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THE COAST ARTILLERY JOURNAL

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MAJOR J. A. GREEN, C. A. C., Manager and Editor.
CAPTAIN D. L. DUTTON, C. A. C., Assistant Editor.

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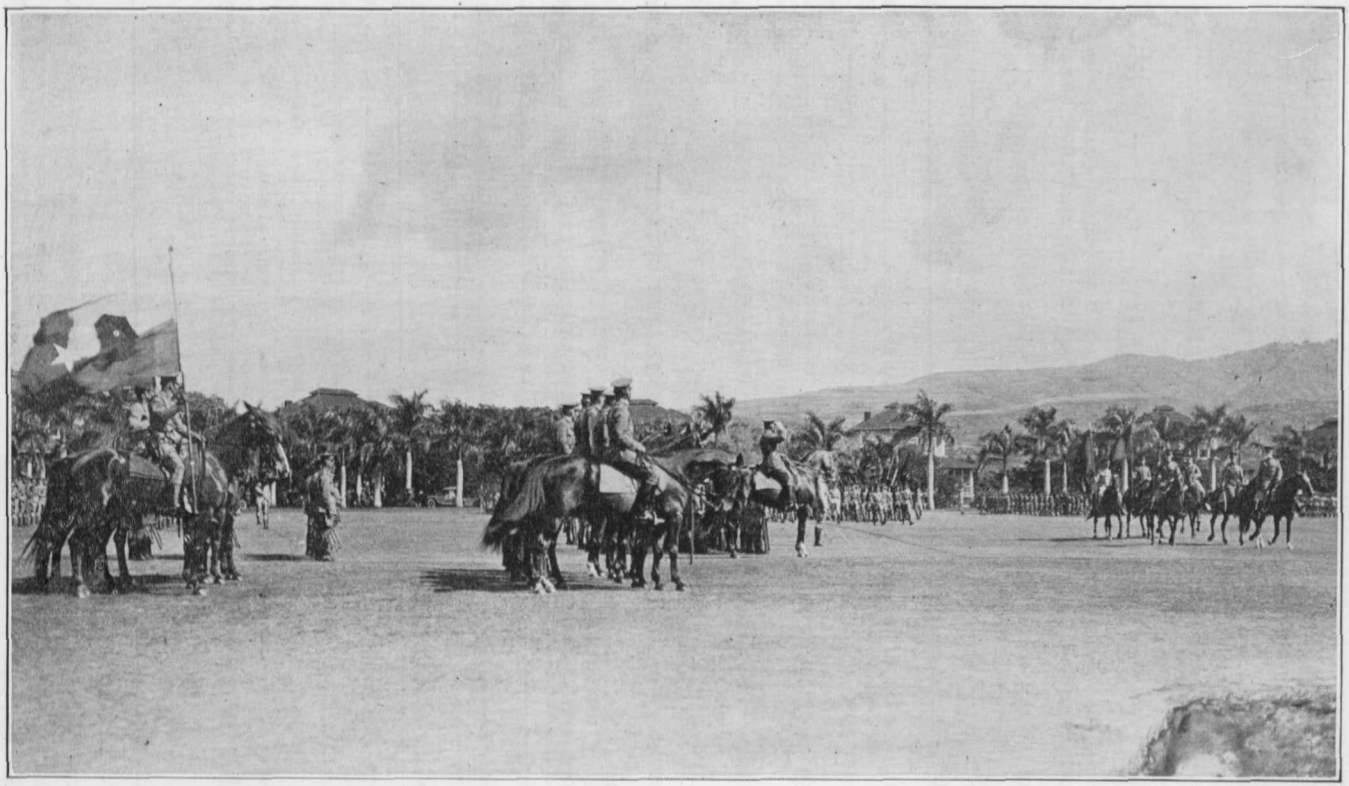


Platoon of Battery "B", 41st Coast Artillery, Commanded by 2nd Lieut. Dean Luce, winner of Precision Drill Competition against troops of all branches in the Hawaiian Department, receives trophy and reviews massed troops of the Hawaiian Coast Artillery District. Brigadier General Barrette and Staff passing reviewing officer, Major General Charles P. Summerall, commanding Hawaiian Department.

The Coast Artillery Journal

Vol. 61 No. 1 JULY, 1924 Whole No. 215

Strategic Importance of the Hawaiian Islands

By MAJOR GENERAL C. P. SUMMERALL, U. S. ARMY

THE present conception of our strategy in the Pacific has been evolved through the gradual territorial expansion and commercial development of the United States for over a century. This strategy is centered in the Hawaiian Islands. While the importance of these islands attracted attention from the earliest days of exploration and trade in the Pacific, their particular relationship to our country for commerce and defense began to be emphasized in the first part of the nineteenth century. In 1832, Commander Downs, U. S. Navy, reported: "These islands, standing at the cross-roads of the pathways of commerce, have a great interest to the United States. During a war, what interest would not these islands hold as sources of refreshment for our men-of-war while protecting our commerce and other interests in these seas?"

In 1842, President Tyler sent a special message to the Senate, in which he said of Hawaii: "Its near approach to this continent and the intercourse which American vessels have with it, could not but create dissatisfaction on the part of the United States at any attempt by another power to take possession of the islands." The attitude of the United States was made plain in 1843 when the commander of a British naval vessel obtained, by forceful measures, cession of the Hawaiian Islands to the government of Great Britain. The United States Government intervened and caused the British

Government to disavow the seizure. At the same time, our Government declined to become a party to a joint convention between England and France, never to take possession of any part of the archipelago. A similar proposal to join England and Germany in guaranteeing the neutrality of the islands was declined in 1888 on the ground that the relation of the United States to the islands was sufficient for the end in view.

The islands were seized once by Russia and twice by France, but were soon relinquished in each case. Daniel Webster, as Secretary of State, wrote: "I trust the French will not take possession; but if they do, they will be dislodged, if my advice is taken, if the whole power of the Government is required to do it."

Both houses of Congress went on record to state that intervention in Hawaii by any foreign power would not be regarded with indifference or would be regarded as an act unfriendly to the United States.

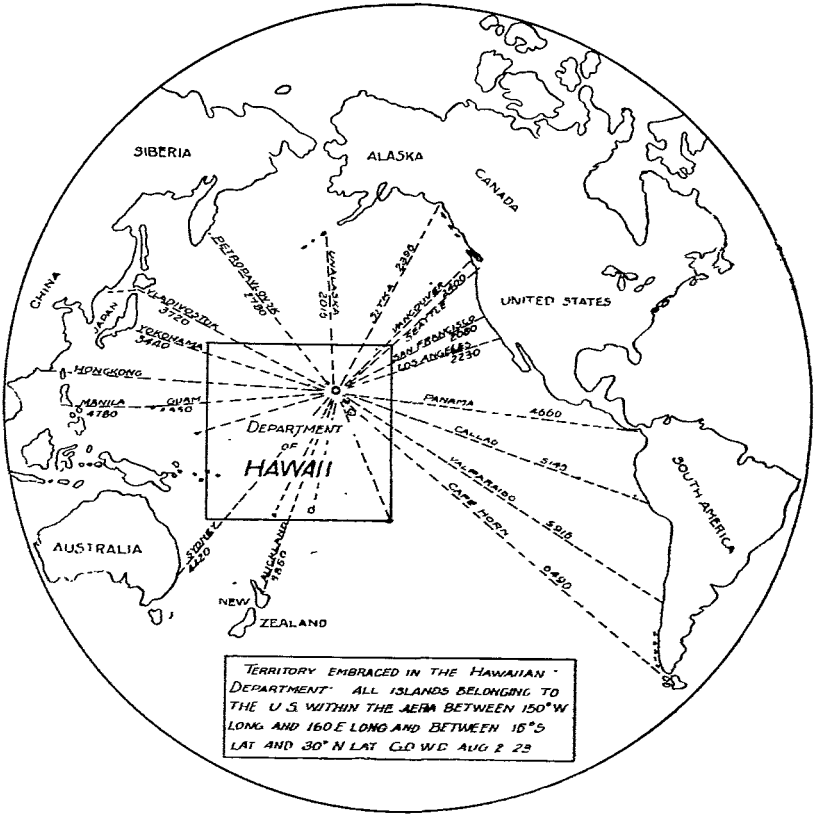
Mr. Hamilton Fish, Secretary of State in 1873, contended that: "The position of the Sandwich Islands as an outpost fronting and commanding the whole of our possessions in the Pacific Ocean, gives to the future of these islands a peculiar interest to the Government and people of the United States. Their transfer to a maritime power would threaten a military surveillance in the Pacific similar to that which Bermuda has afforded in the Atlantic—the latter has been submitted to from necessity inasmuch as it was congenital with our Government—but we desire no additional similar outposts in the hands of those who may at some future time use them to our disadvantage."

Secretary of State Blaine in 1881 wrote: "This Government firmly believes that the position of the Hawaiian Islands, as the key to the dominion of the American Pacific, demands their benevolent neutrality. It is too obvious for argument that the possession of these islands by a great maritime power would not only be a dangerous diminution of the just and necessary influence of the United States in the waters of the Pacific, but in case of international difficulty, it would be a positive threat to interests too large to be lightly risked." Secretaries Bayard and Sherman were equally definite in their views.

As early as 1846, a plan was prepared by Lieutenant Curtis of the old frigate *Constitution* (Old Ironsides) for the protection of the islands by fortifying Pearl Harbor. Generals Schofield and Alexander made an official report on the defensive capabilities of Hawaii in 1872. In 1895 General Schofield wrote: "The Hawaiian Islands constitute the only natural outpost to the defenses of the Pacific

coast. In possession of a foreign naval power in time of war as a depot from which to fit out hostile expeditions against this coast and our commerce on the Pacific Ocean, they would afford the means of incalculable injury to the United States."

In his "Influence of Sea-Power," Admiral Mahan compares our ships of war to land birds unable to fly far from their own shores.



The Hub of the Pacific

He adds: "To provide resting places for them, where they can coal and repair, would be one of the first duties of the government proposing to itself the development of the power of the nation at sea." In 1893 he ably discussed the positive advantages of the Hawaiian Islands, which directly advance commercial security and naval control. "To any one," he said, "viewing a map that shows the full extent of the Pacific, two circumstances will be strikingly and immediately apparent. He will see at a glance that the Sandwich

Islands stand by themselves in a state of comparative isolation, amid a vast expanse of sea; and again, that they form the center of a large circle whose radius is approximately the distance from Honolulu to San Francisco. . . . this is substantially the same distance as from Honolulu to the Gilbert, Marshall, Samoan and Society Islands, all under European control except Samoa, in which we have a part influence. . . .

"To have a central position such as this, and to be alone, having no rival and admitting no rival . . . are conditions that at once fix the attention of the strategist. . . . But to the striking combination is to be added the remarkable relations . . . to the great commercial routes traversing this vast expanse.

* * * * * * * * * *

"Too much stress cannot be laid upon the immense disadvantage to us of any maritime enemy having a coaling station well within 2500 miles, as this is, of every point of our coast line from Puget Sound to Mexico. Were there many others available, we might find it difficult to exclude from all. There is, however, but the one. Shut out from the Sandwich Islands as a coaling base, an enemy is thrown back for supplies of fuel to distances of 3500 or 4000 miles—or between 7000 and 8000 going and coming, an impediment to sustained maritime operations well nigh prohibitive. . . . It is rarely that so important a factor in the attack or defense of the coast line—of a sea frontier—is concentrated in a single position, and the circumstance renders doubly imperative upon us to secure it if we righteously can."

In the same year, Admiral Belknap gave his views, as follows: "Indeed, it would seem that nature had established that group to be ultimately occupied as an outpost, as it were, of the Great Republic on its western border. . . . A glance at a chart of the Pacific will indicate to the most casual observer the great importance and inestimable value of those islands as a strategic point and commercial center. Situated in mid-north Pacific, the group looks out on every hand towards grand opportunities of trade, political aggrandizement, and polyglot intercourse."

The United States Government obtained possession of Pearl Harbor by the reciprocity treaty in 1875, and in 1884 it was renewed, making the cession perpetual. It took the war with Spain, however, and the acquisition of the Philippine Islands, to demonstrate to the American people the military necessity of Hawaii as an integral part of the United States. The Government was thus forced to act upon the conviction deduced over a long period of

years. With the annexation in 1898, steps were begun to fortify the island of Oahu. Since that date, however, two events have occurred, multiplying the value of Hawaii many times. These were the construction of the Panama Canal and the Washington conference.

In his "Sea-Power in the Pacific," Mr. H. C. Bywater says: "Since the whole scheme of American naval strategy now pivots on the Panama Canal, the safety of that waterway in all circumstances may be described as the condition precedent to successful operations, whether offensive or defensive, against an Asiatic foe." Oahu bears the same relation to the defense of the canal that it does to the Pacific coast. Since the abandonment of all defensive measures for the Philippines and Guam by the Washington conference, Hawaii has become the sole point of support in the Pacific for operations involving the more distant islands as well as for the defense of the continental coast line.

As a summary of the foregoing conclusions, it may be stated that the possession of the Hawaiian Islands affords a base 2000 miles from our coast from which our warships can operate against an enemy and his lines of communication in any attempt to attack our Pacific territory from Alaska to Panama; it correspondingly denies to an enemy the use of Hawaii as a base in operating against the American coast and thus forces him to advance from a distance which, even under modern conditions, would be hazardous if not prohibitive; and it advances our base 2000 miles for operations in the western Pacific, should it become necessary to regain our island possessions there.

In order that the country may avail itself of these advantages, the naval base must be adequate to meet the needs of the fleet; the fortifications must be made impregnable, both as to the armament and as to the garrison; and there must be available a fleet commensurate with its mission. Unfortunately, these conditions have been only partially realized. For a comparatively small expenditure, a priceless national asset could be converted into the long dreamed of "Gibraltar of the Pacific."

The Coast Artillery in Hawaii

By Brigadier General J. D. Barrette, U. S. Army

THE missions of Coast Artillery in preventing bombardment of important objectives and in providing debouching area for our fleet and in meeting attacks from the air are quite generally known, but duties of Coast Artillery with the other arms of the service against attempted landings are not so well understood.

An island ordinarily divides itself geographically into sectors which with their adjacent water areas form natural battle commands. Observation posts and wire communications can insure prompt information of enemy approach and accurate tracking on all water areas. At night certain lights can search for targets in all water areas and other lights illuminate targets for the various arms.

Each arm has its problems in the organization of the sector (battle command); for the Coast Artillery the location of observation posts and wire and other communications not only for the fixed but also for mobile heavy artillery; the selection of positions for the latter with marches to and occupation of same with firings at targets moving on the water, with recording and filing of data, ready for use.

Guns such as the 155-mm. G. P. F., if aided by armament suitable for the attack of armored ships supporting transports, should be able to compel distant debarkation from the transports, thus subjecting landing forces for protracted periods to fire while particularly vulnerable and unable to develop efficient return fire. Fire from shore on the other hand will be accurate and progressively increasing in volume as landing parties approach and come within range successively of Coast Artillery, Field Artillery and Infantry weapons.

It is important that armored ships supporting transports be not permitted to approach shore without coming under fire of armament suitable for their attack, such as heavy guns and mortars. Large numbers of these are not necessary to provide this protection against ships' batteries for troops on shore; but some heavy gun fire is necessary so that armored ships may not approach shore without fear of coming under fire.

Transports attempting to land troops should therefore be brought under fire at as great a range as practicable so as to force

debarkation at a distance and armored ships firing at guns and troops on shore should be kept at a distance so as to decrease effects of their fire.

On an island of limited size it is practicable to bring accurate fire promptly upon transports and supporting armored ships at appropriate ranges, assuming appropriate training.

If positions for 155-mm. G. P. F. guns be selected in advance covering waters adjacent; if position data be collected and batteries occupy and fire from positions at targets moving on the water, a subsequent occupation of positions and firings using previously compiled data is a short operation. Similar reconnaissance, occupation and firing in the case of mobile mortars and similar firings with heavy guns at targets moving on surrounding water areas makes it possible to bring fire immediately upon transports and their troops attempting landings and also upon their supporting armored ships to prevent the latter from firing on land forces at short range.

It is believed to be of great importance that transports be compelled to debark landing parties at a distance and this can be accomplished if guns similar to 155s are ready to fire at transports at a distance and some heavy guns are ready to fire on supporting armored ships.

With distant debarkation and our fire progressively increased by Field Artillery and Infantry, decision should be reached before landing shall be accomplished. The enemy's chances are greatly increased if he can get cover on land and be able to make effective use of his weapons. Troops which can defeat an enemy after he has landed should, with the necessary training, defeat him easily before he lands. This mission of the Coast Artillery is not always thoroughly understood. The long ranges attainable by Coast Artillery give it special usefulness in the initial stages of attempted landings, to take transports and troops under fire and also armored ships supporting attempts to land thus protecting troops of all arms on shore.

This assumes that the Coast Artillery is trained to select initial and eventual positions; collect the necessary position data; move to and occupy the positions; fire from them; prepare and conserve the necessary data and orders.

The 41st Coast Artillery

By Major K. B. Lemmon, C. A. C.

THE 41st Artillery Battalion (Railway) was organized January 1, 1922, at Fort Kamehameha, Hawaii, as the Hawaiian Railway Artillery with Headquarters Detachment and two firing batteries. The armament consists of eight M1896 mortars mounted on M1918 railway cars with narrow gauge trucks.

The armament began to arrive in January, 1922. It was unloaded at Pearl Harbor and brought to the post by rail where it was overhauled and mounted by the battalion under direction of the Ordnance Department. As all this work had to be done by hand the mounting was not completed until September 15th. In the meantime, the old track on the post had been altered and repaired to make it suitable for operation and storage and a position had been prepared for two mortars. The battalion then proceeded to artillery drill.

As no standard fire control equipment had been devised for railway artillery, the only equipment provided was azimuth instruments, field wire, field telephones and switchboards. A plotting board, range and deflection boards were borrowed. The sights being graduated in mils, it was necessary to construct a device for converting corrected azimuths of setforward point in degrees to mils deflection. The time interval system consisted of a T. I. bell in a box containing several transmitters connected to the telephone lines to the observers, battery and battery commander; the same type as in use at Battery Closson. A pile approximately 2000 yards in front of the battery was used as an aiming point.

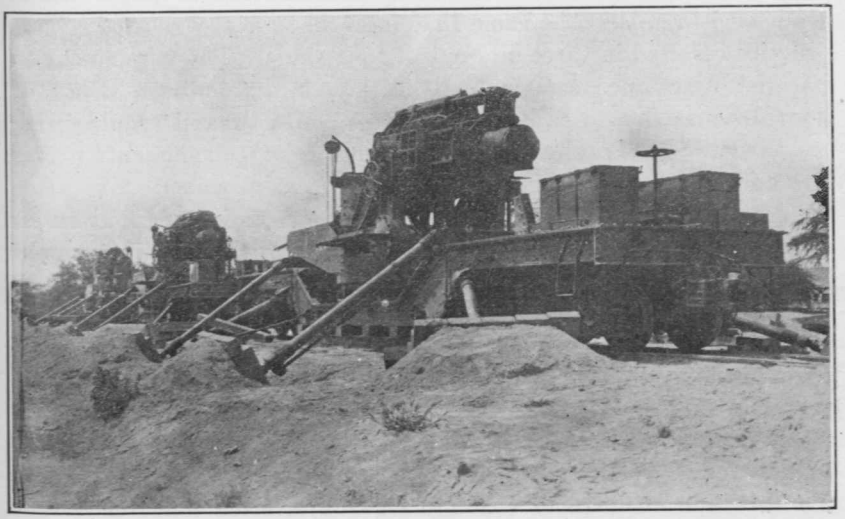
The first service target practice was held at Fort Kamehameha on the 20th of September, 1922. As was to be expected, this system functioned far from satisfactorily, but it furnished the foundation for efficient and rapid development of a fire control system. It was felt that by proceeding immediately to target practice the disadvantage in lack of training would be more than compensated for by the prompt elimination of unsound principles and the feeling of confidence and aggressiveness created in the personnel by a demonstration of their ability to meet an emergency.

Although operated by an officer, the deflection conversion device proved itself unsatisfactory due to the delay in firing data and

errors which occurred. The use of the gun azimuth circle for determining the azimuth of the target was also unsatisfactory.

Not only was there a shortage of fire control equipment but of rail and motor transportation as well. These deficiencies have been overcome, in-so-far as they handicap the battalion, by supplying a sufficient quantity of all kinds of motor transportation, a locomotive crane and an engineer locomotive pending the supply of a locomotive for the battalion.

Through the cooperation and patriotism of the Oahu Railway and Land Company in offering free transportation it was possible to hold the next target practice in the field "somewhere on Oahu."



Acting under instructions to make all maneuvers a step in the actual development of field positions, a position was selected, firing track constructed and all orientation work completed with a view to further development. When the general manager of the railroad was approached relative to making connections with the main line at the desired point he gave orders to have the switch installed at once. The battalion construction detachment completed the spur.

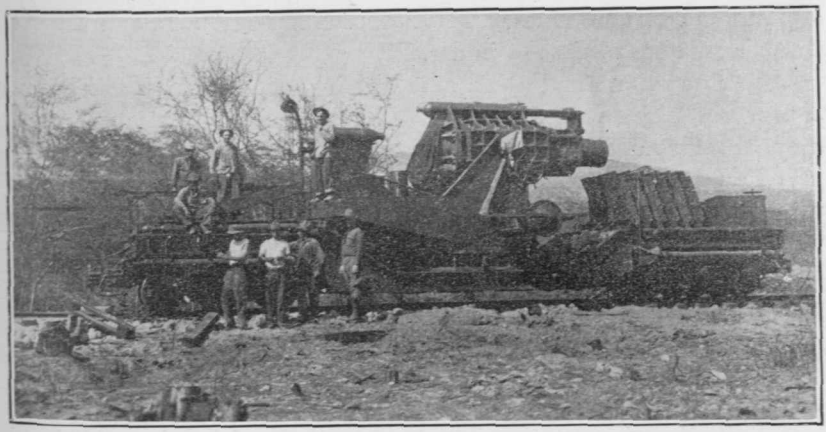
On the 26th of October the battalion was moved into camp by trucks and two mortars followed the next day. Outside of heating of journals the movement was made without difficulty. The question of camouflage was studied during this maneuver. The camp was pitched under cover of trees in the vicinity of the armament and an air photograph disclosed the fact that the entire camp could be made invisible with a small amount of labor and material. For the guns,

ladders were constructed by wiring cross pieces on long poles. After lashing on large branches and brush these ladders were leaned up against the gun and car. They could be raised in a few minutes and thrown down in a few seconds and when in place the camouflage was perfect.

Target practice was held November 4th, 1922, at a moving target, at 8000 yards. As no distant aiming point was available, aiming rules were improvised along the line of the standard aiming rule, which has never been supplied. In order to overcome the necessity of converting azimuth the gun azimuth was read from a diagonal scale, on the plotting board, graduated in mils deflection and the deflection board modified by the addition of paper scales graduated in mils. The same time interval system was used. This practice resulted in three hits out of four shots. The personnel and materiel functioned satisfactorily although there was a delay of several hours due to failure of shore-tug signals and trouble with the target. In the absence of other means of communication flag kits and signal lamps were used but were entirely ineffective after the detailed plans for towing and firing had been interrupted by an excessive lateral deviation. The deviation in question occurred through the application of a 99-mil correction on one of the sights to compensate for an error in the location of the aiming rules, the gun pointer failing to turn the azimuth micrometer through the 99 mils. As a result of this experience no sight corrections of over 50 mils are allowed. The method used in firing this battery demonstrated the high state of efficiency which can be attained by an observer. The battery was fired on the bell after receipt of information from the battalion commander through OP-1 armsetter that the target would come to the predicted azimuth on the bell. The predicted azimuth was sent to OP-1 observer who repeated it to the battalion commander and thereafter kept the cross wires on the target. The battalion commander by the use of a stop watch and watching the index disc of the observer's instrument was able to determine in advance of the bell whether or not the predicted azimuth was correct. The observer repeated the necessary information to the arm-setter. In addition to this he read the instrument, recorded the azimuth of each splash and checked the battalion commander's stop watch with the bell. Two hours after the completion of the practice the mortars were dispatched for the post.

