

THE COAST ARTILLERY JOURNAL

Published as the Journal U. S. Artillery from 1892 to 1922.

MAJOR ROBERT ARTHUR, C. A. C. Editor
CHARLES R. MILLER Business Manager

Volume 70

April, 1929

Number 4

CONTENTS

THE CAPITOL	<i>Frontpiece</i>
THE CORPS ANTIAIRCRAFT REGIMENT	By MAJOR J. C. HAW 283
A GERMAN INSTRUMENT FOR THE PREPARATION OF ANTIAIRCRAFT FIRE	303 By MAJOR P. VAUTHIER
THE TRAINING OF RESERVE COAST ARTILLERY OFFICERS	327 By LIEUT. W. W. DALY
TRENTON—THE FIRST AMERICAN OFFENSIVE	By CAPT. G. J. B. FISHER 336
AMORED CAR DESIGN	By MAJOR C. C. BENSON 346
PROFESSIONAL NOTES	355 <i>Coat of Arms of the 197th C. A. (A. A.)—Coast Artillery Target Practice—More About the Probable Error—Marshal Foch's Story of the Armistice—Ships Instead of Picture Cards—Foreign Periodicals.</i>
COAST ARTILLERY BOARD NOTES	368
BOOK REVIEWS	370 <i>Some Elements of Tactics—Emperor Francis Joseph of Austria—Range Finders—All the World's Aircraft—The ABC of Aviation—The Law in Relation to Aircraft—Citizenship Through Problems—Andrew Jackson, the Gentle Savage—The Flight of the Southern Cross.</i>

Authors alone are responsible for statements in contributed articles

The COAST ARTILLERY JOURNAL pays for original articles upon publication.

Published monthly under the supervision of the Chief of Coast Artillery for the information of the Coast Artillery personnel of the Regular Army, National Guard, and Organized Reserves.

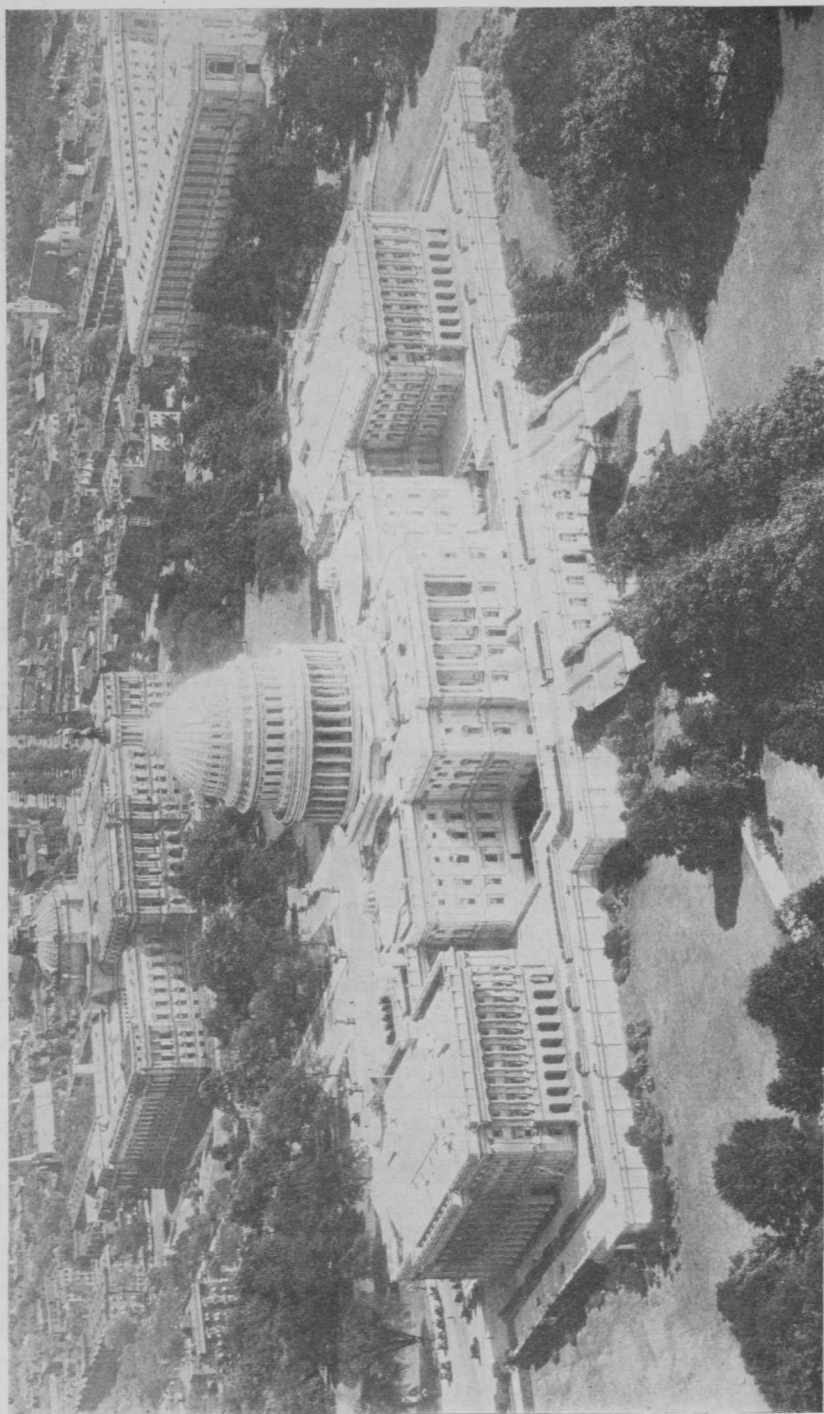
Terms: United States, \$3.00 a year; single copies, 50 cents. Canada, \$3.25 a year; single copies, 55 cents. Foreign, \$3.50 a year; single copies, 60 cents.

Entered as second class matter at the Post Office at Fortress Monroe, Va. Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized May 8, 1920.

Copyright, 1929, by the COAST ARTILLERY JOURNAL.

Address: The COAST ARTILLERY JOURNAL, 1115 17th St., N. W., Washington, D. C.

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE APR 1929		2. REPORT TYPE		3. DATES COVERED 00-00-1929 to 00-00-1929	
4. TITLE AND SUBTITLE The Coast Artillery Journal. Volume 70, Number 4, April 1929				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Coast Artillery Training Center,Coast Artillery Journal,Fort Monroe,VA,23651				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 95	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			



THE CAPITOL

THE COAST ARTILLERY JOURNAL

Volume 70

April, 1929

Number 4

The Corps Antiaircraft Artillery Regiment

By MAJOR JOSEPH C. HAW, C. A. C.

Second Prize, Annual Essay Contest

A knowledge of the tactical employment of the Corps Antiaircraft Artillery Regiment and of its interior functioning constitutes the best foundation for an antiaircraft artilleryman's tactical education. Since the Corps is the smallest subdivision of the mobile army to contain an organization devoted solely to antiaircraft work, it follows that that organization—the Corps Regiment—will necessarily maneuver a great deal more than will the antiaircraft regiments of higher echelons. The latter regiments do not move so frequently, nor are they often confronted with the task of covering combat elements in deployed formation.

The fact that the Corps Regiment is generally regarded as the tactical school of the antiaircraft artillery service is demonstrated by the general use, in the COAST ARTILLERY JOURNAL and in troop schools, of problems involving such a regiment. But many officers who have been, or who will be, confronted with such problems have had little or no experience with such a regiment.

The purpose of this paper is to present a brief and elementary, but comprehensive, view of the regiment and its organization, supply, and interior tactical functioning. There is no single text extant which covers the field; and there are many points that can be learned only by practical experience. First worked up as a lecture for Reserve Officers, nearly two years ago, this study has been carefully revised in the light of over two and a half years of experience in an antiaircraft regiment at peace strength, including three summers of field maneuvers and the training of seven regiments of Reserve Officers. It is believed that anyone who has a good grasp of the points covered will be able to undertake intelligently the solution of map problems or the conduct of field maneuvers involving the Corps Antiaircraft Artillery Regiment or its subordinate units.

Before one can understand the tactical employment of the Corps Regiment, it is necessary to acquire a general working knowledge of the organization and tactics of the Army Corps which the regiment is required to protect. Since battery officers have but little opportunity to gain this information, it is advisable to present a brief discussion of the subject.

THE AMERICAN ARMY CORPS

The normal American Corps consists of Corps troops and three infantry divisions. However, the number of divisions may vary.

Corps troops (War strength) consist of:

(a) Corps Special Troops (Headquarters Company, Military Police Battalion, Signal Battalion, Ordnance Companies, Field Remount Depot, Service Battalion).

(b) Corps Artillery.

(1) One antiaircraft regiment.

(2) One artillery brigade (one 155-mm. gun regiment, three 155-mm. howitzer regiments, one ammunition train of 168 trucks, one observation flash battalion).

(c) Corps Engineer Service.

(d) Corps Medical Service.

(e) Corps Air Service (32 observation planes, 4 observation balloons).

(f) Corps Train.

(1) Motor transport (486 $1\frac{1}{2}$ -ton trucks; 162 3-ton trucks).

(2) Wagon train (270 wagons).

(g) The Corps complete consists of 83,949 men and officers, 22,595 animals, 240 field guns; and on a single road it would be 151.7 miles long.

(h) Corps Troops consist of 23,859 men and officers, 1730 animals, 96 field guns; and on a single road it would occupy 67.4 miles of road space.

The war strength Infantry Division consists of: .

(a) Special troops.

(b) Two infantry brigades (two regiments of three battalions each).

(c) One artillery brigade (an ammunition train and two regiments of two battalions each, 75-mm. guns).

(d) One engineer regiment.

(e) Division Air Service (13 observation planes).

(f) One medical regiment.

(g) Division Train.

(1) 108 $1\frac{1}{2}$ -ton trucks.

(2) 124 wagons.

(h) The Infantry Division contains 19,993 men, 6929 animals, 48 field guns; and on a single road it would be 28.1 miles long.

DISPOSITIONS OF A DIVISION DEPLOYED FOR ATTACK

The elements in contact with the enemy are the combat elements of the division. Hence, divisional dispositions must be understood if one is to dispose the antiaircraft artillery effectively.

Infantry and field artillery elements are provided with machine guns so mounted as to facilitate fire upon low-flying aircraft.

Both in attack and defense, the infantry is disposed in depth. From the

platoon up, every unit (unless it is assigned an excessive frontage) holds out a support or reserve which it places in its rear.

The locations of reserves, artillery, and administrative and supply establishments depend upon the situation, the road net, and the terrain. There can be no standard distances or intervals; however, one of the governing factors is the range of various weapons. Thus, the light artillery is rarely closer than 1500 yards to our own front line, because if it were closer it would be under fire from enemy machine guns, whose effective range is about 2500 yards. Again, field trains are rarely closer than 5000 to 6000 yards to our own front lines, as this would bring them under fire from enemy light artillery, whose effective range is about 7500 yards.

Figure 1 shows a possible layout of a division deployed for an attack. This diagram is not to scale and is somewhat distorted. Elements of infantry units lower than brigades are not shown; but the diagram does show all the principal establishments of a division so deployed. However, the distances from the front of the various elements will vary in different situations, and even their relative positions will vary. Thus, distributing points for Class I supplies may be in advance of a field train bivouac; the railhead and the landing field may be forward of the division rear boundary. On the other hand, elements shown well forward are always ahead of those shown well back, and vice versa; thus, trains are always parked well in rear of the artillery, while distributing points for ammunition are always in front of distributing points for Class I supplies. The following brief discussion of the elements shown in Figure 1 will give some idea of where they are likely to be located and, what is more important for us, of the antiaircraft protection which they need:

Advanced infantry elements are deployed and offer poor targets to aviators.

Infantry reserves will conceal themselves in woods, cornfields, etc., whenever cover is available.

The artillery is not so easily concealed but will generally use camouflage. It is generally 1500 to 3000 yards from the front line.

At the infantry ammunition distributing points, wagons or trucks of the division train, coming from the rear, transfer their loads to infantry combat trains. They are usually located one to two miles in rear of the line. They are small establishments.

Artillery ammunition distributing points serve the same purposes for the artillery and are likewise generally of small extent.

Command posts of units smaller than a division are but small establishments and are generally concealed.

At distributing points for Class I supplies, the division train transfers rations, gasoline, and oil to field trains. There are more vehicles, men, and supplies likely to be congregated here than at ammunition distributing points. On the other hand, the transfer of loads is sometimes made by night. They are often located just in rear of field train bivouacs.

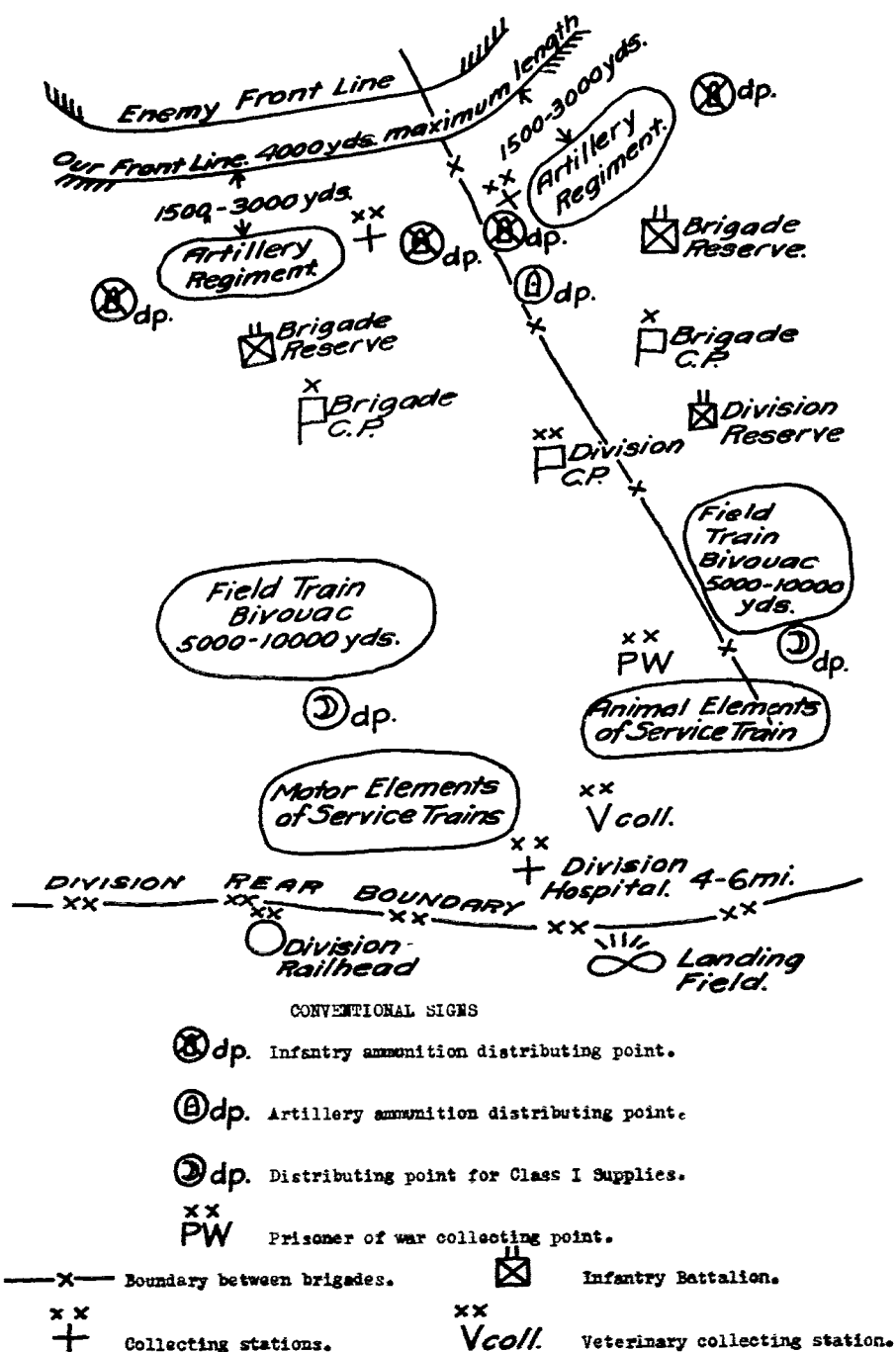


FIG. 1. POSSIBLE DISPOSITIONS OF A DIVISION DEPLOYED FOR ATTACK

The collecting points for wounded are usually one to two miles in rear of the line. At these points, ambulances pick up the wounded for evacuation to the division hospital. They are relatively small establishments.

Wounded and sick animals are assembled at the veterinary collecting station. It is located near the bulk of the animals (therefore near the artillery or trains).

The principle of economy of force will probably prevent our furnishing close protection to prisoner-of-war collecting points.

The large number of vehicles and animals grouped in field and service train bivouacs make them conspicuous and highly vulnerable.

At the railhead, the division service trains procure supplies. At certain times there are likely to be many railway cars, stores, men, animals, and vehicles at railheads.

The landing field is likely to be attacked by enemy aviators and should be protected when practicable. (Tables of Organization, 71W, Sept. 8, 1924, show 3 antiaircraft guns in the organic equipment of the division air service. This number is probably not sufficient for adequate protection.)

The division hospital is protected by the laws of war.

The boundaries between brigades, regiments, etc., are imaginary lines to delineate zones of action. The division rear boundary marks the limit of traffic control by the division.

DISPOSITION OF A CORPS DEPLOYED FOR ATTACK

The maximum frontage of a division in a main attack is generally considered to be 4000 yards. The frontage occupied by a corps will depend upon the number of divisions it places in the line and the nature of the mission assigned—whether a main attack or a holding attack.

Figure 2 shows a corps deployed for attack with three divisions in line. This figure is not to scale and is distorted. No divisional troops or establishments are shown. Each division, however, actually has all the troops and establishments shown in Figure 1, except that frequently the division air service operates from the corps airdrome, so that the division landing field becomes of less importance. Figure 2 does not show a standard arrangement of the relative positions of troops and establishments, for there is no standard arrangement; and the relative positions and distances from the front of corps troops and establishments are subject to a great deal more variation than are those of divisional elements. No elements of the Corps Antiaircraft Artillery Regiment are shown in Figure 2.

While Figure 2 shows the principal establishments of corps troops, there are a number of small elements, usually located at widely separated points, which are not shown. These are: field train bivouacs of Corps Special Troops, Corps Engineer Service, Corps Antiaircraft Regiment, Corps Medical Service, and Corps Air Service: rear echelon of the Corps Command Post; parks for Engineer, Ordnance, Signal, and Chemical Warfare supplies; bivouac of Corps

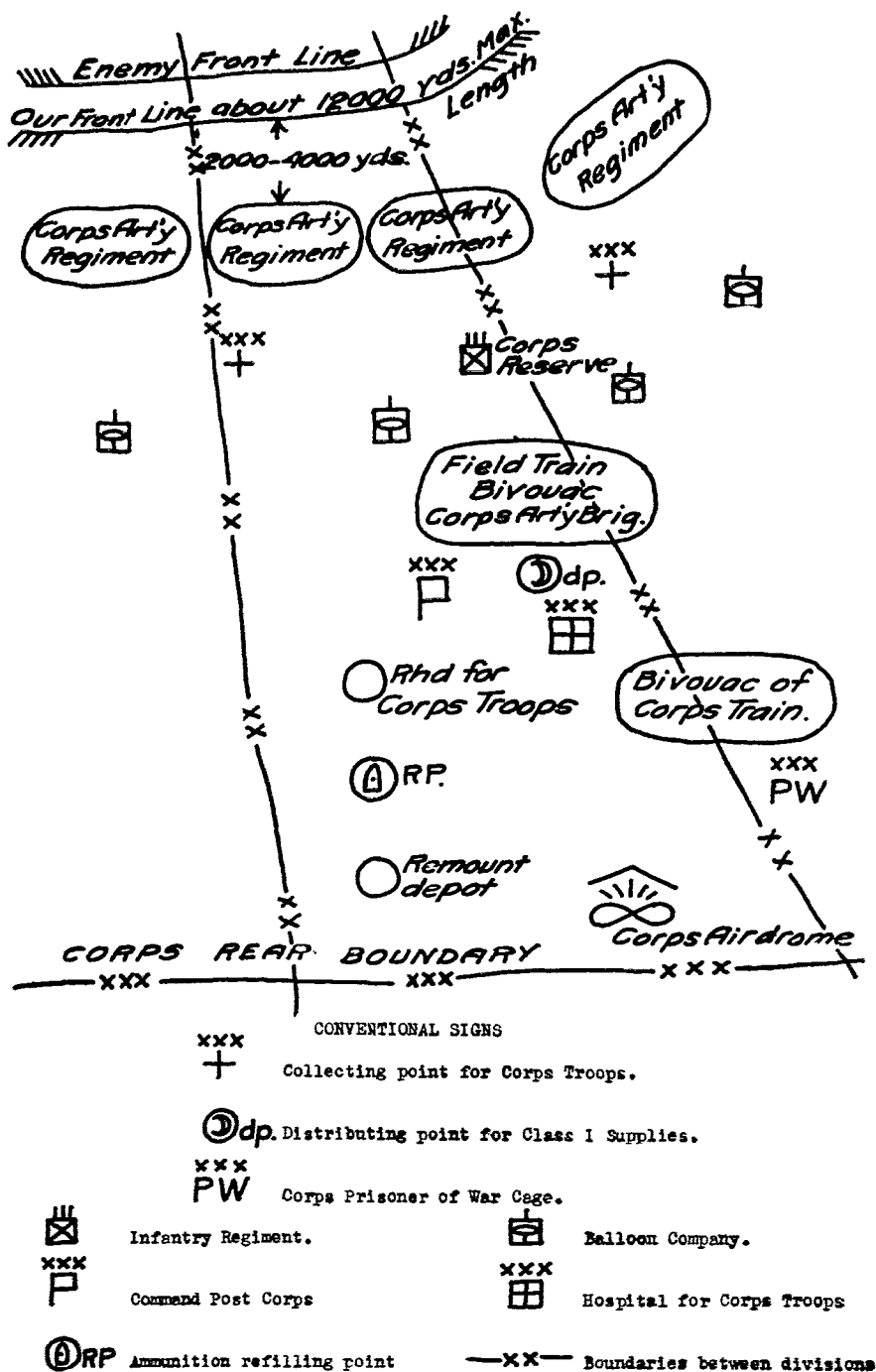


FIG. 2. POSSIBLE DISPOSITIONS OF A CORPS DEPLOYED FOR ATTACK

Artillery Brigade ammunition train; and the bivouacs of Corps Special Troops (the elements of which are rarely grouped together for an attack) and Corps Engineer troops.

The following points are important in considering the elements shown in Figure 2:

The corps artillery has its own antiaircraft machine guns for close defense.

Though no official statement on the subject is available to the writer, it is believed that balloon companies and the corps air service also possess antiaircraft machine guns of their own.

The collecting points are for evacuation of corps troops to the hospital for corps troops. Normally, the Corps Medical Service plays no part in evacuation of wounded from the divisions; the army evacuates directly from division hospitals.

The corps infantry reserve is taken from one of the divisions and has the usual infantry machine guns equipped for fire on airplanes.

The field trains of the Corps Artillery Brigade are not necessarily grouped together.

The hospital station for corps troops is about the size of a division hospital station.

Distributing points for corps troops are similar to those established by divisions. There are usually no distributing points for corps artillery ammunition, as the Corps Artillery Brigade Ammunition Train, which is motorized, generally draws from the refilling point and delivers to battery positions.

It is rarely practicable to give protection to the corps prisoner-of-war cage.

The railhead for corps troops is similar in size and function to that for a division.

The refilling point for artillery ammunition issues to the ammunition trains of divisions and the corps. It is therefore a relatively large and busy establishment.

The remount depot contains about 400 animals. It can rarely be given machine-gun protection.

Divisional air corps units often operate from the corps airdrome. This airdrome is very likely to be attacked by enemy aircraft.

The Corps Air Service, as stated, is believed to possess some antiaircraft machine guns for the protection of the airdrome. When practicable, however, the corps airdrome should receive gun protection and be allotted additional machine guns.

The Corps Train is not always grouped together; indeed, animal and motor elements are often separated, and still smaller subdivisions are often widely separated. The Corps Train is a huge organization, offering a conspicuous and highly vulnerable target.

Each division operates all the establishments shown in Figure 1, while the corps troops operate all those shown in Figure 2.

The chief differences between the dispositions for the offensive and defensive are that greater fronts are held and that all troops and establishments are disposed more in depth, for the defensive. Hence, reserves and supply and administrative establishments are farther from the front line. However, no fixed distances or arrangements can be stated, as everything depends on the terrain, the road net, and the situation.

AVIATION VS. GROUND TROOPS AND ESTABLISHMENTS

One cannot deploy anti-aircraft artillery intelligently without an understanding of the types of military aircraft and their employment.

The four principal types of planes are:

Observation: Usually two-seaters, of medium speed, carrying machine guns and, at times, light bombs. They fly at varying altitudes.

Bombardment (day or night): Large slow planes, with machine guns and a few heavy bombs or quantities of light bombs. They fly high.

Pursuit: Extremely fast, usually single-seaters, carrying machine guns and, at times, light bombs. Their function is to attack other aircraft.

Attack: These planes attack ground forces by machine gunning and bombing. Our army is the only one which makes this a distinct type of plane; in other armies, ground attack missions are assigned to pursuit planes. They fly very low indeed.

Due to the speed and maneuverability of pursuit planes, anti-aircraft guns and machine guns can exert but little influence upon this type of ship. Pursuit planes should be fired upon, however, so that the burst will attract the attention of our own pursuit formations. Attack ships fly low and are targets for the machine guns. Bombing planes are the easiest targets for guns. Observation planes are good targets for guns and, when flying low, for the machine guns.

The corps and division possess observation planes only. Other types pertain to higher units.

VULNERABILITY OF GROUND FORCES

In action, the infantry is so scattered that it presents poor targets to the aviator. The artillery is more vulnerable. On the march, the infantry can scatter, but this delays the progress of the column. However, both arms possess machine guns which are equipped to fire on low-flying aircraft, as already stated.

Trains and administrative establishments offer the most attractive and vulnerable targets, whether in bivouac, on the march, or in action, and possess no means of defense against aerial attack.

ORGANIZATION, EQUIPMENT, AND SUPPLY OF THE CORPS ANTI-AIRCRAFT
ARTILLERY REGIMENT

Having considered the elements which are to be protected and the nature of the attacking force, we are now ready to study the corps regiment itself.

The war-strength corps regiment consists of: Headquarters and Headquarters Battery, Service Battery, Gun Battalion, and Machine-Gun Battalion.

The Headquarters Battery installs and operates the regimental command post, the telephone and radio nets to the battalions, the panels, and a motor-cycle messenger service.

The Service Battery establishes a rear echelon for supply and operates the regimental personnel office.

The 1st, or Gun, Battalion comprises a Headquarters Detachment and Combat Train, a searchlight battery (three platoons of four lights each), and three gun batteries (of four guns per battery).

The 2d Battalion comprises a Headquarters Detachment and four machine-gun batteries, each battery having three platoons of four guns each.

The Gun Battalions are now equipped with 3-inch anti-aircraft guns, Model 1918, mounted on auto-trailer carriage, Model 1917. For tactical purposes we base our dispositions upon the fact that at a horizontal range of 5400 yards these guns are effective to an altitude of 5500 yards. In war they fire high-explosive shells. The maximum vertical range is 8200 yards. Well-trained crews can deliver short bursts of fire at the rate of 15 rounds per minute per gun. Each gun battery has also four 0.50-caliber anti-aircraft machine guns for its close protection.

In war, the machine-gun battalion will be equipped with 0.50-caliber machine guns which should be able to deliver accurate fire to at least 1500 yards altitude at a horizontal range of 1500 yards. The maximum vertical range is 4700 yards and the maximum horizontal range is 6650 yards. They can fire 400 shots per gun per minute in short bursts. Machine guns will be mounted in trucks, so that to open fire it will be necessary only to halt the trucks; but when a position is to be occupied for more than ten minutes, the guns will be dismounted from the trucks and set up on the ground.

