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A VERY MODERN PIECE OF HEAVY FIELD ARTILLERY—THE 155MM GUN—8-INCH HOWITZER

(See Pages 664-667)

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THE ANNUAL REPORT OF THE CHIEF OF FIELD ARTILLERY—1931

SECTION I–PERSONNEL

Regular Army

Commissioned Personnel: Strength Report as of June 30, 1931

	Cols.	Lt. Cols.	Majs.	Capts.	1st Lts.	2nd Lts.	Total
Commissioned in arm	36	67	225	441	460	283	1512
Authorized strength	68	75	235	532	377	212	1499
Difference	–32	–8	–10	–91	+83	+71	+13
Detailed to other arms and services	1	3	4	5	8	44	65
Detailed from other arms and services				2*	5*		7
Available for assignment	35	64	221	438	463	239	1444

*Officers, Philippine Scouts.

The gains and losses during the fiscal year ending June 30, 1931:

GAINS

From the U. S. M. A., Class 1931	77
By transfers from other arms	4
Total gains	81

LOSSES

Promoted to Brigadier General	2
Appointed Professor, U. S. M. A.	1
Retired	7
Discharged per Class B proceedings	2
Dismissed	1
Resigned	4
Died	7
Transferred to:	
Air Corps	16
Coast Artillery Corps	1
Chemical Warfare Service	1
Finance Department	1
Ordnance	1
	44
Net gain	37

NOTE: The next table shows the status of officers under orders on June 30, 1931. Many of these orders are not effective until September, 1931, and a few not until the end of the year.

Seventy-seven second lieutenants, commissioned from the U. S. M. A., Class of 1931, are included in the table—fifty-six as on duty with Field Artillery organizations of the Regular Army, and twenty-one as detailed to the Air Corps.

The distribution of officers on June 30, 1931, is shown in Table A:

TABLE A

	Cols.	Lt. Cols.	Majs.	Capts.	1st Lts.	2nd Lts.	Total
Duty with FA organizations, RA	11	16	48	208	271	207	761
Office Chief of F. A.	1	2	7	3			13
Field Artillery Board	1	1	4	3			9
Liaison Officers			1		1		2
F. A. S. Staff and Faculty		2	17	11	9		39
F. A. Instrs. Other Special Service Schools			3				3
School duty, arm, student		1	5	47	43	25	121
C&GSS, Staff and Faculty		3	7	1	2		13
C&GSS, Students			12	26			38
A. W. C. Staff and Faculty	1	1	3	1			6
A. W. C. Students			9				9
A. I. C. Students			1				1
N. W. C. Students			1				1
Oriental Language Students				2	1		3
U. S. M. A. Detachment			1	1	5		7
U. S. M. A. Staff and Faculty, etc.			3	5	29	4	41
R. O. T. C.	1	3	20	46	41		111
Organized Reserves	12	8	25	38	21		104
National Guard	1	5	34	37	10		87
G. S., W. D.	1	5	8				14
G. S., Troops	3	11	7				21
Duty with G. S. Troops	1				1		2
Office Ass't. Sec. of War			1				1
Office Chief of Staff	1						1
G. S., Military Attachés		3	4	2			9
Staff Mechanized Force				2			2
Detailed to Air Corps					2	36	38
Detailed to A. G. D.				1			1
Detailed to I. G. D.	1	2	3				6
Detailed to J. A. G. D.				1	1		2
Detailed to Ordnance Dept					3	5	8
Detailed to Q. M. C.		1	1	3	2	3	10
Aide de Camps		1		1	18	3	23
American Battle Mon. Com.					1		1
Disciplinary Barracks		1		1	1		3
Recruiting				2	3		5
Bureau of Insular Affairs		1					1
Pub. Bldgs. & Grounds, D. C.				1			1
General Depot	1						1
	36	67	225	443	465	283	1519

To assure each officer of field grade at least one tour of command duty with a Regular Army Field Artillery organization during a period of ten years, the maximum duration of such tours cannot exceed, for colonels, 3.3 years; lieutenant colonels, 2.4 years; and majors, 1.6 years. As such tours should not be for less than 2 years, it is evident that majors cannot expect this duty but once in 12.5 years.

Except as affected by the increased turnover caused by the reduction of the foreign service tour to two years, the duration of assignments of battery officers has been maintained at a minimum of four years.

Enlisted personnel. The situation, with respect to enlisted personnel, is shown in Table B:

TABLE B

ORGANIZATION	Auth. 6/30/31	Strength as of Sept. 30 1930	Dec. 31 1930	Mar. 31 1931	June 30 1931
1st F. A. Brig. Hq. & Hq. Btry	34	40	29	29	26
2nd F. A. Brig. Hq. & Hq. Btry	34	46	31	32	32
3rd F. A. Brig. Hq. & Hq. Btry	5	5	5	5	5
13th F. A. Brig. Hq. & Hq. Btry	45	36	33	40	46
3rd Ammunition Train	64	71	62	63	61
Battery A, 1st Observation Bn.	108	94	91	105	104
1st Field Artillery	1000	1056	988	960	1022
2nd Field Artillery, 1st Bn.	511	425	438	497	531
3rd Field Artillery, 1st Bn.	464	459	444	434	465
3rd Field Artillery, 2nd Bn.	333	352	346	345	326
3rd Field Artillery, Band.	28				27
4th Field Artillery, 2nd Bn.	339	315	290	318	323
5th Field Artillery	714	673	645	671	673
6th Field Artillery	773	716	721	716	728
7th F. A., less 2nd Bn.	570	560	546	537	564
7th Field Artillery, 2nd Bn.	465	470	460	458	450
9th Field Artillery, 1st Bn.	326	294	320	299	260
10th Field Artillery	773	712	701	699	709
12th Field Artillery	745	742	646	640	709
15th Field Artillery, 2nd Bn.	333	316	285	293	324
16th Field Artillery, 1st Bn.	464	422	439	435	448
16th Field Artillery, 2nd Bn.	333	301	289	311	325
17th F. A., less 3rd Bn.	764	736	706	687	718
17th Field Artillery, 3rd Bn.	326	279	287	316	326
18th Field Artillery, 1st Bn.	464	494	464	446	471
18th Field Artillery, 2nd Bn.	464	481	444	445	461
24th Field Artillery (P.S.)	1003	989	1002	996	1000
76th F. A., less 2nd Bn. & Band.	412	443	406	367	403
76th Field Artillery, Band	28	25	24	26	28
76th Field Artillery, 2nd Bn.	333	340	327	296	315
82nd Field Artillery, 1st Bn.	520	458	442	468	473
83rd Field Artillery, 1st Bn.	333	338	335	339	326
F. A. S. Detachment	318	323	323	316	314
Detachment, Office Chief of F. A.	27	26	24	26	26
11th Field Artillery Brigade	2431	2413	2433	2426	2417
Totals	15884	15450	15026	15041	15436

National Guard—The policy of selecting particularly well qualified officers for detail as instructors with the National Guard has been continued.

Officers' Reserve Corps—During the year, the Field Artillery Section of the Officers' Reserve Corps changed as follows:

GAINS

Regular acceptances	355
Dual commissions	616
R. O. T. C.	732
Transferred from other arms	104
Total gains	1807

LOSSES

Died	21
Transferred	65
Discharged (dual commissions)	403
Discharged (Reserve)	178
Declined reappointment	48
Resigned	9
Total losses	724
Net gain	1083

The total number of Field Artillery Reserve Officers as of June 30, 1930, was 12,252, of whom 2,486 held commissions in the National Guard; as of June 30, 1931, 13,335, of whom 2,390 hold commissions in the National Guard.

Table "C" shows the distribution of Field Artillery Reserve officers:

TABLE C

Assignment Jurisdiction	Cols.	Lt. Cols.	Majs.	Capts.	1st Lts.	2nd Lts.	Total
Corps Area	71	131	310	842	1566	5525	8445
Chief of Field Artillery	4	7	22	29	15	86	163
The A. G. O.	2	6	4				12
Restricted	10	21	56	244	533	1461	2325
Sub-total	87	165	392	1115	2114	7072	10945
Dual commission	42	59	108	504	642	1035	2390
Totals	129	224	500	1619	2756	8107	13335

The procurement objective, based on the present mobilization plan, for the Corps Area Assignment Group, Field Artillery Section, requires a total of approximately 11,300 officers, exclusive of those required for Regular Army units. A comparison of this total with the number of Reserve officers (10,945) (exclusive of those holding dual commissions) shown in the above table, indicates that the number of Field Artillery Reserve officers is still inadequate and that continued efforts must be made to build up the section.

During the year, a new and simplified record system for Field Artillery Reserve officers was completed, which dispenses with cumbersome file and record cases formerly in use.

Field Artillery School—The number of Advanced Course students has been increased by reducing that of the Battery Officers' Course, the latter being maintained at the level necessary to reach, by 1935, the objective—that is, attendance on completing four years' commissioned service. This increase in the Advanced Class is essential to the professional educational advancement of the

very large number of Field Artillery officers who have not had the course.

SECTION II—INTELLIGENCE

During the past year, the reports from our military attachés in foreign countries have been studied for matters of Field Artillery interest. Foreign artillery journals and other military journals are carefully read. Any information on development in matériel, training, or organization is brought to the attention of the proper personnel of this office, to the Field Artillery Board, or disseminated to the officers of the arm as may seem appropriate.

Information concerning foreign Field Artillery activities is included in the semi-annual progress reports of this office.

Pertinent data furnished by the several sections of this office is put into proper shape for the *Information Bulletin,* a publication which is sent to the officers of the arm, Regular Army, National Guard, and Reserves, in order to disseminate to them information of a purely Field Artillery nature which would not otherwise reach them in War Department publications or correspondence.

Field Artillery information of general interest to the public is prepared in the form of press releases and submitted to the Public Relations Branch, General Staff, for distribution to the press.

Excellent liaison is maintained with the G-2 Section of the War Department General Staff and with the Historical Section of the Army War College, both of which have cooperated most cordially in providing information of a Field Artillery nature when requested to do so.

SECTION III—TRAINING

Regular Army—The training of Field Artillery troops of the Regular Army progressed during the past year. Progress has been made in reducing the number of officers and men detailed away from their units on special duty and detached service. The heavy demands on Field Artillery troops for the summer training of the civilian components have been fully met.

While the Field Artillery has always had service practice at moving targets, such targets did not approximate in speed to

what may be expected on a modern battlefield. This was due to the lack of a speedy and inexpensive moving target.

Such a target with a speed up to forty-five miles per hour has been devised and is being issued to the service. A method of attacking such speedy targets when invisible from the gun positions has also been devised and will shortly be promulgated to the service.

Long and arduous marches, accompanying other mounted troops, have demonstrated the ability of Field Artillery, properly trained and led, to keep up with and give close support to those troops, in all circumstances of weather and terrain.

Excellent practical results have followed the increasing use of radio for Field Artillery communications. It is felt that the increasing difficulties of maintaining wire lines on the battlefield must force an increasing use of radio and consequent necessity for more radio training for Field Artillery personnel.

There has been a slight increase in service practice with aerial observation, but the results of such practice have not been particularly satisfactory, except in isolated cases. This matter will be given special attention in the near future with a view to correcting what are believed to be some basic defects in the present system.

The Extension Course of the Field Artillery School has been completely revised and rewritten for the 1932 edition and ten special texts have been prepared for use in the course. The Field Artillery Field Manual, in two volumes, has been completed, approved by the War Department, and is now in the hands of the printer. The publication of this manual will obviate the necessity for issue of numerous Field Artillery training regulations.

During the past year, nine Field Artillery officers were graduated from the Army War College, and twenty-three from the Command and General Staff School. In addition, Field Artillery officers were in attendance at the following special service schools:

School	*Number of Officers*
Cavalry School	1
Infantry School	2
Signal School	2

Air Corps Tactical School	2
Chemical Warfare School	5
Ecole de Guerre, Paris, France	1
Italian Cavalry School	1

Under the provisions of the National Defense Act, Field Artillery officers completed courses at the civilian educational institutions indicated below:

Purdue University (Communication Engineering)	2
Purdue University (Automotive Engineering)	2
University of Pennsylvania (Sound Ranging)	2

These special courses are followed by Field Artillery officers in order to give to the army trained specialists for use in considering technical questions on the Field Artillery Board, and as instructors at the Field Artillery School.

The Knox Trophy, awarded annually by the Society of the Sons of the Revolution in the Commonwealth of Massachusetts, to that Field Artillery battery of the Regular Army which shall have obtained the highest rating in a general efficiency test prescribed by this office, was won this year by Battery A, 13th Field Artillery, at Schofield Barracks, H. T. This battery was commanded at the time of the test by Captain Le Count H. Slocum, Field Artillery, and was successful over seventeen competing batteries from all over the United States, as well as over other batteries in Hawaii and in the Panama Canal Zone.

The Knox Medal, awarded annually by the same society for excellence as an enlisted student at the Field Artillery School, was won this year by Corporal Harvey R. Griffith, Headquarters Battery, 1st Field Artillery, Fort Sill, Oklahoma.

THE FIELD ARTILLERY SCHOOL

With the exception of a few alterations in classrooms, no changes were made in the instructional plant during the past year. The present school plant is inconvenient and inadequate in many respects. Now that Fort Sill has been definitely selected as the

permanent location of the school, every effort should be made to inaugurate and carry out the approved construction project.

The courses of instruction have been carried out as prescribed. The details of all courses are under constant study with a view to increasing the effectiveness of instruction. Steady progress in this direction is being made and this progress will be accentuated with a proper plant. The number and quality of instructors have have continued satisfactory.

In the Battery Officers' Course, a small increase in the time devoted to gunnery has been authorized for next year, necessitating a slight curtailment in the activities of other departments, notably the Department of Animal Transport. The courses at the school are controlled primarily by the state of instruction of the students when they report—the higher the state of instruction, the more advanced can be the courses.

In the Advanced Course, a continued effort is made to give more detailed and explicit instruction in the artillery tactical units, especially in the battalion.

As the Field Artillery School progressively attains its full development, it becomes increasingly apparent that it will be able effectively to fill practically all of the higher instructional needs of the Field Artillery. Consequently, it is in the interest of economy and efficiency to concentrate such activities there to the greatest extent practicable. Assuming that the Battery Officers' Course will continue to keep pace in numbers with the inflow of young officers, there may now be made much needed increases in the numbers admitted to the Advanced Course, the Advanced Course, the Advanced Course in Horsemanship, and the Avanced Course in Motors. In short, the principal problems of the Field Artillery School now are to afford adequate general training to all officers of Field Artillery, and to provide a suitable number of qualified instructors for the troop schools of the service.

The enlisted specialists' courses are continually being improved. Enlisted men, who satisfactorily complete these courses, return to their units well equipped to render valuable service both in the performance of special duties and as instructors.

One of the most encouraging phases of the work at the Field Artillery School has been the development of better liaison methods

between Field Artillery and Air Corps, and the practical working out together of more efficient means of communication between plane and gun. It cannot be too strongly stressed that the present tendency to lessen this cooperation by reductions in the Air Corps personnel and matériel at the Field Artillery School, is a backward step and one which will greatly retard the proper development of the Field Artillery by hampering it in its progress toward a correct solution of the difficult problem of observation and control of the fire of modern long range artillery.

The tables below show the number of students who followed the various courses at the Field Artillery School during the school year 1930-31:

OFFICERS

	Duration				*Students*	
Course	*Months*	*Hours*	*Graduated*	*Failed*	*Relieved*	*Total*
Advanced Course	9	1298	33	2	2	37
Battery Officers' Course	9	1322	66	2	0	68
Adv. Course Horsemanship	9	1394	6	0	0	6
Adv. Course in Motors	9	1300	4	0	0	4
Refresher Course	2	331	4	0	0	4
N. G. & Res. B. O. Course (F)	3	482	35	5	2	42
N. G. & Res. B. O. Course (S)	3	504	23	4	1	28
N. G. & Res. F. O. Course	1½	232	7	1	0	8
Totals			178	14	5	197

ENLISTED SPECIALISTS

	Duration				*Students*	
Course	*Months*	*Hours*	*Graduated*	*Failed*	*Relieved*	*Total*
Horseshoers (Fall)	4	680	19	0	0	19
Motor Mechanics (Fall)	4	680	6	0	0	6
Saddlers (Fall)	4	680	15	0	0	15
Communication, RA & NG (S)	4	749	59	6	8	73
Battery Mechanics (Spring)	4	730	2	0	0	2
Saddlers (Spring)	4	680	1	0	0	1
Horseshoers (Spring)	4	680	3	0	0	3
Totals			105	6	8	119

In addition to conducting the above-listed courses, the personnel of the Field Artillery School reviewed all training literature sent it by this office, prepared the Field Artillery Extension Course, including special texts therefor, and carried out tests of Field Artillery tactical formations and doctrines sent to it for study. All this work has been accomplished in an especially satisfactory manner.

National Guard—War Department policies not contemplating any supervision or inspection of National Guard activities by this

office, no contact was had with that important component of the National Defense, except such as was brought about by the attendance of officers and enlisted men of the National Guard at courses at the Field Artillery School.

Officers' Reserve Corps—Special training in sound ranging was given to selected groups of Reserve officers of the Field Artillery Branch Assignment Group. No other training contact with Reserve officers was had by this office, in accordance with present War Department policies.

Reserve Officers' Training Corps—During the past year, the Chief of Field Artillery visited personally all the Field Artillery R. O. T. C. units, and, in addition, inspected many of them during their period of summer camp training. The state of training and efficiency of these units, both at camp and at the institutions was uniformly excellent.

The two Field Artillery R. O. T. C. units of the 7th Corps Area (Iowa and Missouri) which have heretofore received their training outside the Corps Area, are now being trained at Fort Riley, Kansas, within their proper corps area.

In October, 1930, there were enrolled a total of 11,646 basic students and 2,214 Advanced Course students. At the close of the college year, commissions or certificates of eligibility were issued to approximately 826 graduates. The Basic Course for 1930 shows an increase of 300, and the Advanced Course an increase of 270, over the 1929 enrollments. These increases are believed largely due to a greater familiarity with the War Department Program on the part of instructors, this serving to promote morale and to increase efficiency. Also, the increase of Field Artillery instructor personnel this year served to relieve somewhat the high tension caused by overwork at our Field Artillery units, with a resulting ability to impart better instruction and so to popularize our courses.

There is now in process of preparation a revised institutional program to meet the general demand for one of more flexibility and more in keeping with our revised training literature. Such a program also will secure better coordination with the new Field Artillery Extension Course.

Extension Course—During the year, the 1931-32 revision of

the Extension Course of the Field Artillery School was completed after having been continuously in work for over two years. All subcourses, 32 in number, were rewritten completely, and are believed to embody a distinct advance over previous efforts. The greater part of the work was in the preparation of ten special texts, probably the most comprehensive and up-to-date Field Artillery instructional literature our service has had. A total of 25,000 copies of these texts have been printed at the Field Artillery School for use not only in the extension course, but also in that school and in the service at large. Next year, for the first time since the World War, the school will use almost exclusively texts which have been reviewed and approved by the War Department. Several of the appropriate texts will also be used at the Command and General Staff School, and at some of the special service schools of other arms.

SECTION IV—MATERIEL AND EQUIPMENT

Weapons

.45 Calibre Pistol—The present standard pistol is entirely satisfactory for the use to which it is put in the Field Artillery. No change in the basis of issue to Field Artillery troops has been made since the War. The sphere of use of the pistol may be increased due to its possible effectiveness in fire against low-flying aircraft as contemplated by the Cavalry.

Machine Guns—The .30 calibre Browning water-cooled machine gun is still in use by the Field Artillery for anti-aircraft defense on the march and in bivouac or position. The present basis of issue of machine guns to Field Artillery troops does not provide sufficient fire power for anti-aircraft defense. No satisfactory artillery carriage mount has been developed, as yet, to provide for defense on the march.

Development of machine gun mounts continues with every reason to believe that a satisfactory carriage mount will be devised. In the meantime, tests have been and are being conducted with the Browning .30 calibre automatic rifle in an effort to obtain a more efficient available means for anti-aircraft defense for Field Artillery troops. As a result of the first of these tests, the issue of Browning automatic rifles to Field Artillery troops as standard

equipment was recommended. Subsequent tests have borne out the soundness of this recommendation. All tests, however, have not as yet been completed.

It is realized that the Browning automatic rifle is not ideal for this purpose, and that the semi-automatic rifle when developed will probably be superior.

The .50 calibre machine gun has been eliminated from consideration for anti-aircraft defense for Field Artillery due to the superiority of the .30 calibre machine gun in point of hits per elapsed period of time, up to ranges of 1,000 to 1,200 yards. It may, however, find a use for local defense against tanks for Field Artillery units which are likely to such attack.

