.

The following details are among those probably necessary in such a mechanism: The fuze setter should have a cylindrical exterior so that it will slide snugly in the cylindrical magazine. One of the fuze setter rings is rigid with the body of the fuze setter and has on its outer circumference a stud which travels in a straight slot along an element of the cylinder. This stud and two other studs on the outer circumference of the body of the fuze setter travelling along other similar slots cause the body of the fuze setter to proceed along without rotating even when one of them crosses the helical slot. The movable ring of the fuze setter has a larger stud, which, travelling in a helical

slot, causes the movable ring to rotate twice during the travel of the fuze setter to the rear. This last stud is attached to a casting which slides in and out through the movable ring towards the axis of the fuze setter. It carries on the end away from the stud end a slot which catches the pin of the fuze. This casting and therefore the slot on its end are pressed away from the axis of the fuze setter by a spring, but when the stud on the outside of the casting is pressed toward the axis of the fuze setter, the slot will hold the pin on the fuze. The pressure on the stud being relieved, the pin on the fuze is released. The cylinder containing the straight and helical slots is covered by another and concentric cylinder of a length exactly containing two turns of the helix (which must be of constant pitch). The forward end of the outer cylinder is always over the point from which the fuze setter starts in its rearward movement. This outer cylinder compresses the stud on the movable ring of the fuze setter, and by its length insures exactly two turns being given the movable ring. By moving the cylinder containing the straight and helical slots backward or forward along its axis with respect to the point from which the fuze setter moves rearward, the time of burning of the fuze is regulated. This forward and backward movement is accomplished by a rack on it appropriately connected to the range elevating gear of the gun. The corrector gearing is arranged to move the cylinder containing the straight and helical slots without moving the elevating gear of the gun. This would probably involve bringing the corrector reading on the scale opposite a graduation corresponding to the range at which the gun is laid—a device now in use on some of our hand fuze setters.

The magazine, if applied to field guns, would increase the weight of the weapon. But probably a compensating reduction in weight could be obtained by the adoption of the differential recoil.

The Adjustment of Shrapnel Fire

BY REGIMENTAL SERGEANT MAJOR BASIL CONLESS, 6TH FIELD ARTILLERY.

IF our instruments, guns, ammunition and personnel were all perfect and the atmosphere did not change from standard conditions during fire, we could obtain from the instruments the correct deflection, angle of site and range. The proper corrector to give any point of burst above the target can be determined from actual fire. If these data were sent to the guns, applied by perfect gun crews, and fired from perfect guns, with perfect ammunition, the projectiles would be thrown through standard atmosphere along trajectories passing through the target. The perfect corrector can be adjusted to give bursts at any point of the trajectory above or below the target.

We work, however, with imperfect tools. The range finder does not always give accurate ranges to the target, but with experts we usually can get the range to the target within 200 yards. The angle of site is seldom accurately determined except when the gun, observation station and target are on approximately the same level. Over hilly country errors are frequently made in the measurement of the angle of site of from 5 to 10 mils. The atmosphere varies in density and humidity and winds blow from various directions and with varying velocity. These changes in atmosphere and wind affect the trajectory and rate of burning of the time fuze. The ammunition also varies in different lots, so that our guns, even though laid with the same data, will not give us the same ranges, and, finally, the gun crews seldom correctly apply the data which is sent to them.

These imperfect tools which we are obliged to use seldom gives us a trajectory which passes through the target, but by sending proper data to the guns, and by properly training the gun crews, we can obtain trajectories which are surely

short of the target and those which are surely over the target within the limits of the desired bracket. We can give these trajectories their proper position in the sheaf, and we can place the probable position of the point of burst in a plane any number of mils above the true plane of site of the target.

From the above, it appears that the problem which first presents itself in the adjustment of shrapnel fire is: What initial data shall be sent to the guns and what changes shall be made in the subsequent data, to give the greatest chance of adjusting the fire in the fewest number of rounds, or, in other words, what data sent to the guns in fire for adjustment will give the greatest chance of sensing the shots, and thus permit us to obtain most quickly and accurately the most effect?

At mid ranges, if the probable point of burst is in a plane one mil above the true plane of site, we have the greatest chances of sensing the air bursts. All that can be reasonably expected, in opening fire for adjustment, is that the position of the shots of the first salvo can be sensed right or left, high or low, of the target. If these shots can be so thrown that they will give bursts in air, their trajectories can easily be adjusted to their proper place in the sheaf by appropriate changes in deflection, and the probable position of the point of burst brought to the plane one mil above the true plane of site, by appropriate changes in the gun angle of site.

If the guns are laid with range finder range, and a gun angle of site, equal to the measured one, plus the greatest error of the person measuring the angle of site, and if the corrector is that which has previously given normal heights of air bursts, with range finder ranges, the first salvo will probably give air bursts, and appropriate changes can be made in the data sent to the guns, so that the next salvo will be fired with its trajectories in their proper position, in the sheaf, and with their points of burst in the plane where they can be most probably accurately sensed.

In firing for adjustment with shrapnel, the first salvo should

THE ADJUSTMENT OF SHRAPNEL FIRE

then be fired with the corrector, which has been established for the ammunition, time and place, and with the guns laid with the range finder range and an angle of site which will surely give bursts in air, or, grazes above the target when it is on sloping ground. The corrector should not be changed, after it has been established, unless there are sudden changes in head or rear wind, or in humidity or density of atmosphere, and the probable point of burst should be brought to the plane one mil above the true plane of site, by changes in the gun angle of site. The reasons for this are the following: We know that, due to errors in the tools we use, the trajectories we obtain will vary from the one passing through the target, which is the one we are attempting to approximate. In our attempted approximation to the one trajectory passing through the target we first vary the errors, which are most apt to have occurred in the tools we use, and those which will make the least variations in the data we have reason to believe are most correct. The range finder gives ranges to the target with tolerable accuracy, therefore the gun should be laid with range finder range, as we have most changes of bracketing by changes of 200 yards in range. At the same place and with the same ammunition the corrector does not materially change during a day's firing except as above noted. Changes in angle of site do not change range to point of burst; therefore, in adjusting height of burst we should do it by changing the element in the data, which will not change the range of burst and, which has most probability of being in error in its original determination. Corrector does not forget what it did before. Angles of site are seldom accurately measured in difficult terrain.

Of course the above statement applies only to indirect fire. In direct fire methods, where angle of site is automatically corrected for, the reasoning would be quite otherwise. In using direct fire as the angle of site would be the most apt to be correct, we would change the corrector to give points of burst one mil above the true plane of site, and this because, in this

method of fire, the corrector is more liable to be wrong than the gun angle of site.

To sum up then, for adjustment of shrapnel fire, in indirect laying, what we must get are data which when sent to the guns will produce one of two trajectories, which, taken together, will inclose the target within a bracket of appropriate limits, by air bursts, or, grazes which will give definite information in regard to air bursts which would have occurred, had the ground not intervened, and hence, that can be changed to air bursts by a small change in the corrector setting; finally, by observation of these bracketing bursts or grazes to change our data so that it will give a trajectory which will pass through, or near, the target, and on which bursts can be made that will be effective. Only one trajectory can be found which passes through the target, but this can be obtained in any number of ways by proper compensating changes in gun range and gun angle of site, so as to give the same angle of departure (see Ex. II). As stated above this trajectory is seldom, if ever, obtained, but we can obtain trajectories which are near this trajectory, and which bracket the target within the desired limits. It is the purpose of this paper to endeavor to show how these trajectories can be found with the least expenditure of ammunition, and, therefore, in the best and quickest way.

Before effect can be produced on a target by shrapnel fire, approximately correct, range of burst must first be established, for otherwise, the 3 mil height of burst will not give the proper interval of burst to get effect, and, as the obtaining of the correct range of burst depends on the observation of air bursts at the proper height to be sensed (0 to 1 mil high), with respect to the target, it follows, that the problem resolves into: How to get these zero to one mil high bursts on the plane containing the gun and target, and thus the correct range of burst, and how to do this with as small an expenditure of ammunition as possible.

It will be seen from these statements, which are believed to

THE ADJUSTMENT OF SHRAPNEL FIRE

be correct, that first, we must get a sensible air burst if possible, or a graze from which can be determined where the air burst would have been had the ground not intervened; second, by obtaining air bursts to get proper range of burst, and, third, having obtained range of burst, to obtain correct interval of burst by raising the corrector to the 3 mil height. By this method only can we surely get most effect on the target.

If effective shrapnel fire depends, as it does, on correct range of burst, height of burst and interval of burst, and these in turn can only be obtained on a trajectory which passes through, or near and short of, the target, we must find this trajectory, but how are we to do this and do it quickly? This is the question before us.

Let us now consider what may be expected in determining the initial data for the guns. The range finder will give correct range ordinarily to within 200 yards. The corrector will vary within narrow limits at anything approximating the same range, when once established for the day. The angle of site is liable to error in measurement by as much as—possibly 8 mils. This is especially true of the angle of site where the observation station is on a different level than the guns and target. The deflection is easily determined with sufficient accuracy to be readily corrected.

On a comparatively flat terrain where the angle of site varies no more than 5 mils or so from the horizontal, large errors in the angle of site are not apt to be made, though even in this case the height of burst should be adjusted by changing the gun angle of site, leaving the corrector alone, especially if range finder range is used.

But the terrain is not always comparatively flat and angles of site may be met, varying from 280 to 320. In such a country, the establishment of the correct bracket for effective time fire will be found a much more difficult problem than it at first appears to many artillerymen, and it is full of traps into which the unwary may fall. In fact, its difficulty will not be fully

appreciated until confronted, as some have been, by the fact that, due to improper methods, the corrector scale, when worked to its limit, is too short to pull the bursts out of the ground. After the expenditure of many valuable rounds of ammunition—doubly valuable in action—in futile efforts to get bursts in air, the battery commander will no doubt come to a realization of the fact that it would be very good policy to insure that his initial data sent to the guns will give an air burst, for, however high the air burst may be, it can be seen, and unless the fuze is defective, it will be within reasonable limits, its height, with reference to the plane of the target, can be measured or estimated, and by manipulation of the *angle of site scale in the proper sense*, the burst can be placed at the proper height, above the true plane containing the gun and target, *without changing the range of burst*. On the second salvo this burst can then be surely sensed as a "short" or an "over," for, the point of burst in the trajectory having once been placed on the plane containing the gun and target, or any other plane, by the use of the gun angle of site, it will remain practically unchanged as regards range or burst and height above that plane, and therefore, the initial gun range can be accepted as a surely "short" or "over" range, depending upon the sensing of the second salvo.

Now, if the first salvo can be fired by sending data to the guns, such that we will be enabled, by observation of its results, to place the bursts in the vertical plane of the target by proper corrections in deflection, and in the true plane of site by suitable changes in the angle of site scale for our second salvo, and with range finder range, make almost sure a correct sensing of a "short" or "over" on the second salvo, why should not such data be sent to the guns? The next question is: What precautions must be taken with the initial data so that its results will give us all this valuable information for use in the second salvo? The answer, in general, is, make a proper and fearless use of your angle of site scale.

THE ADJUSTMENT OF SHRAPNEL FIRE

In the proper handling of the angle of site scale, we have the solution of this, and most other problems, in shrapnel fire. But, you object, why should I change my angle of site? I have measured it and know exactly what it is. To which objection may be replied, very well, that is all the more reason why you should not be afraid to change it, if you can be shown a good reason for doing so, which this paper will try to do. But do you know your true angle of site? It is extremely doubtful. Do you know it within 8 mils? You may, but that even is not without doubt. Again, you may protest, how could such a large error as 8 mils creep into an angle of site, measured with an instrument? Which protest may be very properly answered, it is not known how such errors are made, but that they are is a fact. If you doubt this, test it, by calling together a half-dozen or more competent men in a broken and hilly terrain, where targets may have angles of site varying from 280 to 320, with the guns on a different level than the observer and target, and, without previous notice, require them to compute the angle of site for a given target, and note the result. This test will more than likely convince you that the measurement of the angle of site is very liable to error and if this is so, why be so determined to stick to something you now have proof may be entirely wrong and, at the expense of the ammunition and time you are sure to waste by doing so, only finally to discover you must change your much-beloved angle of site, or find your fire ineffective. Why, I ask, do you wish to stick to your measured angle of site when, after all, it is not angle of site you are after, but trajectory—a trajectory which will pass through or near your target? Angle of site, true or false, never has, nor will, hurt anything. It is the trajectory which carries the "sting," just as does the curved tail of the scorpion. The angle of site is merely the lever, as it were, by which we adjust the "curved tail" on the point we wish it to strike, and a mighty fine lever it is, in skilful hands. The point of burst, on the trajectory, is the "business" end of it, and that is what we want to

adjust in shrapnel fire. Must we have true angle of site to do this? The answer in capital letters is, NO.

Let us now examine in turn each of the following statements for flaws. If they are free from errors, as far as practical gunnery is concerned, we can proceed with the solution of any problem in time fire and use the assumed facts they state to assist in our solution:

- (a) –1–Changing the angle of site by amounts used in practical gunnery changes the position of the trajectory in the same sense and by the same amount.
 - 2–Changing the angle of site changes the height of burst in the same sense and by the same amount.
 - 3–Changing the angle of site does not change the interval of burst.
 - 4–Changing the angle of site *does not change the range of burst.*
- (b) *The range of burst is practically the same as though it were measured along the plane of site used by the guns.*
- (c) If (a–1 to a–4) are facts, the range of burst will be the same on the true plane of site as on that used by the guns.
- (d) A change made in the corrector changes the height of burst, *range of burst*, and interval of burst.
- (e) Raising the corrector increases the interval of burst, *decreases the range of burst*, and raises the height of burst.
- (f) The corrector does not change materially during the time of firing a problem; hence, it can be expected to give bursts very close to the plane in which it is once placed during that time.
- (g) The corrector does change for different ranges and under different atmospheric conditions, and this change increases proportionately with the increase in range.

THE FIELD ARTILLERY JOURNAL

- (h) Increasing the gun range increases the range of burst, and, for short ranges, decreases the interval of burst by practically the same amount. The converse is also true.
- (i) With the same corrector setting, increasing the gun range by the amount of the bracket, when range finder range is used, will not appreciably change the height of burst.
- (j) A graze short and below the plane of the target proves nothing, except that the trajectory is passing through a point short of the target. The gun range may be right, too short or too long. The angle of site may be true or false. The corrector may be the proper one, but fails to give air bursts, on account of the error in some one of the other factors, viz.: gun range, or angle of site, hence, this is the least desirable of all results to obtain from the first salvo.
- (k) A graze above the plane of the target, when the corrector for the day is being used, indicates that the gun range is too great, and its height above the plane of the target shows by at least how much too great.
- (l) An air burst short and below the plane of the target shows that the gun range is surely short, and that the angle of site is too low.
- (m) An air burst above or below the plane of the target, being a point on the trajectory, can be placed one mil above the true plane of site by $(a-1)$, and can be fixed in direction by the deflection scale.
- (n) The true gun range is the point at which the trajectory intersects the plane of site used by the guns.

Are the above statements correct? They are believed to be,

as was said before, as far as practical gunnery is concerned. Their mathematical exactness is not claimed.

Let us then proceed to apply the knowledge they give us in the solution of the following problems and see how it works, *assuming that all the factors affecting the accuracy of fire are perfect, except the data sent to the guns.* We will then see the effect of the data when applied to the gun.

EXAMPLE I.

Let G be the gun, T the target, GT the true range (3000), and GOT the true plane of site (Fig. 1). The corrector for adjustment has been established by previous fire as 28, and it is decided to use this as a trial corrector; the computed angle of site is 307. The battery commander is directed to adjust for

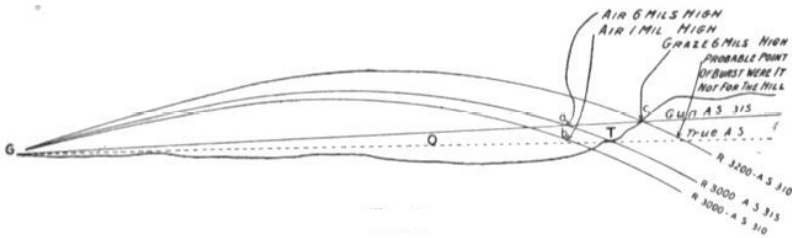


FIG. 1.

time fire on T with his perfect battery and perfect ammunition. Realizing, first, the danger of getting a "below graze," with its poor results, if he has a minus error in his angle of site; second, that the conditions affecting the corrector may have changed considerably since the previous firing upon which he bases his decision to use corrector 28; third, that, as has been explained, his computed angle of site may be in error as much as 8 mils, minus, and if so, the consequences; and, fourth, that the range finder range is 3000 yards, the battery commander considers as follows: "My battery is perfect; my ammunition is perfect; I do not know what changes have taken place which will affect my corrector, for it, however perfect, may vary; my problem requires that I obtain correct range of burst and height of burst; an air burst or high graze will give me the most definite

THE ADJUSTMENT OF SHRAPNEL FIRE

information on which to base corrections for my second salvo. To insure an air burst or high graze, he must have a high trajectory for the gun range given; therefore, he wisely decides to add 8 to cover the greatest error he has ever known himself to make in computing the angle of site, and fires with angle of site 315, corrector 28, range 3000, with the result that his point of burst is at a point *a* (Fig. 1), which we will assume in this case to be 6 mils above and 20 mils to the right of the target, and nonsensical as to range. What does he know? His point of burst is 6 mils above the plane and 20 mils to the right of the target. He commands, "Add 20. Site down 5, 3000" (this will probably put his point of burst in the vertical plane through gun and target and

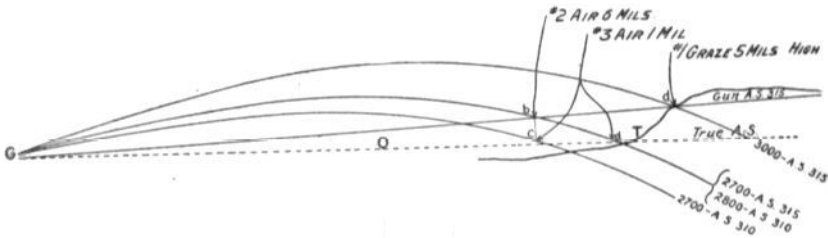


FIG. 2.

one mil above the plane of site containing gun and target, where it will probably stay). The second salvo gives him an air burst at *b* (Fig. 1), and is sensed "short." He commands: "3200," fires and gets a high graze at *c*, 6 mils above T. By this he knows this range is at least 120 yards too great, and that, consequently, his target is in the bracket 3000–3100. He knows that his corrector cannot have changed materially since his second salvo, and that he can obtain his correct height of burst and interval of burst by now raising his corrector 2 points, he is ready to verify, and his problem is solved in three salvos.

EXAMPLE II.

Supposing that instead of getting an air burst by the addition of the 8 mils to his computed angle of site, he gets a graze 5 mils above the target at *a* (Fig. 2). The battery commander

will know that at range 3000, 5 mils equals approximately 100 yards, therefore his target is at least that distance short of the graze, or at about 2900 yards. If now he reduces his gun range by this 100 yards, plus the length of the bracket he is trying for (200 yards with range finder range), he will drop back 300 yards in range and fire at 2700. As this shortening of the gun range will draw his trajectory back from the hill, which intervened, to prevent his getting an air burst on his first salvo, and towards giving him the results to be expected from his addition to his measured angle of site, the probabilities are that the burst will be in air at b (Fig. 2), we will say 6 mils high and non-sensible as to range. The command, "Site down 5," will place his probable point of burst in a plane one mil above the true plane of the site at c , and by firing with range 2800 he should get a "short" at d . His first salvo proved his target to be something short of 2900, if anything, and he has now a bracket of 2800–2900 and is ready to verify. Should he not get an "air" or an above "graze" in his second salvo, he should at once raise his angle of site by 5 mils, which will almost surely give him an air burst that can be placed as before on the true plane of site, and he can proceed then as in the first case, with the same results, except that an additional salvo is required to get the bracket desired.

It will be noted that the data angle of site 315, range 2700 and angle of site 310, range 2800 gives the same trajectory, but with the point of burst 5 mils lower in the second case, also that the range 3000, angle of site 315, which gave a graze 5 mils above the target, gives the same trajectory as range 3100, angle of site 310, and this range and angle of site give a trajectory which is surely over the target. Therefore, if 2800 is short, the bracket is 2800–3000; if 2900 is short, the bracket is 2900–3000; if 2900 is over, the bracket is 2800–2900, etc.

THE ADJUSTMENT OF SHRAPNEL FIRE

EXAMPLE III.

In this case let us assume that the battery commander has not taken the precaution to get an air burst or high graze by adding to his computed angle of site, and, as a result, gets a "below graze" at *a* (Fig. 3). Supposing he has made an error of minus 8 in his angle of site, but persists in using the angle of site he computed, he will more than likely find himself in a bad tangle. His observation tells him any one of several elements of his data may be wrong. If he attempts to get an air burst one mil above the true angle of site by using his corrector, he will have to raise it so as to pull the point of burst back along the trajectory to the point *b* (Fig. 3), thus shortening his range of burst by the distance *bc* (Fig. 3). He is, by this method,

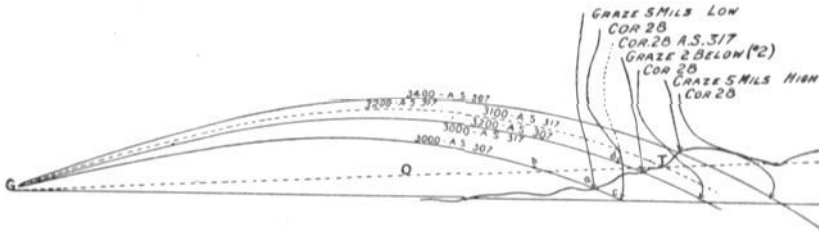


FIG. 3.

shortening the very thing he should increase—his range of burst—and regains this only at the expense of time and ammunition, for, with range finder range given, he will undoubtedly increase his range by increments of 200 yards, and he will finally arrive at a bracket with a gun range much in excess of the true range. Should he make no attempt at all at this stage to get an air burst, but simply increases his range, he will drive his point of burst comparatively deeper into the ground with each increase in range, and make his problem of getting an air burst by the use of the corrector still more difficult and dangerous. The proper thing for him to do is to assume his angle of site is "out" and raise his trajectory at once by the command, "site up 10." This change, we will assume, gives him a burst at *d* (Fig. 3) one mil above the true plane of site. By this he

has not shortened his *range of burst* in any way, which will be the distance "bd" closer to the point he is trying for than in the first case, and at a saving in ammunition and time over the other method. His salvation then depends on using his "lever"—the *angle of site scale*—to pry his trajectory and point of burst on it, out of the ground, leaving his corrector alone. Having obtained an "air," he proceeds as in Examples I and II.

If then, as in these examples, where the gun crews, guns and ammunition are assumed to be perfect, the principle of using the angle of site scale to make sure of throwing the first salvo high, or in air, is found to give results which enable us to inclose the target quickly, within a proper bracket, by air bursts, with the smallest possible expenditure of ammunition, and also when this bracket is established to allow us to use the corrector for its proper function, viz.: to get the proper height, and hence the proper interval of burst, why should not the same principles give *the best results obtainable* with matériel, personnel and ammunition which are not so perfect? It is believed they will, and they have only to be tested to prove their value. Adjustment of shrapnel fire by this method, giving as it does more nearly what may be termed the true range of burst, we can pass to shell fire with a closer approximation to the true range to target. We, of course, cannot pass to shrapnel fire from adjustment with shell.

The principle of assuming the angle of site to be correct, and of obtaining the correct height of burst for sensing in adjustment by changing the corrector by large amounts, is believed to be wrong. Changes in the corrector, "up," shortens the range of burst and necessitates the expenditure of additional rounds of ammunition, in ranging, to overcome the changes made in this way; besides, it may lead to a case of running off the corrector scale, without gaining the much desired air burst, and then the whole process must be started over again.

I have seen these principles put in practice. They are

THE ADJUSTMENT OF SHRAPNEL FIRE

taught in the regiment to which I belong. I have seen the mistakes made I have mentioned by the misuse of the corrector, and I have seen them avoided by the proper use of the *angle of site scale*, as indicated herein.

For whatever wisdom may be found in the foregoing remarks the credit is due, not to me, but to those who taught me; whatever errors they contain are all mine, and are due to the fact that my limitations are such I am unable to state properly what I believe the principles taught to be. Their investigation by competent artillerymen will no doubt determine what is their value, and if they lead to such an investigation being made, they will have served their purpose.

Aviation and Its Employment with Field Artillery

FROM the point of view of important coöperation with the staff departments and the other branches of the service, the aeroplane, to date, has played a rôle in this great war second to no other arm. If its service has been of inestimable value to the present date, when it is still in its infancy, as regards preparation and training of the necessary pilots, not to mention the continued improvements being made in the matériel, what are its future possibilities? The different makes, types and uses that aerial craft are put to to-day are innumerable, but we may safely place them in three distinct categories, and their order of importance is as follows:

First—Specially-constructed machines for direction of artillery fire.

Second—Specially-constructed machines for long reconnaissance and to combat the enemy's air machines.

Third—Specially-constructed machines for destruction of important points by the use of bombs and other explosives.

Commencing with a discussion of the first type, it is believed that for the important duty of artillery fire, a very high degree of training is necessary in order quickly and intelligently to direct the fire on the desired points. This is the coöperation the artillery must reserve in order to combat an enemy effectively, well disciplined and familiar with the new methods of artillery warfare, of firing from concealed positions. Without the effective coöperation of the aeroplane, artillery to-day would lose much of its effectiveness, though the latter be perfectly trained and well disciplined.

In order to fulfil the necessary requisites, the machine must be small, light, fast and easily transportable, and, of great importance, it must be part of the artillery regiment, just as the machine gun is an element of the infantry regiment. It is

AVIATION: ITS EMPLOYMENT WITH FIELD ARTILLERY

believed that at least three of these machines should be assigned to each artillery regiment and at least two pilots; that they should participate in regimental instructions and attend all maneuvers as part of the regiment. To insure easy transportation, some system of dismounting the machines should be arranged for. The great advantage of having machines attached to, and forming part of, the regiment, is that constant association with the officers of the regiment, and an understanding of what is wanted, would naturally bring about perfect harmony between the work of the aeroplanes in conjunction with the regiment, similar to that existing between any other units of the same regiment. On the contrary, where the aeroplanes are assigned, as in France, by squadrons, to the army, and distributed to the corps, an artillery commander may need a machine immediately to direct the fire of his batteries on a concealed enemy, but it takes hours to get one from corps or army headquarters,—if he gets one at all. Often, before the machine arrives, the enemy has either caused great damage, or has changed position. The war of to-day has demonstrated that artillery must take advantage of fleeting targets; the clever enemy does not remain long in the same place, especially if discovered. If the aeroplane is attached to and present with his regiment, the regimental commander, through frequent, short reconnaissances of his machines, is kept constantly informed of what is in his front, and is prepared at a moment's notice to combat any danger. If it becomes necessary to enlist the services of an aeroplane from the higher headquarters, the pilot and his methods are probably strange to the artillery commander, and as has been demonstrated many times in France, the observation, and efficient direction of fire, by aeroplane, have not always been successful.

From very reliable aviation sources, the artillery in France are making every effort to have this system carried into effect, but through the opposition of the aviation corps, it has not yet been adopted. In conversation with aviators and artillery officers,

THE FIELD ARTILLERY JOURNAL

they are, without exception, in accord with this plan, and state that this part of the aviation service must be separate and apart from the service of general reconnaissance at long distances, and placed under the direct control of the regimental commander.

The present war has so demonstrated the vast importance of intimate relations between the aeroplane and the gun, that one is almost inclined to believe that, with a strong artillery of various calibres, a well-trained and efficient aerial service, the task of the infantry would be reduced one-half, and, except in special circumstances, the cavalry would be practically eliminated as a unit of reconnaissance.

From observation and long discussion French officers of great experience strongly recommend the consideration of the assignment of an aviation platoon, or some efficient units to every artillery regiment, as part of that regiment.

Notes on Lost Motion and Jump

BY CAPTAIN FOX CONNER, FIELD ARTILLERY

IN the January-March number of FIELD ARTILLERY JOURNAL an article appeared under the caption, "The Effect of Lost Motion on Accuracy." The arguments adduced in the course of the article are so manifestly specious that only the great interest of the subject warrants serious consideration of the paper.

On page 150 of the same issue of the JOURNAL appears a definition of the so-called principle of the "independent line of sight." To equal the simplicity of the definition would be difficult; to surpass it in inaccuracy would be impossible.

From another source it appears that the idea is held that a rigorously accurate field gun would be disadvantageous and that we must endeavor to retain a reasonable amount of inaccuracy in order to compensate for the imperfections of the field artilleryman.

The difficulties in trying to find common ground for the field artilleryman and the ordnance officer have always, and necessarily, been great. The one expects an essentially delicate mechanism to withstand any treatment, while the other finds it difficult to get away from machine-shop and proving-ground methods.

Many good stories are told to illustrate the slowness of acceptance of the field artilleryman's view-point in our own and other services. No doubt the ordnance stories concerning the narrowness of the field artilleryman's point of view are equally numerous and just as pertinent. If such is not the case, it certainly has not been due to any neglect in presenting ridiculous ideas on the part of the field artilleryman.

Nevertheless, however tedious the process of finding common ground, such a basis has always been found sooner or later—to our mutual benefit. So certain have we been of arriving in the end at a mutual understanding with the Ordnance Department that probably the vast majority of field artillerymen agree in considering that department as one of the best of our supply departments to deal with. Sooner or later it always adequately supplies our real necessities.

It is feared that there is a growing class who refuse to consider the field artilleryman's opinion; who assume that they should compensate for his lack of skill by designing matériel which will possess just the necessary amount of error; and whose self-confidence is ample to enable them to prescribe the most minute details of the drill of the gun squad. With such an element the problem of finding common ground becomes much more difficult. Nevertheless, since the class of officers we refer to seems to be increasing, such ground must be found if our Field Artillery is to continue in its present degree of efficiency, to say nothing of future progress.

It is high time that field artillerymen presented their points of view on many technical subjects. It is true that this is now done by the Field Artillery Board, and those officers who as yet control the Ordnance Department policies invariably call on that Board for its views on all questions of real importance. After all, though, the Field Artillery Board is limited in its personnel and views and there is a crying need for a more extended use of the FIELD ARTILLERY JOURNAL in presenting field artillery views on matériel. In expressing such views no one should be deterred by the fact that he has forgotten, as the present writer has, practically all the mathematics he ever knew. Mathematics are largely a matter of common sense and in our present state of benightedness we are fully justified in rejecting as unworthy of credence any mathematical discussion the result of which tends to show that the sum of two and two is one and one-half.

NOTES ON LOST MOTION AND JUMP

To take up the article in the January-March number of the JOURNAL, the author very clearly sets forth the proposition which he undertakes to demonstrate in his opening paragraph. "Lost motion, to the amount of 8 or 10 mils, in the elevating or traversing mechanisms of the service 3-inch gun carriages, does not materially affect their accuracy. An exaggerated idea of its effect subjects the 3-inch matériel to unjust adverse criticism, and offers an easy explanation for erratic results, which should properly be traced to other causes." It might, of course, be said that the "easy explanation for erratic results" is at least as valuable as the laborious method by which the author demonstrates his total lack of conception of the technic of artillery fire in the field.

From the general tenor of the article it seems reasonable to suppose that of "other causes," the uppermost in the author's mind were errors of personnel. Unfortunately there is a great deal of truth in this idea of the causes of erratic results. It is certainly incumbent upon us to remove, in so far as possible, such of these causes as are actually due to personnel; and there is no doubt but that we can do much more in this direction than we have hitherto accomplished. Surely it is no less incumbent upon the Ordnance Department to remove such causes of error on the part of the personnel as have their ultimate origin in improper design or lost motion. But 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. Certainly when, in firing at 3000 yards, we have bursts at the muzzle as well as at the target, it is impossible to attribute such erratic results to any combination of lost motion and personnel. There are many of us who have made adverse criticisms concerning lost motion who are not at all certain, even yet, that such criticisms were unjust. In the very beginning of the article we are considering, the author takes up in detail the duties, as he conceives them to be, performed by the gun squad in firing the piece. The following

extract is especially pertinent: "No matter how rapid the fire, the direction of the piece is never assumed to be correct but is verified immediately before the final operation of pulling down on the firing handle." The difference in view-point may be well illustrated by rewriting this sentence so as to express the actual truth from the field artillery standpoint: "No matter how great the necessity for rapidity of fire, the direction of any piece which has several mils lost motion in traverse can *never* be assumed to be *even approximately* correct but *must* be verified, etc.," would represent the whole truth, and nothing but the truth. At about this juncture, the author lays special emphasis on the fact: ". . . the slightest changes of the gun from the line of sight (sic) are immediately registered in the eye-piece of the panoramic sight and on the bubble of the quadrant." Clearly, the author of these extracts has not considered, if he has heard of it, the method of "volley fire sweeping." In the fall of 1913 the present writer reported, as required by orders, upon practice of the 2d Battalion, 6th Field Artillery, for the target year 1913. In this report the following paragraph occurred:

"8. There is too much play and lost motion in the traversing and elevating mechanisms. The lost motion in the traversing gear of most of the carriages of this battalion is so great as to preclude any possibility of regularity between the first and second rounds of volley fire sweeping. Existing orders require devising methods of training the personnel to compensate for this play. This has been done so far as practicable but the results are unsatisfactory. It would seem desirable to find some mechanical means of taking up play and lost motion. With a carriage and gun weighing several thousand pounds it would appear practicable to avoid the necessity of relying upon the gunner to hold the piece in position by main strength." It is not believed that such criticism as is contained in the quotation is unjust. In view of the table at the top of page 176 of the January-March JOURNAL, the criticism might

have been extended to include all rounds of volley fire sweeping.