In order to test airbrakes, exercise trucks and otherwise insure that all gun cars were ready to take the road, the superintendent of the Oahu Railway and Land Company loaned a locomotive for the necessary operations. The mortars were run up and down on the

stretch of railroad on the reservation. On the last trip with four mortars one side of the track gave way under the two center cars which were prevented from turning over only by the end cars. At this point the rails were only about 18 inches above the water level. As the result of this accident the railway company lost the use of a locomotive for two weeks and the battalion received valuable instruction in mechanical maneuvers. In two cases it was necessary to sink blocking, some two and a half or three feet through mud in order to get a foundation for jacks. The cars and trucks had to be jacked up until temporary track could be laid under the trucks for their removal and then rails were cribbed up to the dropped deck, the mounts skidded out onto the new tracks and the trucks replaced. It was while laboring knee deep in mud and water that some member



of the command conceived the unofficial distinctive insignia of the battalion—crossed pick and shovel—with which he decorated one of the mounts, and it might be added that this design could well have been included in the official insignia, as the organization strives to excel in all endeavors whether it be drill or fatigue.

Early in 1923 positions were selected and oriented on other parts of the island. While the locations and plans with reference to these positions are secret, it would be proper and possibly interesting to discuss briefly some features of the fire control and communication system and plans for occupation in connection with these positions.

The most important items for consideration were of course plotting boards and base lines. In view of the fact that no standard plotting board had been adopted it was decided to impose no limit on the location of observing stations, selecting those best adapted from the point of visibility, security, concealment, communication, and

favorability of angles of intersection and then procure or construct a plotting board to meet the requirements rather than to sacrifice accuracy and flexibility to make use of any particular board. With this in view, stations were selected which would give the most favorable azimuth and greatest possible length of base line and, where possible, at least two base lines covering the same water area, thus providing emergency stations. Also one base line was selected for each possible field of fire which can be wired in the minimum amount of time for use while the longer line is being wired.

In the selection or design of a plotting board the following points were considered: first, it must be capable of including the longest base line to a desirable scale, and second, must have the greatest possible flexibility. It was found that by providing adjustable couplers, movable station blocks and increasing the size of the station board, the Ordnance 110-degree board met all requirements. One of these boards is now in use.

The question of plotting cars was investigated in due time and chartroom trailers were substituted for them as a matter of economy, greater mobility and usefulness for training purposes.

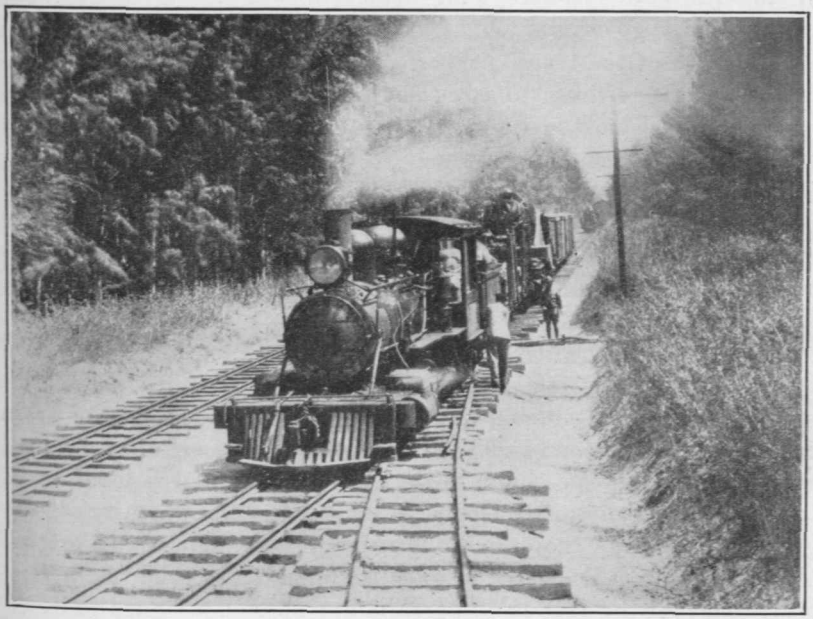
For the occupation of a position each battery is divided into three waves or echelons as follows: First echelon—two ¾-ton trucks will be loaded with field wire, wire laying detail and equipment, observers, readers, instruments and telephones. Both trucks will proceed to the position at the greatest possible speed and wire the short base line, leaving one man at the position to assist in testing out the lines. This detachment will be preceded by a motorcycle wire patrol acting as a scout. Having established communication with OPs, the wire details will return to the position for additional wire brought up by the second echelon. Second echelon—two FWD trucks with chartroom trailer, additional wire, fire control equipment and personnel. The third echelon will consist of the armament and remainder of the personnel. Under certain conditions the body of the chartroom trailer would be removed to a flat car and accompany the battery together with the fire control section and wire details.

This scheme was carried out in the field exercises held on May 7, 8 and 9, 1923, in which 75-mm. guns were substituted for the mortars. Three and one-half hours were required to establish communications with OPs, as wire had to be laid by hand for a long distance in order to avoid annoyance to residents in the vicinity. In time of war this work could be done in less than one hour.

The first annual target practice for 1923 was held at Fort Kamehameha May 25, 1923, each battery firing four mortars.

Battery "A" adjusted by successive approximation and in fire for effect fired four gun salvos. The total time was one hour and ten minutes and two hits were obtained out of twenty-four shots. It will be noted that this was the first time that battery salvos were fired. Battery "B" adjusted by salvo center of impact using four gun salvos throughout. The result of this practice was seven hits out of sixteen shots and the time was 22 minutes.

The primary object of the problems was to determine for adoption the most effective method of fire adjustment and the solution of



the problems left no doubt as to the superiority of the salvo center of impact method.

Aerial and terrestrial observation were used. While the longitudinal deviations were more accurately observed by the aerial observer the terrestrial observers demonstrated their ability to estimate the center of impact with sufficient accuracy to secure prompt adjustment.

An improvised range board was used for these practices. Battery "B" substituted a deflection correction table for the deflection board. The aiming rules were remodelled to do away with the sight and substitute a target which is set on a scale on the rule which is set to the same deflection sent to the gun. The scale is so graduated that the aiming line will remain parallel to a line through the axis of

rotation of the carriage and the center of the rule for any deflection set.

The railroad on the island is a three-foot gauge. There are many sharp curves highly banked for high speed traffic and as each mortar complete weighs 90 tons and stands 14 feet above the rails, there was considerable doubt as to whether or not the armament would take these curves on 2% to 3% grades on the branch line to Schofield Barracks. In order to settle all questions in connection with transportation a test run was ordered covering the greater part of the railroad system. This maneuver was conducted without expense to the government.

In view of the trouble experienced on the previous run special precautions were taken to avoid heating of journals. Brasses were removed and cleaned, axles were thoroughly cleaned and oiled and in packing and oiling on the road, 600W was used instead of the journal oil supplied for that purpose with the result that there were no delays due to overheating although a speed of 25 miles per hour was maintained over long stretches. A total of 133 miles was covered in nine hours and twenty minutes, including delays incident to traffic and taking water.

The train was made up of one mortar and a flat car loaded with heavy maneuvering material. At Waipahu an additional engine was added for the climb to Schofield Barracks and as the train gained headway under orders from the superintendent to take all curves at 20 miles per hour in the supreme test of the mobility of the armament there was a feeling of impending fate which gradually grew to elation as the gun rounded curve after curve and crossed high trestles with the smoothness of a Pullman and it had been demonstrated that the 41st could perform any mission assigned to it.

The way was now cleared for the formulation of a definite policy for the tactical employment of the armament.

The command and communication sections took part in Departmental maneuvers held in October, 1923, the battalion being assigned to the Hawaiian Division. The value of the training received cannot be overestimated.

The second annual target practice was held at Fort Kamehameha during December. The Brewer-Rumford Time Interval System, described in the COAST ARTILLERY JOURNAL for November, 1923, was used with entire success. It is not believed that a system of greater simplicity and dependability can be devised. The McCatty Range Board was also used with highly satisfactory results. The Cole Spotting Board has been used in all practices and adopted as a standard for the battalion.

The fire control system as developed to date has been covered briefly with the exception of the Whistler-Hearn plotting board which is used in the absence of a more suitable board. It has been modified so that the gun center can be moved to any part of the board. Azimuth is read from a diagonal scale.

Communications have been developed by the battalion electrician sergeants to a high state of efficiency. In addition to their other duties one electrician is in charge of communications and communication equipment in each battery and poor service from field equipment has long since been eliminated.

Radio communication is also highly efficient. Instruction in this means of communication was taken up with 67A sets before the present standard equipment was received, but no real progress was made until the District Radio School was established. Using as instructors men who have graduated from the District school, a signal school has been organized in each battery. Buzzer instruction sets have been installed in the barracks. This instruction is under the battalion Communications Officer and is designed to qualify a large number of signal men, increase the efficiency of all communications and develop material for future radio schools.

Both day and night target practices are scheduled for this year, one at the post with the target towed at maximum speed at 15,000 yards and the other in the field with the target towed at the extreme limit of searchlight illumination.

While there are many improvements under consideration and a great number of details to be worked out the organization is prepared to take its part as a powerful element in the offensive defense of Oahu.

The 64th Coast Artillery (Antiaircraft)

By Colonel R. E. Wyllie, C. A. C.

THE oldest antiaircraft regiment in the Army. This sounds ancient, but it is all a matter of comparison and *regiments* of antiaircraft artillery are new things in our organization.

Furthermore, this is the only antiaircraft regiment in the regular service which has ever been complete, the others containing inactive units.

The most superficial study of the defense of Oahu is sufficient to show that operations in the air will undoubtedly constitute the first steps taken by the enemy, and furthermore that there are several vital centers which must be protected against aerial bombing. This means that our own air service and our antiaircraft artillery will bear the brunt of the initial stages of the attack. In order to provide for this the Department Commander, on the 25th of May, 1921, directed the formation of the Hawaiian Antiaircraft Regiment, and on the 3rd of June the initial organization took place by transferring officers and men from existing fixed defense units to the new regiment.

The 1st Battalion was thus formed by transfers from Fort Kamehameha and the 2nd from Forts Ruger and De Russy. The Regimental Commander was directed to prepare a permanent camp on the outside slope of Diamond Head, Fort Ruger. The construction of the camp was pushed and on the 23rd of June the new organizations moved from their former stations and the regiment was consolidated.

The procurement of equipment was next in order and 3-inch trailer mounts and Mack searchlights were supplied from war reserve while a nucleus of trucks, cars and motorcycles were transferred from the Field Artillery at Schofield Barracks.

Active operations were at once started and on the 14th of July, the day after the transportation was received, the regiment took its first march, leaving Fort Ruger at midnight for Schofield Barracks with all guns and equipment. It returned during the night of July 25-26.

This was really a remarkable achievement. The distance from Fort Ruger to Schofield Barracks is about 30 miles, the first 10

miles being through the city of Honolulu, the remainder on a well paved road winding around hills and down gulches, a typical mountain road, especially dangerous in wet weather, as the road then becomes very slippery. A great many improvements have been made in this road in the last two years, particularly in the gulches, so that the thrills are pretty nearly eliminated, but in July, 1921, they were all there and two night marches of the entire regiment, with green drivers of transportation received only the day before, with only one accident would be a noteworthy performance for any organization, but especially so for a brand new regiment.

All vehicles got back to Fort Ruger. The one accident occurred in the famous Kipapa Gulch, on a difficult turn, which has since been eliminated.

In October, 1921, the regiment had its first firings and the searchlight battery took part in joint exercises with the Air Service, illuminating drifting targets for machine gun fire from the air; the targets representing a hostile landing in small boats.

Owing to local conditions it was decided to do away with the machine gun batteries, accordingly the machine gun battalion was reorganized on January 1, 1922, as a second gun battalion identical with the first, Battery "E" becoming a searchlight battery, "F", "G" and "H", gun batteries. Each battery of both battalions was issued four machine guns as alternative armament, and for local protection.

At the end of January, 1922, the regiment was moved from its camp at Fort Ruger to the cantonment barracks at Fort Shafter, where it has remained to the present time. This greatly improved living conditions, as the camp on Diamond Head could not possibly have been made comfortable for permanent occupancy.

The writer has a vivid recollection of making an inspection of that camp while Post Commander one day early in October, 1921, and being marooned in a tent for an hour while Jupiter Pluvius acted according to the best traditions of the tropics. A rain of such intensity is by no means uncommon in Panama and the Philippines, but it is comparatively rare in the benign climate of Hawaii.

However, Lady Luck had not entirely deserted us, as we found that the tent housed the battery glee club, so ukeleles and steel guitars helped to pass the time agreeably, altho it was difficult to hear them above the cannonade of rain on the tent and it was further necessary to elevate the feet, as no tent ditch ever dug could have deviated the flood of liquid red mud which came down the slopes. Our real difficulty, however, was after the heavy downpour, when we tried to navigate from the tent to the road, which was a feat

requiring much skill and attended with not a little danger (to clothing at least). Yes, the change to our cantonment post was a great improvement.

Our life at Fort Shafter has been merely what could be expected of an organization in garrison in a command having unusual opportunities for active work, and this is neither the time nor place to narrate all our experiences; some features, however, are worthy of notice.

The two searchlight batteries have had a great variety of experience, their work not being confined to antiaircraft. A study of their record shows that they have been almost continuously in the field for the past two summers, illuminating targets on the water for Infantry, Field Artillery and mobile Coast Artillery units, in addition to what might be called their normal function with their own regiment. The result is that probably no organizations are as well known among all arms as Batteries "A" and "E", 64th Artillery. For further information of their activities the reader is referred to the article by Captain Brice, commanding Battery "A".

Last year the Department Commander appointed a board of officers to conduct tests to determine the efficiency of aerial bombing and of antiaircraft firing. The latter part of the program was entrusted to Battery "C", 64th Artillery, which trained especially for this purpose and in January the tests were held. The report of the board will undoubtedly be made available to all; in the meantime it is sufficient to say that the antiaircraft firing was a surprise to all, except to its most ardent adherents. Battery "C" dispelled the idea that ground firing at bombing planes was of no value as a defense.

The Hawaiian Department makes a great feature of shows and competitions, the troops are so concentrated that it is almost one post, which greatly simplifies intercourse and competitive tests. The 64th has had the honor of taking the blue ribbon in the heavy truck class in all motor transportation shows held in the post, district and department, since the organization of the regiment. And of course heavy trucks constitute our principal class of transportation. In the last department show at Schofield Barracks, Battery "D" took all three places in that class with its F. W. D's. In the same show the 64th was second of all regiments in the department in total points; one field artillery regiment just nosing us out of first place, the third place in the motorcycle class being the deciding point. (It should be noted that the field artillery here is completely motorized.)

The latest regimental acquisition is a band. For over two years this was the only regiment in the Army without that valuable

adjunct, but the want has now been supplied, as last February the 64th Artillery Band made its debut and is now carrying out the exacting requirements of a headquarters band with distinction.

Mention of the band naturally leads to our new regimental march, composed by Lieutenant Egner of the Military Academy Band, and recently approved by the War Department. The following are the words, "We aim high" being the regimental motto:

When night is dark and dangers near us
And the hum of planes is in the sky,
Alert and quick is our responding,
The foe soon learns that we aim high;
Aloft we send our good shells screaming
To search the heavens, broad and blue,
Our Antiaircraft guns start speaking
With sleepless eye and aim so true.

Chorus:

We are the Antiaircraft gunners,
Archies all are we;
When the Sixty-fourth falls into line
Against the enemy
We'll cheer, boys, cheer along,
The limit is the sky;
Our guns are true, our searchlights too,
And we'll show them that we aim high.

Battery "A" (Searchlights) has the unique record of qualifying every man in the organization as a driver. This is a standing requirement in the battery and faithfully observed.

For nine months Battery "B" held the district pennant for the best mess against all comers, establishing the standard for messes.

It is the proud boast of Battery "C" that it has never had a truck towed into the post or camp no matter what may have happened on the road, each vehicle has come in under its own power. This battery also claims to have brought down every free balloon at which it has fired with machine guns; not one has escaped them.

Battery "F" holds the record for barrage firing, having put up six shots from one gun in a rectangular pattern in 11 seconds. A machine gun team from this battery took first place in the District small arms competition last September.

A squad from Battery "G" won the last District precision drill competition and took second place in the ensuing Department competition.

Battery "H" is the athletic club of the regiment, and this is not surprising when it is known that its Commanding Officer is Lieut. Hogan, of baseball, basketball, football and boxing fame. (Apologies

in advance for anything omitted). At the last Department show at Schofield Barracks Battery "H" detail took first place for smart gun drill and appearance.

Just now the regiment is having its annual target practice under rules formulated as the result of Battery "C's" test firing, to which reference has already been made. Battery after battery has taken up the firing at a towed sleeve like veterans and there is every indication that Battery "C's" record, good though it was, will be bettered in the very near future.

What is the future of antiaircraft artillery? It is noted that Congress has recently cut down the Budget Director's allotment for this service for the reason that it did not believe in the efficacy of the arm. The report of the recent firings of this regiment should be communicated to the two Military Affairs Committees without delay. To an open mind those firings are conclusive. In the present status of bombers and of antiaircraft artillery there can be no doubt that the artillery furnishes a thoroughly adequate defense in the day time. The writer has now had nearly three years' experience with these guns and has no hesitation in saying that a bombing plane of the present day on a bombing mission will have nearly, if not quite, as much difficulty in reaching its objective in daylight in the face of antiaircraft guns, as a naval vessel has in entering a harbor protected by coast defense artillery.

On the other hand there is much to be done to reach the same condition by night. So far as the guns are concerned, there is no difference, but to be of any value they must be able to see the target, and the present condition of our searchlight equipment is such that this is a very difficult matter. Improvements are urgently needed here, one of the most important being distant control for the lights we now have. This is imperative if we are to get full effectiveness from them. The finding of a plane at night and its illumination for the guns is the hardest problem which confronts this branch of the service at the present time.

Another improvement which could be made with advantage is to increase the destructive radius of an antiaircraft shell. The recent tests showed that a very small increase in such radius would cause a material increase in the probability of hits. This point is well worthy of special study.

The 64th Coast Artillery has a large problem on its hands in the antiaircraft defense of Oahu, but it is on the right road, and I envy my successor his chances for further creative work during the next three years.

Notes on the 155-mm. G. P. F. Gun Against Moving Targets

By Major F. A. Mountford, C. A. C.

THE following notes were compiled during my regime as Battalion Commander, 2d Battalion, 55th Coast Artillery, from April, 1922 to April, 1924. Many officers will serve with this armament and it is hoped that these notes will be of value to them to show what we have done during these two years. With this information they can begin where we leave off and should improve on our methods. No claim is made that the ideas expressed herein are original. Some were suggested by the articles in the Coast Artillery Journal. Some were suggested by the efficient officers which I have been fortunate enough to have with me in the battalion. Other ideas were merely standard Coast Artillery methods which experience in the past has shown to be efficient.

The 2d Battalion, 55th Coast Artillery is stationed at Fort Ruger, H. T., in the Coast Defenses of Honolulu, and is composed of four organizations: Headquarters, Headquarters Detachment and Combat Train, Batteries "D", "E" and "F". The organizations are equipped with the special artillery equipment indicated in Table IV G, Circular 373, W. D., 1920, including the major items of four guns, four ten-ton tractors and about twenty motor vehicles.

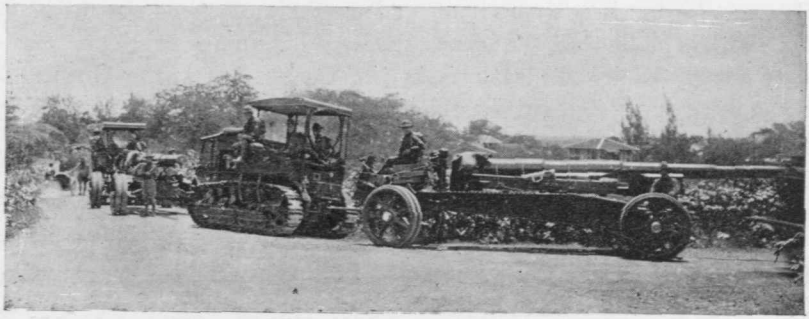
Prior to my assignment to the 55th Coast Artillery I was a strong advocate of the great value of the 155-mm. gun as a mobile intermediate caliber gun against moving naval targets. About 1919 the War Department adopted the policy that in future all intermediate caliber guns for coast defense purposes should be mobile. At the end of the World War there were on hand about one thousand 155-mm. G. P. F. guns. It was highly desirable that this armament be adapted for use against naval targets.

Up to April, 1922, the use of this armament against moving water targets was limited to the firings held during the fall of 1921 by a provisional battalion at Fort Ruger. This battalion, with an improvised plotting board constructed on the impact chart principle for a particular gun position, fired at a drifting target at long range. This firing while slow, showed that these guns could be fired

at a moving water target, and as far as I know, it was the first held under such conditions.

I have always been a firm believer in the soundness and efficiency of the coast artillery methods in use in the fixed defenses prior to the World War. These methods, augmented by the observation and adjustment of fire which we are now able to execute accurately with the aid of improved methods of aerial and terrestrial observation, are just as sound and efficient today. If we can get back to them we will have accomplished much.

It was our idea that "a gun is a gun for a' that" and that the 155-mm. gun could be fired by the standard coast artillery methods just the same as the fixed defense guns. Our war positions, retarded from the shore line and invisible from the sea, demanded the use of indirect fire. Some may say that our methods are complicated but



THE 55TH COAST ARTILLERY LEAVING FOR MANEUVERS

you cannot stand on a hill and grasp out of the air the deflections and elevations which are needed to lay the guns by indirect fire against a rapidly moving naval target. You could do this for firing by *direct fire* and I believe that a battery could be fired by this method with no other fire control apparatus than a good pair of field glasses. But for indirect fire you must have a track of the course of the target.

When I assumed command of the battalion, I set as our objective, to be gained several years later, the problem of firing over the Koolau Range as a mask at a moving water target from a position which meets the eye of the casual observer at Fort Ruger looking at the beautiful view toward Koko Head. Thus our first firing at a moving target was held on July 25-26, 1922, at a range of about 12,000 yards. Sufficient fire control apparatus could be improvised for but one fire control section and a battalion range section was organized which functioned with each battery during the three

practices. These practices were quite successful. Many bracketing salvos were obtained and the great value of the 155-mm. gun against naval targets was demonstrated beyond a doubt. A drifting target was used due to the fact that sand filled projectiles were not available and the H. E. shell would endanger the towing vessel.

The next target practices at a moving target were held during the regimental camp of the 55th Coast Artillery at Puena Point. For these practices sand filled projectiles were available and on October 24, 1922, the three batteries fired at a towed target at a range of about 10,000 yards. This firing was conducted as a group practice using one fire control section. On October 26, 1922, another group practice was held for the Department Commander. General Summerall appeared on the beach at the flank of the battalion at 3 p. m. and at 3:05 p. m. the twelve guns of the battalion

were making it uncomfortable for the towed target at a range of 11,000 yards. An aide of General Summerall's remarked after the practice "Those guns are some moral boosters for the Infantry." The indirect fire practice of October 24, 1922, as far as is known, was the first to be fired by a 155-mm. gun at a *towed* target and preceded the direct fire target practice of the 51st Coast Artillery at Camp Eustis by about eight days.

At the beginning of 1922 it was decided to make each battery of the battalion self-supporting and each organization was required to have its own fire control equipment and range section. A surplus W. H. mortar plotting board was assigned to Battery "E". Battery "D" was equipped with a surplus submarine mine plotting board converted into a gun board with the aid of a surplus gun arm and spider. A surplus W. H. gun plotting board was obtained for Battery "F". Each battery was provided with a Cole spotting board.

With this equipment each battery on May 28, 1923, fired at a drifting target (sand filled projectiles not being available) using H. E. shell and Mark IV star fuses at a range of about 7000 yards.

On July 24-25, 1923, the three batteries fired at a towed target at a range of about 10,000 yards with super charge. The results of these practices showed a marked improvement in the rate of fire. Several series for improvement and effect were fired at the rate of two four-gun salvos per minute. It was noted at the first practice that practically all of the H. E. shell burst on impact with the water sending a column of water and black smoke high into the air. The detonation could be plainly heard from the shore. These practices were preceded by calibration firing of ten shots per gun.