75mm Howitzer—During the past year, the 1st Battalion, 2nd Field Artillery, in Panama, was equipped with this new standard howitzer. This weapon is receiving high praise on all sides. It is one of the most efficient weapons ever developed by the Ordnance Department. Due to this efficiency, its use in other roles is being contemplated. Such contemplated uses are: (1) to replace the 75mm gun in the Cavalry Division; (2) as supporting artillery in the Mechanized Force; (3) as accompanying artillery in the Infantry Division; (4) as a principal weapon in Infantry Division Artillery. Tests of the weapon are now in progress to determine its suitability for (2) and (3).

In view of the above contemplated uses, consideration is being given to the development of a carriage suitable for such use.

75mm Gun—The 75mm guns on hand are made up of four types, the M1897 (French), M1916 (American), M1917 (British), and one new standard M1. The first three are still efficient weapons. Since the French gun forms the bulk of the supply on hand, we will consider its limitations only. Its maximum range with the new standard shell of which only a small stock exists is 12,780 yards. It cannot be towed at high speeds. Its traverse is limited and slow. It is equipped with the French collimator sight. When moved for long distances in draft, even behind horses, excessive wear occurs in the gun slides, and piston rod stuffing box nuts are seriously damaged, requiring expensive repairs. When in storage, the recoil system deteriorates seriously, if not exercised.

Tests and development work are being conducted with a view to

equipping this gun with a panoramic sight and a higher speed running gear, and to reducing vibration in travel. Recoil cylinders in storage are being exercised. However, it may be necessary in the future to rotate the guns in service to insure their continued serviceability.

The new standard M1 gun is a great improvement over the French gun from the point of view of range, power, and traverse. However, it also cannot be towed at high speed and a redesign of the carriage will be required to provide therefor. Only one of the new standard carriages has, so far, been built.

In order to provide the new gun with anti-aircraft characteristics, the T2 and T3 mounts for the 75mm gun, M1, which are capable of all-around fire at elevations up to 80°, were built and are being tested by the Field Artillery Board. These tests should be completed in the near future. Considerable success has been had in fire at aircraft and fast moving targets, using fire control equipment of the type employed by the anti-aircraft service. Simplification of such fire control equipment for this purpose appears to be possible. High speed transport is possible. However, the added possibilities of these carriages are paid for at the expense of tactical mobility and an increase in complicated equipment. This type does not yet possess possibilities for its substitution as the principal weapon of the division.

90mm Gun-Howitzer—Design studies are being made of a 90 mm weapon for gun, howitzer, and anti-aircraft fire. To date, these studies have been limited to ballistic considerations.

155mm Howitzer—At present, two requirements exist for this howitzer, one as a divisional and the other as corps weapon. It will be replaced in the division eventually by the 105 mm howitzer and in the corps by a new 155 mm howitzer.

While the 155mm howitzer, M1917 and M1918, comprising existing stock are still considered extremely efficient weapons, they are heavier and more powerful than required for the division and have less range than is desired for the corps. They cannot be towed at high speeds. Their lack of range is somewhat offset by the presence of the 155mm gun, M1918, in the corps armament in the ratio of one gun to two howitzers. The new 105 mm howitzer which can be pulled by animals has been standardized

for divisional use and will eventually replace the 155mm howitzer in this role. The 105mm howitzer carriage, however, cannot be towed at high speed and a redesign of this carriage will be necessary. The batteries have been equipped with 105 mm howitzer matériel during the past year and an additional battery is about to be so equipped.

A pilot model of the new 155mm howitzer with a range comparable to the present 155mm gun, M1918, is at present under test by the Field Artillery Board. This carriage has improved bearings; however, its speed capabilities are not yet known. If standardized, this weapon should replace both the present 155mm howitzer and 155mm gun in the corps. A redesign of the new carriage may be made as a result of tests thereof and of the new 8-inch howitzer-155mm gun carriage.

155mm Gun—The 155mm gun, M1918, is an efficient weapon, weighing about 25,000 pounds and having a range of about 18,600 yards. It cannot be moved at high speeds. It is inaccurate at the longer ranges. Ammunition development bids fair to increase the range to about 20,000 yards. Investigation is under way by the Ordnance Department to better its accuracy and high speed capabilities.

The pilot model of a new 155mm gun-8 inch howitzer carriage has been constructed and will soon be tested by the Field Artillery Board. This carriage is a radical departure from the present accepted types of mobile mounts. It is a pedestal type mount equipped with anti-friction bearings, sprung weight in traveling, and pneumatic tires. Increased mobility, increased speed of entry into action, and about 6,000 yards increase in range are secured at a cost of about 4,000 pounds increase in weight. This design, if successful, may influence the future design of the 155mm howitzer carriage.

Heavy Field Howitzer—The 240mm howitzers which are available are highly efficient weapons. They are, however, considered to be unnecessarily heavy for GHQ Reserve Field Artillery, the total weight being about 41,000 pounds. This load breaks down for travel into several loads, none of which exceed 17,000 pounds. The various loads cannot be towed at high speeds.

The available 8-inch howitzer matériel is much less efficient than the 240 having a maximum range of only 10,000 to 12,000 yards. It has a traverse of only 8°, although by the use of a platform this can be increased to 52°. It weighs about 30,000 pounds when traveling.

The new heavy weapon carriage discussed under the 155mm gun is also contemplated for use with a new 8-inch howitzer having a range of 18,700 yards. This weapon should be standardized in the near future.

Due to the inefficiency of the old 8-inch howitzer matériel production, planning should provide for the minimum use possible of this matériel.

Ammunition—Service test of H. E. shell ammunition for the 75mm pack howitzer has been completed and this ammunition has been recommended for adoption as standard. This is the first test by the Field Artillery of the T2E1 combination super-quick and short-delay, bore safe fuze. The results of this test indicate that this fuze is superior to any other previously tested. This fuze will be used in ammunition for all new weapons.

H. E. shell ammunition for the 105mm howitzer, M2, and for the new 155mm gun and shrapnel ammunition for the 75mm gun and for the 105mm howitzer, M2, are now under service test. H. E. shell ammunition for all new calibers will be ready for service test in the near future when the manufacture of T2E1 fuzes, now in progress, is completed.

Non-hygroscopic propelling powder has now been adopted for all calibers. This powder is flashless for light and medium calibers. Tests and development work continue on the problem of providing a flashless propellant for the heavy calibers.

Service test is in progress of a quick burning powder charge for the first five zones of the 155mm howitzer, M1918, which is designed to give greater accuracy.

The T1 fuze is now being service tested and preliminary reports indicate that it will be found satisfactory. This fuze is a modification of the Mark III fuze and is made from components of that fuze of which a large stock is on hand. It is designed to give greater safety in handling, and greater certainty of action at small angles of impact, than the Mark III fuze.

The development of a combination time and super-quick fuze for shell of all calibers has been placed high on the priority list. Progress to date has resulted in the design of a mechanical fuze for the 155mm gun and powder train fuzes for lower calibers. These fuzes are designed to be interchangeable with the T2 fuze and have the same bore-safe feature. A pilot lot of the mechanical fuze is now being made. This development is considered to be of great importance, due to the possibility of eliminating shrapnel as a required type and the possibility of high burst ranging at all ranges of which the various weapons are capable. For anti-aircraft firing, a time fuze which will not burst on impact will probably be required.

Investigations are being made by the Ordnance Department to improve the accuracy of the 155mm gun, M1918. Studies are also being made of the design of a 155mm shell which will produce the maximum fragmentation effect.

FAST-MOVING TARGET

During the past year, there has been developed by the Field Artillery Board a moving target which is capable of speeds up to 45 miles an hour over zig-zag courses. This target is very simple and inexpensive in construction, simple in operation, and can readily be used on any Field Artillery target range. The Ordnance Department has taken steps to supply the target, together with a detailed description of its operation, to all Field Artillery organizations for use in service practice.

ANIMAL TRANSPORTATION

Bridles, Field Artillery. The present bridle is satisfactory and no change is contemplated.

Caissons, 75mm gun. The caissons on hand can be used without modification, only for the Mark I and Mark II shells, and Mark I shrapnel. At a cost of about one dollar per round capacity, the caissons can be modified to carry the Mark IV shell. In case a 15-lb. projectile were standardized, it would have to be carried unfused due to its length. The speed of travel of the caissons is limited to about that of the French guns. The desirability of increasing the possible speed of the caisson has not yet

been decided. It will probably be more profitable to discard them in favor of other vehicles when speed is required.

Plans have been prepared for the modification of the caisson to accommodate the Mark IV shell. A project should be set up to provide the modified caissons at the rate required. Cargo carts are also being tested in an attempt to eliminate the cellular type of ammunition vehicle and should eventually replace the caisson. In order to fill the gap occurring before carts become available, the modification noted above will be required.

Caissons, 155mm howitzer. The caissons on hand are decidedly unsatisfactory, being extremely heavy in comparison with the weight of ammunition carried. It is believed that a cargo cart such as is under development will prove to be much more satisfactory.

Cart, artillery. These vehicles are of doubtful utility and may very possibly be entirely eliminated.

Cart, ration, and water. No issue of this type of vehicle is at present provided for, its place being taken by an escort wagon. Such a vehicle is under development.

Harness, artillery. The present standard is satisfactory. Some non-essential changes have been made for future manufacture.

Rolling kitchens. Only a limited number of an obsolete type are on hand. Some development work is under way. Development will be expedited and an attempt will be made to expedite the supply of kitchens as needed. The use of field ranges, however, would provide a satisfactory temporary expedient.

Limbers, 75mm gun-caisson. These limbers will require modification for the Mark IV or new 15-lb. shell.

Forge limber. Some slight changes have been made for future manufacture.

Reel, artillery. These reels include those used in motorized organizations and in headquarters batteries of horse-drawn units. They are fairly satisfactory and will be used until they become unserviceable. A slight modification, only, is necessary to change them from horse to motor-drawn and the reverse. However, they are rather heavy for the amount of wire carried and will not accommodate commercial spools of wire. The Signal Corps

is developing new wire-laying vehicles for future manufacture which it is hoped will correct these deficiencies.

Reel, battery. The same general remarks, as made under the artillery reel above, apply to this vehicle. Remodeled battery reels have been tested and found satisfactory. Arrangements for extended service tests are being made.

Saddles, McClellan. Recent modifications have been approved for future manufacture. Modification of existing saddles is not essential.

Saddles, officers' field. Some improvements in the saddle have been made which are now being tested.

Saddles, pack cargo or aparejos. Only a small portion of the number on hand are the new standard Phillips pack saddles. While aparejos can be used by Field Artillery units, certain of the accessory equipment must be changed when changing from one type saddle to another. Also, since all active units will soon be equipped with Phillips saddles only, it is feared that in the near future few will be sufficiently informed concerning the use of aparejos to insure their efficient use in an emergency.

Wagon, battery and store. The vehicle, due to its weight, is not entirely satisfactory but can be used. It is expected that the cargo cart, if standardized, will replace it.

Wagons, escort. The vehicle is satisfactory. No improvements are contemplated.

Wagons, mountain, 3-seated. The present standard vehicle is, in general, satisfactory. However, certain changes have been made and a modified wagon is being tested by the Field Artillery Board.

The 1½-ton convertible trailers being used in place of mountain wagons are entirely unsatisfactory.

MOTOR TRANSPORTATION

The Quartermaster General has evolved a most promising procurement and maintenance plan whereby vehicles are standardized which have a maximum interchangeability of parts and which can be assembled by the various motor companies from standard assemblies.

This is, undoubtedly, a most economical peace time procedure, but its application to war activities should be carefully considered

before a definite commitment is made to such a plan in the event of a maximum effort.

This office is cooperating with the Quartermaster General by testing vehicles produced according to this plan, and where possible, accepts the vehicle as a standard in its class for Field Artillery.

I am committed to the policy of employing for Field Artillery purposes, wherever practicable, any reasonably efficient commercial product if readily procurable in sufficient quantities in preference to an *ideal special product* whose quantity production would be slow or doubtful, for the reason that I believe it better for the Field Artillery to enter a war with an ample supply of reasonably usable materiel than a limited supply of an ideal article.

This office is, therefore, in addition to the foregoing, making an attempt to doubly insure a full war supply of motor vehicles by determining what strictly commercial vehicles now in production can be used as substitutes throughout a war, or until the standard vehicles have arrived at a point of sufficient production. In other words, if the situation requires it, I want to be able to fill all motor requirements in the Field Artillery from vehicles which may be found on the streets of any American city and whose spare parts and accessories are found in a multitude of repair shops.

To my mind, it is most important that as many as possible of the Field Artillery motor vehicles in a Mechanized Force should be of the most common and numerous commercial types, as such a force cannot be encumbered with spare vehicles, special spare parts, and rolling repair shops, but should be equipped so as to get such replacements by foraging.

It is true that commercial vehicles rapidly procured from the existing stock in the country would probably be not as efficient for the particular purposes desired, but there would be no total absence of necessary vehicles.

For this reason, multi-wheel, multi-drive trucks and track adapters are being thoroughly tested. Following the development in tests of these vehicles, this office should be prepared to take a definite stand as to what classes of vehicles should be provided for all kinds of artillery purposes.

Trailers, medium. It is believed that this requirement can be met by the substitution of trucks for trailers, especially if the heavy artillery which uses this trailer becomes truck-drawn.

Trailers, kitchen and water. Kitchens and water trailers now in use are not entirely satisfactory. Some development work is being done along this line, but its progress is slow. Field ranges and water cans carried on trucks provide a workable substitute.

FIRE CONTROL EQUIPMENT

Aiming circles. The aiming circles on hand are partly French and partly American instruments, the former being superior though both are usable. A new and improved aiming circle has been developed and is now being tested.

B. C. Telescopes. The instrument is quite satisfactory, though as yet no satisfactory night lighting device has been furnished therefor. This project is in the hands of the Ordnance Department.

Field glasses. Field glasses of home manufacture have always been inferior to many made abroad. Several foreign made glasses are being tested by the Field Artillery Board. It is thought that an efficient glass should be developed in this country or that provision should be made for their purchase abroad.

Prismatic compasses. A compass superior to that now used can undoubtedly be developed, and this matter should be investigated.

Range finders. Stereoscopic range finders are now being tested in comparison with the present coincidence type.

Sound and flash ranging equipment. A sound ranging plotting board has been designed and a service test model is now being built. The design of this plotting board embodies features which are calculated to simplify the work and reduce the time necessary for the sound ranging unit to establish itself in action.

A flash ranging plotting board has been developed and is now being service tested. Preliminary reports indicate that, with minor modifications, it will be satisfactory for standardization.

Anti-aircraft fire control equipment. While the equipment now being used by the Coast Artillery for the control of anti-aircraft fire is highly efficient, the difficulties of manufacture are great. In its present form, it is wholly unsuited for Field Artillery use.

An effort to devise a simpler and less heavy equipment is under way.

SIGNAL EQUIPMENT

Radio sets. Three new sets of proven superiority have been adopted for the Field Artillery in the past year, and the entire program of development of radio equipment as it affects this arm is nearing completion. All active units will be completely equipped with these new hand generator sets in the near future.

A new type of radio telephone set is being developed for liaison and intra-battery communication.

Switchboards. Existing stocks consist of 4-line, 8-line, and 12-line boards which are usable, but not entirely satisfactory. Developments are in progress to improve these boards by mounting them in cabinets containing the operator's set and other accessories, and provided with folding legs for use when the board is in operation. Convenient means will be provided for connecting the field lines to the board. Models of the improved switchboard will soon be ready for service test.

A project has also been instituted for the development of an entirely new switchboard. This board will be made up in 6-line and 12-line units.

Telephones. The telephones, type EE-5 on hand, are fairly satisfactory, but developments now nearing completion will result, it is expected, in greatly improving them. In general, these improvements will provide a better and smaller hand generator, a better hand set, a commercial type of battery with increased capacity, and a more efficient induction coil.

Wire. Stocks on hand consists principally of eleven-strand field wire (W-40) and seven-strand outpost wire (W-44); however, a considerable quantity of the new wire type W-110 has been purchased during the past year.

Developments recently begun indicate a possibility of materially reducing the bulk and weight of the wire type W-110 by the use of a new type of insulation.

Wire-laying equipment. Reels for horse and motor draft are discussed earlier in this report under the heading *Reel, artillery* and *Reel, battery*.

A light wire-laying truck, equipped with a power take-off for recovering wire, is being developed and will be ready for test in the near future.

Hand axles, designed for laying wire by hand from commercial spools, are now being service tested as a replacement for the breast reel.

A new wire pack has been developed by the Signal Corps for laying wire from a pack animal. Each side load consists of a standard DR-4 spool of wire with a handle for reeling up wire. Two types of top load are provided. One consists of a DR-4 spool of wire and the other consists of a box for carrying switchboard and telephone. The Pack Artillery Board has also designed a third type of top load for this pack which consists of one of the new types of radio sets. With this top load, it is expected this pack will be found suitable for liaison details.

Signal lamp equipment. After several years of experimental work on the problem, the Signal Corps has developed a signal lamp which promises to overcome the defects of the present signal lamp equipment. Service test models of the new lamp will soon be ready.

Sound and flash ranging equipment. Considerable progress has been made in the development of sound ranging equipment during the past year. Microphones, having greatly improved response characteristics over the desired frequency range, have been developed and are now being service tested. In the near future, an improved switchboard embodying an amplification feature will be ready for test. It is hoped that this equipment will provide a satisfactory solution of this problem.

A project has recently been initiated for the development of an improved flash ranging switchboard.

SECTION V.—ORGANIZATION

Tables of Organization

During the past year, peace and war tables of organization for all Field Artillery elements in the Infantry Division were completely revised and submitted for approval. These tables were tentatively approved and recently returned for further revision in order to conform to the provisions of a War Department study

upon specialists' ratings now awaiting approval. It is expected that this study will be approved early in July, and that the revised tables will be returned for final approval within the same month.

New T/O 153 to 155, Sound and Flash Battalion (formerly Observation Battalion), were submitted and tentatively approved. It is understood that these tables will be returned in the near future for revision as regard specialists' ratings.

T/O 43 to 49. Regiment 75mm Gun, tractor-drawn (tentative) were completed and submitted for special use. It is contemplated that a somewhat similar organization will replace those now prescribed for light Field Artillery in G. H. Q. Reserve.

Changes in Organization

The 11th Ammunition Train, Hawaiian Brigade, and 12th Field Artillery Band were made inactive, and Hq. & Hq. Batteries, 1st and 2nd Field Artillery Brigades, were reduced eleven privates each, in order to provide one hundred and six grades and sixty specialists' ratings for the 4th Increment, Air Corps.

This office has kept in close touch with the Mechanized Force during the past year. I have personally visited it twice to witness field exercises. Other officers from this office have likewise visited it from time to time, and a member of the Field Artillery Board accompanied it on a march the Force made from Fort Eustis, Virginia, to Fort Bragg, North Carolina. It was also carefully observed by the Field Artillery Board during a two days' stay the Force made at Fort Bragg.

The Field Artillery's requirements of such a Force are now well understood, and efforts are being made to fulfill them. Up to date the Field Artillery contingent of this Force has been a single battery with some additional experimental armament and equipment by which the fire requirements of such a Force could be studied. The time has now arrived when the tactical features of the artillery contingent should be likewise studied, and in any future reorganization of the Force, the Field Artillery component should be increased to a battalion for this purpose.

H. G. BISHOP,
Major General, U. S. Army,
Chief of Field Artillery.

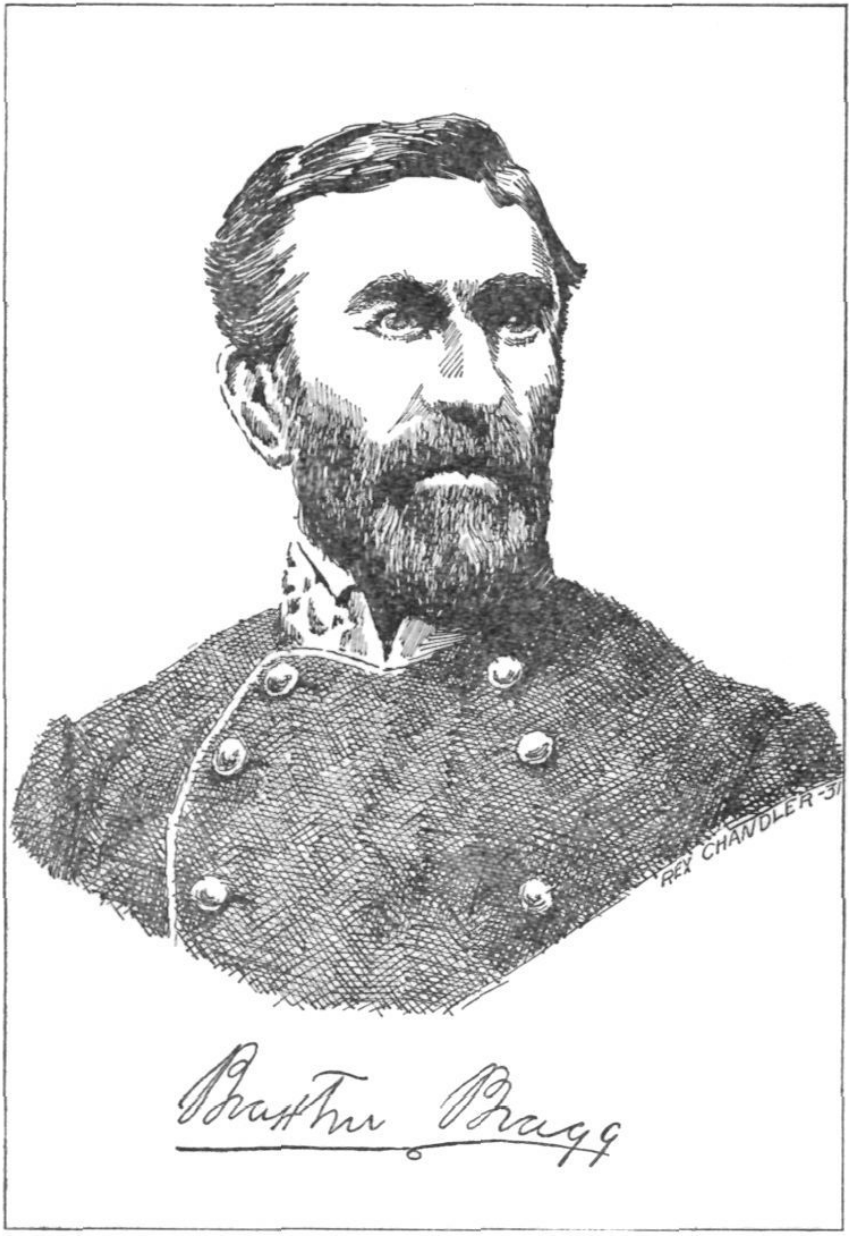
GENERAL BRAXTON BRAGG

BY LIEUT. R. T. BENNISON, F.A., D.O.L.