The 60-inch barrel type is the latest model of searchlight. Six thousand yards slant range is a dependable maximum average for illumination of targets under average conditions of visibility. Each searchlight platoon is equipped with two sound locators to aid in picking up the target.

The regiment is equipped with a limited number of passenger cars, motor-cycles, light trucks, gas trucks, reconnaissance cars, and two tractors for each gun battery, but most of its vehicles are Four-Wheel Drive trucks of 3-ton capacity. All personnel and equipment are carried in motor vehicles. Tractors (on trailers), 3-inch guns, kitchens, and water tanks are towed. Loaded, an F. W. D. truck weighs 14,510 pounds; the auto-trailer carriage with gun weighs 14,085 pounds. A tractor trailer, with tractor on it, weighs 10 tons. This is

the heaviest load in the corps except the 155-mm. G. P. F. gun. These weights must be considered when routing units over bridges.

The battalion sections of the Service Battery establish supply offices, one for each battalion. These offices are usually concentrated at the rear echelon, which is the bivouac of the Service Battery.

These sections send their trucks to the distributing point for Corps troops to receive Class I supplies (rations, gasoline, and oil) and deliver them to the battery positions.

Machine-gun ammunition is carried in the trucks of the machine-gun batteries. It is procured (usually from the railhead for corps troops or the refilling point for corps artillery ammunition) by these trucks or by the Service Battery and delivered to the battery positions.

Ammunition for the gun batteries is carried in the combat train of the gun battalion and in the battery trucks. It is procured (usually from the railhead for corps troops or from the refilling point for corps artillery ammunition) by this train and delivered to battery positions. On occasion, as when occupying a position to open fire at once or when a battery is detached from the battalion, sections of the combat train are attached to gun batteries.

Each machine-gun battery carries 6250 rounds per gun, or 75,000 rounds per battery.

Each gun battery carries 150 rounds per 3-inch gun or 600 rounds per battery; while the Combat Train, 1st Battalion, carries 150 rounds for each 3-inch gun. Thus, in the battalion there are 300 rounds per gun.

Rations are carried as follows: on the man, one reserve ration; in each battery, one field ration; in the service battery, one field ration for the regiment; total in the regiment, one reserve and two field rations per man. On the corps train, two field rations are carried.

The regiment carries two days' supply of gasoline and oil; the Corps Train, one day's supply.

COMMUNICATIONS AND INTELLIGENCE

The regiment has a radio set for communication with higher units and with the battalions, which also have sets. The regiment and the battalions are provided with panels for signalling to airplanes. The regimental telephone net goes down to include gun batteries and machine-gun platoons. Each unit lays a single telephone circuit to each subordinate unit. The regiment, the battalions, and the batteries operate motorcycle messenger services.

The regiment forms a part of the anti-aircraft Intelligence Service. It gives warning to its own units, to the Air Service, and to other interested elements, of the approach of hostile aircraft. It also makes a daily report of the exact operations of all enemy aircraft observed.

It must cooperate with the Air Service in every way. The Air Service should keep it informed concerning the operations of our own aircraft, in order to assist in identification and to facilitate anti-aircraft artillery support.

TIME AND SPACE FACTORS

Theoretically, the road speeds of FWD trucks, including a halt of 10 minutes each hour, should be 8 m. p. h. by day, 6 m. p. h. by night with lights, 5 m. p. h. by night without lights. However, even on good roads and gentle slopes, the gun battalion averages only about 6 m. p. h. by day, due to the heavy gun trailers. Undoubtedly we shall, in the next war, have trucks which can pull the guns at the necessary speeds; while even with the present equipment, the machine-gun battalion and Headquarters and Service Batteries can maintain the theoretical speeds. Standard speeds for light vehicles (passenger cars and Cadillac searchlight units) are by day, 20 m. p. h.; by night with lights, 15 m. p. h.; by night without lights, 10 m. p. h.

ROAD FORMATIONS

<i>Distance in yards between units</i>	<i>Normal March</i>	<i>Moving, closed</i>	<i>Halt</i>
Individual vehicles	21	7	5
Batteries	40	20	3
Battalions	50	50	3

The table below shows road spaces as given in the current Training Regulations. These figures are slightly different from those that would result if we should make a careful calculation on the basis of the vehicles prescribed in new Tables of Organization from time to time, but do not differ materially from them.

ROAD SPACES AT NORMAL MARCH DISTANCES

	<i>Yards</i>	<i>Miles</i>
1 Searchlight battery	700	0.4
1 Gun battery	450	0.3
Hq. Det. and C. Tn., 1st Bn.	860	0.5
Total gun battalion	3070	1.7
1 Machine-gun battery	555	0.3
Hq. Det., 2nd Bn.	165	0.1
Total machine-gun battalion	2555	1.5
Service battery	630	0.4
Headquarters battery	160	0.1
Total Regiment	7000	4.0

The Regiment ordinarily travels in two echelons, a light column and a heavy column. The searchlight units comprise the bulk of the light column; the rest of the regiment, with the exception of a few light vehicles, constitutes the heavy column.

When traveling on roads subject to enemy aerial observation, to bombing by enemy planes, or to the fire of enemy ground troops, distances between vehicles and organizations should be materially lengthened; and at halts, vehicles should be stopped near houses, trees, or other features which reduce visibility and vulnerability.

A gun battery, with attached searchlight platoon, considering all kinds of terrain, will require on the average about one hour to go into position and open fire, and about the same length of time to withdraw and form column on the road. Both operations can be performed in much less time under favorable conditions. A machine-gun platoon can go into or out of a position close to the road in five minutes; if the guns must be transported some distance by hand, the time is longer.

TRAFFIC CONTROL

In field operations, owing to the tremendous traffic and the scarcity of good roads, it is usually necessary for corps and division commanders to institute restrictions on traffic; for example, certain roads may be reserved for motor vehicles, others may be designated as one-way roads. It is therefore usually necessary for unit commanders of the Corps Antiaircraft Artillery Regiment to confer with corps and division staffs in regard to movements of their units. When practicable, however, the regimental commander makes all such arrangements.

Due to the difference in rates of march, it is rarely practicable to move the Corps Antiaircraft Artillery Regiment, a motorized unit, over roads that are in use by foot or animal elements.

The divisions control traffic in advance of their rear boundaries. The corps controls traffic between division rear boundaries and the corps rear boundary.

It must be remembered that very often it will be impossible for the antiaircraft artillery to find roads that are free of foot or animal elements, when going into position or withdrawing. Even when covering a march, this condition is likely to exist; for example, when roads are scarce and several corps are moving abreast or when an independent corps is crossing a defile. In such cases, the time, route, and other details of the movement must be fitted in with the movements of other troops in the most advantageous manner. This will often be an extremely difficult problem and such conditions may result in a considerable lessening of the protection that would be desirable at certain times and places.

TACTICAL DISPOSITIONS WITHIN THE REGIMENT

Battery Dispositions

A gun battery located for action always forms a single compact unit except for the altimeter base-end stations. There is generally attached to it a searchlight platoon, whose lights are disposed at the four corners of a rough square, 2000 yards on a side, the center of the square being approximately at the position of the gun battery; however, they must not be arranged so symmetrically as to indicate the position of the guns. The lights should be parked under cover during daylight. The two sound locators of the searchlight platoon are placed near two of the lights and connected to them by telephone or a "follow-the-pointer" system. The searchlights are connected by telephone to the

platoon commander's post, which is usually at the gun battery. The gun battery commander proceeds to the general position indicated by the battalion commander and picks out the exact location for each element of the battery. The gun battery commander may indicate the general position of each light or may direct the searchlight platoon commander to choose his own positions. The gun battery commander locates his four machine guns. The 3-inch guns of a battery are usually placed in a rough square, 50 yards on a side, with the range section in the center. The trucks and the kitchen should be placed at least 200 yards away from the guns. Alternative battery positions should be reconnoitered.

A machine-gun battery, on the other hand, is rarely grouped in a single firing unit. Instead, the platoon is the fire unit. The four guns of a platoon are rarely widely separated: but the three platoons of the battery are generally located some distance apart, in a manner that depends upon the nature and shape of the ground feature or military element covered by the battery. Thus, to cover a long stretch of road, platoons are placed at intervals near the road; to cover a small area, they are disposed in a triangle. When the feature to be protected is not too large, adjacent machine-gun platoons should be within about 1200 yards of each other, so that all three platoons of a battery can concentrate their fire over the vital spot. The battery commander usually indicates the general location of each machine-gun platoon, of the battery command post, and of the kitchen.

The primary consideration in selecting the firing position of a gun battery or machine-gun platoon is an all-round field of fire, unobstructed to within 10° of the horizon. This usually requires a hill-top. Alternate positions must be chosen, observation and command posts installed, and the trucks concealed at a convenient distance. Proximity to a road is usually a necessity for the guns, since they are so heavy; but their fire must not interfere with traffic. Machine guns may be carried across country by hand. Prominent landmarks, such as cross-roads, must be avoided since they draw shell fire and bombs. Machine guns are usually dug in. In all units, trenches may be dug to shelter personnel from shell-fire.

Except in extremely unusual circumstances, enemy planes are fired upon by gun batteries or machine-gun platoons whenever they are within range, without awaiting any instructions from higher authority.

In disposing machine-gun units, some consideration should be given to the presence of the four machine guns which are manned by each 3-inch gun battery. These guns may be considered as a machine-gun platoon having one-half the effective radius of a regular platoon.

All elements are camouflaged. It is absolutely essential that the necessary steps to camouflage any position be begun at the earliest possible moment. It is useless to camouflage anything that the enemy has already discovered.

If practicable, altimeter stations and altimeter telephone lines should be installed prior to the arrival of the gun battery. Range sections should precede

the battery. It is advantageous to install the regimental telephone net, or parts of it, prior to the arrival of the regiment.

To facilitate control, administration, upkeep, and instruction, the searchlight battery is kept together except when gun batteries are in firing positions or when one or more gun batteries are separated from the rest of the battalion. In these cases, searchlight platoons are generally attached to the gun batteries.

Battalion Dispositions

The gun battalion should cover important elements of the corps. When practicable, it should be disposed so as to combine the fire of two or three batteries for the defense of the most important and vulnerable of these elements. The battalion commander usually indicates the general position of each gun battery and attaches the searchlight platoons to them. He generally indicates the routes of march for the batteries to use in reaching their positions.

A still greater degree of discrimination is necessary in assigning missions and localities to the machine-gun batteries. There will never be sufficient anti-aircraft machine guns to cover all elements of the corps which may be subject to attack; and it is necessary to concentrate our efforts where they will best further the object of the corps commander. The machine-gun battalion commander assigns missions to each battery by indicating the elements each is to cover. He usually indicates also the area within which the battery is to locate its platoons, and he may prescribe routes to positions. To insure coordination between adjacent batteries, he may prescribe how many platoons each battery is to place in the forward part of its area or how many platoons are to be located to cover a given establishment, or he may adopt some other means of indicating the general disposition of platoons within the battery. Only in exceptional circumstances will it become necessary for him to indicate the exact position of platoons, thus depriving the battery commanders of initiative; but he should not hesitate to do so when there is no other way of coordinating the defense properly, as, for example, when two or more batteries are covering a very small area.

Probable directions of approach are important factors to consider; but airplanes can come in from any direction, and it is wrong to stress this consideration too much.

The two battalions must know each other's plans and coordinate their action; but the missions, targets, and capabilities of the two weapons are so different that often the dispositions of one will have no appreciable effect upon those of the other. Nevertheless, there is a real need for coordination; for example, if circumstances demand it, an element ordinarily requiring machine-gun protection may be more readily denied that protection if it is known to be covered by a gun battery.

Battalion commanders indicate the locations of battery command posts.

When it is necessary to change positions, normally at least one battery should be kept in action while others are displacing.

Regimental Dispositions

The regimental commander assigns missions to each battalion and coordinates their action. Occasionally, he may prescribe the location of individual gun batteries and details of the movements of any or all batteries of the regiment. The usual reason for such action is to insure compliance with traffic arrangements which he has negotiated with commanders or staffs of divisions or the corps.

He indicates the location of the Service Battery and of regimental and battalion command posts. There are times (as in preparation for an advance) when the Service Battery and the command posts may be located centrally or even well up in the vicinity of the forward elements of the regiment, instead of being always in rear. However, the regimental commander must have good communication with the Corps Chief of Artillery.

RECONNAISSANCE

On the march, roads must be reconnoitered in advance and guides left at critical points, such as cross-roads.

When going into position, commanders (travelling in passenger vehicles) should precede their units to reconnoiter routes and select positions. If the unit is in march, it should continue the march under the command of the unit executive to an appointed spot, where it should halt and await orders. To avoid delay, this spot should be as close as possible to the expected position of the unit, and the unit commander or his representative should reach this point, to conduct the unit to position, as soon as possible.

The reconnaissance of the regimental commander is of a very general nature. The machine-gun battalion commander often confines his reconnaissance to an inspection of the roads which he expects his batteries to use, it is generally the battery commander's duty to locate individual platoons. The commander of the gun battalion reconnoiters roads and battery positions. In order to avoid attracting enemy attention, reconnaissance parties should be as small as possible. To avoid casualties and to avoid revealing the locations of the elements covered by the antiaircraft artillery, alternative positions should be selected and reconnoitered for all elements of the regiment. In the combat area especially, frequent changes of positions may be necessary.

TACTICAL EMPLOYMENT OF THE CORPS ANTI-AIRCRAFT ARTILLERY REGIMENT

MISSIONS

"The mission of the antiaircraft artillery is to furnish a local defense of our ground forces and establishments against hostile aerial activity."—Par. 5, TR 435-30.

"The antiaircraft artillery regiment of the corps operates under the corps chief of artillery and is employed for the protection of all elements within the corps zone of action, sector or area, except such as are covered by the army.

The corps antiaircraft artillery regiment provides gun defense for all elements of the corps, but, since the combat elements of the corps are provided with their own antiaircraft machine-gun defense, the machine-gun battalion of the corps antiaircraft regiment is generally employed to cover the supply and administrative elements of the corps, rather than combat elements.—Extract from par. 19, TR 435-30.

DEFENSE OF A SMALL LOCALITY

(Such as an Airdrome or Ammunition Dump)

The corps regiment, in its entirety, will rarely be called upon to defend a small locality. However, such an occasion may sometimes arise; moreover, a very brief discussion of this problem will serve to bring out some of the principles which must be applied in other situations.

The gun defense is arranged primarily to meet the attacks of bombing planes.

Batteries should be located so as to concentrate their fire upon approaching planes before they drop their bombs. With present bombing sights, airplanes must fly a straight course for at least twenty seconds before the instant of releasing their bombs. Considering average conditions, it has been calculated that a bomb dropped within 1500 yards of a certain area will fall within the area, while the artillery should be able to open fire upon attacking planes at least one minute before they reach the point where they can discharge their bombs. Thus, there is a belt or "danger zone" 1500 yards wide around the defended area and a "Sensitive outer zone" beyond that. It is considered essential that, when possible, batteries should be disposed to deliver maximum concentrations of fire upon an airplane the moment it arrives within 4500 yards of the defended area. It is highly desirable to deliver fire beyond that limit, but it is more important to deliver the fire of at least one battery over all parts of the 4500-yard sensitive belt.

Because of their short range, machine guns must necessarily be located close to the defended area, so as to fire upon low-flying planes.

Probable directions of approach should be considered. However, the usual tendency is to give too much weight to this factor. While bombing planes may follow a river, railroad, or other feature to guide them on a long trip, it by no means follows that they will fly directly above it when they reach the close vicinity of the target; they may swing out and then come in on the objective from any direction.

The dispositions will be affected by the shape of the area. Bombing planes secure a greater number of hits if they fly over the longer axis of the area.

COVERING THE CORPS ON THE MARCH

Until contact with the enemy is imminent, the Corps usually marches with its divisions and the corps troops rather widely separated, occupying an extent of country that cannot entirely be protected by the corps antiaircraft regiment.

During this phase, it is often advisable to attach machine-gun batteries to divisions and to the corps troops, and even gun batteries may be so attached.

When the corps concentrates, it is usually advisable for the regimental commander to resume control of some or all elements of the regiment.

So much time is required for 3-inch antiaircraft guns to go into and out of position that it is not practicable to cover the route of a day's march by moving from position to position. About all that can be done is to provide a strong defense at the original bivouac until the bulk of the troops have cleared and then, by exploiting the superior speed of the regiment, set up a defense at the destination. The displacement may take place by battery, weakening the defense of the original bivouac gradually as the troops to be covered are reduced. However, troops and trains marching along defiles are extremely vulnerable to air attack, and important defiles along the route should be covered during the passage of the bulk of the troops.

Machine guns may cover marching columns from successive positions if there are parallel roads, since machine-gun platoons can go into and out of firing positions with great rapidity. If the column to be protected is composed of motor vehicles, machine-gun trucks may be distributed through the column and move with it.

COVERING THE CORPS IN AN ATTACK

GUN BATTALION

"In covering combat troops in contact with the enemy the mission of the gun defense becomes primarily the neutralization of hostile aerial observation. In addition, it protects our observation balloons and observation planes and assists our pursuit planes."—Extract from par. 26, TR 435-30.

If we lay out on a map the dispositions of a corps, acting alone, deployed for an attack, it will be found that by a judicious arrangement of two gun batteries forward and one in rear, we can usually bring the fire of at least one battery to bear over most of the troops and important establishments. This can be shown graphically by drawing a circle of 5400 yards radius for each battery. The batteries should be so located that the fire of two or more may be concentrated over the more important troops or establishments, so far as this can be done without uncovering others that must be protected.

Since antiaircraft weapons must be located on commanding ground, they are conspicuous and likely to draw fire from ground troops. For this reason, it will not usually be practicable to place 3-inch antiaircraft gun batteries within less than 2000 yards from the front line. On the other hand, since it is an advantage to bring enemy planes under fire as soon as possible, the batteries that cover forward elements must not be too far back.

The dispositions of the machine-gun battalion must be taken into account.

When the corps is part of the army, the antiaircraft defense must be coordinated with that of adjacent corps and of army antiaircraft artillery units.

Thus, if our corps is between two other corps and is assigned a fairly narrow front, there are times when it is better to place but one battery forward and two back, taking advantage of the presence of batteries of other regiments located near the corps boundaries. Moreover, the army will often furnish protection for some corps establishments.

MACHINE-GUN BATTALION

In the attack, it is difficult to control the advanced elements of the machine-gun battalion. It is difficult also for the regimental and battalion commanders to keep in touch with the rapidly changing situation. For these reasons, in an attack with unlimited objectives it is often advantageous to attach machine-gun batteries to assault divisions. When so attached these units are used by division commanders to reinforce the antiaircraft defense maintained by divisional troops with their own weapons. The attached antiaircraft machine-gun units may cover troops, command posts, distributing points, railheads, and airdromes.

In an attack with limited objectives, control is simpler and it is rarely necessary to attach machine-gun elements to divisions.

Those elements of the antiaircraft machine-gun battalion which are not attached to divisions are employed to cover distributing points, dumps, reserves, and other establishments and elements in rear of the area of combat troops in position.

Due to the short range of machine guns, the small number that are available, and the fact that a platoon of four is usually the smallest group which it is worth while to use for a single mission, it is perfectly obvious that machine guns cannot be assigned to each one of these scattered establishments. We must consider, for each, how tempting a target it offers, how much it can be deranged by an aerial attack, and how seriously the plans of the corps commander would be affected if its functioning should be impaired. Comparing them all by these standards, we pick out those that it is essential to protect and allot our machine-gun units in such a way as to cover them adequately.

The dispositions of the gun battalion, and of the antiaircraft gun and machine-gun units of the army and of adjacent corps, will affect our plans. The army will often furnish protection for some corps establishments.

GENERAL

In the attack, all troops and establishments of the corps, including the corps antiaircraft regiment, are disposed as far to the front as conditions permit and must be prepared to displace forward promptly. The regiment must be familiar with routes of advance and must pick out tentative advanced locations.

In all cases, it is the duty of the army commander to coordinate the defense set up by his corps and army antiaircraft artillery regiments.

DISPOSITIONS OF THE REGIMENT FOR THE DEFENSIVE

On the defensive, the vital thing for the corps is to hold its position unbroken. Therefore, the antiaircraft gun and machine-gun units must be placed with the primary object in view of covering "all forces and elements essential to the maintenance of the position." On the other hand the possibility of a withdrawal is always present, and the antiaircraft artillery must be prepared to cover such a movement. Since the advanced combat elements of the infantry and field artillery are sure to be located and attacked by low-flying planes, some of the antiaircraft machine-gun batteries should be located even further forward than in the attack. The gun batteries, however, should be somewhat further back than in the attack, so as to facilitate withdrawal and also because the corps is extended in greater depth when on the defensive.

Antiaircraft gun batteries should never be located in the outpost area, because they will do very little good there and would be easy prey for an attacking force.

The regiment must be familiar with plans for counterattacks and be prepared to cover them. It must also select routes of withdrawal and possible positions for use if withdrawal is ordered.

After every declaration of peace, our people have apparently assumed that the peace would be eternal, that no more war would come; and now after the Great War, which some phrase has called "The War to End War," there comes from some of our citizens a large demand for the destruction of armament and suggestions that, if we only set an example, the other nations will be moved by our nobility to beat their swords into plough shares, convert their tanks into field tractors, and turn their warships into junk. The advocates of disarmament can visualize the millennium if only their doctrines are followed but cannot or will not see the actual world conditions existing today.—Admiral Hilary P. Jones.

A German Instrument for the Preparation of Antiaircraft Fire

THE SCHÖNIAN INSTRUMENT, MODEL 1918

By MAJOR P. VAUTHIER

Translated from the *Revue d' Artillerie* in the Military Intelligence Division

THE name of this instrument is the *Flakkommando Schöinian 1918* or the *Kommandogerät Schöinian 1918* or the *Auswanderungsmesser Schöinian 1918*.

The Schöinian instrument is to be used for the preparation of antiaircraft fire. Sixty of these instruments were ordered in February, 1917, from the Zeiss firm of Jena. Twenty of them were delivered and placed in service before the time of the armistice; of the remaining forty, some were destroyed and the others were abandoned after the armistice when work was stopped on them. The instrument was used at the front from the beginning of 1918 with guns of 7.62-cm. caliber, 8-cm. caliber, and 8.8-cm. caliber; only the ballistic graphs differ from one caliber to another.

According to Major Neumann (*Die deutschen Luftstreitkräfte im Weltkriege*, Berlin, 1920, page 281), "the Schöinian instrument was the most perfected of the instruments for the preparation of antiaircraft fire used by the Germans."

We shall here give the characteristics of this instrument, as we believe that an examination of the solutions of the problem of antiaircraft fire considered as the most perfect in Germany at the time of the armistice may be of interest to French antiaircraft artillerymen.

After having given a brief description of the general appearance of the instrument, our examination will dwell on the following points:

Determination of the data concerning the present position of the airplane (position, movement),

Solution of the principal problem (future position of the airplane),

Secondary problems,

Determination of firing data,

Operation of the instrument.

I. GENERAL DESCRIPTION OF THE INSTRUMENT

The instrument is supported on a light tripod, of which the feet may be embedded in the ground. The three feet are kept a fixed distance apart by a star-shaped cross brace (Figure 1).

The instrument proper is in the form of a small box: length about 0.50 meters, width about 0.30 meters, height about 0.50 meters. Its weight, not including the tripod, is about 50 kgs. (Fig. 2).

The instrument is closed on all sides excepting one, and in that is a window closed by a transparent plate. Through this window the details of the mech-

anism and several graphs may be seen. One monocular telescope is used for sighting the present position of the airplane. The instrument terminates above in a protuberance which forms a housing for a ballistic graph in all positions which it may assume, and at the bottom by a cylinder on which the system of curves is engraved.

A manning detail of four men is enough to operate it. The cylinder E (Fig. 17) is for reading the corrections for deflection or azimuth for the future

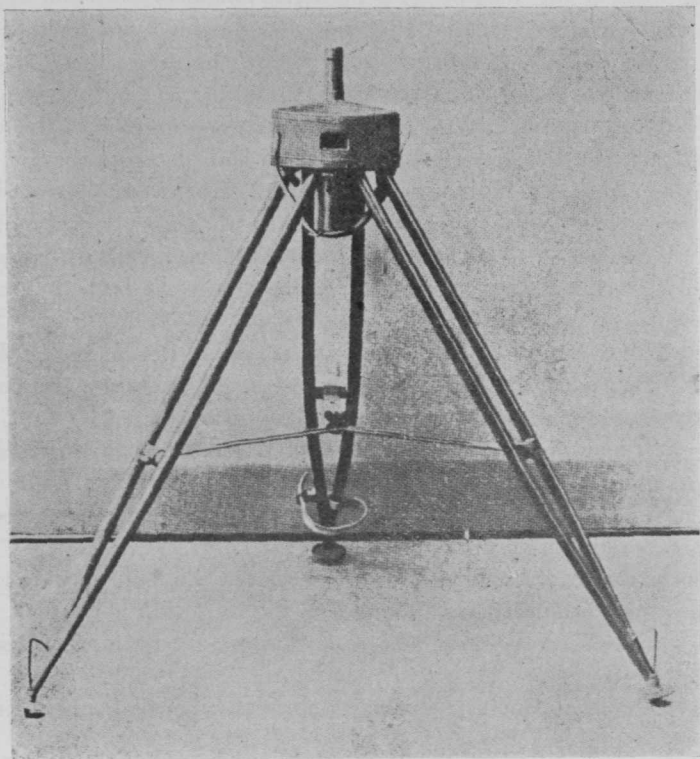


FIG. 1. TRIPOD

position of the airplane. The face AB is for reading the inclinations and the fuze setting, or for reading the corrections in deflection and site. The face CD is used for calculating the elevation.

The instrument may be used:

- (a) In direct fire, in which case the pieces, aimed in direction and elevation on the target, are given from the instrument a deflection correction (in the plane of site), a site correction, a fuze setting, and, in case of need, an elevation;
- (b) In semi-direct fire, in which case the pieces, aimed at the target in direction only, are given a correction for deflection (in the plane of site), a fuze setting, and, depending upon the case, either the inclination (or elevation)

or the altitude, which, combined with the fuze setting, may be used to determine the inclination (or elevation); or

(c) In indirect fire, in which case the pieces do not use their sighting apparatus and are given the azimuth, the angle of elevation, and the fuze setting.

Figure 17 gives a diagrammatic representation of the whole instrument. It has only one monocular telescope L , the observer having to sight at the same time in direction and in elevation.

The present position of the airplane is represented by a point A_0 fixed in relation to the instrument; on the contrary, the point P , which represents the battery, is mobile. The relative locations of A_0 and of P are such that the

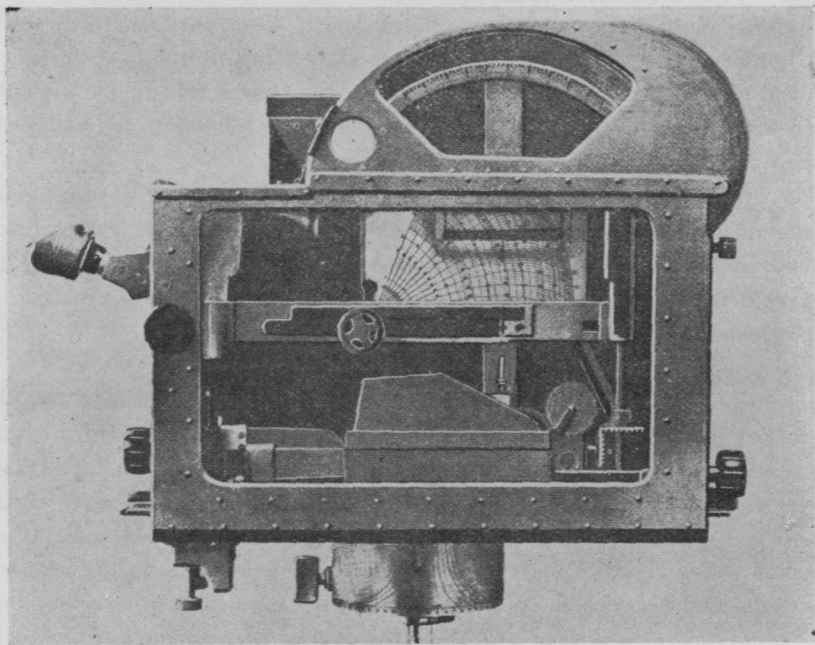


FIG. 2. THE SCHÖNIAN INSTRUMENT

angle made by PA_0 with the horizontal is equal to the angle of site s_0 of the present position of the airplane, and that the distance PA_0 is proportional to the range D_0 to the present position of the airplane. Consequently, the line Pa_0 will be proportional to the horizontal range Δ_0 and the line A_0a_0 will be proportional to the altitude.