So much harmful misconception, concealed under the guise of such seemingly innocuous statements, is contained in the article we are considering that it may be well to recall a few of the fundamental ideas which brought about the adopting of field artillery of the 3-inch type. These ideas, however simple, now seem to be in danger of being forgotten. It is said that the first artillerymen endeavored to suppress all recoil by fixing their guns to carriages sufficiently massive to overcome all shock. However this may be it is certain that mobility began to be sought as early as four hundred years ago. At that time the practice was inaugurated of firing the guns from the carriages upon which they were transported. The next thing sought by artillery officers was a projectile which would actually be effective. It was not until 1803 that Shrapnel made the first really great invention tending to increased efficiency of projectile. Now began a very serious search for increased range and accuracy. This step made its most marked progress in the universal adoption of rifled guns in the latter part of the 19th century. While these changes were taking place there was a constantly increasing demand for rapidity of fire. No doubt the first guns were not rapid-firers, for we read that as late as 1499 certain Swiss troops were so enthusiastic over the sight of the artillery of Louis XII that they exclaimed that with guns and carriages of such perfection, it would be easy to fire 30 rounds per gun per day. Thus it is seen that mobility, range, accuracy, power of projectile, and rapidity of fire are no parvenus, but have been sought for centuries. The interdependence of these elements runs into remarkable ramifications. In some cases the attainment of one of these primary considerations aids in securing another. For example, the introduction of the modern recoil system has for its most apparent result the suppression of movement of the carriage and the consequent increase in rapidity of fire,

but of great importance is the increase in muzzle energy, without increase of carriage weight, which can be secured by permitting the gun to recoil on the carriage. In adopting our present 3-inch matériel in lieu of the 3.2-inch, we increased the muzzle energy by about ten per cent. It is true that the increase in weight of the 3-inch gun and carriage over that of the 3.2-inch amounts to about 26 per cent. But this increase in weight is largely accounted for by the shields, the more complicated and more satisfactory methods of laying, and other improvements. Moreover if we compare the present French gun with our old 3.2-inch gun we find an increase in muzzle energy of about 23 per cent., accompanied by an increase of weight somewhat less than is the case with our 3-inch gun. In other words, the French, through the principle of the gun recoiling on the carriage, have secured an increase in muzzle energy more than double that which we secured by the application of the same principle. Moreover they have secured this increase with less increase in weight than we have utilized. While, as we have just attempted to show, the securing of one of the primary requisites may assist in securing another, it must be admitted that in some cases two or more of the fundamental considerations may be opposed. But by a judicious choice of means it is possible to harmonize the conflicting considerations, and to construct a field gun possessing mobility, range, accuracy, rapidity of fire, and power of projectile. All of these are essential; and, while some concessions must be made, we of the Field Artillery are no longer willing to admit, in view of the feats accomplished by ordnance constructors, any material sacrifice in a single one of the above mentioned characteristics of a light field gun.

To General Langlois is generally ascribed the credit of pointing the way to the modern field gun and carriage. General Langlois was not an ordnance constructor, but in 1891 he pointed out certain requirements which the field artilleryman demanded that a gun should meet in order that he

NOTES ON LOST MOTION AND JUMP

might do his work on the battlefield. General Langlois did not ask the impossible; he made no requirement that had not already been more or less satisfactorily met by one constructor or another. For instance, as early as 1877 the Russian General Englehart had constructed a field gun with a trail spade and an elastic shock absorber. In Colonel Deport and others General Langlois found constructors capable of meeting the demands which he had formulated while instructor in field artillery tactics at the French War College. 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. General Langlois stated as an essential requirement that the piece return to its exact position immediately after firing. Neither he nor, so far as known, any of his pupils discuss so obvious a defect as lost motion. The following quotation is from Captain Campana, an officer frequently considered of some importance as an authority: "The essential condition of rapid fire is that immobility of the carriage which assures us that the laying remains the same. Absolute stability of the carriage requires at the same time the control of the recoil and the suppression of the jump. If both these conditions are not obtained we can only have accelerated fire." There is no escape from the proposition that lost motion tends to reduce rapidity of fire. There is still another effect: Any factor which tends to reduce rapidity tends also to reduce accuracy when speed becomes important. Surely we are justified in believing that lost motion is not advantageous either to rapidity of fire or to accuracy. It is, of course, possible to remove lost motion and yet, through improper design, to have no effect in the way of reducing inaccuracies due to lost motion. A good example of this is found in many of the bracket fuze setters still in service. Standing in rear of one of these fuze setters and examining

it, we find that it has a spring designed to thrust the range worm to the right and so take up the longitudinal play in the worm shaft. But when the projectile is turned in the fuze setter, the fuze stud comes against a stop in such a way as to tend to thrust the range worm shaft toward the left. To say that such a device is useless in so far as concerns the reduction of inaccuracies due to the longitudinal play of the range worm shaft may be adverse criticism, but it certainly is not unjust.

Returning to the article in the January-March JOURNAL, we find that, to indicate "the negligible effect lost motion has in practice" the author introduces an example. The example consisted of subcalibre firing with a carriage having 9 mils lost motion both in azimuth and elevation. The author sums up the results of this firing by quoting the battery commander as saying: "If my guns shoot like this, I have no complaint to register against lost motion." Considering hardly anything beyond the date contained in the article in question, it may be demonstrated that it is scarcely going too far to say that the battery commander was hoodwinked and that the results of this firing may be better expressed by some such characterization as worthless, useless, and misleading. On page 176 the author makes the statement: "The final operation of pulling down on the firing handle with the gun loaded is the only one, as emphasized before, which permits an error due to lost motion." A certain fine distinction is then made, but for convenience the total derangement of the piece is given as nil from zero range up to 1500 yards. The reason for this lack of derangement in elevation is stated to be the excessive preponderance at the muzzle. It is to be inferred that these ranges are to be coupled with an angle of site of about 300. Returning to the report of the subcalibre practice, it seems that while the range setting was 2500 yards the angles of site were 260, 263 and 266. The data used corresponded to a range of less than 1500 yards, when converted to angle of site 300, in every case except when 266 was used, in which

NOTES ON LOST MOTION AND JUMP

case the corresponding range was about 1570 yards. In passing it may be noted that the author has found a new use for the ubiquitous mil, for at the top of page 178 he uses that unit for the measurement of a radius. That the results of the firing were worthless and useless follows from the fact that service ammunition was not used, and from the fact that the author of the test used elevations which he himself asserts preclude the possibility of the error he is investigating. That they were misleading is shown by the fact that the battery commander apparently thought the tests were of some importance. The characterization of the tests as useless, worthless, and misleading may be adverse but it is certainly not unjust.

A close study of the tabulated statement at the top of page 176 is warranted. As has already been pointed out, the stated errors in deflection due to opening and closing the breach are sufficient, in a carriage having much lost motion, to preclude the use of "volley fire sweeping." At 2300 yards an error of two mils in elevation amounts to 50 yards. The several carriages of a battery will probably have different amounts of lost motion and it is possible that the effect of lost motion will vary from round to round. At any rate many field artillery officers agree in believing that, if the pieces of a battery are laid and then loaded and fired without verifying the laying, the total dispersion due to lost motion both in range and direction may correspond to the greatest lost motion in any one carriage. Is it presumptuous for the field artillery to say that with a gun and carriage weighing more than 2500 pounds it should be possible to lay and then load without having the laying disturbed? Certainly it is an extremely desirable demand from a field artillery standpoint. 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 disturbs the laying?

THE FIELD ARTILLERY JOURNAL

Lost motion may or may not be responsible for the failure of instruments to remain properly adjusted, but it is certainly pertinent to know whether or not our instruments for laying will remain correctly set under the shock of firing. A certain amount of data on this subject was obtained during firings at Fort Sill on July 9, 1915. During this firing the guns were in position on ground very favorable for the action of the trail spade and float. The carriages used were numbered 454, 455, 458 and 459. The corresponding quadrant numbers were 757, 756, 667 and 758.

The settings of the quadrant were verified immediately before each round was fired, and special precautions were taken to avoid touching any part of the quadrant or of the elevating and traversing mechanisms, after the round had been fired, until the data sought had been obtained. The ranges used varied between 2300 and 2600 for carriages Nos. 454 and 455, the angle of site being 300. With carriages Nos. 458 and 459 the range for all rounds was 3600, with angle of site 295. From carriage No. 454 eight rounds were fired, the angle of sight reading never changed but the range setting changed three times; once by 25 yards and twice by 50 yards. From all the other carriages seven rounds were fired. With carriage No. 455, the reading of the angle of site changed at each shot, the total change of reading amounting to six mils (in the same sense) for the series of seven rounds. The same carriage, No. 455, quadrant No. 756, showed a change in range setting after each shot but one, the variations from the true setting running from — 12½ to + 50. Carriage No. 458 showed an error in the angle of site setting due to the shock of discharge three times out of seven, and the range reading was deranged twice out of seven times. With carriage No. 459, quadrant No. 758 had its reading for angle site changed every time, the maximum change on any one shot being 1½ mils; the range setting was changed five times out of seven, the changes varying from — 25 to + 50 yards. In view of this it is well to again rewrite

NOTES ON LOST MOTION AND JUMP

our author's dogmatic description of the duties of the gun squad to the end that we may eventually hope to gain a proper perspective of the manner in which we must train our gun squads. After such a revision we might well be justified in teaching our gun squads that: "No matter how great the necessity for rapidity of fire, neither the direction, the elevation, nor the angle of site setting, nor yet the range-reading can *ever*, with the lost motion of our present 3-inch gun matériel in actual use, be assumed to be *even approximately* correct, but each and all of them must be verified, etc." 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 shock of discharge materially disturbs the range and angle of site settings? It is always possible that some one will have the hardihood to express the idea that errors such as we are now considering have a negligible effect on accuracy. But is a field artilleryman to be called unjust if he invites attention to such matters; is he guilty of *lèse majesté* if he asks that his instruments be so designed as to retain their settings under the shock of discharge?

Hitherto it has usually been assumed that the difference between the angle of elevation and the angle of departure necessarily had to be determined by experiment. Not a few fairly well-known mathematicians have even expressed this idea in so many words. But the author of the article we are considering proceeds to calculate the jump by an ingenious mathematical analysis, the intricacies of which the present writer must admit that he is wholly unable to follow. But since the non-mathematician is notoriously prone to evade suspicion of ignorance under the cloak of the assertion that his is a practical mind, our author at once states: "Tests have been conducted at the Sandy Hook Proving Ground, N. J., in which the 3-inch gun was discharged with the elevating and traversing mechanisms removed so that the 'jump' of the gun was not restrained, and only the normal jump of 6 or 7 minutes was

obtained." "Jump" is a term which is somewhat loosely used, but there can be little or no doubt that in the above quotation the author refers to the jump of the gun while the projectile is in the bore. On page 184 he calculates this jump as being 7.26 minutes, under the assumption that the gun is free to rotate about its spontaneous axis, as would be practically the case with the elevating and traversing gear removed. At the bottom of page 184 he discusses the whip to the projectile due to the rotation of the gun and determines that this amounts to 6.74 minutes. He therefore concludes that the jump of the projectile might measure 14 minutes. We are vouchsafed no detailed data as to the ranges, number of rounds fired and other conditions during the Sandy Hook tests. But 6 or 7 minutes would be the jump of the *projectile* we would expect according to the 3-inch Handbook and we cannot consider that a *jump of the gun* of that amount is normal.

However, the entirely practical mind encounters a difficulty when on page 184 it is noted that the author describes the lever arm responsible for the rotation of the gun about its spontaneous axis as "the distance of the centre of gravity of the gun to the centre of gravity of the cylinder." It is indeed difficult for the layman to imagine what this distance (which is relatively considerable) can possibly have to do with the rotation of the gun about its spontaneous axis. But by investigating we find that the lever arm actually used in the calculations is the perpendicular distance between the axis of bore and the axis of the piston rod. But after striving to remove the primary difficulty the entirely practical mind is more at sea than ever when it notes that on page 148 of the same JOURNAL another officer of ordnance states 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 all the recoiling parts. In several places our author speaks of the rotation, in elevation, of the cradle about its pintle. Possibly

NOTES ON LOST MOTION AND JUMP

he refers to some matériel not in service. At any rate in the 3-inch matériel now in service the cradle is restrained by the rocker and in any case the rotation, in elevation, of the cradle is *not* around the pintle. The net result of our author's computation appears to be that, with considerable lost motion we might have a difference in angles of elevation and of departure of as much as 14 minutes. According to the 3-inch Handbook of 1912 we would expect a difference in those angles of from 5.7 minutes to 6.5 minutes at all ranges up to 5300 yards when firing with a gun and carriage in good condition. It is at once seen that, even admitting that we accept the author's conclusions, this increase in jump is of importance to field artillerymen. According to the 3-inch Handbook of 1912 (page 31) the jump which we have a right to expect is 6 minutes when the range is 2800 yards. The difference between this and 14 minutes is 8. One minute in elevation at this range gives a range difference of 7.1 yards of range. Eight minutes is then equivalent to a range error of about 56 yards which might be attributable, using the author's figures, to lost motion. Turning to page 150 of the Handbook we find the probable error in range in percussion fire with a gun and carriage in good condition stated to be about 18½ yards. The error which might result from a great deal of lost motion might therefore, according to the author, be more than three times the probable error to be expected from a gun and carriage in good condition. We have already asserted, and there can be no doubt of the fact, that lost motion is prejudicial to rapidity and that a loss of rapidity tends to react unfavorably upon accuracy. It is probably perfectly true that the jump does not materially affect the accuracy of a gun, which is perfectly laid immediately before each shot, so long as the jump remains constant. This is true whether the jump is great or small. For example, according to Ordnance Department figures, the jump of the 3-inch gun varies with the range between 5.7 minutes and 7.7 minutes, while that of the old 3.2-inch gun varied

with the range between 20 and 30 minutes. Yet from available sources it appears that at 1760 yards the probable vertical error of the 3.2-inch trajectory was 1½ feet, while that of the 3-inch is, from the Handbook, a little over 2½ feet, or half as great again. The figures just given are somewhat surprising when we remember that many authorities tell us that a modern gun should be more accurate than the older types. 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. But the field artilleryman must consider four guns; and it is by no means satisfactory to him to have varying amounts of lost motion, even though such motion caused no material inaccuracies when the guns are fired under proving ground methods.

On page 181 of the January-March FIELD ARTILLERY JOURNAL the statement is made ". . . the springs and friction could be neglected altogether without materially affecting the length of recoil . . ." Field artillerymen have been perhaps too prone to believe that the weakening of springs, aside from the failure to return the gun into battery, had the effect of increasing the recoil. This belief was based on the fact that the springs have an initial compression of over 500 pounds and that, if they follow the usual laws governing spring columns, this compression reaches a maximum of over 1100 pounds during recoil. If the total pull on the piston rod is constant and amounts to 4923 pounds, it appears that the part played by the springs in checking the recoil may at a particular instant amount to some 28 per cent. of the total part played by other causes. However, since we are assured that the springs may for practical purposes be neglected, it is hoped during the coming fall to fire a series of twenty rounds from a carriage with the springs removed. Exact data will then be available on this question.

The article demolishes the adherents of the view that excessive jump is sometimes due to the failure of the trail to

NOTES ON LOST MOTION AND JUMP

hold, etc., by the sentence appearing on page 185: "It is at once seen that the rotation of parts about the spade edge or failure of the trail to hold have infinitely less effect than the proposition investigated." "It is at once seen" and "from this equation we readily obtain the following" are figures of speech greatly in vogue at West Point to take the place of many interpolated pages of abstruse formulæ really necessary to "see" or "readily obtain." Naturally, the present writer has no great sympathy for those so demolished, as he has never been thoroughly convinced that the nature of the platform has any great effect on jump. If, however, the adherents of this view believe that the jump of the projectile is proportional to the total jump of the carriage, they may find some consolation in their extremity by referring to page 150 of the report of the Chief of Ordnance for 1902. On that page the following is found: "Spade 18 inches in ground at end of test, causing excessive jump of wheels."

On page 186 of the January-March JOURNAL there occurs a paragraph which, although somewhat long, is so remarkable that it must be quoted in full. "Firing records are susceptible of intelligent analysis to determine the behavior of the piece as regards lost motion. It would appear that irregular heights of burst, cross fires and the like would be especially prevalent in cases where carriages having considerable lost motion are used. In numerous reports examined the most remarkable feature therein was the absence of such irregularities and the high accuracy with which the pieces responded to the laying. This was especially noticeable in salvo firing. The absence of such irregularities is a more positive proof that lost motion does not affect the accuracy than the presence of irregularities, or proof that it does." The Field Artillery Board examines the records pertaining to every round fired in the regular service. While its analysis may not have been intelligent, the present writer, as a member of the Board, feels justified in asserting that it has never been dumbfounded by the absence of irregularities.

But in this instance our author's meaning when he uses the term "irregularities" must, as in other cases in the article, be intelligently interpreted or, according to the point of view, taken *cum grano salis*. Doubtless he knows, as well as field artillerymen do, that in firing 20 time-shrapnel at 3000 yards we could expect all bursts to be in a vertical zone not greater than 20 yards in height about one time in five hundred. Irregularities are not to be disposed of in any casual remark concerning their striking absence and the high accuracy with which the pieces respond to the laying.

Continuing the author believes: "Investigation of the sources of errors which might be attributed offhand to lost motion should be encouraged by battery commanders." We might go much further and deplore any offhand method of attributing errors to any particular source. An example of such an offhand method is found in items one and two of the discoveries made in our author's inspection from Rock Island Arsenal in 1913. These items concern the range rings of fuze setters which it is claimed were incorrect. Does that prove that firing was conducted with incorrect range rings? The 3-inch Handbook for 1912 enumerates (page 51) three kinds of fuzes as being in service. In 1913 it was necessary for the 6th Field Artillery to keep a double supply of fuze setters on hand until the completion of the target season, for the reason that different models of ammunition were furnished the regiment for its practice. During the month of June, 1915, the present writer saw range rings changed twice during a single morning's firing. Battery B, 6th Field Artillery, is accused of having had four bracket fuze setters with incorrect range rings assembled thereon. Our author would have done more to discourage any tendency which the battery commander of this battery may have to attribute offhand an error to lost motion, had a statement been made as to the irregularities in heights of burst to be expected had these four fuze setters been used in firing a problem.

NOTES ON LOST MOTION AND JUMP

As for the fact that Battery D had an "Erhardt 1911" range ring, even a field artilleryman might possibly differentiate between an error in the fuze and one in the trajectory. We hope that few field artillerymen would confuse errors in elevation, which may be caused by lost motion in the elevating gear, with errors in the fuze, none of which can be caused by such lost motion.

The remaining three items cited as examples from the inspection report refer either to lost motion in the strict sense or to something so similar as to make it somewhat difficult for the non-technical mind to differentiate. Since sixty per cent. of the examples cited refer to lost motion, it does not appear that they are happily chosen for the purpose of encouraging battery commanders to take up the "investigation of the sources of errors which might be attributed offhand to lost motion."

Having completed his investigation, the author proceeds to draw his conclusions. His first conclusion is that the effect of lost motion in traversing and elevating mechanisms is "a maximum at ranges between 1500 and 2500 yards where the effect is in elevation alone and may approximate 3 mils; this is more than compensated for by the dispersion of the shrapnel balls." The idea that an error of three mils in height of burst can be more than compensated by the dispersion of the shrapnel balls shows so fundamental a misconception of the elementary principles of shrapnel fire that it is best to consider that the phrase just quoted is the result of some peculiar typographical error. It is incredible that any one could believe the idea contained in the quotation as printed.

That the first deduction, which we have just considered, is based upon the proposition that the duties of the gun squad are performed in exactly the manner prescribed by the author, is shown by his second and final deduction. That he has abandoned the proving-ground method and let his imagination soar to include the gun squad working under the actual conditions

obtaining on the blood-soaked battle ground of the future, is shown by the opening sentence of deduction number 2. "In the heat of action and with poorly trained gun detachments, it must be realized that the operations of firing might be reversed—the gun directed and then loaded and fired without verifying the laying." The field artilleryman believes that with a gun and carriage weighing more than 2500 pounds it should be possible to direct the gun and then load and fire it without verifying the laying; he insists that this is desirable from his point of view. He also insists that the instruments should not change their readings as a result of the shock of discharge. But after all the author believes: "There are exceptional cases that are possible only under conditions of intense excitement, too great haste, and with poorly disciplined gun squads." Can it be possible that the author believes that the greater part of the gun squads which we must organize in time of war will be other than poorly trained? Does he really believe that "conditions of intense excitement" will be exceptional in battle? "Too great haste" does not convey a definite meaning. The matériel must be considered. The present matériel was designed to increase the rapidity of fire. All parts of the matériel should be maintained in such condition as to reduce in so far as possible the evil effect of "too great haste."

For the peroration the article in the January-March JOURNAL begins: "As a matter of policy it is the intention of the Ordnance Department to eliminate lost motion as far as practicable. . . ." The policy is a good one and cannot but be very satisfying to field artillerymen. But are we to infer from the general tenor of the article that the policy is not founded on any real necessity? We prefer to think that the decision to eliminate lost motion has been based on reasons which appeal to the field artilleryman. Some of these reasons are: Lost motion is inherently disadvantageous wherever it occurs; it prohibits the effective use of a method of fire included

NOTES ON LOST MOTION AND JUMP

in our drill regulations; it reduces the rapidity of fire; it affects the accuracy of fire. In adhering to such a creed, field artillerymen need not be unmindful, although they may disregard, the sentence occurring on page 174 of the January–March JOURNAL: "Moreover, the effect that lost motion has on the rapidity of firing is only briefly mentioned, because, as indicated hereafter and as shown by a little experience, it is a matter of no large importance." A "little" experience is a dangerous thing but it does not tend to make the field artilleryman more content with lost motion.

Battery Administration and the Duties of Lieutenants

BY CAPTAIN WILLIAM BRYDEN, FIELD ARTILLERY.
(Lecture Delivered at the School of Fire, Spring Term 1915.)

NOT long ago I completed ten and a half years' service as a lieutenant. Consequently I approach this subject backed more by experiences with battery commanders than by experiences as a battery commander.

While a lieutenant I served under or had opportunity to observe battery commanders of various degrees of energy and efficiency. As a result of my observations, as well as of many lengthy conferences held with other lieutenants, I believe that many battery commanders do not use to best advantage the officers and noncommissioned officers given them as assistants. There is much routine work to be done about a battery, and unless that work is systematized, and the responsibility for its execution divided among different individuals, time and labor are wasted, and opportunities for instruction are lost.

Now that I am a captain, what plan shall I follow as a battery commander, in an attempt to work out a satisfactory system whereby the routine work of the battery can be best accomplished with the least expenditure of time and labor on the part of all concerned, and which will allow me opportunities for work and thought upon questions of more importance than the making of returns or the checking of property?

In reply to the above question, I submit the following:

In this plan the responsibility for the performance of routine work and for the keeping of certain records is divided, in general, as shown below:

BATTERY ADMINISTRATION—DUTIES OF LIEUTENANTS

THE BATTERY

RECORDS KEPT

Captain.

CARE OF ANIMALS AND THEIR EQUIPMENT

Lieutenant A.Descriptive lists of public animals.
Stable sergeantForage book.
Sick book.
HorseshoerShoeing book.
Chiefs of section.

CARE OF MATÉRIEL

Lieutenant B.
Chief mechanicCleaning schedule.
Repair book (by saddler).
Gunners and caisson corporals.
Privates assigned to caissons.

CARE OF QUARTERMASTER
PROPERTY, BATTERY RECORDS,
PERSONAL EQUIPMENT

Lieutenant C.
Quartermaster sergeantWant book.
Clerk.
Chiefs of section.

CARE OF MESS

Lieutenant D.
Mess sergeant.

GOOD ORDER, POLICE AND DISCIPLINE

First sergeantProperty book for N. C. O.
in charge of quarters (in
garrison).

This assignment of noncommissioned officers must be considered as a general one only; most of them have work in more than one department.

No attempt is made here to list all records that should be

THE FIELD ARTILLERY JOURNAL

kept in a battery; only those are mentioned that otherwise might not be kept at all, or if kept, might not be kept by the persons indicated. When no blank forms are provided, these records are kept in blank books of such a size that they can be securely buttoned in the pocket of the shirt, in order that they can be easily carried when the battery takes the field.

The lieutenants change departments by roster from time to time, but not oftener than once every three months.

Let us now consider the several departments more in detail.

CARE OF ANIMALS AND THEIR EQUIPMENT

The personnel available for duty in this department consists of the lieutenant in charge; the stable sergeant, with his assistants; the horseshoer, with his assistant; the chiefs of section, with their drivers, and such cannoneers as may not be required elsewhere for the time being. The first sergeant also has duties in connection with this department.

As soon as the lieutenant takes charge, he proceeds to make himself familiar with all the details of his work. In order to give him something to start on, the following points are suggested as subjects for investigation:

When and how the animals are watered and fed.

Method of policing the stable and picket line.

Method of procuring forage and of checking same.

Condition of the stables, picket line, dispensary, and horseshoer's shop.

Character of the horseshoer's work.

Condition of the harness and equipment in use and also of that in storage.

Whether or not articles such as saddle-bags, feed bags, and so forth, are kept ready for immediate use; and whether or not the descriptive lists of public animals truly identify the animals in the battery.

The daily work is carried on in accordance with the methods outlined below.

With a competent first sergeant it is not necessary for the lieutenant to be present while the battery is harnessing preparatory

BATTERY ADMINISTRATION—DUTIES OF LIEUTENANTS

to mounted drill. He does arrive at the battery, however, in time to look over the teams while they are hitching. After return from drill, he is present while the chiefs of sections are having wet harness wiped off, and collars and bits cleaned.

Stables is usually held immediately after return from drill. The drill regulations state that "all the battery officers should be present at the grooming which takes place after drill." I have never seen a battery where all officers regularly attended stables together, but if I were to see such a sight, I would consider that the time of all but one of the officers was being wasted, while the work of that one was being interfered with. The lieutenant in charge of animals takes stables on all days except holidays and Sundays. For those days, all lieutenants, and the captain also, if he so desires, are detailed by roster for that duty.

Stables is conducted as follows: The first sergeant assembles the chiefs of section, the drivers, and a number of cannoneers sufficient, if possible, to make it unnecessary for one man to groom more than two animals. A corporal is placed in charge of spare animals; an absent chief of section is replaced by his caisson corporal. No noncommissioned officer is required to attend stables unless he has some definite duty there.

After having seen the grooming properly started, the lieutenant may attend to some of his other duties, such as inspecting the sick animals, the stables or the store-rooms, checking forage, and so forth, taking care, however, that he returns to the picket line in time to complete stables.

It is understood that after having groomed for a specified time, say forty minutes, a chief of section, when he believes his animals are in order, may report that fact to the lieutenant. The lieutenant then carefully inspects the animals of that section, and if they are found to be in satisfactory condition, the chief of section is told to cease grooming and to dismiss his men, provided they are not wanted for any other purpose. If, however, any animal is found not properly groomed, the chief of section is required to have *all* his men continue grooming,

and when he again believes the animals to have been properly groomed, he notifies the lieutenant as before.

This method of conducting stables proves very satisfactory if the inspections are carefully made, and if the chiefs of section are not permitted to get the idea that the officer will allow the men to be dismissed as soon as the forty minutes have elapsed whether the animals are properly groomed or not.

In inspecting it is not sufficient for the officer to walk quickly along the line seeing only the rumps of the animals. He must not be afraid of carrying away with him a little of the perfume of which a mounted officer need not be ashamed. The inspecting officer walks between and around the animals, looking into nostrils, on top of heads, under manes and tails, feeling under bellies, between fore-legs and under fetlocks, and picking up feet to see that they have been properly cleaned. In this way only can a proper inspection be made.

Harness cleaning, when ordered, is conducted in a manner similar to that of stables; the drivers working under the chiefs of section, the lieutenant supervising all. In order that the instructions contained in the authorized handbooks may surely be followed, the closest kind of supervision is required.

Shoes are not left on the animals until they drop off. The shoeing is by roster, a sufficient number of animals being shod each week to insure the shoeing of each animal at least once during a period of from four to six weeks, depending upon the climate and the nature of the work being required of the animals. Shoes that have been pulled off, are, of course, replaced at once without regard to the roster.

The roster is kept by the horseshoer in the "shoeing book." In this book are the names and numbers of all the animals in the battery, with columns, one for each week, in which are recorded the work done and the initials of the inspecting officer.

At a convenient time each day, the horseshoer brings the shoeing book to the lieutenant, and together they inspect the

BATTERY ADMINISTRATION—DUTIES OF LIEUTENANTS

animals that have been shod that day, the officer initialing the entries in the book provided the work has been satisfactorily performed.

For the purpose of having a record of the forage drawn and fed, the stable sergeant keeps a "forage book." This book shows the amount of oats, bran, hay and bedding on hand at the close of each day, as well as the number of public and private animals present.

In his daily inspection of this book, the lieutenant checks the amount of forage actually on hand against the figures shown, and initials the entries if the check is satisfactory.

A record of animals on sick report is also kept by the stable sergeant in the "sick book." This record shows the name and number of the sick animal, the dates of the day on and the day off sick report, the disease or injury, the date on which the record of sickness was posted on the descriptive list, and the initials of the officer posting or checking the posting of this record. The two records last mentioned can usually be kept in a single book.

Specimen pages of these three records are shown herewith.

SPECIMEN PAGE OF SHOEING BOOK. WEEK ENDING

No.	Name	March 1	March 8	March 15	March 22	March 29	April 5
1	Ben		V B.A.				X B.A.
2	Bill	A B.A.			If B.A.		
3	Jack						

V. shod in front; inverted V, shod behind; X, shod all around; If, shod left front; rf, shod right front; lh, shod left hind; rh, shod right hind; B.A., initials of inspecting officer.

Left hand page; dates continued across right hand page.

By making use of a flap or by cutting the pages, several pages can be used without repeating names and numbers.

THE FIELD ARTILLERY JOURNAL

SPECIMEN PAGE OF FORAGE BOOK.

1915 Mch.	Oats (sacks)			Bran (sacks)			Hay (bales)			Bedding (bales)			Animals		Checked
	Drawn	Fed	On hand	Drawn	Fed	On hand	Drawn	Fed	On hand	Drawn	Used	On hand	Pub.	Pvt.	
1	100	10	90			4		12	38			50	124	11	B.A.
2		10	80			4	50	12	76			50		10	B.A.
"															
"															
31															

Left hand page and as much of right hand pages as may be necessary; remainder of right hand page left blank for figuring allowances.

By making use of a flap or by cutting the pages, several pages can be used without repeating headings.

SPECIMEN PAGE OF SICK BOOK.

No.	Name	Date on	Disease or injury
72	Ginger	4/1/15	Quarter crack

Left hand page.

SPECIMEN PAGE OF SICK BOOK.

	Date off	Date posted on D.L.	Remark on D.L. O.K.
	4/11/15	5/2/15	B.A.

Right hand page.

By making use of a flap or by cutting the pages, several pages can be used without repeating headings.

BATTERY ADMINISTRATION—DUTIES OF LIEUTENANTS

CARE OF MATÉRIEL

The personnel available for duty in this department consists of the lieutenant in charge, the chief mechanic, the gunners, the caisson corporals, and such cannoneers as may be needed for the work at hand.

The lieutenant has general charge of all ordnance property in the battery. He must be intimately acquainted with all parts of the matériel, and must know the proper methods of using the various tools and materials that are issued.

The only way for him to acquire this very necessary knowledge, is to get a suit of fatigue clothes and a handbook, and to spend sufficient time at the guns during cleaning periods and at other times to learn the matériel from pole pad to muzzle.

The care of the matériel is a duty that is greatly neglected in the field artillery. Usually this work is turned over to noncommissioned officers who have never had proper instruction in the subject; if, perchance, the work is intrusted to an officer, he is usually content with the cleaning when the mud has been all washed off. Gun carriages are machines, and machines require intelligent care, and much oil.

The principal enlisted assistant in this department is the chief mechanic.

The drill regulations state that "the chief mechanic is responsible to the captain for the good order and repair of the matériel in actual use by the battery; for this purpose he has general supervision of the battery mechanics." If he is to be assigned this duty he should be given the authority to perform the work properly, and should have general supervision also of the gunners, the caisson corporals, and the privates assigned to caissons. In my opinion, the chief mechanic should be a sergeant, who cares for the matériel, just as the stable sergeant cares for the animals, who knows all about the matériel and is

qualified to show the gunners what they should do and how they should do it.

The fact that according to the law the chief mechanic is not a noncommissioned officer, and therefore, strictly speaking, has no authority over corporals, probably accounts for the variety of ways we find the chief mechanic made use of in the different batteries of the service. Seldom do we find him burdened with the responsibility mentioned in the drill regulations. Sometimes he is an extra blacksmith, or a carpenter, or an assistant to the quartermaster sergeant, who knows next to nothing about the matériel, and who never goes near the guns except at the request of a gunner in need of assistance. In any particular battery, however, the necessary authority can easily be given the chief mechanic by an order from the battery commander.