BRAGG was always a leader. He commanded the respect of his adversaries—a criterion of his ability even more illuminating than the judgment of his associates. Such a man—victorious or no—must always have a place in military history. To the student of artillery, his early days in the American Army are especially interesting and it is particularly from this point of view that this brief sketch of the outstanding artilleryman of pre-Civil War days is presented.

Bragg was born in Warrenton, Warren County, North Carolina on March 22, 1817. Both his father and mother were people of extraordinary energy and intelligence. His father, Thomas Bragg, Esq., a contractor, built the Capitol at Raleigh in 1830. His parents seemed to have shared the obvious virtues of their numerous offspring—twelve in number—six boys and six girls. All were educated at the excellent Warrenton Academy. Braxton, after finishing his course there, received an appointment to the Military Academy at West Point from General T. M. Hawkins, who was then the Congressman from the Warrenton district.

He entered the Military Academy in July, 1833, at sixteen years of age and was, with the exception of two, the youngest of a class of eighty-five. His classmates remember him as a tall, ungainly plebe, almost uncouth in manner but bright and engaging in conversation. He was marked from the beginning for his unbending integrity and independent spirit. Never known to hesitate in airing his opinions, the occasion or subject bothered him not at all. He had an utter disregard for the opinions of others and ever seemed conscious of his own righteousness. It is, consequently, quite natural that he felt free to approve or to condemn acts of others and it was also quite as natural that many of his classmates thought him boorish and rude to an extreme degree. To those, however, who enjoyed his closer acquaintance, these harsher traits of character disappeared, and he became to them, a brave, clever and generous companion. Each year as a cadet gained him more and more friends, until at graduation he was considered by the majority of his classmates the equal, if not


REX CHANDLER -31
Braxton Bragg

the superior, of any member of his class. Little trained in habits of study, he nevertheless ranked fifteen in his class his first year. Although he was not considered a laborious student, he managed to rank five in his class at graduation. Other members of this class, which had by this time been reduced in number to fifty, were Joseph Hooker, John Sedgwick, John C. Pembroke and Jubal A. Early.

Graduated in 1837, Bragg was commissioned Second Lieutenant and assigned to the 3rd Artillery at Fortress Monroe. Shortly after he was transferred to the ancient Spanish Fort Marion in Florida where the "Seminole War" was then in progress. This "war" consisted mainly in rounding up scattered bands of Indians and sending them West to the newly opened Indian territory. At this time the garrison of Fort Marion was composed of two companies of artillery, "E" and "G." In July, 1838, Bragg became a First Lieutenant in Company "E." Fort Marion was the Headquarters of the regiment commanded by Colonel William Gates, but as the Commanding Officer was seldom present at the post Lieutenant Bragg was Post Commander. In 1842 the Regimental Headquarters was shifted to Fort Moultrie in the Harbor of Charleston, S. C. Four Companies constituted the garrison there. It is interesting to note that Bragg numbered among his best friends in the garrison, William T. Sherman, George H. Thomas and J. F. Reynolds.

He was now about twenty-five years old with no particular cares or worries. Although the Mexican situation was brewing, the political condition of the country was tranquil enough for Bragg and his companions to live pleasantly and idly. Fort Moultrie itself was not particularly inviting, nor were the living conditions the best to be obtained, but the society was agreeable and pleasant. Nearby Charleston, always a social center of the highest rank in the South, heartily welcomed the officers of the garrison to their midst. Yet this life of comparative ease did not cause Bragg to relax his severe punctiliousness and sense of duty. An interesting story of this side of his character is told of Bragg and his Commanding Officer, Colonel Gates. He was always more or less at odds with this gentleman—in fact he took particular pains to remain on extremely official terms with him. One day, Colonel Gates desiring to break the ice, met Bragg in

their makeshift Officers' Club and attempting to greet him cordially said:

"Lieutenant Bragg, a glass of wine with you, Sir."

Lieutenant Bragg stiffly replied, "Colonel Gates, if you order me to drink a glass of wine with you, I shall have to do it."

Colonel Gates' response is not recorded.

In 1845 the independent state of Texas was annexed to the United States and it became necessary for President Polk's administration to take some military precaution against the manifest resentment of Mexico. General Zachary Taylor with practically our entire fighting force—some 3,500 men—was sent to Corpus Christi, Texas, to await developments. Included in his command was Bragg's battery of "Brass Napoleons," destined to bark a distinguished place into our history. General Taylor, after viewing the situation at Corpus Christi advised the administration that an advance to the Rio Grande was necessary. His advice was followed and on March 28, 1846, Taylor was entrenching himself in position near Matamoras. This concentration led Mexico to bring troops in considerable numbers to the vicinity and in a very short time the stage was set for the Mexican War.

On April 24, 1846, Captain S. B. Thornton with sixty-three cavalrymen was ambushed while on a scouting expedition. Sixteen were killed and the rest surrendered. Three days later, the camp of Captain S. G. Walker's Texas rangers was raided with a considerable loss in killed and wounded. About this time General Taylor heard a rumor to the effect that his stores at Point Isabel were threatened. This caused him to lead most of his force there, leaving the Fort in charge of Major Jacob Brown who retained under his command the 7th regiment of Infantry supported by Lieutenant Bragg's Company "E" of the 3rd Artillery and Captain Lowd's Company "I" of the 2nd. No sooner had Taylor departed than the garrison was attacked from Matamoras. Here Bragg's battery had its baptism of fire. The garrison, although greatly outnumbered, held out until the Mexicans, hearing of Taylor's return, raised the seige. Bragg's gallant work with his artillery during the seven days of the seige earned for him a brevet of Captain. Major Brown, the Commanding Officer, was mortally wounded during the battle and the fort which previously was named Fort Taylor was later renamed Fort Brown in honor

of its courageous defender. Brownsville, Texas, is situated on the site of the original Fort Brown.

Following the news of the attack on Captain Thornton, but still in ignorance of the fight at Fort Brown, Congress on May 13, 1846, affirmed without hesitancy, President Polk's proclamation of war. However, no particular effort was made to provide men or money for carrying on the war. The usual political complications followed. General Winfield Scott, a Whig and presidential possibility in the event of leading a victorious army home from war, construed a bill to provide two new Major Generals as an attempt to deprive him of his rightful place as head of the Army. It might be said that Scott's construction of the bill was accurate. In the deadlock that followed, Taylor was left to carry on the struggle. On August 20, 1846, he started his movement into Mexico with his entire force of about 6,700 men. One month later he was at Monterey ready for action.

Captain Bragg's fighting days now started in earnest. General Taylor had come to place great reliance on his artillery and by this time he was especially impressed with Bragg. On Sept. 21, the offensive against Monterey began with the main body attacking the upper town while a column of 650 men supported by Bragg's battery, attacked the lower town. The fighting in the lower town was much the more difficult as the streets were barricaded and the enemy was well protected in the stone houses. Bragg's artillery kept up a furious bombardment, but the light guns were rather ineffective against the well built walls. So stubbornly did the Mexicans fight that Taylor found it necessary to reinforce his troops in this section, whereupon the enemy promptly withdrew to the upper town. Here again they found excellent shelter and the fighting promised to go on indefinitely. Taylor, however, soon found a way of overcoming the stalemate by starting at the end of a block and going from house to house, breaking through as he went. The artillery meanwhile, had changed their tactics and were concentrating their fire on the streets. Thus caught between the infantry coming through their houses and the artillery pouring cannister down the streets, the Mexicans capitulated.

The fall of Monterey created a lull in Bragg's activities for several months. General Taylor made no further movement

pending instructions from Washington. General Scott had patched up his difference with the administration and as a result, was in Vera Cruz with the purpose of transferring the main operations to that sector. The plan was to attack the Capitol from Vera Cruz rather than follow the longer route chosen by General Taylor. Taylor was ordered to transfer the bulk of his force to Scott while he himself was to remain near Monterey with any regiment he might choose together with two batteries of artillery, Bragg's and Washington's, and a squadron of cavalry commanded by Major Charles May. However, before this plan could be put into effect, Santa Anna, the Mexican commander, decided that he had a golden opportunity to destroy Taylor's army.

Taylor's first intimation of Santa Anna's proximity came on February 1st, 1847, when Ben McCulloch, commanding the Texas Scouts, rode in on an exhausted horse with the news that the Mexicans, about twenty thousand strong, were less than a day's march away. Taylor immediately marched his army to Buena Vista, where he had previously made plans for an engagement. Here Bragg and Washington with their batteries supporting the 2nd Indiana Regiment were left while Taylor advanced to Saltillo, about six miles farther along. On the evening of the 22nd, after more or less movement between Buena Vista and Saltillo, the Battle of Buena Vista began. Bragg's battery was among

BRAGG AT MONTEREY

the first to be assailed. After the first few hours of fighting, the 2nd Indiana Regiment fell out of line leaving Bragg and his guns to shift for themselves. This they did extremely well—falling back so slowly and fighting so fiercely that the Mexicans were held in check until the arrival of Colonel Jefferson Davis and his Mississippi regiment. Davis was wounded almost immediately and after the first charge, that regiment too, fell back. Once more Bragg was left without protection. The intensity of the fighting for the next few moments was such that the outcome of the battle was in grave doubt. It was during this critical time that Bragg's name was immortalized. Perhaps the presence of General Taylor in the thick of the fighting and his words of encouragement spurred Bragg on. The stories of this encouragement vary—one historian stating that General Taylor in passing, advised, "a little more grape, Captain Bragg." Bragg, however, in recounting the occurrence later, states that such delicacy of expression was not customary in "Old Rough and Ready's" vocabulary, and that what he really did say as he dashed up was: "Double shot your guns and give 'em hell, Bragg." At any rate, Bragg's response was rapid and conclusive. With no foot troops to support him and almost face to face with the enemy, he fired an average of about two hundred and fifty rounds per gun, an amazing performance for the muzzle loaders of his day. This shower of "grape" from his guns was enough to turn the tide of the battle. With enormous losses in killed and wounded, the enemy turned and fled in utmost confusion—"the grape still pursuing." There is not the slightest doubt that this brilliant piece of work by Bragg enabled the Americans to defeat an enemy five times their number. General Taylor in his detailed report of the battle states in part:

"On regaining that position I discovered that our infantry had engaged a greatly superior force of the enemy, evidently his reserves, and that they had been overwhelmed by numbers. Captain O'Brien with two pieces had sustained this heavy charge to the very last and was finally obliged to leave his guns on the field, his infantry support being entirely routed. Captain Bragg, who had arrived just then from the left, was ordered at once into battery. Without any infantry to support him, and at the imminent

risk of losing his guns, this officer came rapidly into action, the Mexican line being but a few yards from the muzzle of his pieces. The first discharge of cannister caused the enemy to hesitate—the second and third drove him back in disorder and saved the day."

General Hooker in an account of Bragg in the West Point Graduates Annual says of the exploit: "These exalted words coming from General Taylor and their truthfulness and justice recognized by everyone on that field, would seem to fill the measure of military fame for this young officer to overflowing, as the writer can recall no instance in the annals of warfare, ancient or modern, where a young officer of the rank of Captain saved a pivot battle like that of Buena Vista. We all remember that his peerless conduct electrified the nation to its very center."

Although Scott's plan of conquest was carried through, Bragg was left with Taylor to guard the newly conquered territory and consequently no further opportunity for action presented itself. During this lull in his activities, the Government recognized his services by breveting him Lieutenant Colonel in addition to the brevet Majority he won at Monterey. The fighting around Buena Vista was finished but it made a deep enough impression on the country to make General Zachary Taylor the next President of the United States.

The close of the Mexican War was followed by a more or less confused period of readjustment during which Bragg remained with his battery. In 1849, after an extended leave of absence, he became Assistant Inspector General under General E. P. Gaines and shortly after was married to Miss Elisa Brooks Ellis, the

BUENA VISTA

daughter of a planter in Louisiana. In August of the same year he was returned to his regiment as Captain of Light Battery "C" quartered at Jefferson Barracks, Missouri. His duties there were varied by frequent inspection trips and court duty in the Indian Territory but his letters to his wife indicate that he was very dissastisfied with his lot.

In 1852 the election of Franklin Pierce and the appointment of Jefferson Davis as Secretary of War aroused high hopes in Bragg. He expected that as a result of his friendship with Davis that his own prominence would receive special consideration. This, not forthcoming, he resigned his commission in 1856. On leaving the Army, Bragg proceeded to carry out his long cherished ambition of becoming a planter, which he remained until the begining of the Civil War.

It is not contemplated to recount here the full story of General Bragg's part in the Civil War. However, no comprehensive understanding of the man can be had without pointing out his outstanding achievements in this great conflict. He made his first appearance in the Southern cause as an aid to the Governor of Louisiana, Thomas O. Moore. Although in earlier life he had ridiculed the though of an armed strife between the North and the South, he was now firmly convinced that a break was unavoidable and that the South should begin to put her house in order at once. In 1861, with war inevitable, President Davis selected Bragg to conduct a survey of the South's resources and gave him a commission as Brigadier General. He seemed to be one of the very few in the entire South who seemed to realize that no war could be waged successfully without adequate preparation. Soon after he was given command of all the troops in the vicinity of Pensacola. This increase in responsibility continued until 1862, when he was commissioned Major General and made Corps Commander and Chief of Staff under Albert Sidney Johnston. Following his excellent work at Shilo, Bragg was made a full General, the last of six such appointments in the Confederate Army. The others, in order of appointment were Samuel Cooper, Albert Sidney Johnston, Robert E. Lee, Joseph E. Johnston and Pierre Beauregard. On May 6, 1862, he was given command of what was known as the "Army of the Tennessee" and from then on became the "Stormy Petrel" of the Confederacy.

In June of 1862 he was ordered by President Davis to take over the command of the Department held by General Lovell in Mississippi. At the same time General Beauregard was taken ill and ordered home by his physician and Beauregard insisted that Bragg remain at his post and take over the command after his departure. Bragg, knowing the lack of a suitable commander for the Department, was thus given the choice of doing what he knew was right or ignoring the instructions given him by President Davis. Unable to communicate with Davis, Bragg decided to remain where he was and in due time was sharply reprimanded. However, after the circumstances were explained, he was congratulated on his excellent judgment and made the permanent commander of the department comprising the entire states of Mississippi and Alabama and most of the states of Louisiana, Georgia and Florida.

His first major operation after taking over Beauregard's command was the invasion of Kentucky in the autumn of 1862. In this he was partially successful, but was finally forced to retire and after the battle of Perryville on the 8th of October, retreated into Tennessee. The results of this campaign brought him bitter censure from the civil authorities. His junior officers too, smarting under the sting of his severe discipline, added to the growing demand for his removal from command. President Davis, however, after an investigation by General Johnston, declined to accede to the clamor and retained Bragg in command of his troops. He was in action almost constantly for the remainder of the year and the first part of 1863. His next great battle was Chickamaugua, September 19-20, 1863. Here he inflicted a

GUERILLA INFANTRYMAN CAVALRYMAN

MEXICAN TYPES—1846

crushing defeat on the Union forces and for a time beseiged them at Chattanooga. But Grant was concentrating enormous forces near the threatened spot and in the battle of Chattanooga on November 23rd completely routed the Confederate forces.

Sick at heart and embittered by the failure of his subordinates to live up to his high standard, Bragg asked for and received his relief. After two years, in which he had inflicted far greater damage on the enemy than he had received, his disposition had forced his retirement. The temperament which held the ragged, starving and defeated troops to General Robert E. Lee was not Bragg's. General Grant, in his memoirs, commenting on the fact of Bragg's retirement, had this to say of him: "Bragg was a remarkably intelligent and well-informed man, professionally and otherwise. He was also thoroughly upright. But he was possessed of an irascible temper and was naturally disputatious. A man of the highest moral character and most correct habits yet in the old army he was in frequent trouble. As a subordinate he was always on the lookout to catch his Commanding Officer infringing his prerogatives and as a Post Commander equally vigilant to detect the slightest neglect of even the most trivial order. I have found in the old Army annals an anecdote very characteristic of Bragg. On one occasion, when stationed at a post of several companies commanded by a field officer, he was himself, commanding one of the companies and at the same time acting as Post Quartermaster and Commissary. He was a First Lieutenant at the time but his Captain was detailed on other duty. As Commanding Officer of the Company, he made a requisition on the Quartermaster—himself—for something he wanted. As Quartermaster, he declined to fill the requisition and indorsed on the back of it his reasons for so doing. As Company Commander he responded to this saying that his requisition called for nothing but what he was entitled to and it was the duty of the Quartermaster to fill it. As Quartermaster he still insisted he was right. In this condition of affairs, Bragg referred the whole matter to the Post Commander. The latter, when he saw the nature of the matter, exclaimed, 'My God, Mr. Bragg, you have quarrelled with every officer of the Army and now are quarrelling with yourself.'"

Following his relief from command, Bragg, with his wife, retired to Warm Springs, Ga. For the first time since he had

taken up arms for the Confederacy, he rested—but not for long. Bragg's special attainments led President Davis to call him to Richmond in February, 1864, to serve as Chief of Staff of the Confederate Army. As such, he held no direct command but could—and did—act as the Chief Military adviser to President Davis. With his customary energy, he immediately reorganized the War Office at Richmond. From then on until November, in addition to the routine duties of his office, he was frequently called upon to act is a mediator between the troops and the administration in the disputes that were occurring with alarming regularity in the Southern forces.

In November of 1864, Sherman's boldness completely bewildered the Confederate Military authorities. President Davis now assumed personal/ direction of all military affairs and ordered Bragg to "direct and assemble all available forces to stop Sherman." Sherman, however, was not to be stopped. After this fruitless attempt, Bragg then joined Johnston and was thus included in the surrender of that officer to Sherman. He was immediately paroled by the Union troops and at once set off for Mobile where he made his home.

The eleven years of life left him were calm and uneventful. He first took up the profession of civil engineering and for four years acted as Commissioner of Public Works for the State of Alabama. For several years thereafter he was Chief Engineer of the Gulf, Colorado and Santa Fe Railroad and finally was with the State of Texas in aiding the progress of the railroads being built under land grants.

On September 27, 1876, this great soldier died suddenly in Galveston, Texas. The respect and esteem of the United States for General Braxton Brass is manifested in the great permanent Field Artillery post in North Carolina, which bears his name.

GENERAL LASSITER RETIRES

ON September 31, 1931, Major General William Lassiter retired for age. The Field Artillery thereby loses a most distinguished officer and great leader. He leaves behind him an enviable record of service and accomplishment and he ever commanded the respect of all with whom he came in contact.

General Lassiter was born in Petersburg, Virginia, in 1867 and in 1885 he was appointed a Cadet at the United States Military Academy, graduating in 1889. Upon graduation he was commissioned a Second Lieutenant of the 4th Artillery. With the exception of a detail in the Inspector General's Department and duty as a Staff officer, his entire service through the various grades including the rank of Brigadier General, was in the Artillery. He completed the course at the Artillery School in 1894 and at the School of Fire for Field Artillery in 1913.

General Lassiter's service has been with the 1st, 3rd, 4th, 5th and 6th Field Artillery and among other things includes a tour of duty as an Instructor of Tactics at West Point, service in the Inspector General's Department and duty as a member and recorder of the Field Artillery Board.

During the Spanish-American War he was recommended to be a brevet captain for gallantry in action at Santiago de Cuba July 2, 1898.