The point A_0 is situated in front of a vertical plotted graph on which are traced the trajectories and curves of equal fuze setting for powder-train fuzes, or curves of equal time for mechanical fuzes. The graph F is therefore a graph of trajectories, from which the firing data for the present position of the airplane may be read. The graph F may be moved with two rectangular movements, one in altitude and one in horizontal range, or with a single movement which is the resultant of these two movements. These movements serve to

displace the point P, which represents the piece, so as to give a proper form to the vertical triangle PA_0a_0 . The graduated scale G_h and G_Δ may be used for reading or introducing the values of h and of Δ_0 ; one graduated scale G_{D_0} on a vertical wheel H is used for reading or introducing the value of D_0 .

The data for the movement of the airplane from its present position, which are used in the instrument, are the air speed of the airplane and the direction in which it is moving.

In order to measure the air speed of the airplane, the instrument is used like a tachyscope, counting the time required by the airplane to cover a certain known distance (here 180 meters); in order to make this measurement, it is necessary to halt the instrument during the measuring process. The measurement of the speed therefore can be only intermittent. A partial remedy to this disadvantage is to be found in the wind calculating instrument J; the action of the wind on the airplane is added geometrically to the action of the air speed of the airplane entirely automatically, whatever the direction in which the airplane is flying.

The direction of flight of the airplane is, however, kept up to the minute continuously by the observer; it is even kept up to the minute automatically by the instrument so long as the airplane follows the same straight line. The observer does not have to intervene except in case of change of direction of the airplane.

The point A_0 , which represents the present position of the airplane, is represented by the point of a glass needle I; when the instrument marks a speed of zero for the airplane, the needle is in a vertical position. In order to pass from the present position of the airplane to a future position A of the airplane, for values which are not zero for the speed of the airplane, the glass needle, whose point normally represents the future position of the airplane A, may be moved in different ways and through different amounts, the details of which movements will be considered later. These displacements are complex functions of the speed, the direction of flight, the data concerning the position of the airplane, and the ballistic data for the trajectory. They are given—

(a) On the one hand, by the observer, who in measuring the direction of flight a_0 , determines the vertical plane in which the glass needle may move;

(b) On the other hand, by operator No. 4, who determines the vector Vt with the use of a single milled head V_4 from an examination of the graphs K and M.

After these operations have been completed, the end of the glass needle I represents the future position of the airplane. The firing data i and B are read off on the graphs showing the trajectories F on a line dropped from the end of the glass needle. The azimuth ϕ is read off on the graduation G_ϕ to the right of the index on the lower cylinder E. The correction for deflection and for site may be read off in the reading glass S. Lastly, the elevation may be read off on a disk T, which is on the face GD of the instrument.

II. THE PRESENT POSITION OF THE AIRPLANE

An instrument for the preparation of fire should determine and record the data for the present position of the airplane and the data concerning its movement.

a. Data of Position.—The linear coordinate—altitude or range—is determined aside from the instrument on a monostatic range finder. The Schönian instrument uses at will the altitude, the slant range, or the horizontal range. The continuity of the sighting, in the intervals between the intermittent deter-

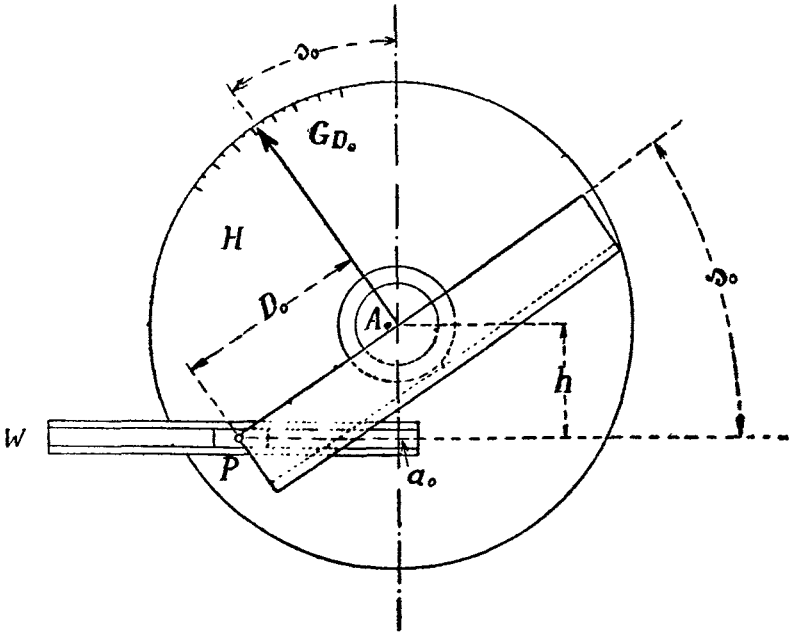


FIG. 3. THE AIMING TRIANGLE U

minations of the monostatic range finder, is assured only by the use of the altitude datum; it is no longer assured when the slant range for the horizontal range is used. But the instrument can, however, receive any one of these three linear coordinates, as the officer controlling fire may desire. It may thus be possible to transfer instantaneously from fire by altitude (airplanes with high altitude) to fire by slant range or by horizontal range (airplanes at low altitude).

This is done by the materialization of the vertical triangle PA_0s_0 in its real size. Figure 3 represents the mechanism U which is situated behind the graph F, bearing the graphs of the trajectories. The point A_0 is fixed. The point P receives two movements: one places the horizontal slide W at a vertical distance h from A_0 ; the other forces P to remain on the straight line PA_0 , which, on the other hand, receives an inclination equal to the site of the present position of the airplane s_0 . The site of the present position of the airplane s_0 is transmitted to the mechanism U by the observer.

The angular coordinates of the present position of the airplane are given, as in all instruments of this kind, by the observer, who follows the movement of the airplane with his telescope. In order to sight in azimuth, the observer moves the whole instrument around a vertical axis, this movement being effected directly, without the intermediation of any sighting instrument, by having the observer turn the control buttons V_1 and V_2 to the side. This device does not make it possible to obtain very precise sighting in direction; it does make it possible to use the observer for another operation and to employ him for de-

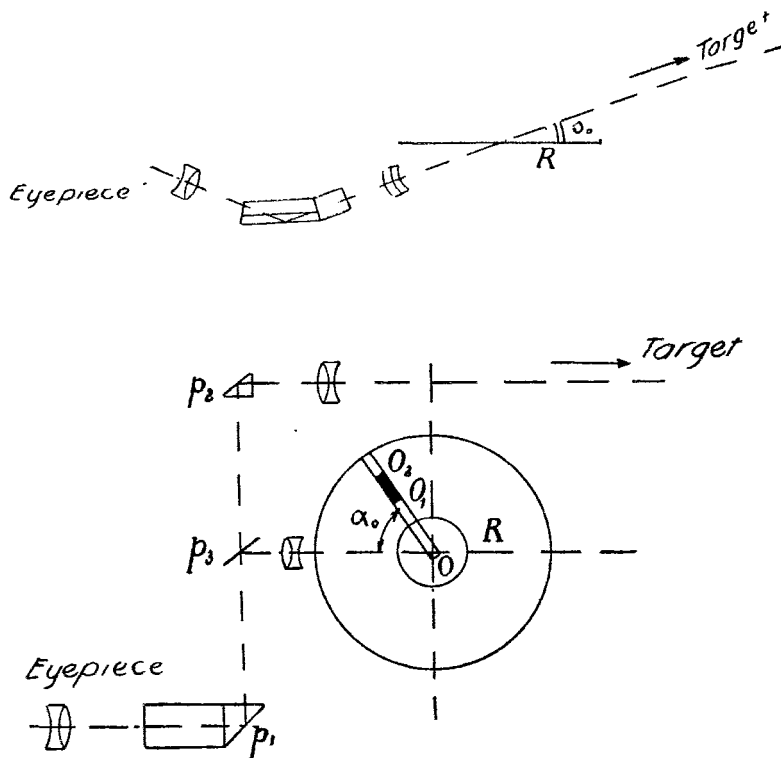


FIG. 4. THE AIMING TELESCOPE L

termining the direction of flight of the airplane. But we cannot help thinking that great demands are placed upon this one operator, for he has to perform three operations: sight in direction, sight in elevation, and determine the direction of flight of the airplane. It is to be feared that each of these operations will be performed with very little precision.

The telescope of the observer has only one magnification, 4, and its field amounts to about 12° . Figure 4 gives the diagrammatic representation of the telescope, which is a prism telescope with a bent line of sight. The luminous rays come from two different sources; first, from the target (prisms p_2 and p_1), then from a horizontal mechanism R which serves to determine the angle of

flight direction a_0 and the air speed of the airplane V (prisms p_3 and p_1). The two sheaves of luminous rays give superposed images.

b. Data of Movement.—We shall see in detail the part played by the mechanism R , which is used for determining the data of movement of the airplane from its present position.

The solution adopted for determining the ground speed is very analogous to the solution employed in France with the tachyscope. The mechanism R is composed essentially of a horizontal micrometer of a special kind. It has a small inside circle with an apparent diameter of 2° ; it also has a radial tube or hand $0\ 0_1\ 0_2$ which can be set at any angle from 0° to 360° in the horizontal plane. The tube, or hand, $0\ 0_2$ has a plug or obstacle $0_1\ 0_2$ in it, and this plug can occupy various positions, so that the distance $0\ 0_1$ always corresponds to the perspective of a constant distance in space, and this distance has been selected as 180 meters. This result is obtained by a connection with the mechanism U , which makes $0\ 0_1$ a function of D_0 .

To measure the speed, the observer stops the movement of the instrument and at the same time starts the split-second hand of a chronometer Q (Fig. 17). He then stops the split-second hand when the airplane has arrived at 0_1 . At that moment the distance covered by the split-second hand is proportional to the velocity to be measured; the chronometer has been directly graduated for ground speeds.¹ It is sufficient to read off the value of the speed on the chronometer and to transfer it to the mechanism J (Fig. 17).

We must call attention to the fact that the micrometer R is always horizontal; on the other hand, the angle s_0 may be of any value between 0° and 90° . Hence the instrument has solved a particularly important problem of optics, that of making the plane of the micrometer independent of the movements of the optical axis of the telescope. The observer, looking in the telescope, sees the perspective of the horizontal plane of the micrometer in a plane perpendicular to the optical axis of the telescope. Any point on the radial hand or tube $0\ 0_2$, 0_1 for example, which describes a circle in the horizontal plane R , appears to the observer to describe an ellipse. This arrangement, which is especially fine from the theoretic point of view, gives an optical solution of the tachyscope which is very superior to the French solution.

The mechanism R also is used for the determination of the direction of flight of the airplane. Besides his functions of pointing or aiming proper, the observer has to keep the radial tube $0\ 0_2$ on the fuselage of the airplane; he controls the direction of the tube $0\ 0_2$ by actuating a button V_1 made for this purpose. The instrument is so constructed that, assuming that it has correctly recorded the direction of flight of the airplane at a given moment, this is kept up to the minute under the action of the operation of pointing the instrument in direction, so long as the airplane does not turn its nose in relation to a fixed direction, the North, for example. This is because of the fact that the rotation of the instrument acts directly on the direction of the radial tube $0\ 0_2$, the observer not having anything to do except to change it for changes in direction

¹The chronometer and the J instrument are graduated from 10 to 75 meters per second.

of the airplane. The mechanism R gives an automatic optical solution of the French orientation telescope (*lunette d'orientation*) which has to solve the following problem: Given the apparent angle of direction B (or perspective of the angle of direction) and the angle of site s_0 , find the angle of direction a_0 . The French solution, which solves the formula: $tg a_0 = tg B \sin s$, necessitates the reading of a graph; the French orientation telescope therefore cannot be connected to an instrument for the preparation of fire without making necessary a reading and a transfer.

The solution offered in the Schöinian instrument, on the contrary, is entirely automatic; the observer does not need to read the value of a_0 . The mere fact of placing the radial tube 00_2 along the fuselage of the airplane introduces a_0 into the instrument. The only criticism, which moreover is serious, which might be made of the German solution is that the determination of the apparent angle of direction β is not very precise; the solution is entirely analogous to that of the French orientation telescope, model 1916. The solution of the orientation telescope, model 1917, with doubled image seems to be superior to it.

But, everything taken into consideration, the solution inherent in the Schöinian instrument, with fixed horizontal micrometer, seems to be superior to the French solution—tachyscope, orientation telescope. It is true that this latter solution is not very good; other French solutions have been very superior to it.

Considered as a whole, in the Schöinian instrument, the determination of the data of motion is very uneven. The determination of the air speed of the target is good, but it cannot be accomplished except by interrupting the preparation of fire and must therefore be intermittent. On the other hand, the determination of the direction of flight of the airplane has been greatly improved, the operator who determines the direction not acting except from time to time to rectify the readings for the direction, which the instrument automatically keeps up to the minute. The solution would be still better if the man who determined the direction of flight were some other than the observer, who has other delicate operations to perform.

III. SOLUTION OF THE PRINCIPAL PROBLEM

The principal problem of the preparation of antiaircraft fire has as its aim the determination of the future position of the airplane, upon the basis of its present position, it being assumed that the data concerning its present position and its movement are known.

We know that this problem cannot be solved except upon the hypothesis of a law of movement of the airplane. The Schöinian instrument is based upon the hypothesis of a uniform horizontal flight; the path of flight is assumed to be horizontal and rectilinear and the speed uniform. The instrument does not help us to fire when the course followed by the airplane is not horizontal (when the airplane dives or ascends).

The solution of the principal problem with the Schöinian instrument is "geometric" in nature. The type of solution reproduces on a given scale figures

in space; it is the opposite of algebraic solutions, which solve certain formulas derived from the same geometric figures. Here the instrument reproduces on the scale of 1:40,000 the geometric figure formed by the gun, the present position of the airplane, and the future position of the airplane. In the figure thus reproduced, the point A_0 is fixed in relation to the instrument, as well as the vertical plane which passes through PA_0 . In connection with the present position of the airplane, we have seen how the point P , which represents the battery, is located in relation to the point A_0 ; we shall now see how the future position of the airplane is determined.

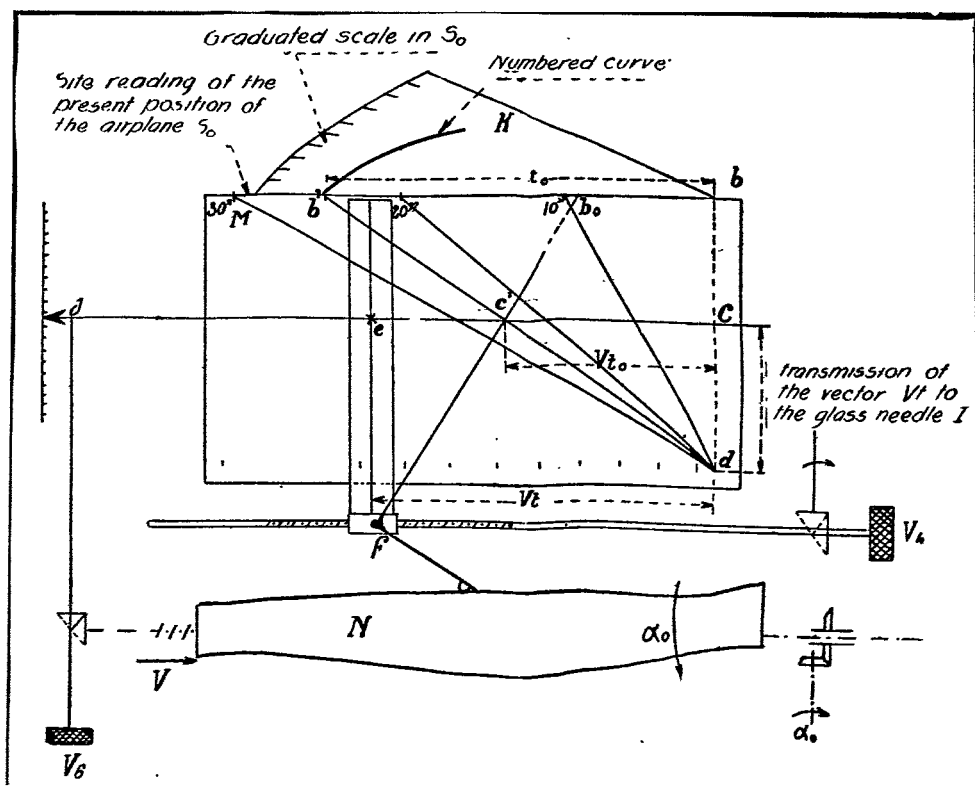


FIG 5. GRAPHS K AND M, CAM-SHAPED PLATEN, FOR DETERMINING THE FUTURE POSITION

As already stated, the observer places the mobile radial hand of the micrometer R along the fuselage of the airplane; this operation determines the direction in which the airplane is flying or the angle between the fuselage and the vertical plane of sight PA_0A_0 . Without the necessity of knowing its value, the direction of the airplane is transmitted mechanically to the glass needle I ; the needle then moves in a vertical plane, which, according to the hypothesis made, contains the path of flight of the airplane. The point A is situated in this plane, on the horizontal passing through A_0 and at a distance A_0A , equal to Vt , t being the time of flight of the projectile to the point A .

point A above the plane of altitude h ; this lowering is corrected by raising the center of rotation of the glass needle by $a_o a'_o$. Let a be the length of the glass needle I, and we get the following relation:

$$\omega = \arcsin \frac{Vt}{a}$$

and

$$a_o a'_o = 2a \sin^2 \frac{\omega}{2}$$

ω may be determined as a function of Vt by some mechanism or device or by a cam; $a_o a'_o$ may be determined from ω by a cam.

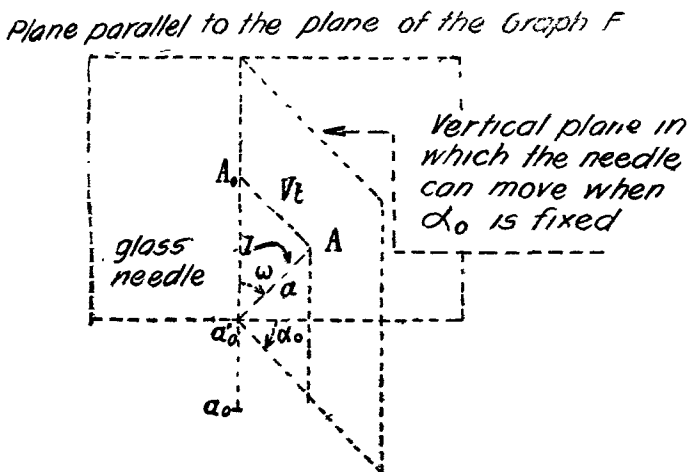


FIG. 8. TRANSMISSION OF THE VECTOR Vt TO THE GLASS NEEDLE

Figure 9 shows the glass needle on its base. The screws 1, 2, and 3 are bearing and adjusting screws for holding the needle in place. At the bottom we can distinguish two conical pinions, one of which serves to move the needle in direction in order to place it in the desired plane of orientation; the other is used to lower the needle in the plane of orientation by the angle

$$\omega = \arcsin \frac{Vt}{a} \text{ and at the same time to show its origin of } a_o a'_o = 2a \sin^2 \frac{\omega}{2}.$$

This solution of the principal problem, which always constitutes an essential part in any instrument for the preparation of antiaircraft fire, requires some explanation.

a. The transmission of the direction to the instruments and parts which are to receive it. The vertical plane in which the glass-needle moves, cam-shaped for the calculation of the value of Δt , is accomplished entirely automatically when the observer keeps the mobile hand of the micrometer constantly along the fuselage of the airplane. We have seen that the determination of the direction is, perhaps, not very precise because of the uncertainty governing the determination of the apparent angle of direction, but we must admit

that the transmission of the direction of flight of the airplane has been brought to a very fine point, as it is accomplished automatically and without any intervention on the part of any operator.

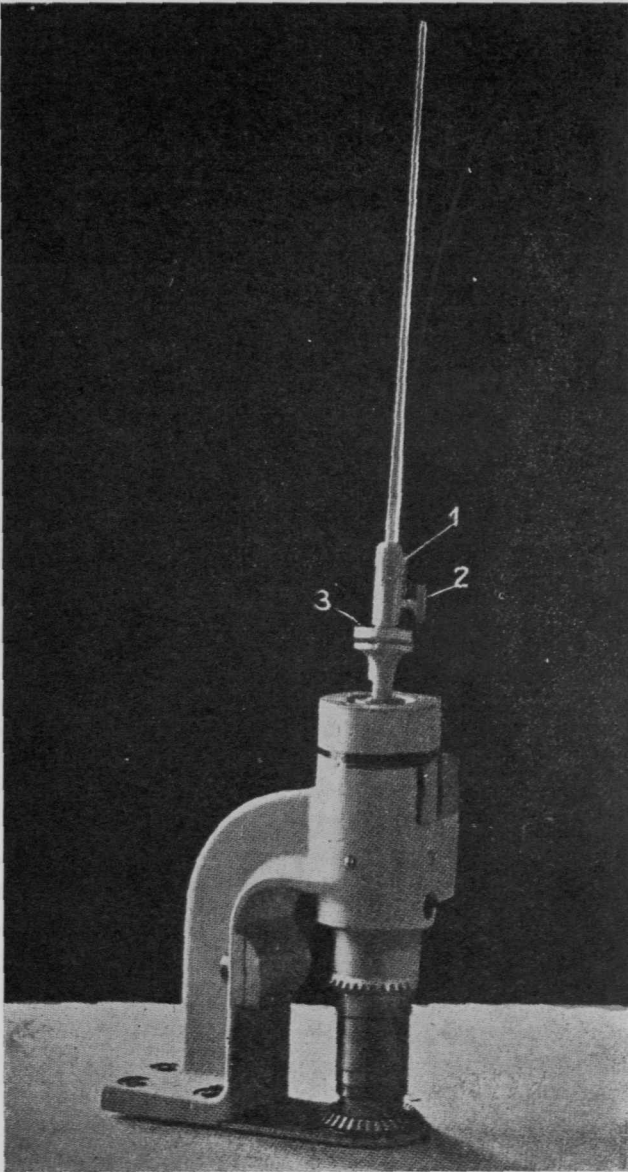


FIG. 9. GLASS NEEDLE

b. The method of taking into consideration the dead time is correct. This time varies according to whether the fire is direct or indirect; the instrument is constructed for a dead time of ten seconds for direct fire and a dead time of

five seconds for indirect fire. In order to take advantage of a dead time which may be considerable, it would have sufficed to provide for a difference in the horizontal position of the point b , around which the graph K turns; this difference would have been equal to the dead time.

As it is designed, the instrument can determine the future position of the airplane, either with a dead time zero (in which case the vertical alidade ff' is brought on the point c') or with a dead time having a value other than zero (when the inclined alidade fb_0 is placed on the point c'). This value for the dead time is, for example, the one to be used for indirect fire. For direct fire, it would have been necessary to provide a second set of curves of actual ranges on the graph K, but this complication was not adopted. For direct fire only one curve of a different color has been traced on the graph K, giving the time of flight for a single altitude $h = 4000$ meters. The resulting errors would not amount to two seconds in the time of flight of the projectile and would be disregarded as unimportant for direct fire.

c. The determination of the future position of the airplane includes a series of approximations which render it very inaccurate.

(1) $\Delta t = t - t_0$ is calculated only in a rather approximate empirical manner.

(2) The angle ϵ at which the alidade is inclined to give Δt is added to the angle ϵ corresponding to the dead time, while it would be necessary to add their tangents according to the construction.

(3) Lastly, the operator determining the future position of the airplane must make a series of readings, of extrapolations of graphs, of prolongations of lines, and of locations of the alidades on the intersections of curves and alidades, which appear complicated and difficult to execute with precision.

A number of difficult operations have been placed on the shoulders of one and the same man. It would have been better to apply the principle of division of work or the principle of the use of mechanisms. In the first case, we would have several operators, each of whom would have to perform simpler operations; in the second case, the number of operators would remain the same, but the operations would be simpler, thanks to the aid of automatic devices which would do some of the operations now performed by men.

(4) The solution does not include any reaction between t (or Vt) and Δ ; it is therefore a solution of the type known as a "direct solution," which cannot make any claims to accuracy.

Whether well or badly determined, the future position A of the airplane is defined in the apparatus by the end of the glass needle I.

IV. SECONDARY PROBLEMS

The secondary problems of the preparation of antiaircraft fire include the calculation of aerological and ballistic corrections and the problem of parallax. None of these problems have been solved by the instrument, excepting the problem of the wind.

The Problem of the Wind

The instrument takes into consideration the *action of the wind on the airplane*.

The ground speed varies with the amount of the wind, and, for a given wind W , it varies with the direction of the air speed V with relation to the wind. For a given wind W , the ends of the ground speed vector are distributed on a

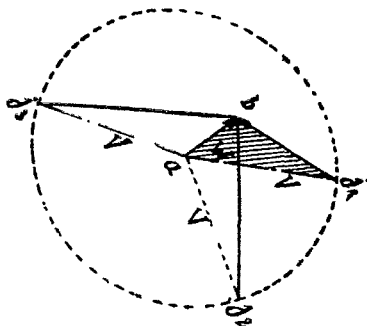


FIG. 10. SKETCH REPRESENTING VELOCITIES WHEN THE SPEED CHARACTERISTICS CHANGE DIRECTION

circle having as center the origin of the vector W and as a radius V . The values of the ground speed vector are bj_1, bj_2 , etc. (Fig. 10). The triangle of the speeds is therefore presented in the instrument as in Figure 11. The value V is obtained once for all, as is also the vector W , in size and direction. The direction of the arm ab should vary with the variation which the path of the

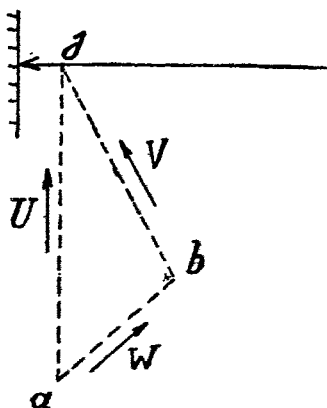


FIG. 11. SKETCH OF VELOCITIES

airplane makes with a direction of origin. This angle is equal to the algebraic sum of the azimuth and the angle of path. The arm ab will therefore be connected to the movement of the apparatus in azimuth and to the reticule R through a differential.

The amount of the wind W and its direction are measured on a cloud or on a shell burst, as with the tachyscope.

The instrument also takes into consideration the *action of the wind on the projectile*. It has been assumed that this action is interpreted by a theoretic wind W_p opposed to the real wind W which acts on the movement of the airplane. The triangle of the speeds then is represented in Figure 12.

The scale of the true speeds is then connected to the point c . The fixed point, the origin of the velocity definitely introduced into the instrument, is the point a . The vector W_p is considered as constant; thus we get quite a bit away from reality.

Figure 12 gives the mechanism with which the triangle of the speeds is obtained.