The drill regulations make the chief of section responsible for the entire section; the gunner responsible to the chief of section for the good order of the piece, and the caisson corporal responsible to the chief of section for the good order of the caisson and also of the caisson team. I believe it a better arrangement to make the chief of section responsible for the entire section as before, to make him directly responsible for the condition of the teams of both piece and caisson, to make the gunner responsible to the chief of section for the good order of the piece and caisson, and to make a specially designated cannoneer (usually the man who operates the brake, cannoneer No. 4) responsible to the gunner for the good order of the caisson. Scouts, signalers, agents, and so forth, are chosen in part from among the caisson corporals, and as a consequence they are often not with the caissons, while the No. 4 cannoneers are seldom separated from them. The suggested division of responsibility leaves the caisson corporal free to replace at stables an absent chief of section, or at the cleaning of carriages an absent gunner. It also gives a very satisfactory method of trying out

BATTERY ADMINISTRATION—DUTIES OF LIEUTENANTS

possible noncommissioned officer material as privates assigned to caissons.

In order to keep the matériel in proper condition, it is necessary that a simple but comprehensive "cleaning schedule" be devised and followed.

A copy of such a schedule for use with a 6-inch howitzer battery is shown herewith. As there are only two such batteries in the service at present, the details of this schedule will not be of interest to many officers, but a similar schedule can easily be devised for any calibre.

CLEANING SCHEDULE.

6-INCH HOWITZER MATÉRIEL

Daily Cleaning.

Before leaving park:

- (1) Unlock boxes and chests, and secure same with snaps.
- (2) Oil brake mechanisms of piece and caisson, pintle of piece limber, and on Mondays and Wednesdays (on marches daily) oil wheels and wheel hooks.
- (3) See that oiler contains oil enough for the day.
- (4) See that tools, paulins and so forth, are properly secured.
- (5) See that oil holes are properly closed, that hub caps are tight and hub-latch plungers in place, and that the carriages are in every way prepared for use.

After returning to park:

- (1) Remove from the carriages all dust, excess oil, and mud. While thus engaged look sharply for missing nuts and split pins, and for any parts broken or needing adjustment.
- (2) Make any repairs or adjustments found necessary.
- (3) Clean and oil bore and breech recess; after firing of any kind, clean with sal soda solution prepared by the chief mechanic, wipe perfectly dry, and then oil.
- (4) Clean and oil exposed gears and teeth of mechanisms, and exposed parts of guide rails and gun slides.
- (5) Clean and oil spade keys, spade bearings and brackets and the front and rear travelling locks.
- (6) If necessary, clean and wipe with oily waste, picks, shovels, axes, and hatchets, and rearrange paulins, picket ropes, and so forth.

THE FIELD ARTILLERY JOURNAL

- (7) Do any special cleaning or repairing ordered for the day.
- (8) Lock bores and chests.
- (9) See that oil holes are properly closed, and that the carriages are left in readiness for immediate use.

During drills, or at other times when the piece is in the firing position and unlimbered, find time to clean the trail clips and oil the elevating, quick-return, traversing and valve-turning mechanisms, and the roller pins of the piece limber.

This oiling should be completed once every week, or oftener when necessary. Oil apron latches at least once a week.

Special Cleaning.

In addition to the daily cleaning, the work indicated in the lists below will be done from time to time. At the beginning of the cleaning period, the chief mechanic will notify those concerned of any special work for the day.

List A.

(To be completed at least once every two weeks.)

Clean and oil:

- (1) Breech mechanism and firing mechanism contained in breech.
- (2) Ball thrust bearing of brake mechanism.
- (3) Gun slides and guide rails (whole length).¹
- (4) Loading barrows, pole props, fuse setter and cartridge case carriers.
- (5) Piece limber.
- (6) Sighting arrangement.

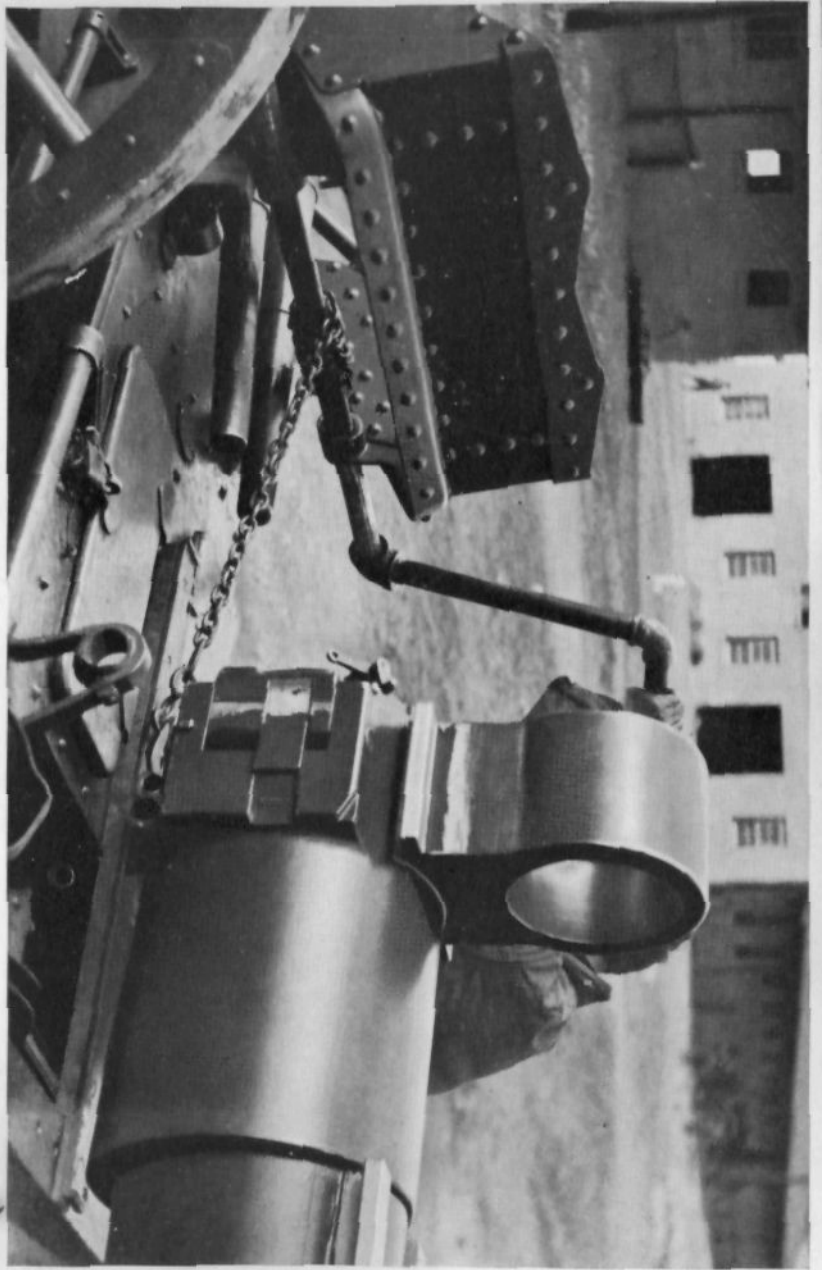
List B.

(To be completed at least once every three months.)

Disassemble, clean, oil and assemble:

- (1) Apron latches.
- (2) Axles and wheels of piece, or of first caisson in caisson sections.

¹By means of a so-called "cleaning track" devised in Battery F, 5th Field Artillery, this operation can be completed without block and tackle by two men in about ten minutes.



CLEANING TRACK FOR 6-INCH HOWITZER

THIS DEVICE IS REFERRED TO IN CAPTAIN BRYDIEN'S ARTICLE ON BATTERY ADMINISTRATION. BY ITS USE THE WHOLE LENGTH OF SLIDERS AND GUN RAILS CAN BE CLEANED BY TWO MEN IN TEN MINUTES.

BATTERY ADMINISTRATION—DUTIES OF LIEUTENANTS

- (3) Axles and wheels of caisson, or of second caisson in caisson sections.
- (4) Brake mechanism of piece.
- (5) Brake mechanism of caisson (of both caisson in caisson sections).
- (6) Doubletrees and singletrees.
- (7) Firing mechanism attached to cradle.
- (8) Leather pouch, fuze-setter case, and all leather straps.
- (9) Pawls, pawl shaft and plungers.
- (10) Pintle and top carriage of piece limber.
- (11) Pintles of caissons and caisson limbers.
- (12) Quick-return mechanism.
- (13) Traversing mechanism.
- (14) Interchange connecting pole and spare connecting pole.
- (15) Replace pole of piece limber with spare pole from battery or store wagon.
- (16) Replace pole of caisson limber with pole from forge or store limber or from another caisson limber, each limber keeping its own pole ferrule.
- (17) Sharpen axes and hatchets.
- (18) Wash all canvas covers.

In order to complete the daily cleaning during Stables, there will be required:

With each gun section, the gunner, the No. 4 cannoneer, and two other men, one of whom will be the caisson corporal, if possible.

With each caisson section, one caisson corporal and the two No. 4 cannoneers.

In addition to these men, one extra man will be required for each carriage concerned, for all pieces of work indicated in List B.

When the carriages require washing, one extra man will be required for each gun or caisson section.

Each day before the work is begun, the chief mechanic will inform the first sergeant of the number of extra men needed.

List C.

(To be completed at least once every three months by chief Mechanic.)
Disassemble, clean, oil and assemble:

- (1) Axles and wheels of battery and store wagons, and forge and store limbers.

THE FIELD ARTILLERY JOURNAL

- (2) Spare wheels and spare wheel fastenings.
- (3) Brake mechanisms of battery and store wagons.
- (4) Leather straps of forge and store limbers.
- (5) Pintles of forge and store limbers.
- (6) Forge.
- (7) Grindstone and vise.
- (8) Blocks and tackle.
- (9) Duplex chain block.

Every three months change by roster caissons with gun sections.

Work not mentioned in the schedule will be done when specially ordered.

TWO WEEKS ENDING

List A	March 14th	March 28th	April 11th	April 25th	
Item Number 1	2d	16th			
" " 2	3d	18th			
" " 3	6th				
" " 4	9th				
" " 5	10th				
" " 6	13th				

THREE MONTHS ENDING

List B	May 31st	August 31	Nov. 30		
Item Number 1					
" " 2					
" " 3					
" " 4					
" " 5					
" " 18					

List C Similar to List B.

The schedule is divided into two parts: the daily cleaning and the special cleaning.

The daily cleaning consists of the work to be done "before leaving park," and the work to be done "after returning to park."

BATTERY ADMINISTRATION—DUTIES OF LIEUTENANTS

The special cleaning consists of three parts: List A, six items of work to be completed at least once every two weeks; List B, eighteen items to be completed at least once every three months; and List C, nine items to be completed by the chief mechanic himself at least once every three months. Work on the carriages not mentioned in the schedule is done when specially ordered. It will be noticed that the schedule includes no items of work at the performance of which the presence of a commissioned officer is required by regulations, so that, if need be, the schedule may be followed throughout under the direction of the chief mechanic in a battery where there is a shortage of officers.

Copies of the daily cleaning lists are pasted on the under side of a trail box lid of each piece, and in the chief mechanic's notebook. A copy of the special cleaning lists is also in this book, so arranged that the date on which any particular piece of work is done may be recorded.

The chief mechanic is in direct charge of the work during cleaning periods. While the drivers are harnessing, preparatory to mounted drill, the gunners and the No. 4 cannoneers are at the carriages performing the work required to be done "before leaving park." After drill, while the drivers and extra cannoneers are at stables, the gunners, the No. 4 cannoneers, any caisson corporals not otherwise engaged, and as many other cannoneers as may be needed for the work at hand, are at the carriages, engaged in the work required to be done "after returning to park," and also any special cleaning that may be ordered for the day.

The work, during a cleaning period, is conducted as follows: As the carriages are parked, the chief mechanic notes their condition with respect to mud or dust; notes the amount of time available for cleansing; and then decides whether or not to order any special cleaning for that day. If special cleaning is decided upon, he requests of the first sergeant the extra cannoneers

THE FIELD ARTILLERY JOURNAL

that are needed in order to complete, by the end of stables, the work he wishes to order. The number of extra men required in the various cases is noted on the schedule, and seldom exceeds two or three per section. If the extra men are available, the chief mechanic then notifies all concerned of the special cleaning for the day.

During the cleaning the chief mechanic moves from carriage to carriage, inspecting the work and looking for needed repairs. He keeps on hand for use the jacks, the block and tackle, and so forth, and a supply of oils and waste; he procures spare parts from the quartermaster sergeant as they are required.

The lieutenant supervises the cleaning. At the beginning of the period he is present to see that the work is commenced promptly; before the men are dismissed he makes a careful inspection of the carriages in company with the chief mechanic; between these times he may attend to other duties. When the work has been properly completed, he directs the chief mechanic to dismiss the men. If possible, the men at the carriages are dismissed at about the same time as the men attending stables.

With the cleaning of carriages and the grooming of animals going on simultaneously, no time is lost, everybody is kept busy, the condition of the matériel like that of the animals in known daily, and it is possible to do away with the usual weekly cleaning of carriages on Friday afternoons.

If at stables no *extra* men are available for work on the carriages and it is, therefore, impracticable to complete the various items of special cleaning in the time mentioned, either that period is extended, or other periods are designated in order that the requirements of the schedule may be complied with.

In case of necessity one officer can supervise both the grooming and the cleaning provided the picket line and the park are not too far apart, which is not usually the case.

BATTERY ADMINISTRATION—DUTIES OF LIEUTENANTS

The shops, with the exception of the horseshoer's, are under the supervision of the lieutenant in charge of matériel.

In the saddler's shop is kept the "repair book," which contains the name and date of receipt of each article needing repairs in that shop, the name of the person from whom it was received, the date of removal from the shop, and the initials of the person removing the same. A specimen page of the repair book is shown herewith. With a prompt and trustworthy saddler this book is not a necessity, but when he is more or less lazy, or when articles left at the shop have been lost or removed without authority, this record is of value.

SPECIMEN PAGE OF SADDLER'S REPAIR BOOK.

Left by	Date left and description of article	Taken	by
	March 1, 1915.		
Sgt. Jones	One off bridle	3/4/15	C. E. J.
Cpt. Smith	One breech cover		
	March 2, 1915		
Clark	Saddle		

Whenever an inspection of quarters is ordered, all shops are considered to be included in that order, and are prepared for inspection accordingly.

CARE OF QUARTERMASTER PROPERTY, BATTERY RECORDS, PERSONAL EQUIPMENT

With respect to the quartermaster property, the lieutenant in charge assures himself that the quartermaster's memorandum receipts are up-to-date; that the property is either on hand in the store rooms, or issued and properly receipted for; and that steps are taken without delay to get rid of unserviceable articles. He is especially careful to see that the allowance of camp equipage is on hand and ready for immediate use.

THE FIELD ARTILLERY JOURNAL

Although the quartermaster sergeant is assigned, in the general plan, to this department, he has interests in all departments.

The drill regulations charge him with responsibility for "the general care and maintenance of the Government property issued to the battery." In performing his duties as thus defined, he has direct charge of all property in the store-rooms and in the battery- and store-wagons; he procures and retains receipts for all property issued. He also prepares all papers required for keeping the battery equipment complete and serviceable. Every such paper is checked and initialled by the lieutenant in charge of the department to which the paper pertains before being submitted to the battery commander for his signature; for example, reports of survey on quartermaster property are viséd by Lieutenant C, ordnance requisition and returns by Lieutenant B.

EQUIPMENT LISTS

(On leather folder in trail box.)

EQUIPMENT PERTAINING TO ONE PIECE

(6-inch Howitzer Matériel)

3 Harness, lead sets	§8 Feed bags
(without halters§)	§8 Grain bags
1 Harness, wheel set	*4 Harness sacks
(without halters§)	4 Horse brushes
4 Curry combs	8 Saddle blankets
	§8 Sureingles

Gunner responsible to the Chief of Section for:

1 Howitzer, No.	1 Wrench, teat
1 Howitzer carriage, No.	a1 Retracting eye
	1 Shifting bar
1 Piece lumber, No.	1 Sight, complete,
4 Buckets, watering, canvas	including sight shank (b)
4 Bucket straps	1 Sight, panoramic, No.

1. Unless directed by proper authority, no serviceable article belonging to this equipment will be turned in.

2. When an article has become unserviceable, it will be turned in, provided it can be at once replaced by a serviceable article of the same kind; otherwise, the unserviceable article will be kept by the responsible person until the exchange can be made.

3. When an article has been lost or damaged, the responsible person will report the facts of the case.

BATTERY ADMINISTRATION—DUTIES OF LIEUTENANTS

Gunner responsible to the Chief of Section for:

- h1 Case for fuze setter
 - 1 Cover, breech
 - 1 Cover, muzzle
 - 1 Cover, sight bar
- b1 Cover, sight shank
- a1 Cover, sponge
 - 4 Dust guards
- b1 Fuze setter, No.
- b2 Lanyards
 - 2 Loading barrows
- b1 Mogul spring, extra
- a1 Oil brush
- a1 Oil-can box
- a1 Oiler
 - 1 Pole prop and strap
- b1 Pouch for spare parts containing:
 - 1 Block latch
 - 1 Block-latch spring
 - 1 Filling and drain plug
 - 1 Firing pin
 - 1 Firing-pin spring
 - 1 Firing-spring sleeve
 - 4 Handy oilers, 5/16"
 - 4 Handy oilers, 3/8"
 - 1 Hinge-pin key
 - 1 Lever-latch pivot
 - 1 Lever-latch spring
 - 2 Lever-pivot detents
 - 1 Locking-bolt, nut and pin
 - 1 Locking-bolt spring
 - 5 Rings, 3/8" packing
 - 1 Sear
- 50 Split pins, assorted
 - 1 Tray latch
 - 1 Tray-latch spring
 - 2 Trigger-shaft detents
 - 1 Wrench, sight

- a1 Spanner for 60" wheel
- a1 Spanner, double
 - 1 Sponge (a) and rammer with staff (2 sections)
- a1 Tool kit, containing:
 - 1 Chisel, cold, 3/4", 8" long
 - 1 Drift, copper, large
 - 1 Drift, copper, small,
 - 1 File, hand smooth, 8"
 - 1 File, 3-square, dead smooth, 6"
 - 1 Hammer
 - 1 Pliers, wire-cutting
 - 1 Punch, small
 - 1 Screw driver, 3" blade
 - 1 Wrench, 3/8" and 1/2"
 - 1 Wrench, 5/8" and 3/4"
 - 1 Wrench and blade, serew-slot
 - 1 Wrench, screw, 8" long
- b1 Trace,, extra
- a1 Valve retainer tool
- b1 Wire, copper, spool
- a1 Wrench, collar
- a1 Wrench, 1.5" and 1.625"
- a1 Wrench, 1" and 1.25"
- a1 Wrench, screw, 15"
- a1 Wrench, socket
- a1 Wrench, spanner
- a1 Wrench, traversing thrust-bearing nut

Extra Articles

- Cyclometer
- Sight extension
- _____
- a In tool box.
- b In sight box.

The chief of section will see that the article is replaced or repaired as soon as possible. If the article was lost or damaged through the fault or neglect of any person, the proper charge will be made against that person. If the responsibility for the loss or damage can not be readily determined, a report of survey will be made.

4. This equipment list will not be changed or marked upon. Any shortage will be noted in pencil in the blank space below and initialed by the quartermaster sergeant or by an officer. When the shortage is made good, the quartermaster sergeant will erase the note.

5. When the battery takes the field, the articles marked (*) are not taken unless specifically marked, (\$) including the halters belonging to the harness, are issued at that time.

6. Drivers are responsible to the chief of section for articles issued to them by him.

Date, 191

Received the equipment listed above, and extra articles noted.

(Signature)

(Rank)

..... Section.

THE FIELD ARTILLERY JOURNAL

(On inside of chest door of caisson.)

EQUIPMENT PERTAINING TO ONE CAISSON

(6-inch Howitzer Matériel)

3 Harness, lead, sets	§8 Feed bags
(without halters§)	§8 Grain bags
1 Harness, wheel, set	4 Harness sacks
(without halters§)	4 Horse brushes
4 Curry combs	8 Saddle blankets
	§8 Surcingles

Cannoneer No. 4 responsible to the Chief of Section for:

1 Caisson, No.	1 Pick strap	
1 Limber, No.	2 Picket ropes	
2 Axes	10 Picket-rope straps (3	
2 Ax straps	front, 3 rear, 2 upper, 2	
8 Blanket straps (4 front, 4	lower)	
rear)	1 Pick-mattock	
4 Buckets, watering, canvas	1 Pick strap with safe	
1 Connecting pole, spare,	1 Pole prop	(Instructions the same as
with key, lunette and 2	1 Pole-prop strap	those accompanying
lunette pins	2 Shot tongs	"Equipment pertaining to
4 Dust guards	2 Shot-tongs straps	one piece.")
1 Grip strap	1 Shovel, L. H.	
2 Hatchets	1 Shovel, S. H.	
2 Hatchet straps	2 Shovel straps	
2 Lantern-bracket pads	1 Spanner for 60" wheel	
2 Lanterns	1 Spanner strap	
2 Lantern straps	1 Wrench, 5/8" and 3/4",	
1 Lunette strap	limber	
1 Oil can, 2¼ gal.		
2 Paulins		
6 Paulin straps		
1 Pick-ax		

Extra Articles

Cartridge cases, empty
Drill projectiles

Date, 191

Received the equipment listed above, and extra articles noted.

(Signature)

(Rank)

..... Section.

BATTERY ADMINISTRATION—DUTIES OF LIEUTENANTS

The quartermaster sergeant makes every endeavor to keep the battery equipment complete. In the trail box of each piece, pasted on a leather folder, is carried a complete list of articles that should be on hand with that piece. This list is arranged to show the articles for which the chief of section and the gunner respectively are directly responsible. A similar list is pasted on the inside of the chest door of each caisson, showing the articles for which in this case the chief of section and the No. 4 cannoneer respectively are directly responsible. When any shortage occurs, it is the duty of the responsible person to report the fact, and to have the shortage noted in the space provided on the list, and initialled by the quartermaster sergeant or by an officer. When the shortage is made good, the note is erased by the quartermaster sergeant.

On the inside of the lid of each compartment of the battery- and store-wagons and of each of the various chests carried in these wagons, is pasted a list of the prescribed contents of that compartment or chest. When the number of any article in a compartment does not correspond with the contents prescribed, the number on the list is crossed out lightly with a lead pencil, and the number actually in the compartment is noted beside the other number. In this way each list shows not only what is actually in the compartment, but also what should be there. The compartments of the battery and store wagons are habitually kept packed, except that the chests mentioned above may be kept in a store-room in garrison in order to facilitate getting at their contents. To keep a check on this system, one or two compartments are chosen at random every now and then, and the actual contents are compared by an officer with the listed contents.

The quartermaster sergeant has with him constantly the "want book," in which he notes shortages. This record does not require a separate book; it may be kept on a few pages of any notebook. If the equipment is to be kept complete, shortages must be written down as soon as they are discovered.

THE FIELD ARTILLERY JOURNAL

In garrison, the accessories (including the straps) for caissons not in use, as well as those for the forge and store limbers, are kept in the store-room, the accessories for each carriage being arranged by themselves and properly labelled. Harness not in use is similarly arranged in sets. In all cases shortages are indicated on cards or tags visibly placed.

The store-rooms are not to be used as depositories for junk. Serviceable articles are neatly arranged in suitable places; unserviceable articles are gotten rid of promptly. Officers having occasion to alter in any way the contents of a store-room in the absence of the quartermaster sergeant, follow the methods of that sergeant while so doing, and as soon as possible notify him of what was done. Store-rooms are prepared for inspection whenever an inspection of quarters is ordered.

The duty of the lieutenant with respect to the paper work of the battery is to prevent errors reaching the battery commander's basket, or being filed away among the records. With an inexperienced clerk, the lieutenant is kept busy; but as the clerk learns, the work of the lieutenant becomes lighter. In any case, however, he is always on the lookout for mistakes, for no clerk is infallible.

With the various "ticklers," model sheets, and so forth, that are now procurable, I believe it sufficient here to state that in this work, orders, regulations, and instructions on blank forms must be carefully studied. The most desirable qualification for a man engaged in paper work is accuracy.

With respect to the care of personal equipment, the lieutenant is charged with the duty of carrying out the battery commander's orders concerning the arrangement of squad rooms when in garrison; of tents when in the field. His assistants in this work are the chiefs of section.

The lieutenant is present at the periods devoted to the cleaning of personal equipment, and he sees to it that the individual equipments are complete and serviceable, and that the

BATTERY ADMINISTRATION—DUTIES OF LIEUTENANTS

cleaning material issued is properly used. He assures himself that the personal equipment in storage is kept in serviceable condition and ready for immediate use, and that all unserviceable property is disposed of as soon as possible.

CARE OF MESS

The lieutenant in charge makes a study of the methods taught and recommended by the Schools for Cooks and Bakers, and causes those methods to be followed as far as may be deemed practicable with the assistants at his disposal. He keeps an accurate check on the accounts of the mess sergeant.

GOOD ORDER, POLICE AND DISCIPLINE

The duties of the first sergeant are too well known to require repetition here.

In performing his duties he should not be bothered with a lot of clerical work. Of course he has the guard and fatigue rosters to keep and a certain amount of other desk work, but he is not the clerk and should not be used as such.

The "property book" mentioned in the plan above as being kept by the first sergeant, contains instructions for the noncommissioned officer in charge of quarters and a list of the property for which he is responsible. This property is checked and receipted for each day by the new noncommissioned officer in charge of quarters.

Now for a few words concerning methods to be employed by the lieutenants in managing the departments.

In the first place, for a week or two before a change in departments, each lieutenant is given opportunities to observe his new department at work, so that when the change is finally effected there is no break or confusion in the battery routine.

A lieutenant takes over a new department with certain ideas in his mind, probably, that he is anxious to try out. Let him "make haste slowly." Before making any changes, he watches

THE FIELD ARTILLERY JOURNAL

the present workings of the department for a while and makes sure that the changes he has in mind are really improvements on the methods now in use. Radical changes are not made without securing beforehand the approval of the battery commander; minor changes, when made, are reported to the battery commander as soon as convenient. The lieutenant does not forget that his department is not an independent command, or that he is supposed to be another man's assistant. His work is carried on loyally in accordance with the known desires of the battery commander. There is, however, nothing to prevent his taking notes for future use.

In the management of a department the following points are kept in mind constantly:

That the department must at all times be ready for service in the field, for a sudden change of station, or for an inspector.

That the system under which the department is taught to work, must be simple and adapted to continuing without change whether in garrison or in the field.

That affairs in the department must be left every night in such condition that if the lieutenant should go on leave before the next morning, his successor could easily pick up the work and carry it on.

That the principal enlisted assistant must be so intimately acquainted with the scheme of management, that in case of necessity, he can act satisfactorily as head of the department.

We are told that the more exalted one's rank, the more one is at liberty to pass unnoticed the relatively small and unimportant details of our profession. I have seen young officers who evidently believed lieutenants to be numbered among those privileged beings. I do not agree with them. It is distinctly the duty of the lieutenant to learn every little detail about his department. He must gain the respect of those under him by quietly showing them in an inoffensive manner that he knows more about their work than they do. The time for an officer to learn the elementary details is when he is a lieutenant. If

BATTERY ADMINISTRATION—DUTIES OF LIEUTENANTS

postponed until later, they never will be learned, and sooner or later he will have cause to regret his former indifference.

The lieutenant tries in every way to get the enlisted men interested in and curious about their work. He encourages the asking of questions, and endeavors to make them talk to one another about the work at hand. Much instruction can be given in this way, and the daily work is thereby made less monotonous.

The most valuable trait for an assistant to cultivate, be he officer or enlisted man, is initiative, a quality which has been defined as merely doing the right thing without being told.

Such is the general plan which I hope to put in operation in a battery some day. I cannot claim to have devised the methods described therein. Most of them I have seen working successfully at some time or other. The plan is not complete,—not perfect—but it is, I believe, a good one with which to start.

In order for this system, or in fact any system, to operate successfully, it must be desired and worked out by the battery commander; it cannot be carried on with any degree of success by one or more lieutenants no matter how keen or energetic they may be, if they are serving with a battery commander who takes no interest in the matter. The converse is not true, however, for a battery commander who so wishes should be able to get good results from the methods proposed whether his subalterns are interested or not.

Lieutenants who may read this paper will doubtless feel at this point that all the work has been parcelled out and none has been left for the battery commander; that while I started by saying I approached this subject from the standpoint of a lieutenant, it appears that I am leaving it with the views of a battery commander whose sole aim is to "pass the buck"! But no. The battery commander is the most important individual in the whole system; without his support there can be no system.

Although the authorized number of lieutenants is four, it is seldom that a battery is seen with that many present for duty.

THE FIELD ARTILLERY JOURNAL

With only three lieutenants present, the captain may, for example, take direct charge of the mess; with only two, he may take charge also of the battery records and office work, and assign the "Care of Quartermaster Property" to Lieutenant B, and the "Care of Personal Equipment" to Lieutenant A.

But even if the battery commander is so fortunate as to have the full complement of subalterns, there will be plenty to keep him busy. His work consists in supervising the various departments; in planning drill and instruction schedules; in attending to the ever-present correspondence and other office work that can not be delegated to an assistant; in judging breaches of discipline, and in settling the thousand and one unimportant but time-consuming questions that are constantly arising.

In supervising the departments, the captain sees with his own eyes that affairs are running smoothly and as he desires. He inspects the animals during stables occasionally; he takes a close look at the harness or at the guns during a cleaning period; thus learning their actual condition. He cannot get the information that he should have along such lines by merely riding around the sections at Saturday inspections. Just because a supposedly responsible person has been put in charge of a department, it does not follow that there is no need of supervision. On the contrary, constant supervision is necessary, and it is best for all concerned that the work be well watched; the captain learns at first hand just what is going on in his organization; the energetic and trustworthy assistant with a well-managed department knows and feels that his efforts are appreciated, while the less efficient assistant receives instruction and advice.

In planning drill and instruction schedules the captain has a piece of work on which he may spend much time if he so desires. Unfortunately many battery commanders do not so desire, and in consequence thereof their drills are most monotonous. There are so many things which can be thought of

BATTERY ADMINISTRATION—DUTIES OF LIEUTENANTS

and carried out to vary the drills and help sustain the interest of all concerned, that it seems a pity more time and thought are not devoted to this part of a battery commander's duty.

With reference to the other duties of the battery commander little need be said here. Official correspondence must be attended to promptly; the quarters must be kept in good repair; and as for discipline, every battery commander will carry out his own ideas on that subject.

When starting an assistant as head of a department, the captain tells him briefly and definitely how the department is to be run; explains in detail any particular hobbies that he may possess with reference to the department in question; and then stands aside and watches for results. He strives to create initiative in his assistants. When he wants a piece of work done in a particular way, he explains in detail, before the work is started, the methods to be employed; if he merely wants the work done, he directs its execution, and then lets the assistant work out his own salvation. Nothing destroys a man's self-confidence and initiative as much as constant interruptions and the ordering of petty changes of method after he has been allowed to start a piece of work in his own way.

The day of the platoon has passed; at mounted drill, movements by platoon are no longer used; at firing, the division of the battery into platoons is practically lost sight of, and I see no advantages, but many disadvantages, in trying to maintain the platoon division in the administration of the battery. We must recognize the fact that the battery is the unit.

I have served in a battery where the division into platoons was insisted upon at all times, and the administration of that battery was far from satisfactory. For example, the drivers received their orders through the three chiefs of platoon in as many different ways; methods were not uniform, and the captain was never commanding a battery, he was commanding three platoons. When the number of lieutenants was reduced

to two, he was commanding two platoons and two sections. His battery was not a unit.

I have also served in a battery where the responsibility was divided about as I have suggested above, and the scheme worked well. In this case, for example, if Lieutenant A, in charge of the animals, gave certain instructions to the drivers, these instructions were executed alike by all, and the unity of the battery was not disturbed. When the number of lieutenants was reduced, no sections were left to get along as best they could without proper supervision. Even if the captain had no lieutenants, he had a responsible enlisted man at the head of each department who was able to take up the duties as head of the department for the time being.

The battery is the unit, and it should be administered as such.

How seldom we see a captain make any real effort to instruct or train his lieutenants in their duties either as lieutenants or as future battery commanders!

When they enter the service, the lieutenants are almost without exception anxious to learn and keen for any work intrusted to them; but all too often they are taught nothing, and are given no work that they can call their own,—just odd jobs. They are allowed to drift along with no definite duties or responsibilities, picking up bits of information here and there, learning by observation and by reading enough to get along somehow, but rarely learning lessons under those most excellent teachers, "experience" and "responsibility."