His experience outside the continental limits of the United States has been unusually varied. He has served in the Philippine Islands three times. He was Inspector General of the Cuban Pacification in 1908 and 1909. In 1910 he visited China, Japan and Korea on leave. Together with other officers he attended the German Maneuvers in 1911, and on that trip abroad also made a study of the French and British military organizations. He was a member of the Vera Cruz expedition in 1914. In 1917 General Lassiter was Military Attaché at the American Embassy in London and later commanded all of the United States troops in England. During the World War he was with the A. E. F. From 1923 to 1926 he commanded the Panama Canal Department. In 1926 he sailed for South America as President of the Plebiscitary Commission on Tacna-Arica. Later that same year he again visited Continental Europe.

MAJOR GENERAL WILLIAM LASSITER

General Lassiter has also had extended service in Washington. In 1908 he came to Washington for a short tour of duty in the Office of The Inspector General of the Army. In 1911 he returned and served in the Office of the Chief of Staff. In 1913 he accompanied the then Secretary of War, Henry L. Stimson, on tours of inspection of Western posts. General Lassiter returned to Washington in 1919, and served on the War Department General Staff, acting as Deputy Chief of Staff for a period of two months. During the years of 1922 and 1923 he served as Assistant Chief of Staff, in charge of Operations and Training.

During the World War he rose to the grade of Major General and participated in the Champagne-Marne and the Aisne-Marne defensives and the St. Mihiel offensive. In the A. E. F. he commanded Base Section No. 3, Line of Communications; the 51st Artillery Brigade of the 26th Division; the Artillery of the First Corps, Fourth Corps, and Second Army; and the 32nd Division during that organization's march to the Rhine.

Since the World War General Lassiter has commanded the Basic School for Field Artillery at Camp Knox, Kentucky, the Panama Canal Department, the Sixth Corps Area, the Philippine Department, the Eighth Corps Area and the Hawaiian Department.

General Lassiter was awarded the Distinguished Service Medal by our Government with the following citation:

> "For exceptionally meritorious and distinguished service. As commander of the 51st Field Artillery Brigade, as Chief of Artillery, Second Army, he showed himself to be a leader of conspicuous ability. His energy and sound judgment influenced greatly the successful operation of his commands on the Vesle, at the St. Mihiel salient and in the Toul Sector; he later commanded with skill and marked success the 32nd Division."

He was also awarded the Order of St. Michael and St. George by Great Britain, the Legion of Honor and the Croix de Guerre (with two palms) by France. The latter citation is as follows:

> "He showed brilliant qulaities in controlling combined action of French and American artillery placed under his command and he obtained remarkable results."

FIELD ARTILLERY R. O. T. C. AT OREGON STATE COLLEGE

BY F. W. BOWLEY. MAJOR, F. A.

MILITARY instruction at Oregon State College, Corvallis, Oregon, dates from 1872 when the United States granted the State of Oregon certain tracts of land for the promotion of agriculture and the mechanic arts. From that time to the present, the

THE ARMORY AT CORVALLIS

Military Department has been a growing concern and its product has improved in quality and increased in quantity. Infantry instruction was practically all that was given up to the period of the World War, although at times there were detachments of artillery, engineers and signal corps under instruction.

The pre-war instructors were varied and we find civilians, retired officers, National Guard officers and a few regulars functioning as Commandant of Cadets. The outstanding figure of the before-the-war era was Major U. G. McAlexander, Inf., to whose efforts we owe the fine armory and drill hall now occupied by the present R. O. T. C. General McAlexander left more than a dedicatory tablet on the corner of the armory—his magnificent

war record and his "Rock of the Marne" esprit is still an inspiration to students and an established campus tradition.

During the war the Students' Army Training Corps was established and numbered upward of three thousand students. On January 1, 1919, the R. O. T. C. was established and Infantry, Field Artillery, Engineer, Motor Transport and Cavalry Units were organized. The Motor Transport and Cavalry Units have since been discontinued. Col. W. H. Patterson, Inf., is the present P. M. S. & T.

The Field Artillery R. O. T. C. was established as a battalion of three batteries, which organization was maintained until the fall term of 1928, when it was increased to a light regiment, less headquarters and service batteries. Freshmen are privates, sophomores are corporals and privates first class, Juniors are sergeants and seniors are cadet officers. The following officers have acted as Director of the unit during its development:

Major E. C. Hanford, F. A., 1919.
Major W. F. Sharp, F. A., 1919-21.
Major W. F. Winton, F. A., 1921-24.
Major H. R. Odell, F. A., 1924-28.
Major F. W. Bowley, F. A., 1928-date.

Other Field Artillery officers on duty at present with the unit are Capt. N. J. McMahon, Capt. M. E. Scott, and 1st Lt. G. A. A. Jones.

Military instruction is compulsory for all able bodied American-born students for two years, and is a requirement for graduation. Advanced training is elective. There is no doubt in the minds of the college authorities of the value of the Military Department to the college, and the R. O. T. C. is loyally supported by the President and the faculty. The fact that the bulk of the student body comes from solid American families removes all the unpleasant elements that prevail in many other institutions of learning and frees the R. O. T. C. from the attacks of the antagonists of military training. The student body is proud of its R. O. T. C. and enjoys the work. There is no difficulty in filling the quota of advanced students, the enrollment this year being in excess of the allocation by Corps Area, necessitating the rejection

R. O. T. C. BATTERY AT FORT LEWIS SUMMER CAMP

of desirable students. This year the unit consists of 456 basics and 94 advanced students, or a total of 550.

Training is with the horse drawn French 75mm materiel. Basics receive four hours a week and advanced students five hours a week of military instruction. The acid test of the character of the student training comes from the comments of officers on Reserve duty and older Reserve Officers who contact young graduates at their summer camps. The way that the new Reserve

OREGON STATE STUDENTS AT AN O. P.

Second Lieutenants have fitted themselves into their Reserve regiments and the professional enthusiasm evidenced by them leaves no doubt that these young officers are qualified. Needless to say, there is a well established liaison between Reserve units in the Pacific Northwest and the Field Artillery Unit of Oregon State College, and an annual spring visitation on the part of Regular Army executives of Reserve regiments results in personal contact with the prospective graduates and greatly facilitates their absorption into the Reserve.

In the summer preceding senior year, the advanced student spends six weeks in the R. O. T. C. camp at Fort Lewis, Washington. A battery of the 10th F. A. stationed at that post acts as associate unit for the R. O. T. C., and to the everlasting credit of the 10th F. A. let it be noted that they have always given their best. But, instead of causing work, the R. O. T. C. has endeavored to relieve the associate unit by caring for their animals and materiel whenever they used them. A little consideration along these lines on the part of the officer in charge of the R. O. T. C. can create a very sympathetic attitude on the part of the members of the associate battery. The summer training is essentially practical — artillery draft, service practice, road marches, camps and bivouacs and tactical problems forming the bulk of the work. Athletic and recreational activities are emphasized, and the summer always includes week-end trips up the beautiful slopes of Mount Ranier and a wonderful boat trip as guests of the Navy up Puget Sound to the Bremerton Navy Yard.

Although our horses grow older year by year, their quality is surprisingly good. Polo is a recognized minor sport. Captain Norman J. McMahon. F. A., and the writer act as coaches for polo. Due to climatic conditions, much of our polo training is in the indoor game and we are fortunate in having one of the finest indoor fields in the country. The posts of Vancouver Barracks and Fort Lewis, civilian and National Guard teams in Portland and Seattle, and a most wholesome rivalry with our associates at Stanford University furnish our polo competition.

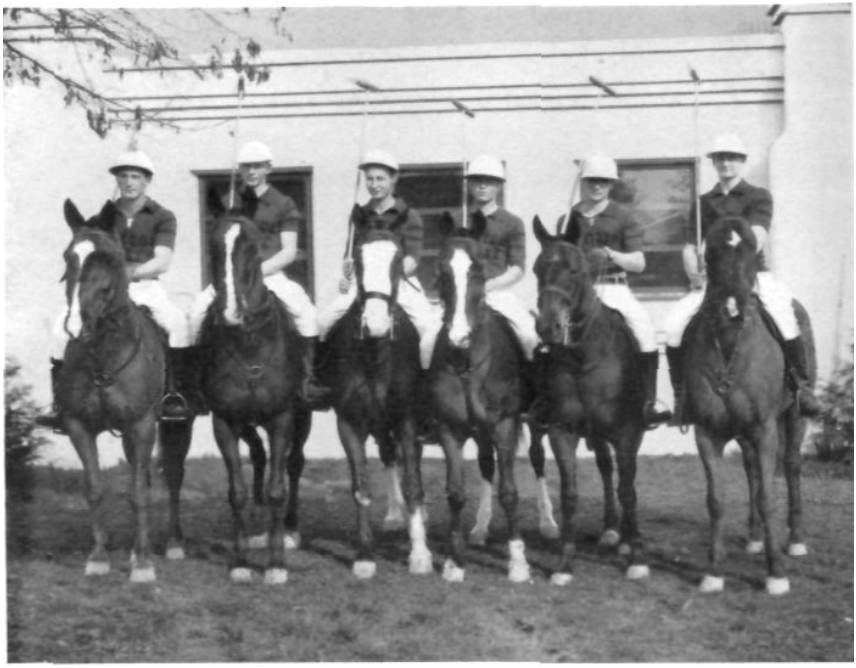
The underlying principle of the F. A. R. O. T. C. at Oregon State is the development of responsibility on the part of the cadet

and the full opportunity for cadet officers to exercise command and initiative. Both at college and in camp, students conduct all drills. On "unit days," so-called, cadet officers train their batteries or battalions, and the only contact that the Unit Director has with the cadet regiment is through the medium of the cadet colonel. This young officer has his Executive Officer, Adjutant, etc., and they issue all orders and prepare all training schedules. Cadet officers have full responsibility for the efficiency of their units and select their own N. C. O.'s. They are never corrected in front of their men. From the start they know that the unit is theirs, not mine. This principle ties in with the principle of senior

CHOW LINE AT THE CAMP ON MOUNT RANIER

control of all campus activities and fosters that very desirable condition. In the classroom, cadet officers are treated as such and in the past three years no one has ever taken advantage of that treatment. Another idea that is emphasized is that in event of an emergency, the young reservist must be able to instruct a cross-section of the American population; therefore he must be able to give his instruction in simple understandable language, in words of one syllable rather than in the technical language of the training regulations or text. At no time do we lose sight of the fact that our mision is primarily to create Second Lieutenants for the Reserve.

BATTERY STREET, R. O. T. C. CAMP, FORT LEWIS



GROUP OF OREGON STATE COLLEGE POLO PLAYERS

The military honor society of Scabbard and Blade maintains an excellent chapter here. The chapter grants awards to outstanding basic students, and sponsors the Military Ball, one of the leading social events of the college year. They do much to promote interest in National Defense and to overcome the influence of antagonistic groups. All officers on duty are associate members, but we do not forget that the chapter belongs to the students and that they must run their own organization.

The Physical Education Department at Oregon State has adopted the organization of the Military Department as a basis for their intramural athletic competition. Inter-battery and company basketball and baseball games are especially heavily contested and do much to develop unit spirit.

In closing this article, the peculiar relationship on matters other than military between officer and student is worthy of mention. The student does not regard his officers as preceptors or pedagogues, but as older men of wider experience and of mature judgment. He freely asks for advice on all sorts of topics and receives close attention and the best possible answer, and his confidences are never violated.

TYPE PROBLEMS

These three gunnery problems, fired at the Field Artillery School, are examples of procedure in conduct of fire approved in the New T.R. 430-85, Field Artillery Firing. These elementary problems are the beginning of a new series to be published in the FIELD ARTILLERY JOURNAL concurrent with the firing instruction at the Field Artillery School this year.

Axial Precision

Target Description: Concrete O. P. *Mission*: To destroy. *Materiel*: French 75 mm, Model 1897. *Visibility*: Excellent. *Wind Direction*: Right to Left. *Initial Data Obtained*: Deflection, Shift–Field Glasses. Range, estimated.

Initial Commands:
No. 2 adjust
B. D. Rt. 180
Shell Mark 1
Fuze short
No. 2
1 rd.
Quadrant.

Commands		Elev.	Rd. No.	Sensings	Remarks
		190	1	?	13 mils left of target.
Right 15		190	2	+	Very near target range. F=7 mils.
		176	3	–	
		183	4	–	
	3 rds.	187	5	+	Mean deviation of rounds fired at
			6	–	187 is 2 mils Rt.
			7	?	
	4 rds.	187	8	–	
			9	–	2 overs, 4 short.
			10	–	Fork equals 7.
			11	+	Adj. El. equals 187+(2/12×7) equals 188.2.
Right 2	6 rds.	188.2	12	+	
			13	+	
			14	–	
			15	+	
			16	–	4 overs, 2 shorts.
			17	+	Adj. El. equals 188.2—½ (2/12×7) equals 187.6.
		187.6	C.F.		

SUMMARY

Errors in initial data: Deflection 13 mils; first shift in deflection 2 mils; Range 37 yards or .7%. Ammunition expended 17 rounds. Classification: Satisfactory.

General comments: An excellent problem, well handled throughout. B. C. showed good judgment in reducing range bound to 2 forks after observing 2nd round at 190. Note that deflection was maintained slightly to windward until adjusted elevation was obtained and then center of impact placed on target.

Axial Percussion Bracket

(See Par. 82, T.R. 430-85)

Target Description: Battery firing effectively. *Mission*: To neutralize. *Materiel*: French 75mm gun, Model 1897. *Visibility*: Very Good. *Wind Direction*: Left to right. *Initial data obtained*: Deflection by aiming circle compass.

Range estimated: r=3000, R=3200, Compass 3700.

Initial Commands:

Compass 3700
On No. 2 open 5 (DD 5 greater than for parallel fire)
Site+5
Shell Mark I
Fuze long
Battery Right.

Commands	*Range*	*Sensing*	*Remark*
	3200	——45 mils—— 15 mils X X X X	——20 mils—— Δ Δ Δ Δ	No range sensing.
Rt. 35 on No. 1 close 8	3200	Δ Δ Δ Δ X XX X	All sensed short for range.
	3600	X X X X Δ Δ Δ Δ	All sensed over for range.
No. 3 Lt. 6	3400	Δ Δ Δ Δ X X X X	All sensed short.
	3500	X X X X Δ Δ Δ Δ	All sensed over.
Btry. 1 rd. Zone 3500—3400			
		Cease firing, end of problem.	

SUMMARY

Errors in initial data: Deflection, 35 mils; range, 250 yards or 7.8%. Time from identification of target to announcement of first range, 1 minute, 40 seconds. Average sensing and command: 6.5 seconds. Total time for problem: 5 minutes, 38 seconds. Ammunition expended, 20 rounds. Classification: Satisfactory. General Comments: The battery commander opened fire with four guns with a sheaf opened 5 mils from parallel fire in the hope of getting a range sensing on the first salvo. He failed to do so, but since the shift is small he is justified in closing the sheaf to the width of the target. He would have saved ammunition by opening fire with one gun and bringing in the battery when he split a 400-yard bracket. Since the data are estimated, this would have been better procedure. After No. 2 gun is seen to be out of its place in the sheaf in two salvos the battery commander is justified in making an individual correction.

Axial Percussion Bracket

Target Description: Trench Mortar on gentle reverse slope, near bush, firing effectively at our troops. *Mission*: Neutralize. *Matériel*: French 75mm gun, Model 1897. Visibility: Fair. Wind Direction: L. to R. Initial Data Obtained: B. C. Scope and good range finder. O. P. well above battery.

Initial commands:

Aiming Point lone tree right rear
P 6 D 120
On No. 1 open 10
Site plus 5
Shell Mark I
Fuze short
Battery Right

Commands	*Range*	*Sensing*	*Remarks*
	3000	x x Δ x x	No. 2 short, width of sheaf, 15 mils.
Lt. 3 on No. 2 cl 5	3200	x x x x Δ	All over
On No. 2 open 8 Battery 1 round Zone	3000-3200		Should have opened 10.
		Cease firing, end of problem.	

SUMMARY

Error in initial data: Deflection, 3 mils. Range, 100 yards or 3.3%. Time from identification of target to announcement of first range, 2 min. 50 sec. Average sensing and command, 8.4 sec. Total time of problem, 4 min. 39 sec. Ammunition expended, 8 rounds. Classification: Satisfactory. General comments: The Battery Commander opened fire with a deflection difference 5 mils greater than that for parallel fire in hopes of getting a range sensing. He succeeded, and then shifted the piece nearest to its proper place and closed the sheaf in order to get observations on all four bursts. He then opened the sheaf to the maximum front which a 75mm battery can cover effectively and fired for effect. Since he had only one observation at 3000 and four at 3200 he started fire for effect at the short limit in order to obtain early verification of this limit. The sheaf for effect was 6 mils or 18 yards; too narrow.

HEAVY ARTILLERY VS. ROCKETS

BY M. A. STUART, CAPT., F. A.

IN this paper the subject of heavy artillery will be touched upon but lightly. As the result of past wars in which this country has become involved, there are official statistics on costs in man hours, machine equipment, and time required to build a single piece of heavy artillery. The cost of transporting (by rail and sea) a battery, battalion, or regiment, of heavy material is a function of weight and mileage. The great over-head necessary to maintain a single heavy regiment in the theatre of operations is a result of experience and a matter of regulations and record.

The last war taught us that the United States can organize, train, and transport troops of a superior sort at a rate which leaves far behind any program for the manufacture of guns—particularly of the heavier calibres.

America's Munitions Report, 1917-19, by Benedict Crowell, Assistant Secretary of War and Director of Munitions, tells us:

"The declaration of war found an American Ordnance Department whose entire commissioned personnel consisted of 97 officers. Only 10 of this number were experienced in the design of artillery weapons. The projected army of 5,000,000 men required 11,000 trained officers to handle every phase of ordnance service. While a portion of this production would have to do with the manufacture of articles of a commercial type, such as automobiles, trucks, meat cans, mess equipment, and the like, yet the ratio of 10 to 11,000 gives an indication of the amount of ordnance knowledge possessed by the War Department at the outbreak of the war as compared to what it would need to equip, with artillery, the first 5,000,000 men for battle.

The Government could obtain commissary officers from the food industry; it could turn bank tellers into paymasters, or convert builders into construction quartermasters; find transportation officers in the great railway systems, Signal officers in the telegraph companies, or medical officers in professional life. But there was no broad field to which the Ordnance could turn to find specialized skill available. The best it could do was to go into the heavy manufacturing

industry for expert engineers who could later be trained in the special problems of ordnance."

Every military power is always striving by the aid of its best engineers, designers, and manufacturers to get a stronger gun, either with or without a heavier projectile, but in every case striving for greater power. As a special development we find in March, 1918, the now famous long-range gun of the Germans, which was at that time trained upon Paris, where it successfully delivered a shell approximately 9 inches in diameter, punctually every 20 minutes for a good part of each day until the gun was worn out. This occurred after a comparatively small number of shots, probably not more than 75 in all. The rapid wearing out was due to the immense demands of the long range upon the material of the gun. The Germans in the shelling of Paris used three of these long-range weapons and 183 shells are known to have fallen in the city.

The Germans evidently calculated with great care and experience the factors leading up to this famous long-range type of gun, which had a range of approximately 75 miles. In this connection it is interesting to note that the great French ordnance works at LeCreusot in 1892 produced the first known long-range gun, which was constructed from the design of a 12-inch gun, but bored to throw a 6-inch projectile. And instead of the usual 8 miles expected from the flight of a 6-inch shell this early Creusot long-range gun gave a range of approximately 21 miles with a 6-inch projectile, using a 12-inch gun's powder charge.

Closely connected with the development of the gun itself, and a necessary element of the gun's successful use, is the requirement that the weapon itself be transported from point to point, where its available range and capacity for throwing the projectile can be made most effective against the enemy. Then, too, the gun carriage must have stability in order to withstand, absorb, and care for the recoil energies let loose by the firing of the gun.

So, after finding a gun, a carriage must be constructed for that gun, as well as a recoil and counter recoil mechanism, and an aiming device—all requiring designing, and men, and money, and machines, and time. All operations connected with the life of a gun, its manufacture, its transportation to the place where it is to

be used, its aiming its loading and all its functions are bound up in the single purpose of actually firing the shot.

Let us look at the life of one of our 14-inch guns—in the steel mills it requires thousands of workmen to constitute the force necessary to handle the masses of steel through the various processes which finally result in the finished gun.

From the first operation in the steel mill it requires perhaps as long as 10 months to produce the gun ready for the first test. During the 10 months of manufacture of one 14-inch rifle there has been expended for the gun and its carriage approximately $200,000. Of course, while it requires 10 months to make a final delivery of one gun after its first operation is commenced, other guns are following in series and in a well-equipped ordnance factory two and perhaps three guns per month of this kind can be turned out continuously, if required.