The fire control system as improved to date may be described as follows:

Each O. P. is equipped with a 1910 azimuth instrument for observing, a 1918 azimuth instrument for spotting, and three field telephones with headsets, one each for the spotter, reader and observer. The reader and the observer are on the same readers line. In the plotting room is a W. H. plotting board, with the station arms graduated from 0°-180°. Facing the field of fire the instrument at the right O. P. is oriented to read 0° when sighted on the left O. P. The instrument at the left O. P. reads 180° when sighted on the right O. P. This method makes the plotting board universal and without regraduation it has been used successfully for gun positions on three different shores of the Island of Oahu. (This system first came to my attention in an article in THE COAST ARTILLERY JOURNAL by Major Meade Wildrick, C. A. C.)

The gun arm azimuth circle is graduated counterclockwise to conform to the panoramic sights, from 90° to 180° to 90°. This gives an offset of 90° from the graduation of the station arm azimuth circles. The aiming stakes for each gun are accurately installed so that the line gun-aiming stake is perpendicular to the base line. The gun arm azimuth circle then reads the gun deflection of the setforward point in degrees. This is converted to the deflection in mils on a slide rule or tape deflection board which is provided with a mil arbitrary scale for moving the index to conform to the direction corrections ordered by the battery commander. The range of the setforward point in yards read from the gun arm is converted to the elevation in mils on the percentage corrector described in the December, 1923, COAST ARTILLERY JOURNAL. One battery commander prefers to use the plotting board for plotting the course and for determining therefrom the rate of change of range and deflection in one minute. On a separate slide rule this is converted into range and deflection travel during one minute plus the time of flight. It is then applied as a flat correction on the elevation and deflection boards. This flat correction is changed as the average travel or time

of flight changes. The predicting interval is one minute and data is sent to the guns every thirty seconds or at shorter periods of time. To give flexibility in the interchange of stations and baselines and for the introduction of a time interval impulse at a central point, all communications are routed through the battalion switchboard in the battalion chart room trailer. At present this is equipped with three eight-drop and one twelve-drop standard Signal Corps switchboards. Each of the eight-drop boards is used for the O. P. lines pertaining to one battery. The twelve-drop board is used for the command lines to the batteries, for the lines to higher command and for the battalion stations such as radio, first aid, ammunition dump,

etc. The present allowance of switchboards for battalion headquarters should be increased to at least four twelve-drop boards.

From the battalion switchboard two lines are installed to each of the six battery O. P.s, one reader's and one spotter's. Four lines are installed from the switchboard down to each of the three battery plotting rooms, two for the armsetters and two for the Cole board operators. These lines are kept habitually cross-connected by means of the cross connecting cords.

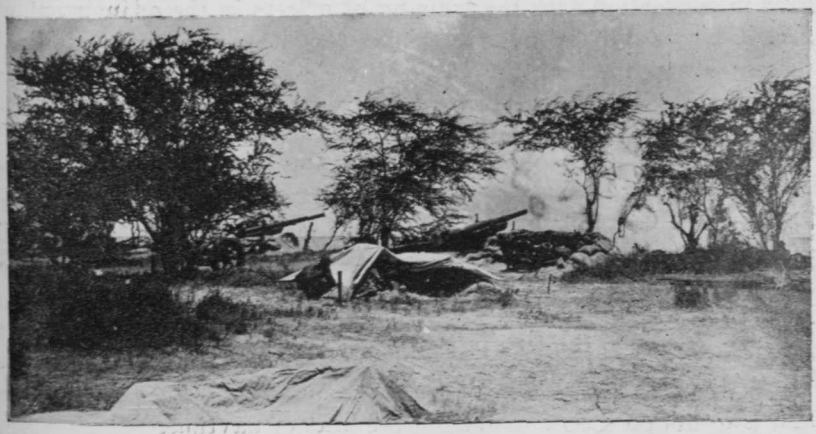
Type EE telephones are provided for use as follows per battery: spotters, 2; Cole board operators, 2; elevation board operator, 1; deflection board operator, 1; switchboard operator, 1; executive station, 1; gun telephone operators at position, 4; lateral observer (where target is not visible from plotting room), 1; observers, 2; readers, 2; armsetters, 2; in plotting room to executive, 1; in plotting room to battalion commander, 1. All these telephones should be provided with headsets as all operators must have their

hands free for the operation of apparatus or for making records. The present standard fire control headset is being used, but it would be more satisfactory if it was designed specially for use with the field telephone and its lower voltage. The present allowance of telephone and headsets is entirely inadequate for moving target work and should be increased. A time interval buzz is introduced into the receiving circuit of the armsetter-reader lines at the battalion switchboard by an excellent device. A time interval clock at two seconds before, one second before, and on the thirty-second interval, completes the electrical circuit with several dry cells and causes a series of locally constructed relays to operate. The operation of the relays completes the circuit between a dry cell and a small telegraph buzzer. In the buzzer circuit is a primary winding

on an induction coil. In parallel across each armsetter-reader telephone circuit is a secondary winding on the same induction coil. Three buzzes are thus produced in the telephone receiver at the end of the time interval corresponding to the three strokes of the time interval bell. The use of the relay prevents cross talk. For the first practice in July, 1922, an ordinary instruction buzzer was used as a time interval system across the outside terminals of the battalion switchboard. As there was cross talk at times, especially when it was used for more than one battery, the improved scheme described above was adopted. This system is remarkably simple and satisfactory. From the battalion chart room it operates over the entire battalion net including O. P.s 6000 yards distant. The observer should be equipped with a headset and telephone on the armsetter-reader line so that he can hear the time interval buzz.

A firing signal for firing the guns on the third bell of the observing interval is provided by another excellent device. Each battery emplacement is provided with a box containing a six-volt storage battery or dry cells, a small telegraph relay and a time

interval bell. The time interval clock in the battalion chart room through a field line actuates the relay at the proper time interval. The operation of the relay completes the local circuit with the battery and produces three loud rings of the bell. The use of the relay is necessary due to the distance of the time interval clock from the battery and the small source of power available. It is possible that this system can be used for a time interval system instead of the scheme described in the preceding paragraph. This method would obviate the use of the telephone receiving circuits for the time interval buzz, would give a system similar to the present fixed defense apparatus, but would require the installation of an additional field line to each O. P.



For spotting, each battery is provided with a Cole spotting board constructed locally. The two spotters using 1918 azimuth instruments are connected on separate spotter's lines to the Cole board operators. The use of separate spotters and spotter's lines is considered essential for rapid spotting and to prevent interference with the plotting of the course of the target. The Cole board is of the general type designed by Captain Joseph M. Cole, 41st Coast Artillery. This board is considered very satisfactory. It should be manufactured by the Ordnance Department and issued to all batteries. The improvised boards are not sufficiently accurate.

The guns of the battalion in the gun park are kept in the firing position with deep recoil pits. The complete battalion net and fire control system is installed habitually. Each battery has its plotting room in a small frame shack. O. P.s at the ends of a horizontal baseline overlooking the fixed defense water area are manned during the drill period. With this installation drill closely simulates target practice and service conditions. A target is tracked if available;

otherwise a hypothetical course is used. Data is determined and transmitted to the guns, which are loaded with dummy projectiles and powder charges. When a salvo has been fired, at the expiration of the time of flight the spotters send in hypothetical splash data with which the Cole board operators determine the deviations. Based on these deviations the battery commander adjusts the fire and orders the necessary corrections. Records are kept on the forms indicated in Training Regulations 435-10. These forms are mimeographed at battalion headquarters. Analysis is held frequently.

The spotters are trained in reading the angular deviations of the center of impact of four gun salvos by the use of the 75-mm. field gun and rifle grenades. Salvos from four 75-mm. field guns are fired in connection with the training of officers in the adjustment of fire. This provides excellent training for the spotters, especially if officers are present at the O. P.s to check the deviations. Rifle grenades fired from the stern of the vessel used for tracking have also been used for training spotters and aerial observers.

Each target practice is held at a point some distance from the gun park, varying from five to forty miles. Preparation for these marches is accomplished by short night marches on the night drill nights, twice each month. As a general rule trouble develops on a long march in the first few miles. These short marches develop most of the troubles and are invaluable in the training of tractor drivers and chauffeurs. All the marches on the Island of Oahu by 155-mm. guns are made at night on account of the effect of the guns and tractors on the roads during the heat of daytime.

Target practices are held as a part of an assumed special tactical situation and are preceded by a march on and occupation of position as in actual service. The battalion light and heavy columns march in accordance with the instructions contained in the battalion commander's field order.

The average rate of march for the heavy column for a march of about forty miles is a little over two miles per hour. Returning from Puena Point in October, 1922, the 2d Battalion on the second night made twenty miles in seven hours.

The batteries of the battalion have habitually fired four-gun salvos—that is, four shots from the battery fired simultaneously. These guns are rapid fire guns and should be fired and the fire adjusted as rapidly as possible. The center of impact of a four-gun salvo is a very good indication of the ultimate center of impact and is a much more rapid method of obtaining this indication than four individual shots. The bracketing method of adjustment was used as it was considered to be the most rapid. Bilateral terrestrial obser-

vation from the base end stations was used with the Cole spotting board. This was supplemented by aerial observation from an aeroplane with two-way communication. It cannot be said that this latter method has been a complete success in the battalion. In some cases radio communication failed and no reports were received from the plane. In the cases in which radio communication was satisfactory the observations were received too late to be of use in rapid fire. It is believed that the intensive training program recently held in radio communication and aeroplane observation will produce better results in coming target practices. The difficulties to be overcome by aerial observers in radio communication in the air and their lack of satisfactory equipment are appreciated.

Photo by Geo. Nock, Honolulu

No. 2 Gun, Battery D, 55th Artillery, Nauakuli, H. T.

For long range firing I am now inclined to favor the trial shot method for trial fire with the bracketing method for improvement fire and fire for effect. Heretofore the plane has been required to report the lateral and longitudinal deviation of the salvo center of impact with reference to the gun-target line. I believe it will be easier for the aerial observer and will be more rapid if during improvement fire and fire for effect the plane reports the number of overs and shorts in each salvo, as: all over, mixed over (three over and one short), mixed short (three short and one over), all short and target (two over and two short) with code signals to indicate these observations. A code signal could be introduced to indicate whether the salvos, that are all over or all short, were near the tar-

get, way short or way over. The battery commander then improves his fire by the correction necessary to equalize the overs and shorts. If the trial elevation has been obtained by the trial shot method the fire of the 155-mm. gun should not be interrupted for the application of corrections. The corrections should be applied without holding the fire and the battery commander in his subsequent adjustment should take into consideration the total correction that was actually applied to each salvo.

When using indirect fire it is essential that the lateral deviation be observed by battery personnel on the gun-target line. Aeroplane and bilateral observation is not reliable for accurate adjustment in direction. If the battery commander can have his spotting section with him and has a range officer at the plotting room I believe he should observe the lateral deviation himself from an elevated point as near the gun-target line as possible. This would be excellent for service conditions, as he could observe the effect of his fire on the enemy. However, with the Cole spotting board and the necessity for obtaining data from the plotting board for application on the former, it appears to be more satisfactory to have the spotting done in the plotting room. With the battery commander at a distant O. P. time is lost in transmitting the deviations to him and receiving back his corrections. For the next practices an officer or non-commissioned officer will observe the lateral deviation on the gun-target line and will transmit this data to the battery commander in the plotting room. In service in a naval engagement I believe the battery commander should be at his O. P. where he can see the enemy.

The 155-mm. gun is a valuable asset in the positive defense of our coast line. Its value in the land warfare phase of this method of defense was demonstrated beyond a doubt in Europe in the World War. Its great value against naval targets has been demonstrated during the past two years, both here in the Hawaiian Coast Artillery District and elsewhere in the Coast Artillery. Considering its simplicity, its comparatively large traverse for a mobile gun, its accuracy and its mobility, it is difficult to conceive how it can be improved upon without a sacrifice of some of these valuable characteristics. Service with this armament is an inspiration. The sight of three batteries of twelve of these guns thundering down and up the steep inclines of Kapapa Gulch in the darkness of night with the manifolds of the tractors red hot with their efforts, cannot but send thrills of pride up and down the backbone of the most ardent pacifist. Equally thrilling is the firing of these guns at fast moving targets at ranges of 15,000 and 16,000 yards, at a rate of fire almost as rapid as that of the fixed armament.

Development of Coast Artillery Principles in the Defense of Oahu

By Major W. K. Wilson, C. A. C.

WHEN the fixed defenses for the Island of Oahu were planned, it was the general belief that an enemy could land at only a few selected places on the island, and that enemy warships were not likely to approach the island except in the vicinity of the two developed harbors, Honolulu and Pearl Harbor.

Based on these assumptions, the fixed defenses were located so as to attack enemy warships in the vicinity of the two harbors. Mobile army units were provided to attack any enemy who might land either in the vicinity of the harbors or in any of the few selected places where it was believed possible to land. Apparently, the doctrine at that time was to destroy the enemy at sea if he were within range of the fixed defense armament, but to destroy him after he had landed in case he could make a successful landing outside the range of the fixed defense armament.

Since that time conditions have materially changed. The navies of the world have added to the power and to the range of their guns. War has taught us that insofar as natural obstacles are concerned, troops in small boats can land practically anywhere.

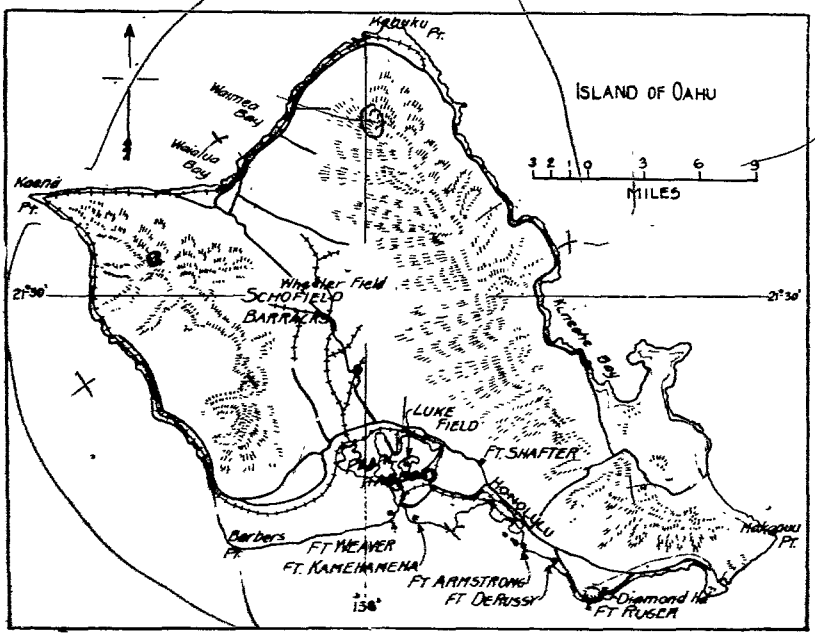
To meet these changed conditions, long range artillery and heavy mobile artillery have been added to the armament in Oahu. No enemy ship can approach any shore of the Island of Oahu without coming within range of the heavy artillery. We are no longer content to wait for the enemy to land before we destroy him. Like the French slogan, which has now become famous, "They shall not pass," Oahu has its own slogan, "They shall not land."

The defense of Oahu, insofar as the Army is concerned, naturally divides itself into three phases. The first phase exists when the enemy ships are beyond the ranges of the heavy artillery. For the first phase, the air service with her bombing planes must be depended upon to make life uncomfortable on any enemy warships that dare approach our shores. For the second phase, the heavy artillery armament must destroy any enemy warships which come within range. Against the enemy transports, the 155-mm. heavy mobile artillery can be used very effectively. For the third phase, we must

depend upon machine guns and 75-mm. guns placed so as to cover every portion of the shore line, backed up by a mobile army prepared to make counter attacks against an enemy who succeeds in landing anywhere on the Island.

The second phase is the Coast Artillery phase, and the Coast Artillery in Oahu is prepared to perform its mission. No ship can come within 25,000 yards of any shore-line without coming under the fire of heavy artillery.

The greatly increased ranges for the fixed armament, the ability of the long range fixed armament to fire in any direction, and



the possibility of moving heavy mobile artillery (both railway and tractor) from place to place so as to fire in any direction have introduced some very interesting problems in fire-control.

To meet the situation, it has been necessary to divide the water area surrounding Oahu into battle areas. The officer who controls the fire of artillery into any one of these areas is called the battle commander.

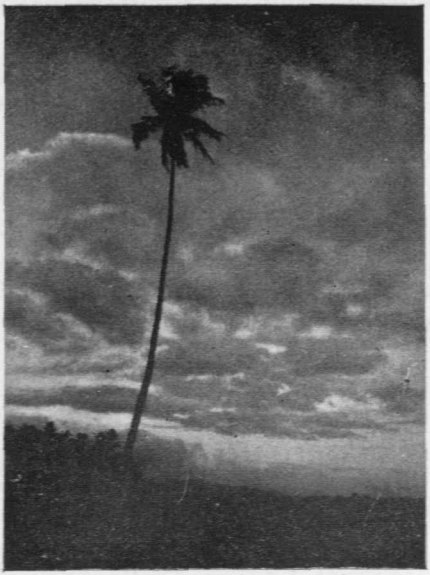
It is a fundamental principle that one man and only one can control the artillery fire into any one battle area. He must also control all searchlights operating over his battle area. Battle command stations have been located so as to exercise this control no matter how distant the firing batteries may be located.

Long range fixed artillery capable of firing into more than one battle area is assigned to battle commands by the Department Commander, or within a sector by the sector commander. Heavy mobile artillery is moved from one sector to another under orders of the Department Commander, and is assigned to battle commands by the Department Commander, or within a sector by the sector commander. As the sea fight develops both the long range fixed artillery, and the heavy mobile artillery is reassigned to battle commands by the Department Commander or by the sector commander concerned.

The important principle which it is desired to emphasize is that the battle commander must exercise control of the sea fight within his battle area, and that this control cannot be exercised by a coast defense commander or any other commander from some headquarters charged with many other duties in addition to the sea fight.

In preparation for the second phase in the defense of Oahu (the Coast Artillery phase) target practice is being conducted at extreme ranges for all armament. Night practice within the maximum ranges of illumination is also being conducted with gratifying results.

The Coast Artillery in Oahu can be depended upon to do its part in making true the slogan "They Shall Not Land."



Long Range Aerial Position Finding and Adjustment of Fire

By Lieut. Colonel A. L. Fuller, C. A. C.

Editor's Note: *The attention of the reader is invited to the September and October* Journals *of 1923, which contain articles on long range firing with Airplane Observation from Battery Frank G. Smith, Fort Mills.*

THE advantage to be gained from the development of effective means for adequate position finding for long range armament probably is as great or greater in connection with the defense of the Island of Oahu than elsewhere within the sphere of the present activity of the Coast Artillery Corps. It has long been a conviction on the part of many Coast Artillery officers that the solution of the problem of long range position finding might be solved through cooperative effort of the Coast Artillery and the Air Service.

It is well known that the proper defense of the Island of Oahu and the established means therefor offer exceptional opportunities for the fullest development of the part to be played by all arms of the service. This applies with special force to the Coast Artillery and the Air Service, both of which are capable of engaging the enemy while he is in the air or on the surface of the sea, and before other arms of the service come in tactical contact with him.

The variety of Coast Artillery armament, Air Service equipment, and the favorable opportunities for the use of each in this Department, naturally led the War Department to assign to the Commanding General of this department, the duty of determining by actual performance a fair measure of the capabilities and limitations of the Coast Artillery armament and Air Service equipment in coast defense. Such a determination cannot help but be of great value as well as of intense interest. The action of the Air Service in coast defense beyond the effective range of the coast artillery armament has been omitted purposely from this discussion. That is a totally different matter, and one that has special interest for the Air Service and the Navy. It presents a field in which wonderful opportunities may be found for properly coordinated effort. There is, however, a phase of Coast Artillery-Air Service activity that should now call for the closest attention and one which may well have the whole-hearted and enthusiastic support of both services. That phase

has to do with the cooperative action of the two services, particularly as to joint action against enemy aircraft, in which our aircraft, antiaircraft artillery and searchlights must be used in the highest sort of team work. Likewise both our aircraft and artillery may be used simultaneously for the attack of enemy ships. Then again the use of airplanes may be the most effective means for position finding at extreme ranges and beyond the range of effective observation from terrestrial stations. It is this latter phase, i.e., aerial position finding for which a solution was sought in connection with the last target practice at Battery Closson, (12-inch B. L. R., Model 1895, on Barbette Mount, Model 1917), Fort Kamehameha.

The following is quoted from a report made to the Commanding General, Hawaiian Coast Artillery, on the subject. A copy of the report follows:

1. On August 13, 1923, the Commanding General, Hawaiian Department addressed a communication to the Commanding General, Hawaiian Coast Artillery District which contained the following:

(a) "Airplane observation will be used exclusively in position finding, including the speed and course of the target, and in the conduct of fire. Terrestrial observation will be used independently as far as practicable to obtain data for checking the airplane observations and for analyzing the practice."

(b) The range will be as great as practicable.

(c) Two way radio telephone will be the principal means of communication.

(d) The target will be prepared sufficiently large to be readily visible by the airplane.

(e) The 17th Composite Group will furnish the airplane observation . . .

2. The Commanding General, Hawaiian Coast Artillery District prescribed as follows in transmitting the instructions of the Commanding General, Hawaiian Department to the Commanding Officer, Coast Defenses of Pearl Harbor:

"In view of the special requirements of this problem, care will be taken to insure that the Battery personnel, Air Service observers, and radio details are thoroughly familiar with their duties prior to date set for the practice. To insure accuracy of airplane position finding data, frequent drills will be conducted prior to the practice at which time the accuracy of the position data of the target as reported by the Air observer, will be checked against the data as obtained from the plotting board."

3. Following extended preliminary consideration of this problem, the Commanding General, Hawaiian C. A. District conducted a conference at his headquarters at which there were present, among others, the following:

a. The Assistant Chief of Staff, G-3, of the Hawaiian Department; *b.* the Hawaiian Coast Artillery District Staff; *c.* the Air Service Officers concerned with the problem, including the Group Commander; *d.* Department Signal Officer; *e.* the Commanding Officer, C. D. of Pearl Harbor, and the officers of his command concerned with the problem.

At this conference the following means of aerial position finding were considered in their more general aspects:

1. Measurement of vertical angle to the plane at the instant it passed over the target.

2. Measurement of the time it takes the plane to fly from the battery to the target, the speed of the plane being determined by terrestrial plotting.

3. Resection at the plane of bearings taken on prominent land marks, at the time it is over the target.

4. By locating the position of the plane by means of radio direction finding from two or more stations ashore.

4. The following is a statement of pertinent facts relating more in detail to each of the methods described above as developed during the combined Air Service and Coast Artillery drill and practice:

a. Measurements of the vertical angle to the plane when over target.

An ordinary surveyor's transit was used for this purpose. This instrument was far from satisfactory on account of its optical characteristics of small field and lack of definition, and the fact that it was used on an ordinary tripod. The vertical scale was difficult to read rapidly. It was found desirable to use an azimuth instrument, Model 1918, as a finder for the transit and to read the azimuth of the plane at the instant the plane passed over the target. It was found desirable for the plane to fly on the battery-target line for about one thousand yards going in the direction of the target, then when over the target to bank off sharply and to fly parallel to the course of the target for a short distance—only long enough for the compass to come to rest—then to circle around and fly toward the battery on the battery-target line passing over the target again. At the instant of passing over the target each time, out and back, the signal "T" was made by the plane's radio. As the target was approached on the outward course the altitude of the plane was radioed to the battery. The plane's sharply banking off the battery-target line served as a visual indication of the instant the plane passed over the target. The speed and course of the target was radioed to the battery between the time the plane passed over the target on the outward course and on the inward course. It was found that the plane would not sensibly change in altitude between the outward and inward courses.