With the division of duties as outlined above, each lieutenant is responsible for the good order and efficiency of an important department of the battery, and, because he is interested in the execution of this duty, he learns. By causing the lieutenants to change departments by roster, the captain requires each to learn the ins and outs of the different departments; compels, for example, the ardent horseman to get a speaking acquaintance with the guns, and vice versa; in short, gives his subaltern

BATTERY ADMINISTRATION—DUTIES OF LIEUTENANTS

a well-balanced preparation for their future duties as battery commanders. In talking over one point of this paper with a captain, he exclaimed, "What, would you put a lieutenant in charge of the mess? Would you want the whole battery to desert?" To my mind, however, it is better for the service, if not for one particular battery, for a lieutenant to get some experience with the mess while he has a captain to supervise his work, than to let him grow up with no experience along that line, and make it necessary for him, when he finally gets his own battery, either to learn the mess proposition from the beginning at a time when he should be busy with other things, or else to "throw a big bluff" that he knows all about it.

Whenever I hear a captain complain of his lieutenants, I feel at once that he does not understand how to make proper use of them. He has failed to keep them interested in their work, and they are expending their energies in other directions.

If such battery commanders would give their lieutenants definite and important duties, help and counsel them if need be, but hold them responsible for results, and make them feel that their assistance is necessary in the handling of the battery, I believe that the efficiency of the administration of the batteries concerned would be infinitely increased.

The Firing Battery

BY FIRST LIEUTENANT HARRY PFEIL, 1ST FIELD ARTILLERY

THE ideal firing battery would be one wherein all functions were performed automatically, so that the instant the battery commander's mind operated the guns would be accurately laid, with such data or changes as calculation based on observation indicated. Such an ideal, however, is far from achievement. But the recognition of our shortcomings is no excuse for hesitating to make an effort to get from our units all that they are capable of giving.

In what follows it is hoped that there will be found some hints of value to officers who may be engaged in training a firing battery or who may be about to enter upon this interesting work. If so, the writer wishes it understood that they are the result of his observations during two summers with the 2nd Battalion of the 3rd Field Artillery, at Tobyhanna, Pennsylvania.

THE GUN SQUAD

To reach the maximum of efficiency the squad must work as a unit, each cannoneer doing something each moment. For a simile, one probably cannot do better than to compare the gun squads to machines, worked by well-trained operators, who in turn are directed by a master mind. When called upon to do so, each operator should be able to deliver the finished product in the minimum of time. No part of the machine should ever be permitted to wear out, or, because of non-use, become clogged and troublesome. If one part interferes with the efficiency of the rest, it should be thrown out and another substituted. To leave our simile and return to a consideration of the squad, each

THE FIRING BATTERY

cannoneer has his specific task laid out for him, and he should be taught to take pride in turning out creditable work, which in this case means displaying a high degree of accuracy and speed in the execution of his task, and not allowing himself to become a hindrance to other members of the squad.

The very natures of their duties require that the cannoneers be instructed in the setting of their instruments, but the setting should first be performed by the instructor, probably several times, before these men are required to do it, in order that bad habits may not creep in at the beginning.

THE GUNNER

It should be demonstrated to the gunner, first of all, actually how to lay the piece, both for direct and indirect fire, before ever teaching him to set the sights. To do this, lay off a deflection, and cause the gunner and No. 2 to lay on target or aiming point, time after time, impressing on the gunner the fact that, first of all, he is a gun-pointer.

When the gunner has learned to lay his piece accurately, instruction may commence in the setting of the sights.

The gunner should be instructed that as soon as the gun is fired he must bring the sight back on the target or aiming point.

When our guns have been used for a considerable time, play in the bearings develops, and it becomes necessary for the gunner to take this fact into consideration when laying. Before laying the sight on the target or aiming point, he should apply his right shoulder to the piece and push it as far to the right as possible, then, by means of the traversing mechanism, lay the sight accurately. In some cases, play in the sight and sight shank socket will be noted. This also must be corrected by the gunner. In one case it was noted that play of the gun permitted an error of 17 mils, the sight shank 2 and the sight itself 2, making in all a cumulative error of 21 mils. Such an error is formidable, in spite of recent statements in this Journal.

THE FIELD ARTILLERY JOURNAL

SPECIFIC DUTIES OF THE CANNONEERS

No. 1 opens the breech, lays for range, when so directed, and sets off the angle of site. The quadrant offers peculiar difficulties to the green man, the principal one apparently being inability to comprehend exactly what function the quadrant performs. The setting itself is not particularly hard to understand, although constant training is necessary to insure accuracy. But keeping the bubble centred seems to appear to the novice in the light of a useless refinement, something that can be disregarded at will, without evil result. This erroneous impression must be avoided at the outset, before the cannoneer is ever trusted to lay the piece. It is, therefore, the safest procedure to consider at the start that the cannoneer knows nothing whatever about quadrants, and take nothing for granted, but to begin by showing him how to set a quadrant. Explain the readings of the range disc; show how to set the range for even hundreds of yards and for fifty-yard increments. Explain that for any range the line of graduation must be exactly in prolongation of the index, and that any deviation from this rule is an error. Next take up the setting of the angle of site. Explain that 300 indicates the horizontal plane, that any object requiring a setting less than 300 is below the level of the guns, etc. The relation of the micrometer disc to the level scale must be brought out, and the same pains taken in requiring that the cannoneer be as accurate in this as in the setting off of a range. Whether or not a cannoneer understands the function of the quadrant, the necessity for considering the angle of site, etc., provided he can set the instrument, when so directed, and lay the gun accurately every time, is utterly inconsequential. When he is able to do that much, and only then, will the time have arrived to speed him up. The breech should be opened immediately any indication arrives that firing is to be taken up or resumed, and after the gun returns to battery, so as not to delay the cannoneer who loads the piece.

No. 1 must remember that errors in range due to lost motion

THE FIRING BATTERY

in the bearings will occur unless he corrects for this defect. The last motion of the elevating mechanism should be in the direction upward, so that the full weight of the breech is brought to bear on this mechanism. Errors as large as 375 yards in range have been found to exist, and such an error is too large to neglect.

No. 2 must be taught to use the scale on the front shield.

This scale can be painted on the shield by any battery mechanic. The graduations should be of sufficient size to be seen from the position of No. 2, when he is in the act of shifting the trail, and should be placed along the upper edge of the upper and middle shields in this manner:



A plus (+) sign should be painted in the left corner of each shield and a minus (-) sign in the right corner; also a plus (+) sign on the right side of the float and a minus (-) sign on the left side.

It must be firmly impressed on his consciousness that the word "add" indicates that the muzzle is to be shifted to the left, and that "subtract" is an indication that the muzzle is to be pointed to the right. The cannoneer must remain on the alert at all times for any changes that are sent to the battery, and, without waiting for the word of command from the gunner, move the piece the approximate amount directed. During practice in the gun park, frequent large changes in deflection should be announced, to keep the cannoneer aware at all times of the responsibility for speed which rests upon him. The training of the gunner and No. 2 in laying the piece should be simultaneous from the very start.

This cannoneer should be a man of more than average strength. The trails will not always be dropped on even ground, but more often than not in places where to move them will tax the strength of powerful men. Calling other cannoneers

from their duties to aid in this, delays the delivery of fire, and every avoidable delay is inexcusable.

No. 3 is charged with keeping the range and corrector scales of the fuze setter at the settings ordered. Here, again, it is necessary to start on the basis of an utter lack of knowledge of the instrument on the part of the operator. Here, also, it matters not that the cannoneer knows nothing about the functioning of a fuze. His specific duty is to keep the fuze setter set, and in order that he may do it properly he should be shown how until he understands the operation so thoroughly that the chance of his making an error from lack of knowledge is at a minimum. There is no particular technic required to set a fuze setter. It requires a man with good eyes and one able to perform a monotonous duty without fatigue for a considerable period of time. If he is taught to take such a position as will permit him to operate the range worm crank with one hand, and the corrector worm with the other, time will be saved. This will require that he sit half facing the instrument, rather than with his back directly against the wheel. But he must not permit himself to protrude so far that he will interfere with the free movement of No. 4. In operating the corrector worm, some men find that they can expedite matters by simply bringing the upper edge of the right hand and forefinger in contact with the worm knob, and moving the hand backward or forward, as the case may be, instead of gripping the knob with the fingers each time a change in corrector is announced. The movement is so slight, however, that it is doubtful if this method saves any appreciable amount of time, and where the corrector worm is hard to operate, it is absolutely essential that the knob be firmly gripped. No. 3 must have a full appreciation of the responsibility devolving upon him. He should be told enough about the operation of a fuze to understand that if he makes an error, it is likely to cause confusion and wastage of ammunition; that if in the same platoon salvo one cannoneer sets off correct data and another incorrect data, it is impossible for the officer conducting

THE FIRING BATTERY

the fire of that platoon to do other than guess at his changes.

In time fire No. 4 insures correct setting of the fuze by turning the projectile to the right before removing it from the fuze setter, and here is where trouble often arises. In his hurry to get the piece loaded, No. 4 will often fail to give to the projectile that slight final twist so essential to get a correct setting. He should therefore be practiced, from time to time, with a service projectile, in order that he may get the feel of it. It is well to have the four No. 4's working at the same time, by announcing the same setting to all, and then checking them up by determining the time opposite the index on the outer edge of the lower time-train ring. By this means uniformity of setting is very apt to be secured throughout the battery, which, in the end, is really what we are after.

In loading the piece, No. 4 should hold the middle of the projectile in his left hand and the base of the cartridge case with his right. This is the natural way, and any other would be awkward. This distance between the fuze setter and the breech of the piece can be covered in two steps, starting off with the right foot, then advancing the left up to a point near the flask. From this position the projectile may be inserted in the breech and then pushed smartly home. The cartridge case should be permitted to drop on the ground when the breech is opened after discharge, for to require No. 4 to remain in position to catch this case detracts from his efficiency as well as from the rapidity of fire. In shell fire, No. 4 receives the projectile directly from No. 5.

"No. 5 takes the ammunition from the chest. In percussion fire he passes it directly to No. 4. In time fire he strips off the water-proof hood, places a round in the fuze setter, and sets the fuze. As soon as No. 4 removes a round from the fuze setter, No. 5 inserts another round, and sets the fuze."¹ The duties of

¹ Field Artillery Drill Regulations.

THE FIELD ARTILLERY JOURNAL

this cannoneer require celerity of movement. He must not at any time during firing allow the fuze setter to remain empty. The instant No. 4 removes a projectile another should be placed in the fuze setter and set with the last setting. In fire for effect, No. 5 becomes responsible for the final setting of the fuze, No. 4 simply transferring the projectile to the gun. In this phase of the action the entire operation of firing is so rapid that Nos. 4 and 5 will be taxed to the limit of their combined ability, and, if anything, the greater responsibility will be No. 5's. He therefore must be trained as thoroughly as No. 4, and if the training of both these men is properly directed, they should be on a par in efficiency and hence interchangeable.

THE CHIEF OF SECTION

The chief of section is the link between the Executive and the gun squad. He exercises supervision over the squad, and should hold himself ready at all times to aid the individual cannoneers in performing their duties. He keeps a record of the data sent to his gun, and when data is called for by any member of his squad he should be able instantly to supply it. It frequently happens that, due to his attention being engaged in some other direction, he misses portions of the data. In such event he should at the earliest moment apply to the executive.

When the guns are laid with the initial data, the chief of section should look through the bore to determine whether or not the guns will clear the crest in front. He must be prompt to assist the gunner in getting on an aiming point in rear. In directing No. 2, he should use his arms, and not caution "trail right," or "trail left," for it often happens that he means his own right and not No. 2's.

In salvo firing he must accustom himself to taking a full three-second interval. In his anxiety to get off a shot, the chief of section will often violate this rule. When a battery commander orders a salvo, he is justified in expecting it; if he desires a platoon volley, it is a simple matter to order one fired.

THE FIRING BATTERY

THE EXECUTIVE OFFICER

The duties of the executive are similar in some respects to those of the foreman of a shop. The battery commander confides to him the execution of a certain job, with exactly the same assurance of receiving back a finished piece of work as an employer would have when dealing with one of his foremen. The duties of the executive officer are really not many, but he must have a thorough knowledge of them. He must know to the minutest detail the working of the guns and the duties of the squads, how best the guns may be served, and what degree of efficiency may be reasonably expected of the men under him. When any of his working force goes out of commission, he must know how to remedy the ailment; or when parts are lagging, how to speed them up. When the unexpected happens, his resources must be such that the difficulty, however great, may be overcome. The executive who constantly seeks aid from his battery commander in the performance of his legitimate duties, is not only an annoyance, but a hindrance, and should be eliminated.

Although the duties of the executive are not many, they are important. The drill regulations are not of much assistance. They enumerate the duties of lieutenants in the firing battery in paragraph 267, concluding with this sub-paragraph: "In addition to these duties, the senior chief of platoon with the firing battery acts as executive officer. When necessary, he repeats the firing data. He supervises the fire discipline of the battery."

The statement of the duties is more comprehensive than specific. No attempt is made to state in what manner the duties will be performed. Indeed, the drill regulations do not specify which officer shall be the executive. And this is perfectly right. Great latitude is allowed the battery commander in his selection of an officer for this important duty, and it is left to this officer to work out the means of meeting the requirements placed upon him by his superior. The only restriction which the regulations

THE FIELD ARTILLERY JOURNAL

do place upon the battery commander is that the executive be the senior officer on duty with the firing battery. It is even conceivable that he may be the junior officer in the battery and act alone at the guns. One officer is sufficient at the guns anyway, as far as actual handling of the firing battery is concerned, but since it is necessary to figure on casualties, there should be at least two familiar with the work. Every man is not gifted with executive ability. Any officer can learn the abstract rules of procedure, but not every man can apply these rules and produce a machine that will work with the minimum loss of efficiency. Hence, the battery commander is permitted to try out his lieutenants and select that one best suited to execute his commands at the guns.

Under the present method of employing the special detail (Subject No. 19, School of Fire for Field Artillery, June, 1915), the executive approaches the selected position at the head of the firing battery. Eventually he is joined by the first sergeant, who communicates to him "the position of the combat train, whenever the battery combat trains are posted separately, the gait for the battery to use in approaching the position, any necessary instructions relative to the formation and manner in which the battery should approach and occupy the position, the aiming point and the position for the limbers."

"In approaching the position, the executive, in the absence of instructions, understands that the position is ready for occupancy if he sees that the gun markers are posted (two flags, red for the right gun, white for the left gun, are useful in marking this position). If he sees that they are not posted, he halts in a suitable place until they are, or until he receives instructions."

Having placed the guns in the selected position, the executive assembles the chiefs of section and carefully points out to them the aiming point and the direction of fire. He also communicates to them the method of fire, if he knows it, and directs that they lay on the aiming point, with the guns pointing in the

THE FIRING BATTERY

proper direction, and determine the minimum range at which their respective guns will clear the covering crest, with angle of site 300. When this report is received from the chiefs of section it should immediately be communicated to the battery commander for his information.

The executive should be a man of few words. When it becomes necessary for him to issue orders, they should be couched in clear, incisive words, easily comprehensible to men working under strain. As soon as possible after the limbers have cleared the guns, he should select a position for the telephone operator such as will permit of the operator's being heard clearly by every member of the firing battery. It is better that this man be about 25 yards in rear of the line of spades. If this man is properly placed, it will seldom be necessary for any one else to repeat the data. Sometimes, due to his attention having been diverted in another direction, a chief of section may be forced to indicate a desire that certain portions of the data be repeated, in which case the executive should himself make the announcement, as nearly as possible directly to this chief of section, by means of his megaphone, which should always be at hand. Since there are but two megaphones issued to a battery, the executive should equip himself with one made of leather, which any battery saddler can make. A record should be kept by the executive of all data received at the battery, and the method below has been found to work satisfactorily. For example, the commands and data are announced by the No. 1 operator as follows: Right from the right, deflection 3250, close by 5, site 315, corrector 23, 3600.

The record would appear,

Method	Def.	DD.	AS	C	R
RR	3250	-5	315	23	3600

The first change might be, add 50, close by 5, up 5, same. The second line of the record would show

3300	-10	28
------	-----	----

THE FIELD ARTILLERY JOURNAL

Next might come subtract 10, open by 2, down 3, same
The third line of the record should show

3290 -8 25

Then, 200 more (or the concrete range).

The fourth line of record would be

3800

Finally, battery one round, add 5, open by 1, up 3, 200 less,
the fifth line of the record being

B1 3295 -7 28 3600,

and so on. In its entirety the record would be

Method	Def.	DD.	AS	C	R
RR	3250	-5	315	23	3600
	3290	-8		28	
					3800
	3300	-10		25	-
B1	3295	-7		28	3600

It will be observed that the actual operations of addition and subtraction are performed mentally. The executive should possess a certain facility with figures, and not find it necessary to go through the mechanical operation of adding and subtracting. This is hardly too much to ask of any officer, and especially of one otherwise qualified to act as the executive of a firing battery.

It frequently happens that during the process of adjusting by platoon salvos, one gun of the platoon fails to fire. The executive should immediately order the next gun into action, and, upon the completion of the salvo, notify the battery commander as to which gun failed to fire, and that such and such gun fired in its stead. It can all be done in one sentence, thus, "Numbers 1 and 3 fired." In the event of such failure in a battery salvo, notification should be sent the battery commander as to which gun failed to fire. This is necessary in order that

THE FIRING BATTERY

the officer conducting the fire may know which guns he is dealing with in adjusting the width of his sheaf. If, in firing platoon salvos, a gun has been called into action to take the place of one which failed to fire, the substituted gun remains in action until a return to the proper gun is ordered by the executive. For example, while adjusting with the right platoon from the right, No. 2 misfires. The executive cautions, "No. 3 in," and as soon as loaded, the gun is fired at the command of the chief of section. When the next command comes down to the battery, the executive cautions, "Nos. 1 and 3," meaning that these two guns will continue to fire, or if No. 2 has again been placed in commission, he would say, "Nos. 1 and 2."

It is better that the executive give his commands to fire by word of mouth, rather than by signal. In the latter case, the men who fire the pieces are required to look at the executive for the command, when their attention is needed elsewhere; besides, due to smoke and dust incident to firing or others obstructing their vision, it often becomes difficult for them to see the executive, while in the former case the command comes to them clearly through the megaphone, and they can be attending to their prescribed duties without interruption. It is true that vision travels more quickly than sound, but when the distance is so short, the difference is not appreciable. In salvo firing the actual command to fire each piece should be left with the chief of section, the executive simply giving the general command, "Fire," directed toward the chief of that section which will fire first. This preserves the time interval and keeps the gun squads in the hands of the chiefs of section. In volley firing the executive commands "Fire" immediately after the range is announced, and the guns are fired at the command of the gunner without loss of time.

Whenever there comes a lull in the firing the executive takes the opportunity to straighten out any errors that may have crept in by announcing the data thus, "deflection 3295, 3288, 3281, 3274, corrector 25, 3600," mentioning only those data

which are constantly undergoing change. But the instant the operator commences to announce new data, the executive should cease talking, and it should be a standing order in the battery that only one person shall be talking at a time, precedence always to be given the telephone man. Chiefs of section should always stand ready to assist their gun squads by supplying data that may have been missed by the cannoneers, but they must be instructed that their voices are to be held down to a pitch that will not carry beyond their own sections.

At firing practice, when the completion of the problem has been reached, the executive commands, "In rear of pieces, fall in, check data"; whereupon the chiefs of section step up to the guns, and, at the command from the executive, "Quadrants," they call off from right to left the quadrant settings, thus, 315, 3600. The executive then cautions "Sights," whereupon the chiefs of section call off in the same order the sight settings, 3295, 3288, 3281, 3274. Lastly, the executive says "Fuze setter," and the chiefs of section call off from right to left the corrector and range, in this manner, 28, 3600.

It may be considered as not unusual for the executive to lay the guns. If a portion of the sector of fire is visible, the battery commander may direct the executive to select some object in the sector for a reference point, and lay the guns on this point for parallel fire; or the battery commander may designate the reference point and direct that the guns be laid thereon. The method is simple. The executive causes the right gun to be laid on the reference point with zero deflection, selects a suitable aiming point, causes the deflection to this point to be measured, announces this deflection with the proper deflection difference, and notifies the battery commander that the guns are laid as directed. In the first case he would, of course, also describe to the battery commander the reference point.

It will also be found convenient sometimes to lay the guns by compass bearing. To do so the battery commander determines the necessary offset, takes the compass bearing of the

THE FIRING BATTERY

point marking the offset and sends this bearing by telephone or messenger to the executive, who lays the directing piece according to the data sent him, being sure, however, to remain far enough in rear of his gun to avoid deflecting the needle, selects an aiming point, measures the deflection to this point, announces this deflection with a suitable deflection difference and reports that the guns are laid. By using a high initial corrector, the battery commander should have no trouble in promptly bringing his guns on to the target. Reciprocal laying is described in the drill regulations, and should be firmly fixed in the mind of the executive for use when the battery commander's telescope is employed as an aiming point.

When direct fire is being employed the duties of the executive are substantially the same as when the indirect method is being used. Although the drill regulations prescribe it as the duty of the officers at the guns to make changes in deflection to adjust the distribution, the writer believes that nothing but confusion will result. The duty of handling the sheaf belongs to the officer conducting the fire. If he is not able to distribute his fire properly over a target, he should step down and let some one else conduct the fire for him. The executive has all he can do to see that the guns are promptly and efficiently served, and cannot be expected to have his eyes on the target and in the battery at the same time. If he is able to keep the guns working without a hitch, he is doing all that can be expected of any one man and more than lots are able to do.

In conclusion, let me offer this to battery commanders: Always have a problem in mind when working the entire firing battery, and endeavor to make only such changes as would be made during the actual firing of a problem. In a well-trained battery the cannoneers will know in their own minds what changes are coming, and will be ready to receive them. To develop dexterity in handling the instruments, wide changes, even illogical and erratic ones, may be made, but this only occasionally, to wake the battery up when it has gone stale.

THE FIELD ARTILLERY JOURNAL

A short, snappy drill of about fifteen minutes per day is all that a well-trained firing battery needs. More than this results in indifferent service, due to the monotony of the work. Even with green men, one hour's drill per day is sufficient to train a battery to set instruments and lay the guns accurately. When this lesson has been learned, it is no difficult task to work up speed.

Every member of the gun squad should have impressed on his mind the knowledge, that if he fails to call back for data not clearly understood, blame for a resulting error rests rightly on his shoulders. A proper attitude to assume toward a firing battery is that every member is striving to do his best. When any member makes an error, and immediately upon discovery of it reports the fact, the man should not be punished, but he should be admonished to be more careful, and if it is found that he is naturally careless and inefficient, he should be relieved and a better man sought.

Draft in Batteries of Heavy Field Artillery

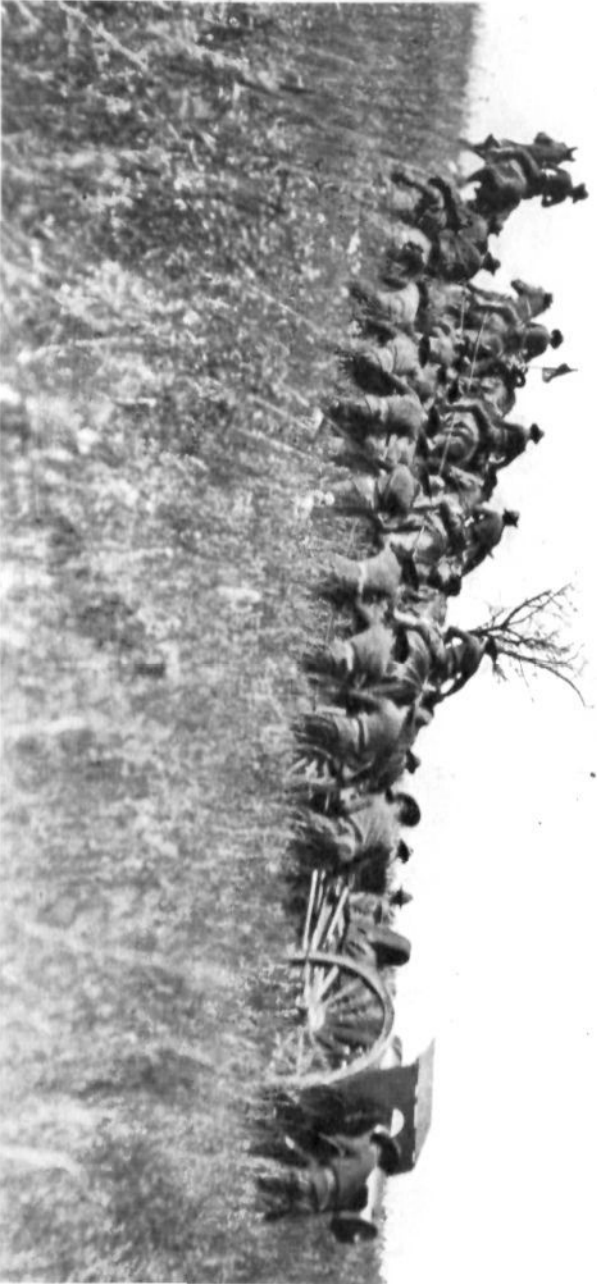
BY CAPTAIN FRANCIS W. HONEYCUTT, 2ND FIELD ARTILLERY

IN paragraph 2, Drill Regulations for Field Artillery, there are two requisites mentioned which it is essential that field artillery should possess. The first one of these, relative to reaching the point for delivering an effective fire, is one which will not be acquired by a unit armed with heavy matériel without constant and tireless effort on the part of officers and men. The question of draft, or of getting the guns forward, in wet weather on dirt roads, or on board roads of any description, is a very serious question. It will often require every ounce of power in horses and men, coupled with keen ingenuity in applying this power, to move a heavy unit over a difficult place in the road or in the open. It is not an exaggeration to state that if this training is not properly conducted in garrison, the unit will be quickly immobilized in the field, and additional draft animals, if obtainable, will be of no avail, until the personnel learns the proper working of man and beast at hard draft work.

We must bear in mind that there is a limit to the draft power of eight horses, which is less with the four pairs arranged one behind the other, than eight times the power of a single horse. This is true on a straight, level pull, and the decrease is more rapid as the pull becomes uneven and curved. A practiced eye will soon see if it is surely possible for the animals to do a certain task. Unless this condition exists, make it an unvarying rule not to try to find out whether the animals can perform the task, by allowing repeated trials and failures, unless in case of urgent necessity, which case will probably

never occur in peace training. When a well-trained and well-driven team stops on a hard pull, never try to start them immediately, even if convinced that they can pull out; the horses are either taking an absolutely needed blow, or showing by their action that they need assistance. The opposite course will ruin the best of teams. When a good team realizes that assistance will be afforded if absolutely necessary, it will pull its best, which is all that is desired. They will not have to look forward to the most annoying incident in poor driving, namely, trying to urge, whip, and start a team out of a place from which it is impossible for them to move. It should be made an invariable rule never to allow a team to try to start a carriage unaided more than once after they have failed in the pull. Remember that this refers to trained teams; untrained teams are the fault of lack of instruction or the supply of unsuitable animals. The use of the cannoneers with drag ropes at the proper time is one very important, if not the most important, way to success. The intelligent application of this principle will open the eyes of any one not having given it a trial or even consideration. The short, hard pulls are where men on ropes do the best work; for a long, hard, level pull the horses must be relied upon, giving them the necessary starts after breathing spells; a man can exert his utmost for a comparatively short space, but quickly recuperates and is able to give nearly the maximum power many times with short spaces of rest. This is the key-note to passing a bad spot on the road where there is footing for the cannoneers. The great difference between the draft work of light and heavy matériel must be thoroughly realized, and no success will result unless there is a readiness and quickness to utilize every available means to keep moving. The power of one additional man on a drag rope, one plank under a sunken wheel, or even a cheerful word, may mean many minutes, if not hours, saved, and this one little thing not thought of may mean failure in a time of need.

Bear in mind this truth: the first tendency when a team



6-INCH HOWITZER IN HEAVY DRAFT

Demonstrating the effectiveness of the use of cannoneers and drag ropes as advocated by Captain Honeycutt in his article in this issue

DRAFT IN BATTERIES OF HEAVY FIELD ARTILLERY

stops is to urge it forward again immediately, this is wrong; the proper thing to do first is to think hard.

Every five cannoneers applied means, at least as much as, and in nearly every case more than, one good horse, and this power is applied intelligently.

An extra double-tree should be carried along in order to fasten teams by ropes at a distance from carriage in a place where horses cannot obtain a good footing; it is unhandy to tie a good knot around a single tree with a heavy rope, or two hooks to go through a single tree eyes should be carried, having an eye large enough for a picket rope to pass through easily.

In the Collar

BY VETERINARIAN GERALD E. GRIFFIN, 3RD FIELD ARTILLERY

"THE first duty of an artilleryman is to hit. The second duty of an artilleryman is to hit, and his third duty is to hit."

The above was the defensive remark of a field artillery officer with whom the writer was discussing draft animals a few years ago.

The reply was promptly made that the first duty of a field artilleryman was to reach a position from which the hitting might be done; and that the nearer that position the better, considering the present condition of the horses of the artilleryman in question. It was noticed that no remark was forthcoming on the fourth, fifth and sixth duties of an artilleryman.

The training and disciplining of gun crews, the proper occupation of position, the correct computation of firing data, the accuracy of observation, the development of the best method of concealment, entrenching, ranging, distribution and fire control are matters of hard work, incessant practice, military intelligence and common sense: all and each of which are primary factors in effective fire, but although endowed with these—the essential qualifications of a good artillerist,—the field artillery officer must possess still another before being considered competent.

He must be a horseman. It may be thought that the divine gifts of intelligence and what is known as common sense, but which is really nothing but mental poise, would be sufficient equipment with which to manage the horse of a battery, and quite often it appears to be. Nevertheless, the additional gift of horsemanship is practically invaluable to the field artillery officer.

In recent years the terms rider and horseman have been much confused in the minds of superficial thinkers, yet there is

IN THE COLLAR

a very broad distinction and a well-defined difference between them. A young man, below the age of thirty, possessing good health, proper riding conformation and a courageous heart, may, in the course of a year of constant practice under competent instruction and intelligent criticism, become an expert horseback rider and still be a poor horseman. Horsemanship demands no special conformation, age or courage: neither does it demand that its apostle shall possess robust health, or even the ability to ride or drive.

Who, then, is a horseman? He who is blessed with an even and good natured temperament, leavened by a dash of humor, free from attacks of moods and "brain storms," and who cherishes within his soul a love and sympathy for animals. Such a one is a horseman. And in such a one there exists a sense that unerringly causes him instinctively to do the proper thing at the right time for the animal or animals committed to his charge.

To elucidate—the rider pure and simple may become very fond of a particular mount, and may even visit his stall late at night, offer him a piece of sugar, pat him on the neck and go away satisfied. The horseman—in addition to the caress—would examine the feed-box, manger, bedding, clothing and droppings, and sense the cleanliness, comfort and ventilation of the stable. He would scorn to resist the impulse which directs him to offer a drink of cold water at this particular time, late at night, when it is much needed. The horseman understands, he is in sympathy with his equine servant and friend. He does not have to refer to the books for guidance in "doubtful" cases, neither does he have to debate within himself as to the right and wrong of the matter. He is a horseman, though he may never have been in the saddle.

The accumulation and display of various types of saddles, martingales, bridles, bits, riding whips and spurs may help to convey the impression to the casual observer that their possessor is a horseman of parts. To the person who is blessed with

"horse sense"—the knowledge of horses—these possessions mean little. He looks deeper into the matter. He scrutinizes, if interested, the motive hidden behind such a display and in a short time arrives at a correct estimate. As a matter of fact the expert rider and good horseman limits himself to a riding equipment that is simple, comfortable, well made and of good quality.

In the regular field artillery service much of the energy of those who love to work at their profession or who work as a matter of duty is, in the case of the younger officers, expended on firing problems, drills, and the like, and on their individual seats and hands.

The ambition to excel with the guns indicates the sterling qualities within the officer. The ability to ride well is an accomplishment of which to be proud; but to be a horseman implies the ability to march a battery, battalion, or regiment for two or three weeks through a country where forage is not plentiful and where water is long distances apart, to do the hard, laborious work of actual service when the firing position has been reached, and to keep the animals in such working condition and in the collar, that they may be depended on to go forward, or to retreat. In one word, to be a horseman is the equal of being a good field artilleryman in other respects. In the organized militia batteries that have visited the camp of instruction, near Tobyhanna, Pennsylvania, within the past two years the knowledge of animal conservation and management is very poor indeed. In fact, the writer does not hesitate to state, that such knowledge, in his opinion is, in a number of these batteries, almost entirely lacking. This statement will no doubt strike the reader as being an alarming one, especially when it is remembered that in time of need, to horse it properly, from thirty to forty-five thousand dollars worth of unseasoned and untrained horse flesh will be supplied to each militia battery.

There must be some excuse for such lack of knowledge on the part of these batteries. There are many:

IN THE COLLAR

First—The advent of the low-priced automobile has directed the attention of the young men of the nation to gasoline engines and machinery to such an extent, that the horse, as a means of regular business transportation and pleasure, is practically ignored. As a consequence the ubiquitous livery stable, from time immemorial the repository of equine love for the masses, has been eliminated.

Second—The militia artillery soldier has little, very little, opportunity for practical instruction in the branch of his military duties which has to do with horses.

Third—The more or less intimate intermingling with the trained horses of a regular battery for a brief period of ten days in camp each year, is barely sufficient to give the average militia soldier more than a superficial insight into their management and none at all into their training.