Remembering now that it requires 10 months to produce one such 14-inch rifle and that its whole purpose is to fire, consider now the time actually required in firing. As the primer is fired and the powder charge ignited the projectile begins to move forward in the bore of the gun at an increasingly rapid rate, so that by the time it emerges from the muzzle, it has taken from a thirtieth to a fiftieth of a second in time, depending upon velocity of the projectile and length of the gun.

Assuming that a fiftieth of a second has been taken up and that the life of a large gun at a normal rate of firing is 150 rounds, it is obvious then that in the actual firing of these 150 shots only three seconds of time are consumed. Therefore, the active life of the gun, which it has taken 10 months to build, is but three seconds long in the actual performance of the function of throwing a shot.

However, after the gun has fired its life of 150 shots it is a comparatively simple matter to bore out the worn-out liner and insert a new liner, thus fitting the gun again for service, with an expenditure of time and money much less than would be required in the preparation of a new gun.

As the size of the powder charge decreases, a progressively longer life of the walls of the bore of a gun is attained, so that we have had the experience of a 75-millimeter gun firing 12,000 rounds without serious effect upon the accuracy of fire.

The number of workmen employed in gun production at once in this country totaled 21,329, and fully that many more are estimated to have been employed in the manufacture of gun carriages and fire-control instruments. Consequently in turning out the complete big guns there were fully 42,000 workmen engaged by the month of October, 1918—as well as vast quantities of machine tools and shop space.

The approximate cost of certain types of guns *without* carriages, and of relining is taken from the Handbook of Ordnance Data No. 1861.

Type	*Cost*	*Estimated Relining Cost*
75mm gun, model 1916	$3,800	$1,500
5-inch antiaircraft gun	5,000	2,000
4.7-inch gun, model 1906	7,600	2,300
155mm howitzers	7,700	2,500
155mm (Filloux)	13,000	4,000
240mm howitzers	18,000	5,400

The estimated cost of the carriage and sighting equipment is practically that of the particular gun for which it is made.

No mention will be made of the cost for personnel, equipment, spare parts, and training that must be necessary to make four pieces of artillery into a mobile battery, capable of transporting at least some of its ammunition, and its personnel—to enable it to bring "effective fire to bear on the appropriate target."

Those who have given the matter a thought know that the sum is tremendous.

ROCKETS

Before preparing this paper, the writer had no idea of the scarcity of material that exists—(particularly in English) on the design and construction of rockets.

The editor of the *Scientific American* in a personal letter says: "There is a large literature on rockets, mostly in German. Scherschevsky's Die Rakete, has a bibliography of 55 titles, nearly all in German, and referring to publications you would not be likely to find in this country, even in large libraries." (He sent a copy of Die Rakete and attempts are being made to translate portions of it.)

Professor James Randolph, formerly of the Rhode Island State College, now a Mechanical Consultant, Cambridge Massachusetts, has looked into the subject of rockets from the angle of military use.

In answer to a letter, Professor Randolph states in part:

"The only real publication I know on high altitude Rockets is a paper by Dr. Robert H. Goddard, published by the Smithsonian Institute in 1919. Dr. Goddard, is, as you know, the American pioneer in this field. I believe he is now somewhere in Texas, carrying on experimental work with a grant from the Guggenheim fund.

"Dr. Goddard carried out some experiments on military rockets during the war. My understanding was that their accuracy compared favorably with that of artillery at the same range. While I have never worked this out in detail, I should say, off hand, that the total weight of a rocket the size and range you mentioned would be not much greater than that of a comparable artillery shell and power charge. For starting, I'd recommend a mortar, giving the rocket an initial velocity of, say, 500 ft. per second, and the whirl caused by the rifling. The design of a rocket using smokeless powder, should be well within the ability of modern engineers.

"For a given diameter, the amount of T. N. T. would be about half as great as for an airplane bomb. The great weight of the rocket is in its propelling charge. In competition with artillery, the rocket's advantage is the lessened weight of the heaviest unit, adapting it to jungle and mountain warfare, and other situations where transportation is difficult. Small rockets, of short range, could be carried forward by the infantry, which might be an advantage in some situations.

"But the big field of the rocket, as compared with heavy artillery, is due to its unlimited size and range. There is no limit on the diameter, since other means of whirling could be devised, or gyroscopes used. And whirling is the chief function of the mortar. Rockets carrying a thousand tons of poison gas and T. N. T. are no more impossible than steamers of equal capacity were a hundred years ago. It is all a matter of engineering.

"As to range, that depends on the jet velocity obtainable. A rocket's action, as you know, depends on the simple momentum equation. MV = mv, where large letters apply to the rocket's mass and velocity and small ones to the gas jet from the nozzle. But all the velocities are strictly relative. Thus, if a rocket is going 10,000 ft. per second, gas issuing at 5,000 ft. per second

will increase its speed just as much as the same gas would do if it were standing still. Hence the speed and range of the rocket are by no means limited by the velocity of the gas. It is theoretically possible to build rockets that could attain a speed sufficient to escape the earth's gravitation entirely (seven miles per second). Such a rocket could go to the Moon or Mars. It could be discharged from Krasnoyarsk and land in New York City. A pilot could go along to direct its flight, escaping in a small airplane as the rocket returned to the air.

"The difficulty here is that the ratio of speed and gas velocity enters into the exponent of the equation that gives the relative weight of the propelling charge. (I can give you the mathematics if you desire). Hence, doubling the speed does not double the weight of the charge. It squares it. Doubling the jet velocity does a whole lot more than cut the weight in half.

"The problem of getting the greatest possible gas velocity is Dr. Goddard's principle problem now. With smokeless powder, I understand, he was able to get as high as 8,000 feet per second; with a mixture of oxygen and hydrogen, 12,000 feet. But all these results are several years old. Goddard doesn't talk much about his work, only he's able to give it all his time now." Attempts are being made to secure a copy of the Smithsonian paper).

On writing to Doctor Goddard, who is now experimenting on rockets near Roswell, New Mexico, he was rather non committal at this time, due in part to the nature of his present experiments. He did say, however, "The most suitable form, particularly from long range point of view, will, I believe, depend on my present experiments, which are not completed in so far as actual long range work is concerned."

In answer to another question on design, Doctor Goddard states: "I believe I can answer that best by considering the proportions, by weight, to be expected of an efficient rocket. Thus, for a 20,000 yard range, I should say that the propellant would constitute 28 per cent of the total weight, and the rocket proper 20 per cent of the remainder.

"Thus, of a 100 lb. combination rocket-shell, 28 lbs. would be the weight of propellant, about 14 lbs. the weight of the rocket, and about 58 lbs. the weight of the shell, including both T. N. T.

and its container. It is very probable that a more extensive research will result in an even lighter rocket for the given weight of propellant."

Doctor Goddard continues in reply to another question: "I do not believe the dispersion would be great, if the necessary ballistic factors were taken into account." "———the flight of a properly designed rocket is not erratic, a thing not true of the war rockets of Revolutionary days. The mounting can be simple and light, a tube or frame would be adequate."

Looking up the history of rockets, very little is found aside from the use of them in pyrotechnics and so called "fire works."

That such tests were carried out in earlier days is borne out by a translation from Kreigstechnische-Zeilschrift, Jahrgang XVI—No. 5, translated by Captain John N. Hodges, C. of E., U. S. Army in 1913:

"The starting point for these tests was the ordinary rocket which is driven into the air by means of its expanding gases, the long wooden staff serving as a rudder. These rockets have been employed in war for centuries. The ordinary rockets provided with a long wooden staff are very difficult to use in modern field operations. Among the objections encountered, the following may be named: the transportation is difficult, the firing under certain circumstances is dangerous and the results obtained are insignificant."

The Historie des Fusees de Guerre, Paris, 1841, contains a number of wood cuts clearly indicating early methods of discharging rockets and pyrotechnic arrows against hostile ships and troops. The rockets used were huge in size and of the type known to us as boys for use on the Fourth of July, and by no means instruments of precision.

The Encyclopaedia Britannica, page 433, Volume 23, indicates that a rocket is:

> "A cylinder of paper, pasteboard or metal filled with an explosive mixture. This word which appears in many forms in various languages is from the Italian—'rochette,' a diminutive of 'racca,' a distaff, the obsolete English 'Rock'; the application is due to a resemblance in shape. Rockets are

used in pyrotechny for the purpose of display, scattering showers of stars, colored balls, etc., on bursting."

Nothing there to assist us—at least from a military point of research. But—looking more into history we find that: before 1805 Sir William Congreve, British inventor, suggested that rockets might be used to good effect in attacking cities, fortifications, or fleets of ships, and to him we owe much of our modern conception of the uses to which rockets may be put. Previously the rocket had been only a pretty product of the pyrotechnist's art, suitable for displays at celebrations. He perceived in the recoil principle that drove these fiery toys, a force that could be turned to the uses of mankind, and since England was at that time embroiled in wars across the channel, his mind naturally linked rockets with military operations.

Carrying on earlier experiments made by General Desaguliers at the Woolwich Laboratory, Congreve mastered the rudiments of rocket-craft, as it was understood in his day, and set himself to the task of making a rocket capable of carrying an explosive or incendiary charge and having a range of two miles or more. At length, he obtained permission for the construction of several rockets after his design in the Royal Laboratory. Military authorities were impressed and preparations were made to try out Congreve's scheme in actual battle.

When Sir Sidney Smith's expedition went against Boulogne in 1805 it included a number of boats equipped with rockets and apparatus for firing them. Congreve himself went along and participated in the subsequent attack against the French flotilla, but rough weather prevented the use of rockets in the battle. The following year, however, they were used in another attack against Boulogne and were credited with doing considerable damage. In campaigns in 1807, 1808 and 1809, they were used on land and afloat at the siege of Copenhagen, in Lord Gambier's fight on the Basque Roads and in the Walcheren Expedition.

So successful were they in competition with the undeveloped artillery of the day that Congreve predicted that in a few years rockets of an improved design would supersede cannon entirely. Unfortunately for this prediction, they were too costly and uncertain, as then constructed. Congreve's rocket used fuel not unlike

that which propels ordinary modern skyrockets. They had a long stick to guide them as have the pyrotechnical pieces of today. The science of chemistry had not progressed to the stage where better explosive fuels could be adopted and little was understood about rocket trajectories, ballistic properties of projectiles, or the mathematical calculations necessary to produce accurate aim. Too much fuel was required to carry the rocket itself into the enemy's lines; too little weight could be allotted to the explosive.

Nevertheless, rockets constituted an important adjunct to artillery for the greater part of the nineteenth century. A field rocket brigade was formed in the British Army in 1812 which joined the Allies before Leipsic in 1813, and contemporary accounts have it that the rockets fired on this occasion were markedly effective, causing great damage and inducing confusion and terror among the enemy.

The rocket brigade later distinguished itself in the battle of Waterloo, but already the use of rockets had begun to decline. Congreve's rocket was superseded by an improved stickless type invented by Hale, but the development of artillery had already outstripped military pyrotechnics. With the invention of the smokeless powder, the advantages claimed for war rockets were discounted in favor of artillery.

The libraries in this area were found to contain very little of value on modern rockets.

Looking for more modern information, contact was made with the American Interplanetary Society. They also advise us that Professor Robert H. Goddard is experimenting at present and "—— could doubtless give some valuable material if he would." "We have found him most unwilling to release any information before the completion of his experiments."

"The best experimental work, however, seems to have been done in Germany, and most of the practical literature dealing with the subject is in German."

"Before his death the late Max Valier wrote a remarkable paper in one of the German periodicals, in which he discussed the use of artillery with a rocket projectile and presented the design for such a gun." "He claimed that a range of 90 miles would be possible for such a gun." ". . . am unable to locate the article or date of publication."

"There is also quite an elaborate literature on the subject in Russian—none of which is available in this country."

David Lasser, President of the American Interplanetary Society in *Scientific American* for March 1931; states:

"The experiment of Goddard, Oberth, and others, have demonstrated that the rocket operates at its greatest efficiency when the gases of combustion flow out of the exhaust nozzle at the greatest speed. Goddard found in his experiments that when, for example, the speed of expulsion of the gases is about 1000 feet per second, the efficiency of the fuels—the obtained percentage of their latent chemical energy—is about 2 per cent. When he obtained a speed of expulsion of 7,000 to 8,000 feet per second, the efficiency was between 55 and 65 per cent. In other words, with greater speeds of expulsion of the gases, the efficiency rises very rapidly. Furthermore, the work of these experiments has revealed that the efficiency is greatest when the speed of the rocket approaches the expulsion speed of the gases. From this it is easily seen that the rocket is a means of transportation whose efficiency is best developed at very high speeds compared with those to which we are accustomed."

So, to find what experiments were being made by our Ordnance people, letters were written to members of the Army Ordnance Association, for information. It was then advised that the writer get in touch with Doctor G. C. Hale, Chief Chemist at the Picatinny Arsenal. His reply follows:

"In reply to your interesting letter of February 10, I am sorry to say that I do not have much information on the subject of your paper. Picattiny has done no experimentation on self-propelling projectiles and as far as I know, the Ordnance Department has done very little if any.

"I was acquainted, however, with an article published by Major Goddard in the November-December, 1926, issue of *Army Ordnance* which deals with this specific subject. Thinking that you might not have this reference available, I have had a photostat copy of the article made and am enclosing it. It should furnish some very good information for your thesis.

"I have discussed your letter with some of the engineers in the Mechanical Department here but find that they also have very little information on the subject. Two of the men who were

formerly with the Bethlehem Steel Company when it manufactured ordnance, stated that they had experimented with a wide variety of projectiles including some with wings but they had nothing on this particular subject to offer.

"It would seem to me that there would be great difficulties in working out a suitable design of shell or rocket that would carry its own propellant. The fact that the propellant changes in weight during flight would introduce quite a problem in stabilization of the projectile. It may be that you are considering some other source of power than propellent powder. In this case it would also seem to me that the problem of stabilization would be extreme but I am not much of a mechanical engineer and wouldn't want much weight given to my opinion on the mechanical makeup of such a device.

"I am sorry that I can't furnish you much information on this subject but hope that the attached article of Major Goddard's will prove of some assistance to you.

"Sincerely yours,
(Signed) "G. C. HALE."

The photostat copy of Major Goddard's article in the "Army Ordnance" is a study of U. S. Patent Office records on self-rotating and self-propelling projectiles. The search covers the period 1783 to 1925, of such records as were available in the files of the New York Public Library. The patent records of other countries were not consulted.

From 1783 to 1856 there were no patents granted on such projectiles. From 1856 to 1925 the following were granted:

Selfrotating	48
Selfpropelling	14
Selfrotating and Selfpropelling	9

The matter of self-propelling rifle, pistol and shot gun projectiles is well covered and description given of several.

On artillery projectiles, Doctor Goddard states: "I included only those types which were projected by the release of power *from within themselves,* rather than from some external source."

In as much as Professor Randolph—after experiments,—recommended a mortar, giving the rocket an initial 500 f.s. velocity

and the whirl caused by rifling—and as these patents presented no "noteworthy characteristics, and never attained popularity," according to any records available—no serious study was made of them.

The following extract is from *Science and Invention*—November, 1930:

"The new development of the rocket has come through the study of it as a means of propulsion. The pioneer work in this direction was done by Dr. Robert H. Goddard, of Clark University, who has been working at the problem since 1909 and is now, with the aid of generous funds, supplied by Daniel Guggenheim, preparing to build a rocket capable of soaring through the mantle of atmosphere surrounding the earth and sampling the conditions of outer space.

"But the engineers and scientists of Europe have not been far behind him. Since the war a great impetus has been given to the study of rockets in Austria, France and Germany, principally as sources of power for automobiles, airplanes and rocket-cars intended to travel at great altitudes. The late Max Valier, who was killed while experimenting with a liquid-fuel rocket motor invented by himself, and Dr. Paul Heylandt in Germany are generally credited with having made an actual flight in a rocket-driven plane in secret tests. His development of liquid fuel for rocket-craft has been hailed as a revolutionary contribution.

"Other Germans, including Dr. Hermann Oberth and Gritz Von Opel, have also made great strides, perfecting fuels of such power as to make Congreve's two-mile rocket seem like the toy of a child. The important point in connection with these new fuels is that such rockets are controllable. Unlike the dry powder in a common skyrocket, liquid fuels are subject to throttling, so that a rocket propelled by them can be speeded up, slowed down, guided or brought to a stop at the will of the operator.

No longer are these powerful rockets guided by a stick. In the simplest form they are equipped with large blades or vanes that direct them through the air in trajectories calculated in advance to compensate for distance and wind interference. Experiments have shown that swift, scientifically designed rockets of this sort can be landed accurately on a relatively small target at long ranges, restriction to deviations of fifty feet or less being possible.

This accuracy approaches or surpasses that possible for artillery.

"For long range bombardment metal cased rockets using the multiple-rocket principle, in which two or three rockets are built together in such a way that as soon as one is burnt out another is set off, may be devised. Such rockets would travel at incredibly great speeds."

W. J. Humphreys, C.E., Ph.D., Meteorological Physicist, United States Weather Bureau says, in the *Scientific American*:

"Nearly every one thinks of the rocket as something new under the sun. Well, it isn't, except in details of construction, for it has been in the air, so to speak, a long while, and written about for centuries. One could even collect a rocket library, for there are two or three dozen books on the subject, and a much greater number of papers, both ranging in dates from several hundred years ago to the present—mostly written in highly technical German and Russian."

"In this country the most persistent and effective investigator of that problem is Professor Robert H. Goddard of Clark University. Just now he is at work on it harder than ever before, having both financial backing and the counsel and moral support of many eminent men of science. Of course, none of these conservative savants is envisaging an early Jules Verne trip to the moon in this super sky rocket—at least not for himself. He does envisage, however, the acquisition through it of much new information of both the solar and the terrestrial atmospheres, matters of very great scientific interest—answers to many questions which for decades we have been vainly asking. For every 'good sport' this is game enough for the quest."

"Jules Verne's trip to the moon was visionary, but mining the strata of the upper atmosphere for treasures of knowledge—knowledge that will have application in our daily affairs—is not visionary. This mining needs to be done. It can be done, and will be done."

Thomas A. Edison recently told Lieutenant Richard Aldworth, director of the Newark, N. J., airport that he had been experimenting with an exploding rocket to help incoming aviators get their altitude in a fog. The rocket is planned to explode at a fixed altitude of 4,000 feet, and attract the attention of air men by noise, smoke, and light.

The *Scientific American* tells us of what is probably the most unique hangar in the world, situated on the outskirts of Berlin. It is a hangar that houses moon rockets. Here inventors working on their heaven exploring devices are provided with every facility for carrying out their projects.

Popular Science for February, 1931, tells us that there is under construction, in a closely guarded room of the Junkers Factory in Germany, a craft designed to fly 700 miles per hour.

Fritz von Opel, German experimenter, and the first man in the world to ride a rocket plane says man-made meteors, capable of 5,000 mile an hour speeds, will be common in 1942.

Maurice Poirier and F. L. Wallace are conducting experiments at Los Angeles, California, with two all metal rocket planes built to withstand speeds of 650 miles per hour.

These models are each equipped with 38 steel cylinder rockets, ten of which are used for driving and 28 for stabilizing. The combined rockets are said to develop 21 horse power.

The Oklahoma City *Times* for Tuesday, March 17, 1931, carries a photograph of a rocket sled in motion, moving 75 miles per hour. This was constructed by a 21 year old student of Syracuse University.

If sleds, and airplanes, and mail craft, can be propelled by rocket motors it appears reasonable that projectiles carrying gas, explosives, etc., can also be so propelled, either initially from a state of rest or by using a rocket built into the projectile to maintain (or increase) its velocity after it has been discharged from a simple gun (such as the Chemical Mortar, or Trench Mortars), to give it initial velocity—and rotation.

Ludvik Ocenasek, of Vienna, has been experimenting for several years on rockets designed to carry mail from city to city. In recent months the Austrian government has moved to give him financial aid for the continuance of his experiments, perhaps with an eye to their possible future use not only as carriers of mail.

Whatever the ultimate type or design, it appears likely that Congreve's early evaluation of rockets as military aids may be borne out. Guns are too heavy and unwieldy. They are too easily damaged, too costly to furnish in large quantities, too weighty to transport swiftly and secretly, and wear out too

quickly. Rockets need no cannon for firing. They can be started from the ground or placed in a simple, easily-constructed frame for proper aiming and elevating, and in the hands of trained men they can be fired with virtually the same general accuracy as the shells of a big gun. Relatively less expensive than heavy artillery, greater numbers of them can be used.

Heavy artillery has grown from the old-fashioned iron cannon to the Big Bertha that shelled Paris, but this is about the ultimate range of such weapons and surely not an efficient method of propelling explosives to that range.

In modern rockets we have a new and almost untried weapon that may assist in revolutionizing warfare, make possible the accurate bombardment of cities at great range, turn every infantryman into a traveling artillery man.

About the time Professor Randolph's letter was received—"recommending the use of a mortar giving the rocket an initial velocity of about 500 feet per second and the whirl caused by the rifling"—Captain L. M. McBride, Chemical Warfare Service, U. S. A., gave the Advance Class, Field Artillery School, his well prepared, illustrated lecture on the development of the new 4.2 chemical mortar.