After considerable drill it was found that a pilot and an observer could send in this data once each minute. Much difficulty was experienced with the radio service, especially the radio telephone beyond 15,000 yards. The modulated buzzer gave much better service than the radio telephone. The success of this system depends on the plane being visible from the battery. Conditions of visibility were such that the plane was not visible from the battery up to 25,000 yards on most days and at times when the target (a 100-foot tug) was not visible from the base end stations at Punch Bowl, and Salt Lake Crater, which are approximately 400 feet above M. L. W., and form a baseline about 9000 yards long, situated approximately 6000 yards in rear of the battery which is about 1000 yards from the shore line. Visibility from these stations was frequently interrupted by low-lying fog, clouds and rain when the visibility seaward from the battery was excellent. It is to be noted that the vertical angle may be read to whole minutes only and that the variation in range for 1 minute change in vertical angle with 6000 feet constant altitude is 54 yards at 19,000 yards range, corresponding to 6° vertical angle and 100 yards at 28,600 yards range corresponding to 4° vertical angle while the range variation for the least reading in altitude of 100 feet, at a constant vertical angle of 5° is 330 yards at 28,600 yards and 375 yards at 18,300 yards. Inasmuch as the altimeters used in the planes are not accurate to within 2 per cent., an error in range might be expected one way or the other of 400 yards at 28,600 yards or 450 yards at 18,300 yards. It was found in drill and practice that very satisfactory results could be obtained by

applying a percentage correction to the altitude reading such as to bring the range determined by this method into agreement with the actual range and that such a correction would give quite satisfactory results over such changes in altitude as were used on any one day.

No instruments were used by the aerial observers to determine when exactly over the target and time did not admit of determining by test what error might be expected as a result of the signal being given before or after actually passing over the target. The error, if any, was quite constant by reason of the fact that the same sighting points on the side of the plane were used at all times and the ship was carefully "leveled off" when the observation was taken.

b. By determining the time it takes the plane to fly from the battery to the target knowing the speed of the plane.

It is a simple matter to accurately measure the time it takes the plane to fly from the battery to the target. The instant the plane passes vertically over the battery can be easily determined and the plane signals by radio when it passes over the target. With a stop watch this time can be read to one-fifth of a second. Flying at 100 miles per hour a plane travels 50 yards per second, or 10 yards in 1/5 second. The method presents the advantage that the plane need not be visible from the battery all the way to the target. The plane may fly on the battery-target line and be observed in azimuth well out on its course to the target and thereby give a usable azimuth indication notwithstanding the fact that it may not be observed all the way out to the target. In this locality it is generally probable that the plane may be observed 20,000 or more yards out on its course and that the target may then be visible to the observer and pilot at least 10,000 or 15,000 yards beyond the plane at that time. The standard azimuth instrument is satisfactory for use at the battery for observing the plane under this system.

c. Resection at the plane of bearings on prominent land marks taken when over the target.

This system was not followed to a fair conclusion. It was, however, found better to have the aerial observer take his bearings on the prominent land marks, previously designated for a particular field of fire and then to send in the bearings to be plotted at the battery. It is difficult to do any plotting with precision in a plane where the plane table or map board must be small and the observer works under the difficulties of high wind and low temperatures at the higher altitudes. It is much better to do all such plotting at the battery. No instruments were found which could be used in accurately measuring the bearings to the points ashore. It was found that the most promising method was to have the plane fly on the line through the target and the point ashore and to take the compass reading as the bearing of the line in question. But a few seconds are required to take the second reading (i.e., on the second point ashore) after the first one is read. The target changes position but slightly in this short time. Here the question comes up as to how much the compass to be used in the plane may be developed over the ones now in use. It would seem that much improvement in this respect might easily be made.

d. Location of plane when over the target by means of radio direction finding from two or more stations ashore.

There was no equipment available in this department for trying out this system in any way of value. It is thought that this is one of the most promising means and should be developed to the fullest extent of its possibilities. Recently a conference has been had by representatives of the Chief of Coast Artillery,

Chief Signal Officer and the Chief of Air Service on the subject of developing equipment for this purpose. It is understood that as a result of this conference the Supply Services concerned will actively take up the development of the required equipment. It is to be noted in all the so-called systems referred to herein for position finding radio communication is an indispensable feature. This being so the fullest advantage should be taken of it and if it fails to meet the requirements all attempts at long range aerial position finding along the lines herein described will fail. In this connection it should be noted that almost every day during these tests much trouble was caused by interference from other stations and by the lack of suitable radio equipment. No small part of this difficulty was due to imperfectly trained radio personnel, but the greater part was no doubt due to inadequate radio equipment especially that installed on the planes. It is confidently expected that all avoidable difficulty had with radio equipment will be overcome by the use of the new and greatly improved equipment soon to be supplied by the Signal Corps. The preliminary tests made with this new equipment give definite promise of marked improvement over the old equipment produced during the war, now seven years ago.

Plotting and Predicting

5. The plotting board consisted of board, gun arm and diagonal azimuth circle. A pyramidal target of the standard size especially prepared to be visible from the plane was used. For drill it was towed and for target practice it was set adrift.

A circular slide rule was constructed (logarithmic scales of numbers and tangents) from which the range corresponding to any vertical angle—plane, battery, target—could be quickly read. The range could be read to the fourth significant figure from this slide rule. The range and azimuth to the target having been indicated the position of the target was plotted and a 360° transparent protractor was oriented by reference to the gun arm while set at the azimuth of the target. By use of the protractor the course of the target as reported by the aerial observer was drawn on the board, the protractor being centered over the plotted position of the target. The time which elapsed between the last time interval bell and the instant the plane passed over the target was noted. Then the plotted position of the target for the last and the next "bells" were determined by using the standard prediction ruler in the following manner. Speed of target as radioed by the plane in knots per hour was converted to yards per minute. The index of the slide of the prediction ruler was set at this travel. The logarithmic time of flight scale on the prediction ruler was extended to its point of origin. These reading opposite the following points on the time of flight scale, viz.: point of origin, sixty seconds and the time in seconds which elapsed between the last bell and the instant the plane was observed over the target fix the plotted position of the target with reference to its position at the time of the last bell and the next bell. From this point on there are no novel features to the plotting and predicting. The guns were "fired on the bell." The system contemplates that the plotted course of the target will be adjusted as to either course or speed or both as may be indicated by the fall of the shots as reported by the aerial observer.

6. At times there was wide variation between the position of the target as plotted by terrestrial observation and as determined from the vertical angle to the target and the altitude of the plane when over the target.

The following actual results using a moving target, speed ten knots per hour, are typical of the results after considerable drill:

Range to Target	DIFFERENCE	
	Range	*Lateral*
Mean 25,000 yards	— 800 yds.	Left 240 yds.
	—1000 yds.	Left 240 yds.
	—1400 yds.	Left 240 yds.
	—1000 yds.	Left 200 yds.
	—1360 yds.	Left 440 yds.
	— 880 yds.	Left 360 yds.
	—1600 yds.	0
	— 600 yds.	Left 280 yds.
	—1000 yds.	Left 280 yds.
	—1280 yds.	
	—1080 yds.	
	—1000 yds.	
	—1000 yds.	
Mean	—1077 yds.	

The uniformity of these variations and the fact that they are all short indicate that had a percentage correction been applied to the altimeter readings a very satisfactory result would have been obtained. In this connection it should be noted that the altimeters in different ships appeared to vary to a considerable extent and that a correction factor would have to be determined for each instrument. At the practice the mean range to the target was 20,250 yards, approximately, and the following variations were recorded as plotted, by terrestrial observation and by the method altitude-vertical angle; plus 670 yards, plus 590, plus 180, plus 210, minus 240, minus 880, plus 390 and left 90 yards, L 67, L 56, R 121, R 72, O, L 225. These results include such corrections as were applied by the battery commander based on aerial observation of fire. (These results are submitted prior to analysis of the practice). At other times as many as seven successive plotted points would vary not more than 100 yards over or short from the course as plotted by terrestrial observation. Then on another day the results would be very unsatisfactory varying as much as 1200 yards over and in the next position as much as 1200 yards short.

7. No data was secured on the determination of range by time of flight of the plane to the target for the reason that drill was concentrated on the altitude-vertical angle method because it presented more difficulties. It is thought that the time of flight of plane method will give more satisfactory results as to range to target. When the plane flies beyond range of vision from shore the azimuth error will be greater than range error by this method because the position of the plane when last observed on the battery target line must be taken as an indication of the azimuth of the target from the battery.

Conclusions

8. The period of drill preceding the practice at Battery Closson is equally significant with the practice itself as to promising means and methods for aerial position finding and therefore no distinction is made between drill and practice in this report and conclusions drawn are based on the results of both drill and practice. It is desired that it be understood that the very limited time available for devising means and methods for this drill and practice and the necessary use of such instruments and equipment as could be found on hand or improvised makes the opinions herein expressed inconclusive except as to general methods and of value principally as indicating means and methods which offer such promise as

to justify their further development and trial. The conclusions drawn will be stated under the headings marked (a) (b) and (c) below:

(a) It is considered that the most effective methods for cooperation by the Coast Artillery and the Air Service as demonstrated by the drill and practice may be stated as follows:

An airplane which has located the target visually flies on the battery-target line from the battery to the target at a constant speed. As the plane passes over the battery a stop watch is started and then stopped when the plane signals "take" as it passes over the target preferably at considerable altitude—8000 to 10,000 feet. The speed of the plane is determined by plotting its course by the terrestrial horizontal base lines as far out as it can be seen. Knowing speed and time of flight of the plane the range to the target can be computed. The course of the plane (plotted as far as the plane can be observed by the base end stations) will be taken as the azimuth of the target. If the plane is visible from the shore the vertical angle to the plane is read at the instant the plane signals "take." The vertical angle so read and the azimuth of the plane will fix the location of the target. Then the plane signals the magnetic course and the estimated speed of the target which data is desired for predicting the target on its course. Then the plane signals to the battery the bearings of two lines intersecting at the target, each of which bearings is taken on prominent points ashore, such, for instance, as Diamond Head and Barber's Point. By means of these two bearings the position of the target may be plotted as by observation from a horizontal base line. In addition to the foregoing, the radio signals of the plane when over the target will be used for setting the radio direction finders to be installed ashore at the ends of a long horizontal base line.

It is to be noted that all features of this system are progressive so far as the use of the plane is concerned and the data obtained by each step is accumulative and, eliminating personnel errors, should be confirmative within the instrumental errors.

It is proposed that after the first few shots are fired, the plotted course of the target will be altered as indicated by the fall of shots as reported by the airplane, and when indicated as necessary the position of the target will be located again as in the first instance.

(b) Practicability of employing Air Service personnel in conjunction with Coast Artillery armament for position finding and observation of fire when other means are not available.

The system described above (a) furnishes a ready means for position finding, even for short range work when for any reason the terrestrial system of position finding is inoperative due to destruction, interruption of communications, smoke screen or otherwise. Mobile batteries may find it very useful when time does not permit laying the many miles of field telephone wire which is, at times, otherwise necessary. For the fixed defenses it should permit effective fire at night when it may not be desirable to put searchlights into action. This applies especially to moonlight nights when searchlights are least effective and at all times when by use of searchlights at extreme range the plane will pick up the target when it cannot be seen from shore. In this phase it should be noted that on a clear night (absence of intervening clouds) objects on the surface of the water can be seen easily from a plane when it is not at all visible to an observer on the earth's surface at approximately sea level.

The combined Coast Artillery and Air Service drill and practice at Battery Closson has demonstrated beyond doubt that it is wholly practicable to employ

Air Service personnel in conjunction with Coast Artillery armament not only for observation of fire but also for position finding. The work at Battery Closson demonstrated that the aerial observer and the pilot become a most important and integral part of the range section and that good team work can be had only by daily drill together. Aerial position finding introduces many new complexities which can be met properly only by intensive training. The intense interest and keen intelligence of the two pilots and two observers assigned to this work has done much to make possible the progress made. Their names are: 1st Lieutenant James E. Adams, A. S.; 1st Lieutenant H. W. Prosser, A. S.; 1st Lieutenant W. C. Goldsborough, A. S.; 2nd Lieutenant E. S. Davis, A. S.

Appreciating the necessity for intensive training for this duty, the Group Commander, Major Goolrick, A. S., made it possible for the same pilots and observers to work continuously on this problem. It is thought that the pilots and observers who work with the Coast Artillery on aerial position finding must be assigned exclusively to that duty in order that a high degree of specialized training may be attained. It is certain that no less time should be spent by them on this work than is devoted to it by the Coast Artillery personnel, for their part is no less exacting or complex than that of the Coast Artillery personnel.

(c) Recommendations as to materiel required in combined Coast Artillery and Air Service operations of this nature:

1. Air service equipment:

(a) There is no present indication that any plane adopted as standard for the observation type would not be satisfactory for this purpose. In this connection it should be noted, however, that more powerful radio, both telephone and buzzer, should be carried and that it would be an advantage if the plane should also carry photographing equipment.

(b) The compass should be made to read accurately to single degrees.

(c) Some sort of sight should be provided to enable the observer to know when he passes vertically over the target.

(d) The pilot should have means for knowing when he is flying exactly on a line through the target and selected land marks ashore. The open ring sight of fixed machine guns could be made to answer this purpose, it is thought.

(e) A sensitive, deadbeat, and accurate altimeter is a necessity. It should read to 50 feet or less. The altimeters now installed in the ships used for this purpose are quite unsatisfactory.

(f) A good instrument for observation of fire would be a great help, especially when fire is being directed at a target 20 to 28 miles from shore under which circumstances the observer easily may be confused as to the battery-target line on account of the invisibility of the shore due to one of several possible reasons. In the case of a target moving on a straight line its course is a good line to which the observer may refer his overs and shorts, rights and lefts. But the target may not be moving or may be changing direction. This makes the magnetic north the best reference for the spotting work.

(g) The radio communication equipment and the radio direction finding equipment present difficulties which can be overcome only by research and development, it is thought. With the radio equipment as installed in the planes in this department, the radio telegraph proved more reliable than the radio telephone.

2. Battery Equipment.

(a) An instrument is required for determining when the airplane passes vertically over the battery on its timed flight to the target (a) and (b) may be combined in one instrument.

(b) A vertical angle measuring instrument with the optical characteristics of the azimuth instrument, Model 1918. This instrument might well be an azimuth reading instrument also. It should be mounted on a rigid pedestal.

(c) The regular plotting room equipment including plotting board can be used with the addition of a few devices which can be made at any post.

(d) The radio messages from the plane must be received at the battery preferably by amplifier so as to be heard by several persons in the range section at the same time. The results of position finding by radio direction finding must be made available at the battery the instant received.

9. It is considered that the results obtained are very encouraging and it is recommended that steps be taken to secure improved instruments and equipment as recommended above and that this experimental firing be continued at Battery Closson and Battery Williston (16-inch rifles) during the next target practice year.

(Signed) A. L. FULLER,
Lt. Col., C. A. C.

The foregoing report was submitted on the work done in the Hawaiian Coast Artillery District in an experimental way, for the purpose of trying out certain proposed methods which appeared to offer something of promise in the solution of this problem.

It would be logical in connection with this problem to first determine the greatest permissible "probable error of position finding" which, combined with the probable error of the gun, will justify fairly the firing of this armament at these extreme ranges. This would be a general and somewhat theoretical determination. There is, however, a very practical side to the question of firing this armament, in action, at these extreme ranges and that is whether the accuracy life of these guns should be conserved for use at ranges where position finding can be made extremely accurate.

Even though the answer in the mind of the reader be that, generally speaking, the accuracy life of these guns should be so conserved, is it not probable that necessity may arise, at all places where long range armament is installed, even though the occasion be exceptional, for the use of this armament to the full extent of its range?

I believe that such is the case, and therefore that effort should be continued for determining the best method of position finding at extreme range.

Training in the Hawaiian Coast Artillery District

By Major Meade Wildrick, C. A. C.

THE problem of training organizations in the Hawaiian Coast Artillery District differs somewhat from that existing in other Coast Artillery Districts, due to the fact that there are no National Guard or Reserve Units in Hawaii which the Regular Coast Artillery are required to train. On the other hand, it is essential from an operations standpoint that the standard of training of all the Hawaiian Coast Artillery Units (both from an Artillery and Infantry point of view), be kept at the highest possible state of efficiency throughout the entire year. This requirement, in addition to the responsibility for large quantities of war reserve materiel, complicates to a considerable degree the training problem.

From a professional standpoint, service in Hawaii is most broadening. This results from the fact that all important types of Coast Artillery armament are manned, including fixed, railway, heavy tractor and antiaircraft artillery, and that the units assigned thereto are trained in conjunction with the Infantry, Field Artillery and Air Service commands in the performance of their primary tactical mission involving coast defense operations. There is probably no other station in our Army where there are better training facilities on account of the large number of troops available, and the ideal climatic conditions existing the year around.

Training Policies

The training of organizations in the Hawaiian Coast Artillery District is based on the following general policies:

(a) The mission of this Department is offensive, a position in readiness for attack. Mobility is vital. Under no circumstances will training foster a defensive spirit, sluggishness or immobility.

(b) Training will be progressive; however, all troops must be in condition for active service throughout the year.

(c) Discipline is all-important, and will be developed and enforced at all stages of training. It will be evidenced by the *exactness* and *precision* with which all duties are performed.

(d) In general, training takes precedence over all other duty except guard. Every effort will be made to have the attendance of officers and men equal to the number present for duty as shown by the morning report, with such exceptions as Post Commanders may specially prescribe in published order. The informal excusing of individuals from a particular drill or exercise is forbidden.

(e) Schedules will be based on a minimum of four hours training a day, except Sundays and holidays.

(f) The preparation of training programs and schedules will be given careful attention by commanders of all grades. Training cannot be conducted with full effectiveness unless planned and studied in advance.

Photo by Signal Corps, U. S. Army

FORT KAMEHAMEHA TRANSPORTATION SHOW, A QUARTERLY EVENT IN HAWAII. WINNERS IN VARIOUS CLASSES ARE NAMED AND GIVEN APPROPRIATE COMMENDATION

(g) Training within organizations will be conducted according to weekly training schedules, prepared in detail by Company and Battalion Commanders and based on the monthly programs. These schedules will be kept on file in each Company or Battery and will be available for inspection at all times.

(h) Training should be conducted so that all officers and noncommissioned officers, after they have attained proficiency in the duties of their own grades, shall be instructed in the duties of the next higher grade.

(i) An officer charged with instruction should see that he himself is thoroughly conversant with the subject matter under consideration, or if subordinates are to be used as assistant instructors, he should satisfy himself that they are qualified to carry out the instruction in an efficient manner.

Time Allotments

The Training Year is divided into two parts, November 1st to May 31st, Troop Training and Military Education, and June 1st to October 31st, Troop Training exclusively. These periods are sub-allotted to the various organizations so as to permit of continuous use of tug facilities for target practice purposes and of firing ranges for small arms practice. The training during the months of January, February and March is the same for all organizations and is basic in character as follows: (a) Gunners Instruction; (b) Preparation for Service Target Practice; (c) Preparation of Armament for Field Service; (d) Elements of Field Service and manipulation of Field Equipment, including convoy instructions.

Photo by Signal Corps, U. S. Army

Ceremony at Fort Shafter

The month of October is reserved for Departmental Exercises and the War condition period for the organizations assigned to the Fixed Batteries.

Service Target Practice

In preparing Target Practice schedules, an effort is made to have sub-caliber and service target practices conducted continuously throughout the period devoted to artillery training, thereby using available tug facilities to maximum advantage. Successive practices by a battery are so scheduled as to permit of careful analysis between each practice so that any weakness or errors developed can be corrected. Target practices are based on the solution of a written tactical problem involving the organization firing. Battery commanders are required to analyze their drills prior to target practice

and to exercise care in the preparation of target practice reports, as outlined in Training Regulations 435-55, and Sec. 2, Coast Artillery Memorandum No. 1. At least two weeks before each practice, the organization firing submits to District Headquarters a program of the firing for approval covering the following points:

(a) Type of armament. (b) Organization firing. (c) Number of rounds. (d) Statement of assumed tactical situation. (e) Method of adjustment to be used. (f) Methods of observation and fire to be employed. (g) Date, hour and location of practice.

In the conduct of target practices every effort is made to secure the maximum of benefit to the greatest number with the minimum of

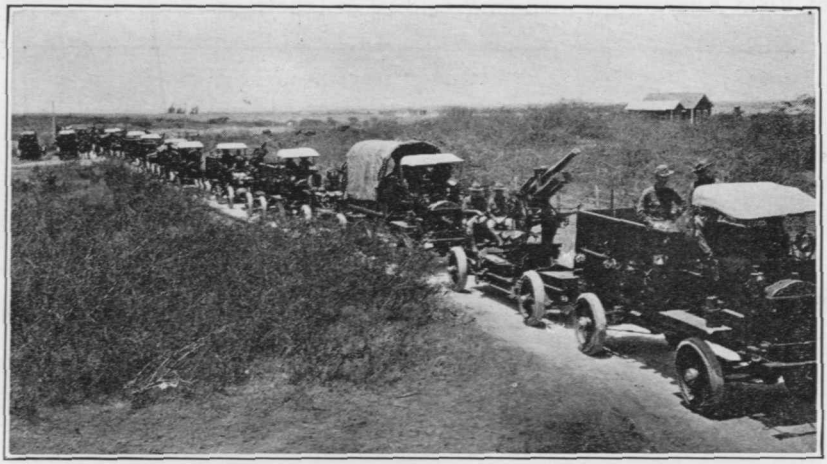


Photo by Signal Corps, U. S. Army
64TH COAST ARTILLERY LEAVES FOR A TEST RUN

expenditure of ammunition, and to train the command as a whole in the most advanced methods of fire. All officers not connected with the firing are encouraged to be present as spectators so as to make them conversant with the conduct of fire from all types of armament in this command.

MANEUVERS

During the period assigned to field training, all mobile organizations are required to be prepared to take the field on short notice.

When practicable, the organization commander in charge of the maneuver is required to submit an outline of the proposed maneuver to District Headquarters for approval at least ten days prior to the date scheduled. This outline includes the following information:

(a) Troops involved in the maneuver. (b) Equipment to be taken. (c) Location of camp. (d) Date and hour of departure. (e) Routes to be followed.

(f) Assumed tactical situation. (g) Brief schedule of instructions to be followed while in camp.

During these periods of instructions special attention is paid to convoy discipline and to training in castrametation. In case war positions are occupied, mimeographed position data forms are filled out and turned into District Headquarters for file.

Tactical Exercises

Each regiment and separate battalion is required to conduct two formal tactical exercises each month. These exercises normally are based on the training prescribed for the period in which

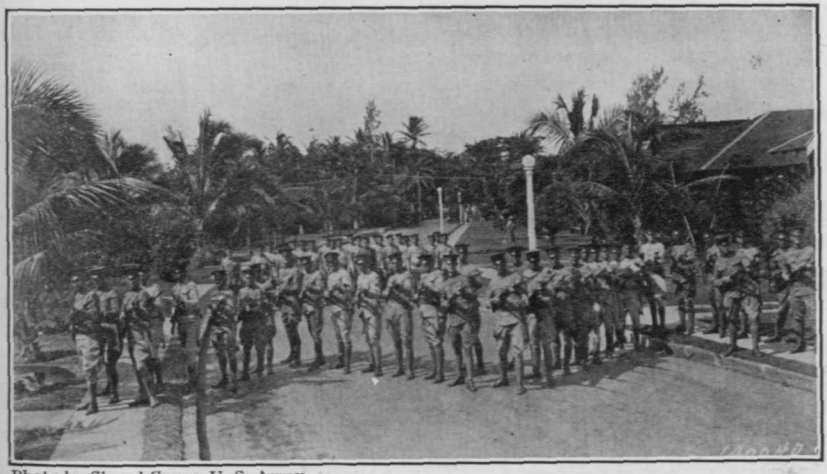


Photo by Signal Corps, U. S. Army

Students of the Hawaiian Coast Artillery District Noncommissioned Officers School receiving instruction in Riot Duty

scheduled. They are arranged so as to be progressive in character and may be in the form of communication tests, terrain exercises, field exercises, field maneuvers, etc. At least one-fourth of these exercises are required to be held at night. These exercises are numbered serially throughout the year in each organization and are mimeographed for general distribution.

Artillery Drills

The following are the general instructions with reference to artillery drills:

(a) During periods allotted to artillery instruction, time equivalent to at least one day per week will be held available for Infantry instruction.

(b) Night drills will be held twice a month during artillery instruction periods, and once a month during other periods. Searchlights and flares dropped by aeroplanes will be used to illuminate targets. A boat for the Fixed Defenses

and an aeroplane for the Antiaircraft Regiment will be available according to the following schedule.

Coast Defenses of Pearl Harbor—First and third Thursday of each month.

Coast Defenses of Honolulu—Second and fourth Thursday of each month.

64th Artillery (Antiaircraft) Fort Shafter—Second and fourth Tuesday of each month.

This instruction will be given to all organizations, both fixed and mobile, for the purpose of training the personnel in the efficient service of their armament at night. Protective measures against gas will be included in this instruction from time to time to test the adequacy of equipment and training.