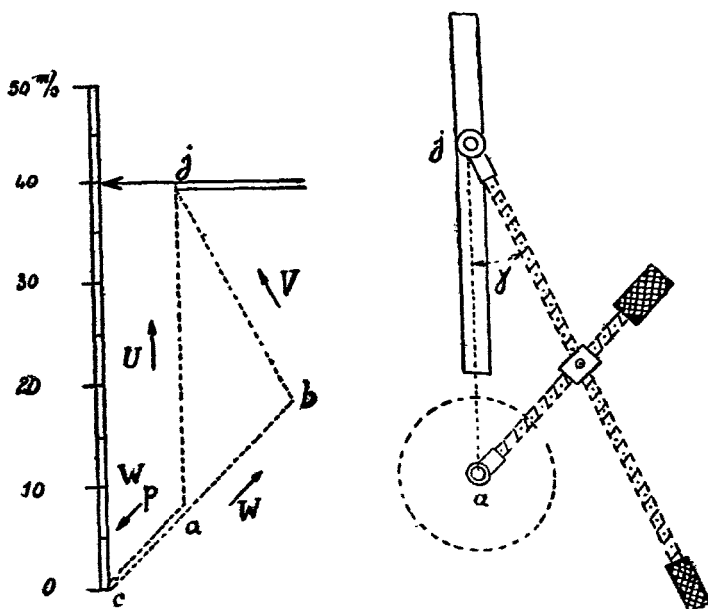


FIG. 12. AUTOMATIC WIND MECHANISM

It is not sufficient to introduce into the instrument the amount of the ground speed; we must also introduce the angle of the course, instead of the angle of direction. For this it would be necessary to have the observer place the mobile hand of the micrometer in the direction of the path of flight (direction for the ground speed) and not in the direction of the fuselage (direction for the speed in still air). This solution does not appear to be possible, as the observer does not have any means for knowing the direction of the path of flight. If the observer places the movable hand of the micrometer in the direction of the fuselage, he gives the angle of direction, and he must add to that angle, with the proper sign, the angle of the path of flight and the air speed. This angle is marked γ (Fig. 12) in the triangle of speeds. It is not certain that this addition is accomplished in the instrument; in this case there

would be confusion between the angle of direction and the angle of the path of flight.

The horizontal alidade of the speeds ec (Fig. 5) is connected at the point j .

V. THE FIRING DATA

The firing data are—

a. In direct fire: the correction for deflection in the plane of site, the site correction, the elevation, and the fuze setting.

b. In semi-direct fire: the deflection correction, the inclination, and the fuze setting.

c. In indirect fire: the future azimuth, the inclination, and the fuze setting.

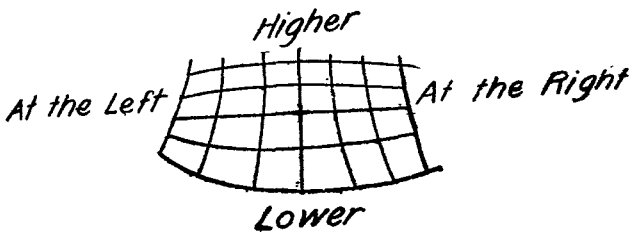


FIG. 13. MICROMETER OF THE READING GLASS S

The deflection correction and the site correction for direct fire are taken in the deflection system known as “in the plane of site.” They are read off in the reading glass S (Fig. 17) which makes it possible to examine the end A of the glass needle I on the micrometer having the form indicated in Figure 13.

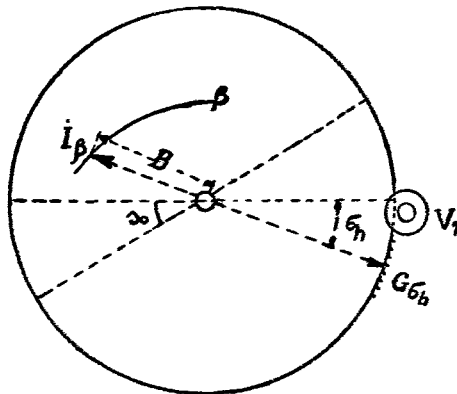


FIG. 14. CALCULATION OF THE ELEVATION

As in the German tachymeter, model 1916 (*Auswanderungsmesser 1916*, or *Am. 16*), the curvature of the graduated curves of the reticule ought to increase with the angle of site, but it was not desired to place on the reading glass S the complicated operating system and micrometer of the German tachymeter (*Am. 16*). A micrometer graduation corresponding to an average site, which constitutes a cause of considerable error, was selected.

The elevation is read off on a device T, placed opposite the face CD on the instrument (Fig. 17). The graph graduated in elevation graduations B turns in the present site by the direct control of the pointing triangle U of Figure 3. The method of controlling the site may be seen in Figure 17. A button or milled head V_7 makes it possible to add the site correction to the present site; this is done by rotating the index pointer I_β (Fig. 14). Moreover, the distance to the center of the index I_β is proportional to the fuze setting B. It may be seen that it is easy to read off the elevation opposite the index pointer I_β .

The fuze setting is read off on the graph of the trajectories F (Fig. 17). Figure 15 shows the operating mechanism of the graph of trajectories F. The button V_3 is to inscribe the altitude; the button V_2 is to point the instrument in site, acting on the horizontal range.

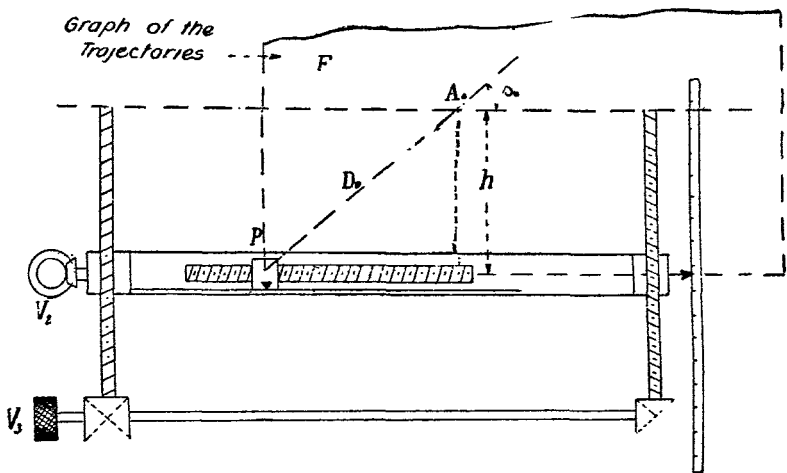


FIG. 15. MECHANISM FOR MOVING THE GRAPH OF TRAJECTORIES

The graph shows the trajectories and the curves for equal fuze settings on the scale of 1:40,000. The fuze setting is read off on the graph of the trajectories opposite the end A of the glass needle I. In order to avoid errors in parallax, which might be very great, since the end of the glass needle I may be removed very far from the graph F, a vertical mirror mm' is placed in the vicinity of the horizontal plane where the end of the glass needle I moves. These arrangements facilitate operation; before proceeding to the work of making the readings, the operator should move until he sees the image of the needle in the mirror move above the needle itself.

Like the fuze setting, the inclination is read off on the graph F, opposite the point of the glass needle and the same precautions are taken. Attention is called to the fact that the reading of the fuze setting and the inclination are a little off, because the point A is projected on the graph, instead of being transferred to it, by rotation around the vertical line through the point P which represents the piece. The error is zero for an airplane which is coming toward or going away from the operator, but it may be more than 100 meters when the line of flight is transversal.

This error is cancelled by automatically adding to the measured direction a quantity which corrects the error; the vertical plane of displacement of the glass needle therefore is slightly modified in relation to the measured direction.

The azimuth for the future position of the target is read from the cylinder E, which is at the bottom of the instrument (Fig. 17). Figure 16 gives the details of the cylinder as constructed. The index k moves vertically as a function of the present site of the target. This movement is obtained by a cylindrical pinion connected to the graph K, the index k bearing a toothed rack engaging with the cylindrical pinion wheel. The cylinder has curves, graduated in deflection correction, of the deflection system known as "in the plane of site." The cylinder E may move around its axis, with the aid of the handles (Fig. 17),

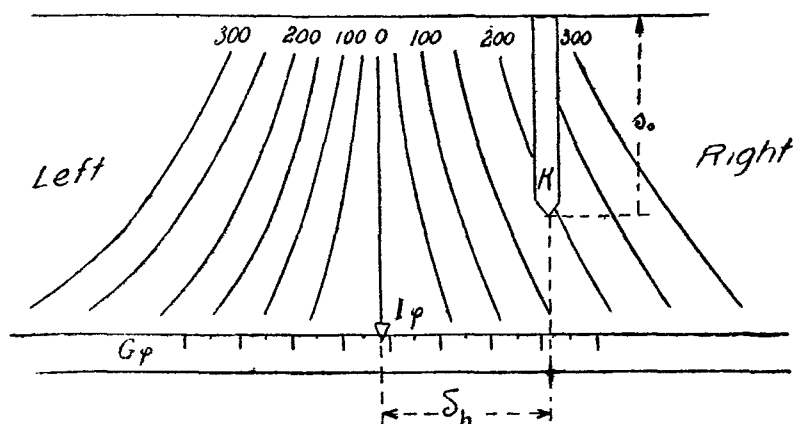


FIG. 16. FUTURE AZIMUTH

so as to bring the desired curve before the index k . When this operation has been done, the future azimuth may be read opposite the index I , on a graduation G_φ , which is stationary in relation to the base of the instrument.

The calculation of the firing data introduces new errors:

- a. The corrections for deflection and site are determined only very approximately.
- b. The determination of the elevation does not introduce new errors excepting the errors in σ_h and B , beginning with which the elevation is determined.
- c. Errors in reading the parallax are greatly to be feared for the readings for i and B made at the end of the glass needle. The reading mirror gives a means which does not seem very effective when it comes to eliminating completely the errors.
- d. The errors in the projection of the point A on the graph are corrected only by an empirical process which permits a part of them to remain.
- e. The calculation of the azimuth for the future position of the airplane still retains some error because of the fact that the vertical index k moves in the site of the present position of the airplane, and not the site of its future position, as it would have to do.

VI. THE OPERATION OF THE INSTRUMENT

Operator No. 1 (observer) takes position at the telescope, facing the target. Operators Nos. 2 and 4 take position to the right of No. 1, opposite the open face of the instrument. Operator No. 3 takes position to the left of No. 1 and in front of the graph showing the elevations.

The following table sums up the functions of these operators (see Fig. 17).

MEASUREMENTS AND INTRODUCTION OF TELEMETRIC DATA

<i>Operator</i>	<i>Datum</i>	<i>Operating parts</i>	<i>Graduations and index</i>	<i>Remarks</i>
1	s_o	V_2	Center of the fixed micrometer of the telescope L.	s_o is taken by the use of the horizontal range Δ_o (see Fig. 15).
	a_o	V_1	Mobile hand of the micrometer of the telescope L.	
3	B	Cylinder E	Index I_β	Figure 14.
	δh		G_φ	
	σh		$G_{\sigma h}$	
	h		G_h	
4	V	V_6		
	W	V_5		
	Vector Vt	V_4	Gvt	
<i>Readings</i>				
2	B		A	
	h		Micrometer of the reading glass S	
	σh		ditto	
	i		A	
	s_o		Upper edge of M	In case of need.
3	β		T	
	ϕ		G_φ	
4	U		Gv	In case of need.

All these measurements and all these readings are not made simultaneously; that depends upon the method of fire selected. Summed up below are the functions of the operators in the different operations to be executed by the instrument.

a. Marking the range to the present position of the airplane.

The telemetrists measures the distance to the present position of the airplane and announces it at intervals. During this time the observer follows the target

with his telescope L. No. 4 turns the button V_3 in order that the range D_0 announced may be inscribed at GD_0 on the disk H.

b. Measuring the speed of the airplane.

The observer (No. 1) follows the airplane and gives the direction of flight with the use of the mobile arm of the telescope L, which is operated by the button V_1 . No. 4 marks the present range as described in the preceding paragraph. At the moment when the speed is measured, No. 1 stops the instrument and, with the aid of the chronometer Q, measures the time it would take the airplane to cross the segment of 180 meters, marked off by the first cross line on the micrometer. No. 4, by actuating the button V_6 , introduces on the graduated arc Gv the ground speed read from the chronometer Q.

The work of measuring the velocity or speed interrupts the preparation of fire.

The work of measuring the velocity of the wind is accomplished in a similar manner, sighting on a cloud or the burst of a projectile. The wind velocity is marked by the aid of the button V_5 .

c. Direct fire.

The telemetrist announces the present ranges.

No. 1 (observer) follows the airplane in azimuth (general movement of the instrument) and in site (button V_2); he places the mobile radial hand of the micrometer along the fuselage of the airplane.

No. 4 sets the present range (see *a*); he operates button V_4 in order to place the point c' so that the prolongation b' of dc' falls constantly on the curve of the graph K, referred at the range D_0 , marked at GD_0 .

No. 2 reads off the fuze range opposite the point A, the end of the glass needle.

Then No. 4, operating button V_4 once again, places the point e so that the prolongation b' of dc' corresponds to a special curve on the graph K, marked at the fuze range B, which has just been read. When this has been done, he reads on the squared micrometer of the reading glass S the correction in deflection and in site.

No. 3 places the index I_β at the fuze range ordered; he marks the correction for site with the button V_7 and reads at I_β the angle of elevation β (see Fig. 14).

Nos. 1 and 4 verify the speed of the airplane at certain instants.

Whenever operator B_4 sees that the range D_0 marked at GD_0 moves away from the range D_0 announced by the telemetrist, it is because the airplane has changed its altitude. Operator B_4 reestablishes the agreement by modifying the altitude with the aid of the button V_3 . He should use judgment in changing the altitude, so as not to introduce the result of the oscillations of the monostatic range finder into the instrument.

d. Semi-direct fire.

(1) 1st Variant. The values of δ , i , and B are sent to the guns.

The telemetrist operates as he usually does. The speed is measured as for

direct fire. No. 1 (observer) has the same functions as when executing direct fire.

No. 2 reads off the fuze setting and the inclination at the end A of the glass needle.

No. 4 has the same functions as he does when executing direct fire; he operates the button V_4 , sometimes at c' for reading B, and again at e . He reads off δ and σ .

(2) 2nd Variant. The data δ , h , and B are sent to the guns.

In this case, the fuze setting is read as for the first variant. At the same time No. 2 reads off the value of h . δ is read off by No. 4.

This variant requires that the pieces possess an inclination sight making it possible for them to calculate i as a function of h and of B.

c. Indirect fire.

The following data are sent to the guns: ϕ , i , and B.

The operations performed by the telemetrist, the part played by No. 1 (observer), and the measuring of the velocities do not change at all.

No. 4, with the aid of the button B, keeps the point e' constantly on the straight line db' , b' being defined by the range D_0 marked at GD_0 . Moreover, every time the vector Vt varies and at every change in direction of the airplane, No. 4 reads the deflection correction in the reading glass S and reports it to No. 3.

No. 2 constantly reads off i and B immediately underneath the end A of the glass needle.

No. 3 operates cylinder E in order to place the reported deflection correction in front of the vertical index k , and reads the azimuth opposite the index I_ϕ on the graduated scale G_ϕ .

An examination of the functions performed by the different operators brings out several important points:

a. Each of the operators has a great many functions to perform. In indirect fire, No. 2 is to read off the values of i and B, two data which may vary rapidly. It sometimes even occurs that the operations performed by two men are connected, coming one after the other, like those of Nos. 2 and 4 in direct fire, with the alternative operation of knob V_4 first for the calculation of the fuze setting, then for the calculation of the deflection and site corrections. It may also happen that one operator has one or several operations to perform before he reads off his data, like No. 3 in the execution of direct fire (the reading of β) or in indirect fire (the reading of the value of ϕ).

It seems that too much is required of the operators; the multiplicity of the operations required certainly spoils the precision of all of them taken separately.

b. The instrument has certainly been designed for indirect fire, and it was only after it had been completed that it was adapted to use for direct and semi-direct fire. The functions of the operators in these last two methods of fire are, as a matter of fact, much less natural than the functions of the operators in indirect fire.

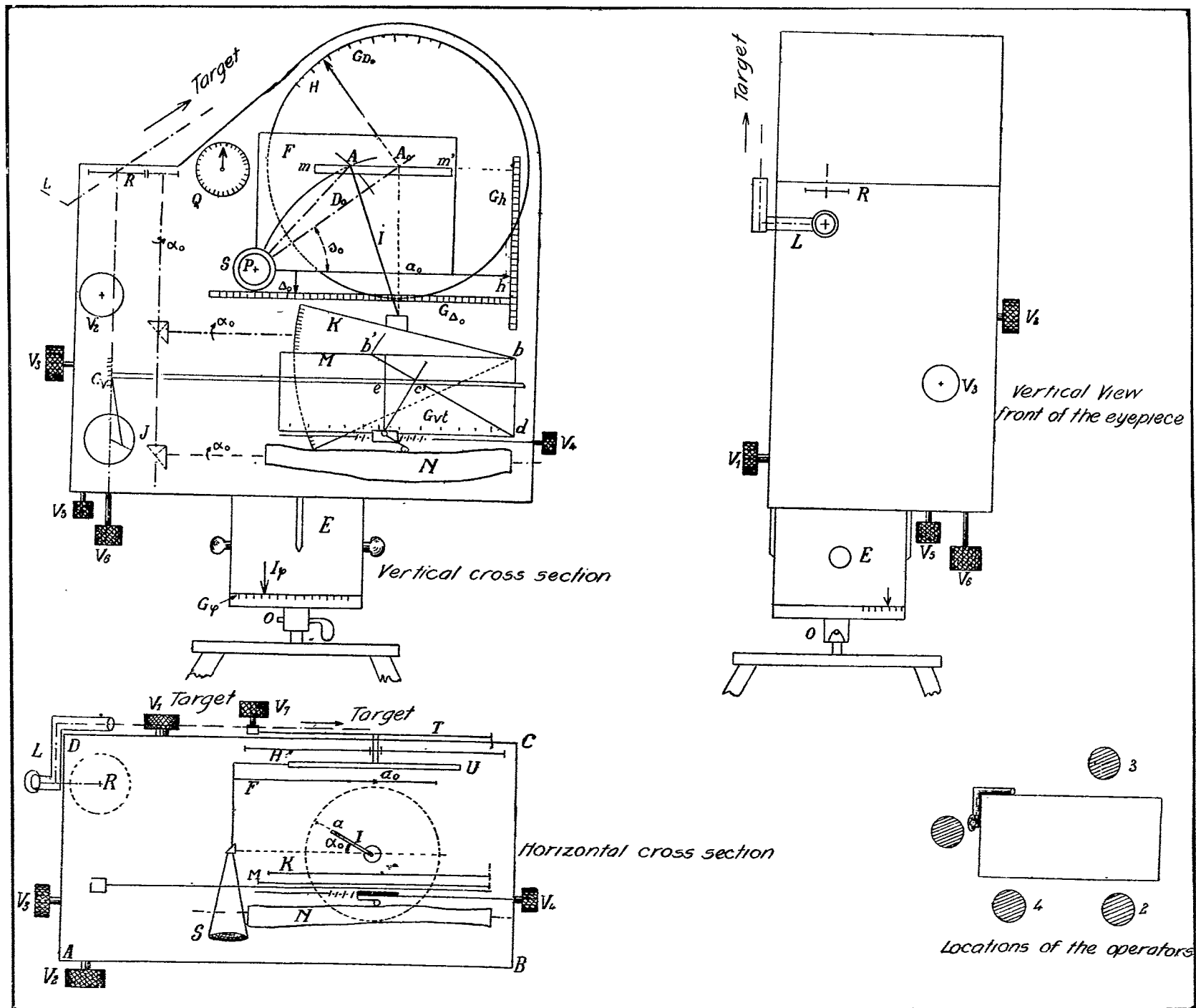


FIG. 17. THE SCHONIAN INSTRUMENT

c. The Germans have always shown a certain dislike to the use of the altitude. Here the altimeter is separated from the range finder and included in the fire-preparation instrument. If the range finder furnished the data for the altitude, the functions of No. 4 would have been very greatly simplified; he would have been relieved of the trouble of examining the agreement between the ranges D_0 reported by the range finder and the ranges D_0 marked at GD_0 . Moreover, the curves on the graph K might have been graduated in altitude, a coordinate which varies much more slowly than the actual range D_0 .

The reason for this ostracism of the altitude may perhaps be the fact that this coordinate cannot be utilized at low sites. But here, since the instrument enjoys the valuable characteristic explained above, namely, that the linear coordinate may be either the real range or the altitude, it would apparently have been wiser to choose the altitude and to use the actual range for small sites.

SUMMARY

The brief description just given of the Schönian instrument shows that it has serious defects:

a. The operation of measuring the speed of the airplane, which operation is intermittent, interrupts the operations of preparation of fire.

b. The solution of the principal problem is not precise.

c. The instrument cannot make corrections in parallax nor corrections in inclination, nor ballistic or aerological corrections (excepting those for the wind).

d. The instrument is deprived of the advantages given by the use of the altitude for the solution of the principal problem.

e. The operators are few, but each one of them has to perform numerous and complicated operations.

f. Lastly, the instrument is fragile and its transportation and manipulation require great precautions. The glass needle, transported separately, must be put in place and adjusted at every setting up of the instrument; this adjustment is apparently a long and delicate operation—a very serious fault in an instrument to be used in the field.

But it is well to place the advantages of this instrument beside its faults:

a. Aiming at the present position of the airplane is executed with an aiming triangle in which the geometric elements are proportional to their actual size. Thus it is possible to fire by altitude, actual range, or horizontal range, as desired.

b. The instrument measures the direction and transmits it, without the need of reading, in a particularly excellent manner; the direction of flight in a straight line is kept up to the minute without the intervention of the operator.

c. The optical solution of the tachyscope for measuring the speed is excellent.

d. The automatic calculation of the ground speed, which takes into consideration the action of the wind, when the airplane changes direction, is also to be retained.

Lastly, in order to give a fair estimate of the instrument, we must consider that it was designed as far back as the end of 1916 and that it was at that time a complete instrument for antiaircraft fire preparation suitable for use for both direct and indirect fire.

Such as it is, it merits the study of antiaircraft artillerymen who are interested in knowing how other countries, during the war, solved the difficulties peculiar to antiaircraft fire.

This movement against military training is part of a widespread and consistent plan to destroy the military defenses of the United States—her Army and Navy—and all that might contribute to their personnel and their efficiency. It includes the Citizens' Military Training Camps, the University and High School drills, and it has even marked the Boy Scouts for destruction, as whispers of "militarism" about them are in the air. Finally, the flag will be pulled down from our school houses, as being too suggestive of war and too intimately associated with patriotism. This is the program; and many unsuspecting persons are being swept into the current. Every established government is being assailed today.—Rev. Marion D. Shutter.

The Training of Reserve Coast Artillery Officers

By LIEUT. W. W. DALY, 211th C. A. (Mass. N. G.)

EDITOR'S NOTE.—*The writer has served as an enlisted man and as an officer in the Old Militia and National Guard before the War, in a regular army unit during the War, and subsequently as a Reserve Officer and National Guardsman. He has been a C. M. T. C. instructor and has had various close associations with the R. O. T. C. as it is at present constituted. Some of the ideas, therefore, expressed in this article, are based on experiences which, while personal, have been sufficiently general to give a basis for sound deductions.*

CERTAIN fundamental facts seem to be generally agreed upon by our military historians.

a. Trained and disciplined American troops have always given a good account of themselves.

b. Units of long standing can absorb many raw recruits and still keep up their morale and the greater part of their efficiency.

c. A small nucleus of trained troops is an absolute essential, because around this can be built a much larger force.

Probably one further observation can be made. Trained, efficient officers can be expected to take over groups of recruits and in a comparatively short time weld them into an effective military unit.

With the present condition of our Regular Army and National Guard, and the obvious tendency toward increased efficiency in the latter, it becomes more and more apparent that there are many things which may be done toward rendering Coast Artillery National Guardsmen more effective in the event of an emergency. In developing the National Guard for such an emergency, the writer feels that much may be accomplished beyond what has already taken place if a policy is adopted having in mind the utilization of our present peacetime units.

During the World War many units went overseas at the time of our first entry into the war, containing men who were probably better officer material than could have been obtained in any of the training camps. Many of these men served through the War as noncommissioned officers or as privates when they would have been much better employed in more responsible capacities.

One of the most regrettable features of the first few terrible months of England's share in the war was the manner in which some of their finest young men were utterly wasted, with the result that less desirable officer personnel came to be relied on later, in the closing year of the conflict.

In the same way it should be a matter of grave concern whether it might not be possible again that our army would lose the services of the younger men who were distinctly officer material, but who preferred in peace time to remain in the ranks. As it has been true in the past that many good potential officers were used in the enlisted grades, so it might take place again unless care were taken to prevent just such an occurrence.

It is my thesis here that, with a minimum of expense and with little or no change in our existing establishment, these men could be so located and trained that in time of war they would be of much greater value to the military establishment. In addition, such a plan could call into being a sufficient number of reserve officers so that our skeleton units could be constantly maintained, not only at a higher state of efficiency, but also as more effective nuclei around which to build future armies.

The mission of Coast Artillery, as laid down in General Orders, is the manning of our heavy armament on our coast. It has come to include the four distinct divisions of harbor defense, railway, tractor, and antiaircraft artillery. In the event of another emergency there would be an immediate need for a considerable number of trained, or at least partially trained, officers for supervising the handling of this armament. It is, consequently, a very pertinent question, in considering the mission of coast artillery, to examine the methods by which such officers are now being secured, can be secured in the future, and how they might be secured in an emergency.

We have at the present time C. M. T. C. and R. O. T. C. units, both of which send in to the Officers' Reserve Corps every year a few junior officers. The number, however, is probably barely more than enough to take care of the normal replacements for the older officers who are dropping out of the service. Furthermore, these younger officers, while possessing a certain degree of skill and understanding of the technique of coast artillery, do not possess the general knowledge of the service and the experience in handling men that would be expected of them if suddenly called into active service.

Their greatest weakness, furthermore, is not now being strengthened in the summer tours of duty, as the programs of these tours are usually concerned with basic artillery and not with troops, the handling of men, and the ordinary daily routine of soldiering. An older officer in the regular service, who has seen much of the Reserve and the Guard, once summed up the entire case for both in a sentence: "The Reserve Officer is probably better trained in the technique of artillery than the Guardsman. He lacks, however, the experience in handling troops, and given a battery, he would hardly know what to do with it."

In discussing the present military policy of the United States in relation to the training of emergency officers, we see that notable steps have been made in the establishment of a definite policy under the National Defense Act of 1920 with its subsequent amendments. We also have the comparatively new organization of the Officers' Reserve Corps, which would supply the nuclei around which the reorganized militia would be built into an effective fighting unit.

The old feeling that once existed on the part of the officers of the regular establishment toward the "citizen Officers," that the Guardsman and the Reserve Officer were "only volunteers," has, in the opinion of the writer, almost entirely disappeared. Guardsmen and Reserve Officers now mingle socially and otherwise with their brothers in the regular service to a degree that would

have been inconceivable twenty or thirty years ago. This is due in part to the fact that many of the present regular officers were themselves civilians before the World War. It is due in part to the fact that under the National Defense Act the type of officer in the National Guard is a great improvement on the old time *Militia Officer*. It is due, probably more, however, to the definite attitude of each toward the service; on the part of the regular Army Officer to his realization that those who play at soldiering have made it a hobby and a study, and on the part of the amateur, that he can learn much from the professional.

We still have, however, a distinct problem. In the event of an emergency, we must have a much larger number of emergency officers than is in sight at the present time. This, to a certain extent, will be taken care of by such production methods as were in vogue during the last emergency, when selected young men were sent to the Officers' Training Camps and then to the special schools at Fort Monroe and elsewhere.