Captain McBride assisted in the design and development of the 4.2 mortar, its carriage and projectile, while Chief, Mechanical Division, Edgewood Arsenal. Knowing his subject thoroughly—and, having the ability to explain details, Captain McBride, unknowingly, convinced the writer that this new weapon was exactly the type of mortar recommended by Professor Randolph.

During a later conference with Captain McBride, he stated that he had already given the matter of rockets some thought—but that thus far had not experimented with them. However, he kindly loaned his personal copy of Report No. 26 on the 4.2-inch Chemical Mortar. The Report consists of some 180 pages of typing, photostats and photographs—showing the immense amount of research necessary in the development of a new weapon and projectile.

"The object of the research was the development of a weapon that would have an attainable accurate range ... to 2,800 yards, be no heavier and preferably lighter than the 4-inch Stokes Mortar, be easily transportable and handled, ..." And we might

add—cheap in construction as compared with a 3-inch field gun.

Among the conclusions are the following statements (extracts):

"1. It is concluded that the 4.2-inch Chemical Mortar, as a type, satisfactorily meets the requirements of the project."

"2. That the wheeled mount offers promise of more stability with probable greater accuracy and higher actual rate of fire."

After studying Report No. 26, keeping in mind the fact that from beginning to end there was no precedent to follow, or former work to use as a guide, it is believed that, following the line of development as recorded in the report, mortars of 6, 8, 10 inches, and larger can be designed and constructed at a very small percent of the cost of mortars and howitzers as now used in the Field Artillery.

It Is Concluded That—

In the case of a major emergency the United States can organize, train, and transport troops at a rate which leaves far behind any program for the manufacture of guns of the heavier calibres.

Great masses of artillery will be used in future wars. Every effort must be made to have a larger number of heavy guns ready at the outbreak of hostilities, or have designs and specifications completed for cheap, easily constructed weapons to be used effectively in lieu of heavy weapons.

Every nation is searching for methods of increasing the effective range of its artillery.

With such men as Edison, Goddard, Randolph, Valier, Oberth and others working on rocket motors, it is believed that a study of the use of such motors in connection with low velocity projectiles will pay large dividends; and that the range of such projectiles can be increased many fold.

The use of low pressure, low velocity non-recoiling mortars greatly simplifies the construction problem—both in time and money. (Recoil and counter recoil apparatus cost about three times that of the finished mortar tube to produce.)

As soon as Doctor Goddard makes known the results of his present line of experiments, use should be made of his work and a thorough study made on the application of rockets to increase the range of our present low pressure projectiles of the Trench Mortar variety.

AN AUXILIARY RANGE DISK FOR USE WITH 37MM SUB-CALIBER TUBES ON 75MM GUN, MODEL OF 1897 (FRENCH)

BY MAJOR J. E. LEWIS, F. A.

THE lean years are upon us and a very large percentage of our ammunition allowance for service practice is 37mm L. E., for sub-caliber use. Approximately, it is as follows:

Unit	*75mm*	*37mm*	*Cal. 30*
Each 75mm Battery	200	500	2,000
Each Student F. A. S. (B. O. Course)	300	65	0

Each Reserve Officer on Active Duty Training: About $150.00. (48 rds. approximately of 37mm, or about 15 rds. of 75mm), so it behooves us to employ 37mm profitably.

With a change in range setting of 100 yards on the 3" and 75mm guns when firing 37mm L. E., in the sub-caliber tubes, the range is changed only approximately 60 yards; also, a false range setting is required. For example, when using the French 75 to attain a range of 2,000 a range setting of 3,170 is required and for 3,000 a setting of 4,875.

This leads to some difficulty even in axial observation and in lateral it requires a proportional change in the value of the factors to compensate for the reduced range increment.

Due to the reduced ammunition allowances especially for the service practice of Reserve Officers and for batteries of the regular service it becomes imperative to use 37mm L. E., for lateral as well as axial, retaining the service ammunition for the newer and the more complicated types of fire such as high burst transfers, corrections for conditions not standard, and in general, air observation, night firing, adjustment by observation units and in fire on balloons, in all of which a fully competent Field Artilleryman must be proficient.

In the hope of reducing the above limitations of the 37mm sub-caliber ammunition the author devised an auxiliary range disk for attachment to the standard scale of the 3" Field Gun, Model of 1905, used by the 1st Bn., 1st F. A., at the Field Artillery

School, giving range increments of approximately 100 yards when the range setting thereon was changed 100 yards, and not requiring a false range setting.

With the technical assistance of 1st Lt. J. A. Cella, 1st F. A., a pilot model was produced by hand and tested by firing on level ground. It seemed satisfactory so the entire battalion was equipped with them through the co-operation of the Materiel Department and the Reproduction Plant of the Field Artillery School.

The 3" disk is readily detachable, completely covers the regular range disk when attached, and presents no difficulties to be incurred by the gun squad. The changes necessary in the materiel are acceptable to the Ordnance Department.

Profiting by the above experience and working along the same general lines an auxiliary range disk was designed for use on the 75mm Gun, Model of 1897 (French). A pilot model was also produced by Lt. Cella and tested by firing on level ground at ranges of 1,900 and 2,900 yards. At 1,900 yards a center of impact was obtained at 1,920 yards. A 200-yard range bound upward gave a C-I at 2,131 yards, and a decrease in setting to 1,800 yards gave a C-I at 1,818 yards.

At the longer range (2,900 yards) a C-1 was obtained at 2,924 yards and a setting of 2,800 yards gave a C-I at 2,816 yards.

This devise for the French 75mm Gun consists of a brass disk (See Fig. 1) on the perimeter of which is etched the correct range scale for 37mm L. E. ammunition, fitted into the crater of the 75mm range drum, and an auxiliary index of sheet brass attached by two small screws to the "range rack guide, rear," opposite the 1,250 mark of the regular disk (See Fig. 2, Photo) when it has a zero range setting. This point was selected for two reasons: i. e., because it was the most convenient place to attach it as the holding screws of the disk did not interfere with the numerals on its face or the moveable pinion spring (See Plate XXII, 75mm Handbook) on the reverse of the 75mm range drum. The auxiliary disk is attached to the regular disk by two small screws with its Zero in concidence with the brass auxiliary index and while readily detached may be retained permanently attached, and its presence presents no difficulties to the gun squad

in firing nor is its installation prohibited by Ordnance Technical Regulations.

The brass index is bent to conform to the beveled edge of the 75mm range drum, passes over it and lies in contact with the outer face of the auxiliary disk. The lower screw hole in it is a slot ⅜ inch in length which permits rotation about the upper screw and thus a calibration correction of 50 yards on either side of the center. The screws used are ⅛ inch standard, oval head.

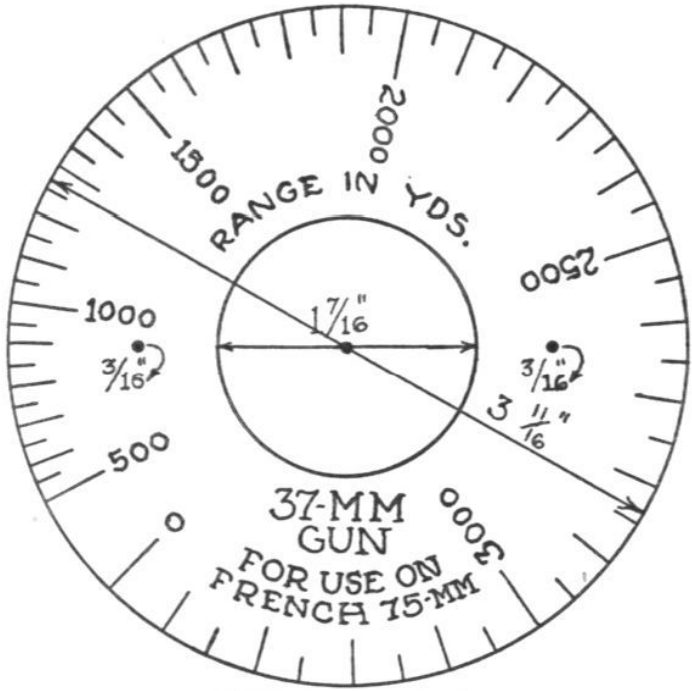


FIGURE 1—CORRECT SCALE

The disks are produced of sheet brass No. 13, 3/32 inch thick, which just fills the crater of the 75mm drum and etched from Fig. 1 by the Reproduction Plant F. A. S. The two holding screws are S. A. E. 3/16 inch, oval head.

To attach the auxiliary disk, remove the 75mm range drum, place the auxiliary disk on it over the hub with its Zero in concidence with the 1,250 range of the 75mm range drum, mark the holding screw holes through to the 75mm drum, remove the disk, drill and tap out the screw holes and then attach the disk accurately and firmly in place.

Having attached the auxiliary disk, and replaced the 75mm range drum, to attach the auxiliary index, set Zero range on the 75mm range drum, place the brass index in concidence with the Zero of the 37mm range scale which should coincide with 1,250 range on the 75mm range scale, mark through the upper hole for the pivot screw and the center of the slot for the lower holding screw, remove the index, drill the indicated holes, tap out for the screws, and attach the index.

If on firing the battery with 37mm tubes it shows need of calibration, it may be done approximately by rotating the index forward to decrease the range or backward to increase it, by the number of yards correction in comparison with the standard piece. Or it may be done by shifting the index the exact amount indicated as a correction using the 37mm L. E. range table and a tested gunner's quadrant.

The two batteries of the 2nd Bn., 1st F. A., using 75's have been equipped with them.

The two battalions of the First Field Artillery (one armed with 3" and the other with two batteries of French Guns and one with New American 75's, T-1, E-1, and E-2), used the disks with entire satisfaction during the firing for two Reserve Officers' Training Camps during the summer of 1931, which included both axial and lateral and K Method Transfers.

The ranges agreed so much more closely with range finder ranges than the 75mm service ammunition that it was rare that a 200 range bound did not yield a bracket. A range table does not have to be consulted to obtain a false range as when using the service ammunition range scale.

It is believed that its use saves time and ammunition, as well as being very convenient.

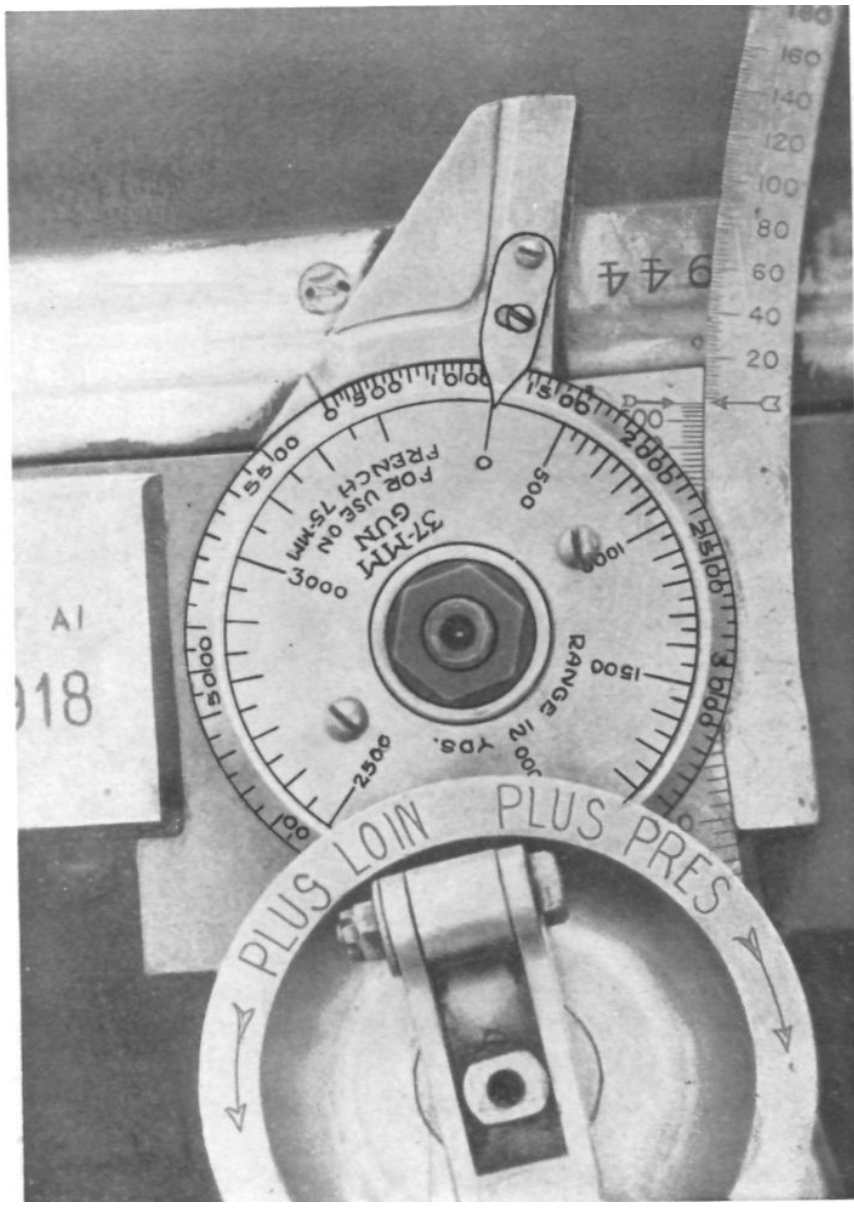


FIGURE 2—SCALE REDUCED APPROXIMATELY .75

THE FIELD ARTILLERY PISTOL TEAM, 1931

A FIELD ARTILLERY Pistol Team, selected by competition among Field Artillery officers on duty at the National Rifle Matches who were able to secure their practice only at odd times after duty hours, gained the distinction of winning the sixth place out of thirty-six teams entered in the National Pistol Team Matches at Camp Perry, Ohio, on September 8, 1931. As a result of this year's match Lieutenants Kerr and Magruder received the rating of distinguished Marksman. Lieutenants Bullock and Clearwater receive two and one legg respectively on the above rating and Lieutenants Pyle and Harris who already hold the above rating received some additional medals to add to their collections.

The names of the team members in the illustration, from right to left, are: Lieutenants Bullock, Kerr (team captain). Pyle, Clearwater. Young and Harris. Lieutenant Magruder was unable to remain for the picture.

FOREIGN MILITARY JOURNALS: A CURRENT RESUME

Journal of the Royal Artillery, October 1931

"Twelve Years After" is the title of the leading article in this issue. It is an excellent and thorough discussion of the shell versus shrapnel problem and well worth reading. The author, who signs himself "Peripatetic," after discussing all the advantages and disadvantages of shrapnel and shell comes to the conclusion that shrapnel should be abolished. It is believed that the following quotations will be of particular interest:

"It is significant, however, that the Germans have dropped shrapnel since the war. This would seem to disprove the importance which some attach to the statements made by German prisoners in the early months of the War, namely that our shrapnel was terrifying and deadly. * * * * The French carry only a very small proportion of shrapnel; and they of all people are not likely to neglect any aid for the development of the full power of their artillery.

The following artillery of the field army (in the British service) exclusive of A. A. Artillery, is supplied at present with time and percussion fuzed shrapnel:

The horse artillery weapon	75%
The light artillery howitzer	(not yet laid down)
The field gun	53%
The medium gun	25%

The percentages show the proportion at present authorized to be carried in ammunition echelons in the field. The field gun and light howitzer are supplied with smoke as well as high explosive shell. It is possible that in the future smoke may also be carried by the horse artillery. It may be worth recalling the fact that, at the outbreak of the great war, shrapnel was used in the 4.5 inch howitzers and speedily dropped."

"The inherent unreliability in the burning of the time composition (of shrapnel) produces a mean error of burning which involves a large fuze zone, even at medium ranges. * * * * Furthermore, the employment of shrapnel is only possible up to about

half the maximum range of the field gun, at which the full time of burning of the fuze is reached."

"A very general impression appears prevalent that H. E. is more dangerous than shrapnel to our infantry, when following up behind a barrage. A few divisions did prefer a H. E. and smoke barrage, and casualties from short shooting did not apparently occur; but it must be admitted that such formations were in the minority.

Assuming 50 yards to be a reasonably safe distance behind the point of burst of an 18 pounder H. E. shell, it can be shown mathematically that there is more danger from the shortest bullets of the shrapnel fuze zone. Moreover, this theory holds good at all ranges. The danger from short bullets of shrapnel increases with range. The base of the H. E. shell does indeed come back, either as a whole or in parts. It is believed that, with angles of descent of about 4 degrees and over, the bit or bits in nearly all cases are flying at a height of more than 6 feet at a distance of 50 yards behind the burst—in other words they are rising. When they do come down again, the wounds they might inflict would certainly be less serious than when on their upward flight."

"Screening effect also, more noticeable in shrapnel bursts than in the present H. E. shell, can be obtained by inclusion of a small proportion of smoke shell. Alternatively, it may prove possible to produce a better H. E. shell, containing some smoke composition. * * * * In the great war many barrages were ordered to be fired with 50 per cent on graze. Was not this an admission of the danger from short bullets? The result was frequently 90 per cent on graze. Extra casualties were no doubt caused among our own troops from enemy weapons, which would probably have been silent had the barrage been more demoralizing."

"In these days of survey, of calls for fire from the air, and of well planned and carefully staged attacks in cooperation of all arms, would it be heresy to suggest that 50 per cent of our field artillery fire will be of a predicted nature (map firing)? In the case of medium guns this proportion will probably be greater, while with horse and light artillery, it will no doubt be less. It is believed the French say bluntly that 90 per cent of their fire will be predicted. * * * * For pointblank firing, e. g., the local protection of a battery position, troops in "square" in uncivilized warfare,

or the defense of a perimeter camp, it is admitted that shrapnel or case shot is the only thing worth considering.* * * *

At the same time it cannot be supposed that H. E. is ever likely to be very effective for "in-shooting" at close ranges. The steeper the angle of descent, the better is the splinter effect parallel to the ground. With equipments which have more than one charge, it is necessary to get the best angle of descent for engagement of troops in the open, compatible with desired gun accuracy. The peculiarities of shrapnel and H. E. in this respect are about equal and opposite. At its maximum range shrapnel is very ineffective; at very close ranges its powers of destruction are good. There exists probably a mid-way point at which the relative figures of merit for the two shells are about equal. * * * *

But should it be insisted that artillery must be capable of delivering very effective point-blank fire, then it is considered that a modern type of "case" shell is required. * * * * Such a shell could be fitted with a very simple fuze, which would require no setting and could be designed to burst only between fixed distances from the muzzle—say 0 to 100 yards. The shell would be cheap to manufacture and stocks could be held for issue when and where required.

"Time shrapnel is definitely unsuitable for observation from the air, since the burts do not give correct indication of range. There is always difficulty too on any but dry ground in observing the fall of bullets during fire for effect except from a close distance."

"When opposing landing operations such targets as "boat-tows" are engaged best with shrapnel, although it must be remembered that H. E. will burst on the surface of the water. Likewise for sweeping beaches, shrapnel may be more effective. On the other hand, in the support of landings, smoke is undoubtedly valuable. Probably many lives would have been saved in the fateful attempt at "V" Beach at Gallipoli, had a couple of 3.7" howitzers or mortars firing smoke been mounted on the "River Clyde." * * * *

On very soft ground, admittedly shrapnel is more effective. On sand, it is difficult to hazard an opinion. In thick wooded or bush country, both kinds of shell are likely to burst prematurely, but

the effect of H. E. detonating in the air is distinctly greater. In very hilly and mountainous features, one is faced in the case of shrapnel with the angle of site problem and the consequent difficulty of maintaining effective height of burst with constant changes in angle of site. * * * *

The effect on training of the abolition of shrapnel should be very marked. The whole tendency will be towards simplification of equipment, fire control, drill and standardization of methods.

Fire control will tend to become easier. A diminution in the number of fire orders will result. Observers will have less to worry about—only "line" and "range" will come into the picture. Adjustment of range during fire for effect will always be assured in that ground bursts can be relied on to give correct indications. * * * * In certain cases, when speed is essential, one can afford to be less particular over the accuracy of angle of site, the error caused in range by such discrepancies being small, while that in height of burst can never be neglected. * * * *

For barrages, concentrations, etc., fuzes will no longer require to be set before hand, with the ever attendant mischance of mistakes being made or alterations occurring before actual firing takes place.

"Shrapnel Shell and Time Fuzes are more trouble to make. To quote one instance whereas any small firm can turn out No. 117 fuzes without difficulty, only certain firms of repute in this country can produce reliable time and percussion fuzes, e. g. No. 80.

"If then the total abolition of shrapnel paves the way for the design of a universal field artillery weapon, whose calibre and muzzle velocity are derived from the basis of a given weight of shell, then one may arrive at a heavier shell than the 18 pdr. Also it may then be possible to include a smoke box which will not detract from its moral and destructive value or its fragmentation, while at the same time assisting observation and screening effect. In designing new equipments, one should think, not in calibres, but in weight of shell; after all the shell is the weapon and not the gun. * * * *

Among regimental officers today—especially among brigade and battery commanders—there is an almost unanimous desire to abolish shrapnel. After all, these are the people who will have to use it, or supposedly so."