(c) A boat will be available during the artillery drill day period for tracking or towing of sub-caliber targets according to the following schedule:

Coast Defenses of Pearl Harbor—Tuesday and Thursday of each week.

Coast Defenses of Honolulu—Monday and Wednesday of each week.

The Adjutant, Coast Defenses of Honolulu, will be notified as to the hour the tug is wanted, the course desired, and whether or not a target is needed. On Friday and Saturday, the tug will be available for either Coast Defense as the necessity may arise.

(d) Spotting drills will be held weekly using aeroplane and terrestrial observation. Rifle grenades fired from tug to simulate splashes.

(e) War Game Instruction will be given each organization at least once a month during the training periods devoted to Artillery instruction, this to include everything given in the War Game Instruction pamphlet, so far as the apparatus on hand permits. Special attention will be paid to the development of efficient communication details and to training in assignment and identification of targets.

Objects and Standards of Training to Be Obtained

The minimum training specifications for the Hawaiian Coast Artillery District are in the form of a questionnaire compiled by Lieutenant Colonel H. T. Matthews, C. A. C.

In general, the standards to be obtained and the subjects to be covered, other than that of Interior Company Organization are as follows:

(a) Infantry (Precision) Instruction. This instruction is the foundation of all training and will be progressive throughout the year. Every advantage will be taken of this instruction to instill in the troops smartness of appearance and military precision.

(1) Military Courtesy. (2) Soldierly Deportment and Personal Appearance. (3) School of the Squad, Company and Battalion in close order. (4) Interior guard duty. (5) Ceremonies. (6) Sufficient extended order drill to perform assigned missions. (7) Castrametation.

(b) Artillery Instruction will include the following:

(1) Service of the armament to which assigned. (2) Care and preservation of materiel. (3) Training of Fire Control details, including plotting, spotting, telephone and radio communications, and panel sections. (4) Fixed batteries to be prepared to fire on all water and land areas within range of armament and to develop and be prepared to use auxiliary and emergency fire control installation. (5) Batteries of the 55th Artillery and 41st Artillery to be prepared to fire on moving water targets and terrestrial targets from all field

positions. (6) Batteries of the 64th Artillery to be prepared to bring artillery fire and machine gun fire on aerial targets from all field positions. (7) Training in designation and identification of targets. (8) Miniature ranges to be prepared in the gun parks of all mobile organizations for the garrison training of fire control and spotting sections. (9) Each Battery to be self-sustaining in equipment and trained personnel.

(c) Development and occupation of Artillery Positions. This will include:

(1) Selection of field positions by mobile organizations to perform their missions. (2) Completion of Position Data Forms, H. C. A. D., for all positions. (3) Training of mobile organizations in the prompt and orderly occupa-

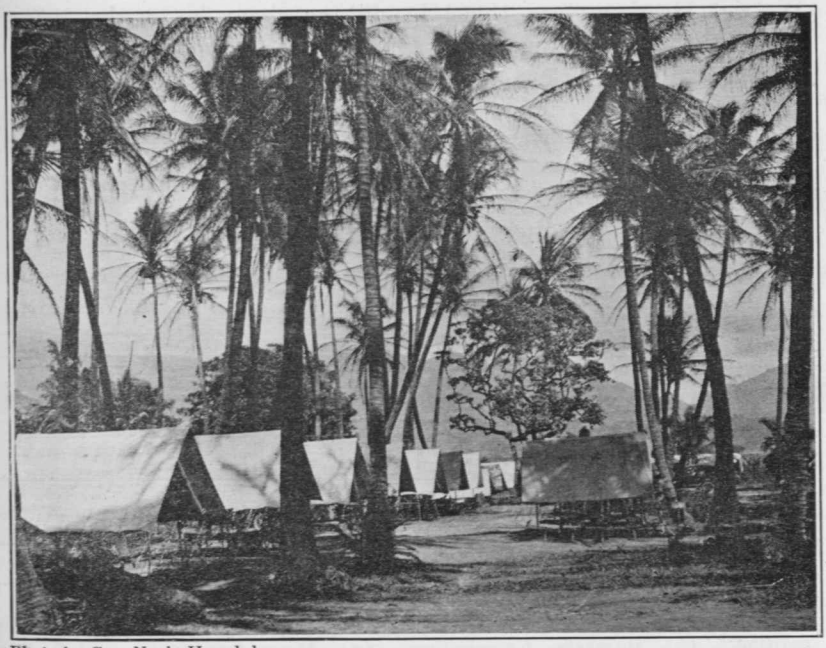


Photo by Geo. Nock, Honolulu

A Camp in Hawaii. More like the setting of a movie studio. 64th Coast Artillery at Waianae, Oahu

tion of all field positions. (4) The conduct of target practice from each position when practicable.

(d) Miscellaneous instructions will include:

(1) Equitation. (2) Saber Manual. (3) Giving commands. (4) Map reading and sketching for selected details. (5) Signalling. (6) First Aid. (7) Personal and Social Hygiene. (8) Moral Training.

Inspections

Each Coast Defense Commander and the Commanding Officer, Fort Shafter, is required to make a formal tactical inspection of his command each month for the purpose of checking the efficiency of the training of the various organizations in the subjects covered in the approved training schedules for that month. A report of this

inspection is submitted to District Headquarters for the information and guidance of the District Commander. In addition to these monthly inspections, the District Commander makes an annual inspection of the whole command during the months of November and December of each year as prescribed by paragraph 6, A. R., 265-10.

Training Schedules

Monthly Training Schedules are required to be submitted to District Headquarters, through military channels, by the 20th of each month, for the succeeding month by each Regimental, separate Battalion and Fire Commander. When approved by District Headquarters they are returned to the organization concerned and a copy is furnished Department Headquarters. Weekly schedules based on the above approved monthly schedules are then prepared in graphic form by each of the lower echelons. A file copy of each weekly schedule is required to be kept on the bulletin board of the organization concerned. In preparing schedules, unit commanders are required to make a study of the man hours available and to so arrange their schedule as to obtain the maximum benefit from the time available for training.

Competitions

Competitions are conducted periodically throughout the entire year for the purpose of raising the standard of all organizations. They are scheduled so as to fit in with the training of the command as a whole, and cover the following subjects:

(a) Transportation shows (animal drawn and motor). (b) Guard Competition. (c) Barracks Competition. (d) Mess Competition. (e) Post Competition. (f) Bugler Competition. (g) Precision Drill Competition. (h) Target Practice Competition. (i) Small Arms Competition.

Cups and pennants are given the organizations winning the above competitions and are presented to the organizations concerned with appropriate ceremonies. The standing of the various organizations and individuals in these competitions are published to the command.

Athletics

Competition in massed and recreational athletics is held normally on Wednesday and Saturday afternoons. It is believed that athletics represents one of the best means of promoting morale and esprit de corps, and for this reason Post Commanders are encour-

aged to develop as large a number of contestants as possible. Organized competition is held in the following sports: Boxing, football, baseball, basketball, track and swimming.

Unit Schools for Officers

The following courses of instructions are given in the Officers' Unit Schools:

(a) Basic Course for officers required to take same. (b) Advanced Course for all officers on duty with troops, excepting those taking the basic course, or acting as instructors.

The subjects to be covered in the advance course are submitted to District Headquarters for approval by the organization commander concerned. The minimum time allotted for this instruction

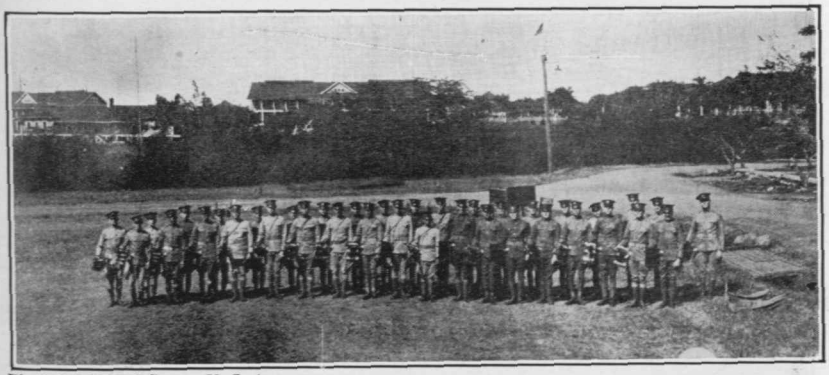


Photo by Signal Corps, U. S. Army

Buglers from all organizations of H. C. A. D. assembled at Fort Shafter for Competition. Individual and massed competition was held

during the year is 85 hours. An attempt is made to consolidate courses being given on a post by various units stationed thereat, so as to permit a saving of overhead in instructor personnel. Records are kept on file at each headquarters to which each school pertains, showing for each school day the attendance by name, the period of instruction, and the nature thereof. Certificates of proficiency are given each student upon the successful completion of a course, and the certificates so given are entered in the records of the school. Upon the completion of each course, a report is made to District Headquarters by the organization concerned, giving an outline of instruction covered, the name of the instructor, the names of the students enrolled, and the name of those students to whom certificates of proficiency have been given.

In addition to the above, Post Commanders prescribe a course of reading in Military History.

PROPERTY OF U.S.

Unit Schools for Enlisted Men

These schools are conducted by organization commanders concerned for the purpose of providing adequate trained personnel to accomplish their special mission. The activities of these schools normally cover courses of instruction not available in the Post Schools.

Post Schools

Post Schools in the Hawaiian Coast Artillery District are conducted on the policy that each command will have the following-named courses and will be self-sustaining in these and allied subjects:

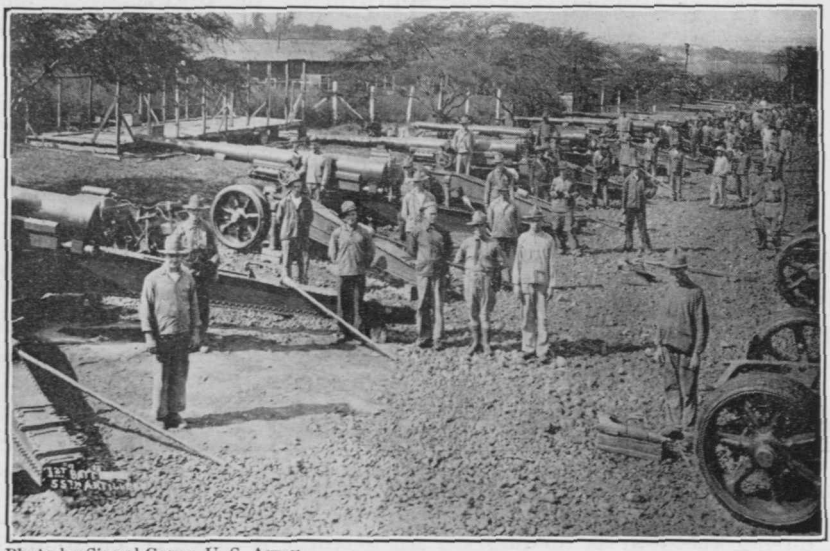


Photo by Signal Corps, U. S. Army

Artillery Drill in Battalion Gun Park of the 55th Coast Artillery

(a) Automotive Course. (b) Electrical Course. (c) Clerical Course. (d) Orientation Course.

Organization commanders are required to make a study of the number of specialists needed in their organizations to insure a high standard of efficiency therein, and if courses covering these subjects are available in the Post Schools system, they are required to detail students to take these courses, in case the vacancies cannot be filled by volunteers. During the past year a special District School in Radio Electricity was conducted at District Headquarters for the purpose of training Radio Operators. This centralization was necessary due to the shortage of qualified instructors in the three commands.

Noncommissioned Officers' School

A School for Noncommissioned Officers is conducted at Fort De Russy for the purpose of standardizing the training of noncommissioned officers in the District and of providing organization commanders with specially trained personnel available to fill vacancies. The capacity of the school is about seventy students, the duration of each course being about three months. To date twelve sessions of the school have been held and it is believed in time that a beneficial effect from this school will be felt throughout the entire Coast Artillery Corps.

Photo by Signal Corps, U. S. Army

Fun mixed with strenuous work. Hawaiian Hula Dancers entertaining the men of the 64th Coast Artillery during the annual encampment

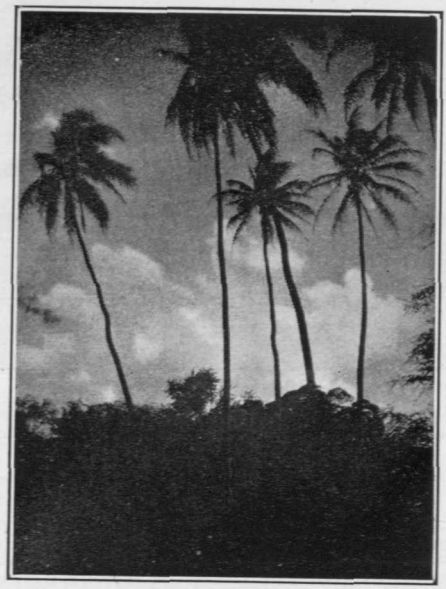
Conferences

Monthly conferences are held at District Headquarters on the last Friday of each month for the purpose of bringing the officers together, and of discussing some phase of the training of general interest to all. From time to time these conferences take the form of Map Problems, Terrain Exercises and Map Maneuvers, to illustrate the strategical and tactical principles involved in the performance of the missions of the various organizations assigned the Hawaiian Coast Artillery District.

Conclusion

The training of organizations in the Hawaiian Coast Artillery District as outlined in preceding paragraphs has for its main objective the preparation of all Coast Artillery units for immediate field service and the development of a great artillery machine wherein each type of armament is always ready to perform its mission, insofar as personnel is available.

In building up this great Coast Artillery organization during the past three years, Brigadier General J. D. Barrette, the District Commander, has insisted on simple and direct methods. There has been little lost motion due to waste effort, and as a result each officer and enlisted man can now clearly see the great progress that has taken place and can take pride in the fact that he himself has assisted in the accomplishment of the District mission.



Operations in the Hawaiian Coast Artillery District

By Major C. A. French, C. A. C.

Editor's Note: *The purpose of this paper is to outline briefly the operations, policies, methods and accomplishments of the Hawaiian Coast Artillery District.*

This subject may logically be discussed under the following heads:

a. Peace time operations; which may be further divided as follows: (1) Operations which have for their principal purpose the training of personnel and development of equipment, including map problems, maneuvers, target practices, etc., and (2) Operations which involve principally the securing of data for use in the preparation of war plans, preparing of field orders, operation maps, etc., including the selection and orientation of, and compilation of battery, battalion and regimental positions for mobile units; O. P.s for all units; searchlight positions; plans for modifying fixed emplacements to give all-around fire; camouflage studies; camps; ammunition dumps, etc.

b. War time operations: These include the employment of troops immediately preceding and during actual hostilities.

The armament of the Hawaiian Coast Artillery District is comprised of practically all calibers of fixed guns and mortars; 12-inch railway mortars; 155-mm. guns; 3-inch antiaircraft guns and 240-mm. howitzers.

Map Problems, Maneuvers, Etc.

Each unit is required to hold two tactical exercises each month; these may be by regiment, battalion or smaller units, and may be in the nature of map problems, assumed tactical situations during drills; maneuvers; transportation shows and other exercises of this general nature. In general these exercises assume some phase of an attack on the Island of Oahu and are carried on progressively throughout the year for the various units. For the harbor defenses these may include assumed attacks, raids, etc., by enemy naval craft; enemy landing operations in which the harbor defenses are supporting mobile troops; local battery protection; practice marches; castrametation; camouflage problems, etc. For mobile units these

exercises include, in addition to those given above, convoy problems, occupation of various positions about the island, etc.

Each unit is required to have some maneuvers away from its home station some time during the year. For the mobile units these maneuvers are as frequent as the supply of gasoline will permit. As far as practicable, gasoline is allotted to the various units based on the maneuvers planned for the year and training requirements at the post. The following figures though more or less approximate, give some idea of the speed at which various types of armament can be moved and placed in position ready for action, and amounts of gasoline required for their movement with present equipment, assuming that positions are previously prepared as to orientation and installation of all communication except local battery nets.

Unit	*Miles per hour*	*Gallons Gasoline per mile*	*Hours to go into position*	*Gasoline per day to maintain unit in camp*
Bn. A.A. (3-Gun Battery) 1 S. L. Battery	7	25	1 to 3	150
Bn. 155-mm. Guns (3 batteries)	2	50	2 to 4	100
Bn. Railway Mortars (2 batteries)	12	10	1½	20

These figures depend considerably upon the nature of the terrain, weather conditions, etc. Each unit is required during each maneuver to keep records from which these figures can be compiled. The figures given here are based upon the results of last year.

In order that all units may have training with some type of mobile armament, the five active companies assigned to harbor defenses have an alternate assignment to mobile antiaircraft guns and searchlights. They are organized into a provisional antiaircraft battalion and receive training with the mobile equipment of the 64th Coast Artillery under officer and noncommissioned officer instructors from that regiment. The provisional battalion goes into camp at some place preferably away from the harbor defenses and carries on the regular drills, firings and other operations that pertain to such a unit.

From time to time throughout the year, combined district tactical exercises are carried on involving all units of this command. These take the nature of map problems, using the operations map at these headquarters; communication problems, first on a miniature scale and later involving the actual communication equipment of the District; and District maneuvers in which some tactical situation is assumed as for actual hostilities. These involve issuing of necessary

orders by commanding officers concerned; operation of all message centers; certain movements of troops and all other operations incident to a state of war.

Target Practice

Target practice has for its principal purpose the training of personnel in the efficient use of its equipment at all ranges and under all possible conditions, and the perfection of such equipment with a view toward its use in war. The importance of hits per gun per minute and the ability to fire at ranges including maximum range at moving targets, both aerial and water as well as fixed targets, is impressed upon all concerned. Both terrestrial and aerial observation with two-way radio communication are required. The Coast Artillery works in close cooperation with the Air Service, both in preparation for and during actual target practice. Coast Artillery officers are encouraged to make flights during target practice to observe the effect of fire from the air and to familiarize themselves with the difficulties of aerial spotting. Sleeve targets towed by airplanes have been developed and used with excellent results, both during drills and actual target practice with the antiaircraft artillery.

This has not only afforded the antiaircraft artillery considerable training and assurance in their equipment, but has furnished valuable data for use in future firing. Target practices for fixed and mobile artillery are fired at moving water targets towed at maximum speed to include maximum ranges for day and to maximum range of illumination at night. For the present year these are on a competitive basis. This has given an added interest to all concerned and is already showing excellent results. Before the beginning of target practice season for the present year a district target practice schedule was prepared based on recommendations of units concerned. Preparations for the target practice season included, in addition to the usual drills, rehearsals for target practice in which rifle grenades fired from the towing tug were used to simulate splashes, aerial and terrestrial spotting, two-way radio communication and all other operations incident to actual target practice. These have contributed a great deal toward the success of the practices.

Operations in War

Before the Island of Oahu can be attacked the enemy must have at least temporary command of the sea. Our Navy, which will be the first force to come in contact with the enemy, must be driven in. The first military force the enemy will encounter will be the local Air

Service whose mission will be the destruction of enemy craft, both aerial and water, and observation of enemy movements and of the effect of our long range artillery fire.

In time of war the Coast Artillery in Hawaii will naturally perform functions of corps artillery. Targets for the fixed armament and for the railway artillery will be principally armored naval craft. This armament may also be used in support of mobile troops against enemy landing operations. Railway artillery, which can move about the island and occupy various previously prepared positions, will be effective against armored craft which might otherwise come in sufficiently close to shore to cover landing operations with their lighter caliber guns. The selection and occupation of such positions constitute an important part of the peace time training for units assigned to this armament. Targets for the 155-mm. guns will be principally transports and smaller enemy craft from maximum range (approximately 17,000 yards) to the shore line. This armament may also be used against enemy personnel and guns on shore in case a landing is effected. Actual maneuvers and target practice against moving water targets from various positions about the island have demonstrated the effectiveness of these guns against targets of this nature. Here again the vital necessity for mobility is demonstrated. These guns must be capable of being moved to any position about the island and of bringing effective fire against transports as soon as they come within range, causing landing forces to take to small boats at a considerable distance from shore. The antiaircraft artillery working in cooperation with the local air service must be prepared to protect all important utilities, fortifications, etc.

Conclusions

Each type of armament has an important mission in the scheme of defense, and each must be highly developed and trained to properly perform its mission. It is a great deal to expect of organizations that are under strength and burdened with other work such as construction of shelter for war reserve materiel, handling of such materiel, and carrying on such routine work as pertains to any post, to be always ready to efficiently and effectively maneuver and fire their armament; yet this is the standard we are striving to maintain; that is, to be able at all times to occupy any position on the island and to bring effective fire to bear on any target within maximum range.

The 240-mm. Howitzer

By Major E. B. Colladay, C. A. C.

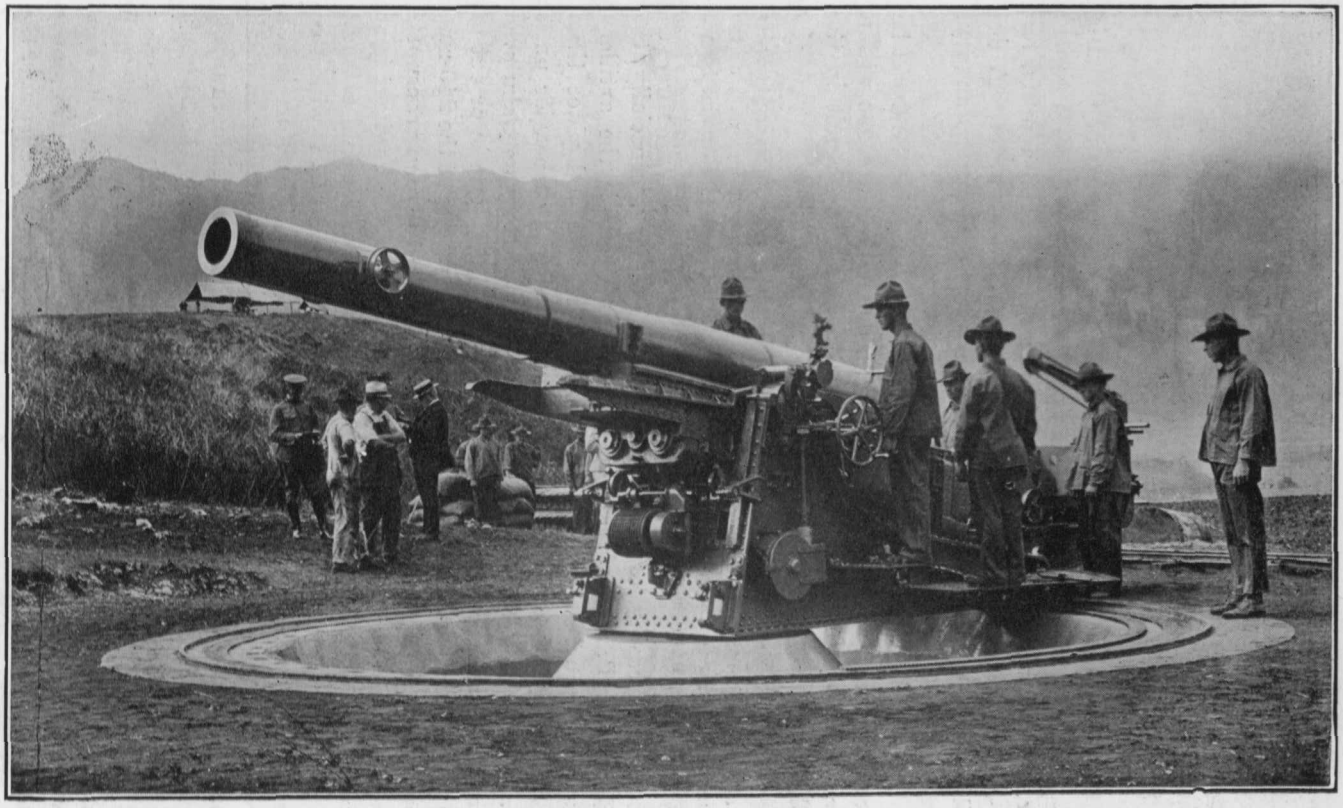
THE latest addition to the armament of the defenses of Oahu is the 240-mm. howitzer. The carriage of the howitzers designed for use in firing at land targets has been modified and adapted for all-around fire at moving targets on either land or water. A detailed description of this modification was published in the January, 1924, issue of The Coast Artillery Journal.