Let us analyze this ten-day camp period solely from a horseman's point of view:

The first day is lost, as it is spent in making camp. The second and third days are mostly devoted to harness—its fitting and nomenclature. The men have not yet ceased to look upon their work as a lark and are still excited by their surroundings and novel mode of life.

Fourth to eighth days inclusive: The men absorb considerable information but as the instruction by the very nature of things is irregular and sporadic much of it is not assimilated.

Ninth day: The men are weary and footsore and are now thinking more of returning to their homes than of the work in hand.

The tenth day is lost, as on this day tents are struck and organization entrains.

From the above it may be learned that, giving six full hours daily with the horses and admitting that eight days are occupied, there are no more than forty-eight hours of practical work and instruction along the lines of horsemanship and

driving. It is absurd to believe that a green man can learn to be a horseman, rider or driver in forty-eight hours.

Numerous books and short articles have been written on the subject of horsemanship but these writings are usually too dry and are intended for students. As the militiaman is intensely absorbed in the business or profession which affords him a livelihood, it should not be expected that he will have time to become a student, and seek information from the printed page. Information thus obtained is, at the best, but theoretical. Theoretical horsemanship has practically no value from a military aspect.

The wonder is that the militiaman finds time to devote the many hours he does to military duties which bring him much worry, little compensation, considerable inconvenience and no glory. He must be considered as a practical patriot and that too in time of peace, and the practical patriot at such a time is little honored or revered.

How may the training of our militia artillery be sufficiently improved to meet the requirements of military horsemanship? Nobody seems to know. Federalization of the militia will not help much along the lines discussed unless much more time can be devoted to field work under selected, competent and interested instructors.

Energetic artillery officers claim that, given a nucleus of good noncommissioned officers, cooks, horseshoers, farriers, saddlers and *trained* horses, they can, inside of five or six months, turn out from raw, human material a good and fairly efficient battery ready for actual service, and from what little knowledge the writer is supposed to possess on this subject he believes the claim to be correct. He also believes that he himself could, working six hours per day, turn out from thirty to forty fair artillery drivers in one month. Several officers were consulted on their ability to turn out good, efficient batteries in the short period of five or six months. All of them claimed that it can be done when selected officers, noncommissioned officers and

IN THE COLLAR

trained horses form the nucleus. They were all unanimous in the statement that to do this thing the battery in training must be exempt from military post "red tape" and other time-wasting devices.

Our country produces annually thousands of light draft horses of an artillery type. This production is due to the introduction and the crossing of Percheron and other nimble draft breeds on our well-known light harness stock. Nevertheless, there exists a tendency among militia artillery officers to horse their batteries with animals that are better suited for the saddle. This preference for a light horse that will serve for saddle purposes may be explained on the ground of offering horseback riding to intending militia recruits as an inducement to enter and remain in the service of the State. The fact is being lost sight of among the organized militia that a saddle type of horse is absolutely unfitted for draft purposes and that the general purpose horse is a *rara avis*. The moment the artilleryman begins to look with favor upon saddle types with which to horse an organization that moment his efficiency as a field artilleryman is reduced by from thirty to thirty-five per cent.

The good artillery type of horse sums up about as follows:

Color—Bay, brown, chestnut, black, red roan.

Height—15.3 to 16.2 hands.

Weight—1200 to 1300 pounds.

Age—Six to twelve.

Sex—Mare or gelding.

The additional requirements are: Clean head; short neck; wide breast; normal withers; fairly upright heavily muscled shoulders, possessing a distinct collar bed; short, clean legs, with strong articulations and plenty of bone; dense concaved hoofs; deep chest; large, springy abdomen; strong, straight, short back; well muscled loins; regular croup; strong and heavily muscled quarters; full tail and mane; tractable disposition,

and soundness of wind, limb, vision, heart and digestion. In addition to these he must have clean gaits. Undersized horses of any kind are an abomination in a battery; each and every animal of an organization should be able to go in the collar and stay there if necessary.

The regular batteries draw most of their horses from the remount depots, one each of which is located in Virginia, Oklahoma and Montana. Here these horses are trained for a period varying from six months to a year before being issued, and here also they practically pass through a strict quarantine period. It is rarely indeed that any of them become sick from colt diseases on arrival at station; instead, after a few days of rest from the fatigue of the railroad trip, they are ready to take their place in the teams.

The contract system is another method of furnishing horses which is not so good. By this method the horses are assembled by the contractor—usually the lowest bidder—at central horse markets: Kansas City, St. Louis, Chicago, New York, and so forth, and there inspected, examined and accepted. In passing through these markets, saturated with disease-producing germs, the younger animals are infected and in the course of a few days, usually eight to twelve, become so sick that on arrival at station many of them are unable to go into training for from six to eight weeks, while a certain percentage die. In time of war the remount depots could not begin to furnish the horses needed. Consequently they will be collected from contractors, dealers and farmers. They will be sent in train loads to militia batteries, the men of which know little about their management and training. Large numbers of these animals will become sick on the picket-lines and those who do not succumb will be unfitted for service for weeks. In such an event these batteries will wait a long time before they can move their carriages.

The organization that in time of peace looks around and locates the seasoned horses, fitted for artillery draft, in its

IN THE COLLAR

vicinity, may, when the proper time arrives, notify the authorities who may perhaps take steps to purchase such seasoned animals.

After the South African War the British Government listed all suitable military horses in the British Isles, took an option on each and paid a small yearly bonus for such option. When war was declared an inspector and veterinarian visited the owners of such horses in a given district, paid the price agreed upon and took the horses needed. These were sent to mobilization points and issued. As all of the horses selected were seasoned and in good working condition they were ready to be matched in teams and go into the collar the day after arrival.

This seems to be a simple scheme enough. Would such a scheme be practicable with us?

There is at present a system about to be inaugurated to supply each militia battery with ten or more artillery horses, to be used for official purposes only. It is hoped that this system will be of value in stimulating practical work in horsemanship, but the care of animals in the field is so different from their care in garrison or stables that it is not easily understood how these batteries can gain the necessary knowledge for good field work. Officers who are horsemen should be detailed to give weekly talks and demonstrations on this subject during the drill season. These talks should cover the inspection of forage and bedding; management of picket lines; systematic feeding, watering, grooming, shoeing, fitting of harness, sanitation and veterinary police. In addition to this, artillery types and breeds should be gone into with slides. Inspection, endurance, conservation and draft should not be neglected.

The collar and its adjustment are difficult subjects to discuss on paper. It is believed that the solution of this question will be the substitution of the breast strap for the present steel collar.

Proper feeding is of course governed by the amount of work. There is no other rule. The offering of a full ration to idle horses is dangerous and expensive.

The watering is a simple proposition enough, and it makes little difference whether the animal is watered before or after feeding. The main thing is to offer plenty of it frequently except when the animal is heated by exercise. The custom of denying horses water between the hours of 4.30 P.M. and 7.00 A.M. is responsible for nearly all intestinal disturbances and loss of flesh. Horses should be watered as late as 8.00 P.M., or better still, have a supply before them during the night. Those watered late at night thrive better on a small quantity of grain and hay. In camp, night watering is out of the question, but it could be done later than is customary.

Salting—The offering of salt is not as necessary as may be imagined. Well-fed army animals may be kept in excellent condition without it, as good forage contains sufficient salt within itself. Horses and mules are often very fond of salt and appear to relish its presence. It undoubtedly aids digestion, also increases the thirst and induces a desire for greater quantities of water. It should be added to bran mash as a condiment.

Bran—This substitute for grain has very little digestible nutritive value. Its functions are to act as a laxative and to practically deny the nutrition contained in grain feed for one meal. It should be offered at the last feed Saturday to prepare the digestive tract for the long Sunday rest. When preparing bran mash the necessary salt should first be dissolved in sufficient water before adding it to the bran. A small quantity of dry bran mixed with oats causes "bolters" to masticate slowly, as it takes much more saliva to prepare it for safe swallowing. Whilst the brain is being ensalivated, the oats with which it is mingled is ground and crushed by the molars much more thoroughly than when masticated alone.

IN THE COLLAR

Indian corn, barley, rye, millet, wheat, bread, potatoes, apples, straw, molasses, sugar, rice and similar foods, are all good foods for horses and mules. Great care should be taken that an animal does not receive full rations of an unaccustomed forage until the system becomes used to it, otherwise considerable trouble will be caused by intestinal disturbances. It should be borne in mind also that a measure which will contain exactly three pounds of oats will contain a greater weight of corn, barley, rye, wheat, or other grains. In changing from one kind of grain to another this weight capacity of a measure should not be lost sight of. The harder varieties of grain, such as corn, barley, and rye, should, when practicable, be crushed before offering.

Condition—By condition is meant muscular fitness for the work required. It does not mean "dealer's condition," which is nothing more than fat placed on the animal by excessive feeding and little exercise, with the object of giving a round, plump appearance and of pleasing the eye. Animals thus prepared are unfitted for prolonged exertion. Condition is the standard by which an animal is judged by the horseman, breeding and good conformation are valueless in its absence; in the field it is priceless; its value in war cannot be estimated in dollars and cents; and unless the animals of an organization possess it they are practically valueless from the artilleryman's point of view. Condition is laboriously obtained by proper feeding and healthy exercise judiciously combined, and continued over a long period. The transformation of fat, flabby flesh into hard, tough muscle, is a gradual process that cannot be forced. A regular course of graduated exercise, in draft for artillery horses, is the only way to accomplish it.

Grooming—The objects of grooming are cleanliness, prevention of disease and improvement of the animal's condition and appearance, all of which may be obtained by a good cleaning once a day. The relation of regular exercise to the amount of grooming required should be kept in mind. It is well known

to horsemen that an idle horse is more difficult to clean than one which is at work. It is almost impossible to keep some skins free from scurf and grease when the horse is idle. The idle horse therefore requires even more attention as regards his grooming than his fellow at work, whilst regular exercise is, in addition to its other benefits, a labor-saving procedure. It is to be regretted that in our service we do not use the "wisp" which, to a great extent, should take the place of the brush. Wiping stimulates the skin, brings more blood into it and produces a vigorous circulation which has a beneficial effect on the oil glands of the hair, increasing their output and thereby giving a marked gloss to the coat.

Washing—Washing the legs and body is dangerous when the coat is not properly dried afterward. The water applied is permitted to evaporate by the body heat, the consequent chilling of the skin is injurious and may be productive of disease. Washing mud off the belly and legs of an animal warm from exercise usually produces stiffness and cracks around the pasterns, cracked heels and mud fever. The mud should be allowed to dry thoroughly and then removed by the grooming tools.

Clipping—Clipping helps condition when the clipped animal is properly housed and cared for. It eliminates the cold, sweaty blanket of moisture that clings to the coat after exercise and is seldom properly dried out.

Shoeing—Much has been written on the shoeing of horses for the correction of gaits, development of speed and height of action. These subjects have little interest for the military man, whose horses are supposed to be true in gait and normal in action. For field artillery horses and mules the shoes selected should be of the simplest type, and their weights and size should correspond to the class of work and size of hoof. For small horses the sizes usually used are ones, twos and sometimes threes. For the larger horses fours, fives, sixes and frequently sevens are in demand. The shoe consists of a plain

IN THE COLLAR

iron web having a crease or fuller on the ground surface of each quarter for the protection of nail heads. In each crease, or fuller, there are punched four nail holes for the reception of the eight nails by which the shoe is attached to the hoof. The foot surface of the shoe is slightly concaved to obviate pressure on the sole, the shoe itself being attached to the ground surface of the wall. Service horses are re-shod once a month whether shoes show evidence of wear or not. The object of this is to keep the growth of the wall within proper bounds, for should it be permitted to overgrow, the normal angle of the pastern would be changed and undue strain thus put upon its ligaments.

The secret of good, plain military shoeing consists in noninterference with the sole and frog; selection of the proper size and weight of shoe adapted to the particular kind of work to be done. It implies producing an absolute level of the ground surface of the wall, and of so forging the shoe that it will fit the already prepared hoof in true level bearing and in circumference. The nails being properly driven, turned, clinched and finished, the horse is properly shod. This seems to be a simple operation, but the difficulty is in getting such an absolute level on both shoe and wall that the union will be air tight.

Caulkings are frequently used in case of icy footing. Their presence is dangerous where horses are tied on picket lines or turned loose. In these situations horses shod thus are liable to kick each other with the sharp caulking.

The wear of shoes will of course depend upon the amount of work, the character of the roads, and the peculiarity of gait of the individual animal. Some horses will travel as much as 300 miles in one set of shoes while another in the same team will wear them out in 100 miles. The wear of hind shoes is greater than that of fore and the outside of the shoe than the inside. The outside toe is usually the first place to be worn through. Hind shoes are lighter than front. There is no good reason why this should be so.

Breast Collar—The simplest form of collar with which the writer is familiar is the breast, or "Dutch," collar. The term "breast" is scarcely correct, as the shoulders and not the breast, are the points from which the work is done. The steel collar oscillates from side to side in traction: the breast collar has a sawing action. Sawing of course, is a greater source of friction than oscillation, therefore the make and fit of breast collars must be such as to present a perfectly smooth surface next the horse's skin. Neglect of this is soon evident. The writer believes he was the first to introduce breast collars in the service, as he gave them a fair trial on the march years ago with the sanction of Captain L. G. Berry, 21st Battery, now Colonel, 4th Artillery. A well-made breast collar should be wide, the lining of soft leather being wider than the leather work on which draft comes. The lining itself should be of one piece, without seam or stitch. This is effected by taking a piece of soft leather and folding it; the inside fold goes next the hide, while the outside one is used for the attachment of the breast-piece proper, the piece to which the buckles and fittings are attached. Chafes and injuries from breast collars are quite frequent if their adjustment, cleanliness and softness of bearing surface are neglected. The steel collar when properly adjusted and cleansed has no superior. Its one drawback is the short limit of its adjustment. When it reaches this limit there is nothing for it but a smaller collar or a breast collar. It might be wise to equip each section with four breast collars in addition to the steel article. The humane collar has been given a trial in the service and is giving much satisfaction.

Generalities—Steer clear of public watering places, public hitching racks and posts, horse sheds in fair grounds and race tracks. The germs of glanders and other diseases may be abroad. When shipping examine the inside of all horse-cars for nails, broken boards, cleanliness and disinfection. When shipping in common stock cars remove halters and be sure all doors are properly secure. Do not take chances on a defective

IN THE COLLAR

ramp, platform, or boarding board. Eliminate the timid men when boarding and unloading.

Never ship animals in time of peace while harnessed. This is a dangerous proceeding and is fatiguing to the horses, moreover it indicates carelessness and lack of horse knowledge on the part of the officer responsible.

Horses often become car sick, therefore it would be a reasonable plan to feed lightly at the feeding time preceding loading.

The horse and mule, fortunately for those who abuse and maltreat them, are not endowed with much intelligence, or cunning. They are what their masters make them in their training and handling.

There is a popular opinion that the mule is obstinate, stupid and vicious. This is not the case, however. On the contrary, with correct training this animal gives evidence of much more intelligence than the horse; is not at all obstinate and as a rule is more docile, and just as dependable.

Gentleness, kindness and patience will develop the responsive powers of both horse and mule to a marvellous extent; whilst harshness and irritation will be productive of timidity, fear, ill-temper and viciousness.

The most essential equipment for the proper training of these animals is patience, firmness, calmness and fearlessness. There must be a complete absence of abrupt motions, also of harsh or loud expressions and absolutely no punishment except in very rare instances.

It is distressing and humiliating to see a full-grown, intelligent human being, whose reason appears to be usurped by rage, beating, kicking, cursing and bit-jerking one of these dumb, unreasoning, defenseless beasts who are incapable of retaliation, and whose natural disposition is usually superior to that of the human brute at whose hands he suffers. The individual who vents his chagrin or rage, on a dumb, unreasoning animal, may be safely classified as a coward.

THE FIELD ARTILLERY JOURNAL

A coward is usually cruel and is easily aroused to excited action where he knows the object of his spleen is unable to retaliate in kind. The coward will punish a horse or mule most unmercifully, knowing that his own worthless carcass will go unscathed, and while so doing will lose all control over his reason, but let him be annoyed by a vicious dog or other aggressive animal and one may notice how philosophically he will take it. No unmerciful punishment here; the physical fear in his brain keeps reason on her throne for the protection of the despicable brain which incases his soul.

In the service there are means of severe punishment for those whose early individual discipline has been neglected or ignored and who are given to the abuse of animals. In civil life, public opinion has sanctioned the organization of societies for the punishment of such individuals, and for the protection of our dumb servants. The officer, who so far forgets the duty he owes the military service as to permit the abuse of horses or mules over which he has control, is very apt to permit the abuse of the human animals, over which he has command.

Have patience with your animals; train them to do one thing at a time; be considerate of their welfare; be interested in their care; be very sparing of whip and spur; be true to yourself by being kind and gentle to these dumb, willing toilers and slaves, who serve so faithfully the thankless human race.

CURRENT FIELD ARTILLERY NOTES

Rapidity of Service of 3-inch Batteries

STATISTICS recently compiled at the School of Fire have resulted in a definite statement of the time which may be expected to be consumed from the identification of the target to the first shot. The results are as follows:

Time from identification of target to announcement of 1st range.	Classification.
10 seconds or less	Excellent.
10 to 20 seconds	Very good.
20 to 40 seconds	Good.
40 to 60 seconds	Fair.
Over 60 seconds	Poor.

The above figures should be a matter of gratification to the field artillery officer who is mindful of the unpardonable delays which until recently were characteristic of our target practice. To the officers of other branches who naturally look to the field artillery for support and who trust that this support may be furnished promptly, the figures should be extremely encouraging.

Late Notes on French Artillery

GAITS.

The French Field Artillery receive a great deal of instruction in movements at a uniform trot at a rate of from seven to eight miles per hour. On the march where the roads permit the trot is the habitual gait. It may be said that the trot is the rule, the walk the exception.

ROAD ROUTINE.

During marches, when a halt is ordered, all carriages close up on the right hand side of the road; the individually mounted men dismount and hold the horses facing outward between the carriages; and all drivers dismount and stand by their horses' heads. The duration of the halt is from ten to fifteen minutes every hour or every hour and a half. The absence of invariable rules and the good common-sense which governs their routine seem characteristic of the French Field Artillery.

THE FIELD ARTILLERY JOURNAL

EMPLOYMENT OF EXECUTIVE OFFICER.

The French always try to have at least one lieutenant at the guns. He corresponds to our executive officer. Sometimes there is another lieutenant, but the absence of a second officer is not felt, because the French sergeants are so well trained that they can replace absent officers and conduct the fire of their batteries in emergencies. The value of the executive officer is greatly enhanced by the custom of keeping him entirely in touch with the situation and with the problem which the captain is solving, so that if the captain is disabled the efficiency of the battery will be reduced only temporarily.

USE OF RANGE FINDERS.

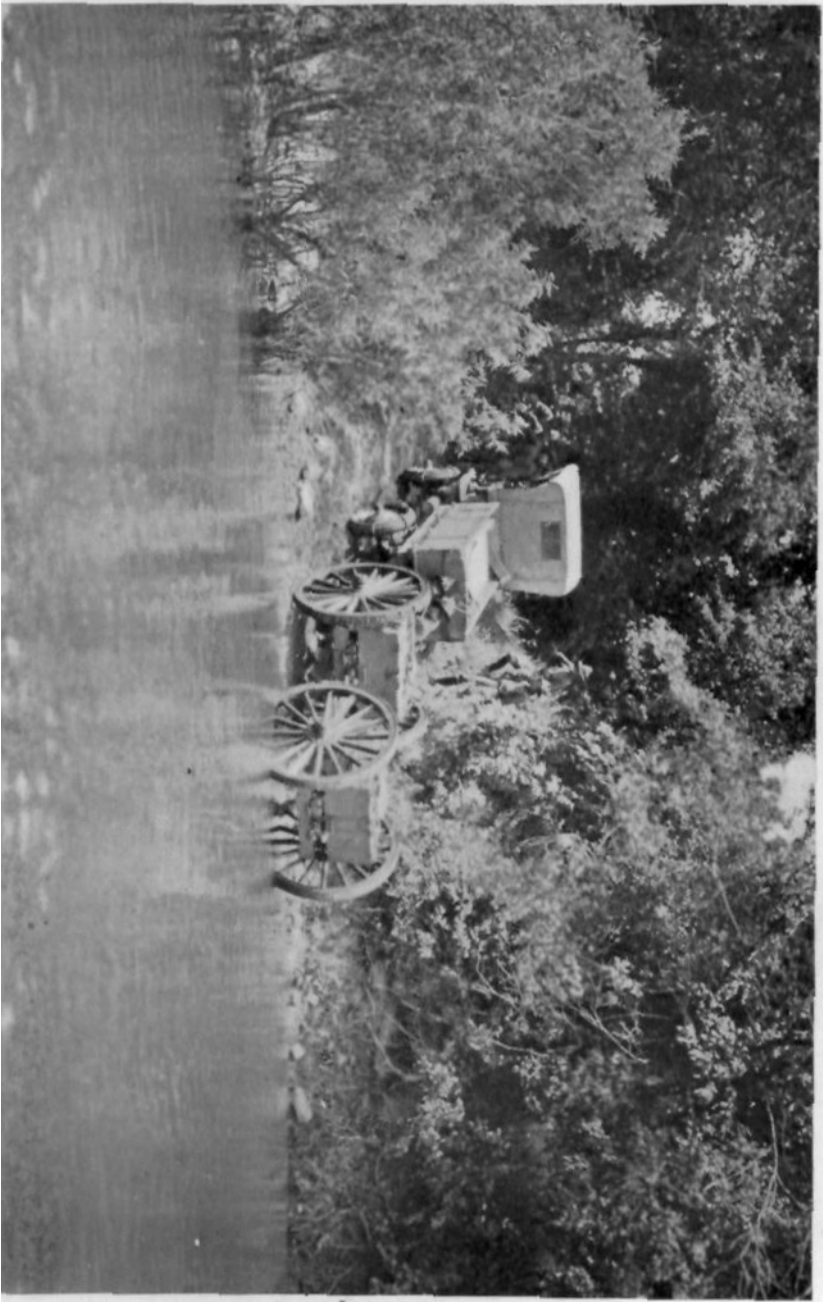
About a month before the beginning of the war the French batteries had issued to them Barr and Stroude range finders. Before the beginning of hostilities little use had been made of them, but they are now generally used.

SPEED, ACCURACY AND AMMUNITION SUPPLY.

It is reported that as a rule French field artillery officers obtain a preliminary rough adjustment with extreme rapidity, and that they then proceed to deliver fire for effect with apparent disregard of the ammunition supply. The prevailing idea is that it is the duty of the ammunition columns in rear to replace the rounds which have been used.

BATTALION EMPLOYMENT.

Sectors are usually covered by battalion, and all the batteries are well masked. Seldom, however, do more than two batteries fire at one time. Generally while two batteries are in action the third remains in observation. If the hostile artillery locates one of the batteries which is firing that battery ceases its fire. The battery which has been in observation then opens fire. This procedure has on some occasions given the impression to the Germans that the first battery had changed position and they have ceased firing when a continuance of the fire would have been effective.



MOTOR TRUCK TESTS AT FORT SILL, JULY, 1915
FOUR-WHEEL-DRIVE TRUCK HAULING TWO 4.7-INCH GUN CAISSONS ACROSS FORD IN MEDICINE CREEK. NOTE THE EXTRA AMMUNITION CARRIED THE TRUCK.



MOTOR TRUCK TESTS AT FORT SILL, JULY, 1915

FOUR-WHEEL-DRIVE TRUCK HAULING FOUR 4.7-INCH GUN CAISSONS ACROSS SOFT SAND FORD IS MEDICINE CREEK.

CURRENT FIELD ARTILLERY NOTES

German Losses

FIELD ARTILLERY OFFICERS.

The following list shows the number of German Field Artillery officers who have been killed or who have died since the beginning of the war. The figures in parentheses denote officers on the reserve or inactive list.

Lieutenant Generals	0	
Major Generals	3	
Colonels	3	
Lieutenant Colonels	9	(3)
Majors	26	
Captains	113	(18)
First Lieutenants	56	(28)
Second Lieutenants	292	(160)
Lieutenants of Ordnance	1	
Chief Surgeons	2	(2)
Staff Surgeons	1	(1)
Surgeons	1	
Chief Veterinarians	1	
Staff Veterinarians	3	(2)
Veterinarians (1st Lieut.)	2	
Veterinarians (2d Lieut.)	0	
Paymasters	2	
<hr/>		
Total	515	(214)

Test of Motor Traction for Heavy Field Artillery

It is believed that the service will learn with interest and approval that the question of motor traction is at last receiving in this country the careful consideration which it deserves.

Under the supervision of the Field Artillery Board, the test of motor trucks outlined below will be carried out first in the 4.7-inch gun battalion and then in the 6-inch howitzer battalion under the direction of the battalion commanders.

Two trucks, one manufactured by the Thomas B. Jeffery Co., the other by the Duplex Motor Car Co., are at present available for the test.

It will be noted that on both trucks all four wheels are motor wheels; on the Jeffery motor all four wheels are also guide wheels.

The tests will be conducted so as to determine as far as possible:

(a) The comparative efficiency under service conditions of motor and animal traction, as well as of the two kinds of motors, in the draft of heavy field artillery; and

THE FIELD ARTILLERY JOURNAL

(b) The comparative economy of motor and animal traction, taking into consideration original cost, maintenance, probable length of service, and the like.

The tests will be carried out with the view of ascertaining the greatest amount that can be accomplished with motors when ingenuity and care are exercised in overcoming obstacles, and not with a view to the undertaking of unnecessarily severe tasks.

To determine comparative efficiency under service conditions.

TEST I. EFFICIENCY IN THE SUPPLY OF AMMUNITION.

A. To determine the most favorable combination of tow and load of motor, considering the amount of ammunition transported, the rate of speed desired, the overcoming of obstacles, and so forth.

1. Load of motor—weight equivalent to ammunition carried in one chest, and cannoneers normally assigned in the battery to the carriages constituting the tow, excepting cannoneers at brakes of tow.

Tow—one loaded caisson and limber.

Distance—about 5 miles.

Route—ordinary roads about 3 miles; and cross country about 2 miles; to be traversed on same day by remainder of battery with animal traction.

Rate—about half of road distance to be at rate of teams; other half at rate most favorable to motor; same for cross-country distance.

Obstacles—similar to those that the battery with animal traction is accustomed to encounter successfully in ordinary field work, such as: fords of various depths, banks and bottoms; ditches; sharp corners and winding roads; grades, both ascending and descending; sand; mud and soft ground.

2. Same as (1) except:

Tow—two loaded caissons and one loaded limber.

3. Same as (1) except:

Tow—two loaded caissons and limbers.

4, 5 and 6. Same as 1, 2 and 3, respectively, except:

Load of motor—weight equivalent to ammunition carried in two chests, and cannoneers as in (1).

From these tests, and from others of a similar nature if necessary, the most favorable combination of tow and load of motor for use in the general case should be approximately determined.

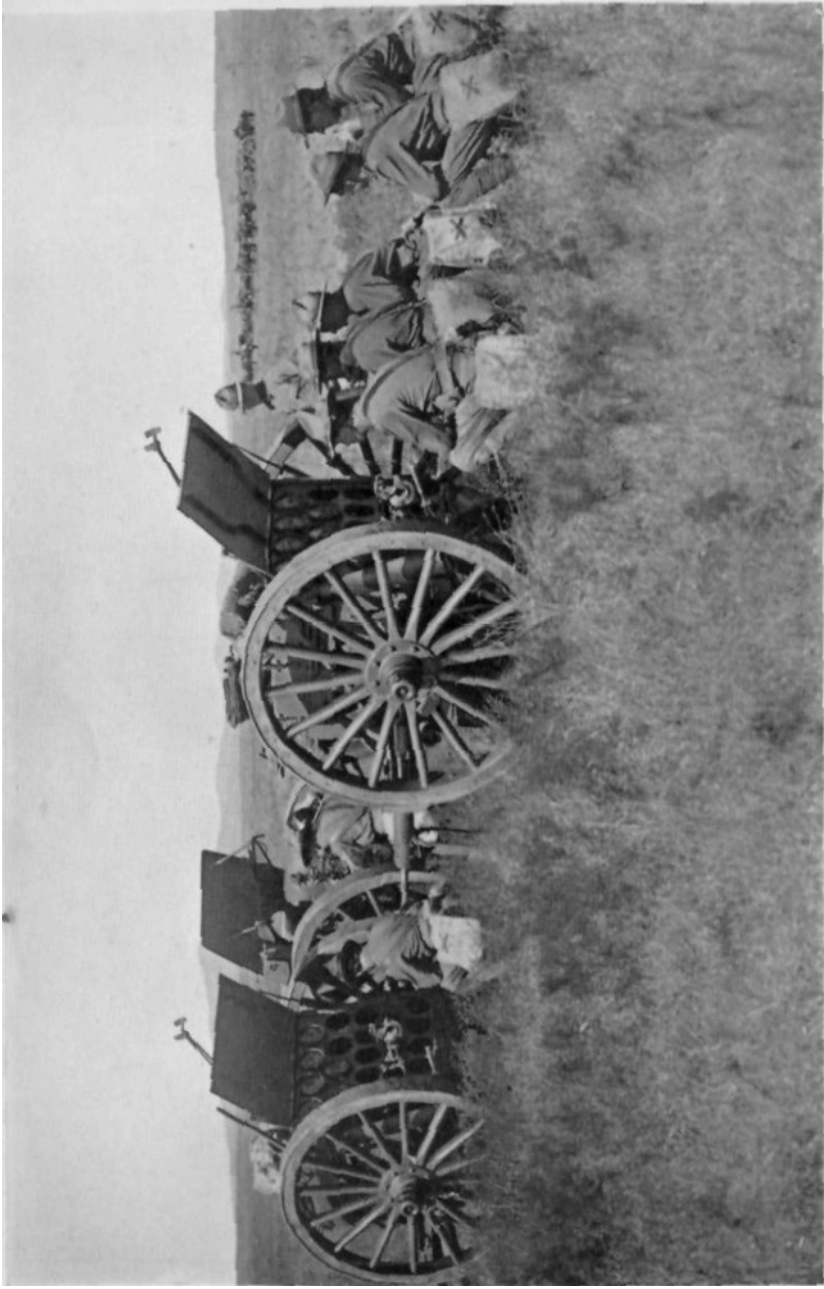
B. 1. Ammunition supply problems.

Motors with most favorable loads and tows as determined in (A),



MOTOR TRUCK TESTS AT FORT SILL, JULY, 1915

CANNONEERS ASSISTING FOUR-WHEEL-DRIVE TRUCK ON A 45° SAND SLOPE AFTER CROSSING MEDICINE CREEK.



DISPOSITION OF HEAVY FIELD ARTILLERY IN BATTERY

PROPOSED METHOD OF PLACING 4.7-INCH GUN CAISSON DIRECTLY IN REAR OF ITS LIMBER WHEN IN BATTERY. THE CAISSON WAS FORMERLY DROPPED ON THE LEFT FLANK OF THE PIECE. THE LIMBER WAS THEN DRIVEN TO RIGHT AND UNHITCHED. THIS DISPOSITION REDUCES VISIBILITY FROM THE FRONT.

CURRENT FIELD ARTILLERY NOTES

and remainder of battery with animal traction; the motors with tows to constitute the combat train.

The battery to proceed to a position at least 3 miles from starting point at the rate of the teams, and to occupy same.

The ammunition distributing station to be indicated by filled caissons and limbers, the distance between this station and the post of the combat train being at least 2 miles, the route being partly on and partly off the roads, and presenting several obstacles. After the combat train is posted, empty chests will be hauled by the motors from the combat train to the ammunition distributing station, and filled chests will be brought back to the combat train, simulating the replenishment of ammunition under service conditions.

2. Same as (1) except:

Load of motors when hauling filled chests as in (1); when hauling empty chests to consist of only the cannoneers normally assigned to the carriages constituting the tow.

In this problem will be sought the determination of the greatest number of empty caissons and limbers that, in the general case, the motors may be expected to haul.

TEST II. EFFICIENCY IN THE TRACTION OF ELEMENTS OF THE FIRING BATTERY.

A. To determine most favorable tow and load of motor as before.

1. Load of motor—weight equivalent to ammunition carried in one chest, and gun squad excepting cannoneers at brakes of tow.

Tow—one piece.

Distance, route, rate, obstacles—same as in TEST I.

2. Same as (1) except:

Tow—one caisson and one piece.

3 and 4. Same as 1 and 2, respectively, except:

Load of motor—weight equivalent to ammunition carried in two chests, and gun squad as in (1).

From these tests, and from others of a similar nature if necessary, the most favorable combination of tow and load of motor for use in the general case should be approximately determined.

B. Battery problems.

1. Firing battery to be composed of motors with most favorable loads and tows as determined in (A).

Each problem to include the reconnaissance and occupation of a

THE FIELD ARTILLERY JOURNAL

position, the pieces being hauled to their positions by the motors; the resupply of ammunition by motor traction, filled chests being brought to the battery from the combat train and empty ones returned thereto; and the withdrawal from the position.

Distance, obstacles—as in TEST I.

Route—ordinary roads about 3 miles; and cross-country about 2 miles.

Rate—that most favorable to motor.

2. Same as (1) varying route, obstacles and position.

TEST III. EFFICIENCY ON MARCHES.

One-day marches equipped for field service.