In conclusion the author states: "Artillery tasks involving unobserved fire are likely to use up 50% of the ammunition carried in the field. With ground and air observation it has been shown that H. E. is either essential or to be preferred for the majority of tasks, which field and medium guns are called on to perform. The above summary may well comprise 80% of the total ammunition expenditure. Smoke is definitely valuable and will be retained. The proportion left for the exclusive use of shrapnel becomes infinitesimal, and can, it is urged, be ignored with safety and advantage. Only against certain area targets, and for enfilade and point-blank fire has shrapnel any real superiority; and in such instances it is by no means indespensible. Shrapnel is only effective up to half the range of the present field gun. H. E. has a definitely greater moral effect, especially against raw troops. In training and equipment the disappearance of shrapnel will lead to greater efficiency and economy. The manufacture, inspection and supply of ammunition both in peace and war will be simplified, standardized and cheapened. * * * *

If merely a substantial reduction was effected in the proportions carried in the field, it would be but a poor compromise, because many of the advantages brought about by its total abolition would be foregone. There is no doubt that a decision to abolish shrapnel would be welcomed throughout the regiment, if not throughout the service.

Finally, the disappearance of shrapnel would, it is thought, lead to a very careful consideration of the problem as to the most suitable weight of H. E. shell for the divisional artillery. From this investigation would probably emerge a new weapon for the field artillery firing a shell heavier than the 18 pdr, and lighter than the 4.5" howitzer. The design of such an equipment could in the space of a few years be perfected for final provisions on the outbreak of war."

Revue Militaire Francaise

June and July, 1931

Commandant Morel writes of **"The Military Forces of the British Empire."**

In the chapter devoted to the regular army he discusses its

numerical strength, the characteristics of its enlisted and commissioned personnel, and its military doctrine.

There are about 200,000 men in the regular army, divided into two almost equal groups: (1) the "home" group, composed of five divisions of infantry and one division of cavalry, organized as an expeditionary force; (2) the "outside" group which includes 60,0000 men in India, 8,000 in the Mediterranean, 12,000 for the protection of the Suez Canal, and 6,000 at Singapore and in China. In the "outside" group there are: 22 regiments of cavalry, 212 batteries, and 136 battalions of infantry.

There is a system of relief whereby organizations are sent home after 15 years' foreign service. In addition there is a more frequent relief of individuals. To effect this relief it is necessary that the army be composed of small units. The highest permanent unit in the infantry is the battalion; in the cavalry, the regiment; and in the artillery, the battery. All higher units are temporary groups. The artillery is composed of independent batteries. Two battalions of infantry are theoretically united to form a regiment, which exists only as a depot and for purposes of tradition. Each regiment has a battalion in England and one outside of England. The home battalion receives and instructs the recruits of the foreign duty battalion. In case of emergency the home battalion is skeletonized to strengthen the other battalion.

In the colonies the battalions and the batteries are generally isolated. In India they sometimes enter temporarily into mixed units, brigades and divisions, along with native units.

The English soldier enlists for 12 years, of which 5 or 6 are spent in active service. The physical standard is very high; and about 50 per cent of the applicants are rejected. This standard is necessary as the English soldier must be capable of enduring all types of climate.

Sandhurst trains infantry and cavalry officers and Woolwich turns out artillery and engineer officers. A few well qualified individuals are commissioned from the ranks.

"If we should try to define the character of the English officer we would not stress his individual worth but rather the strength of the corps of officers, its homogeneity, and its collective qualities.

We do not want to intimate that he lacks individual qualities. Far from that."

In speaking of the British military doctrine, Commandant Morel explains the British enthusiasm for motorization. The British feel that their army, though excellent, is too small to engage a Continental enemy in a type of warfare such as they encountered at the outbreak of the last war. Their greatest hope of military power lies in the tank and the armored car.

Colonel Loizeau concludes his article **"Strategic Success, Tactical Success,"** by summing up the relation which should exist in modern warfare between strategic and tactical success.

"Of the two theories of war, destruction or exhaustion of the enemy, only the first will procure decisive strategic success.

"It is this theory . . . that Schlieffen adopted as the basis of his strategy. Apparently the younger Moltke and Ludendorf did not recognize its value. At least, they did not know how to apply it.

"Foch, on the other hand, faithful to this doctrine, obstinately sought the destruction of the material and moral power of the enemy; and he knew, thus, how to obtain, by the capitulation of their armies and the collapse of their political power, the most decisive strategic success.

"Schlieffen, in proposing, in a war on two fronts, to defeat first France, the more powerful and more dangerous enemy, and in choosing the Seine from Paris to Troyes as the point of attack to throw the French army back to the Swiss border and to cut it off from the heart of France, displayed a general plan which was sound and which had but one goal.

"The strategic idea was to flank the fortified barrier of the Meuse-Moselle and to advance by way of Belgium and Northern France, where the terrain and lack of fortification permitted initial tactical success indispensable to strategic exploitation. This was a well conceived plan which assured the convergence of all efforts toward strategic success.

"General Moltke, though following the plan of Schlieffen, altered it seriously. In attempting to protect the frontier provinces, he kept in mind the possibility of an offensive in Lorraine. He thus created a double goal. In the execution of his plan, he aggravated his initial error. In Lorraine, the secondary plan

developed each day until it became the principal one. After the victory of Morhange, the Germans went on to the Moselle and then to Neufchateau; and finally made the mistake of encircling the fortified position of Toul-Verdun, a zone where the terrain and enemy forces forbid any strategic exploitation of tactical success. On the other hand, the fundamental plan, which sought strategic success, crumbled little by little and was finally abandoned.

"The initial strategic idea of General von Ludendorff, to defeat the English and to separate them from the French, was clear and single. This plan provided for two distinct fields of action separated by the Somme. To the north was the offensive sector where strategic success would be sought; to the south was a defensive sector where a holding engagement would be conducted against the French.

"However, influenced by tactical successes in the French sector, Ludendorff changed from the defensive to the offensive; he subordinated the strategic plan to the possibilities of pure tactical successes. The original idea, to defeat the English, was replaced by two ideas, defeat the English and the French. This plan, in turn, soon disappeared to be replaced by a new plan, beat the French."

Thus the German strategy failed because Ludendorff did not persist in following his original plan, which was designed to assure strategic success.

"On the contrary, we have seen Marshal Foch, from the very first hour, select a distant goal in a direction favorable to strategic success; then, in spite of the most violent reactions of the enemy, conduct the successive acts of his campaign with a vision clear and unwavering, always subordinating tactical to strategic success."

FIELD LINE CONSTRUCTION*

BY MAJ. P. W. EVANS, Signal Corps

THREE of the world's great powers have today armies which include separate signal corps branches charged with installing, maintaining, and operating signal communications in the field. The American Army produced a separate Signal Corps during the Civil War, the German signal corps was founded at the time of the Franco-Prussian War, and the British signal corps was separated from the engineers immediately after the South African War but was not constituted as a separate branch until after the World War.

During the World War all three of these signal corps placed their chief dependence for wire laying in the forward areas upon horse-drawn wire carts. The Americans used the well-known cart drawn by two horses and carrying two nonremovable spools of wire. The British used a pintle type of wire cart drawn by six horses and carrying in addition to the wire considerable line construction material, including lance poles, tools, guys, and also including telephone instruments and spare parts. The Germans used two types of pintle wire carts drawn by four and six horses, respectively. The wire carts did not carry any pay-out reels but carried a number of breast reels for the use of line-construction material, including lance poles, etc.

Since the war all three signal corps have been experimenting with newer and more modern equipment, but curiously enough the original wire carts are in every case continued in use and have not been more than partly superseded by later developments. All three of the signal corps have experimented with and in some cases have gone into limited production with motor vehicles. The British Royal Corps of Signals has made an attempt at a fast moving wire cart drawn by a 6-wheeled truck and has also conducted experiments with self-propelled tractor-type wire-laying device. The drawbacks they have encountered with this have been mainly those of disposing of the wire as it is let off the reel and of securing a proper take-up mechanism for recovering the wire.

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The British claim that it is of no particular value to lay wire at 20 miles an hour if it is impossible to get that wire off the road at the same rate. They feel that the wire-laying vehicle will not be alone on the road in actual war-time conditions and that the wire will be damaged beyond repair before it can be hung on trees or fences or elevated on lance poles. As a partial solution to this problem they have been trying to develop a motorized pikeman who can follow in a motor-cycle sidecar and throw the wire off the road as fast as it is laid. Another solution has been a sort of swinging arm from the rear end of the tractor.

The Germans, true to their characteristic of thoroughness, have never attempted to do any hasty wire laying with a moving payout reel. The latest development of the German Nachrichten Truppe is a large 6-wheeled truck which resembles the line-construction trucks used by our commercial communication companies. This truck has power and traction enough to negotiate difficult roads or dry fields. It has carrying capacity sufficient to transport a construction gang and drop off detachments at regular intervals. Each detachment then proceeds to lay wire from breast reels and immediately places the wire at such a height that it is out of danger. The construction cart contains enough lance poles to lift about one-third of all of the wire carried. The car also contains a large supply of heavy insulated hooks with a pigtail device at the lower end and these hooks are raised with pikes to carry the wire when it can be festooned on telephone-pole steps, cross-arms, buildings, trees, etc.

It will be of interest to note that neither the British nor the Germans have as a result of the experience gained during the war changed to a twisted pair wire for long circuits. Both of them use single conductor field wire of a type similar to that used in our Army prior to the war. Practically all of the circuits except the local ones are ground return. In some instances the ground rods are placed 100 yards or more from the switchboard and in the general direction of the line with a view to cutting down the cross talk. Cross talk is sometimes quite annoying but the British and Germans claim that they prefer it to paying the price of additional weight which twisted pair would entail. In stabilized situations they will use a twisted pair or two field-wire conductors.

Neither the British nor Germans are as heavy users of the telephone in the field as our Army. The Germans during the grand maneuvers of 1930, for instance, did not expect or desire more than one ground-return channel from division command post to each of the three infantry regiments which are the next subordinate units. The telephones were not very busy and there was never more traffic than these channels could carry. This was probably due to a large extent to the smaller staff at division and regiment as compared with our Army.

We must guard against the tendency in our Signal Corps to believe that conditions which obtain in maneuvers and in command-post exercises at full distances are very similar to those which will obtain in time of war. It is wrong to conclude that these peacetime conditions ever approximate much more than the mere traffic problems which we must overcome in combat. In these exercises the roads are seldom crowded with troops, and when they are crowded the troops are under strict orders not to leave the road or trespass upon private property. The plans for road movements are usually carefully worked out so that there is plenty of room for various units at peace strength and with reduced motor transport to arrive expeditiously and without delay at their destinations. There is no shell fire or bombing to drive the men off the road nor are there obstructed roadways and wrecked bridges to tie up road traffic. Signal corps lines can be laid in the ditch alongside the road or looped over the fences at the side of the road so long as the simple precaution is taken to elevate the wire or bury it in a shallow trench at road crossings.

If anyone has forgotten the difficulties which overtake the signal corps wire laying when the roads become congested, and sometimes completely blocked for hours, he should renew his mental picture of the situation by reading reports of the road conditions which existed in the areas of the French and British Armies during August 25 to September 16, 1914. The confusion and impatience of the troops caused them to overflow from the roads into the ditches and beyond into the fields. The only reason they did not forsake the roads and march across the fields was because the transportation of that day would not permit such a move.

In the next war the roads will certainly be congested, or at least

congested up to the point where units provided with suitable vehicles for cross-country travel will leave the roads and march in the desired direction, clearing fences ahead of them and leaving useless behind them any field lines which are not buried or so high overhead as to be entirely out of their way. Even then, we must keep our eye on balloon winches which may be changing position with their sausages on short leash.

It becomes apparent that the quick and handy peace-time method of laying field wire in ditches or on fences and bushes with an eye to rapid and easy recovery after the exercise is over is not very good training for war in so far as our line construction detachments are concerned. They should be trained to string their wire so high that the lowest loops are not less than 12 feet from the ground. This will protect the wire from our own troops in most cases. Then they must be trained and properly equipped to construct their line across country when occasion demands. Here it must still be elevated and must follow a given bearing without reference to likely trees or poles. This leads us to two methods. One is to have a truck like the Germans, which can send out parties with light portable reels or hand carts so that the line can be constructed away from the roads while the vehicle follows in general along the highway. The other is to have a real cross-country wire cart, such as the British have in their 6-horse pintle cart and such as they are trying to develop in a self-propelled, track-laying vehicle. Of the two it would seem that the British vehicle is the more desirable, since a construction car even though it be a 6-wheeled vehicle like that of the Germans, would have great difficulty getting around a mass of troops blocked on the road with deep mud in the fields or ditches to cross. We must remember that the exact moment when the superior unit, such as the division, desires to run forward its wire circuits to the brigade command post is very often the moment that the brigade itself and a great deal of the divisional artillery are occupying the road along which the wire circuits must be laid. We must not put too much value in the statutory priority which gives favor to the signal corps vehicles engaged in using the roads for tactical purposes, since other arms, even though they may be willing to concede this priority, are not always able to give way.

THE OLD POST CHAPEL AT FORT SILL

BY CHAPLAIN MILTON O. BEEBE, U. S. ARMY

THE charming chapel located at Fort Sill, the seat of the Field Artillery School, is not only one of the most historic houses of worship in the state of Oklahoma, but one of the loveliest churches in the entire military service. The mere mention of the Old Post Chapel will appeal to a very large number of officers of the Field Artillery as an interesting theme, for they and their families have shared in the services of worship conducted there and enjoyed the quiet, restful beauty and the worshipful atmosphere of that place.

The chapel is intimately related to the early history of Fort Sill, though there is little place in this brief summary for those many interesting facts of that frontier post, all of which would make profitable and enjoyable reading for the personnel of the entire Army. The records, both at Fort Sill and in the War Department, are incomplete in the facts of the building of the chapel, but the very best information available would indicate that it was constructed in 1870 of native lime stone from Quarry Hill, just east of the Frisco station and by soldier labor. Mr. William H. Quinette, for many years the Post Trader, is authority for the statement that it was the last of the permanent buildings, which now comprise the Old Post, to be completed. The lime was obtained from the two kilns near the quarry. The lumber was from native timber cut along the banks of Cache Creek and shaped into the required sizes by the post saw and planing mill located just south of the "Geronimo" guardhouse.

The Old Post Chapel was a part of the original housing plan of Fort Sill, although as late as 1887 it had not been dedicated. It served as social hall as well as church. It was the center of post activities, in that early day, for the men and women who shared in the hardships of pacifying the Indian tribes among which they lived. There is every reason to believe that there were many christenings and marriages under regimental colors and standards and that many burials were from that hallowed spot. Indeed, there is no building at Fort Sill that has known so

much of the joy and sorrow common to all men and women of the military service as the Old Post Chapel.

It is believed that the chapel is now greatly different in appearance from the time of its construction. While there are no records confirming it, there is ample evidence in the building itself that it has been remodeled. It may have been that the first roof was flat. Of that we have only a suspicion. However, workmen are agreed that the walls were raised approximately six feet and the windows arched at the top at some time later than the original construction. It is probable that the belfry and vestibule were added at the time of the alteration. In the year 1930, being the sixtieth anniversary of the construction of the chapel, the addition of the vestry was conceived as an anniversary symbol. One of the windows was changed into a door directly connecting the vestry with the nave. The charming symmetry of wall and window was preserved in constructing the addition, and the seating capacity was increased by the removal of the small enclosed area opposite the organ dais which had long served as a vestry. The interior of the vestry is fitted with attractive cabinets and a large window seat, all of dark oak.

Of the windows in the chapel little can be said with certainty. They are of stained glass, predominantly yellow in color making the interior glow with a golden light as of perpetual sunshine. Since Fort Sill was for many years a Cavalry station, the color may be considered emblematic of that branch of the Army.

In 1927, four bare walls with arched windows of georgian simplicity formed the Old Post Chapel. There was a simple but lovely altar of dark oak; beautiful brasses consisting of a cross, tall candle-holders and vases; pulpit chairs to match the altar in design and color; pews and beamed ceiling; with carpet and chancel draperies of dark red appropriate to the Field Artillery. The handsome national colors were presented to the chapel by the Fort Sill Sunday School and the Estey organ, electrically powered, was provided by friends of the garrison. Mrs. Paul R. Smith, who served as organist for a number of years and who has made an extensive study of the chapel and its relation to garrison life and activities said, "This was the beginning of the transformations in the aspect of the chapel which the following

five years saw—transformations which were a fulfillment of its possibilities in atmosphere and beauty. Perhaps the most telling was the installation in the chapel, hung upon its walls and breathing its spirit, of twenty-two colors and standards, all but six of which have been presented by regiments that have been stationed at Fort Sill at some period in its history." In addition to these, the most historic national colors or flag in Oklahoma is there, having been presented to the chapel by Mrs. H. Ben Turner, of Lawton, who received it as a gift from Grant Post, G. A. R., Oklahoma City. It is the first flag ever used in a public ceremony in Oklahoma, after it was admitted to the Union, with a star in the blue field for that new state. This flag carries forty-six stars in its field. While the silk is badly torn and broken, and the intrinsic value of the colors is very little, it has been coveted by persons and organizations for its great historic value.

The antiquated coal stove has given place to modern gas steam radiators. Noiseless ceiling fans were installed to make summer worshippers more comfortable and all pews and pulpit chairs and the chancel step were cushioned. A baptismal font, beautifully in harmony with its setting, was presented to the chapel on Christmas, 1928, by Major John Alden Crane, F. A., and Mrs. Crane. The chapel has been marked by the Oklahoma Society, Daughters of the American Revolution, with a bronze tablet-marker as an historic building in the state. A chancel screen in wrought iron of simple and graceful design and another of similar design for the organ dais were presented by Sergeant Fred C. Thomas, F. A. S. Detachment (White), a skilled workman in metals.

As is becoming to a "battle abbey," the Old Post Chapel contains a number of memorial tablets. Two of these were erected by the Fort Sill Masonic Club in 1930 to the memory of two of its former members—Brigadier Generals Dwight E. Aultman, Commandant of the Field Artillery School at the time of his death, and Daniel F. Craig, founder of the club. Due to the interest of the Lawton Chapter of the Daughters of the American Revolution, a tablet was erected to the memory of I-See-O, the last of the Fort Sill Indian Scouts and was unveiled June 7, 1931, in the presence of a large and picturesque assembly. Beside many garrison and Lawton friends, the entire surviving family of I-See-O was present as well as some thirty other members

of the Kiowa tribe, many in tribal costumes, who shared in the unveiling program. On June twenty-eighth a tablet was dedicated to the memory of the late Major General George LeRoy Irwin, formerly Commandant of the Field Artillery School. The most recent tablet to be erected was to the memory of a chaplain, Brant C. Hammond, who served at Fort Sill for seven years. The tablet was erected by his children.

For the first time since its construction, the chapel services are announced by a sweet toned bell which was purchased from offerings received for that purpose. The bell was installed December 19, 1930, and was first rung to announce the Christmas services.

The Old Post Chapel boasts a communion service worthy of the altar of a cathedral. Through the interest of a friend it was presented to the chapel in November, 1929, by Miss Rebecca A. Scarborough of Cincinnati, Ohio, as a memorial to one of the heroic men of Fort Sill, Lt. Colonel Harold Hubert Bateman, who, on July 4, 1919, gave his life in an effort to save an enlisted man from drowning. The service consists of three pieces—chalice, flagon and paten—each marked, "In Memory of Harold Hubert Bateman, Lieutenant Colonel, 9th F. A., 1887-1919." Around the flagon is the Scriptural, "Greater love hath no man than this that a man lay down his life for his friends." Colonel Bateman was the son of Chaplain Cephas C. Bateman, D. D. (Retired) and Mrs. Bateman.