Such a method, however, should not be employed if it is possible to avoid it as it smacks of the old idea, so evident in our early conflicts, of not preparing for anything until preparation was forced upon us and then muddling through at a terrific cost of blood and treasure.

* * * * *

This problem of training in peace-time Reserve Officers, who in time of war will be able to function adequately, shows at the start three distinct aspects:

- a. It must be done at a minimum of expense.
- b. It must employ existing agencies, rather than set up new bureaus.
- c. It must not interfere with the regular, ordinary, peace-time missions of the units involved.

In addition, it must be sufficiently flexible so it can be easily expanded at any time to meet an emergency and train a large number of officers in a brief period. It must not be inconsistent with any emergency plan, such as the R. O. T. C. of 1917-19, but rather must aid and supplement it. It must, finally, be capable of turning out officers with a reasonable degree of skill, who will be able to function without any hiatus, and who in turn will be able to train others.

It is unfortunate that in many cases the Officers' Reserve Corps at the present time is in a state which may be described as sour. It has been the writer's personal observation that many officers, particularly those of field rank who served during the war, and who for a number of years following the war were active in the Reserve Corps, have, nevertheless, left the service, either by allowing their commissions to lapse or through resignation because of lack of adequate means of preserving their interest.

This is not a reflection on some of the excellent members of the regular establishment who are trying to keep up interest in the Reserve Corps; it is rather because of a fundamental feeling that paper reserve units have been allowed to become more and more paper and less and less units. In one instance an officer commanding a unit, developed a considerable feeling of esprit

and interest by holding frequent meetings of his officers, in which problems were discussed, and in which various methods of troop handling were considered. Plans were made for developing the unit more and more to the place where it would be an effective nucleus around which a regiment could be built, but department orders required the transfer and breaking up of this organization, with the result that valuable officers left the service, chiefly, it would seem, because of a lack of any function which they could perform.

As regards the younger officers who have entered the Reserve Corps since the War, there is little opportunity for them to get any systematic training with troops. Rarely does it occur that a reserve officer can go into a National Guard organization and work with them. The majority of camps for Reserve Officers held during the summer are productive of a certain amount of basic training, and it is only for two weeks, during which time the officer may become slightly familiar with one type of armament, but has little or no contact with troops.

It is definitely established in the Manchu Law that a regular officer must serve a large proportion of his time with troops, but there is no provision at present for similar training for the reserves. It does occasionally happen that a reserve officer is appointed to work as instructor at our R. O. T. C. or C. M. T. camps, but in such case, it is dangerous to detail any but an experienced officer, as the juniors who have just come out of such units are themselves not in a position to be of great value. The only officers who are really effective in such units are those who need the training least.

At the present time we have two general methods of providing Reserve Officers—the C. M. T. C. and the R. O. T. C. units. Both of these are effective to a certain limited extent. In each of them, however, the number of men who start in the Freshman Year in the R. O. T. C., or the basic C. M. T. camp, in no way resembles the number of men who attain commissions. The casualty list is very heavy—probably in the vicinity of 80% to 90%. Of course, the R. O. T. C. students are a selected group to begin with, because those who attend such colleges are themselves a selected group, and it is frequently the athletes and the more virile men among the students who take courses offered by the various departments of Military Science. Similarly, those who are attracted to C. M. T. camps are frequently the best young men in their community, and the selective process is going on with each college year or each camp.

For the number of men who complete the course and receive their reserve commissions, however, there are many young men who would make excellent officer material who fall by the wayside. While the requirements are probably not difficult, they are frequently too difficult or too technical for the young man unfamiliar with the service to comprehend. The result is a tremendous wastage of officer material, which, with a proper method of tying up one unit with another, could be salvaged to the extent of obtaining almost all of the men desired for the service.

Training Reserve Officers, or training civilians or part-time soldiers to become Reserve Officers, in order that they may function effectively, may be divided into four separate sections:

1. It must cover the technical training necessary to the arm. For the Coast Artilleryman it must include:

- a. Basic gunnery and fire control.
- b. General materiel, explosives, and the like.
- c. Special training in all of the details of one of the four branches of Coast Artillery.
- d. A general knowledge of the other three.

2. A training in administration—that is, the routine duties of an officer in the Army of the United States. This would include military paper work and correspondence, military organization, and such other subjects as are necessary for a battery officer. It should include any general information which would enable him to function in any capacity in which, as a battery officer, he might be detailed.

3. Probably one of the most difficult to describe is personal training. This would include the habit of the exercise of command, which ordinarily can be achieved only with years. It may, however, be built upon the civilian habit of control so that the man who is a sales manager, office manager, or shop foreman may bring to the military service the qualities which he has developed in civilian life. If the proper methods are followed and men who are accustomed to exercise the habit of command are gradually drawn into the Reserve Corps, the years of practice will be greatly lessened. This drawing in of the proper men is a recruiting “sales” proposition which later will be covered.

4. The training in general military subjects which are common to all arms, including map reading and sketching, military law, logistics, health, hygiene, sanitation, military policy, and other matters technical in their nature, with which every officer should be familiar or with which he should have a bowing acquaintance.

In the organization and development of a method whereby new officers can be secured and a steady reservoir of material built up, it is obvious that some method must be obtained wherein the National Guard and the R. O. T. C. can be used to the great benefit of both. It is such a method that this paper suggests. We have in the National Guard today many real and efficient officers. In many cases we have enlisted men who are officer material, and more can be secured. Most National Guard units, in fact, derive the greater part of their commissioned personnel from the enlisted ranks. College men, particularly, find the National Guard an outlet for their social energies and most of the younger officers in many units today are college men who have come up through the ranks.

In the Adjutant General's circular of March 22, 1928, the provision was made whereby enlisted men in the National Guard might secure commissions in the Officers' Reserve Corps by passing suitable examinations and tests, a part of which might be waived in the case of men who have taken courses in the Army Correspondence School. By using a method of this sort, it would be

possible to take men into the National Guard, give them their basic training in the course of a year or two years, and then have them take such correspondence courses as would fit them to be capable and efficient reserve officers in the case of an emergency.

The four types of training referred to above could very well be taken concurrently. If the gun drill and the normal routine work could be learned in the battery, the candidate could learn both the fundamentals of his technical training and the routine which is covered under the general heading of "Customs of the Service." He could, once he received the basic training, go into the Army Correspondence Schools, and there secure the additional information and theoretical training which are so necessary, once he goes into the field and puts his theories to practice. If he has the theories and has basic practical training, he will, under normal circumstances, be an efficient officer. If he lacks either one—the ground work or the theory—his superiors will find him lacking.

Such a course of training would normally take three years—the ordinary term of enlistment in the National Guard. In his first year he would learn what the military profession has to offer him. In the second year he would be attending a noncommissioned officers' school or similar form of training, and in his third year he could, without great difficulty, complete the required correspondence course which would enable him to qualify as a Second Lieutenant. Once having received a certificate of capacity or a reserve commission, he could carry on in his unit, taking a more advanced course which would qualify him for a higher grade. Over a period of two additional years he could complete his requirements for the next grade, and his increased interest would bind him more and more closely to the military service. He could function as an additional officer with the regiment, without pay, to be sure, but nevertheless assist in the performance of a large number of duties which fall to the National Guard organization; or he could go into a reserve regiment and become an active member of it. In any event, the advantages of training would be tremendous, both to him and to the organization which is served.

* * * * *

Now let us consider for a moment the effects of such a program. In the first place, the National Guard unit which was employed as a training school for reserve officers for a three-year period would find a material improvement in its personnel because men would go into it with much more earnestness, and the result would be a greater efficiency. Not only would the type of personnel be improved, but the unit would gain numerically, for again the social contacts which are so much a part of National Guard life would be enhanced, and other men who perhaps would not work for a reserve commission, but rather because of a desire to associate with the particular individuals who would, would join and partake of the National Guard work. In peace time men would consequently be performing more effectively through such units, so that the general strengthening of the existing units would necessarily result. The matter of expense would be slight. It would, of course, be necessary to have greater

facilities in the correspondence schools, more papers, and more copies of training regulations, but additional personnel would not be necessary. The Reserve Officers, as they become commissioned, could, in turn, become instructors, and while fulfilling the requirement of a given number of hours in each year, would work with those coming in after them, and handle the instruction and training. All of this could be done under the supervision of Regular Army instructors, who would act as supervisors of training rather than as actual teachers. The Reserve Officers in giving this training would benefit greatly, proving the old maxim that "a man never knows a subject until he has taught it successfully."

In instituting such a scheme, certain re-arrangements would be necessary. In the first place, a closer relationship, already referred to in the introduction, with a genuine spirit of cooperation and a realization of the need for mutual helpfulness, must be built up between the National Guard and the Organized Reserve. Second, there should be a more ready method of transfer between the second and third components of the Army. The National Guard Reserve might perhaps be joined with the third component, so that when an officer in the National Guard leaves his active status, he goes not into the National Guard Reserve but into the Officers' Reserve Corps—an active rather than a moribund unit—which, while it does not require as much time as the Guard, nor entitle him to Federal pay except for camp duty, does give him a definite status.

This might necessitate changes in policy on the part of different Adjutant Generals in the States, or even in State Statutes, but it should not present insurmountable difficulties.

The greater part of the labor involved, particularly the organization work, would necessarily devolve on one or two National Guard Officers in each unit who would actually see the work done.

I have not the slightest doubt that in every State and in every Regiment there are officers capable of doing such a job, once they realized its possibilities. All officers could not do it; a few could and would. Now, in carrying out such a scheme the officer handling it would see what was necessary when he got the machine in motion. Here again we would employ existing agencies and would use facilities that are at hand. Basic training, of course, would come during recruit instruction; if men had been in attendance at C. M. T. C. or R. O. T. C. units, they would be able to start in with certain fundamentals. The N. C. O. Schools, which should be held in every unit, would serve the second phase of instruction. The Army Correspondence School's Basic Subcourses would form a ground work for officer training. During the time the man was doing all of this work he would be functioning as a soldier and learning his job. The officer in charge of Reserve Corps training should, once the method was established, generally supervise the work and conduct of this school; the course would not in any way interfere with the normal function of the unit but should be in addition to, and outside of it.

In the working out of this plan there would, of course, be a strong urge for recruiting even better men than would ordinarily be the case, and such men would be glad of an opportunity to obtain commissions in the Reserve Officers'

Corps. Some men enter the National Guard and go from there to the Military Academy. Many other men, while not caring to enter the military profession as such, would be very glad to adopt it as an avocation, and in the working out of this plan, ordinary intelligent sales methods, properly employed, would give excellent results.

Here again the work might devolve on one or two men, but I am confident that there will always be men who will undertake such work if their talents are only directed into the proper channels.

With regard to the question of what units would be used as the basis for training enlisted men in the National Guard, it would probably be advisable at the start to select one or two units in each vicinity, leaving it open to any others, who so desire, to avail themselves of this plan. Some units, obviously, would not care to undertake it; others would welcome it.

In the event of an emergency it would probably come about that certain units would show greater adaptability at training officers than others. These units could immediately serve as training groups; their officers would probably be admirably equipped to handle officer training on a larger scale, and in that way the system could be readily expanded to meet any possible need. This, of course, involves the development of certain skill and technique in the art of teaching the fundamentals of the military profession. This technique developed and perfected in time of peace, could readily be at hand to meet an emergency.

Now, as has been indicated, this method of training Reserve Officers employs existing agencies. It is, as far as can be discovered, in accordance with all of the existing regulations, and is only an additional method for procurement of Reserve Officers. Such a plan would greatly increase military interest on the part of young men. Many virile youths now graduating from our colleges and secondary schools could be attracted to a hobby which would be decidedly worth while and would give them a method of self expression—one to which they could continue to devote their energies for a number of years. They would, at the same time, be putting themselves in a position, by taking such training, that they would be of greater value to themselves and to the nation in the event of an emergency.

In the employment of these existing agencies, it is obvious that some slight expansion on the part of the Army Correspondence School might take place, but as this work is constantly going on, and constantly being improved, such expansion would be only a slight acceleration of the continued improvement. In the matter of expense to the Government, here again there would be no particular change. It is true that, as noted, additional slight cost to the Correspondence Schools would be incurred, but the question is one only of a minor degree.

In the third place, as noted, the adoption of a definite training program by a National Guard unit would result immediately in a stronger and more efficient peace-time unit through an improvement of personnel, which would obviously enable it better to perform any peace-time mission it might have.

It is probable that we shall not soon have any major emergency. If, however, one should arise and units were at hand which were available for training officers, and if other Reserve Officers were scattered about through our service who had been trained in the manner in which has been outlined, the resulting conduct of our first few months would avoid the dilemmas in which we found ourselves on previous occasions.

There are always in the United States plenty of young men—who are officer material who would be interested in learning something about our service, its history, possibilities, and its organizations—if they were properly approached. This is, after all, like all recruiting—merely a sales problem which must be properly handled. If it is properly handled there is little doubt that we shall be much better fitted to meet any emergency of any sort; at the same time, we shall be building up the morale of our units and making a distinct contribution to the ancient profession of arms.

War can never be abolished by objecting to it, by requesting the abolition, or by resolutions of any body or association of bodies whatever. We might as well pass resolutions to abolish fire and flood and call on nations to do away with them. War, like fire and floods, is not a cause, but an effect. Its likelihood can only be lessened when its causes are lessened.—Rev. John W. Day, D. D.

Trenton---the First American Offensive

By CAPTAIN GEORGE J. B. FISHER, C. A. C.

ON December 25, 1776, the British occupied East and West Jersey with a force of 12,000 professional soldiers. A fortnight later Cornwallis had been forced back eastward to the Raritan, his hold on the Jerseys practically broken. The intervening days were momentous, for they witnessed the inception of American military power.

In considering the romantic rise of the United States, it is apparent that the episode of Trenton was the first smile of destiny.

When Washington struck at Trenton, he was hitting in desperation. He sensed his opponent's weakness and only hoped for that to offset his own lack of military strength. "Nothing but necessity, dire necessity," he writes, "will justify an attack." Had he been a more formal soldier he would never have risked his dwindling reputation against such unfavorable odds.

But, fortunately, Washington was more than a mere general. He had become a Zealot. The only certain way of overcoming an army so commanded is by capturing its leader. Howe realized this fact and was accordingly gleeful when General Charles Lee was brought before him; but he later saw that his dragoons had caught the wrong general. The real military leadership of the revolt had yet to be appraised.

The fortunes of the revolutionists were at a low ebb indeed when, on December 8, the ragged remnants of the thrice defeated Continental Army were chased across the Delaware into Pennsylvania. Not only was armed resistance apparently broken; the enemy occupied a position of surpassing military and political value which, if properly developed, could have easily carried the war to a far different conclusion.

At no time do the British appear to have properly valued their easy conquest of the Jerseys in 1776.

British statesmen and soldiers alike were obsessed with the idea of capturing cities, forgetting that the states were rather rural than urban and that the roots of the rebellion lay in the provinces.

When Cornwallis found that Washington had escaped into Pennsylvania, drawing after him all the boats on the Delaware, he settled his troops down at ease to wait a more favorable opportunity for attacking Philadelphia. The Jerseys he considered merely an avenue to that city.

They were, however, much more than that. Their strategic value was to be found in their peculiar geographic relation to the other revolting states, a relation which any map of the period clearly shows.

The spirit of active resistance against the Crown was at the time centered in two distinct areas: New England and Virginia. The remainder of the

colonies blew hot and cold on the idea, as these two sections stimulated them with their own fanaticism for independence.

Yet, aside from their determination on self-government, Massachusetts and Virginia had little in common; they were, in reality, more or less antagonistic. An acquaintance with Colonial politics should therefore have indicated the most favorable direction for British military action as being toward the isolation of these two revolutionary centers.

In capturing the Jerseys, this had actually been accomplished.

The main line of communication between New England and the South ran then, as it does now, across the narrow neck which connects the Delaware and Raritan rivers. In 1776 this avenue was merely a single dirt road between Trenton and Amboy. Over this passed and repassed the fiery propaganda of the common cause. With this path firmly held and the coast blockaded, there was little to unite the states except a name.

Had Cornwallis, when he moved westward through the Jerseys, insisted on a reasonable treatment of the inhabitants, that section would probably have remained as loyal to the Crown as it undoubtedly was when he entered it. Instead, his mercenaries did much to antagonize and inflame the peaceful farmers and to force them to arms.

With a conciliatory attitude toward non-combatants, coupled with a reasonable military alertness, the British could have held indefinitely this wedge which so effectively sundered the American states.

Not only were the British ignoring the best strategy—they were apparently none too concerned over tactics. There is every indication that they saw, in the scattering of the Continental Army after Haarlem Heights, the end of the revolt. Even Burke, writing his impressions at the time, stated that the Americans had accomplished more than he expected but conceded that they could do little more. The same attitude is reflected in the casualness with which West Jersey was held by the British soldiery.

It was the failure of Sir William Howe to appreciate at this juncture the deadly determination of General George Washington which led to the British losing their hold on the Jerseys and which paved the way to their eventual loss of the colonies.

Seeing no need for immediate action with the remainder of the Continental Army beyond the Delaware and a cold winter already set in, Cornwallis returned to New York and was readily given leave to visit England. Command in the Jerseys fell to Major General Grant who, not being a politician, was not so likely as Cornwallis to divert from Howe the credit for the expected capitulation.

Grant established his headquarters at New Brunswick and cantoned his troops in the surrounding villages. The winter proved to be one of unusual severity; shelter was scarce, so that it became necessary to scatter out his force into a dozen towns from Raritan Bay to Burlington.

It is significant that, in disposing his troops, Grant placed his Hessian contingents along the Delaware between the British regiments and the Americans.

The reputation of the Hessians as professional soldiers was, up to this point, very high. It was evidently the intent of Grant to have them bear the brunt of the defense, leaving the English and Scotch in greater security for the concerted enjoyment of the mid-winter holidays. He intended to permit the mercenaries fully to earn their hire.

The river towns were held by Count Carl von Donop with 3000 sturdy soldiers. Remaining himself in the center at Bordentown, he sent a detachment to Burlington and a heavy force north to Trenton.

Of these three towns Trenton, commanding the Delaware river crossing, has always been the most important. Here were stationed three infantry regiments, some chasseurs and dragoons, and six pieces of artillery: 1500 men in all.

The senior of the three regimental commanders, Colonel Johann Gottlieb Rahl, became acting general of brigade and assumed command of the town. This important post fell to him as a recognition of his successes earlier in the war.

Rahl is an interesting example of the type of professional soldier who performs well under an accomplished leader, but who fails when given independent command. His was the error of attributing too wholly to his own worth victories won under the leadership of his superiors. Many officers have overcome this failing through the chastening of defeat; but the shortcomings of Rahl cost him his life.

While the British Army was thus scattered among the Jersey villages, comfortably preparing for the winter, the situation of the Continental troops on the Pennsylvania side of the Delaware was far less happy.

Perplexities beset Washington on every hand. Within the army was disloyalty; the Continental Congress was hopelessly incapable of supporting an army in the field, and patriots throughout the country were disheartened by continued military defeats. The situation of the soldiers themselves was most distressing. Their clothing and shoes were outworn; they lacked food, shelter, and money. Hannibal's army in Italy was better equipped than was this handful of men fighting in the heart of their own prosperous country. Knowing these conditions, the British felt at ease.

But Howe and his subordinates failed to gauge the temper of their adversaries, a serious military oversight. They did not realize that the small force across the river had been purged by the fire of adversity; that in its defeats and retreats it had shaken off the weak-willed and the indifferent, leaving only the desperately determined. Such men as remained were the material with which a real leader accomplishes miracles. And Washington was at hand to lead them.

Feeling reasonably safe for the first time in months, Washington proceeded to do what he could toward improving his hazardous position.

He dispatched innumerable letters in every direction—to Congress, to the governors of nearby states, to influential friends, and to his subordinate generals, in an effort to increase his strength and prepare for the offensive.

The correspondence of Washington during December, 1776, indicates that his greatest concern was the prospective disintegration of his army. The enlistments of the majority of his men were to expire on January 1, thanks to the faulty policy of the government in recruiting troops for the Continental line. Yet, with supreme confidence, he proceeded to plan a winter campaign. He therefore called for militia from Philadelphia and from all the surrounding country and wrote daily for his troops in northern Jersey to hasten to his aid.

Help finally came from the latter source as the result of a bit of timely good fortune.

Instead of marching directly from Fort Washington to join the Commander-in-Chief, as he had been ordered to do in November, Charles Lee, at the head of a considerable force, hesitated, equivocated, and endeavored to cover his evasions with a series of silly explanations. It is now evident that his real purpose was to hover on the north of the British column across the Jerseys, hoping that the fortunes of war might give him an opportunity to strike a blow which would enhance his personal popularity and perhaps even secure for him the supreme command. His dream came to a sorry end on the morning of December 12, when he was caught dallying in an inn near Baskingridge and was hustled off to New York a prisoner of war.

Had Lee eventually joined Washington, he would probably have attempted at Trenton some such role as he later played at Monmouth and with more disastrous effect. Safely captured, however, his second in command, Sullivan, proceeded rapidly to Newtown, where he reported to Washington.

This reinforcement, together with several accretions of militia, built up Washington's force to 5000 and more. Having thus consolidated all his resources, he prepared to strike the first blow toward clearing the Hessians from West Jersey.

The region being infested with spies and with much disloyalty on both sides, each commander was surprisingly well informed as to the projects of his opponent. Major General Grant, writing from New Brunswick on December 24, stated: "On last Sunday Washington told his assembled generals that 'The British are weak at Trenton and Princeton.'" Such a leak, considering that Washington was especially cautious in council, is striking evidence of the espionage which existed.

Washington, however, had even more precise intelligence as to conditions among his enemies. From his headquarters in the house of William Keith, near Newtown, he and his aides received daily the reports of spies who, in the guise of loyalists, overran the Jerseys.

One of these, John Honeyman, lived near Trenton for many years after the revolution to enjoy the acclaim of his exploits at this stage of the war. He was accepted as a Tory even among the Continental troops, who repeatedly arrested him, but he always managed to escape and return to Trenton carrying with him soothing reports as to the inertness of the rebels.

It was upon the dissimulation of Honeyman and other spies that Washington planned the approaching attack. Espionage and counter espionage provided the preliminary phase of the battle of Trenton. Washington knew quite well what was taking place in West Jersey, and he was at the same time generally successful in misleading the British as to his own intentions.

"Christmas day at night, one hour before day, is the time fixed for our attempt on Trenton," Washington writes to Cadwalader.

The details of the attack were carefully planned, and the general plan was admirably suited to the situation. In fact in no battle does Washington show more consummate generalship than in this, his first real offensive. When he assumed command of the revolutionary forces a year and a half before, his military shortcomings were many, as he frankly admitted to Congress. Yet in this short time he had developed rapidly in both generalship and statesmanship. Now he was about to demonstrate to a nation already commencing to murmur doubts, his ability to plan and his ability to act when his plans went awry.

Opposite Newtown the Delaware thrusts southeast, as if intent on crossing New Jersey to the sea; then at Bordentown it suddenly changes direction toward the southwest, broadens out, and proceeds leisurely toward the Delaware capes. Situated on the inside of this wide curve, Washington was almost equidistant from the three towns held by the British—Burlington, Bordentown, and Trenton.

It is interesting to view these dispositions in the light of our later knowledge of the geological formation of New Jersey.

The lower Delaware is a wide stately river, in striking contrast to the narrow stream above Trenton. It is now supposed that the section of the Delaware below Bordentown was once part of a prehistoric sound which extended northeast to the Atlantic, cutting off southwest Jersey from the mainland. Following the geological reconstruction, the Delaware once entered this sound at Trenton. To this day the tide ebbs and flows as far north as Trenton. This fact materially influenced Washington's plan of action, as did also the width of the lower river.

When the upper reaches of this so-called Pennsauken Sound gradually filled by erosion in past ages, it became a natural avenue for coastwise land travel. It was so used by the Indians and by the Colonists, and continues as an important route in modern times. In 1776 it still marked the natural division of the Jerseys, although the political boundary, arbitrarily set up by the original proprietors, had been abolished some years earlier.

Archeologists contend that the site where Trenton stands was once an important rendezvous for prehistoric man, it being at the protected outlet of the Delaware. Its centrality gave this whole area a strong strategical value which Washington did not fail to appreciate.

With the purpose of attacking from the north, the Commander-in-Chief planned to cross the Delaware some eight miles above Trenton, where the

river is narrow. A second column was to cross below the town, with the dual mission of preventing the escape of the Hessians to the south and of holding off reinforcements from the garrison at Bordentown. Still a third column was ordered across from Bristol which, with a force moving up the Jersey side from Philadelphia, was intended to distract the attention of Von Donop from the attack on Trenton.

It was the mission of General James Ewing to move the center body of 500 Pennsylvania militiamen across below Trenton and take position at the Assanpink bridge, thus preventing the escape of Rahl's troops. But Ewing was blocked by the drifting ice, which filled the river at this point.

Likewise Colonel John Cadwalader, at Bristol, was unable to ferry his force over for the attack on the lower river town. He did, in fact, secure a foothold near Burlington, but was obliged to return to the Pennsylvania side and write mournfully to Washington, "I imagine the badness of the night must have prevented you from passing over, as you intended."

But Washington had the desperate determination which surmounts obstacles. "The town must be taken," he announced, "I am resolved to take it." After weighing all the evidence, we must conclude it was the inflexible will of Washington that carried the left to Trenton while the right and center failed.

The Commander-in-Chief concentrated his greatest strength in the wing which he himself commanded. Here were the ablest and most trustworthy of the Continental generals—Greene, Mercer, Knox, Sterling, and Sullivan.

The officers who assembled at Washington's headquarters on the afternoon of December 25 may have realized that they were on the eve of the first real campaign in American military history, although they could scarcely have visioned the far-reaching consequences which were to attend their efforts.

Just before sunset the troops were paraded in two brigades, one under Greene, the other under Sullivan. They were dressed in the most part in scant summer clothing, illy shod and poorly protected against the freezing winds which swept down from the mountains to the north. Quotations were read from recently written papers of Paine's "Crisis." The watchword was given as "Victory or Death." The order for the attack, containing Washington's famous dictum, "No man is to quit his ranks on pain of death," was published. The spirit of the moment was grim and earnest. Every effort was made, apparently, to inspire enthusiasm against the trying hours ahead.

As darkness approached, the troops moved down to the river and commenced embarking at McKonkey's Ferry, opposite the place now designated on maps of New Jersey as Washington's Crossing.

Major Wilkinson, an aide to the scheming Gates, gives in his *Memoirs* an interesting picture of Washington at this juncture:

I got up with my brigade near McKonkey's Ferry about dusk, and, inquiring for the Commander-in-Chief, was directed to his quarters where I found him alone, with his whip in hand, preparing to mount his horse, which I perceived as I entered.

When I presented the letter to him, before receiving it, he exclaimed with solemnity, "What a time is this to hand me letters!" I answered that I had been charged with it by General Gates. "By General Gates? Where is he?" "I left him this morning in Philadelphia." "What is he doing there?" "I understand him to be on his way to Congress." "On his way to Congress!" he earnestly repeated, "On his way to Congress!," then broke the seal, and I made my bow and joined General St. Clair on the bank of the river.

What a pity that this naive recital was not penned in an age of greater frankness! For we may easily recognize that Wilkinson, writing in the days of Washington's glory and attempting to expiate some of his own baser actions, deleted the raciest of the "exclamations" made on that momentous afternoon. The vagaries of Gates, the unnecessary hardships being imposed on his command, the uncertainty of the immediate project, these things were all weighing heavily on the Commander-in-Chief. His so-called "solemnity" is therefore seen to be nothing more than the quite human and understandable gravity of a much harrassed soldier who does not know if impending events are to mark him a traitorous renegade or a national hero.

The movement across the river commenced in the early mid-winter dusk.

The ferrying was done in river boats about 35 feet long, ordinarily used for hauling ore from the upper Delaware. Colonel John Glover, with his regiment of Marblehead fishermen, who maneuvered the audacious retreat across Long Island Sound, served as ferrymen.