1. Motors with most favorable loads and tows as determined in TEST I, and remainder of battery with animal traction.

Both elements of composite battery to start in the same direction, the motors preceding; each of these elements to move at the rate most favorable to itself; to make only the halts required by its personnel or tractive power in an ordinary day's march; and to return at approximately the same time. Battery to be absent from post at least eight hours.

2. Same as (1) except:

Motors with most favorable loads and tows as determined in TEST II.

3. (If possible). Same as (1) during or immediately after a rain while roads are muddy and slippery.

4. (If possible). Same as (2) during or immediately after a train while roads are muddy and slippery.

5. Motors with most favorable loads and tows as determined in TEST II, and remainder of battery with animal traction. Battery to be kept together and the rate to be that most favorable to the animals. Distance about 15 miles.

Any further tests of a similar nature that may be considered necessary or desirable may be undertaken by the battalion commander.

To determine comparative economy.

During all tests, an accurate and detailed record shall be kept of mileage, actual running time, length of halts with reasons therefor, repairs, supplies consumed, and like data.

From this record and other accessible data a report of the comparative economy will be prepared.

The original cost of the Jeffery motor will be taken as \$2400; that of the Duplex as \$2245.

CURRENT FIELD ARTILLERY NOTES

During the progress of the several tests prescribed, the obstacles should increase in difficulty until the use of the cannoneers on the ropes and wheels, the use of blocks and tackle, the overwhelming of the obstacle by a motor hauling one element of its tow at a time, or by one motor assisting the other, and other expedients, shall be necessary.

At the completion of the tests in each battalion a detailed report will be submitted by the battalion commander.

In these reports should be considered, among any other points that may be deemed pertinent:

(a) The necessity for tires different from those with which the motors are at present equipped.

(b) The necessity or desirability of equipping each motor with an emergency winch for the purpose of pulling itself or its tow over difficult ground.

(c) The necessity of elastic couplers between motor and tow, and between the elements of the tow, and the efficiency in this respect of the springs now assembled on the shanks of the pintles of the motors.

(d) The most favorable distribution of the load of the motor.

(e) The advantages, if any, in having all four wheels guide wheels.

(f) Any changes in the present material that would be required if the battery were to be equipped with motor tractors.

Improved Smoke-Bomb Outfit.

It often happens that smoke-bomb practice is desirable under conditions which preclude the installation of the regular Ordnance Department equipment. The following description indicates how an outfit was improvised out of ordinary materials at the militia camp of instruction at Gigling, California, in June, 1915.

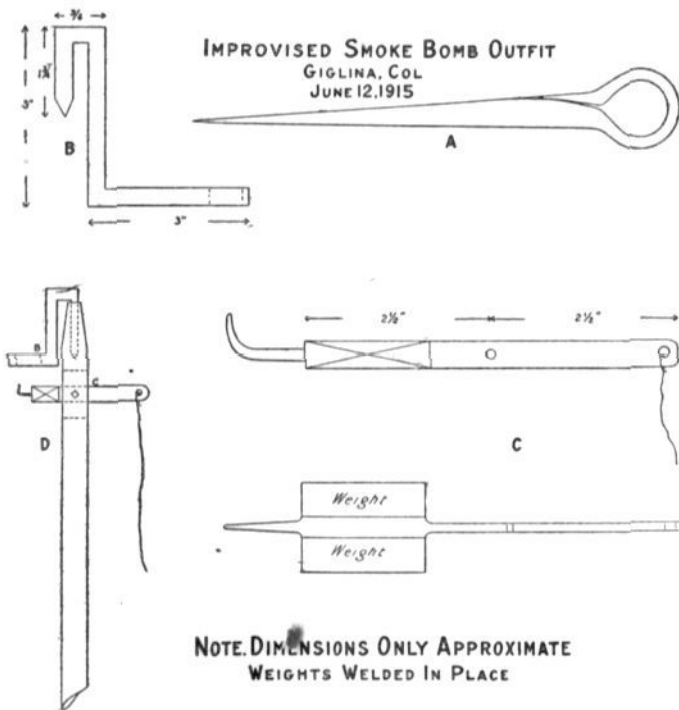
An ordinary piece of ½-inch round iron stock was worked by the blacksmith into the form marked "A." It was then bent to the form "B" and the pointed end driven into the end of a rake handle, the ferrule being left on the handle. Next a piece of the same stock was worked into the form "C" to form a hammer, the broad shape given its striking end being purely for the purpose of increasing its weight. A slot was cut into the rake handle and the hammer bolted in the slot as shown in "D." The striking end of the hammer beyond its weighted part was worked into a point, and a small hole was bored in the other end

THE FIELD ARTILLERY JOURNAL

through which a lanyard was run. The circular hole worked in the iron shown in sketch "A" was filed smooth to form a snug fit for a 12 gauge brass shot gun shell. The shell was inserted and the point of the hammer trued up with the cap of the shell.

Eight of these were made, and in addition to the pole as described, each outfit consisted of the following:

- 3 twelve gauge brass shells.
- 1 twelve gauge priming tool.



- 1 twelve gauge decapping tool.
- 1 sub-calibre cartridge case with stopper (for primers).
- 1 empty tobacco tin (for powder).
- Powder.
- Primers.

This outfit was constructed in less than 24 hours notice and has been used successfully at ranges beyond 2000 yards.

With each man supplied with a complete outfit and three brass cases no difficulty was experienced with the speed of fire.

CURRENT FIELD ARTILLERY NOTES

The shell was primed, filled half full of black powder, and one thickness of ordinary tissue paper was put over the powder to prevent jolting out.

The smoke given out was in the shape of a truncated cone from two to three feet across the base.

The retail price of the commercial components of eight of these, or one complete set, was as follows:

24 Twelve gauge brass shot gun shells	\$.96
8 Reloading tools .....	.80
8 Decapping tools	1.20
	<hr/>
Total	\$2.96

The retail price of the primers is \$2.00 per thousand.

It is suggested that these outfits might be constructed by organizations with 8 gauge, 10 gauge, 12 gauge, or 16 gauge brass shells. 12 gauge was the largest to be obtained here at the time they were needed.

Something of the same pattern, using a 16 gauge shell, might be used to advantage by the Militia in armory or short range work.

Destruction of Wire Entanglements by Means of High Explosives.

IN France, they use rigid or flexible cartridges charged with melinite. The charges are large enough to be placed by hand in the obstacle. The cartridges are usually tied together in groups of three and assembled on a stick 4 centimetres thick, 6.5 centimetres wide and 5 metres long. The end of stick terminates in a cylindrical socket 20 centimetres long in which another stick may be inserted in case it is desired to make up a charge more than 5 metres long. Each stick has a wooden head of conical shape upon which are mounted an iron cap and a pair of small wooden wheels of about 12 centimetres diameter. The charge as made up is then placed either in or under the wire entanglement, being inserted with the head first. Due to the form of the latter and with the assistance of the two wheels, the stick is easily inserted in the obstacle. When necessary another charged stick is placed next to it. Detonation is produced by means of a time fuze, attached to a detonating cap inserted in a cartridge about the centre of the base of the charge. Each stick will carry 99 cartridges—or about 2.65 kg. of melinite per metre of length. It is carried by two persons. French regulations state that a path 4 metres wide can be cleared with such a charge.

THE FIELD ARTILLERY JOURNAL

In Russia, rigid cartridges attached to sticks 2.5 to 3 metres in length, are used. These are thrown into the obstacle to be demolished. In this way a path 3 metres wide can be cleared, but if the charge is not favorably placed some parts of the obstacle may remain intact. The Russians have copied the French model and constructed charges as follows: Wooden sticks, 2.5 to 4 centimetres thick, 7.5 centimetres wide, and 1.8 metres in length carry an explosive charge of Pyroxylin cartridges. Each stick has at one end a wooden latch projecting 4.5 centimetres, and at the other end a socket to permit attachment to another stick. The first end tapers to a point, the second is hollowed out to permit the insertion of the point of another stick. The end of the first stick is equipped with a head which facilitates the insertion of the charge in the obstacle and prevents injury to the charge. To the sides are attached two small wheels not more than 15 centimetres in diameter to permit the charge to be inserted under the lowest wire. The charge is placed in a tubule of cloth material and attached to the flat side of the stick. On an average 3.5 kilogrammes of Pyroxylin per metre are used. A number of detonating caps, according to the length of the charge, are distributed along the stick. One man can carry a stick. Having arrived at the place where the charges are to be used, the proper number of sticks are lashed together and shoved under the obstacle.

In England demolition is produced with dynamite torpedoes, consisting of a soft lead tube 7 metres in length and 6 centimetres in diameter filled with dynamite. The total weight of the charge was 16.3 kilogrammes. These torpedoes are inserted in the wire entanglement about half way from the ground. The resulting explosion produces a passage or breach averaging about 6 metres in width. Tests were next carried out with pliable sticks or charges of gun-cotton. These were 8 metres long and were composed of 250 conical explosive cartridges of guncotton each weighing 28 grammes. These were strung on a stout cord without being covered by cardboard. After the charge had been thrown in the wire entanglement, a detonating cap and fuze were attached to the last cartridge. The resulting explosion produced a passage or breach about 1.80 metres wide.

In India so-called torpedoes, lead tubes 2 metres long and 6 centimetres in diameter filled with explosive, are used. One end of the tube is closed, the other is open but is extended by a sleeve or coupling 20 centimetres long which serves to couple the closed end of another torpedo if it is desired to make up charges greater than 2 metres long. The number of torpedoes to be used depends upon the width of the obstacle. Each torpedo tube is filled with 23 packets, each containing 4

CURRENT FIELD ARTILLERY NOTES

explosive cartridges, thus giving a charge weighing 2.5 kilogrammes for each metre in length. When several torpedoes are joined, the closed end of one tube or torpedo is touching the explosive charge at the open end of the next torpedo. The detonator is inserted in the last torpedo of the charge and the whole mass is detonated by transmission through the closed end walls between the torpedoes. Each torpedo has attached a grip handle. The weight of an empty tube with grip handle and point is about 3.8 kilogrammes, and with the tube loaded with dynamite it is about 9 kilogrammes, for the transport of which one man is allowed. In this combined torpedo, the point is left on the first torpedo inserted, and the grip handle on the last of the three, through which the fuze is inserted into the detonating cap. The results obtained with these torpedoes are said to have been wonderful, producing passable breaches through the wire entanglement. The attacking columns could take position without danger 100 metres from the point of explosion.—Translation from *Artilleristische Monatshefte*, April, 1915, by 1st Lieutenant E. L. Gruber, 5th Field Artillery.

Reorganization of the Italian Field Artillery

IN pursuance to the law of Jan. 3, 1915, light batteries were organized into 4 gun batteries. Minister of War, M. Znpelli, has stated that thereby the field artillery was increased by 36 battalions or 90 batteries (formerly there were only 75 battalions). Under the old organization there were 196 light batteries and 8 horse batteries, a total of 204 batteries or 1224 guns. Under the new organizations there will be 294 batteries or 1176 guns. The number of guns has therefore been reduced by 46 but the efficiency of the batteries has been increased. The Minister of War states that a four gun battery has a greater mobility, which is so necessary for the artillery in accomplishing its principal mission, the support of its infantry. The mobility a six gun battery did not possess this on account of the large number of ammunition wagons which it required.—Translation from *Artilleristische Monatshefte*, April, 1915, by 1st Lieutenant E. L. Gruber, 5th Field Artillery.

Revision of Drill Regulations.

THE 1911 edition of the Drill Regulations for Field Artillery (Horse and Light) is exhausted. The Field Artillery Board has been directed to revise the entire book as soon as possible. This is a subject which virtually concerns every officer of field artillery and upon which every

THE FIELD ARTILLERY JOURNAL

officer who has recently been on duty with troops should have definite ideas. THE FIELD ARTILLERY JOURNAL is always open for the proper discussion of matters of this kind.

Increase of Ammunition Allowance

IT is understood that the Ordnance Department hopes to be able to include in this year's estimate a substantial increase in the allowance of ammunition for field artillery target practice.

Revision of Greble Board Report

THE board of officers, which was appointed last spring for the purpose of revising the report of the Greble Board has, it is understood, completed its work and submitted its report.

Issue of Aiming Circles

A CONTRACT has been let by the Ordnance Department with the Bausch and Lomb Co., for the manufacture of 150 aiming circles for the use of the field artillery. This convenient little instrument is believed to be the best known device for the use of instrument sergeants in the calculation of firing data. It is light enough to be carried on the belt without discomfort, and the tripod can easily be carried on the saddle. Its optical power is not great; but in other respects it is the equal of any other angle measuring device for field use. In addition to the azimuth and angle of site devices it includes an excellent compass, which is of the greatest utility in laying guns in close country in which no common aiming point is visible and in which the battery commander is hidden from his guns.

Brief Artillery Note from France

FROM an entirely reliable but non-official source the following brief note relating to field artillery in France has been received:

"At the guns things are much the same as with us, except that the matériel is better. . . . the breechblocks are simpler, stronger and quicker, the sights are better and the shields much more complete.

"The fuze setters, on the other hand, where I expected a great increase of speed, do not impress me much. Of course these remarks apply only to the newest guns and are not true of the older '75s.' We've got something to learn in harness, too—no collars and double traces which insure a straight draft."

EDITORIAL DEPARTMENT

Plattsburg and the Field Artillery

THE lessons of the 1915 Plattsburg camp are so far-reaching that it is as yet impossible even to approximate an estimation of their results or their value. From the point of view of the Field Artillery they are at once disappointing and encouraging.

At a time when the entire military world is being roused to an appreciation of the value and importance of field artillery, the Plattsburg camp was provided with only two 3-inch guns, both of which were borrowed for the occasion from militia batteries. The instructional work devolved upon two officers, assisted by two selected noncommissioned officers. Later one battery was sent to the camp, but its detachment from the joint camp at Tobyhanna seriously interfered with the instruction of a battalion of militia field artillery.

Thus the arm to which the present war has brought a new prominence was almost lost sight of. Both the Field Artillery and the business men who attended the camp suffered. These conditions were not caused by any neglect or by any lack of desire to represent the Field Artillery adequately. They were caused by the fact that, east of the Mississippi River, there are but twelve 3-inch guns in the hands of the Regular Army and available for instructional purposes. This fact was emphasized at Plattsburg; and in this negative emphasis there may be found some ground for hoping that the shortage of field artillery in this country has at last been brought forcibly to the attention of thoughtful, responsible, influential men.

Reorganization and Increase

IT is neither possible nor desirable for military men to discuss publicly at this time questions which concern the reorganization and increase of our military forces. The entire matter is in the hands of the Secretary of War and is by him to be presented to Congress.

It is difficult to conceive of conditions which will prevent a substantial increase in field artillery. The lessons of the European War, the proportion of our regular field artillery now considered necessary in the minor crisis on the Rio Grande, the difficulty of providing horses for an adequate number of militia batteries, and the intelligent discussion of our field artillery deficiencies by the country at large will all combine to convince Congress that existing conditions are intolerable.

The nature of the reorganization and the extent of the increase are neither of them so important to the regular Field Artillery as is the need for a painstaking, unselfish and conscientious discussion of the ways and means at our disposal for accommodating ourselves to the resulting changed conditions, for doing our part in organization and instruction, and for the elimination of every influence which now stands between us and the efficiency which should be our goal. The Army cannot be increased and reorganized in any obscure fashion. If we are not now ready to have our personnel, our matériel and our methods closely scrutinized by thoughtful, able, keen-sighted men of affairs it is high time that we made ourselves ready for such scrutiny. The correction of existing faults and the preparation of officers and men for the duty of organization and instruction are far more important than the selfish contemplation of the advancement which any increase will cause. Advancement will follow increase, but unless officers are broad enough to adapt themselves to changed conditions and to attain to a new point of view their advancement will be but temporary.

An Obvious Comparison

IN the *Revue de Paris* a French lieutenant declares: "Germany will never experience a deficiency in powder or explosives because it has an adequate supply of raw materials. A comparison of what it and what the Allies must do in this respect is entirely in its favor. Before the war, the Germans

EDITORIAL DEPARTMENT

had succeeded in securing for themselves the entire manufacture of materials of war, including explosives, for non-manufacturing nations. Even for the French guns, the powder used was often of German manufacture, a consequence of the undisputed commercial weakness due to the government monopoly in powder and saltpetre as it exists in France. In the bargain Germany also furnished even the manufacturing nations and its present enemies a great part of their powder material, containers, mixing machines, etc. These industries which in time of peace lived on their export trade, now operate only for the needs of Germany and its allies. In this respect our enemies need not envy us, but rather to the contrary."

The lesson for our country is plain. The present tendency is to ignore the private manufacturer, to use him only when he is indispensable and seldom to coöperate with him properly. It is not too much to say that, had it not been for the war in Europe, recent legislation in this country, together with recent governmental attitude, would have driven a large percentage of the arms and munition manufacturers into other lines of work. By encouraging and supporting the private manufacturer Germany so strengthened herself that she has been able to defy the rest of Europe for over a year. By making the manufacture of powder a government monopoly, France placed herself in the ignominious position of a nation forced to purchase powder from German firms.

It is difficult to determine to what extent the influence of labor unions and to what extent a spirit of self-sufficiency on the part of our supply departments has produced the conditions which existed at the outbreak of the war. But, whatever may have been the cause, it has surely been demonstrated that a nation which cannot command the output of its private manufacturers of arms and munitions to the fullest extent is doomed to failure in war. It is the plain duty of both Congress and the supply departments so to amend both the law and the regulations

that government arsenals and depots shall hereafter work hand in hand with private manufacturers in order that in time of war the country may be able instantly to command its own resources.

At present the resources of this country in so far as the manufacture of arms and munitions is concerned are almost incalculable; but a spirit of hostility or distrust on the part of the government in time of peace will neutralize the asset in time of war.

The Need for Discussion

DISCUSSIONS among military men concern usually either matters of military policy or matters of military technique. To what extent discussion of military policy is at present advisable it is very difficult to determine. The *Infantry Journal* has advanced the opinion that officers in our country have less freedom in such discussion than the officers of any other army; and we are inclined to believe that this statement is not very far from the truth.

But if we are thus to a certain extent deprived of the free discussion of matters of policy, surely there is no check on discussions which concern the technical development and the tactical employment of our military establishment. For officers of the Field Artillery there are countless subjects for such discussion. They come into prominence at almost every salvo which is fired at target practice, on every march, and at almost every reconnaissance and selection of position.

Nor are we slow to enter upon such discussions. Field Artillery officers seldom meet without expressing their views upon matériel, methods and result. This is especially noticeable during the summer period of field work, service practice and militia instruction. In these discussions there are brought out the views of officers on duty with batteries who have the practical difficulties and the object lessons of their profession

EDITORIAL DEPARTMENT

fresh in their minds. In the lulls between firing problems, at the rear of the dusty column on the march back to camp, and at night about the camp fire—these are the occasions when field artillery problems are talked over in the most direct manner, and are stripped of everything except the application of sound theory to sound practice. Here the detailed ordnance officer meets the battery commander; here the field officer can get the point of view of the alert executive officer who knows just what does happen and what does not happen in a firing battery; and here the regular officer meets the militia battery commander and begins to get an insight into the difficult and well-nigh hopeless task of the militia field artilleryman.

These frank, friendly and direct discussions which concern so vitally the progress of our arm are of the utmost value to those who hear them and profit by them. But their influence is both restricted and transitory. The camp fires die out, the batteries return to the rut of garrison life, the lessons of the summer are too often forgotten, and the problems more than likely left to be solved again and again, summer after summer. To a regrettable extent we are working in a treadmill.

The FIELD ARTILLERY JOURNAL stands ready to correct this evil. It requires only the coöperation of those who take part in the discussions referred to. Not until our own officers and those of other arms can be roused to record and submit for publication the results of their technical and tactical discussions, shall we be in a way to take advantage of what experience has taught us. The expression of our opinions in the journal devoted to our interests will bring about our release from the treadmill existence which is not only keeping us back, but will, sooner or later, when the spotlight of public opinion is turned upon the Army, neutralize or destroy its prestige. It is only by giving proper publicity to our needs and frankly discussing our shortcomings that we can ever hope for the support which is so necessary to our progress.

Target Practice

FIELD artillery target practice is just beginning to emerge in an encouraging way from the kindergarten stage of development. For years we forgot that we were supposed to shoot at all; for years we struggled more or less impotently in a maze created by a combination of new methods and old precedents; and at last we have begun to set up a standard which is worthy our profession.

The fact that batteries sometimes fall below that standard is not altogether discouraging so long as the standard exists and is always being raised. But as progress in attainment is accomplished so should improvement in facilities be provided. No one believes that our ammunition allowance is sufficient, and many officers feel that the present target practice order is more of a restriction than an incentive to development.

It is believed that the target practice of any regular command should extend so far as is practicable throughout the year and should not be confined to a few weeks, and that the program should be progressive, starting with elementary problems to test the training of the firing batteries and to demonstrate the principles of observation and conduct of fire. The first firing in any year might well be held at the discretion of battery commanders who alone know when their firing batteries are ready for service ammunition. These elementary problems should be followed by others more advanced, and the year's practice should culminate in battle exercises as advanced as the previous results may justify.

Nothing could be more absurdly less like a battle than our present practice. The occasion of the annual field artillery inspection is the only one at which simultaneous firing by the batteries of a battalion is permitted or in which fire for effect can even be attempted. Thus the efficiency of battalions is judged by performance for which no practice has been provided. Some regular officers have even been humiliated by seeing their less-restricted comrades in the militia attempt

battalion fire direction which has been denied to them or their superiors.

The allowance of ammunition will undoubtedly be increased before another target practice season. It is to be hoped that the target practice order will be brought into accord with conditions as they now exist and that we may at least be given an opportunity of attempting in practice what will be expected of us in action.

The Revision of the Drill Regulations

A REVISION of the drill regulations for Field Artillery (Light and Horse) has been made necessary by the rapid technical development of the arm and by the exhaustion of the present edition.

The work of revision offers to the Field Artillery Board an opportunity of preparing a manual which shall be suitable not only for the instruction of existing batteries and battalions, but also for the basic training of the hundreds of new batteries which must be created at the beginning of any war.

Well-instructed regular troops should be to a certain extent independent of drill regulations. Manuals and drill regulations which are written solely from the point of view of regular troops in time of peace are comparatively valueless. Every officer who has attempted in the instruction of militia batteries to use most of the existing manuals or who has discussed them with militia officers recently appointed must have realized that the books contain a mass of information useful to officers and men who have lived in a military atmosphere, but too often more confusing than enlightening to men who have been engaged in civil pursuits. The point of view is too often that of the garrison and not of the field. The results are disappointing and scarcely creditable to the wisdom and foresight of the regular service.

We of the Field Artillery take pride in the progressiveness of our arm. In the present revision of our drill regulations there lies an opportunity for discarding a worn-out, non-progressive point of view and for presenting to the service a manual of real value which will not have to be thrown away at the outbreak of war.

The School of Fire for Field Artillery and the School of Musketry

IT would be difficult to overestimate the benefit which the entire military service would derive from a full realization of the possibilities contained in the close association of the two schools which are primarily designed to increase its fire efficiency. This realization can be attained, however, only by the most complete coöperation and coördination.

Such coöperation and coördination imply a total lack of selfishness and partisanship and a most wise utilization of the existing facilities at Fort Sill, and of the increased facilities which must be provided before the two schools can even approximate their full usefulness.

It should be recognized that the School of Fire for Field Artillery already possesses an extensive permanent installation and has successfully converted to its own proper use certain appropriate portions of the reservation. To interfere in any material way with what has already been accomplished by one school would appear to be a costly and short-sighted manner in which to build up the other.

Some administrative scheme should be devised which will make it possible to safeguard the interests of both schools, divide up equally the almost unlimited resources of the great reservation, and establish a spirit of harmony and mutual helpfulness which will bear its fruit in a better understanding among the mobile arms. This understanding will result in an increased fire efficiency of which the entire Army may be proud.

EDITORIAL DEPARTMENT

Field Artillery Songs

ABSORBED as we are in the solution of technical problems and in the comparatively prosaic routine of daily life, most of us have not entirely forgotten the appeal which field artillery has always made and always will make to everything that is picturesque and sentimental in military life.

Veterinarian Gerald E. Griffin, 3d Field Artillery, has preserved much of this sentiment and picturesqueness in a song entitled "The Red Guidon." Many of us who have heard this song around the camp fire and the mess table will be glad to know that Dr. Griffin has decided to publish it, and that he will follow it with "O'Reilly" and "The Mountain Battery" if there is a sufficient demand for "The Red Guidon" to warrant the publication of the others.

Information may be obtained by addressing Dr. Griffin at Fort Myer, Virginia.

The J. B. Lippincott Company

WITH this issue, the printing of the FIELD ARTILLERY JOURNAL is placed in the hands of the J. B. Lippincott Company, of Philadelphia.

This change was made in the interests of a better journal in every way; more sightly, more readable and to a greater extent designed to give the Field Artillery Association increased dignity and prestige.

The changes made in type, paper and size will prevent the present volume being bound into an absolutely homogeneous whole; but it is hoped that those members who bind their JOURNALS will feel that the improved form will compensate for the temporary inconvenience.

BOOK REVIEWS

The Immaterial Forces of a Nation in War, by Major-General Sir J. K. Trotter, K. C. B., C. M. G., R. A.

The readers of the FIELD ARTILLERY JOURNAL will find in the *Journal of the Royal Artillery* (issues of April and May, 1915) an article by General Trotter of the Royal Artillery on the immaterial forces of a nation in war. General Trotter opens his thesis by a statement that the forces which are brought into play in war are of two natures: In the first instance those forces which appeal to the eye, such as the men, the horses, and their weapons, the guns, the rifles, the bayonets and the sabres. In addition he refers to the vast, varied and complicated equipment for carrying on war, such as ships, trains, airships, motors, carts and all the innumerable paraphernalia connected with them. In the second instance General Trotter refers to those forces the nature of which is more or less unseen and, hence, in his phraseology, "Immaterial." "It is something which, in a greater or lesser degree, is behind all the animate forces of the material side of war. How it is composed, and what its strength is in any army issuing forth to war can be estimated only by study and insight, and then uncertainly." The author further states: "The term 'moral force' is generally used to express the influence that affects the action of troops in war, which is not material. But, if we use this expression here in the same sense, it is necessary to make it clear at the outset that it cannot be held to denote a single force of a definite nature, acting in a particular way. Its effect is produced by an army of forces as varied and complex as those of the material side of war. And of these forces, while some are the means of carrying men to victory, others are of an exactly opposite nature, and drive men to flight and disgrace. And we must realize that men are always or practically always, acting under the influence of one or more of the moral forces, for it is very rare for their actions to be purely mechanical and automatic. If such a condition ever arises in war time, the value of their work must be very small, having behind it no driving power and no main spring."

In chapter two of the article under review General Trotter considers the moral forces of a professional army and classifies them first

BOOK REVIEWS

as those which come to the man through his military training and his life as a soldier; and secondly those which are national in character. The first is subdivided into a number of agencies available for increasing moral force and for combating the influences which oppose the calls of duty, namely, (a) health and its effect on the condition of the body and the mind, the nerves and will; (b) self-control; (c) discipline, and the unconscious yielding to his superiors by doing every day things that are unpalatable to him and contrary to his inclinations; (d) training; (e) tradition and esprit de corps; (f) education; (g) the inspiration of leaders. In closing chapter two General Trotter states: "It is worthy of note here that, whilst the physical force applied by men in a mass is very much less in the aggregate than the sum of the forces applied by each man taken separately, the effect on moral force of massing men is to increase it far beyond the sum of that developed by each man. The effect, in fact, on moral force of massing men is dynamic. When circumstances arise amongst a mass of men to set free the force, the individuals composing it perform deeds far beyond those they could have attempted on their own initiative. And in case of alarm men sink to doing those things which, when acting alone, they would never have conceived of. We are thus led to see that the moral force of a mass, if rightly directed, is able to produce results which cannot be measured by any material standard."

A chapter is devoted to the consideration of the moral force of a nation, the influence on which moral force General Trotter conceives to be the will, the needs, the aspirations, the hopes, the fears, and sometimes the despair of a nation. "The strength of this force is dependent (1) on the moral condition of the nation, (2) on the influence on its soul of the cause which calls it forth to war."

"The moral condition of a nation is measured by the standard of character in the citizens of which it is composed. The qualities essential to the development of national character are; (a) Physical efficiency, based on a reasonable state of prosperity. As in the case of the soldier, moral qualities flourish best in a well-nourished frame. (b) Freedom; the moral forces of each individual belong to him in his own right, and can only be called forth by his volition. The freer every man is, therefore, the greater the room for the development of character. (c) Education, which helps to give him an insight into the matters that call upon his moral nature. (d) Patriotism, that sentiment which draws its inspiration from the love of home, the sanctity of the family life, and the

THE FIELD ARTILLERY JOURNAL

spirit of sacrifice, and which expresses itself by the union of all discordant elements, and the stilling of all internal disputes in face of danger from without. (e) Religion, the strongest of all forces for influencing national spirit. Wherever it has been an active influence in war, either in the form of one faith struggling against another, *e.g.*, in the recent Balkan War, or as a means of stimulating the individual soldier to face death, as in the case of the Boers in South Africa, 1899–1902, or the Japanese in Manchuria, 1904–'05, its effect has been overwhelming."

Chapter four is generally evidential and is meant to sustain concretely the theories advanced by the author in preceding chapters. The nature of the moral force is illustrated by short analyses of early wars, the American War of Independence, the Invasion of Russia by Napoleon, the Italian Wars of Regeneration, the Franco-German War, the South African War, the Russo-Japanese War, and the war of the Balkan Confederation against Turkey.

"The lesson, in fine, that we learn is that, if a nation goes to war, it can only hope to bring it to a successful issue provided that it is pursuing a national purpose, that it is supported by the soul of the nation, and that the nation's moral forces are in such healthy and active condition as to answer to the calls of duty and sacrifice. If, in addition, its fighting forces are in a highly efficient condition, the decision will be obtained at a proportionately reduced cost.

"This lesson is indicated by history throughout all ages. But at the present day it applies with far greater force, and far less qualification than in previous eras. Every great Power is becoming more and more democratic; the matters which bring nations to quarrel are those which affect the people directly, and no longer questions of dynasties or of policy; the armies which do the fighting are composed of the whole manhood of the nation, and, so far as the rank and file are concerned, of men who are, in fact, civilians temporarily serving the State as soldiers. The feeling of the nation with regard to any war is thus brought very directly into the field. On the other hand, all the elements which make the professional army's moral force have, as has been explained, disappeared or, at least, have lost most of their force."

The first four chapters of General Trotter's article have to do with certain theories in connection with the immaterial forces of a nation in war; in chapter five and those which follow to the end of the article he considers the application of the forces which make for better preparedness. It should be borne in mind that General Trotter does not at any

BOOK REVIEWS

time consider progress in the purely material features of preparedness. It is taken for granted the question of improvements in arms and ammunition and the equipment of troops will be looked out for by the staff corps of the army in time of peace. General Trotter feels, however, that there is a very serious demand for progress along purely moral lines. It is concluded that in order to succeed in war the nation must take up arms with some definite national purpose and that the moral forces of the people must be awake and active in order to give strength and driving power to that purpose. "As regards a national purpose, we may hope that the statesmen, who set the military machine in motion, would take care that it was never done without some real national necessity. But, as for the condition of the moral forces of the people, there is room for anxiety. The nation has always shown itself ready to accept sacrifice when emergency has come upon it. But so long as there is no emergency to face it is unwilling to undergo sacrifice. And, as in modern days the periods between the crises of great causes grow longer, so there is less and less opportunity for calling out the moral forces of the people, and less and less pressure on the nation in general. Meanwhile other interests occupy all their attention. The great idol of material prosperity, worshipped by all civilized nations, and by all classes of the nation, demands the unremitting service of the people. They have no time to turn their attention to other matters, however important they may be. Here and there are to be found some who realize the needs of their country, but the great masses hurry by, grudging every moment lost to the business of their life. Their attitude is one of amiable good-will to any movement of national awakening, so long as neither money nor personal service is demanded of them. That we do need to look to the condition of our moral forces probably no thinking man will dispute."

Chapter six has to do with the training of the rank and file. "No man can be in a favorable condition for assimilating moral ideals, or for grasping their bearing on his duties as a soldier, unless he has had some education, and some training directed to the formation of his character. It is the business of the State to see to these matters in the boy, and the more thoroughly the national duty in respect of education and moral training is carried out, the better the prospect of making satisfactory material out of the recruits who join the army and navy. The country is filled with valuable agencies which supplement the training given in the nation's elementary schools, such as continuation schools, technical

THE FIELD ARTILLERY JOURNAL

schools and classes, boy scouts, boy brigades, church lads brigades, Gordon Boys, cadet corps, etc. The work done by each and all of these institutions is of an importance which cannot be easily expressed. They afford the support and guidance which every boy needs in the building up of his character, and which, but for them, is rarely at hand in the case of the boy trained in the national elementary school. Amongst these the boy scouts institution stands out pre-eminent, and it is almost sufficient for the purpose of this work to say that to promote boy scout ideals in the army and to carry on an advanced stage of boy scout methods would give us all that we can hope for in the way of moral training. The weakness of the boy scout and other agencies is that the growing lad passes out of their hands at the time when he is most urgently in need of support in order to find stable foundations for the ordering of his life. It is then that the call comes for work to be done, and it is then that the recruit joins the army, much younger in age than his comrades in the armies of the Continent. An opportunity of profound importance is thus offered to the military authorities, if they only had their eyes opened to it, and to the fruit which might be gathered by taking advantage of it. The young recruit is raw, inexperienced, pliable, ready to assimilate the first thing offered to him. Some of the recruits will have been boy scouts, and in the future it may be hoped that many will have passed through that organization. There will thus be a nucleus with a valuable practical training in matters affecting character formation, and they should be encouraged to give a tone to the whole body." The author discusses in this chapter the question of physical deficiencies, the cultivation of will-power, and certain questions of education in so far as the potential fighting man is concerned.