The distribution of the howitzer positions on this island will be such as to cover all possible landing beaches that are not within range of the guns of the fixed defenses. This will result in the following:

(a) Prevent the scattering of heavy mobile artillery now necessary in order to anticipate probable attempts of an enemy to land troops at any part of the island. (b) Force an enemy to disembark and take to small boats and barges beyond a range of 18,000 yards.

The releasing of the heavy mobile artillery, especially the 155-mm. G. P. F. and railroad mortars, will enable the artillery commander to hold these heavy units in reserve and place them where later needed. Any unnecessary movements of heavier units that can be avoided will aid materially in operations on Oahu even though the time required to place a 155-mm.G.P.F. gun in or out of position is comparatively short. It is believed that fire of the 240-mm. howitzers should be confined as much as possible to troop transports when within range. From recent tests the fire of the howitzer is so accurate that it is doubtful whether any transports would attempt to discharge troops within range of this gun which means within an approximate range of ten miles of the coast line. Therefore it is a great advantage if hostile forces are attempting a landing in small boats to be able to subject them to artillery fire at maximum ranges. It is assumed that the same support would be afforded the 240-mm. batteries as those of the fixed defenses.

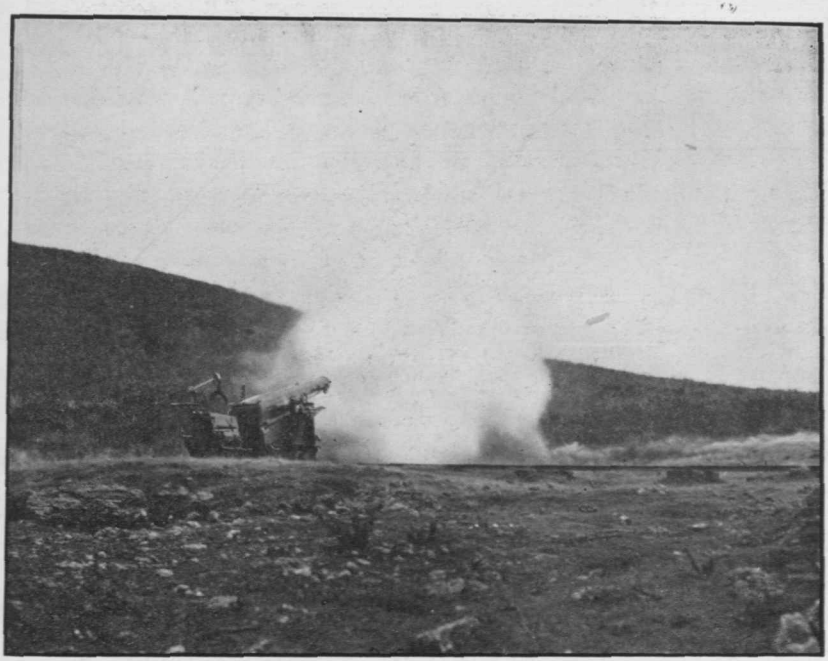
It is not intended to give the impression that this mobile gun has been transformed into a fixed mount; in fact, it is quite the contrary. The gun and carriage for the purpose of transportation are divided into four separate loads, viz.: the tube, the top carriage, the cradle, and the platform. As noted in the article previously referred to, the platform is not used when the carriage is mounted on the con-



THE 240-MM. HOWITZER IN SEMI-PERMANENT POSITION

crete gun block. It has been demonstrated that the loads can be hauled by trucks on practically all roads on the Island, and so far as mobility is concerned their use is not restricted to the original concrete gun blocks.

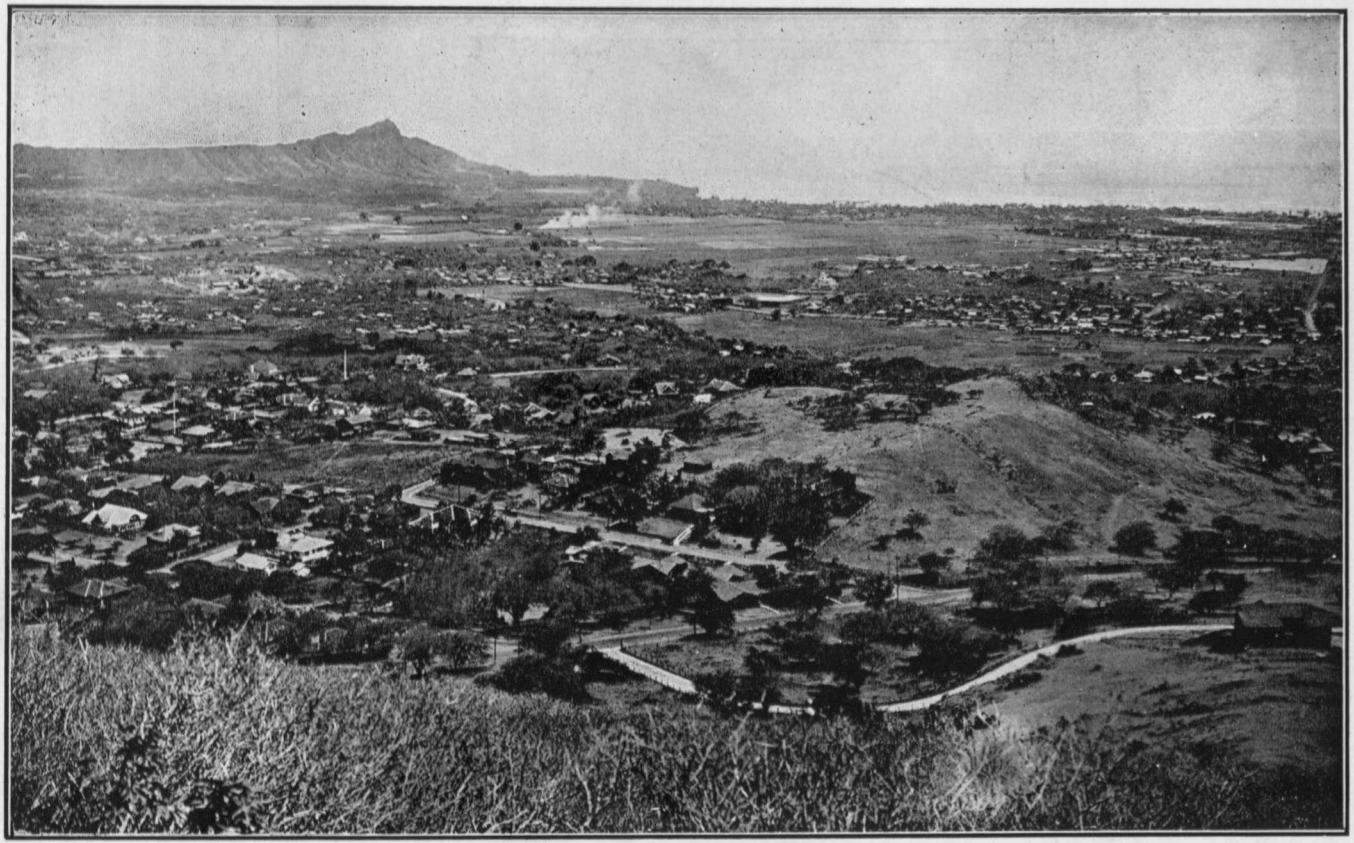
The fire control contemplated for use against a water target is practically identical with that now in use for the 155-mm. G. P. F. guns. Sufficient base lines must be established to give complete observation in all directions and a plotting board designed for rapid



240-MM. GUN IN ACTION

shifting from one base line to another. The terrain in the vicinity of each battery position is, of course, an important factor. If enemy transports are prevented from disembarking troops within range of these guns their mission has been accomplished. To do this, rapidity of fire is essential; hence the less complicated the fire control the better. Rapid fire at a ship, even though it is protected by a smoke screen or darkness, will cause it to move out of the danger zone.

This raises the question of efficient illumination of the target and the necessity for further development of mobile searchlights with greater visibility at long range. In the near future, regular target practice will be conducted, at which time problems arising in regard to fire control will be studied.



Waikiki and Diamond Head from Round Top; Fort Ruger at the extreme left at base of Diamond Head; Fort DeRussy at the right; a part

They'll Have to Fly Higher in Hawaii

By Captain W. C. Braly, C. A. C.

WITHIN what vertical range can aircraft approach coast defenses armed with the latest existing antiaircraft devices, for the purpose of bombing, without being subjected to effective fire?

The War Department asked the question and Battery "C", 64th Coast Artillery, wrote the answer against Hawaiian skies in figures both legible and conclusive. This answer was the result of special firing conducted by the Battery for a Board of Officers known as the "McNair Board," appointed by the Department Commander to consider and report on the "Powers and Limitations of Coast Artillery and Air Service." Exhaustive bombing tests were first conducted by the Board. These were followed by a program of antiaircraft firing which is the subject of this article.

The original schedule required preliminary firing at toy balloons followed by approximately thirty record shots at a sleeve target towed by airplane at altitudes of 4000, 6000 and 8000 feet, both day and night. (Total for record, 180 rounds.) This was later modified to omit night firing at 6000 feet.

The position selected was a point on the beach in front of Battery Selfridge on the Fort Kamehameha Reservation. The strength of the battery was such as to permit of only one gun section, a range section and communications section. Guns used were the 3-inch trailer mount, Model 1918 A. A., on the 1917 carriage. Range equipment included the altimeters, R. A. corrector and A. A. telescope. The base line measured 3063 yards from B′ on the parapet of Battery Selfridge to B″ on the cable hut at Ahua Point. An observer was stationed at B″ to report overs and shorts in range. This man's line of observation was almost perpendicular to the plane of fire during a large part of the course.

The Regimental Operations Officer stationed two observers at each base end to observe and record deviations right or left, over or under, from their respective stations. Two other details similarly stationed and using A. A. telescopes read the horizontal angles from base line to target at the instant of burst. The data obtained from these observations was used later in plotting the absolute deviations of the burst from the target. The method was as follows:

Referring to Figure 1, B′B″ represents the base line laid off to scale. B″B′T′ is the horizontal angle from base line to target at instant of burst, from B′. B′B″T′ is the angle, base line to target, at the same instant from B″. Then T′ is the horizontal projection of the target at instant of burst. The angle T′B′S′ is the lateral

OBSERVATIONS.

(all angles in mils)

Horizontal angles to Target at instant of burst.		Deviations of Burst Lateral		Vertical
B′	B″	B′	B″	B′
560	2250	20 R	20 L	+10 (high)

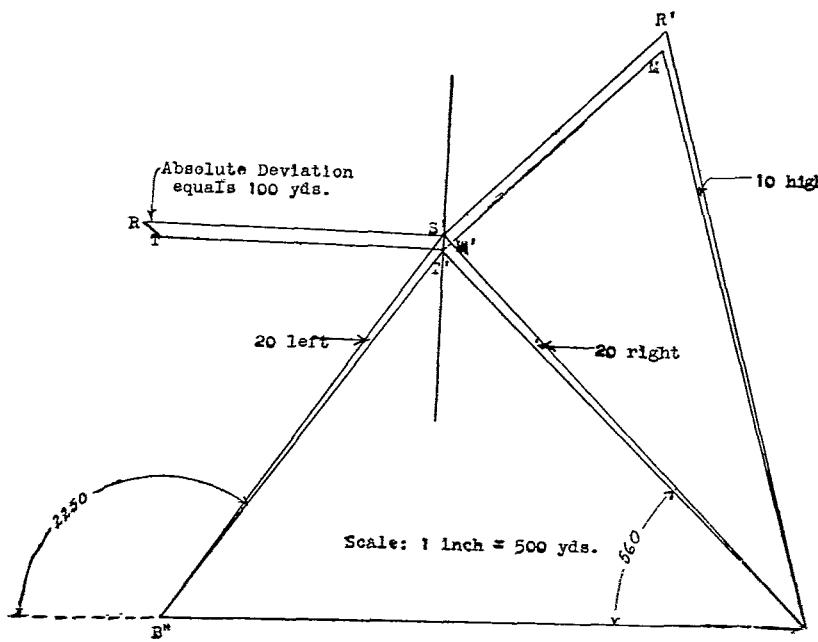


FIG. 1

deviation of burst as measured from B′ station. T′B″S′ is the lateral deviation of the burst as measured from B″. The point S′ is then the horizontal projection of the burst. Suppose a vertical plane is passed through T′ perpendicular to B′S′ and intersecting that line at M′. The point M′ is the horizontal projection of the point where the line of sight from B′ which has the same angular height as B′-target, pierces the plane whose trace is T′M′. Revolv-

ing the vertical plane whose trace is B′S′ down into the horizontal plane, this point will fall at M, a distance from M′ equal to the altitude of the target. MB′R′ is then laid off equal to the vertical deviation as measured from B′. The intersection of B′R′ with the perpendicular through S′ is then the revolved position of the burst. Suppose a vertical plane through T′S′ is revolved down into the horizontal plane, and T′T is laid off equal to the altitude of the target (M′M) and S′R is laid off equal to the altitude of the burst (S′R′). The distance RT is then the absolute deviation of the burst from the target.

A safety officer was stationed in rear of the firing position on the parapet of Battery Selfridge from which point the entire field of fire was clearly visible. An additional safety officer was stationed behind the gun with orders never to permit the piece to be fired when it was pointed ahead of the towing plane. In order that this officer might know the location of the plane during night firing an automobile spotlight was installed under the fuselage of the bomber, pointing downward.

Searchlights for night firing were furnished by Batteries "A" and "E" of the regiment. A light was placed on each flank of the field of fire, the stationary beam marking the entrance to the danger zone. Roving lights were placed on each flank of the battery about 300 yards away to illuminate the target. It was arranged with the pilot of the night towing plane that he would fire a white flare 30 seconds before beginning his turn at each end of the course. Searchlights would be taken off the target at that signal. When he had completed his turn and straightened out on his course he would fire a green flare at which signal the searchlights would pick up the target again. These signals worked admirably.

This was our first practice since receiving the R. A. corrector and A. A. telescope. We were therefore anxious to try out the new range equipment in preliminary firing at balloon targets. These consisted usually of a group of eight or ten red toy balloons and were released, on signal from B″ station, at a point about two miles down the beach from the battery. From this point the prevailing wind carried them across the field of fire at about 2500 yards horizontal range. The altitude attained varied with the velocity of the wind.

The results of the balloon firing proved very satisfactory, direct hits being obtained on several targets on different days and under varying weather conditions. The firing on one day was particularly interesting. The first target was destroyed by the twelfth shot of the series, one minute and forty seconds after opening fire.

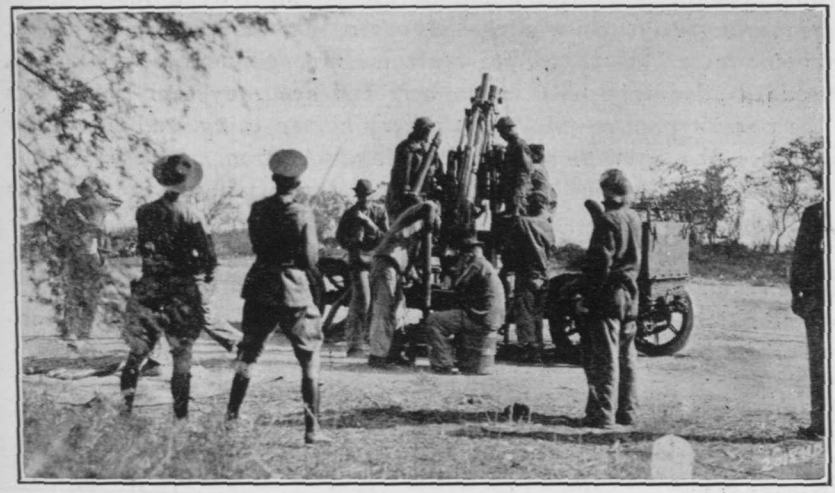
The second target was destroyed with the exception of one balloon, by the sixteenth shot of that series in two minutes and eight seconds, whereupon the gun pointer remarked, "Let's quit; this is getting monotonous." The altitude for this firing was about 1500 yards, and the true distance about 2800 yards. The next day, on the first shot at the second target the latch plate bolt broke. The gun section shifted to the next gun, opened fire on the same target and on the first shot destroyed the target. During four successive days the battery fired at thirteen balloon targets and secured direct hits on five.

The target finally adopted for record firing was the result of various experiments at Luke Field. It was a cylindrically shaped sleeve 5 feet in diameter by 8 feet long for 4000 and 6000-foot firing. The length was increased to 10 feet for 8000-foot firing. We found a red sleeve preferable for day firing and a white sleeve for night practice. The bomber took off with only a short tow line and reeled out the desired length after gaining altitude. At first a tow line of 3000 feet was used. This was reduced to 2000 feet when the absolute safety of the plane became apparent, and our final night firing at 8000 feet altitude was conducted with a tow line of only 1730 feet. At the conclusion of each practice the sleeve was dropped on the landing field after being released from the cable by means of an ingenious device perfected by mechanics at Luke Field. The cable was then reeled up before the plane landed. Throughout the practice the Air Service cooperated splendidly, towing the target day or night, whenever called upon.

This was the first firing of this nature to be conducted in Hawaii and attracted considerable attention among civilians, a number of whom were interested spectators, especially at night. The speed of the target, the searchlight beams, the rapid flashing of the guns, the bursting shrapnel and the safety of the aviator all combined to make the night firing unusually spectacular. The night of January 31st will be long remembered by "those present." The battery had fired two "strings," 16 rounds, a number of which appeared very close to the target. When the sixth shot of the next series burst right on the target and a cheer went up from the men everyone knew something had happened. The sleeve was seen to crumple and start downward while the towing plane moved rapidly away. Two searchlight beams followed it all the way down to the water where it sank at once, thereby depriving the battery of a valuable trophy. When one remembers the complications of deviations in all three dimensions, and that the target (5 ft. x 8 ft.) was moving at 70 miles per hour more than two miles from the battery,

the difficulties of this feat can well be appreciated. Next morning the Air Service reported the target and six feet of the cable missing. Mr. Donald Thompson, famous World War photographer, was on hand with his moving picture machines and photographed the event. These films were to have been released to "Fox News" but unfortunately were lost a few nights later in a fire which destroyed Mr. Thompson's rooms.

The writer has been unable to obtain authoritative information as to the effective radius of 3-inch shell. The consensus of opinion



among officers of the 64th Coast Artillery seems to be that a burst within 60 yards or less would be damaging to a plane and should be considered a hit. One fact is certain—that an increase in the effective radius of the shell results proportionately in a much greater increase in the number of hits. This is due to a definite law of spherical probability and it is thought more attention will be given to such a development in the future. The results of the five days of record firing are tabulated below:

	50 yds. or less	*60 yds. or less*	*70 yds. or less*	*75 yds. or less*	*100 yds or less*	*Total fired*
Day 4000 ft.	0	1	2	5	8	19
Day 6000 ft.	5	10	11	12	15	28
Day 8000 ft.	1	4	5	5	16	32
Night 4000 ft.	3	6	6	7	14	25
Night 8000 ft.	7	9	11	13	19	41
Totals	16	30	35	42	72	145
Pct. hits of total fired	11	20.7	24.1	29	49.7	

Our target represented a bomber on a mission, that is, flying at a constant altitude and on a straight course, therefore the results

obtained are what might reasonably be expected against an enemy bombing attack. During the time a plane is within range before dropping its bomb one battery can fire more than 100 rounds. Increased altitude does not materially affect the accuracy of antiaircraft fire. Eight thousand feet is near the maximum altitude attainable by service bombers, yet it is not even mid-range for antiaircraft artillery, hence it is difficult to see in the face of the above figures how any measure of success could attend a bombing attack on a position defended by antiaircraft guns. It has been suggested that any bombing squadron would be accompanied by a fast pursuit squadron with machine guns. However, such an argument does not "hold water," as the antiaircraft machine gunners would have a decided advantage both in numbers and accuracy over gunners in the pursuit planes. Morale is a very human thing, and the writer believes the average enemy bombing squadron would be doing "squads right about" by the time a leading plane or two was brought down.

While this article was being written the battery completed its first regular service practice for 1924. The results are worth mentioning. A burst within 60 yards or less of the target was considered a hit. Only one gun was used.

	DAY	*NIGHT*	
No. rounds fired	17	21	Total— 38
Elapsed time	68 sec.	117.8 sec.	Total—185.8 sec.
Average time per shot	4 sec.	5.6 sec.	Av.— 4.9 sec.
Number of hits	7	8	Total— 15
Mean deviation of hits	22 yds.	41 yds.	Av.— 32 yds.
Percentage of hits	41%	38%	Av.— 39.5%

Fifteen hits in 185.8 seconds is equivalent to *4.84 hits per gun per minute.* That means bringing down a bomber every 12.4 seconds for each gun, or over 19 planes per minute for one battery of four guns. The Regimental Motto is "WE AIM HIGH." The men of Battery "C" believe they have set a new mark for antiaircraft units to shoot at. As they say in Hawaii, "Hoao e oi ae, ina e hiki." (Beat that if you can).

Searchlights of the 64th Artillery in the Hawaiian Department

By Captain C. S. Brice, C. A. C.

THE peculiar problem of mobile searchlight organizations in the Hawaiian Department is the upkeep of a constantly increasing number of units (without an increase in personnel), and the necessity of such training as will make possible a rapid expansion into a large number of new organizations. The function of the mobile lights is at the same time threefold; antiaircraft work, seacoast work with intermediate and major caliber coast artillery guns, and beach illumination with infantry and field artillery organizations.

The materiel assigned at present to the two searchlight organizations, Batteries "A" and "E" of the 64th Artillery is twenty Mack Searchlight units to Battery "A" and fifteen Cadillac units to Battery "E". The number is constantly increasing. Coast Artillery coast defense alone requires a much larger number of mobile lights than on hand at present and this number is hardly more than half those needed for all purposes on Oahu. During the past two years the major portion of the work of the searchlight batteries has been on maneuvers with mobile coast artillery batteries, with field artillery, and with infantry regiments, with a little display work with various civilian organizations—yacht races, regattas, celebrations, etc.—thrown in to complete a well rounded life. Almost constantly from March 1st until November 1st one or more searchlight platoons has been in the field.

Aside from the pleasure of the cooperation with other organizations, and the joy that the men always take in maneuvers, considerable constructive work has been done in calculating the efficiency of different types of lights, and in formulating principles for the selection of positions for the illumination of naval targets. Comparative tests with photometric readings made by the writer largely with personnel and materiel from "A" Battery, 64th Coast Artillery, indicate a marked superiority both in range and in intensity of illumination for seacoast work of the 60-inch fixed light over either the Cadillac or Mack lights. The Cadillac light showed a similar superiority over the Mack light, but suffered in comparison with the Mack as regards length of continuous operation.

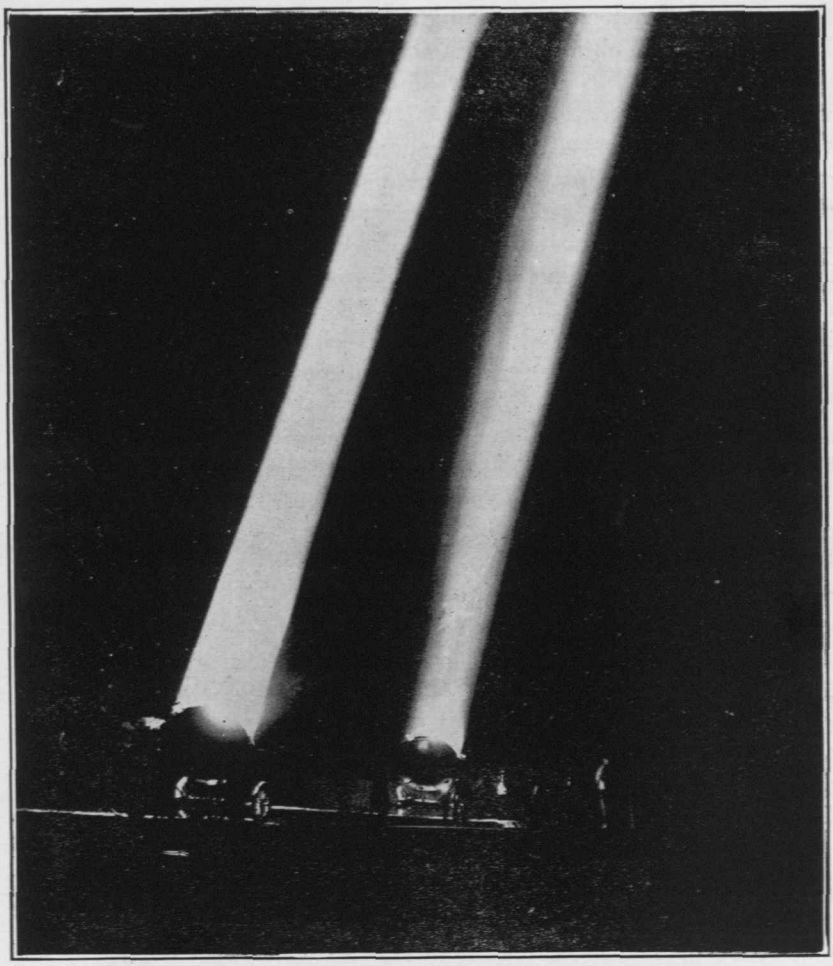
The commonly accepted effective range of the Mack light is 8000 yards, though no authoritative statement as to the ranges of either the Mack or the Cadillac lights seems to exist. An actual effective range for the Mack light under favorable conditions, by photometric test at Wailupe Radio Station August 17, 1923, was found to be 10,500 yards. The intensity of illumination of the Cadillac light is to the Mack light as 3 is to 2 (photometric test Fort Shafter, June 26, 1923), which gives an effective seacoast range for the Cadillac of 12,800 yards, approximately.