The crossing place was above tidewater on the Delaware. Here the stream was not wide, yet it was choked with floating ice; not in such sizeable chunks as are portrayed by Leutze in his celebrated painting, still in very sturdy cakes which made the 1000-yard crossing in such small craft a very slow and difficult undertaking.

Washington went over in one of the first boats and spent the night on the river bank, impatiently watching the tedious progress of his troops. Boat after boat reached the east bank, deposited a handful of half-frozen soldiers and started wearily back for another load. More impeding than the sluggish ice and the numbing cold was the inky darkness. It was the "stentorian lungs of General Knox," we are told by Wilkinson, that did much toward urging and guiding the troops across.

It seems more than strange that during this entire movement, carried forward slowly throughout the whole night and with its attendant shouting and confusion, not a single British sentry was struck.

This ignoring of the principle of security, the first law of the professional soldier, is sometimes attributed to the carousing of Rahl and his troops in Trenton. It seems more probable however that it was rather a mistaken concept of American psychology than an overpowering appreciation of native vintages that caused the Hessians to leave the river bank unguarded.

Colonel Rahl had been duly warned to expect an attack on Christmas day. Somewhat earlier a scouting party, of which James Monroe was a member,

accidentally encountered a Hessian outpost and was beaten off. Washington, on receiving this information was filled with dismay, apprehending that the Hessians might become aroused and his whole plan be thus foiled. When the incident was reported to Rahl, however, that complacent commander accounted it as the expected attack and continued to rest in the fancied security of his own military prowess. The poor provincials, he thought, were sufficiently cowed by his very presence in Trenton.

So the movement across the Delaware continued unmolested throughout the night.

Struggling in the darkness against a high wind, the oarsmen numbed by the piercing cold, it took nine hours to ferry the 2400 men, their horses and guns. Unexpected difficulty was encountered in handling the artillery, which later, however, proved to be well worth the extra efforts expended in its movement. Washington had expected to commence the march not later than midnight, so as to reach the town an hour before dawn; it was after three o'clock on the morning of December 26 before his troops were formed in column and ready to proceed.

It so became apparent that a surprise attack under cover of darkness was impossible. Yet surprise was the element on which Washington principally based his hopes and he had timed his blow for an hour when defensive strength is at its lowest ebb. Snow and hail had commenced to fall. The Continentals, half frozen during the vigils of the night, could not complete the march on Trenton in less than five hours. One by one the carefully laid plans of Washington had failed, until there was left little hope for the success of the expedition.

This night was the darkest in the military history of the United States. Never before nor since were the fortunes of the nation so low. A single regiment could easily, during these hours, have crushed the backbone of the force that supported the incipient republic. The depth of darkness just before the faint glow of dawn.

But the very force of circumstances swept Washington forward. To retreat was now more arduous than to advance. The possibility of a surprise attack under cover of darkness was gone, yet there remained some chance of defeating the enemy in open daylight battle. At least it was the only chance left, and Washington unhesitatingly accepted it.

There were in Colonial times but two roads into Trenton from the north: River Road and Scotch Road. These roads converged in the center of the town, forming its two principal streets.

Following the road which runs west from the river, the column moved a mile and a half to Bear Tavern, thence turned south along the River Road to Birmingham.

From Birmingham, Greene's brigade, with Washington accompanying, left Sullivan and cut across country a mile to Scotch Road. Thence the two columns moved grimly forward to envelop Colonel Rahl and his unsuspecting garrison.

The sufferings of this ill-kept "army" during its movement over those desolate, wind-swept roads is difficult to appreciate in these days of physical comfort. Blood on the frozen snow marked the course of the march. Two soldiers dropped out of ranks during the night and perished from freezing. It was the personality of the Commander-in-Chief that dominated the men and held them doggedly to their objective. Falling snow wet the flintlock rifles, rendering fire discipline uncertain, but Washington refused to permit any obstacles to interrupt his determined march on Trenton.

It was eight o'clock and broad daylight before the first Hessian picket was struck. One of the sentries, firing at Washington, hit the sword in his uplifted hand but did not injure him. However, the alarm was spread and the whole town was soon aroused.

From this point the fortunes of war favored the Revolutionists, as if to reward their fixed and steady purpose of mind in precipitating the battle.

The element of surprise, it seems, aided Washington quite as much at eight o'clock as it could have had the attack been delivered earlier as was planned. The Hessian field pieces were quickly captured and, with those of the Americans, turned on the town. This artillery, emplaced so as to cover the two important streets, was able to rake the Hessians as they came tumbling out of their quarters, thus preventing any semblance of formation. Disorganized, the German was an easy prey for his foe.

After the first fifteen minutes of action, the outcome of the engagement was never in doubt. The only resistance which Colonel Rahl was able to offer came after he had assembled a few of his men on the outskirts of the town and returned in fighting alignment; but by this time it was too late. The Continentals were deployed, served their field pieces as modern machine guns, and had only to fire at the advancing Hessians to complete the first decisive victory of the Revolution.

Rahl and 100 of his men were killed in action, 500 escaped across the unguarded Assanpink bridge, and nearly 1000 were captured. Of the attacking force only two were killed. Thus within an hour was the whole complexion of the war changed from despair to courageous optimism.

Washington lost no time in following up his victory. Gathering up the increased strength which became his after the fall of Trenton, he at once attacked the British line of communications across the Jerseys. It is in this type of action that Washington shows best as a military leader—rapid maneuver and unexpected dissimulation to bring about his opponent's discomfiture, rather than in great sweeping battles; in fact, with the limited resources at his disposal Washington was never able to try his fortunes in a battle of first magnitude. At Princeton he brilliantly outwitted Cornwallis with an inferior force, and by threatening New Brunswick, where the British stores were concentrated, quickly forced a complete evacuation. Thus Trenton proved to be the key to a development which modified the whole strategy of the war.

While the direct effects of the battle of Trenton were evident enough, it appears that the indirect or negative effects were the more profound.

The British ministers who undertook to conduct the war from London were always intrigued with the idea of separating the colonies. When they finally adopted this strategy, however, their tactics were employed in the direction of the Hudson valley-Canada junction. The weakness of this scheme was strikingly evidenced later at Oriskany and Saratoga. Had the British troops retained their control of the Jerseys, it is probable that even Howe would in time have seen the needlessness of the upper Hudson campaign, since a prolonged grasp on the area held by the British on the eve of Trenton would have strangled the Revolution.

But, once ousted from the Jerseys by the aggressiveness of Washington, Howe never again attempted to occupy that district. Even the operation against Philadelphia, resumed the following summer, had to be undertaken via the Chesapeake, since Washington stubbornly refused to relinquish this vital position which he had so arduously won.

Still, though they may not be deemed as strategically important as the denial of the Jerseys to the British, there is no gainsaying the direct and immediate benefits which followed the victory at Trenton.

The response within the country was instantaneous. Credit, supplies, and men became available in more liberal measure than ever before. The prestige of the professional European soldier was lowered and that of the Continental trooper correspondingly increased. The spark needed to ignite popular enthusiasm and confidence had been supplied, and the forces in the field began to receive whole-hearted public support.

The news, when it reached Europe, produced equally salutary reactions. In England, France, and Germany the struggle of the colonists commenced immediately to receive serious attention. The aid later furnished by France would never have been forthcoming had there not been some such exhibition of leadership and fighting ability to presage ultimate victory. The Tory element in England was most disconcerted to learn of such a reversal while confidently awaiting a report of the complete subjection of the colonies.

In every sense the effects of the victory at Trenton were profound. The battle was the first of the chain of events which culminated at Yorktown; yet if it had not been fought, the outcome of the war would in all probability have been far different. And the group of courageous men who achieved the victory bequeathed to the army of the United States a tradition of aggressiveness and originality in fighting which flavored the battle of St. Mihiel and which justified the Meuse-Argonne.

Armored Car Design

By MAJOR C. C. BENSON, *Cavalry*

ARMORED CAR DESIGN

THE business of designing fighting machines for ground troops has received far more attention from automotive engineers than from those who use the machines. Unfortunately, the engineers are not fully conversant with the needs of the troops and are prone to over-emphasize mechanical features. As a result, we find machines that are mechanically correct in which the driver cannot see and the gunner cannot shoot. Mechanical perfection is of little use if the completed machine lacks fighting ability; hence there is need in the design of fighting machines to shift the emphasis from mechanical to tactical features. To illustrate the application of this idea to a specific problem, the author presents herewith his views on the design of a heavy armored car.

FUNDAMENTALS OF DESIGN

The heavy armored car will be used by all arms for important reconnaissance work. In addition, it will be extensively employed to attack ground troops and to give protection against aircraft and against armored vehicles. It must provide mobility, fire-power, and protection for the crew. If it can have crushing power as well, so much the better, as it will have frequent need to overcome obstacles that would otherwise block its operations. To be sufficiently mobile, the machine must be capable of sustained high speed on the road and across country. Cross-country ability is especially important, because the machine will be of comparatively little use if confined to the roads. Fire power implies weapons for use against ground troops, aircraft, armored cars, and tanks. Protection for the crew, in so far as protection is possible, requires speed, armor, and suitably protected eye slits. Armor of sufficient thickness to withstand even the fire of .50-caliber machine guns will weigh more than an agile machine can carry; hence, speed enough to avoid or escape from hostile fire will be of great importance. A vehicle that embodies these characteristics will necessarily be a non-commercial product—a special machine in the same sense that attack and pursuit planes are special. No commercial machine now being built can meet the demands that will be made on a heavy armored car.

There are four main factors to consider—running gear, power plant, driver, and gunners. For the present, we shall consider only the arrangement of these elements with respect to each other. As the running gear must rest upon the ground, its position will give no trouble. The members of the crew should be together, either forward or aft of the engine compartment, because

NOTE.—By special arrangement with the editors, this article appears in the April issues of publications other than the COAST ARTILLERY JOURNAL.

they must cooperate continuously. If the engine is forward, as in some of the pioneer tanks, it may obstruct the driver's view; furthermore, its heat and fumes will nauseate the crew. The engine can do its work efficiently whether forward or aft; consequently, it should be aft, where it will not interfere with the operation of the vehicle. The central and forward positions remain available for the driver and gunners. For cross-country movements, the driver should be where he can observe closely each obstacle that is in his path; hence, the logical place for him is in the bow. This position subjects the driver to severe jolts, because the pitch of the bow is greater than amidships; but he can brace himself against expected shocks far better than can a gunner who is intent upon handling his weapons. A gunner needs the steadiest gun platform that the machine affords; therefore, he should be amidships, where the jolts and vibrations are reduced to the minimum. The most desirable arrangement of the four main elements may be represented graphically as follows:

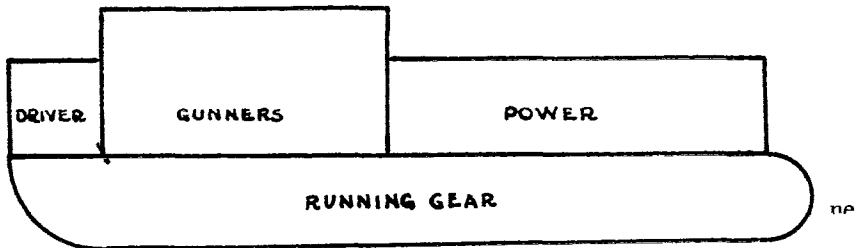


FIG. 1

Accustomed as we are to the conventional arrangement of units in pleasure vehicles, this arrangement may look queer. However, pleasure and warfare differ; we are less concerned with the appearance of an armored car than with its efficiency as a fighting machine.

With these ideas on the arrangement of the main elements, we may proceed with other features of the design. Automotive engineers will have to produce the running gear and power plant; the using service must design the hull, with suitable facilities for the crew. Part of the problem is tactical and part is technical, but responsibility for results rests upon the using service. To secure results, the using service must state definitely what it wants.

RUNNING GEAR

Various forms of running gear have been tried. They include four wheels, six wheels, eight wheels, caterpillar tracks in rear and wheels in front, full caterpillar tracks, and a combination of wheels for the road with tracks for cross-country work. Driving power is usually applied to two, four, or six wheels: or to the caterpillar tracks through rear driving sprockets. The wheeled vehicles, when equipped with oversized balloon tires, have shown far better cross-country ability than the average commercial car, and their sustained speed on the road

leaves nothing to be desired. However, even those with six-wheel drive bog down in soft ground, have insufficient traction for climbing steep slopes, and cannot surmount obstacles. Unless equipped with complicated dual controls for steering backwards or forwards, they require considerable room for turning. Caterpillar tracks in rear are better than wheels all around for cross-country travel, but not so good for speed on the road. The full caterpillar tracks give excellent service across country and enable the driver to turn his machine around in about half its own length; but the caterpillar machine cannot compete with wheeled vehicles on the road. The combination of wheels for the road and full caterpillar tracks for rough going is the most desirable that has as yet been produced. If the change from wheels to tracks, and reverse, can be made readily, this combination will meet all military needs.

For fast-moving vehicles, springs and shock absorbers are essential. Even at slow speeds, vibrations and road shocks quickly wear out machinery that is rigidly supported by an unsprung frame, because every blow is transmitted directly to the working parts. In our rigidly constructed Mark VIII tank, vibration is so great that engine bolts must be tightened after each three hours of running time. Imagine what would happen if instead of six miles an hour this machine could attain sixty! A heavy armored car will encounter good roads, poor roads, and extremely rough going where there are no roads at all, and it must rely greatly upon speed to avoid destructive fire from the enemy's weapons. In a fast fighting machine, the stability of the gunner's firing platform is another important consideration which depends largely upon the elimination of vibration and jolts. Rigid construction entails inaccurate fire except at very low speeds; and even at a snail's pace, it is difficult for a gunner to keep his sights on the target. These considerations indicate the need for the best combination of springs and shock absorbers that can be devised.

Heavy armored cars must travel under their own power; they cannot be carried on trucks, as light tanks have been in the past. It will therefore be necessary to depart from the types of running gear that have been devised for tanks. The desired type should provide wheels for road travel and full caterpillar tracks for cross-country work. The tracks must be of high grade metal to combine light weight with strength and long life; and suitable devices must be provided for changing readily from wheels to tracks or reverse. The shape of the bearing surface of the track when adjusted for operation should approximate the arc of a great circle, thus—



FIG. 2

to enable the machine to surmount obstacles and to facilitate turning. Individually sprung wheels and double-action shock absorbers should suffice to

eliminate most of the vibrations and jolts. These items cover the principal features of the running gear that is needed for a heavy armored car.

POWER PLANT

Lack of reserve power is a serious fault in any military vehicle. In commercial use, vehicles usually operate singly rather than in groups; each driver can take full advantage of conditions which favor his progress, and can avoid placing undue strain on his motor. In the military service, group operation and control is necessarily the rule. Even on good roads, drivers must often halt on steep grades and yet be prepared to maintain their proper places when the column moves on. While the column is moving, some machines will be going down hill while others are struggling up. Excessive extension of the unit or considerable reduction in speed will result, unless each machine has enough reserve power to meet unusual demands. In addition, military vehicles frequently have to operate on roads that commercial machines would avoid and in areas where there are no roads whatever. In combat, an under-powered machine forces the driver to shift gears for minor obstacles, and thus increases greatly the time allowed for hostile gunners to register a destructive hit. The fighting machine must have plenty of reserve power to enable it to survive.

The maintenance and repair work on military vehicles must often be done in the open. Wind, sand, rain, mud, snow, sleet, and cold impose far different conditions than are usually found in the steam-heated commercial garage. And when conditions are worst, tactical demands are often most pressing. The men available to do the necessary work will not be expert mechanics. There is, therefore, an especial need in the military service for an engine that is rugged in construction and extremely simple in design.

Invention and development are advancing so rapidly in the automotive industry that the sensation of today may be a back number tomorrow. Diesel engines, steam engines, and gasoline engines—some air-cooled and some water-cooled—present a bewildering array. Among the many excellent motors that our manufacturers produce, only those built for aircraft or for marine use have sufficient power to operate a heavy armored car. The aircraft motors will run efficiently whether top-side up or not, a very desirable feature, but none of them are designed to withstand the shocks of rough going across country. The marine motors are simpler and more rugged, but their water jackets require an unlimited supply of cool water to keep the engine at an efficient operating temperature. An armored car must carry its own water supply, and cargo space is extremely limited. An air-cooled motor of the type used in the Vickers medium tank (British) would afford distinct advantages, especially in freezing weather, but there are no high-powered American engines of this type except in airplanes. Obviously, the purpose for which a motor is intended governs its

design. We are forced to the conclusion that the right motor for a heavy armored car has not yet been built.

Rather than wait until a proper motor is designed and put into production, we may proceed with an admittedly inferior substitute. Capable automotive engineers can produce the new engine long before the Army is ready to use it. Their problem is merely to add one more engine to the hundreds they have already designed; ours is to learn how to use this new weapon tactically, and how to defend ourselves against it. It is time for us to start on our share of the business with such means as are at hand. The Army has in storage some thousands of Liberty motors which can make shift to meet our needs temporarily. They have power (338 B. H. P. at 1400 r. p. m.), and are compact; at comparatively slight expense many of their original faults can be eliminated by rebuilding. Experiments with air-cooled Liberties, already started by the Air Corps, would provide designers with valuable data. The use of the Liberty motor, air-cooled or "as is," would involve excessive maintenance and repair work, but at least we would have something to use at once for tactical instruction.

For the benefit of those who are qualified to design an engine for use in our heavy armored cars, we may briefly summarize our needs as follows: simplicity, power (about 350 B. H. P. at 1500 r. p. m.), dependability, compactness, rugged construction, accessibility, and again simplicity.

THE HULL

Having thus disposed of the parts that will concern automotive engineers, we must now tackle our own share of the design. The first step will be to determine the shape and size of the hull. It must provide excellent observation, all-around fire, low superstructure and low center of gravity, balance, suitable clearance, and room for the power plant, equipment, and crew. These somewhat conflicting requirements will be troublesome, yet there are certain features which can be settled at once. The bottom of the hull will be flat, with bow and stern rounded to avoid scoop-shovel action when pulling out of depressions; the driver will be in front, and the engine compartment in rear. Experience gained in the construction of tanks provides enough data for the design of these parts. Resort to the drawing board gives the following results for progress thus far.

It is probable that with a power plant designed for use in a heavy armored car, the size of the engine compartment can be reduced, but for the present the requirements of the Liberty motor will govern. Experiments have shown that the space allowed above is sufficient. The space allowed for the driver is purposely made liberal, to accommodate the facilities with which he must be provided. The main point to note is that the design provides the driver with excellent observation to the front and flanks.

The midsection of the hull must accommodate the remainder of the crew. As the driver will have his hands full, there must be at least one gunner to use the weapons. A third man in the crew, to handle signal communications, will double its efficiency; and a fourth would be desirable. If the size of the hull is to keep within reasonable limits, so that the machine will be readily maneuverable, it will be well to draw the line at four men.

To give this crew the maximum combat value, there must be communications equipment, and weapons. Extensive experiments will be necessary to determine what should be included in the signal equipment. Radio telephone and telegraph, panels, semaphore flags, pigeons, heliograph, and pyrotechnics will all have to be tested for armored-car use. The necessary space for the selected equipment must be provided, for signal equipment in an armored car is just as important as armament. As to weapons, there should be caliber .30 machine

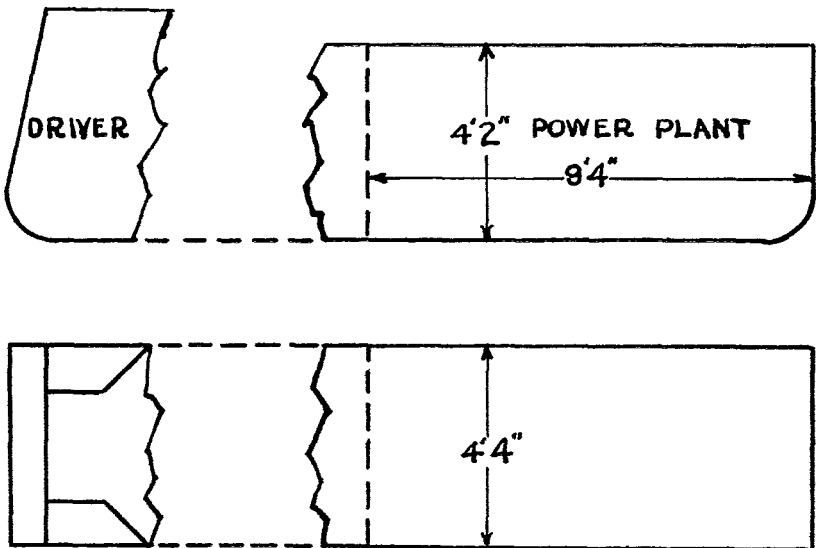


FIG. 3

guns for use against personnel; a caliber .50 machine gun for antiaircraft fire; and a three-pounder cannon to deal with hostile armored cars and tanks.

Much might be written about other items of equipment and detailed facilities that should be provided for the driver and for other members of the crew. Some of the items that need attention are: Ammunition racks, an instrument board with luminous dials, compass, periscopes, gas masks, tools, spare parts, responsive controls, interior lights, head lights, tail light, flashlights, towing cables and brackets, individual lockers, fire extinguishers, fire-proof bulkhead for engine compartment, camouflage materials, splash guards, demolition equipment, photographic equipment, food and water containers. These and related

matters are properly the subject for thorough investigations, which should be made with full-sized wooden models before the first steel hull is built. Until these investigations have been made, we cannot draw up a complete design. It is possible, however, to prepare a lay-out that will accommodate at least the major items. Without more ado, we submit the following design for the hull.

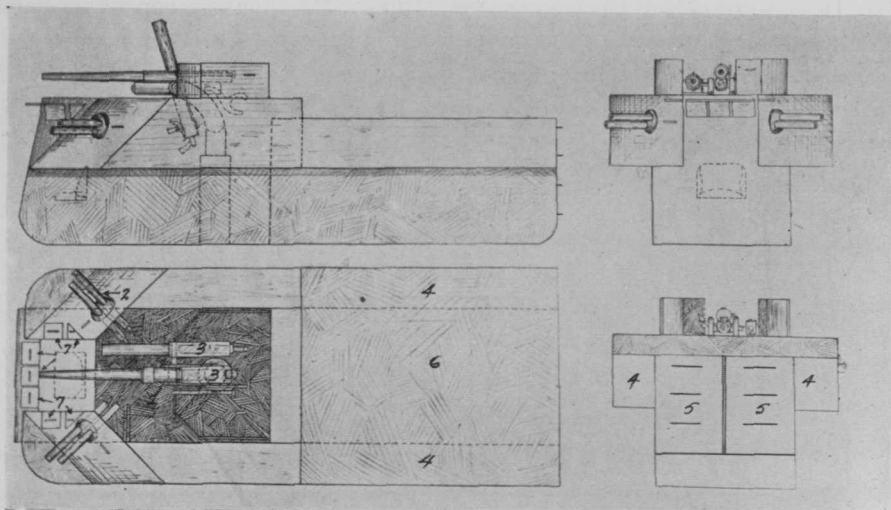


FIG. 4

The following numbers refer to corresponding numbers on the sketches.

1. Fighting compartment (heavy line), extends out over running gear, normally open at the top, roof in suitable sections carried on top of engine compartment. Permanent roof over driver's seat. Front plates slope forward at an angle of 45 degrees. Entrance and exit over the top.

2. Caliber .30 machine guns, air-cooled, two in each mount. Horizontal traverse about 130 degrees. Mounts placed to allow each gunner as much room as possible. Primarily for fire to the front and flanks against personnel; can also furnish some antiaircraft fire.

3. Three-pounder cannon on pedestal mount, semi-automatic, high velocity, all-around traverse. Small shield on gun to protect gunner from machine-gun fire. Caliber .50 machine gun, air-cooled, for antiaircraft fire, on same mount, to right or left of cannon.

4. Armored gasoline tanks, extend out over running gear, capacity 100 gallons each. Beneath the armor are inner tanks, self-sealing if punctured.

5. Water-tight hinged doors which give access to power plant. There are similar doors in the fireproof bulkhead which separates the fighting compartment for the engine room. Door handles serve also as steps of ladder to roof. Tool racks on inner surface of each door.

6. Flat roof of engine compartment provides a place for carrying caterpillar tracks when the machine is operating on wheels.

7. Observation ports, backed with thick shatter-proof glass, and protected outside by steel doors with suitable eye slits or holes for use when under fire.

ASSEMBLY

There remains the important matter of fitting the running gear to this hull. As previously mentioned, the combination of wheels for the road with full caterpillar tracks for cross-country work, is most desirable for our purpose. Running gear of this type, invented by Mr. Walter Christie, is now undergoing tests on a new experimental machine. The performance of this gear to date has been fully satisfactory, but whether it will stand up under the full load of the completed machine remains to be seen. The total weight of the machine, fully equipped and armored against .30-caliber bullets, will be about twelve tons. To travel at sixty miles an hour on the road and about thirty across country, this machine must have running gear of exceptional quality. The tracks particularly will have to be strong enough to withstand terrific strains, and yet light enough to permit easy removal and handling. The following sketch shows running gear of the Christie type combined with the hull described above. Note that the caterpillar tracks extend beyond the hull, so that neither bow nor stern can dig into an obstacle or steep bank.

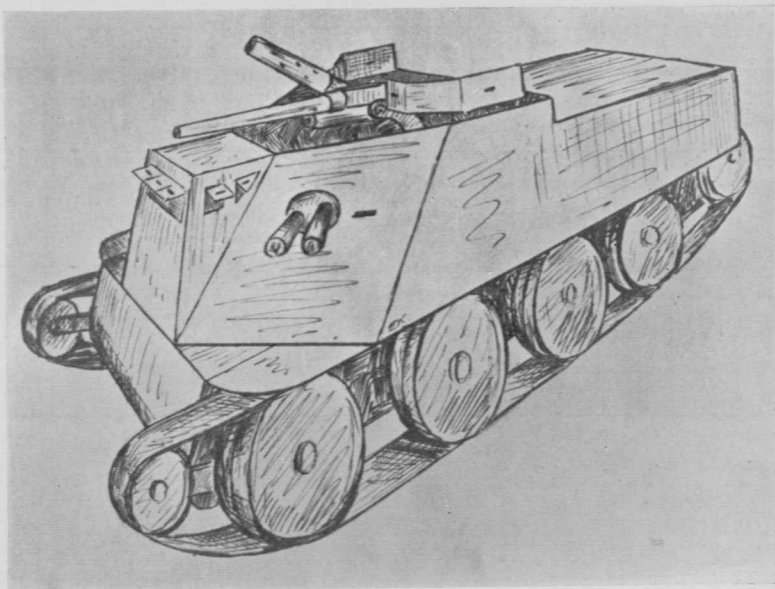


FIG. 5

In producing a new model automobile, manufactures consult not only their designers but also the production, service, and sales departments. A similar

system might well be applied to new fighting machines for the Army, but unfortunately we have no arm or service which combines these viewpoints under the control of one responsible head. Lacking such an agency, we must rely upon the cooperation of interested officers throughout the Army to point out mistakes and suggest improvements. Costly mistakes and needless delays will occur in building heavy armored cars unless we develop sound ideas on the fundamentals of design. In addition, there must be careful consideration of matters that affect production and service. The ultimate consumer—the using service—should get what it needs for tactical use in combat. If the using service neglects its share of the problem, it must be satisfied with what others produce.

The system of education at West Point, I have opportunities for observing . . . and I believe in it. Thanks to the discipline, to the small divisions, where every pupil studies every day, and the liberal course of study, every graduate of West Point and of Annapolis is an educated man. I have not met one exception.—Professor William Lyon Phelps, of Yale.

PROFESSIONAL NOTES

Coat of Arms for 197th Coast Artillery (A. A.)

Shield: *Azure*, in base a lion passant guardant *or*, and in fess a lozenge and a fleur-de-lis *argent*; on a chief *gules* fimbriated of the second a winged projectile, wings inverted, of the last.