Chapter seven has to do with the training of the officer. "The officer is the instructor of his men in all matters, and as he teaches them their duties as soldiers he must in particular be their teacher in all matters affecting the development of their moral powers, if such teaching is to have any effect. The first and great qualification for an officer's work of instruction is the power of influencing by example. No man can do any good by preaching a doctrine which he himself neglects to practise. He must, therefore, in the first place, give all pains to cultivate his own character, and to set such an example to his men, that, by following it they will develop their moral powers. An officer, who by his method of life, is not helping in this work, is acting as a stumbling block to the forces which make for the efficiency of an army, and the more

BOOK REVIEWS

closely we examine this question, the less possible it is to resist the conclusion that all officers must in their own persons set an example to those under them of the way to cultivate the moral forces which are the most important parts of the efficiency of a military body."

Chapter eight has to do with the making of leaders. "All those points to which we have had our attention directed, in connection with the promotion of health and physical energy, and the rank and file, acquire vastly greater importance in the case of anyone aspiring to be a leader in war. And first, as regards health, whilst the physical condition of officers and men is a matter of great moment to an army about to embark in war, to a General in command it is vital. The success of his operations is bound up in the leader's stomach, heart, and nerves. Any physical weakness, any cause which interferes with the functions of the body, and which reduces the working powers, affects the nerves, acts prejudicially on the moral forces, and produces a less favorable outlook on surrounding conditions. The demoralizing effect of lowered health on the part of the leader, and its consequential action upon the work in which he is engaged, affects subordinates, and, through them, the whole force in a degree altogether out of proportion to the cause." Further, General Trotter states that no better example of a leader in regard both to his own character and to his attitude to the State is to be found than that of the late Count Nogi, who states:

"The soldier who would perform his duties with credit on the battlefield, must have trained himself to perform all that is expected of him in time of peace. There ought not to be any neglect or defects in his daily life. The conqueror of himself in time of peace must be a man, if he would aspire with any right to the honor of fighting under the flag of the Rising Sun."

Chapter nine deals with the statesmen and war, and chapter ten concludes the article under review. "The object aimed at in this work is to study the effect of moral force in war, to consider whence it comes, in what way it acts, and how it may be recruited and made available when required. We learn, first of all, that all wars are a conflict of moral forces, and that victory and defeat are far more moral than material effects. We see, further, that every army has a certain equipment of moral force of its own, as an organized body, trained to fight, and with a history and tradition to live up to, and that force may be strengthened by the inspiration of leaders, or by other means connected with its training and efficiency. Such a force, it appears, can be made into an instrument

THE FIELD ARTILLERY JOURNAL

of great power on the battlefield. But the influence of any army so equipped with moral power proves to be limited, and we are finally brought to the conclusion that success in war, *i.e.*, not necessarily success in military operations on the battlefield, but success as gauged by the results achieved, and by the lasting benefits secured, can only be obtained by the outpouring of moral force drawn from all the people of the nation. The moral forces of an army are valuable helps in war, and training, organization, equipment, and armament matters most important to attend to, but even they can achieve nothing without the moral forces of the people."

It is not possible to give an adequate review of General Trotter's article, which article, in the reviewer's opinion, is considered to be one of the most comprehensive things ever done on this subject; the general reader is advised to get the April and May numbers of the *Journal of the Royal Artillery* and read the ten chapters of "The Immaterial Forces of a Nation in War."
W. I. W.

Military Sketching and Map Reading for Noncommissioned Officers, by Lieutenant Lorem C. Grieves, 30th Infantry. 3rd Edition. The United States Infantry Association. Size: 8 × 10½ inches. Price, in full cloth, \$1.25.

This is a concise, well-arranged and well-written work admirably adapted for its purpose. It could well be used to standardize the instruction of noncommissioned officers in the regular service in the subject of Sketching and Map Reading. Due to its conciseness, it should be of value to military officers of all arms as an aid to obtaining facility in reading maps.
M. McC.

Shrapnel and Other War Material. A Reprint of Important Articles Presented in *The American Machinist* from January to June, 1915. McGraw-Hill Book Company, Inc., New York. Price \$1.50.

THE FIELD ARTILLERY JOURNAL is particularly pleased at this time to review this timely gathering together of descriptions of processes that have been developed to produce shells, guns and other war materials in the various machine shops about our country.

The American Machinist has done a most patriotic work in this matter; for, through its carefully prepared columns, machine-shop owners and managers may, with reasonable study, familiarize themselves

BOOK REVIEWS

with the general methods of making munitions of war and with their own capabilities along such lines. The people of the United States are interested in the question of National preparedness. Some among us feel that we shall never fight; some feel that we should never fight; all, however, are curiously interested and, perhaps, day-dream a tiny bit about what we would do if, nevertheless, we did have to fight.

THE FIELD ARTILLERY JOURNAL senses in this work of the *American Machinist* a valuable thought on the subject of matériel preparedness. Let all industries which may through their product affect success in time of war be taken into the War Department confidence in time of peace with a view to analyzing their possibilities. This will help in the solution of one of the many problems of preparedness. The war now in progress bears testimony to the value of industrial organization.

W. I. W.

What is Back of the War, by Albert J. Beveridge. 8vo, cloth, price \$2.00. The Bobbs-Merrill Company, Indianapolis.

In "What is Back of the War," Mr. Beveridge has drawn a set of three pictures of the three nations, France, England, and Germany, as he saw them. It is not clear to his readers just why he ignores Russia, numerically and physically the largest nation in the war and whose claims (in case of a victory for the Allies) promise to be of great interest to the world.

Mr. Beveridge is frankly pro-German. To the average reader this fact tends to weaken his influence. Notwithstanding this, Mr. Beveridge does put before us very conclusively the psychological fact that the moral unity of Germany is endowing her with almost superhuman strength. He shows that in France there is the same enthusiasm for the war and the same devoted willingness of the people to give all for the cause of their country, but at the same time there has been graft in high places and unpreparedness in vital points. In England, he declares, there is unpreparedness in all directions, friction in parties, and, among the middle classes, a feeling of indifference or worse toward the war. These two powers have had to call to their assistance colonial armies of every race, color and religion, with varying degrees of knowledge of what they are fighting for.

No matter with which side of the question the reader may sympathize, he cannot fail to be impressed with the picture Mr. Beveridge

THE FIELD ARTILLERY JOURNAL

draws of Germany. A great people welded together by conviction, absolutely putting away all individuality, not keeping back anything (material or spiritual) for self, giving sons and worldly gear, time, thought, blood—anything and everything for the Fatherland. No man who has studied the psychology of a crowd can doubt that such concentration will give of power a thousandfold more than the same number of troops of varying faiths, languages, and convictions.

Mr. Beveridge paints the Germans as an innocent, industrious, and frugal people, set upon without provocation by the multitude, and now fighting splendidly for life, not gain. He gives his interviews with von Hindenburg and von Tirpitz and with His Majesty the Emperor. They treated him with great consideration and expressed entire mystification as to the attitude of the American people. Only when Mr. Beveridge tells us that it was absolutely necessary to explain to a grieved and bewildered von Hindenburg the meaning of the word "militarism" we cannot refrain from suspecting that doughty warrior of being guilty at least of gently fooling if not actually making game of our distinguished fellow-citizen.

Individuals of every class were undoubtedly interviewed by Mr. Beveridge. He quotes many French prisoners of war as expressing perfect satisfaction with their treatment at the hands of the Germans. One is irresistibly reminded by these expressions of content of a letter in one of our comic papers, purporting to be written by a Jewish prisoner of war. He expresses delight with his surroundings and his German keepers, and closes his letter with the significant statement, "Heaven knows I ain't going to complain—Ikey was shot for complaining this morning."

At every prison camp Mr. Beveridge visited he was satisfied that the food was sufficient and that no great hardships were being suffered. The English prisoners were incessant gamblers, and showed up poorly in comparison with the cheerful, kind-hearted Frenchmen. He makes no effort to draw conclusions, but was himself convinced that the French were drawn into this frightful war by a misconception of German aims. He states that everywhere in France he heard the same story, "We had to fight Germany some time—we must settle this question for all times." Or, "We were waiting for Germany to strike." In Germany he heard, "Germany did not want war." "Germany did not want to injure France." But for England there was the greatest rancor on every side. He was told that this was England's war, a

BOOK REVIEWS

war to destroy Germany, to crush her commerce rather than to compete with her through frugality and hard work. Mr. Beveridge is not kindly in his criticism of England; and it seems pertinent to call attention to the fact that whereas in Germany he interviewed the greatest authorities, in England he questioned or at least quotes only a few literary men who had no connection with the government, and some of whom favored arbitration rather than war. This course hardly seems to coincide with Mr. Beveridge's evident desire for fairness.

In conclusion Mr. Beveridge expresses the optimistic belief that the very magnitude and horror of this conflict will forever cure the war fever of the world.

F. MACD. B.

Index to Current Field Artillery Literature

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

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

- Aerial guns*.—Information from France about successful firing of a 3-in. gun from an aeroplane. Some details. (Arms and The Man, May 27, 1915, p. 167.)
- Ammunition—artillery—manufacture of—United States*.—Hydrostatic tests of 6-inch, 3-inch, and 2.95-inch shrapnel cases; hydrostatic test of 4.7-inch shrapnel case; shock and tensile tests of shrapnel-case metal; hardness and warpage of shrapnel-case metal; and steel for experimental shrapnel case. Illustrated description of the tests, and the results at Watertown Arsenal. (In U. S. Ordnance Dept. Report of the test of metals and other materials . . . during the fiscal year ending June 30, 1914, Washington, 1915, pp. 11–39, TA410.U7, 1914.)
- Ammunition supply, artillery*.—Failure of shrapnel to explode at the right moment. With sketches. (Current Opinion, June, 1915, p. 413.)
- Ammunition—artillery—Great Britain*.—Details of supply system from base to front and quantities provided. (Pp. 319–330, Active Service Pocket Book, B. Stewart, London, 1915. U167 S843.)
- Ammunition supply—artillery—France*.—The field artillery ammunition supply according to the French regulations. Artilleristische Monatshefte, April, 1915, p. 161.
- Ammunition supply—artillery—Japan*.—Field artillery ammunition supply and expenditure in the Russo-Japanese War, 1904–05. With table. Artilleristische Monatshefte, April, 1915, p. 153.
- Ammunition—artillery—Switzerland*.—Ammunition allowance per piece in the various establishments. P. 388, l'Armée Suisse. By Ch. Egli, Paris, 1913. UA802 E311 (bk.)
- Anti-balloon gun fire*.—Shooting at aeroplanes. Suggestions for shooting at aircraft as contained in the Engineering Supplement of the London Times of March 26, 1915. (In Army and Navy Journal, v. 52, May 1, 1915, p. 1100, U1.U7.)
- Anti-balloon guns—European war*.—Anti-aeroplane guns in the field. By anti-aircraft. The results of the British as to what an observer sees in aerial reconnaissance. What the gun can do and what it cannot. (In The Journal of The Royal Artillery, Woolwich, March, 1915, v. 41, pp. 797–803, UF2. J5.)
- Arsenals—Japan*.—Petition for public manufacture of ordnance. The petition of private manufacturers against the exclusive government control of the manufacture. (Japan.) (In Translation No. 2847, part IV, par. 119.)
- Artillery fire—Austria-Hungary*.—"Ranging practice with aerial bursts." Study explaining method found best with the aid of sighting instruments employed in the Austrian artillery. With lithographic plate. (Mitteilungen Artillerie und Geniewesens, Copy 4, 1915, pp. 255–273.)
- Artillery—European war*.—The war on land. By a military officer. Data relative to the German, British and French artillery, as used during the earlier stages of the war, 1914–15. (In The Army and Navy Gazette, London, April 17, 1915, v. 56, pp. 320–321, U2. A7.)
- Artillery—France*.—Further regulations concerning the organization and employment of French artillery, especially to the supply of ammunition. (Memorial de Artilleria, April, 1915, pp. 547–560.)
- Artillery—Japan*.—Hasty augmentation of artillery. The need for a regiment of artillery to each division as a result of experiences during the war of 1914–1915. This is reported to be the idea of the Upper House. (Japan.) (In Translation No. 2847, part IV, par. 133.)

INDEX TO CURRENT FIELD ARTILLERY LITERATURE

- Artillery—Spain.*—Proposed increase by minister of war of artillery will give 540 guns. Other data upon reorganization. (Memorial de Artilleria, 1915, pp. 540–545, April.)
- Auto trucks—European war.*—The motor truck in modern military service. Many uses for motor vehicles, which have become indispensable in war. An illustrated article describing the many uses to which motor vehicles are put in military service. Belgian armored automobile with machine gun, p. 273. (In Scientific American Supplement, v. 79, May 1, 1915, pp. 280–282. TA1. S52.)
- Ballistics.*—A dissertation on the influence of the rotation of the earth on the flight of a projectile. With diagrams. (Schweizer. Zeitschr. f. Artillerie und Genie, April 1915, pp. 125–135.)
- Field Artillery.*—A war of unseen artillery. A clear exposition of the value of artillery in actual warfare. Extracted from the World's Work. The general organization of field artillery and the number of guns to a battery in France, Great Britain, Germany, Austria, and Russia. (In Arms and the Man, v. 58, July 1, 1915, pp. 263–265. U1.A6.)
- Field artillery—Austria-Hungary.*—The Austro-Hungarian school of fire. Principles governing the use of Prussian and German field artillery. (The International Military Digest, July, 1915, p. 110.)
- Field artillery fire—Spain.*—Serial studies of the zone covered by the explosion of shrapnel, and means of correcting the altitude of the bursting point of shrapnel. (Memorial de Artilleria, May, 1915, pp. 636 and 661.)
- Field artillery fire.*—How it works. Effects of shell-fire. The essential difference between shrapnel and high-explosive shell when bursting among an enemy. Illustrations showing the action on bursting. (The Illustrated War News, London, June 2, 1915, part 43, pp. 38–39.)
- Field artillery fire.*—A method for calculating that part of the recoil momentum of a gun which is due to the action of the gases after the projectile leaves the muzzle. By Wm. S. Franklin. (In Journal of the Franklin Institute, v. CLXXIX, May, 1915, pp. 559–577.)
- Field artillery fire—European war—France.*—Why more shells are urgently needed at the front. A day's expenditure of a single French battery of "75's." Illustration showing the number of shells fired by a battery of six guns in one day, the firing lasting only a few hours. A graphic illustration. (In The Illustrated War News, London, June 2, 1915, part 43, p. 23.)
- Field guns—Great Britain.*—How it works. The quick-fire field-gun. An article illustrating and describing the field-gun recoil mechanism used by the British army. (18-pounder.) (In The Illustrated War News, London, May 26, 1915, part 42, p. 12.)
- Field guns—Great Britain.*—Some details of British field artillery. Muzzle velocity, calibre, weight of projectile, number of rounds carried, range and weights of gun carriage, and limber. (In Great Britain War Office. Field Almanac, 1915, London (1915), p. 23. U175. G7A33, 1915.)
- Field guns (high angle).*—Brief description and Illustrations of a gun particularly adapted to fire at high angles. A British patent No. 12,261, May 18, 1914, granted to Eugene Schneider of Le Creusot, Sadne-et-Loire, France. Issued May 26, 1915. (In The Engineer, London, June 18, 1915, v. 119, pp. 617–618, TA1. E48.)
- Field artillery fire—Russia.*—Achievements of the Russian artillery. Translation of an article which appeared in the Militär. Wochenblatt, No. 175/176, December 15, 1914. (In the Journal of the Royal Artillery, Woolwich, March, 1915, v. 41, pp. 850–852, UF2. J5.)
- Field artillery—Russia—drill and tactics.*—Russian artillery action in the European war, 1914. Present artillery tactics and fire; choice of position; gun cover; trenches; reconnaissance; observation; fire control; expenditure of ammunition, and so forth. (From Schweizer. Zeitschrift f. Artillerie und Genie.) (Artilleristische Monatshefte, April, 1915, p. 175.)
- Guns—France.*—History of the French 75-mm. field gun given. Pages 271–272. (Artilleristische Monatshefte, May, 1915.)

THE FIELD ARTILLERY JOURNAL

- Guns—Germany.*—Long range guns and long range firing. Discussion as to the possibility of shooting across the Straits of Dover. (Pages 268–269, *Artilleristische Monatshefte*, May, 1915.)
- Heavy artillery.*—Fortifications and extra heavy artillery. By Woelki, Colonel. Translated from "Jahrbücher für die Deutsche Armee und Marine, October, 1914. A general criticism directed against extra heavy artillery, which has many limitations. Filed Env. Case-Heavy artillery.
- Heavy artillery—France.*—The total strength of the French heavy artillery is estimated at 70 batteries, but it is not known whether all these batteries were formed by the time war broke out. (In *The Journal of the Royal Artillery*, Woolwich, March, 1915, v. 41, p. 848, UF2. J5.)
- Heavy artillery fire—Germany.*—German heavy artillery in front of Antwerp. Precis of an account of the use of German heavy artillery in the attack on Antwerp, 1914. (In *The Journal of the Royal Artillery*, Woolwich, March, 1915, v. 41, pp. 849–850, UF2. J5.)
- Heavy artillery—drill and tactics—Great Britain.*—Hints on organization and training for heavy artillery. By Lieut. Col. H. de T. Phillips. British training for heavy artillery. (In *The Journal of the Royal Artillery*, Woolwich, March, 1915, v. 41, pp. 801–803, UF2. J5.)
- Observation of fire—France.*—Co-operation of the aeroplane in the control of artillery fire, based on French army regulations—pp. 329–340. (*Revista Militar*, Argentine, May, 1915.)
- Hill, H. W.*—The conditions necessary to produce shrapnel effect and report on grouping trials, 1913. UF409. H64.
- Metallurgy.*—Metallographic investigation of shell fragments. Compilation of the properties of French, English and Russian shells. (*Artilleristische Monatshefte*, March, 1915, p. 152.)
- Observation of fire—France.*—Good observation in the French field artillery. The comments of a Bavarian reserve officer on the French field artillery. (In *The Journal of the Royal Artillery*, Woolwich, March, 1915, v. 41, pp. 848–849, UF2. J5.)
- Observation of fire—Great Britain.*—An apparatus for the practice of observation of fire. By Capt. H. R. Thomas, R. G. A. Description and illustrations of a device adapted for the practice of observation in time shrapnel ranging as devised and used on a British transport. One folded diagram. (In *Journal of the Royal Artillery*, Woolwich, March, 1915, v. 41, pp. 804–809, UF2. J5.)
- Range-finders.*—"The measurement of distances in war." Ingenious modern methods and instruments now used. Illustrated. (*Scientific American Supplement*, May 22, 1915, pp. 324–325. No. 2055.)
- Range-finders—artillery.*—Descriptive article with illustrations of sighting devices for use by artillery officers. (*Schweizer. Zeitschr. f. Artillerie und Genie*, March, 1915, pp. 83–94.)
- Range-finders—Great Britain.*—British methods for judging distances without range-finders. (Pp. 331–340, *Active Service Pocket Book*, B. Stewart, London, 1915, U167. S843.)
- Range-finding—Great Britain.*—Map and compass in the field. By temporary 2d Lieut. H. S. Rowell, R. G. A. Artillery ranging for determining lines of fire ranges and angles of sight. (Great Britain.) Diagrams, one folded. (In *The Journal of the Royal Artillery*, Woolwich, April, 1915, v. 41, pp. 834–838.)
- Range-finders.*—The range-finder. How distances are measured on the battlefield. From *Illustrated War News*, London, March 31, 1915. Part 34, 26–27 pp. An illustrated description of various types of range-finders, (Mekometer and Mrindin), apparently used by the British army, war of 1914–15. (In *Scientific American Supplement*, July 10, 1915, v. 80, p. 20, TA1. S52.)
- Schools—Japan—artillery.*—Artillery artificers' school regulations, from the *Official Gazette* of 24/V/15. (In Translation No. 2847, par. 204.)
- Skoda, E. Pilsen.*—Photos and short descriptions, of the 24-cm. siege mortar. (UF600. S61. 24-cm. A2.)
- Skoda, E. Pilsen.*—Photos of the 7-cm. quick-firing gun. (UF570. S61. 7-cm. A2.)
- Spaulding, O. L.*—Notes on Field Artillery for officers of all arms, 2d ed., 1914. (UF400. S71.)

INDEX TO CURRENT FIELD ARTILLERY LITERATURE

- Shrapnel*.—Shrapnel and shrapnel manufacture. Historical sketch of the development and methods of manufacture. By Douglas T. Hamilton. An article illustrating and describing the shrapnel shell used by the various nations; illustrations of fuses and timing rings, and also danger zone diagrams. (In Scientific American Supplement, No. 2059, v. 79, June 19, 1915, pp. 385–388. TA1. S52.)
- Siege artillery fire—European war*.—Long range firing. Comparisons of the 15-inch German gun and the English 15-inch gun. Gives ranges and velocities. The need of elevating the guns. Stated that with the necessary elevation the 15-inch guns of the Queen Elizabeth would throw projectiles 46,000 yards instead of 21,000. (In United Service Gazette, London, May 27, 1915, v. 164, p. 322. U2. U4.)
- Star shells—Germany*.—Light for German Zeppelins: a parachute-shell fired from a pistol. Light to disclose advancing troops; a parachute shell fired from a gun. Star shells fired by aircraft and artillery. Illustrations. (In The Illustrated War News, London, June 9, 1915, part 44, p. 44.)
- Transportation, guns—Japan*.—Invention of endless rails. A device said to have been invented by Mr. Umeji Takamatsu, a Japanese inventor, that is claimed to have been taken advantage of by the Germans in transporting heavy guns. (In Translation No. 2847, part III, par. 99; part IV, par. III.)
- Traction engines*.—The creeping grip tractor. An article illustrating and describing an American tractor driven by an internal combustion engine for hauling heavy loads over rough country. Illustrations show flexibility of driving mechanism, and two diagrammatic views. (In The Engineer, London, June 4, 1915, v. 119, pp. 560–562. TA1. E4.)

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.
Artilleristische Monatshefte, Berlin, Germany.
Cavalry Journal, Fort Leavenworth, Kansas.
Circular Militar Argentio, Buenos Aires, Argentine Republic
Dansk Artileri-Tidsskrift, Copenhagen, Denmark.
Flight, London, England.
Infantry Journal, Washington, D. C.
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 Estado Mayor Jeneral, Santiago, Chile.
Militär Wochenblatt, Berlin, Germany.
National Guard Magazine.
New York Sun.
New York Tribune.
Norsk Artileritidsskrift, Kristiania, Norway.
Our Dumb Animals, Boston, Massachusetts.
Professional Memoirs, Corps of Engineers, Washington, D. C.
Revista de Artilharia, Lisbon, Portugal.
Revista di Artigleria e Genio, Rome, Italy.
Revista Militar, Buenos Aires, Argentine Republic.
Revue d'Artillerie, Paris, France.
Revue d'Infanterie, Paris, France.

Field Artillery Directory

REGULAR ARMY

Name.	Batteries.	Name.	Batteries.
FIRST FIELD ARTILLERY. (Light.)		<i>Second Lieutenants—Continued.</i>	
Schofield Barracks, H. T.		Maxwell, Russell L	Qm. and Comy.
<i>Colonel.</i>		Winton, Walter F	2 Batt.
Sturgis, Samuel D		Daly, Joseph O	B
			C
		<i>Veterinarians.</i>	
<i>Lieutenant Colonel.</i>		Donovan, Andrew E	
McMahon, John E		Haynes, James R	
		SECOND FIELD ARTILLERY. (Mountain.)	
<i>Majors.</i>		<i>Colonel.</i>	
Cruikshank, William M	2 Batt.	Philippine Islands.	
Guignard, William S	1 Batt.		
		<i>Colonel.</i>	
<i>Chaplain.</i>		Millar, Edward A	
Fealy, Ignatius (1 lieu.)			
		<i>Lieutenant Colonel.</i>	
<i>Captains.</i>		Lassiter, William	
Cassels, Arthur F	A		
Kilbreth, John W	Unass'd	<i>Majors.</i>	
Williams, Harry C	E	Snow, William J	1 Batt.
Apple, George M	F	Horn, Tiemann N	2 Batt.
Mason, Roger O	C		
Browning, William S	Adj't.	<i>Chaplain.</i>	
Ennis, William P	Unass'd	Houlihan, James F. (1 lieu.)	
Frankenberger, Samuel	Unass'd		
Ferris, Charles J	D	<i>Captains.</i>	
Rehkopf, Ned B	Adj't.	Spaulding, Oliver L., Jr.	Unass'd
	2 Batt.	Austin, Fred T	Unass'd
Glassford, Pelham D	B	Boiseau, Louis T	Unass'd
		Stuart, Edward A	B
<i>First Lieutenants.</i>		Birnie, Upton, Jr.	E
Neal, Carroll W	E	Warfield, Augustus B	Comy.
McKinlay, Louis H	A	Barnes, Joseph F	C
Seagrave, David C	Unass'd	De Armond, Edward H	Unass'd
Dodds, William H., Jr	C	Hollyday, Thomas W	A
Huntley, Harold W	C	Myers, Joseph E	Unass'd
Lyerly, Ballard	D	Allin, George R	Adj't.
Potter, Waldo C	A		1 Batt.
Pfeil, Harry	Unass'd	<i>First Lieutenants.</i>	
Naylor, Harold S	F	Cubbison, Donald C	A
McCleave, William	D	Riley, James W	C
Martin, Truby C	E	Parker, Cortlandt	E
Rogers, Wilbur	F	Lewis, Robert H	Unass'd
Palmer, Albert K. C	B	Pritchett, Edwin E	D
		Rucker, William H	E
<i>Second Lieutenants.</i>		Shepherd, William H	B
Gay, George S	Qm. and Comy.	Gottschalk, Telesphor G	Qm. and Comy.
	1 Batt.		1 Batt.
	Unass'd	Sparks, Leonard C	Unass'd
Selleck, Clyde A	B	King, Edward P., Jr	Unass'd
Beard, Louie A	A	Rumbough, Joseph W	D
Jones, Ivens	Unass'd	Brabson, Joe R	Qm. and Comy.
Goetz, Robert C. F	E		2 Batt.
Bowley, Freeman W	E	Magruder, Marshall	Unass'd
Hatch, John E	D		
Andrews, Joseph	F		
Deshon, Percy	D		
Vanderveer, Harold C	D		

THE FIELD ARTILLERY JOURNAL

FIELD ARTILLERY DIRECTORY—Continued

Name.	Batteries.	Name.	Batteries.
<i>Second Lieutenants.</i>		<i>Second Lieutenants.</i>	
Wallace, Fred C.....	B	Greble, Edwin St. J., Jr.....	Qm. and Comy.
Dawley, Ernest J.....	E		2 Batt.
Magruder, John.....	C	Bateman, Harold H.....	A
Riggs, E. Francis.....	D	Odell, Herbert R.....	B
Nance, Curtis H.....	A	Simpson, Bethel W.....	F
Beatty, John C.....	E	Browne, Charles J.....	B
Proctor, Mert.....	Unass'd	Parker, Edwin P., Jr.....	D
Meyer, Vincent.....	C	Eager, John M.....	F
Anderson, Jonathan W.....	Unass'd	Brewer, Carlos.....	A
Barnes, Julian F.....	F	Cain, David E.....	C
Gillespie, James A.....	D	McMahon, John E., Jr.....	C
Clarkson, Herbert S.....	B	Kilburn, Charles L.....	E
Helmick, Charles G.....	F	Thurber, Philip L.....	D
<i>Veterinarians.</i>		<i>Veterinarians.</i>	
Gould, John H.....	Unass'd	Beukema, Herman.....	Unass'd
Mitchell, Aquila.....		Zundel, Edwin A. (addl.).....	Unass'd
THIRD FIELD ARTILLERY. (Light.)		<i>Veterinarians.</i>	
Hdqs. and Battys. A, B, and C, Ft. Sam Houston, Tex.		Howard, Clinton W. (addl.).....	Unass'd
Battys. D, E, and F, Ft. Myer, Va.		Wallace, John H. (addl.).....	Unass'd
<i>Colonel.</i>		<i>Colonel.</i>	
Van Deusen, George W.....		Griffin, Gerald E.....	
<i>Lieutenant Colonel.</i>		FOURTH FIELD ARTILLERY. (Mountain.)	
Menoher, Charles T.....		Gage, Fred B.....	
<i>Majors.</i>		<i>Colonel.</i>	
Lyon, Le Roy S.....	1 Batt.	Berry, Lucien G.....	
McCloskey, Manus.....	2 Batt.	<i>Lieutenant Colonel.</i>	
<i>Chaplain.</i>		<i>Majors.</i>	
Perry, Barton W. (maj.).....		Gatley, George G.....	2 Batt.
<i>Captains.</i>		McMaster, Richard H.....	1 Batt.
Stephens, John E.....	A	<i>Chaplain.</i>	
Gallup, Fred H.....	Adj't.	Joyce, Francis P. (capt.).....	
	2 Batt.	<i>Captains.</i>	
Farrar, Henry B.....	Qm.	Merrill, Thomas E.....	Adj't.
Donnelly, Edward T.....	F		2 Batt.
Jones, Clarence N.....	E	Newbold, Henry L.....	B
Bunker, Charles M.....	Adj't.	Faulkner, Albert U.....	E
	1 Batt.	Langdon, Jesse G.....	A
Hennessy, Frederick B.....	B	Craig, Daniel F.....	Unass'd
Locke, Morris E.....	D	Lawson, Laurin L.....	Adj't.
Michel, William N.....	C	Brewster, Alden F.....	Qm.
Mortimer, Charles G.....	Unass'd	Kilbourne, Henry S., Jr.....	D
<i>First Lieutenants.</i>		McNair, Lesley J.....	Unass'd
Hammond, John S.....	B	<i>First Lieutenants.</i>	
Smith, Edwin De L.....	B	Quinn, Leo P.....	Qm. and Comy.
Burleson, Richard C.....	D		2 Batt.
Olmstead, Dawson.....	F	Prosser, Walter E.....	A
Hall, Albert L.....	A	Collins, Leroy P.....	F
Paine, George H.....	E	Harlow, Charles W.....	B
Downer, John W.....	Unass'd	Mort, John E.....	C
Dunn, William E.....	E	Barrows, Frederick M.....	E
Parrott, Roger S.....	A		
Kirkwood, Robert G.....	Unass'd		
Hopkins, Samuel R.....	F		
Daly, Charles D.....	C		

FIELD ARTILLERY DIRECTORY

FIELD ARTILLERY DIRECTORY—Continued

Name.	Batteries.	Name.	Batteries.
<i>First Lieutenants—Continued.</i>		<i>First Lieutenants—Continued.</i>	
Hughes, Everett S.....	Unass'd	Pennell, Ralph McT.....	D
Smith, Thomas J.....	Unass'd	Sturgil, Walter S.....	E
McBride, Allan C.....	Qm. and Comy. 1 Batt.	Gilmor, Albert.....	Unass'd
	E	Cruse, Fred T.....	B
Hollingsworth, Charles P.....	B	Thorp, Frank, Jr.....	D
Stewart, Frederick W.....	B	Perkins, Kenneth S.....	A
Hayden, Herbert B.....	C	Marr, Harold E.....	B
Erlenkotter, Herman.....	D	Crane, John A.....	Unass'd
		Prince, Frederick A.....	Unass'd
		Booker, Phillip W. (att.).....	Unass'd
<i>Second Lieutenants.</i>		<i>Second Lieutenants.</i>	
Devers, Jacob L.....	Unass'd	Seaman, George G.....	D
Peyton, Bernard R.....	D	Reynolds, Charles C.....	Unass'd
Hobbs, Harvey M.....	Unass'd	Oliphant, Thomas G. M.....	Qm. and Comy. 1 Batt.
Wrona, William J.....	A		Qm. and Comy. 2 Batt.
Thomason, Alfred G.....	A		E
Morrow, Norman P.....	B	Jones, Lloyd E.....	C
Andrus, Clift.....	F	Polk, Newton N.....	A
Anderson, Richard E.....	B	Hauser, John N.....	B
Scott, Richard C.....	C	Greenwald, Karl C.....	E
Eager, Howard.....	D	Frankenberger, Bertram.....	A
Eikel, Joe.....	F	Young, William C.....	D
Harris, Arthur R.....	E	Wyeth, John C.....	F
Dunigan, Francis J. (addl.).....	Unass'd	Burr, John G.....	C
Waldron, Albert W. (addl.).....	Unass'd	Burr, William E.....	Unass'd
Swing, Joseph M. (addl.).....	Unass'd	Lester, James A. (att.).....	Unass'd
		Struble, Herbert S. (addl.).....	Unass'd
<i>Veterinarians.</i>		<i>Veterinarians.</i>	
Le May, Daniel.....		Jewell, Charles H.....	
Power, Richard H.....		Sproule, William A.....	
FIFTH FIELD ARTILLERY. (Light)		SIXTH FIELD ARTILLERY. (Horse.)	
Regt., less Batty. A, Ft. Sill, Okla. Batty. A, El Paso, Tex.		Hdqrs. and Battys, A and B, Douglas, Ariz. Battys C and D, Nogales, Ariz. Batty E, Laredo, Tex. Batty F, Eagle Pass, Tex.	
<i>Colonel.</i>		<i>Colonel.</i>	
Adams, Granger.....			
<i>Lieutenant Colonel.</i>		<i>Lieutenant Colonel.</i>	
McGlachlin, Edward F., Jr.....			
<i>Majors.</i>		<i>Majors.</i>	
Bowley, Albert J.....	Unass'd	Aultman, Dwight E.....	1 Batt.
Bishop, Harry G.....	Unass'd	Payne, Brooke.....	2 Batt.
<i>Chaplain.</i>		<i>Chaplain.</i>	
		Dickson, Thomas J. (maj.).....	
Sutherland, Alexander D. (1 lt.).....		<i>Captains.</i>	
<i>Captains.</i>		<i>Captains.</i>	
Smith, Wright.....	E	Butner, Henry W.....	D
Starbird, Alfred A.....	C	Lloyd, Charles R.....	A
Lanza, Conrad H.....	Unass'd	Lambdin, William McK.....	Unass'd
Moore, Dant T. (gen. staff).....	Unass'd	Yule, Edgar H.....	B
Greene, George R.....	Qm.	Deems, Clarence, Jr.....	Unass'd
Briggs, Raymond W.....	D	Griffin, Francis W.....	E
Currie, Dennis H.....	B	Campbell, Tilman.....	C
Wood, Norton E.....	Adjt.	Corey, John B. W.....	F
Baker, Scott.....	F		
Hand, Daniel W.....	Unass'd		
<i>First Lieutenants.</i>		<i>First Lieutenants.</i>	
Smith, Emery T.....	C		
Danford, Robert M.....	Unass'd		
Gruber, Edmund L.....	F		
Osborne, Thomas D.....	Unass'd		

THE FIELD ARTILLERY JOURNAL

FIELD ARTILLERY DIRECTORY—Continued

Name.	Batteries.	Name.	Batteries.
<i>Captains—Continued.</i>		<i>Second Lieutenants.</i>	
Margetts, Nelson E.....	Unass'd	Taliaferro, Lucien H.....	F
Wood, William S. (att.).....	Unass'd	Turner, Frank A.....	B
		Finch, Neil G.....	C
<i>First Lieutenants.</i>		Erwin, Vincent P.....	Unass'd
		Hicks, Edward H.....	D
Blakely, Charles S.....	C	Bailey, Wesley M.....	A
Bishop, Albert T.....	B	von Holtzendorff, John D.....	D
Starkey, John R.....	A	Austin, Raymond B.....	E
Hoyle, Rene E. De R.....	Unass'd	Crane, William C., Jr.....	E
Maul, John C.....	A	Sedlacek, Ernst.....	F
Marley, James P.....	C	Houghton, William C.....	C
Merrill, Walter W.....	D	Anderson, John B.....	A
Tyndall, John G.....	F	Busbee, Charles M. (addl.).....	Unass'd
Sands, Alfred L. P.....	D	Marsh, Raymond (addl.).....	Unass'd
George, Charles P., Jr.....	B		
Randol, Marshall G.....	E	<i>Veterinarians.</i>	
Higley, Harvey D.....	E	Hill, William P.....	
Ahern, Leo J.....	F	Stokes, Wilfred J.....	