The test referred to was made in the following manner. A Cadillac light and a Mack light were placed facing each other at a measured distance of 316.57 meters, and the lights turned directly on each other with a photometer in between. The photometer showed an equality of illumination at a distance of 141.12 meters from the Mack light, and 175.45 from the Cadillac light. 175.45 squared is to 141.12 squared approximately as 3 is to 2.

The experimental work in picking positions for lights was even more interesting and instructive, and resulted in conclusions of a more radical nature. The conclusion drawn is that as a rough though fairly safe rule of thumb a light may be moved back two yards from shore for each gain of one foot in elevation with a resulting gain in efficiency in illumination over the sea level shore line light.

The topography of the island of Oahu is such that high elevations can be gained within comparatively small distances from nearly all points on the coast. In the tests made Mack lights were placed at elevations of 10 feet, 200 feet, 350 feet, 470 feet, 585 feet, and 975 feet with distances back from high water mark of two yards, 800 yards, 950 yards, 1175 yards, 1200 yards, and 2200 yards respectively. Four complete sets of measurements were made, ranges of target from directing point varying for the first set from 4700 to 5125 yards, for the second set from 6200 to 6800 yards, for the third from 5500 to 7000 yards, and for the fourth from 8400 to 9400 yards. The third set of readings was discarded, due to the fact that the course of the tug, carrying the target in the bow, facing toward the stern, during this period was perpendicular to the line of sight, presenting the side of the tug to the lights instead of the stern, thus throwing the beam on the target at an acute angle, and distorting the calculation of candle power. The relative efficiency of the six lights, however, was the same in this set of readings as in the others. Measurements were taken with a photometer. A target four feet square was placed, as stated, toward the bow of the boat, and covered with a sheet; a light of known candle power, in a box open toward the target only, was maintained at a constant voltage

at about 35 feet from the target, and on a line between the target and the light beam; the photometer measured the candle power of the light reflected from that portion of the target covered by the orifice of the instrument.



SEARCHLIGHTS OF BATTERY A, 64TH COAST ARTILLERY, TRACKING A TOWED AERIAL TARGET

In strictly antiaircraft work successful searchlight illumination has been seriously crippled by two factors, one the lack of any listening apparatus, and the other the lack of any method for distant control. Without these two things, or without either of them, antiaircraft guns are seriously handicapped in night work, a handicap which can be minimized slightly by unusual skill in the controller

and by expedients adopted to offset the noise of the power unit and the blinding effect of refracted light on any operator closer to the searchlight than about 150 yards. In tracking water targets excellent results have been obtained by using telephone control. The observer is connected by a direct line to a headset worn by the controller. All movements of the light are at the observer's command. Best results were obtained by an observer on the flank with sufficient elevation (regardless of the elevation of the light) to obtain a good view. This same method has been tried with airplane targets with some success, but is too slow and clumsy for effective use. The best expedient tried by Battery "A" is a cupped shield constructed of tin, painted black, placed over the controller, or maneuvering bar, between the controller and the lamp. The distant telephone control is of assistance in finding a plane, and the shield in following. Best results in tracking have been obtained with the use of one light only, though it is believed that with distant control two lights, as laid down in training regulations, would be most efficient. Actual following of the towed sleeve in target practice has been fairly simple, due to the fact that the approximate location of the target was known from the safety lights carried by the plane.

The relative efficiency of Mack and Cadillac lights in antiaircraft work has likewise been subject to test, but as no instruments of precision were applicable, it remains a mooted question. The writer inclines toward the Mack on account of its dependability, endurance, and ease of maintaining a proper focus. On June 12, 1923, a Mack light picked up and followed for some distance a low flying plane at an actual range of 8000 yards. Its normal effectiveness, given proper control, against aircraft has proven to be about 5000 yards actual range.

Athletics in the Hawaiian Coast Artillery District

By 1st Lieutenant R. W. Crichlow, C. A. C.

ATHLETICS form a very important part in the life of both the officer and enlisted man of the Hawaiian Coast Artillery District. From the time of his arrival until his last day on the Island, there are opportunities for the trained man to display his prowess, or for the untrained man to improve and develop along some line of athletics.

Photo by Signal Corps, U. S. Army

Presentation of Honolulu Sector Baseball Cup to Fort Kamehameha

In general, the seasons for football, baseball and basketball are divided into four periods, or phases, as follows:

1. The Preliminary Season. 2. The Honolulu Sector League. 3. The Department Championship Series. 4. The Service Championship Series.

The Preliminary Season covers a period immediately preceding the regular season. At this time, post leagues, composed of teams from batteries and companies, are formed in each post. In these post leagues, many hard fought battles are staged in the struggle for the much coveted post championship. This preliminary season serves to interest a large number of men in the sport, and results in

Photo by Signal Corps, U. S. Army

THE ARMY-NAVY FOOTBALL GAME AT SCHOFIELD BARRACKS

the discovery of new material that might otherwise be overlooked. During the past basketball season there were approximately 250 men participating in the past leagues throughout the District.

A league composed of teams from the six posts in the Honolulu Sector, and known as the Honolulu Sector League, is formed at the close of the preliminary season. The enthusiasm first aroused in the preliminary season, grows as the regular season progresses. This fact is demonstrated by the large attendance at the Sector League games.

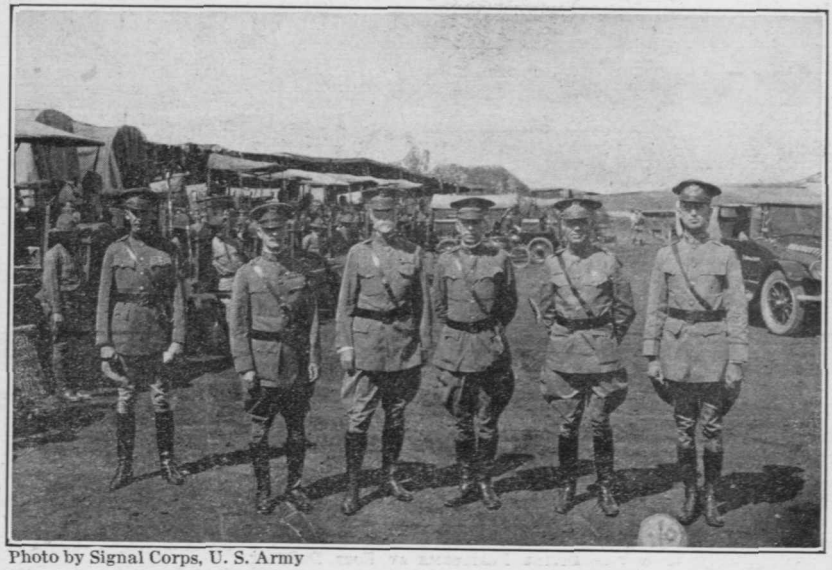


Photo by Signal Corps, U. S. Army

FROM LEFT TO RIGHT: *Lieut. G. R. Burgess, C. A. C., Aide-de-Camp to General Barrette; Major General W. J. Snow, Chief of Field Artillery; Brigadier General J. D. Barrette, commanding the Hawaiian Coast Artillery District; Colonel R. E. Wyllie, C. A. C., commanding the 64th Coast Artillery; Captain B. C. Anderson, F. A., and Major W. C. Foote, C. A. C.* THE JOURNAL *is especially indebted to Lieutenant Burgess for valuable assistance rendered in preparing the Hawaiian number of* THE JOURNAL.

The team winning the championship of the Honolulu Sector League automatically becomes the nucleus about which a team to represent the Sector is built. The Honolulu Sector team is organized for the purpose of playing a series of games with the Schofield Sector, to determine the championship of the Hawaiian Department.

From the material of these two Sector teams an Army team is formed, the Army champions winning the privilege of forming the team. The one objective of this team is to beat the Navy.

It may be seen that the four periods of a season are progressive steps in the building of stronger and better teams. Each period is a stepping stone to bigger and better games, with the season finally ending in an "Army-Navy Game."

The above procedure was slightly changed during the past football season, in that a Department Football Team was organized at the beginning of the football season, and was entered in the Honolulu Football League. This was done in order that the Army team might have a longer training period, as a team, before meeting the Navy. The plan was a success. The Army team emerged from the conflict on the victorious side of a 16-14 score, before a crowd of 12,000 spectators.

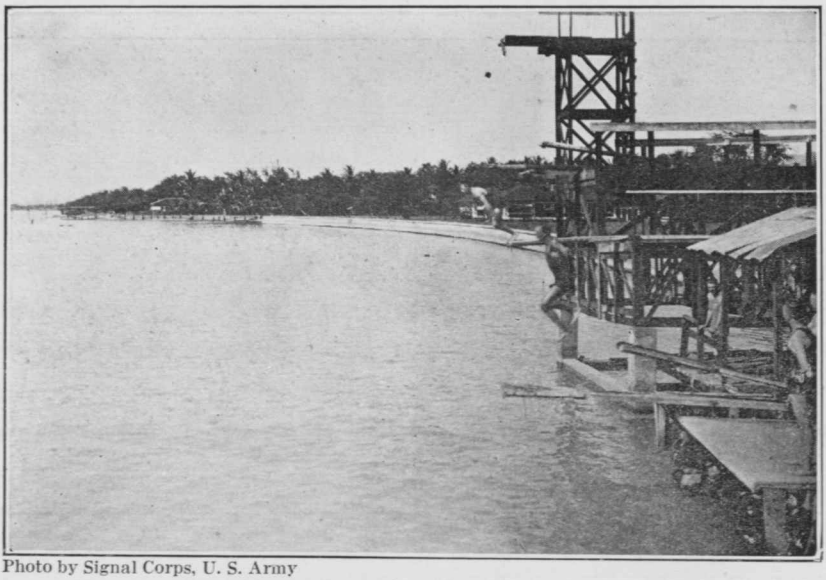


Photo by Signal Corps, U. S. Army

DIVING PLATFORMS AT FORT DERUSSY

The Army-Navy Basketball and Baseball Series were also won by the Army. This gave the Army the Service Championship in the three leading sports.

Boxing, a favorite sport everywhere in the Army, is no less popular in Hawaii. Each post in the District has a local boxing smoker every month. The fighters for the local smokers may be secured by the post giving the Smoker, from any post within the Honolulu Sector. In addition to the local smokers, each post is required to hold a General Smoker twice a year. A General Smoker is defined as one in which fighters from the Navy, National Guard, or Schofield Barracks participate. The smokers are always well attended. Army, Navy, and civilians gather to back their favorite fighters. With the material available from their own and other posts, athletic officers are usually able to put on a card which pleases the most bloodthirsty fight fan.

In Hawaii, the law prohibits the charging of admission to, or the offering of prizes in, the boxing contests. In order to meet the expenses of these smokers, athletic associations have been formed at some of the posts. Members of these associations pay dues and receive membership tickets which admit the holder to all athletic entertainments given by the Post Athletic Association. The fighters, in the General Smokers only, are paid a small sum as "training expenses." No training expenses are paid for the local smokers.

Photo by Signal Corps, U. S. Army

A SECTION OF THE ARMY STAND, ARMY-NAVY GAME

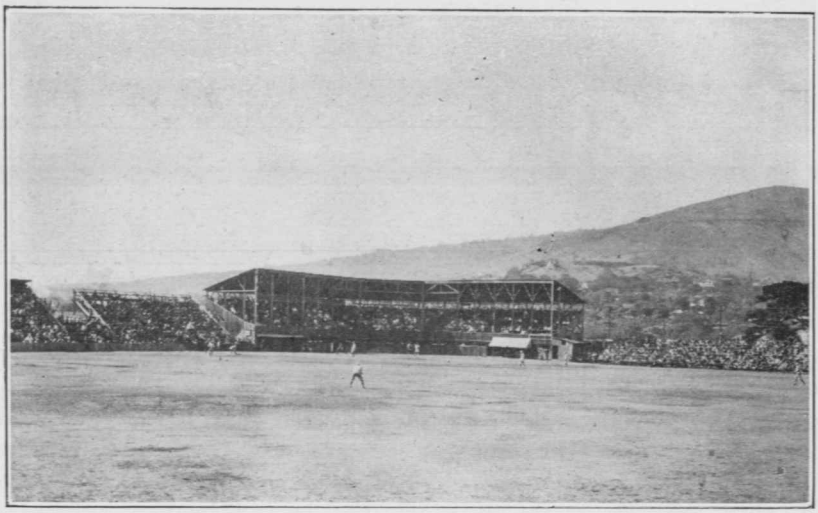
Swimming is, more or less, an everyday occurrence, especially at the posts of De Russy and Kamehameha, where there is excellent salt water swimming, and at Fort Shafter, where there is a very good fresh water tank. Swimming meets are held from time to time throughout the year, and Army swimmers make a very creditable showing, even in meets in which the best Hawaiian swimmers compete.

The Department Field Day is an annual event and is another contest in which the Honolulu Sector meets the Schofield Sector. As a means of selecting and preparing the Honolulu Sector Team, a District Field and Track Meet is held prior to the Department Meet. The winners in the District Meet constitute the team which competes with the Schofield Sector.

One of the bright lights in the future of athletics in the Hawaiian Coast Artillery District is the athletic field now under

construction at Fort Shafter. The field is being built in a natural amphitheatre commonly known as "The Gulch," and when completed will have a football field and baseball diamond encircled by a running track. This field will undoubtedly be the scene of most of the big athletic contests in which the service teams are engaged.

The athletic work for the entire year is outlined in a Training Memorandum published the first of each year. This plan has been found very satisfactory in that it gives each post something more definite upon which to work, and advertises the sports long in advance of their season.



A TIGHT GAME IN THE ARMY-NAVY BASEBALL SERIES

Rifle Grenades for Spotting Practice

By 2D LIEUTENANT E. C. ENGLEHART, C. A. C.

TO TRAIN spotting observers and spotting sections, it has been found practicable by the Coast Defenses of Honolulu to fire phosphorus rifle grenades from the tug to simulate the splash of a major caliber projectile.

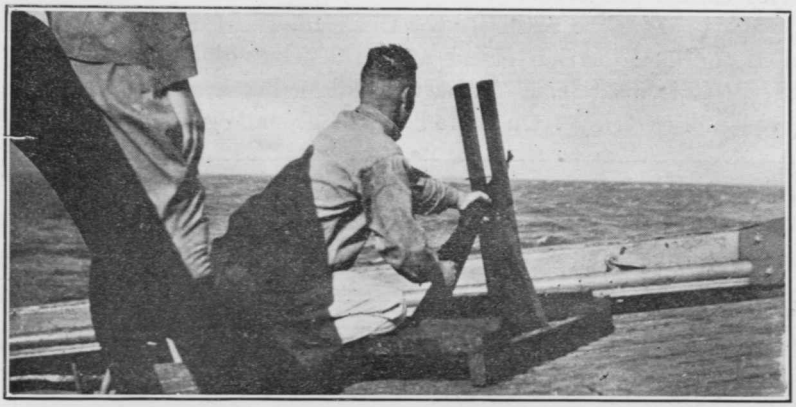
This grenade is made by the Chemical Warfare Service and is called the Combination Hand and Rifle Grenade Mark I, W. P. Filler. It is fired from the service rifle using a special C. W. S. Pyro blank cartridge. On exploding, the grenade gives a dense cloud

of white smoke, easily seen at a range of 15,000 yards, and probably visible at any range at which the tug may be seen by observers on short. The grenade bursts 4½ seconds after being fired from the rifle, but if it bursts under water it does not produce the smoke to spot on.

In using these grenades for the Coast Defenses of Honolulu, an elevation of the rifle was found for which the burst would be a foot or two above the surface of the water. A stand was then built to hold the rifle at that elevation, which gave a distance from the rifle to the burst of about 200 yards. By using a tow-line a little less than 200 yards long, and firing the grenades from the stern of the tug, bursts were then placed with respect to a pyramidal target.

In using these grenades only a few difficulties will be encountered. Rough weather not only has its effect on the detail firing the grenade, but also requires that the grenade be fired at the instant that the tug is on an even keel. If it is fired at any other instant,

the burst is either high in the air, or else under water. In the latter case, nothing to spot on will be seen. A second difficulty is due to the fact that the grenade will always explode at the same actual distance from the tug. Therefore, bursts cannot be shifted for deflection and range with respect to the gun-target line separately. A third difficulty is that the smoke is persistent, and observers are apt to take their time in reading on it. A slight wind will carry the smoke a considerable distance in a fraction of a second, but this gives an excellent opportunity to impress on observers the necessity of reading at the instant of burst.



However, regardless of any difficulties, there are a great many possibilities for training. If the tug is equipped with a radio set, a battery commander on shore may assume a small probable error, and fire a problem, adjusting for range only, by sending the correction called for from the results of his spotting section to the tug by radio. The officer on the tug can then place the next burst in accordance with the correction ordered by the battery commander. In actual trial, it was found that only about three minutes elapsed between bursts in a problem fired in this manner.

Salvos may be simulated by using several rifles, giving an opportunity to train spotters in reading on a group of splashes. Any type of fire may be easily simulated.

If it is expected to have aerial observation for target practice, the use of grenades for preliminary practice presents a good opportunity to determine the accuracy of the aerial observer.

In addition to day practice, these grenades were also fired by the Coast Defenses of Honolulu for spotting practice at night. It was found, though, that the burst of the phosphorus grenade at night more nearly resembles a Fourth of July celebration than the splash of a major caliber projectile.

COAST ARTILLERY BOARD NOTES

Communications relating to the development or improvement in methods or materiel 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.—H. J. HATCH, *President Coast Artillery Board.*

New Projects Initiated During the Months of April and May

PROJECT NO. 220, COAST ARTILLERY FIRING.—This project is a review and coordination of the most important Coast Artillery Board Projects of the past two years. It gives the Coast Artillery Board's opinion as to the primary missions of Coast Artillery weapons. It is a comprehensive discussion of Preparation and Regulation of Fire, covering in detail the steps necessary in the preliminary preparation of a battery for action, and the detailed procedure in the fire control section for the regulation of fire using devices and methods which the Board has recommended for all classes of seacoast armament.

PROJECT NO. 221, FIRING TABLES FOR 14-INCH GUN, M-1920-MII, FIRING 1400-LB. A. P. PROJECTILE were received and commented on by the Board with a view to putting them into final form for printing.

PROJECT NO. 222, TIME RANGE AND TIME AZIMUTH INTERPOLATING DEVICES.—The Board is considering several methods of determining ranges and azimuths and sending this data to the guns at intervals more frequent than the observing interval. There are several advantages to be gained if this can be done quickly, conveniently and accurately. In case of a relay in mortar fire it should be unnecessary to wait a full predicting interval before firing. In Case II fire, especially from rapid fire guns, the correct range or elevation can be kept set continually, thus permitting the guns to be fired as rapidly as they can be loaded. If the interval between predictions is 30 seconds it is quite feasible to send corrected ranges, and azimuths, if necessary, to the guns every 10 or 15 seconds. Several means for accomplishing this result are being tried out during the present season at Fort Monroe and Fort Eustis and report on their relative merits will be made later. More detailed descriptions can be obtained by anyone interested on application to the Coast Artillery Board.

PROJECT NO. 223, MEADE UNIVERSAL SPOTTING DEVICE.—Papers in reference to this device were transmitted to the Coast Artillery Board by letter from Captain E. C. Meade, C. A. C.

The basis of the device is the measurement with a spotting instrument at the battery of the vertical angle subtended by a line joining the target and the splash when both are waterlined. The waterlining of a splash under any condition is impractical of attainment with any accuracy. This condition is too well known to require discussion. The proposed device requires simultaneous waterlining of both target and splash. Very small angles being measured, very small errors in

waterlining target or splash will affect results considerably. In view of these conditions, the Coast Artillery Board believes that Captain Meade's proposal is based upon a principle which cannot be applied satisfactorily to the spotting problem. It is therefore unnecessary to pass on the mechanical features except to state that the Coast Artillery Board believes the proposed instrument would be quite expensive. It is noted that this device was used at Fort Mills, P. I., where there is considerable height of site. Under this condition and at short ranges the inherent errors would not be so apparent as in the ordinary case where the angle subtended would be very small.

The Board recommended: *a.* That no action be taken toward development of the Meade Universal Spotting Device.

b. That all papers and drawings in connection with the proposed device be returned to Captain Meade with an expression of appreciation for the spirit of cooperation which he has shown.

Project No. 224, Radio Equipment for Harbor Vessels and Mine Planters.—As a result of the Board's recommendations in Project No. 171, "Radio Equipment for Vessels Used by Coast Artillery," (see C. A. B. Notes, December, 1923, Coast Artillery Journal), the Signal Corps has submitted for test a radio transmitting set, Navy type, Model T-M, a 50-watt, C. W. two-tube set, such as is used on submarines. This set is undergoing test on the Mine Planter Schofield.

Project No. 225, Time Intervals for Mobile Coast Artillery.—This project has been initiated by the Board for the purpose of consolidating several studies previously made on various types of apparatus for sending out time interval signals in the field and the kind of signal best suited for field use and installation. Instead of using bell signals it is proposed to send buzzer signals over telephone lines. The signals to the base end stations to go out over the readers or observers telephones. Firing signals to plotting room and guns would go over separate lines to suitable telephone receivers (Howlers).

Project No. 226, Test of G. E. 60-inch Semiautomatic High Intensity Searchlight Lamp.—The G. E. Semiautomatic lamp is designed to use standard 16-mm. high intensity positive carbons and standard 11-mm. high intensity uncoated negative carbons. Current is 150 amperes; arc voltage is 78 to 80 volts; line voltage 115 to 125 volts. The feeding of both carbons is mechanical and is adjusted for a fixed rate which is the burning rate of average carbons. All automatic feeding features, such as thermostat and negative feed current control relay, have been eliminated. Regulation of the carbons, when necessary, is accomplished by means of handles at the side of the lamp frame.

During all tests made by the Board, from May 5th to 8th, inclusive, the G. E. semiautomatic lamp functioned satisfactorily. Hand adjustment of the feed mechanism, though seldom necessary, was made quickly and easily.

Photometric tests made on May 8th show that there is no material difference between the illumination provided by the G. E. semiautomatic high intensity lamp and the improved Sperry high intensity lamp. This was to be expected, as both lamps use the same carbons and take the same arc voltage and current.

In Project No. 79, (see C. A. B. Notes, February, 1924, issue of The Coast Artillery Journal), the Coast Artillery Board recommended that the improved Sperry high-intensity lamp be preferred in future purchases of searchlight lamps for fixed defenses. For fixed defense purposes the improved Sperry lamp is thoroughly satisfactory. So far as the Board knows no improved Sperry lamps have been purchased for the Coast Artillery. Furthermore, due to the fact that fixed

defense lights do not encounter very rough usage, as compared with mobile lights, and due also to the fact that in general, the fired defense lights will be operated by personnel more skilled than those operating the mobile lights, automatic features are less likely to get out of order in fixed lights than in mobile lights. The Board adheres to the recommendations made in Project No. 79.