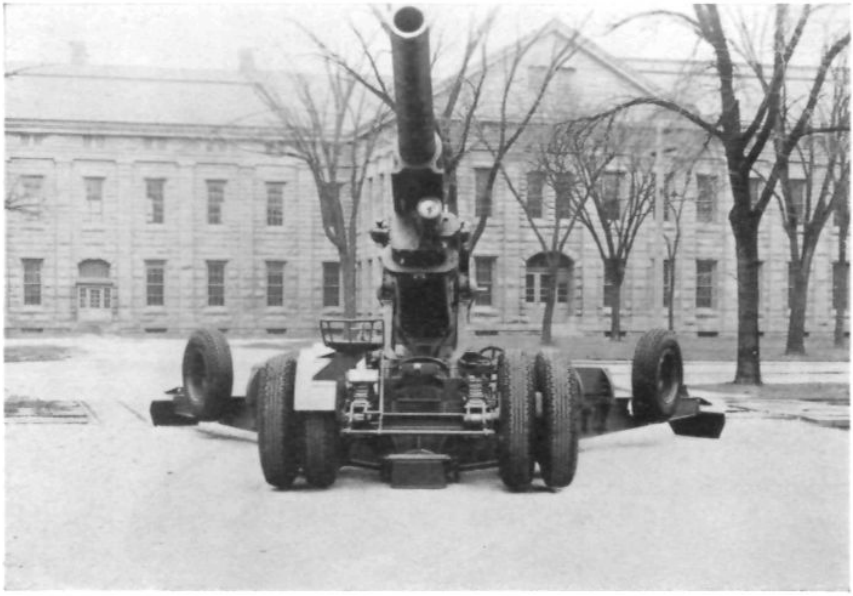
It cannot be truly stated that the Old Post Chapel at Fort Sill is the grandest or the most beautiful in the Army for there are wonderful military chapels elsewhere, as West Point, Governors Island, Fort Snelling, Fort Leavenworth, Fort Riley, Fort Monroe and the Presidio of San Francisco. However, the Fort Sill chapel is charming with a quiet beauty that makes it holy as a house of prayer. Its doors are always unlocked to worshippers. Colorful as a little "battle abbey" should be, it is a monument to those who established that post in the heart of the Indian country and remains a visible symbol of the place that religion has held in the lives of military men in this nation from the times when General Washington knelt upon the battlefields with his armed troops to pray.

THE OLD POST CHAPEL AT FORT SILL

TRAVELING POSITION

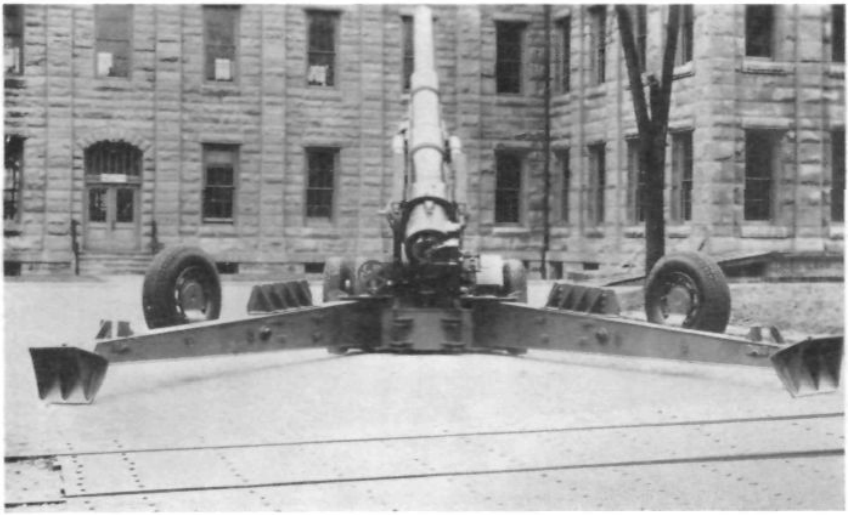
THE 155MM GUN—8-INCH HOWITZER

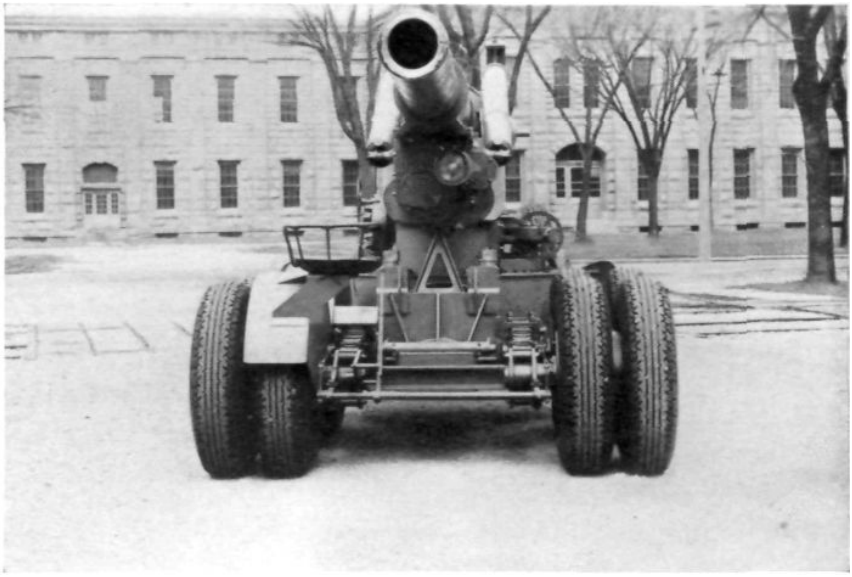
FIRING POSITION



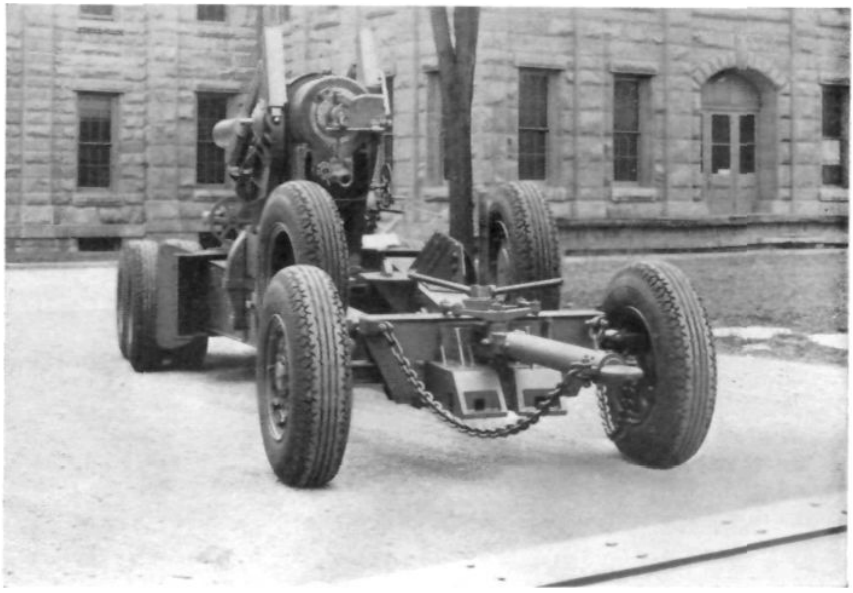
155MM GUN—8-INCH HOWITZER

THE HOWITZER IN BATTERY. IT IS NOT NECESSARY TO DIG A PIT FOR THE BREECH TO RECOIL INTO





155MM GUN—8-INCH HOWITZER
TRAVELING POSITION, NOTE GREAT FLOATATION (TEN 10½″ × 20″ TIRES)



FIELD ARTILLERY NOTES

155mm Gun-8 Inch Howitzer

The pilot model of this very modern weapon was built at Rock Island Arsenal and is now at Aberdeen where it is being proof fired. It will eventually be sent to Fort Bragg for service tests. The weapon is described in the May-June, 1931, FIELD ARTILLERY JOURNAL and a photograph of it is shown as the frontispiece in in this number. Other illustrations of it appear on pages 664-666 of this number. The proving ground tests have been very satisfactory. The carriage has been put in the firing position at Aberdeen from its road position in twenty minutes. This is possibly because it is not necessary to dig a pit in order to fire.

The following data on the 155mm gun-8 inch howitzer, carriage T2, mounting the howitzer, have been received from Major John H. Wallace, the Field Artillery representative at Aberdeen:

Weights (approximately): limber—1849; howitzer—8817; carriage—12,455; transport truck—5675.

Weight, carriage limbered on scales: weight on limber wheels—7825; weight on rear wheels with one man—21,960; Total—29,785 pounds.

Over-all length—32 ft. 10 in.; over-all width—8 ft. 3 in.; overall height—8 ft. 7¾ in.

Tread, limber—6 ft.; ground clearance—11 in.

Wheel base—limber to front of bogie: 17 ft. 4 in. bogie—axle to axle—3 ft. 10 in.; total—21 ft. 2 in.

Turning diameter—60 ft.

Brakes held on 20 per cent slope.

Individual wheels can be lifted 12 in., others remaining on ground.

Tires are 10½ in. × 20 in.

Powder charge—26½ pounds for fifth zone.

New Design of Carriage for 75mm Pack Howitzer

The Chief of Field Artillery has requested the Ordnance Department to design a carriage for the 75mm pack howitzer M1 which will be suitable for draft either by horses or by high speed prime movers. One of the uses foreseen for such a carriage is for operating with Cavalry divisions.

Special Anti-Aircraft Machine Gun Mount

A machine gun mount designed by the Air Corps for all around anti-aircraft firing has been procured by the Field Artillery and sent to Fort Bragg for test, particularly as regards its suitability for use on vehicles or on the ground.

Tests of 1½ Ton Ford Truck

A 1½ ton Ford truck with special Warford transmission, Hipkins tracks and special body, has been sent to Fort Bragg for test by the Field Artillery Board as a prime mover or cargo vehicle for light artillery.

Soldier's Medal Awarded to Four Officers and Fourteen Enlisted Men of Battery A, 5th F. A.

For heroism at Fort Bragg, North Carolina, June 4, 1931, the following officers and enlisted men were awarded the Soldier's Medal:

Captain Loyal M. Haynes, Captain Alan M. Campbell, 1st Lieut. Harry C. Dayton, 1st Lieut. Donald Q. Harris, Sgt. Ralph P. Runyon, Sgt. Golden W. Tullos, Sgt. Lawrence L. Mackey, Cpl. Chelsie G. Ross, Cpl. James H. Freeman, Cpl. Alex. Stewart, Pvt. 1st cl. Hampton T. Hill, Pvt. 1st cl. Arnold A. Hunter, Pvt. Lawrence F. Thayer, Pvt. Noah L. Sprouse, Pvt. Thomas W. Coderre, Pvt. Gilbert Sullivan, Pvt. Mills G. Porter, Pvt. John H. Hooper.

The citation reads as follows:

> "During the firing of a 155mm howitzer by Battery A, 5th Field Artillery, the muzzle blast ignited the camouflage net which in turn ignited the grass and brush in the immediate vicinity of the howitzer. The members of the gun squad, with utter disregard of the danger of an explosion from shells which were on a burning paulin in the midst of the flames, rushed from the gun pit and, despite the excruciating heat, succeeded in removing the exposed explosives to a place of safety. Thereupon they extinguished the flames and brought a dangerous fire under control. The high degree of heroism displayed by this squad on this occasion contributed to the saving of government property and possibly human

life and is characteristic of that splendid standard upon which the traditions of our military establishment are founded."

The New Experimental 155mm Howitzer

Tests of the 155mm howitzer T1 which has recently been shipped to the Field Artillery Board will be started in the near future. This weapon can be fired at a maximum range of 16,390 yards, an increase of about 4,000 yards over that of the M1918 howitzer. Its weight however in traveling position is 16,500 pounds, an increase of 7,000 pounds over that of the M1918 howitzer. It has a sprung carriage, but is not equipped with pneumatic tires or anti-friction bearings.

General Glassford Appointed Chief of Police, Washington, D. C.

The FIELD ARTILLERY JOURNAL congratulates Brigadier General Pelham D. Glassford upon his recent appointment to the important position of Chief of Police of the District of Columbia. This distinguished Field Artilleryman was placed upon the retired list on July 31, 1931, at his own request after more than thirty years of service, almost all of which was in the Field Artillery. At the time of his retirement he was a Lieutenant Colonel of Field Artillery on General Staff duty, and according to law when he was placed on the retired list he reverted to his highest war time rank, Brigadier General.

General Glassford was born in Las Vegas, New Mexico, in August, 1883. He was appointed to the Military Academy from Missouri in 1900. Upon graduation he was assigned to the 20th Battery of Field Artillery at Fort Riley where he attended the School of Practical Application of Cavalry and Field Artillery. During the World War he was Secretary of the Artillery School at Saumur and later commanded the 103rd Field Artillery. Upon promotion to Brigadier General he took command of the 51st Field Artillery Brigade. Since the War he has been instructor at Leavenworth and at the War College and has served in the Inspector General's Office in Washington, D. C., and as Chief of the Mobilization Branch, War Department General Staff.

Major Boles Wins International Titles

Major J. K. Boles, F. A., on duty in the Office of the Chief

of Field Artillery, has recently returned from Poland where he represented the United States as delegate to the International Shooting Congress, held this year at Lwow (Lemburg).

He achieved two world titles in capturing the single-shot and double-shot running deer matches. It was the first time in the history of rifle competition that any one competitor has been known to hold both of these titles at the same time. Gold medals were awarded for both championships and in addition Major Boles received a large crystal cup as a prize in the single-shot match and a Polish tapestry, interwoven with gold and silver, as a prize for the double-shot match. Major Boles is the Olympic champion in the single-shot running deer event.

In the small-bore competition, Major Boles entered three of the matches, winning second place in the 100-meter shoot, third place in the 100 and 200 meter match and seventh place in the 200-meter match. His prize in the first match was a Polish Oriental rug. For the other two matches he received silver cups.

.30 Caliber Sub-Caliber Equipment

A modified set of .30 caliber sub-caliber equipment has recently been sent to the Field Artillery Board and will soon be tested. This equipment consists of a .30 caliber rifle and outside mountings for 75mm guns and 155mm howitzers. Gallery practice ammunition M1919 will be used with these guns.

Stokes-Brandt 81mm Mortar

Four sets of Stokes-Brandt 81mm mortar equipment with a quantity of ammunition have recently been received by the Ordnance Department and are being tested at the Aberdeen Proving Ground. This is a highly developed weapon of the Infantry mortar type which promises to be interesting to the Infantry, Cavalry and Field Artillery. One weapon is to go to the Boards of each of these arms for test. The weapon complete weighs 132 pounds and is divisible into three loads, none of which exceed 45 pounds. It fires a 7.7 pound fin-tailed projectile to ranges of from 40 to 3,300 yards and a 14 pound projectile up to 1,200 yards. Probable errors of 1/300 of the range in range and 1/500 of the range in direction are promised. The effect of the light projectile compares favorably with that of the high explosive 75mm gun

projectile, and the effect of the heavy projectile compares favorably with that of the high explosive 105mm howitzer projectile.

T2 and T3 Tests

In conjunction with the tests which are being conducted by the gunnery section of the Field Artillery Board, mobility tests of T2 and T3 mounts and prime movers have been conducted at Fort Bragg. The gun was transported both on the truck and on the bogie towed behind the truck. With the empty truck it was necessary to put sand bags in the truck to weight it down enough to give it traction when towing the gun on its bogie. The T2 and T3 tests are now being conducted by Battery C, 5th F. A. due to the departure for Madison Barracks, N. Y., of Battery B, 5th F. A., to which organization the T2 and T3 weapons were assigned. This change required the training of a complete new gun squad.

Army Olympic Teams

In accordance with War Department plans for the participation of the Army in the Xth Olympiad at Los Angeles, California, in 1932, the War Department has issued orders for the movement of the Army Equestian Group, from Fort Riley, Kansas, to Fort Rosecrans, California, where it will undergo its final training preparatory to entering competition next summer with the riders and horses representing various foreign nations.

The Army Equestrian Group has been in training at Fort Riley, Kansas, during the past year. In order that the cream of the Army riders and horses could be selected to go to the Pacific Coast for final training, the Army Equestrian Group gave an exhibition at Fort Riley during the week October 4-10, before members of the 1932 Olympic Games Equestrian Committee (which includes Major General Guy V. Henry, Chief of Cavalry, Colonel Pierre Lorillard, Mr. Gustavus T. Kirby, Mr. Alfred B. Maclay and Lieutenant Colonel C. L. Scott). As a result of this exhibition the best Army riders and horses were selected to go to the Pacific Coast for further training. The Field Artillerymen chosen to go to Fort Rosecrans are: Captain Isaac L. Kitts, Captain Edwin Y. Argo and 1st Lieutenant LeRoy J. Stewart. Captain James G. Watkins, Field Artillery, will report at Fort Rosecrans,

upon his return from the Italian School at Tor di Quinto, where he will complete the course on December 15. He will probably not reach Rosecrans, however, until February as he will go by boat from New York.

In addition to the Equestrian Team the following Field Artillerymen are in training at West Point for the Army pentathlon team which will take part in the Olympiad: 1st Lieut. H. J. John, 2nd Lieuts. R. W. Mayo, T. J. Sands and J. A. Berry, Jr.

Field Artillery Computer

The Field Artillery Board is testing a German made computer, called the T4 or Pannke computer, by means of which firing data measured from the map can have corrections of the moment applied mechanically by the computer. This instrument weighs approximately 100 pounds including its chest and is very expensive. Its operation, however, is simple.

Nonogram Sheets

Two types of graphs or sheets for use in applying the corrections of the moment to firing data obtained from the map by scale or protractor are being tested by the Field Artillery Board. These nonogram sheets can be made up for each type of Field Artillery weapon and enable officers applying corrections of the moment to do so graphically instead of going through the long and laborious mathematical processes which are necessary at the present time. There are two different types of these graphs. With one type the several component corrections are found separately and then added algebraically before being applied to the graphs on the chart; with the other type the factors are applied as found and the final correction read directly from the chart. A straight edge is all that is required to read the charts. Both types consist of several sheets of paper about 20 inches square which can be bound and used as a pad or loose leaf book or can be rolled.

The nonogram sheets for the 75mm gun, model 1916, have been received at Fort Bragg and are being tried out along with the Pannke T4 computer to determine the speed and accuracy of these various methods of applying corrections of the moment. The present method of using the map and firing tables is being compared with the computer and nonogram methods. There is no doubt that they will greatly increase speed and accuracy of determining firing data from the map.

Faster Tractors

The necessary gears and parts to convert one caterpillar "20" tractor from a speed of about 4½ miles an hour to a maximum speed of 9 miles an hour have been received at Aberdeen Proving Ground. These parts are being installed, and the tractor thereafter will be subjected to tests. Similar sets of parts have been furnished for the modification of one tractor at each of the following stations: Fort Hoyle, Md.; Mechanized Force, Fort Eustis, Va.; Fort Sill, Okla., and Fort Bragg, N. C.

Fuzes for Pack Howitzer

Reports have been received in Washington on results of service tests of the T-2 P. D. fuze in 75mm pack-howitzer ammunition. In view of the satisfactory performance of the fuze, it has been recommended for standardization in this weapon.

155mm Howitzer Inspections

The War Department issued recently a technical regulation. designated T. R. 1405-155A, prepared under the direction of the Chief of Ordnance, pertaining to 155mm howitzer materiel, models 1917 and 1918. The purpose of these regulations is to furnish suitable instructions for maintenance and shop repair of the 155mm howitzer materiel.

The six sections of the regulations are: General tools for inspection; instructions for inspection; tools for maintenance and repair; instruction for dismounting, mounting, disassembling, and reassembling, and instructions for maintenance and repair. Paragraph 3 of the first section reads as follows:

All pertinent information relative to description, operation, and functioning of the materiel will be found in T. R. 1305-155A; instructions for star gauging, and a complete method with illustrations for taking gutta-percha impressions of the bore of cannon, in T. R. 1495-A; instructions covering the characteristics, purpose, handling, etc., of cleaning and preserving materials, tools and materials for use therewith, and special oils, grease, and cutting oils issued by the ordnance department, in T. R. 1395-A; instructions for proof of guns and carriages in Proof Officers' Manual, February 10, 1929; pressure gauge outfits for cannon and the uses thereof, in T. R. 1495-C; fire-control and sighting equipment, in T. R. 1420-C; complete list of parts and equipment

and basic spare parts, in Standard Nomenclature Lists Nos. C-3, C-7, and C-17. Personnel charged with the maintenance and repair of this materiel are required to be familiar with the publications listed above.

The average life of the 155mm howitzer is 7,500 rounds. Howitzers in service should be star gauged after each 1,500 rounds fired, i. e., 1,500, 3,000, 4,500, and 6,000, and thereafter more frequently during the remainder of their service. The inspection of the howitzer, howitzer carriage, howitzer carriage limber, and the 155mm howitzer caisson, as outlined in section 5, T. R. 1305-155A, should be followed. Those regulations also outline inspection, and verification and adjustment of the sights.

Fiber Containers

In an effort to cheapen and simplify the design of fiber containers for complete rounds of ammunition, Picatinny Arsenal was authorized to proceed with experimental work to ascertain if the wooden block could not be eliminated from the container. An attempt also is being made to obtain a better holding of the round within the container to prevent the partial separation of the projectile from the cartridge-case that now is being experienced at times.

Annual Meeting, U. S. Field Artillery Association

In compliance with Article VII, Section 1, of the Constitution, notice is hereby given that the Executive Council has fixed 4.00 P. M., Wednesday, December 9, 1931, as the time of the annual meeting of the Association, to be held at the Army and Navy Club, Washington, D. C.

The business to be disposed of will be the election of eight members of the Executive Council and the transaction of such other business as may properly come before the meeting.

Since one-half of the active members in the United States are required to constitute a quorum, any member unable to attend the meeting in person is urgently requested to execute the proxy which has been mailed to him.