Crest: That for the Regiments of the New Hampshire National Guard. On a wreath of the colors (*or* and *azure*) two pins branches saltirewise proper crossed behind a bundle of five arrows palewise *argent*, bound together by a ribbon *gules*, the ends entwining the branches.

Motto: *A Bas l'Avion* (Down with the Plane).

The 197th Coast Artillery (A.A.), New Hampshire National Guard, was formed in 1922 from existing companies to perpetuate certain units of the 1st Infantry, New Hampshire National Guard, and also certain units of the former Coast Artillery Corps, New Hampshire N. G. Federal recognition was given the regiment on June 30, 1922. The present regimental organization is as given below:

<i>Unit</i>	<i>Originally Organized</i>	<i>Federal Recognition</i>
Bn Hq & Combat Train	1922	June 9, 1922
Hq Battery	1865	June 29, 1922
Battery A	1891	Dec. 22, 1921
Battery B	1780 (about)	Mar. 17, 1922
Battery C	1861	Mar. 30, 1922
Battery D	1861	Feb. 16, 1922
2nd Bn Hq & Combat Train	1898	May 16, 1922
Battery E	1879	Dec. 6, 1921
Battery F	1878	June 30, 1922
Battery G	1878	Jan. 27, 1922
Battery H	1878	May 15, 1922
Medical Detachment	1922	Aug. 7, 1923
Service Battery	1887	June 29, 1922

The oldest unit in the regiment is Battery B, claimed to have been organized some time prior to 1780 as the 1st Company, Light Infantry, 2nd Regiment, 2nd Brigade, 2nd Division, New Hampshire Militia. This company was in federal service during the War of 1812 from May 25 to July 2, 1814, under command of Captain Pierce, and was attached to "Long's command, New Hampshire Militia," at Portsmouth harbor. In December, 1823, this company was reorganized as the Strafford Guards of Dover, N. H.; the Strafford Guards were a part of the escort for the Marquis de Lafayette on the occasions of his visits to the towns mentioned. In 1825, on September 6, this company participated in the memorial ceremonies for Lafayette. On January 8, 1863, the company gave military burial to a soldier of the 11th N. H. Regiment, who had been killed at Fredericksburg. Mustered into U. S. service on May 5, 1864, for sixty days, and served at Fort Constitution, being mustered out of the U. S. service on July 25, 1864. The Strafford Guards were also known during the Civil War as Littlefield's Company, N. H. Militia. On Nov. 15, 1864, participated in a celebration of the re-election of President Lincoln. On April 10, 1865, participated in celebration of the surrender of General Lee. On May 5, 1865, ordered to participate in the funeral ceremonies for president Lincoln. No record of service in the Revolutionary War or Mexican War can be found.

The following table showing units of the 1st Infantry and Coast Artillery Corps, N. H. N. G., the corresponding units in the present 197th Coast Artillery (A. A.), N. H. N. G., and the Civil War units of the present regiment is tabulated for convenience in reference:

<i>(1917)</i> <i>Units of</i> <i>1st Inf.,</i> <i>N. H. N. G.</i>	<i>Present</i> <i>Designa-</i> <i>tion in</i> <i>197th C. A.</i>	<i>Originally</i> <i>Organized</i> <i>As</i>	<i>Date</i> <i>Organized</i>	<i>Civil War</i> <i>Designation</i>
Co. C	Hqrs. Btry.	State Capitol Gds.	Oct. 31, 1865	
Co. D.	Ser. Btry.	Co. C, 2d Rgt., N. H. Mil.	Apr. 30, 1887	
Co. E	Btry. A	Co. E, 3d Rgt., N. H. Mil.	Apr. 14, 1891	
Co. M	Hq. 2d Bn.	Co. M, 3d Rgt., N. H. Mil.	Jan. 28, 1898	
Co. I	Btry. E	Co. I, 2d Rgt., N. H. Mil.	Apr. 3, 1879	
Co. L	Btry. F	Co. G, 3d Rgt., N. H. Mil.	Apr. 24, 1878	
Co. H	Btry. G	Co. H, 2d Rgt., N. H. Mil.	Apr. 29, 1878	
M. G. Co.	Btry. H	Co. H, 3d Rgt., N. H. Mil.	Apr. 25, 1878	
<i>Units of</i> <i>former C. A.</i> <i>C., N. H. N. G.</i>				
4th Co.	Btry. B.	1st Co., L. I., N. H. Mil.	About 1780	Strafford Guards or Littlefield's Co.
2nd Co.	Btry. C	Laconia Vols.	Apr. 15, 1861	Co. F, 2d N. H. Vol. Inf.
1st Co.	Btry. D	Goodwin Guards	May 30, 1861	Co. K, 2d N. H. Vol. Inf.

It will thus be seen that three of the present units of the 197th C. A. (A. A.), N. H. N. G., were in U. S. service in the Civil War; two companies (F and K) in the 2d N. H. Volunteer Infantry. The latter regiment was mustered into the U. S. service on June 10, 1861, at Portsmouth, N. H., and was finally mustered out of the U. S. service at City Point, Virginia, on December 19, 1865, having participated in the following battles:

Bull Run, Va.	July 21, 1861.
Yorktown, Va.	April 4 to May 4, 1862.
Williamsburg, Va.	May 5, 1862.
Fair Oaks, Va.	May 31 to June 1, 1862.
Savage Station, Va.	June 29, 1862.
Malvern Hill, Va.	July 1, 1862.
Groveton and Bull Run, Va.	Aug. 29 and 30, 1862.
Gettysburg, Pa.	July 1 to 3, 1863.
Swift Creek, Va.	May 8, 1864.
Drury's Bluff, Va.	May 16, 1864.
Cold Harbor, Va.	June 1 to 12, 1864.
Petersburg, Va.	June 16 to Aug. 31, 1864.
Fair Oaks, Va.	Oct. 28, 1864.
Appomattox Courthouse, Va.	April 9, 1865.

(Authority: Old Records Div., AGO, WD—Volunteer Battle Register, 1861-65)

Ten of the units in the present regiment were mustered into the service of the United States for the Spanish-American War, as follows:

*Present Designation
in 197th C. A. (A. A.), N. H. N. G.*

Headquarters Battery
Service Battery
Battery A
Battery B
Battery C
Battery D
Hqs. 2d Bn. & Combat Train
Battery F
Battery G
Battery H

*Designation in Spanish-
American War*

Co. C, 1st N. H. Volunteers
Co. I, 1st N. H. Volunteers
Co. E, 1st N. H. Volunteers
Co. F, 1st N. H. Volunteers
Co. K, 1st N. H. Volunteers
Co. A, 1st N. H. Volunteers
Co. M, 1st N. H. Volunteers
Co. G, 1st N. H. Volunteers
Co. L, 1st N. H. Volunteers
Co. H, 1st N. H. Volunteers

The 1st New Hampshire Volunteers was mustered into U. S. service at Concord, N. H., on May 8 to 14, 1898, and was mustered out of the Federal service at Concord, N. H., on Oct. 31, 1898. It had no foreign service.

Eight units of the present regiment were in service on the Mexican Border at Laredo, Texas, as follows:

*Present Designation
in 197th C. A. (A. A.), N. H. N. G.*

Headquarters Battery
Service Battery
Battery A
2d Bn. Hqs. & Combat Train
Battery F
Battery G
Battery H
Battery E

*Designation While in U. S.
Service on Mexican Border*

Co. C, 1st Regt. Inf. N. H. N. G.
Co. D, 1st Regt. Inf. N. H. N. G.
Co. E, 1st Regt. Inf. N. H. N. G.
Co. M, 1st Regt. Inf. N. H. N. G.
Co. L, 1st Regt. Inf. N. H. N. G.
Co. H, 1st Regt. Inf. N. H. N. G.
Machine Gun Co. Inf. N. H. N. G.
Co. I, 1st Regt. Inf. N. H. N. G.

In the World War the entire 1st Regiment, N. H. N. G., was mustered into U. S. service on July 25, 1917, at the home stations of the various companies, and the regiment was mobilized at Concord, N. H., on July 27, 1917. In August, 1917, 1630 officers and men of the regiment were transferred to the 103d Infantry, 26th Division. The balance of the regiment was redesignated the 1st Army Headquarters Regiment on Feb. 11, 1918, per G. O. No. 11, Hq. 51st Depot Brigade, 26th Division, dated Nov. 5, 1917. The 1st Army Headquarters regiment arrived in France on April 2, 1918, and served in the S. O. S. until the Armistice. The regiment is not entitled to battle credit but is entitled to credit for service in France from April 2, 1918, to Nov. 11, 1918.

The three companies of the former Coast Artillery Corps, New Hampshire National Guard, now incorporated in the 197th C. A. (A. A.), N. H. N. G., show the following history in the World War:

*Present Designation in
197th C. A. (A. A.), N. H. N. G.*

- Battery B Mustered into U. S. service July 25, 1917, as 4th Co., C. A. C.; redesignated the 8th Co., C. A. C., Ft. Constitution (Portsmouth, N. H.); demobilized Dec. 20, 1918. Reorganized 1921 as Battery B, 197th C. A. (A. A.), N. H. N. G.
- Battery C Mustered into U. S. service July 25, 1917, as 2nd Co., C. A. C., N. H. N. G.; redesignated the 6th Co., C. A. C., Ft. Constitution (Portsmouth, N. H.); demobilized Dec. 18, 1918. Reorganized 1921 as Battery C, 197th C. A. (A. A.), N. H. N. G.
- Battery D Mustered into U. S. service April 13, 1917, as 1st Co., C. A. C., N. H. N. G.; redesignated 9th Co., C. A. C., Ft. Constitution (Portsmouth, N. H.); demobilized Dec. 19, 1918. Reorganized 1921 as Battery A, 197th C. A. (A. A.),

N. H. N. G. Redesignated Battery D, 197th C. A. (A. A.), N. H. N. G., by G. O. No. 5, W. D., Feb. 12, 1923.

All service was at Ft. Constitution, Portsmouth, N. H., and therefore no battle credits are involved.

Under authority of G. O. No. 16, W. D., 1921, as amended, the 197th C. A. (A. A.) is entitled to the following battle honors:

Civil War

Bull Run	Virginia 1864
Peninsula	Cold Harbor
Manassas	Petersburg
Gettysburg	Appomattox

World War

(Streamer without inscription)

The shield is blue to indicate the longer service of the unit as Infantry. The gold lion passant guardant is for the service in the War of 1812; the white lozenge—the corps badge for the 2nd Division, 3rd Corps, during the Civil War—represents Civil War Service; and the fleur-de-lis indicates service during the World War. The chief is red for Artillery and the winged projectile indicates that it is an antiaircraft unit.

Coast Artillery Target Practice

The Chief of Coast Artillery, Major General Andrew Hero, Jr., has completed a study of the results of all target practices in the Coast Artillery held during the year 1928 and has submitted a confidential memorandum to the War Department indicating the results obtained. In general, the target practice year 1928 has been highly satisfactory. The excellent results that have been obtained are partly due to the inauguration, in 1926, of a system of scoring all battery organizations, whereby all are on a competitive basis.

Prior to the commencement of artillery firings for the year 1928, upon the recommendation of the Chief of Coast Artillery, the War Department prescribed minimum ranges for all seacoast and antiaircraft firing. Notwithstanding the increased range at which target practice was held the comparison with the similar results for 1927 show marked progress as:

The average range of 87% of the practices was greater.

Increased accuracy was obtained in 58% of the practices.

The rate of fire was increased in 98% of the practices.

The hits per gun per minute were increased 79%.

Some of the outstanding records for the year follow: In one practice with the 155-mm. guns the average time to fire one round was 11 seconds at a range of approximately 15,000 yards and 27% of hits was obtained. In another practice with this type of armament at a range of over 5500 yards conducted at night 54% of hits were made. In a practice with the 14-inch guns 58% of hits were obtained at a range of approximately 17,000 yards wherein the battery secured over 1.5 hits per battery per minute. A 3-inch gun battery made 68% of hits at a range of over 5000 yards resulting in 9 hits per gun per minute.

For the antiaircraft artillery marked improvement over the previous year's shooting was obtained. This is especially true with machine guns. In one practice at a range of approximately 900 yards (2700 feet) and during 9 separate flights by a tow target airplane approximately 13% of hits were secured. The rate of fire obtained during this practice indicates that 90 hits per gun per minute were obtained. With the 3-inch antiaircraft guns there was one practice where 45 hits were made at a range of over 15,000 feet (5000 yards).

There were five regiments in which all regular target practices were classified as "excellent" (the highest classification for Coast Artillery units). These were:

92d Coast Artillery (HD), Philippine Islands.

2d Coast Artillery (HD), Canal Zone.

15th Coast Artillery (HD), Hawaii.

41st Coast Artillery (RY), Hawaii.

1st Coast Artillery (HD), Canal Zone.

The 92d Coast Artillery, manning 155-mm. guns, stationed in the Philippine Islands has been selected as the leading regiment for the year 1928. Forty-nine per cent of all organizations firing were classified as "excellent" by the War Department and are entitled to wear the badge of "E" on the sleeve denoting excellence in target practice.

More About the Probable Error

By CAPTAIN HAROLD R. JACKSON, C. A. C.

Although the subject of the probable error has been discussed many times, there appears still to be room for debate as to how to determine the value of the probable error of a battery for use in adjustment of fire; also, opinions differ as to the fairest method of using the D. A. P. E. in computing the score by which a battery is to be rated.

In two articles which appeared in the COAST ARTILLERY JOURNAL during the past year, considerable space was devoted to showing the effect on adjustment and effectiveness of fire due to the assumption of a probable error either one half or twice the correct value. In both articles it was apparently assumed that the proper probable error for use in adjustment of fire would be the D. A. P. E. of the practice; and that, since the D. A. P. E. cannot be determined until a practice has been fired, the battery commander must use a probable error which may be as much as 100% wrong.

As a matter of fact, an adjustment correction should be a function, not of the D. A. P. E., but of the true probable error of the battery; and this we can determine with reasonable accuracy.

The probable error does not vary with each practice any more than it varies with each salvo or each round. It changes only when the condition of guns or carriages changes, as after a general overhaul. In general, such a change will probably be very small.

The best method of determining the probable error of a battery is by an examination of records of former practices. But how many previous practices should be considered? And, if insufficient records of past practices are available, what value should be assumed?

An answer to the first question was found by a study of the practices fired by certain G. P. F. batteries in 1926 and 1927. At first thought, it would seem that one hundred rounds would be sufficient to determine the probable error. But it was found by tabulation that the probable error developed in one hundred rounds varied from that developed in one hundred seventy-five rounds as much as 20%. It was also found that the probable errors developed by the nine batteries considered in the two years' practices varied from the firing-table probable errors by an average of only eight per cent and a maximum of twenty per cent. The conclusion was therefore made that when fewer than one hundred fifty rounds are available for the computation, the firing-table probable error should be taken as the field probable error.

The average probable errors at different ranges for a number of batteries developed in several hundred rounds were found to agree within about ten per cent with the firing-table values.

A tabulation of results follows:

<i>Range</i>	<i>Firing Table P. E.</i>	<i>Developed P. E.</i>	<i>No. of Shots Considered</i>	<i>Regiment by Which Majority of Practices Were Fired</i>
8000	52	57	443	55th C. A.
10,000	63	56	186	51st C. A.
15,000	97	88	278	55th C. A.

All these practices were fired with the supercharge.

It will be noticed that the 51st Coast Artillery developed a smaller probable error at 10,000 yards than the 55th developed at 8000 yards. This result is probably due to superior calibration of the batteries of the 51st. They have held calibration practices at least once since those of the 55th.

At 15,000 yards the firing-table probable error appears to be about ten per cent too large. More data at this range will be available when the results of the 1928 practices are published.

If the probable error is determined as indicated above, it will practically always be within twenty per cent of the true value, and usually within five per cent, and the effectiveness of fire will not be materially reduced because of such error.

Having decided that the D. A. P. E. has no bearing on the adjustment of fire, its use in computing the score by which a battery is rated was next considered. Although the revised method of computing the score has already been published, a discussion of the score used in 1928 will be of interest to officers who fired in that year. For this purpose the *A*, *B*, and *C* components of the 1928 score were taken up separately.

Since the fall of a limited number of shots may be very erratic, it would be difficult, if not impossible, to determine, theoretically, whether the percentage of hits, and consequently the hitting component, should be a function of the D. A. P. E. or of the true probable error. Consequently the problem was solved by a tabulation of all 1927 practices in which adjustment was attained. In this way it was found that, while no regular law was apparent, yet exceptionally large percentages of hits usually occurred when the D. A. P. E. was smaller than the firing-table probable error, and vice versa. It was concluded, therefore, that the use of the D. A. P. E. in the *A* component was justified.

Incidentally, it was found in the course of this investigation that the percentage of hits obtained averaged forty per cent higher than the expected percentage, based on either the firing-table probable error or the D. A. P. E., thus indicating an unaccountable hump in the probability curve in the vicinity of the *C. I.*

The results of the 1927 practices show relatively few points lost in the *B* component. Of the batteries that were penalized in this component, two-thirds had D. A. P. E.'s smaller than the firing-table probable errors. It seems illogical that batteries that develop small probable errors should be penalized for poor calibration, yet such was the case. The use of the firing-table probable error instead of the D. A. P. E. would have remedied, in part, what seems to have been an injustice.

"In part," because it was also found that the factors by which the probable errors were multiplied appear also to be erroneous. By a tabulation of the fall of one thousand fictitious rounds fired with the hit bag, it was found that the average dispersion of four-round volleys was 3.1 probable errors, of three-round volleys was 2.6 probable errors, and of two-round volleys was 1.8 probable errors. Hence, with perfect calibration and normal dispersion, the average score for batteries firing four-gun volleys should be eight out of ten. So, while calibration is a thing to be worked for, it is not believed that the 1928 *B* component was a fair measure of it.

For the *C* component, nothing but a theoretical discussion could be evolved. As used in 1928, the adjustment component varied directly as the D. A. P. E. Should it? Suppose that a battery develops a relatively small probable error in a practice. Such a D. A. P. E. would indicate that the shots of the practice were distributed more closely

about the center of impact than the average. It is easily conceivable that an abnormally close grouping of the shots on which adjustment corrections are based might seriously hamper adjustment by the bracketing method. In such a case, the battery would be penalized twice because of no fault nor error: once by having poor adjustment, and once by the use of the small D. A. P. E. in the adjustment component.

From these considerations, it seems that the size of the D. A. P. E. bears little relation to the adjustment, and that there is no cause to fear that adjustment will be prevented because of an erroneous assumed probable error. Moreover, none of the adverse criticisms made above on the 1928 score are applicable to the new score.

Marshall Foch's Story of the Armistice

An Interview by STEPHANE LAUZANNE

Translated from *Candide*, and published in *The Living Age*

EXTRACT

* * * * *

As I looked at them I said to myself, 'Behold the German Empire, beaten and asking for peace. *Eh bien!* Since it is coming to me, I shall treat it as it deserves. I shall be firm and cold, but without bitterness or brutality.'

* * * * *

'They came into my car,' he said, 'looking stiff and pale. One of them, whom I assumed to be Matthias Erzberger, mumbled a request that I make the necessary introductions. But I was content merely to reply: "Have you any papers, gentlemen? If so, let us examine their validity." Whereupon they showed me papers signed by Prince Max of Baden, which I regarded as satisfactory. Then I turned to Erzberger and asked: "What do you want?" He replied, still mumbling: "We have come to receive the proposals of the Allies for an armistice." I stopped him abruptly. It was the only time that I was cutting. "I have no proposals to make." The four Germans looked at each other. "Well," said one of them, Count Oberdorff, "*Monsieur le Maréchal*, tell us how you want us to put it. Our delegation is ready to ask you for the conditions of an armistice." But I insisted: "Are you formally asking for an armistice?" "Yes." "Then please sit down and I will read you the conditions of the Allies."'

* * * * *

'I began to read the conditions of the Armistice slowly,' Marshal Foch went on. 'After each paragraph I stopped to allow the interpreter to translate. Then I watched the men to whom I was talking and as the translation proceeded I studied the impression it was making in their faces. Little by little I saw disturbance spread over their countenances. Winterfeldt especially was very pale. I believe he even wept. When the reading was finished, I said simply: "Gentlemen, I will leave you the text. You have seventy-two hours to reply. At the end of that time you may let me have your observations in detail." Erzberger, however, became pathetic. "In heaven's name, *Monsieur le Maréchal*," he said, "do not wait seventy-two hours. Stop the fighting today. Our armies are a prey to anarchy. We are threatened by Bolshevism. Bolshevism may sweep all Germany and menace France itself." "I do not know in what condition your army may be," I answered. "I know only in what situation my own armies find themselves. Not only is it impossible for me to stop the offensive, but I am giving an order for redoubling the vigor of the pursuit." Winterfeldt intervened in his turn: "But, *Monsieur le Maréchal*, it is necessary for our staffs to meet and discuss in detail the carrying out of the Armistice. How can they do this if hostilities continue? I beg you to halt hostilities for technical reasons."

'Again I replied, "Technical discussions can take place just as well seventy-two hours from now. Until then, the offensive will continue." That was the last of it. The four plenipotentiaries rose and departed.'

During the two days that followed, November 9th and 10th, Marshal Foch slept very little. He had no doubt that the German plenipotentiaries would accept his conditions; but wireless messages intercepted at the Eiffel Tower brought news that revolution had broken out in Berlin. Then Foch began to ask himself this disturbing question: 'What government did those men in the forest represent?' Nevertheless, on the evening of the tenth he regarded it as necessary to remind the Germans, through General Weygand, that at daybreak the next day the seventy-two hours would be over. Then they must sign or go.

Scarcely had Weygand completed his mission when Captain de Mierry, one of Foch's staff officers, was called to the telephone and a wireless message just received at the Eiffel Tower was read:—

THE GERMAN GOVERNMENT to the GERMAN PLENIPOTENTIARIES at the ALLIED HIGH COMMAND. (6:30 p. m.)

The German Government accepts conditions of the Armistice which were offered to it on November 8th.

THE CHANCELLOR OF THE EMPIRE,
3084

* * * * *

'Then,' said Foch, 'I slept no more. A little after two o'clock in the morning, the German plenipotentiaries came back to my car and began a final discussion. They demanded that, in view of the troubled conditions of all Germany, the army should be allowed to keep a larger number of machine guns to maintain order. I therefore allowed them five thousand machine guns and a hundred motor trucks. That was all. At exactly 5:15 in the morning they signed the Armistice, writing their names in big, angry letters. . . .'

* * * * *

Ships Instead of Picture Cards

We have heard that the cry of "Wolf!" loses its force if too often and falsely sounded, and it is equally true of the cry of "Lamb!" when over-used. The long cruiser debate and the vote that followed it showed conclusively, not only that the prophets of peace have lost their persuasion, but that the fondly indulged gesture of pretending to rebuild the American navy to scare foreign powers into disarmament conferences at last has been revealed in all its emptiness and futility.

The senate and the country could no longer back away from the facts. The belief that the good faith of this government was played upon at the Washington arms limitations conference has been growing since the failure of the Geneva naval parley. It was freely expressed in the senate debate, where the strongest reflections were thrown on the subsequent naval policy of Britain in contrast to the almost fatuous course of this government in sacrificing its own navy and indulging hopes to the point of credulity in the ever dimming prospects of disarmament by international agreement. The senate's present action is the result of the awakening.

The senate has said, in effect, as did the house in its passage of the cruiser bill with a time limit clause, that if authorization of the ships is a good card to play in the armament limitations game, construction of them is a better. The action of congress means we are to have ships instead of picture cards.—*The Kansas City Star*.

Foreign Periodicals

BALLISTIC ATLAS. In this article, by Giovanvi Conti, Captain of Artillery, published in the *Rivista di Artiglieria e Genio* for October, 1928, the author, after indicating the difficulties encountered in determining with any degree of accuracy the elements of a

trajectory by the present methods, shows how it is possible to deduce from a single trajectory the elements of an infinite number of others and proposes to construct once for all, by rigorous methods, a certain number of trajectories, assembled in tables (Ballistic Atlas) from which it will be easy to find the elements of any other trajectory.—F. E. H.

AN ARMY OF BRITISH SCHOOL BOYS. The *Militär-Wochenblatt* announces: "A number of British School boys put in during the past Summer for ten days a part of their vacation in military uniforms and under military restraint and military discipline, camping out with troops. The fact that all who were selected for these camps regarded it as a special distinction is evidence of the favorable acceptance of this voluntary participation in the defensive system of the country. The young boys obtained from their experience in the camps a perception of the value that their experience would have in case of war. They participated in tactical exercises with cavalry, flyers, and mechanized troops or looked on these exercises as spectators. The effect of this training was evident when it was seen that during the entire period of the encampment they cleaned their buttons and shoes made their beds and washed their dishes and kept their rifles clean."—G. R.

EXCLUSION AND ELIMINATION OF UNSUITABLE PSYCHOPATHIC MEN FROM THE ARMY. The October 18, 1928, issue of the *Militär-Wochenblatt* publishes an article written by Surgeon General Dr. Herold, German Army, retired, on the above subject, in which he says: "During my term of service in the army I was frequently called upon by military courts to give medical judgment in regard to the responsibility of men who had been guilty of serious offenses against military discipline and order. They were mostly persons whose intelligence was not in question but who exhibited defects in ethical and moral respects—cases of so-called psychopathic personalities. They were men unstable, irritable, irascible, showing deficiency of endurance in the work assigned to them, with outbursts of exaltation and inclination to suicide, unsocial in civil life, and disobedient and insubordinate in the military service. Their influence in injury to troops cannot be underestimated.

"The destructive moral epidemics that can menace the security of an army are revolt and cowardice. The psychopaths of the class above referred to are ready subjects of the destructive vagaries of communism; they display a strong tendency to cowardice, desertion in face of the enemy and from among them are recruited almost exclusively the mass of shirkers of whom, it is to be regretted, we had an abundant supply especially during the latter end of the war. In the recruiting supply methods of our old army it was practicable to exclude weak-minded men from the army by means of information and records always at hand or readily available and such men seldom succeeded in getting through and if they did were soon detected and disposed of, although men of that class are less dangerous than the psychopaths who are not deficient in intelligence."

As a remedy for these conditions, or at least to minimize their effect, Dr. Herold recommends that officers be qualified by lectures to be given by sanitary officers with information that would enable them early to detect men who show any tendency toward abnormal ethical conduct. They would bring such cases at once to the attention of competent medical officers who would then determine the status of the individual in question and pass judgment as experts. The same course would be pursued for officers having charge of examination of applicants for enlistment in the Reichswehr. It would also be necessary that medical officers be thoroughly trained in study of mental disorders. In many families of today youths are no longer brought up with religious impressions and become facile subjects of communistic doctrines openly promulgated. The material and sensual impressions are also given greater facilities for exercise of their influence than ever before and exert such influence to a larger extent on persons of unstable character and psychically deficient.

The author further holds that what he has here said about measures of discrimination in admission and exclusion of enlisted men from the army applies with even greater force to those seeking admission or who may have already been admitted to the commissioned

ranks and that the greatest possible care shall be exercised that they possess in full measure the spiritual harmony for the avocation they seek. Intelligence, which will undoubtedly not come into question in their cases, is not in itself all sufficient. The suggestive effect that the officer can exercise on his men in peace and in war is very important; in the fight it is the issue that turns the scale.—G. R.

AN APPEARANCE OF BRITISH PACIFISM. A newspaper report asserts that the Town Council of the town Bradford in England disapproved, by a vote of 38 against 30, permission for a proposed large "Retreat" celebration on armistice day anniversary because such a celebration of a military character would be in violation of the fundamental idea of the Kellogg pact. The same Council contemplates removal of the figures of a soldier and a sailor from the town's memorial monument to fallen soldiers in order that persons passing by the monument may not have warlike feelings aroused by such military displays.—G. R.