LINEAL RANK

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

a Additional in grade.

FIELD ARTILLERY DIRECTORY

FIELD ARTILLERY DIRECTORY—Continued,

No.	Name, rank, and date of rank.	Reg't	No.	Name, rank, and date of rank.	Reg't
<i>Captains—Continued.</i>			<i>First Lieutenants—Continued.</i>		
55	<i>Browne, B. F.</i>	11 mar.	44	<i>Thorp, F., Jr.</i>	14 jan. 10
56	<i>Pratt, R. S.</i>	11 mar.	45	<i>Tyndall, J. G.</i>	3 mar. 11
57	<i>Brewster, A. F.</i>	11 mar.	46	<i>Sands, A. L. P.</i>	11 mar.
58	<i>De Armond, E. H.</i>	11 mar. 11	47	<i>George, C. P., Jr.</i>	11 mar.
59	<i>Wood, N. E.</i>	11 mar.	48	<i>Harlow, C. W.</i>	11 mar.
60	<i>Fuger, A. S.</i>	11 mar.	49	<i>Naylor, H. S.</i>	11 mar.
61	<i>Michel, W. N.</i>	11 mar.	50	<i>Rucker, W. H.</i>	11 mar.
62	<i>Wheeler, E. S.</i>	11 mar.	51	<i>Shepherd, W. H.</i>	11 mar.
63	<i>Hollyday, T. W.</i>	11 mar.	52	<i>Randol, M. G.</i>	11 mar.
64	<i>Corey, J. B. W.</i>	13 apr.	53	<i>Greely, J. N.</i>	11 mar.
65	<i>Churchill, M.</i>	13 apr.	54	<i>Capron, W. A.</i>	11 mar.
66	<i>Jones, W. F.</i>	13 apr.	55	<i>Mort, J. E.</i>	11 mar.
67	<i>Mortimer, C. G.</i>	26 may,	56	<i>Barrows, F. M.</i>	11 mar.
68	<i>Margetts, N. E.</i>	26 May, 6	57	<i>Dunn, W. E.</i>	11 mar. 11
69	<i>Davis, R.</i>	7 june,	58	<i>Burns, J. H.</i>	11 mar.
70	<i>Myers, J. E.</i>	7 sept.	59	<i>Hughes, E. S.</i>	11 mar.
71	<i>Wood, W. S.</i>	8 sept.	60	<i>Smith, T. J.</i>	11 mar.
72	<i>Frankenberger, S.</i>	18 oct.	61	<i>Parrott, R. S.</i>	11 mar.
73	<i>Morrison, W. F.</i>	9 feb. 12	62	<i>Gottschalk, T. G.</i>	11 mar.
74	<i>Ferris, C. J.</i>	26 aug.	63	<i>Higley, H. D.</i>	11 mar.
75	<i>Rehkopf, N. B.</i>	11 july, 13	64	<i>King, E. P., Jr.</i>	13 apr.
76	<i>Baker, S.</i>	9 oct.	65	<i>Perkins, K. S.</i>	13 apr.
77	<i>Howze, M. W.</i>	24 oct.	66	<i>Kirkwood, R. G.</i>	13 apr.
78	<i>Kilbourne, H. S., Jr.</i>	22 nov.	67	<i>Marr, H. E.</i>	26 may,
79	<i>McNair, L. J.</i>	19 apr. 14	68	<i>Rumbough, J. W.</i>	7 june,
80	<i>Allin, G. R.</i>	13 june,	69	<i>McCleave, W.</i>	13 june,
81	<i>Glassford, P. D.</i>	18 nov.	70	<i>McBride, M. C.</i>	20 june,
82	<i>Bryden, W.</i>	10 jan. 15	71	<i>Brabson, J. R.</i>	20 june,
83	<i>Honeycutt, F. W.</i>	27 june,	72	<i>Sparks, L. C.</i>	1 july,
84	<i>Hand, D. W.</i>	25 jan. 07	73	<i>Crane, J. A.</i>	1 july,
<i>First Lieutenants.</i>			74	<i>Prince, F. A.</i>	1 apr.
1	<i>Blakely, C. S.</i>	25 jan. 07	75	<i>Magruder, M.</i>	28 may, 12
2	<i>Smith, E. T.</i>	25 jan.	76	<i>Martin, T. C.</i>	31 may,
3	<i>Danford, R. M.</i>	25 jan.	77	<i>Rogers, W.</i>	31 july,
4	<i>Quinn, L. P.</i>	25 jan.	78	<i>Dougherty, L. R.</i>	22 aug.
5	<i>Gruber, E. L.</i>	25 jan.	79	<i>Hopkins, S. R.</i>	26 aug.
6	<i>Neal, C. W.</i>	25 jan.	80	<i>Hollingsworth, C. P.</i>	6 sept.
7	<i>Cubbison, D. C.</i>	25 jan.	81	<i>Daly, C. D.</i>	5 may. 13
8	<i>McKinlay, L. H.</i>	25 jan.	82	<i>Palmer, A. K. C.</i>	22 nov.
9	<i>Osborne, T. D.</i>	25 jan.	83	<i>Stewart, F. W.</i>	13 june, 14
10	<i>Seagrave, D. C.</i>	25 jan.	84	<i>Hayden, H. B.</i>	18 nov.
11	<i>Dodds, W. H., Jr.</i>	25 jan.	85	<i>Ahern, L. J.</i>	10 jan. 15
12	<i>Lund, J.</i>	25 jan.	86	<i>Beere, D. M.</i>	10 jan.
13	<i>Hammond, J. S.</i>	25 jan.	87	<i>Erlenkotter, H.</i>	12 may,
14	<i>Bishop, A. T.</i>	25 jan.	88	<i>Thummel, C. B.</i>	15 may,
15	<i>Prosser, W. E.</i>	25 jan.	<i>Second Lieutenants.</i>		
16	<i>Riley, J. W.</i>	25 jan.	1	<i>Miner, H. E.</i>	11 june, 09
17	<i>Huntley, H. W.</i>	25 jan.	2	<i>Greble, E. St. J., Jr.</i>	11 june,
18	<i>Smith, E. De L.</i>	25 jan.	3	<i>Devers, J. L.</i>	11 june,
19	<i>Pennell, R. McT</i>	6 july, 07	4	<i>Taliaferro, L. H.</i>	14 july,
20	<i>Sturgill, W. S.</i>	7 july,	5	<i>Bateman, H. H.</i>	14 july,
21	<i>Miles, S.</i>	8 july,	6	<i>Turner, F. A.</i>	13 nov.
22	<i>Parker, C.</i>	8 july,	7	<i>Seaman, G. G.</i>	13 nov.
23	<i>Burleson, R. C.</i>	9 july,	8	<i>Reynolds, C. C.</i>	13 nov.
24	<i>Gilmor, A.</i>	10 july,	9	<i>Gay, G. S.</i>	18 jan. 10
25	<i>Starkey, J. R.</i>	11 july,	10	<i>Wallace, F. C.</i>	15 june,
26	<i>Hoyle, R. E. DeR</i>	11 july,	11	<i>Lewis, B. O.</i>	15 june,
27	<i>Olmstead, D.</i>	12 july,	12	<i>Odell, H. R.</i>	15 june,
28	<i>Maul, J. C.</i>	12 july,	13	<i>Selleck, C. A.</i>	15 june,
29	<i>Hall, A. L.</i>	13 july, 3	14	<i>Dawley, E. J.</i>	15 june,
30	<i>Paine, G. H.</i>	13 july,	15	<i>Beard, L. A.</i>	15 june,
31	<i>Collins, L. P.</i>	16 july,	16	<i>Jones, I.</i>	15 june,
32	<i>Lyerly, B.</i>	19 july,	17	<i>Goetz, R. C. F.</i>	17 aug.
33	<i>Lewis, R. H.</i>	26 july,	18	<i>Peyton, B. R.</i>	8 sept.
34	<i>Booker, P. W.</i>	12 aug.	19	<i>Magruder, J.</i>	9 sept.
35	<i>Pritchett, E. E.</i>	5 mar. 08	20	<i>Riggs, E. F.</i>	11 feb. 11
36	<i>Cruse, F. T.</i>	1 july,	21	<i>Nance, C. H.</i>	13 june,
37	<i>Marley, J. P.</i>	20 july,	22	<i>Bowley, F. W.</i>	13 june,
38	<i>Potter, W. C.</i>	25 aug.	23	<i>Beatty, J. C.</i>	13 june,
39	<i>Pfeil, H.</i>	17 sept.	24	<i>Hatch, J. J.</i>	13 june,
40	<i>Merrill, W. W.</i>	16 june, 09	25	<i>Walker, C. A., Jr.</i>	13 june,
41	<i>Downer, J. W.</i>	10 sept.	26	<i>Simpson, B. W.</i>	13 june,
42	<i>Bailey, B. M.</i>	29 sept.	27	<i>Finch, N. G.</i>	13 june,
43	<i>Sharp, W. F.</i>	30 sept.			

THE FIELD ARTILLERY JOURNAL

FIELD ARTILLERY DIRECTORY—Continued.

No.	Name, rank, and date of rank.	Reg't	No.	Name, rank and date of rank.	Reg't
<i>Second Lieutenants—Continued.</i>			<i>Second Lieutenants—Continued</i>		
28	Hobbs, H. M.	14 june, 4	61	Scott, R. C.	15 jan. 13 4
29	Andrews, J.	15 june, 1	62	Eager, H.	25 mar. 4
30	Oliphant, T. G. M.	20 july, 11 5	63	Young, W. C.	12 june, 5
31	Proctor, M.	20 july, 2 64	64	Crane, W. C., Jr.	12 june, 6
32	Wrona, W. J.	20 july, 4 65	65	Brewer, C.	12 june, 3
33	Erwin, V. P.	19 aug. 6 66	66	Cain, D. E.	12 june, 3
34	Bloom, F.	27 sept. 5 67	67	McMahon, J. E., Jr.	12 june, 3
35	Meyer, V.	28 sept. 2 68	68	Clarkson, H. S.	26 june, 2
36	Hicks, E. H.	28 sept. 6 69	69	Kilburn, C. L.	14 july, 3
37	Thomason, A. G.	29 sept. 4 70	70	Helmeick, C. G.	18 july, 2
38	Morrow, N. P.	7 oct. 5 71	71	Sedlacek, E.	30 aug. 6
39	Jones, L. E.	7 oct. 4 72	72	Thurber, P. L.	12 june, 14 3
40	Polk, N. N.	7 oct. 5 73	73	Houghton, W. C.	12 june, 6
41	<i>Bradley, F.</i>	2 dec. 74	74	Wyeth, J. C.	12 june, 5
42	Anderson, J. W.	3 dec. 2 75	75	Harris, A. R.	12 june, 4
43	Deshon, P.	24 apr. 12 1 76	76	Burr, J. G.	12 june, 6
44	Barnes, J. F.	24 apr. 2 77	77	Anderson, J. B.	12 june, 5
45	Vanderveer, H. C.	24 apr. 1 78	78	Burr, W. E.	12 june, 2
46	Andrus, C.	24 apr. 4 79	79	Lester, J. A.	12 june, 15 5
47	Maxwell, R. L.	12 june, 1 80	80	Beukema, H.	12 june, 3
48	Browne, C. J.	12 june, 3 5	<i>Additional Second Lieutenants.</i>		
49	Hauser, J. N.	12 june, 5 2	1	Struble, H. S.	12 june, 15 5
50	Greenwald, K. C.	12 june, 5 2	2	Dunigan, F. J.	12 june, 4
51	Anderson, R. E.	12 june, 4 6	3	Zundel, E. A.	12 june, 3
52	Gillespie, J. A.	12 june, 2 6	4	Howard, C. W.	12 june, 3
53	Bailey, W. M.	12 june, 6 3	5	Busbee, C. M.	12 june, 6
54	von Holtzendorff, J. D.	22 july, 1 4	6	Waldron, A. W.	12 june, 4
55	Winton, W. F.	23 july, 1 5	7	Wallace, J. H.	12 june, 3
56	Frankenberger, B.	30 nov. 5 6	8	Marsh, R.	12 june, 6
57	Austin, R. B.	30 nov. 6 1	9	Swing, J. M.	12 june, 4
58	Daly, J. O.	30 nov. 1 7			
59	Parker, E. P., Jr.	30 nov. 3 8			
60	Eager, J. M.	30 nov. 3 9			

MILITIA

FIRST INSPECTION DISTRICT

Capt. Robert Davis, Inspector, Boston, Mass.

Massachusetts

FIRST BATTALION

Headquarters, Boston

Maj. J. H. Sherburne.

Capt. Roger D. Swaim, Battalion Adjutant.

1st Lieut. Winthrop Miller, Battalion Quartermaster and
Commissary.

BATTERY A, BOSTON

Capt. Richard K. Hale.

1st Lieut. E. B. Richardson.

2nd Lieut. H. S. Allen.

2nd Lieut. R. C. Ware.

BATTERY B, WORCESTER

Capt. John F. J. Herbert.

1st Lieut. Walter J. Cookson.

1st Lieut. Arthur P. Twombly.

2nd Lieut. George Bieberbock.

BATTERY C, LAWRENCE

Capt. T. D. Howe.

1st Lieut. George McLane, Jr.

1st Lieut. W. W. Roberts.

2nd Lieut. R. A. Daniels.

2nd Lieut. Sumner H. Needham.

Connecticut

BATTERY A, BRANFORD

Capt. Charles S. Yeomans.

1st Lieut. Charles S. Scoville.

2nd Lieut. John J. Ahern.

Rhode Island

BATTERY A, PROVIDENCE

Capt. Everette S. Chaffee.

1st Lieut. Wm. Gammell, Jr.

1st Lieut. Daniel Howland.

2nd Lieut. Gerald T. Hanley.

2nd Lieut. Donald S. Babcock.

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.

It is requested that all errors be reported to the Editor

FIELD ARTILLERY DIRECTORY

FIELD ARTILLERY DIRECTORY—Continued

BATTERY B, CAMDEN

Capt. Samuel G. Banard.
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.
Capt. Dawson Olmstead, Adj. (1st Lieut., U.S.A.).
Capt. Francis D. Bowne, Quartermaster.
Capt. Alvin W. Perry, Commissary.
Capt. Prentice Strong, Battalion Adjutant.
Capt. Leonard B. Smith, Battalion Adjutant.
Veterinarian Eugene Combs.

BATTERY A, STRACUSE

Capt. Guedo F. Verbeck.
1st Lieut. George G. Bailey.
1st Lieut. Thomas E. Hitchcock.
2nd Lieut. William H. Thomas.
2nd Lieut. Edward R. Granger.

BATTERY B, NEW YORK CITY

Capt. Robert D. Mills.
2nd Lieut. Channing R. Toy.
2nd Lieut. Walter C. McClure.

BATTERY C, BINGHAMTON

Capt. Chas. R. Seymour.
1st Lieut. Arthur S. Douglas.
1st Lieut. John T. Shinners.
2nd Lieut. Chas. G. Blakeslee.
2nd Lieut. Arthur E. Kaepfel.

BATTERY D, NEW YORK CITY

Capt. James E. Austin.
1st Lieut. Benjamin Van Raden.
1st Lieut. Sylvester Simpson.
2nd Lieut. Frederick J. Koch.

BATTERY E, NEW YORK CITY

Capt. John T. Delaney.
1st Lieut. Frederick H. Ryan.
1st Lieut. Joseph H. de Rivera.
2nd Lieut. George B. Gibbons.
2nd Lieut. Robert L. Russell.

BATTERY F, NEW YORK CITY

Capt. Harold Lawson.
1st Lieut. Raymond M. Reid.
1st Lieut. Philip N. Lawes.
2nd Lieut. Frederick F. Moore.
2nd Lieut. James S. Larkin.

SECOND FIELD ARTILLERY

Headquarters, Brooklyn

Col. George A. Wingate.
Lieut. Col. Frank H. Hines.
Maj. Chauncey Matlock.
Maj. Joseph I. Berry.

Capt. DeWitt C. Weld, Adjutant.
Capt. Louis F. Kuntz, Quartermaster.
Capt. Wilbur T. Wright, Commissary.
Capt. Wm. B. Short, Battalion Adjutant.
Capt. Eugene F. Lohr, Battalion Adjutant.
1st Lieut. Albert D. Washington, Battalion Quartermaster and
Commissary.
2nd Lieut. Herbert C. Dienst, Battalion Quartermaster and
Commissary.
Veterinarian Harry F. Nimphius.
Veterinarian Robt. A. McAuslin.

BATTERY A, BROOKLYN

Capt. Walter P. Fox.
1st Lieut. John D. Butt.
2nd Lieut. Roger P. Clark.

BATTERY B, BROOKLYN

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

BATTERY C, BROOKLYN

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

BATTERY D, NEW YORK CITY

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

BATTERY E, NEW YORK CITY

Capt. John J. Stephens, Jr.
1st Lieut. Francis T. Colby.
1st Lieut. Robert W. Marshall.

BATTERY F, NEW YORK CITY

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

THIRD INSPECTION DISTRICT

Capt. Marlborough Churchill, Inspector,
Washington, D. C.

District of Columbia

1ST BATTERY, WASHINGTON, D. C.

Capt. Louis C. Vogt.
1st Lieut. George G. Wilson.
1st Lieut. George A. Bonnet.
2nd Lieut. Harry E. Shilling.
2nd Lieut. Ellwood S. Moorhead.

Pennsylvania

BATTERY A, SOUTH BETHLEHEM

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

It is requested that all errors be reported to the Editor

THE FIELD ARTILLERY JOURNAL

FIELD ARTILLERY DIRECTORY—Continued

BATTERY B, PITTSBURGH

Capt. William T. Rees.
1st Lieut. Clinton T. Bundy.
1st Lieut. John S. Puruker.
2nd Lieut. Chas. C. Williams.

BATTERY C, PHOENIXVILLE

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

BATTERY D, WILLIAMSPORT

Capt. William B. Reilly.
1st Lieut. John D. Andrews.
2nd Lieut. John H. Ball.
2nd Lieut. Clyde R. Shelley.

Virginia

FIRST BATTALION

Headquarters, Richmond

Major Thomas M. Wortham.
Capt. William W. LaPrade, Adjutant.

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. Robert C. Lehman.
1st Lieut. Lee F. Lawler.
1st Lieut. P. W. Kear.
2nd Lieut. McChesney H. Jeffries.
2nd Lieut. Edmond L. Sylvester.

BATTERY C, PORTSMOUTH

Capt. Robert B. MacDonald.
1st Lieut. Walter J. Tennent.
2nd Lieut. Ralph O. Oliver

FOURTH INSPECTION DISTRICT

Lieut. Charles S. Blakely, Inspector, Atlanta, Ga.

Alabama.

FIRST BATTALION

Headquarters, Birmingham

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

BATTERY A, BIRMINGHAM

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

BATTERY C, BIRMINGHAM

1st Lieut. William S. Pritchard.
1st Lieut. Julian P. Smith.

Georgia

FIRST BATTALION

Headquarters, Savannah

Maj. Richard J. Davant.
Capt. William W. Douglas, Adjutant.

BATTERY A, SAVANNAH

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

BATTERY B, ATLANTA

Capt. Andrew J. McBride, Jr.
1st Lieut. Robert G. Mangum.
1st Lieut. Leonard F. Wilson.

BATTERY C, SAVANNAH

Capt. Edward D. Wells.
1st Lieut. Joseph H. Thompson.
1st Lieut. Charles G. Lang.
2nd Lieut. Cecil Cheves.

Louisiana

FIRST BATTALION

Headquarters, New Orleans

Maj. Allison Owen.
Capt. Bryan Black, Adjutant.
1st Lieut. Joseph C. Sanders, Quartermaster and Commissary.

BATTERY A, NEW ORLEANS

Capt. Stanley M. Lamarie.
1st Lieut. William K. Nourse.
2nd Lieut. Guy R. Molony.
2nd Lieut. Maurice B. Lamare.

BATTERY B, NEW ORLEANS

1st Lieut. James E. Edmonds.
1st Lieut. Edwin M. Kursheedt.
2nd Lieut. Prentiss M. Johnson.
2nd Lieut. Harold P. Nathan.

BATTERY C, NEW ORLEANS

1st Lieut. Gabriel S. Adams.

FIFTH INSPECTION DISTRICT

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

Indiana

FIRST BATTALION

Headquarters, Indianapolis

Major Robert H. Tyndall.

It is requested that all errors be reported to the Editor

FIELD ARTILLERY DIRECTORY

FIELD ARTILLERY DIRECTORY—Continued

BATTERY A, INDIANAPOLIS

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

BATTERY B, PURDUE UNIVERSITY, LAFAYETTE

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

BATTERY C, LAFAYETTE

Capt. Thomas S. Wilson.
1st Lieut. Joseph A. Andrew.
1st Lieut. Rosier W. Levering.
2nd Lieut. John C. Doyle.
2nd Lieut. Frank Nisley.

Michigan

BATTERY A, LANSING

Capt. Chester B. McCormick.
1st Lieut. Amos H. Ashley.
1st Lieut. Fred G. Fuller.
2nd Lieut. F. G. Chaddock.
2nd Lieut. Earl H. Spencer.

BATTERY B, LANSING

Capt. Frank P. Dunnebacke.
1st Lieut. Chester E. Boelio.
2nd Lieut. Joseph H. Lewis.

Ohio

FIRST BATTALION

Headquarters, Briggsdale

Maj. H. M. Bush.
Capt. Carl H. Hirstius, Adjutant.
2nd Lieut. John B. Morton, Battalion Quartermaster and
Commissary.

BATTERY A, CLEVELAND

Capt. Quida A. Kulish.
1st Lieut. Fred T. Mudge.
1st Lieut. Everete C. Williams.

BATTERY B, MT. VERNON

Capt. Paul L. Jensen.
2nd Lieut. Robert D. Dowds.
2nd Lieut. Vincent B. Welker.
Veterinarian, Frank R. Lunn.

BATTERY C, BRIGGSDALE (COLUMBUS)

Capt. Rodney E. Pierce.
2nd Lieut. George H. Bartholomew.
2nd Lieut. Lawrence S. Schlegel.

SIXTH INSPECTION DISTRICT

Lieut. Louis R. Dougherty, Inspector, Chicago, Illinois

Illinois

FIRST BATTALION

Headquarters, Waukegan

Maj. Ashbel V. Smith.
Capt. George H. Gould, Adjutant.
1st Lieut. Curtis G. Redden, Quartermaster and
Commissary.

BATTERY A, DANVILLE

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

BATTERY B, CHICAGO

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

BATTERY C, WAUKEGAN

1st Lieut. Joseph R. Durkin.
1st Lieut. Fred C. Morey.
2nd Lieut. Philo J. Burgess.
2nd Lieut. Edward E. Barclay.
2nd Lieut. Albert C. Ofenlock.
Wisconsin

BATTERY A, MILWAUKEE

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

Iowa

BATTERY A, CLINTON

Capt. R. S. Whitley.
1st Lieut. J. E. Brandt.
1st Lieut. James L. Oakes.
2nd Lieut. Martin Purcell.
2nd Lieut. L. R. Brooks.

SEVENTH INSPECTION DISTRICT

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

Kansas.

BATTERY A, TOPEKA

Capt. Clarence G. Grimes.
1st Lieut. Martin C. Pennekamp.
1st Lieut. Dana T. Jennings.
2nd Lieut. Frank E. Barnard.
2nd Lieut. Charles E. Edwards.

Missouri

FIRST BATTALION

BATTERY A, ST. LOUIS

Capt. Frank M. Rumbold.
1st Lieut. Walter J. Warner.

It is requested that all errors be reported to the Editor

THE FIELD ARTILLERY JOURNAL

FIELD ARTILLERY DIRECTORY—Continued

Missouri—Continued

BATTERY A—Continued

1st Lieut. Robert C. Rutledge.
2nd Lieut. Edwin R. Nieheus.
2nd Lieut. Daniel F. Jones.

BATTERY B, KANSAS CITY

Capt. Arthur J. Elliott.
1st Lieut. Roy T. Olney.
1st Lieut. Fielding L. D. Carr.
2nd Lieut. Harry W. Ruttinger.
2nd Lieut. Herman H. Kube.

BATTERY C, INDEPENDENCE

Capt. Edward M. Stayton.
1st Lieut. John L. Miles.
1st Lieut. Spencer Salisbury.
2nd Lieut. Harry B. Allen.
2nd Lieut. George W. Cassell.

Texas.

BATTERY A, DALLAS

Capt. F. A. Logan.
1st Lieut. Sanford A. Stewart, Jr.
1st Lieut. Fred M. Logan.
2nd Lieut. Ward C. Goessling.

EIGHTH INSPECTION DISTRICT

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

Colorado

BATTERY A, DENVER

1st Lieut. John P. Donovan.
1st Lieut. Guylan A. Branchard.
2nd Lieut. William H. Schade.
2nd Lieut. Harry O. Nichols.

BATTERY B, DENVER

Capt. B. M. Lake.
1st Lieut. Ittia A. Elliott.
2nd Lieut. Earl L. Edwards.

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. Alex R. Thomas.
2nd Lieut. Fred T. Gundry.
2nd Lieut. Paul W. Billings.

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.
1st Lieut. John S. Riley, Quartermaster and Commissary.

BATTERY A, LOS ANGELES

Capt. Jesse McComas.
2nd Lieut. Harold G. Ferguson.

BATTERY B, OAKLAND

Capt. Harry F. Huber.
1st Lieut. Edward E. Vicary.
2nd Lieut. John W. White.
2nd Lieut. Howard W. Enefer.

BATTERY C, STOCKTON

Capt. Edward Van Vranken.
1st Lieut. Otto E. Sandman.
1st Lieut. Asa M. Clark.
2nd Lieut. Charles H. Young.
2nd Lieut. Hunt A. Davidson.

Oregon

BATTERY A, PORTLAND

1st Lieut. George B. Otterstedt.
1st Lieut. Bert V. Clayton.
2nd Lieut. Charles L. Johnson.
2nd Lieut. Arthur H. Friese.

STATE OF MINNESOTA

Capt. C. C. Pulis, Inspector, St. Paul, Minn.
FIRST FIELD ARTILLERY

Headquarters, St. Paul
Col. George C. Lambert.
Lieut. Col. William J. Murphy.
Maj. Gates A. Johnson, Jr., First Battalion.
Maj. George E. Leach, Second Battalion.
Capt. Charles A. Green, Adjutant.
Capt. Fred L. Baker, Quartermaster.
Capt. William H. Donahue, Commissary.
Capt. Harry M. Boyer, Battalion Adjutant.
1st Lieut. John H. Schoonmaker, Battalion Quartermaster and
Commissary.
2nd Lieut. James K. Scott, Jr., Battalion Quartermaster and
Commissary, First Battalion.

BATTERY A, ST. PAUL

Capt. Arthur G. Teuchert.
1st Lieut. John Hammerbacher.
1st Lieut. Henry A. Stempel.
2nd Lieut. Otto K. Seidel.
2nd Lieut. Charles Weiss.

BATTERY B, ST. PAUL

Capt. Frederick A. Tiffany.
1st Lieut. Theodore A. Kaldunski.
2nd Lieut. Chester W. Gaskell.
2nd Lieut. Horace S. Sorrells.

It is requested that all errors be reported to the Editor

FIELD ARTILLERY DIRECTORY

FIELD ARTILLERY DIRECTORY—Continued

BATTERY C, ST. PAUL

Capt. Thomas J. O'Leary.
1st Lieut. John H. McDonald.
1st Lieut. Roger J. Finn.
2nd Lieut. Philip J. McCauley.

BATTERY D, MINNEAPOLIS

Capt. George T. Gorman.
1st Lieut. Douglas G. Burrill.
1st Lieut. William J. Gilmour.
2nd Lieut. Julius H. Pohlson.

BATTERY E, MINNEAPOLIS

Capt. Jerome Jackman.
1st Lieut. Louis Baker.
2nd Lieut. William R. Cross.
2nd Lieut. Thomas A. Hillary.

BATTERY F, MINNEAPOLIS

Capt. Walter F. Rhinow.
1st Lieut. Fletcher Rockwood.
1st Lieut. William H. Kennedy.
2nd Lieut. Edwin Rollmann.
2nd Lieut. John L. Haskins.

UNASSIGNED

New Hampshire

BATTERY A, MANCHESTER

Capt. Edwin L. Towle.
1st Lieut. Frank J. Abbott.
1st Lieut. Henry A. Worthen.
2nd Lieut. Lucius E. Hill.
2nd Lieut. George W. Upton.

It is requested that all errors be reported to the Editor

ACTIVE MEMBERSHIP, FIELD ARTILLERY ASSOCIATION.

REGULAR ARMY.

5th Field Artillery	93 per cent.
Unassigned to regiments	91 per cent.
6th Field Artillery	90 per cent.
1st Field Artillery	83 per cent.
3rd Field Artillery	79 per cent.
2nd Field Artillery	78 per cent.
4th Field Artillery	76 per cent.

MILITIA.

Nex Mexico	100 per cent.
Rhode Island	100 per cent.
Utah	80 per cent.
Massachusetts	71 per cent.
Ohio	62 per cent.
Indiana	60 per cent.
Pennsylvania	59 per cent.
Missouri	47 per cent.
Virginia	40 per cent.
New York	36 per cent.
Connecticut	33 per cent.
New Jersey	30 per cent.
Georgia	29 per cent.
Illinois	20 per cent.
Colorado	29 per cent.
Texas	25 per cent.
Louisiana	25 per cent.
Minnesota	22 per cent.
Wisconsin	20 per cent.
District of Columbia	20 per cent.
California	14 per cent.
Alabama	13 per cent.
Michigan	13 per cent.
Kansas	0 per cent.
New Hampshire	0 per cent.
Oregon	0 per cent.
Iowa	0 per cent.
Illinois	29 per cent.