BOOK OF INSTRUCTION FOR THE ARTILLERYMAN. Following is an extract from an article published in the December 11, 1928, issue of the *Militär-Wochenblatt* in which the author comments on the newly issued German "Manual" of "Instruction for Recruits, Gunners, and Non-Commissioned Officers of the Artillery and their Instructors" compiled by Captain Gilbert, of the Fourth Artillery Regiment, detailed for service at the Artillery School: "Formerly in 'the golden days of the past' of our youth the 'Service Instructions for the Gunner and Driver of the Field Artillery' was a book that could be easily shoved into a side pocket and it comprised within itself all the wisdom that a good old artillerist could imbibe during his two years of service. Now it is a thick-bodied volume of 1150 large-sized, closely printed pages. This is not to be taken as a reproof but only as a quiet monition that the cord of the bow should not be drawn too tight. We are all of course aware how the stuff has become expanded and how the demands on officers and men have been stimulated in all directions and would ourselves be undecided on the question as to just what could be omitted. The book is intended to serve everyone, the recruit as well as the advanced artilleryman. Thus the one must take into his reckoning much that is incomprehensible to him while the other passes by much that is to him self-evident; each will soon come to an understanding of his several part; what is offered is in itself a model of what has been accomplished; it handles exhaustively the whole scope of their arm, furnishes instruction and information on every question that forces itself into recognition in and out of the service. The author knows how to present his subject simply and clearly whether it involves army affairs, interior service of infantry or artillery training, horses, guns, fire, and fighting. We can only wish for the book an extended distribution, not only within the circles of the young Reichswehr soldiers but also among our older artillerists and their sons and grandsons, so that the inspiration of the highly esteemed inspector of our arm for so many years, General of Artillery Bleidorn, may be fulfilled when he says: 'Our weapons they can smash up but not our spirit.'"—G. R.

GERMANY'S MILITARY POLITICAL SITUATION. A German military journal, alluding to the constantly reiterated fairy tales of the menace of German military aspirations present and prospective against the peace of Europe and more particularly against the countries immediately adjacent to it on the East and West, presents the following outline of the present comparative military strength of Germany to the nations most directly affected by that "menace."

According to the views of General Groener, the German minister of Defense, "the deciding factor in estimating the comparative military strength of one nation to another is the ratio of the standing army to the reserves. France can, in ten days after mobilization, assemble 45 fully armed and well-trained divisions across its Eastern boundary; a fighting force of about 1,200,000 men. It has full equipment on hand in storage for such a force and also for a second contingent of about the same strength to follow it immediately. This is no secret but is well known and generally admitted.

"Following is an exhibit of the military strength and resources of Germany and the nations immediately adjacent to it on the East and West:

	<i>Peace Strength</i>	<i>War Strength</i>
France	678,000	4,500,000
Belgium	66,800	600,000
Czechoslovakia	140,000	1,300,000
Poland	200,000	2,000,000
Rumania	144,000	1,000,000

"On Germany's Western boundary there are on hand and available for each 10 kilometers of boundary line military equipments as follows:

	<i>France</i>	<i>Belgium</i>	<i>Germany</i>
Flying craft	36	15	0
Tanks	41	14	0
Artillery guns	51	58	0.7
Heavy machine guns	318	187	0.2
Light machine guns	258	75	2
Soldiers, incl. reserves	1153	8506	243.0

No heavy guns for Germany.

"On the Eastern boundary of Germany for each 10 kilometers:

	<i>Poland</i>	<i>Czechoslovakia</i>	<i>Germany</i>
Flying craft	5	3	0
Tanks	1	0.6	0
Guns	10	7.0	0.7
Heavy machine guns	22.0	88.0	0.2
Light machine guns	32.0	42.0	2.0
Soldiers, incl. reserves	1153	8506	243.0

"But still, according to frequent press reports of the nations adjacent to Germany that are intent not only on retaining their present military forces and equipments but increasing them, 'Germany is a dangerous menace to the peace of Europe and to them,' although its comparative numerical military strength is in the proportion of about 1 to 30 and in its military equipment Germany is deprived of tanks, fighting airplanes, and heavy guns. In case of an actual conflict the chances for Germany would seem to be somewhat discouraging to say the least."—G. R.

STATISTICS OF OFFENSES AGAINST DISCIPLINE IN THE GERMAN REICHSWEHR FOR 1926. A writer in the *Militär-Wochenblatt* for November 28, 1928, states that delay of publication of reports of military delinquencies in the German federal army for a period of nearly two years is somewhat unusual but explains that the delay is due, in part at least, to assembly in proper form of the many details involved in the final summary.

From observation of the number of all convicted of military offenses from 1922 to 1926 it appears that the total has, after counting out a temporary increase for 1923, been materially reduced since 1924, namely: from 2.94% to 1.35% of effective strength of the troops. This is a reduction of numbers of offences from those of 1913. There is good reason to believe that the two following years of 1927 and 1928 will show a still greater reduction.

Of these convictions those pertaining to the more important military delinquencies are naturally of greater interest, namely: desertion, insubordination, abuse of service authority including personal abuse and ill treatment, and crimes against military property. The crime of desertion has been decreasing continuously from 0.48% to 0.12% so that in 1926 there was approximately only one desertion to 1000 men, but even so the percentage for this is relatively still too high. A reason for this may, to some extent at least, be due to the long period of enlistment (12 years imposed by the treaty of Versailles). Delinquencies involving infractions of military duties have also (exclusive of the temporary rise in 1923 when the troops were engaged in suppressing revolts and disorders of the population in the interior)

been very greatly reduced, namely, from 0.47% to 0.12%. In connection with this it may be noted that about $\frac{1}{4}$ of the offences of this nature were due to drunkenness.

Offences of serious insubordination, involving acts of violence against superiors (mutiny and instigation to mutiny), have also been reduced in like measure and of those about two-thirds were committed by men when intoxicated. Convictions for offences against military property have also decreased from 0.75% to 0.32%. The circumstance that soldiers in the comparatively well-paid army dispose of better financial means than ever before carries with it, in their close association, temptations to violations of property rights. A reduction of the number of offences of this class is very gratifying. Delinquencies involving abuse of military authority and mistreatment of subordinates have remained about the same from 1922 on. It is incumbent on the higher authorities to keep a watchful eye in this direction.

In distributing the numbers of men convicted to the separate years since 1919 and 1920, it appears that those two years were *exceptionally criminally distinguished*, but this distinction disappeared after 1920 when the disorderly after-war elements contributing to it had been eliminated.—G. R.

Rivista di Artiglieria e Genio, November-December, 1928

THE PROBLEM OF THE INFANTRY GRENADE. By Start.

THE TACTICAL-TECHNICAL RECONNAISSANCE OF ROADS DURING OPERATIONS INVOLVING OPEN WARFARE, WITH SPECIAL REFERENCE TO BRIDGES, VIADUCTS, TUNNELS, ETC. By Col. Ettore Ciarretti, Eng. Corps.

OFFENSIVE ARMED FORCES AND DEFENSIVE ARMED FORCES. By General Ambrogio Bollati.

STUDY ON THE THEORY OF THE MUZZLE BRAKE. By Lieutenant Ermanno Ravelli, Artillery.

THE FUTURE WAR. By General G. Douhet.

NOTES ON THE ROMANI TELEPHONE SWITCHBOARD, ANTI-AIRCRAFT TYPE. By Lt. Col. Alessandro Romani, Engineer Corps.

WITH THE TELEGRAPH OPERATORS OF THE CARSO. By General Giovanni Grisolia.

Rivista Marittima, November, 1928

FOR AERIAL WARFARE. By General G. Douhet.

INTRODUCTION AND DEVELOPMENT OF SHORT-WAVE RADIO IN ITALY. By G. Pession and G. Montefinale.

THE ELECTRIC PROPULSION OF WARSHIPS. By Captain Luigi Barberis, Construction Corps.

LOSS OF THE SUBMARINE F 14.

THE ACTION OF AUGUST 28, 1914 IN THE GULF OF HELIGOLAND. By Commander R. de Courten.

Rivista Militare Italiana, November, 1928

VITTORIO VENETO. By Ugo Cavallero.

THE RESERVE IN THE WAR OF MASSES. By Major Faldella.

QUESTIONS RELATING TO THE EMPLOYMENT OF THE ARTILLERY IN THE PREPARATION OF THE ATTACK IN OPEN WARFARE. By Col. Targa.

MAY THERE STILL EXIST A LAW OF WAR? By General Bollati.

DISCUSSING MILITARY EXPENSES AT GENEVA. By Prof. Zugaro.

L'Universo, November, 1928

TRIPOLITAN SAHARA.

LERO. By F. Bertoni.

THE TOPOGRAPHIC REPRESENTATION OF ROCKS. By U. Castellani.

Rivista Marittima, December, 1928

ON AERIAL WARFARE. By Rear Admiral G. Valli.

A GERMAN OPINION ON THE SUPREMACY OF THE AIR.

COMPARISON OF LAND AND SEA AS BEARING ON WAR. By Commander Berardi.

CONSIDERATIONS UPON SOME CHARACTERISTICS OF THE PRINCIPLE TYPES OF SURFACE VESSELS. By Commander G. Tioravanzo.

THE NUMBER OF PROPELLERS FOR MAXIMUM EFFICIENCY. By Comd'r. Leonardo Fea, Construction Corps.

Rivista Militare Italiana, December, 1928

MILITARY GEOGRAPHY NOTES ON THE MEDITERRANEAN. By General Deambrosio.

THE RESERVE IN THE WAR OF MASSES. By Major Faldella.

PERMANENT MOUNTAIN FORTIFICATIONS. By Colonel Ferreri.

QUESTIONS OF MARITIME LOGISTICS. By Commander G. Fioravanzo.

Rivista Aeronautica, December, 1928

DIVAGATIONS ON THE INTEGRAL PROBLEM OF WAR. By Guilio Douhet.

CONSIDERATIONS UPON AERIAL WARFARE IN RELATION TO SURFACE WARFARE. By Colonel Riccardo Moizo, Arty.

NOTE UPON RECONNAISSANCE AIRPLANES. By Colonel Cesare Antilli.

EUROPEAN AIR POLITICS. By Lt. Col. G. M. Beltrami.

AERIAL OBSERVATION IN COAST ARTILLERY FIRING. By Lt. Col. Pasquale Salvatore.

The author briefly discusses the subject of observation by means of captive balloons and shows that it has marked limitations though possessing obvious advantages over terrestrial observation. He states that the greater number of such limitations may be obviated by using seaplanes and while refraining from indicating any system he refers to simple and rapid methods for locating the position of an enemy vessel and for the successive control of the fire of one's batteries.

After touching on the excellent results obtained during the last war with aerial observation in land firing he urges that special effort be made to overcome rapidly the difficulties now encountered in observation of seacoast firing.—F. E. H.

THE AERIAL ATTACK OF SHIPS. By Lt. Comd'r. Franco Maugeri.

THE METEOROLOGICAL AND AEROLOGICAL SERVICE DURING THE MEDITERRANEAN FLIGHT. By Filippo Eredia.

STATIC TESTS OF METAL WING SPARS. By Captain Corrado Gustosa.

AIR TOURING AND AERONAUTICAL SPORT. By Renato Ranalli.

L'Universo, December, 1928

THE EARTHQUAKE OF MARCH 27, 1928, IN THE PREALPI DELL'ARZINO. By Michele Gortani.

THE IIIRD GENERAL ASSEMBLY OF THE INTERNATIONAL ASTRONOMICAL UNION.

THE XXVIIITH REUNION OF THE ASTRONOMISCHE GESELLSCHAFT. By Luigi Carnera.

THE XXIIIRD INTERNATIONAL CONGRESS OF THE AMERICAS AT NEW YORK. By Lidio Cipriani.

COAST ARTILLERY BOARD NOTES

Communications relating to the development or improvement in methods or material for the Coast Artillery will be welcome from any member of the Corps or of the service at large. These communications, with models or drawings of devices proposed, may be sent direct to the Coast Artillery Board, Fort Monroe, Virginia, and will receive careful consideration. W. E. COLE, Colonel, Coast Artillery Corps, President, Coast Artillery Board.

Project No. 687, Adoption as Standard of Camera Method of Measuring Deviation of Bursts for Antiaircraft Artillery.—The Coast Artillery Board was requested to submit comments and recommendations reference to the adoption of the camera method of measuring deviation of burst as the standard method of measuring deviation of burst for all anti-aircraft gun target practices. The Board has recommended that this method be adopted as standard, and that the Camera Unit of two cameras (known as the Jackson Camera, or Antiaircraft Spotting Unit T-1) be adopted as standard for manufacture and issue.

Project No. 688, Issue of Radio Set SCR-54-A.—The Board was requested by the Chief of Coast Artillery to submit comment and recommendation concerning the desirability of issuing the SCR-54-A radio set pending the availability of the SCR-136 set. The Board is of the opinion that the SCR-54-A radio set is entirely unsuitable for fire-control purposes and recommends that if a more suitable set than the SCR-54-A is not available for immediate issue, the provision for radio equipment for long-range batteries be held in abeyance pending the development and issue of suitable equipment.

Project No. 689, Training of Aerial Observers.—A program of special firings for the training of aerial observers has been prepared.

Project No. 690, Light-Weight Demountable Observation Tower for Railway Artillery.—A battery commander of the 41st Coast Artillery (Ry.) has suggested the desirability of securing light-weight portable observation towers for railway artillery for use in field positions. The Coast Artillery Board is of the opinion that a tower meeting the requirements laid down by him is suitable for use as an observing station and believes that such a tower should be regarded as an essential item of the fire-control equipment of a railway artillery battery. It has been recommended that such a tower be purchased and shipped to Fort Kamehameha for test by the 41st Coast Artillery.

Project No. 691, Blast Shield on 75-mm. Subcaliber Equipment for 14-inch Gun, Railway Mount, M1920.—While the Coast Artillery Board has no information as to the effect of the blast of 75-mm. subcaliber equipment for 14-inch Gun, Railway Mount, M1920, from a study of drawings submitted, the Board is of the opinion that if a shield is necessary, the design shown on the drawings is satisfactory. The Board concurred in a suggestion made by the Chief of Ordnance that such a shield be manufactured and submitted to service test at Fort MacArthur.

Project No. 692, Service Test of Improved Monocord Switchboards, Six and Twelve-Line.—Improved monocord switchboards, embodying the following new features, have been received and will be subjected to service test:

The Switchboard is housed in a carrying case so that it can be operated in the open in ordinary inclement weather. The upper half of the front of the carrying case, when open, affords protection from the weather to the face of the switchboard units, and the lower half of the front provides a shelf for holding a message blank or other material to aid the operator in making notes.

The operator's set, including talking, ringing, and night alarm circuits, is included in the switchboard case.

A folding breast transmitter and double head receiver are furnished as part of the switchboard and are connected to the operator's panel by means of plugs and jacks.

The operator's panel carries switches for the transmitter battery and night alarm circuit, a small lamp for illuminating the face of the switchboard units, and emergency binding posts for the transmitter or receiver.

A compartment is provided in the carrying case for holding the transmitter, receiver, and night alarm battery, and space is provided for two spare batteries.

A terminal strip is permanently connected to the switchboard through a ten foot length of cable.

Project No. 693, Test of Glider Targets and Targets Towed In Formation.—During the concentration of the 61st and 62d Coast Artillery (AA) at Fort Story this spring there will be certain firings conducted at glider targets and at targets towed in formation. At the conclusion of these tests the Board will submit its recommendations as to—

a. The suitability and advisability of adopting the glider target as a form of training for anti-aircraft artillery.

b. The employment of targets towed in formation for training of anti-aircraft artillery.

Of the two groups which go to make up the pacifist movement, the first group are not pacifists at heart, but are cleverly, stealthily, and craftily using the cloak of pacifism to attain their ends. These are the advocates of bolshevism, sovietism, communism, and similar revolutionary theories. They seek to overthrow the firm foundations of our country by force. They realize that the first step in a successful revolution by force is to weaken the country's means of defense.—Assistant Secretary of War, Dwight F. Davis.

BOOK REVIEWS

Some Elements of Tactics. By F. S. Besson, Major, Corps of Engineers. Washington: The Society of American Military Engineers. 1928. 6"x 9". 60 p. \$1.00.

This is a collection of twenty-six problems illustrative of as many different principles of tactics. The author presents his subject matter in a novel way. He feels that the most important task of a military commander is to make decisions and that decisions come from the addition or application of tactical principles to situations. He therefore illustrates each principle by starting with a situation, shown on a sketch map accompanying the problem. To this he adds the elements affecting the situation—objective, time, etc.—and from these he leads the student to a decision.

The volume is not a text book, complete in itself, but it will supplement any text book on tactics. Its principal value lies in the aid which it will afford to military students in the solution of tactical problems, but it also will be of assistance to instructors whose duties require them to prepare problems. It is particularly recommended to those who are engaged with correspondence courses.

Emperor Francis Joseph of Austria. By Joseph Redlich. New York: The Macmillan Company. 1929. 5¼"x 8½". 547 p. 1l. \$5.00.

Although termed a biography by its author the book is in reality a study of the effects caused by Francis Joseph upon the course of events of his time—his influence upon the other institutions of the state—simply because he was the Emperor, not because he was Francis Joseph. He was, in fact, only a mediocre man endowed by nature and early training with a strong personality which was guided by just two principles: his belief in legitimacy of his reliance in the army. He was the last absolutist; in the twentieth century and with the forms of constitutional government, he steadily refused to believe in nationalism or liberalism. He was so unshakably steadfast in his legitimist faith and so impregnable in his control of the army that he could afford to be curiously opportunistic in actual affairs.

To him the ideal state was a monarchy by divine right, served by bureaucracy, guarded by police, and supported by bayonets. He was cool, aloof, and reticent. In his dealings with men he could be singularly heartless. In public affairs, whether internal or foreign, he was absolutely without a conscience. Quoting from the chapter "His Own Foreign Minister" we find "the reason for this want of understanding is not far to seek. Francis Joseph lacked the capacity for any deeper insight into the facts and forces of human life. . . . At this period (age 22 years) he certainly was far from seeing personality as the strongest force in life; later, too, such a view hardly visited him. . . . For him as for most *rulers*, personality as such had no attractions. Unfortunately for him his own personality was so strong, that even in his early youth, he was immune to charm—often dangerous charm—of strong individuality in others."

Although infallibly manifesting these characteristics to the end and with a seeming insensibility to the disasters resulting therefrom, his personality finally became enabled to

such an extent that he retired from intercourse in human affairs leaving a memory of respect and even love in the minds of his former subjects.

The book is a great theme done by a competent writer with definiteness of purpose and mastery of touch. The chapters on constitutional history are the best, but those on general history and personalities are also excellent. The style is solid, serviceable, and ponderous without being dull. The pages contain an excessive number of typographical errors which somewhat jar the serenity of the reader.—J. L. W.

Range Finders. By the Duke de Gramont, D. Sc. New York: Brentano's & Co. 1928. 5" x 7½". 109 p. Il.

In view of the increasing use of range finders in the service, artillery and other officers will find much information of theoretical and practical value in *Range Finders*, by the Duke de Gramont, D. Sc.

After a general description of methods and the various instruments employed as self-contained range finders, the author discusses at length the theory, optical systems, and mechanics of the stereoscopic and coincidence types of range and height finders. Paragraphs are devoted to precision and accuracy of telemetric measurements and cause of error.

A comparison is made between these two types in the final chapter, in which data and curves obtained at dusk indicate the superiority of the stereoscopic type for work under adverse conditions of light. It is stated that, with the exception of men with really defective sight, the absence of the stereoscopic sense has not been observed and that systematic tests of men with normal vision should soon determine those possessing the necessary qualifications for becoming good observers.

Numerous diagrams, curves and photographs illustrate the test.—E. G. C.

All The World's Aircraft. Edited by C. G. Grey. Compiled by Leonard Bridgman. London: Sampson Low, Marston & Co. 1928. 8" x 13". Il. 2 Guineas.

This eighteenth issue of *All The World's Aircraft*, which is just as elaborate and interesting as its predecessors, brings the history of aviation progress in every country up to date.

Part A, "The World's Aeronautical Progress," consists of a series of historical notes on the year's work of each nation in military, naval, and civil aviation, together with the names and addresses, where obtainable, of the aeronautical officials, departments, associations, and publications of the various nations.

Part B, is devoted to purely "Service Aviation History" and contains a complete directory of the aircraft commands and stations for each nation.

Part C, "All The World's Aeroplanes," contains detailed information on airplanes and airplane producers. In this part, all countries which are known to have produced airplanes within the past year are placed in alphabetical order and the machine built therein are described and illustrated.

Part D, "The World's Aero-Engines," is treated in the same style as Part 'C'. Detailed description of the various aero-engines of each nationality is alphabetically arranged.

Part E, "The World's Airships," contains the post-war developments in airship construction in Great Britain, France, Germany, Italy, and the United States. It includes detailed descriptions of the great airships of the present day.

The entire book is profusely illustrated in a style similar to that of *Jane's Fighting Ships*. It is a reference book of great value to anyone interested in the past history and present development of aviation.—J. L. W.

The ABC of Aviation. By Victor W. Pagé, Major, U. S. Air Corps Reserve. New York: Norman W. Henley Pub. Co. 1928. 5"x 7¼". 160 p. Il. \$1.00.

As stated by the author, the purpose of this book is to assist the layman in becoming airminded. The particular method employed is to acquaint the reader with the elementary mechanics of aviation in order that familiarity with the technical features of aircraft may overcome some of the feeling of mystery with which the general public surrounds aviation.

The subject matter is divided into five chapters treating respectively of Lighter-Than-Air-Craft, Heavier-Than-Air-Craft, Airplane Construction, Engine Types and Propellers, and Airplane Control and Flying Instruments. It is presented in a simple manner that should be easily understood by the average layman.—J. L. W.

The Law in Relation to Aircraft. By Lawrence Arthur Wingfield, M. C., D. F. C., and Reginald Brabant Sparks, M. C. New York: Longmans, Green and Co. 1928. 5½"x 8½". 304 p. \$5.00.

It was early found, in the flying game, that unrestricted flying could be no more permitted than unrestricted automobile driving. Agencies for the control of aviation came into being, and gradually, as the necessity developed, legal and other restrictions were imposed with a view to making aviation as safe as practicable for both the man in the air and the man on the ground. Today the question of aviation and its control has reached international proportions.

The authors have collected in one place the regulations and laws with which an aviator should be familiar. The body of their book is concerned principally with British restrictions and much of the appendix is taken up with British regulations and laws. There is, however, enough of international requirements in the volume to make it worth having, and any aviator who contemplates flying in British territory should certainly study the book.

Sixty-four pages are devoted to discussions of international regulations of air navigation, general principles of English law, airdromes, regulation of aircraft, personnel of aircraft, flight, and the investigation of accidents. The remainder of the work, in the form of an appendix, presents various documents, as the International Convention, 1919; Air Navigation Act, 1920; Air Navigation Directions, 1926; and Airworthiness Handbook for Civil Aircraft. An index enhances the value of the book.

Citizenship Through Problems. By James B. Edmonson and Arthur Dondineau. New York: The Macmillan Company. 1928. 5¼"x 7¾". 550 p. Il. \$0.88.

Among the most important of the courses being taught in high schools today is that of civics. In this age of bolshevism, communism, and socialism it is particularly important that the youth of the country be thoroughly imbued with the idea of good citizenship, and for this a knowledge of citizenship and of community life is a prime necessity.

The authors, recognizing a need for interesting the young student, have attempted "to prepare a textbook that differs from all other books in community civics in certain important respects." They make use of the applicatory system—so dear to the heart of the military pedagogue—but they leave sufficient flexibility to meet the needs of individual instructors. To supplement the text, another volume, *A Pupil's Workbook* (8½"x 11". 193 p.), is provided for notebook work and tests. These books proved their value through trial while in manuscript form, and they might well be included in any reading course in civics.

Andrew Jackson: The Gentle Savage. By David Karsner. New York: Brentano's. 1929. 5½"x 8¼". 399 p. Il. \$3.50.

This is an excellent story of the life of the great Militant Democrat. His personality, a most colorful one, is accurately sketched; but this very accuracy does much to destroy the implication of the subtitle. Andrew Jackson was a savage even for a savage time on a savage frontier. As a youthful public prosecutor he personally arrested delinquent debtors at the point of his pistol. As a judge he challenges to duels those who appear in his court. As a husband protecting his wife's good name he engages a superior marksman, allows him to fire first, and while wounded coolly sends a ball through his opponent's body. As a general he signs the death warrant of six country boys who were honestly mistaken as to the term of their service. In the Indian wars he lays waste village after village in gory slaughter. And he leaves the high office of President regretting that he never had an opportunity to hang John C. Calhoun or to shoot Henry Clay. High handed, imperious, brooking no will but his own, he lapses into gentleness only within the gates of the Hermitage.

Jackson's military career is but sketchily described, being used more as a background on which to project his personality. The causes of the War of 1812 are described only as they appeared to the people on the then Western frontier. All were eager to fight their old enemies, the British, and all wanted more territory. Jackson entered this war as a Major General of the Militia and in 1814 was made a Major General in the Regular Army, although up to that time his victories had been against the Indian allies of the British. But he soon repaid his country by his brilliant victories at Mobile, Pensacola, and New Orleans. This last victory gave him the great following among the people who three times gave him the largest popular vote for the Presidency. But the first election was thrown into Congress where reactionaries caused his defeat.

Mr. Karsner has written a colorful book of Andrew Jackson and his time. It is as readable as a novel and hides neither his faults nor his virtues.—H. C.

The Flight of the Southern Cross. By C. E. Kingsford-Smith and C. T. P. Ulm. Robert M. McBride & Co. 1929. 295 p. Il.

There are four books that should rest side by side on the library shelves of those who pretend to keep abreast of the wonderful age in which we are living: *We*, which takes us to Paris with Lindbergh; *Record Flights* in which we are carried to Germany with Chamberlain; wherein we accompany Byrd to his historic wet landing, at Ver-sur-Mere and now *The Flight of the Southern Cross* which transports us across the Pacific to Australia. To each one of these narratives there is a similar objection. Being written by one of the principals of the voyage in each case, we suffer a loss in reading from the modesty which each one displays in writing. There is a certain indescribable something missing in the pages—which well becomes the writers to have omitted.

The authors of *The Flight of the Southern Cross*, possibly, give us more technical details of their preparations than is true in companion books. We learn of wing loading, power loading, and composite loading. We read in detail of the technique of blind flying and of the various instruments to assist therein. Problems of navigation and navigation instruments are covered. The personal training and preparation of the crew—in short, the account is complete from the end of the World War, when Kingsford-Smith first began to project his flight, until the Southern Cross landed at Sydney.

Certain features stand out preeminently:

- (1) The length of time spent in working up the flight.
- (2) The personal and mechanical preparation.
- (3) The financial difficulties encountered.
- (4) The deadly monotony of the night hours.
- (5) The terrific experience of riding the storm between Suva and Brisbane.
- (6) The continual worry about gasoline consumption.

We read every word in the newspapers, avidly, of this great flight. Now it is really worth while to study over the actual details of the flight and see how it was accomplished. *The Flight of the Southern Cross* is the very readable account of a great achievement, well prepared and ably carried out.—B. F. H.

Those who wish to destroy all defenses against their own unbridled action and substitute the red for the red-white-and-blue, do not want our people to respect the flag any more than they want them to have faith in our established governmental institutions. They desire our flag to become only a piece of bunting, a rag, so that it will no longer serve as the rallying point of those who believe in home, country, and God. They are now working for the abolition of the Flag Day Exercises and are discounting all reverence to the flag. They are planning the abolition of our Army and Navy and the repeal of our National Defense Act. Disrespect for the flag, reduction of our military defenses, discontent with our form of government and its institutions, are the first steps in what is communistically termed the peaceful phase of the revolution. They know, and we must never forget, that disrespect for the emblem of our government fosters disrespect for that government.—Assistant Secretary of War Dwight F. Davis.