The Coast Artillery Board has expressed a preference for mobile searchlights of the barrel type for antiaircraft artillery. It is understood that both the General Electric Company and the Sperry Gyroscope Company are designing such a type of light. The governing factor in such a design is weight. Recently perfected alloys give promise of enabling a barrel type light within the weight limit to be manufactured. That having been accomplished there remains to determine the type of lamp with which the mobile lights shall be equipped. While it may be claimed that the automatic features of the improved Sperry lamp may not stand up under the severe usage of field service as well as a mechanical type or semi-automatic type of lamp, the Board believes that definite opinions on the question cannot be formed until a comparative field test of the two types shall have been made.

Project No. 227, Test of Cloke Plotting and Relocating Board.—A Cloke Board of the approved design has been manufactured at Frankford Arsenal and submitted to the Board for final test before quantity production is engaged in.

Project No. 228, Metal Personal Equipment Tags.—The Board was called on to recommend on the advisability of doing away with the metal tags used at present for marking equipment and substituting therefor stencil markings for all textile articles and punch markings such as are made by the Marking Outfit, Model 1910, for leather. The reason given for making this change was that in case of loss or theft the metal tags being easily removable are practically worthless as a means of identification. The Board recommended the use of stencil or punch marks in place of equipment tags.

Project No. 229, Test of Raincoats *(Varnished and Rubberized Types)*.—Several new types of raincoats designed for issue to troops have been received by the Board for comparative test.

Project No. 230, Fire Control Headset Cords *(Navy Type)*.—Ten of these sets have been received for comparative test with the headset cords now standard. They differ from the present standard cord in that each tinsel conductor is strengthened by two steel wires and the braid is impregnated with a moisture-proof compound. The cords have been installed in the fire control system at Fort Monroe for service test.

Project No. 231, Simulation of Artillery Fire in Joint Army and Navy Maneuvers.—The Board was called upon to study and submit recommendations as to the best method of simulating heavy artillery fire during joint Coast Artillery-Navy maneuvers. During the recent joint Army and Navy exercises held in Panama, fire from both battleships and shore batteries was simulated during the day time by use of searchlights. This method was found to be unsatisfactory. The Board was unable to suggest a better method of visual signaling to indicate a firing battery than by use of a searchlight. The Board was of the opinion, however, that the most reliable method of giving to umpires and to parties to the maneuvers information of what is taking place at any battery would be by radio message.

Project No. 233, Service Test of Improved Sperry Fully Automatic S. L. Lamp and G. E. Semiautomatic Lamp.—Preliminary tests of the G. E. semi-

automatic lamp have been made. So far the Board does not feel warranted in changing its opinion, as expressed in an earlier report, that the Sperry improved automatic lamp is to be preferred for use in fixed defense lights. The two lamps are being given a comparative service test at Fort Monroe.

PROJECT No. 234, FIRE CONTROL SYSTEM *(Braccialini)*.—The Board is making a study of the Fire Control System (Braccialini) used by the Italian Coast Artillery.

PROJECT No. 235, STEPHENS UNILATERAL SPOTTING DEVICE.—Several spotting devices designed by Staff Sergeant Thomas J. Stephens, C. A. C., are being considered by the Board.

PROJECT No. 236, CASE, CARRYING, FOR BROWNING AUTOMATIC RIFLE.—The Board has been called on to recommend whether or not the carrying case for the Browning Automatic Rifle should be continued as an article of issue. The Board recommended that the issue of the carrying case be continued.

PROJECT No. 237, REVISED RANGE CORRECTION DATA FOR 1-POUNDER SUBCALIBER GUN.—Data is being computed and tabulated by the Ordnance Department.

PROJECT No. 238, TEST OF TRACERS FOR ANTIAIRCRAFT ARTILLERY.—There have been received for test 40 rounds of tracer ammunition for the 3-inch antiaircraft gun.

Previous Projects on Which Work Has Been Accomplished

PROJECT No. 172, SEARCHLIGHTS FOR ANTIAIRCRAFT ARTILLERY.—

1. This project was originated by the Coast Artillery Board, the purpose being to study and make recommendations on the desirable characteristics of antiaircraft searchlights and the necessary adjuncts in order that recommendations, if approved, may serve as a guide for future antiaircraft development and purchases.

2. *The open and barrel type lights contrasted.—a.* The open type searchlight was developed at a time when it was considered that the inferior limit of weight for a 60-inch searchlight was represented approximately by the weight of a 60-inch seacoast barrel type light. Manifestly this weight was excessive for mobile units, and the open type light was considered as the correct solution of the weight problem, at that time. 36-inch barrel type lights were constructed for mobile units but in that connection it may be stated as a basic consideration that the service requirements of an antiaircraft light demand a larger light, specifically, 60-inch.

b. Possibility of a mobile 60-inch barrel type light.—Representatives of the Sperry Gyroscope Company and the General Electric Company have stated officially to the Board that progress in the development of aluminum compounds has made possible the successful design of a mobile 60-inch barrel type light with a total weight approximately the same as the present 60-inch open type light. In view of this positive and authoritative statement it appears advisable to present the relative merits and demerits of the two types.

c. Advantages of the open type light.—(1) Light weight with attendant ease of portability and maneuverability. (2) Minimum trunnion height. This factor affects the total weight of the carrying unit and the ease of emplacement for bomb protection. (3) Minimum shipping space. This was of importance because of the transport conditions during the war, but is not of great import now.

(4) Operation by untrained personnel. (5) Lower initial cost than the barrel type.

d. Disadvantages of the open type light.—(1) Automatic features cannot be incorporated in the lamp mechanism. (2) It has thus far been impossible to design a frame rigid enough to prevent distortion of the mirror. Not only does this cause an irregular and poor beam, but it results in frequent cracking of the mirror. (3) The arc is not protected from the wind. Because of this the arc will be so shortened that the illumination will be decreased or, if operated at the proper length, is very likely to be blown out by the wind. At any rate the wind effect on the arc will decrease the illumination. (4) The wind tends to create hot spots on the mirror which intensifies the probability of cracking. (5) The mirror fouls very rapidly, particularly in summer, due to insects and dust. (6) The combined effect of the five preceding factors is estimated to reduce the amount of illumination of the open type light to 50 percent of that afforded by a barrel type light operated under similar conditions.

e. Advantages of the barrel type light.—The advantages inherent in the barrel type light are the exact opposites of the six disadvantages enumerated in subparagraph *d* supra.

f. Disadvantages of the barrel type light.—The disadvantages so far as they are now apparent, are the opposites of the five advantages specified in subparagraph *c* supra; in connection with those disadvantages the following considerations are of moment:

(1) In connection with the weight factor attention is invited to subparagraph *b*, which states that the barrel type light can be made approximately of the same weight as the open type. At any rate the limit of weight is that which can be carried on a truck or touring chassis and maneuvered therefrom by the light crew. While on the subject of weight and mobility, it is worthy of note that it is not considered necessary or advisable to consider the design of a fixed A.A. light. This opinion is based on the supposition that a mobile barrel light is practicable of manufacture; that the tactical location of searchlights generally will require their installation outside of present government reservations and that concentration on one type will simplify supply and training.

(2) The design of a barrel type light capable of 90 degrees elevation with a trunnion height comparable with that of the open type light is admittedly difficult. That design has now progressed to the point, however, where the trunnion height is only 1 foot more than in the present open type mount.

(3) Whereas it was the original intention that the open type lights would be shipped to France "stacked", such was not the actual practice as they were crated individually. At any rate it is not considered that the space factor is of vital importance.

(4) The barrel type light with automatic features would require more highly trained personnel for successful operation and maintenance.

(5) While the initial cost of the open type light is lower than that estimated for the barrel type, the difference, as experience has shown, actually will be offset by the expense due to more frequent mirror breakage in the open type light.

(6) An additional disadvantage in the barrel type light is that the front door absorbs about 20 percent of the light. Therefore the front door of the barrel should be removable in order that this absorption may be eliminated on calm clear nights.

g. The Board is of the opinion that there is a decided preponderance of advantages inherent in the barrel type light. Particularly it is anticipated that the better illumination afforded by the barrel type will be a deciding factor.

3. *Control.—a.* The present pipe control is unsatisfactory, aside from the visibility consideration, because elevation is too slow and too jerky, and because the operation of the control shakes the light itself appreciably.

b. Manual control of any kind is not satisfactory in that it does not enable the operator to take his station at the point of most favorable visibility. This point has not been definitely determined yet, but experiments so far undertaken indicate that it is about 100 feet on the flank of the light.

c. Manual control has the advantage of simplicity and reliability. While it may be possible to develop a satisfactory electric control it can never be as reliable in operation as a mechanical control similar to that now in use.

d. The pipe control places the operator always on the flank of the light. In a remote control it is difficult for the operator to maintain his position on the flank but this disadvantage can be overcome by making the control portable as hereinafter specified.

e. By means of a remote electric control the operator can concentrate entirely on observing his target inasmuch as no application of force is required to maneuver the light. This presupposes that the observer can be trained to the point where the operation of the remote control will not require thought—that is, that the observer will not think of the direction in which he must move his control handles, but will act subconsciously. That this proficiency can be obtained through training is the present belief.

f. It is the opinion of the Board that a remote electric control is desirable and essential for the efficient operation of an antiaircraft searchlight. The Board is now testing an impulse type controller and while that test is not completed, (nor is it the intention that this should be in any way a report of that test) reference will be made to some of the results so far obtained to show that such results have been attained in contradistinction to those that are desirable but not yet noted in the actual operation of a controller. Following, then, are the characteristics of a remote control as they are now held desirable:

(1) Synchronous operation.—The operation of the control synchronously with the light is not necessary and therefore is not desirable. It is not necessary because the operator is interested in but one elevation and azimuth, namely, the original data furnished by the sound apparatus. It will be required therefore, that a disengaging mechanism of some description be given the light in order that it may be set according to the data furnished by the sound apparatus, independent of the control system. Being unnecessary synchronism is not desirable because of the added complication, weight and expense incident to the synchronous system. Of course, if a synchronous system can be devised without the objectionable features now considered inherent in such a system, the objections noted here will not obtain. It has been suggested that a repeat back synchronous transmitter should extend from the pilot light to the plotting section for a continuous record when the target is "seen." This point is worthy of consideration, but is separate from a study of control requirements. The G. E. impulse type controller is non-synchronous.

(2) Power.—The controller and motors must operate from the searchlight power plant without interfering with the power necessary for the efficient maintenance of the arc. This is accomplished in the G. E. impulse controller.

(3) Speed.—The speed characteristics of the G. E. impulse type controller are satisfactory. The slow speed in azimuth is one complete revolution in about 25 hours and the maximum speed is three revolutions per minute. The speed in elevation is about two-thirds (2/3) of the speed in azimuth. This speed may be insufficient for a plane passing close by the light, but such a target would be extremely difficult to follow regardless of the speed of the light.

(4) Operation lag.—There should be no appreciable lag in the response of the light to the controller. It should be possible to change from full speed in one direction to full speed in the opposite direction instantaneously. In these respects the G. E. impulse type controller is satisfactory.

(5) Method of controller operation.—The necessity for turning a crank at varying rates of speed or performing some similar operation detracts from the ability of the operator to concentrate on following the target. The G. E. controller has a vertical and an azimuth lever which are thrown in one of two directions without appreciable application of force. The direction of throw determines the direction of movement of the light and the amount of throw its speed. This system is eminently satisfactory. It has been suggested that a "joy" stick or single lever type of controller be developed. Past experience with such a type would indicate that it is much easier to control the elevation and azimuth separately unless the controller could be pointed like a telescope and operate the light synchronously. This would probably introduce greai complication, increased weight and added expense.

(6) In general the controller and control system must be rugged and relatively simple to insure continuous operation under field conditions.

(7) Weight.—The controller and cable must be light. The principal advantage in a remote control is the ability of the operator to station himself at the point of maximum visibility, which is on the flank of the light. As the light is traversed parallax becomes a factor and the advantage of maximum visibility is lost unless the operator be able to move with the light (within reasonable limits). The amount and frequency with which the observer will have to change position depends on the rate of angular travel of the target. A light weight controller with 100 feet of cable can be moved easily but during such changes of position the target will escape the beam unless it be held by the other lights of the group. This contingency should not be relied upon. It appears that the controller should be carried on a light wheeled support which can be propelled over the ground without interrupting the manipulation of the controller. The top of this supporting stand should revolve freely that the operator may orient himself continuously with respect to the light.

4. *Characteristics of the lamp mechanism.—a.* Medium and High Intensity.—Comparisons between high and medium intensity lights have been made on various occasions and opinion of the value of the medium intensity light still varies. It is conclusive, however, that the role of the medium intensity light (if it be given a role at all) is for searchlight operations under certain peculiar atmospheric conditions. It is to be substituted in a specific emergency for the high intensity light. It is the high intensity light that should receive greatest attention and development. It is quite likely that the medium intensity light may be omitted entirely as a result of future tests.

b. Automatic features.—It is exceedingly difficult, if not impossible, to rotate the positive carbon correctly or maintain the focus properly by hand, which entails great loss in illumination. The mechanism must be either automatic or

semi-automatic in operation but in any event hand operation must be possible immediately upon failure of any automatic feature. Whether the full automatic or semi-automatic lamp be adopted should depend on future comparative tests of the two types.

c. Weight and rigidity.—Weight should be made a minimum as it affects the total weight to be carried by the unit. The lamp must be absolutely rigid in order that the arc length and focus will not be altered as the lamp supports become inclined upon elevation of the light. The system of supporting the lamp in the barrel must be such as to permit rapid removal of the lamp without sacrificing firm support in the barrel.

d. Inverted operation.—The lamp must be capable of inverted operation for at least the duration of an ordinary searchlight action. It is noted here as requirements for the mount itself that 180 degrees elevation range is desirable to obviate the necessity for a 180 degree traverse when the target passes the zenith.

5. *Carrying Unit.—a.* Self-contained.—It is considered desirable that the present practice of carrying the light itself on the vehicle which furnishes the power for its operation be continued, thus avoiding trailers or duplicating vehicles with attendant increase in road space, amount of materiel and maintenance difficulties. There are three general types to be considered: The touring chassis type, as exemplified in the Cadillac unit; the speed wagon, or light truck type, as represented by the Sperry Duplex unit and the truck type like the Mack truck mobile searchlight unit.

b. The touring chassis type.—The performance and test records of the Cadillac power unit leave little to be desired particularly from a consideration of reliability and continued operation under full load. The continued use of this same unit is amply warranted by its established records. It is possible that it may not be practicable to carry a barrel type light on this chassis in which case it would be necessary to revert to a heavier type of chassis. So long as the Cadillac unit can carry the light, it should be retained because it is a satisfactory power unit, because of the greater maneuverability of the touring chassis type and because its retention does not complicate the problem of the supply of spare parts. The following minor changes in the Cadillac unit are suggested:

(1) The present vehicle is capable of a rate of speed far beyond any tactical requirement and is therefore likely to be dangerous in the hands of enlisted chauffeurs. This is intensified by the great weight of the loaded unit and its high center of gravity. The center of gravity of the loaded vehicle should be lowered and the gear ratio reduced.

(2) Decrease the load on the rear tires. The rear tires on the present mount are overloaded. Perhaps this defect could be overcome by the use of double wheels or balloon tires.

(3) The cable reels should be redesigned so that only the length to be used need be unrolled.

(4) A winch and cable or other means for maneuvering the light in and out of the truck should be supplied.

c. The light truck type.—This has characteristics very similar to those of the Cadillac. It has sufficient speed and carrying capacity for present lights but the characteristics and reliability of its power unit are not known. It appears that its substitution for the Cadillac unit would be warranted only by a thorough demonstration of a comparable reliability or perhaps the question may be affected by cost or supply considerations.

d. The truck type.—There are numerous objections to this type due to its massiveness. While it has sufficient speed for all tactical requirements on good roads, its weight precludes its successful operation in places easily accessible to the lighter units, and results in much greater fatigue on the part of the drivers. It will carry greater weight than the other types. It is believed that this type should be resorted to only when and if the necessary weight for a 60-inch barrel type light and accessories exceeds that which can be carried efficiently by the smaller vehicles.

Recommendations.—It was recommended that such of the points covered in this discussion as may be approved by the Chief of Coast Artillery be forwarded to the Chief of Engineers in order that the development service may be coordinated with the tactical service.

PROJECT NO. 195, TEST OF SEARCHLIGHTS AGAINST AIRPLANES—COMPARISON OF HIGH INTENSITY AND MEDIUM INTENSITY LIGHTS.—In January, 1924, the Development Section of the Corps of Engineers requested the Coast Artillery Board to make a comparative test of the illumination of an airplane with a high intensity searchlight and with a medium intensity light.

On several nights during February and March, 1924, the two searchlights were tested against a Martin Bomber flying at heights from 3500 feet to 4500 feet. The plane was followed by first one light and then the other and then both beams were fixed approximately parallel and the plane passed first through one beam and then immediately through the other. The pilot of the airplane noted the intensity of the two lights as observed from the plane.

In none of the tests carried out by the Board did the medium intensity light give the same amount of illumination of the plane as the high intensity light. The pilot of the plane was of the opinion that the light from the medium intensity lamp was not so intense as that from the high intensity lamp.

It has not been practicable to conduct tests during conditions of visibility under which the medium intensity light is theoretically superior, because under such conditions targets will not fly.

The Board bases its conclusions not only on the tests just conducted, but on the unanimous opinions expressed by artillerymen, aviators and searchlight engineers. It seems conclusive that the high intensity light is far superior to the medium intensity light under conditions of good visibility. It is the opinion of the members of the Board and others consulted that the conditions of poor visibility under which the medium intensity light is theoretically more efficient will also be conditions of least danger from night bombardment aeroplanes and furthermore, that the actual increased efficiency, if any, of the medium intensity light under those conditions would not be sufficient to warrant the additional cost and supply difficulty incident to the duplication of lamp mechanisms.

It was therefore recommended that future antiaircraft lamp mechanisms be high intensity only.

It was further recommended that existing medium intensity lamps be recalled from the service and returned to the Corps of Engineers.

In addition to the above, the following projects have been completed, but space available in this issue of THE JOURNAL is too limited to permit publication of complete reports.

PROJECT NO. 75, FIRE CONTROL INSTALLATION AND EQUIPMENT FOR 155-MM. GUNS.—This report is quite comprehensive in its scope and carried with it a recommendation that if approved, it be mimeographed for distribution to all Coast Artillery officers.

PROJECT NO. 107, GAS MASK TELEPHONE TRANSMITTERS.—Two types of masks were tested. In one type the telephone transmitter (microphone) is an integral part of the mask and is connected to the field telephone by wires. Masks equipped with both mica and aluminum diaphragm microphones were tested. The second type of mask (Navy) is equipped with a simple vibrating diaphragm (non-microphonic). In using this type the standard telephone transmitter is held in front of the diaphragm in the mask. As a result of the test the Board was of the opinion that speech transmission is reliable and of good quality through both of the microphone transmitter masks and that the aluminum diaphragm transmitter is superior to the mica. Speech transmission through the Navy type mask is generally fair, but not always satisfactory. The Board recommended that none of these masks be adopted as standard until further experiments have been made with the Navy type mask with a view to improving its qualities of speech transmission.

PROJECT NO. 179, ANGULAR TRAVEL METHOD OF POSITION FINDING.—A complete description of this method as submitted by Captain Albert M. Jackson, C. A. C., appears in the December, 1923, COAST ARTILLERY JOURNAL. After a thorough study of this method the Board reached the following conclusions:

a. The method is impracticable because of the limitations of the field of view possible to obtain in observing instruments.

b. The method as proposed is not applicable to service conditions and therefore should not be used in target practice.

c. In general terms the proposed method is attended by undesirable complications, and does not possess sufficient advantages to merit its adoption in place of present standard methods.

It is regretted that limitation of space prevents a full discussion of the advantages and disadvantages of this method, and especially of the considerations that led to the above conclusions.

PROJECT NO. 193, RADIO SET SCR NO. 132.—Test of this set has been completed and the set has been returned to the Signal Corps Laboratories at Camp Vail, N. J., with certain modifications recommended.

PROJECT NO. 70, TATELAC WATERPROOFING PROCESS.—Uniforms and equipment waterproofed by the Tatelac process did not show up to enough advantage to warrant a general recommendation to the effect that all clothing and equipment be so treated. It was recommended, however, that overcoats and shelter halves be waterproofed by the Tatelac method.

PROJECT NO. 169, STEPHENS RANGE CORRECTION DEVICE.—The Board has completed its study of the Stephens Range Correction Device and it is hoped to publish a complete report on this project at a later date.

PROFESSIONAL NOTES

The English Long Range Gun

Extract from a report based on a trip through France and England during 1918-19, by Professor Oswald Veblen, Princeton University (then Major, Ordnance Department). Compiled by Lieutenant Philip Schwartz, O. D.

The following information was secured with regard to a long range gun which had recently been manufactured in England. This gun had not yet been fired on account of the difficulties encountered in the carriage.

The caliber of the gun is just over 8 inches. It is about 122 calibers in length overall. The chamber is about 10 feet long. There is no forcing cone but a slight taper all along the powder chamber. The chamber capacity is 11,500 cubic inches. The travel of the projectile is about 84 feet. The rifling is about one in 45; the maximum pressure about 28 (long) tons; the muzzle pressure 15 tons.

The weight of the projectile is about 240 pounds, while the weight of the powder charge is about 350 pounds.

One piece of powder which was seen was about 2½ feet in length and roughly elliptical in cross section, the axes being about one inch and one-half inch respectively.

The projectile was said to be a rifled projectile with no gas check or copper rotating band. It was said to be 8 calibers long, but this figure seems doubtful. It is possible that it was meant that the radius of the ogive was 8 calibers.

The muzzle velocity expected is 5000 feet per second and the estimated range 60 or 70 miles. French authorities who have seen the plans, however, estimate the range at 80 miles.

The gun was made by relining a 16-inch B. L. gun. It has been lengthened in such a way that no joint is evident on a superficial inspection.

The British usually allow 50 per cent of the tensile strength of the gun to be used. In this case, they are allowing 75 per cent. An interesting point to notice is that the weight of the powder charge as given above is greater than that of the projectile. If this weight were very considerably increased, the remark was made that a big part of the energy of the gas would be absorbed in the work of accelerating the charge rather than in accelerating the projectile. It is not thought, however, that the excess of the weight of the charge over that of the projectile is too great in the case of this gun.

It may be remarked that cordite is considered to be a safer propelling charge where high pressures are employed than the United States nitrocellulose powder because of the erratic behavior of nitrocellulose at very high pressures. The bursting of several guns has been attributed in England to this phenomenon. On the other hand, it may be remarked parenthetically that there is corresponding difficulty with cordite at very low pressures.

The absence of a forcing cone in the ordinary sense of the word is one of the salient features of this gun. The opinion was expressed by some officers that in future design the powder chamber will be of precisely the same diameter as the barrel. The obvious reason for the elimination of the forcing cone is that this is the point at which a gun suffers most from erosion. The erosion is due in the opinion of the British officers to the encounter of the gases with the obstruction which is offered by the forcing cone.

There is, of course, a very considerable difference of opinion as to the value of long range guns. Many officers expressed the opinion which has been cultivated by the newspapers in the public mind that long range guns are of no practical military importance. Other officers, however, pointed to the undoubted military value of the disorganization of government businesses in Paris caused by the bombardment of that city by the Germans, and expressed the opinion that there are other specialized objectives for which long range guns will be useful. It is the opinion of the writer that long range guns are bound to have a permanent place in any military establishment.

It is considered that the attempt to design long range guns will have the same beneficial effect on the design of ordinary guns that the design of racing cars has had on that of ordinary automobiles, for in order to design a gun of this type satisfactorily, it is necessary to obtain very exact knowledge on all questions having to do with interior ballistics, propelling charge, strength of the materials, design of projectiles, etc., which enter into the design of any gun whatever. It is only by having a definite and difficult problem to work toward, that advances can be made in any science.

Thoughts of a British Officer on the War of the Fnture

By General von Zwehl

(Translated from the *Militar-Wochenblatt* by Colonel George Ruhlen, U. S. Army.)

Translater's Note: *This brief extract from an essay covering twenty-three printed pages shows that the prize author confines himself almost wholly to questions of armament, technical war implements and organization. What general conditions were given him for treatment, especially in respect to scope of the work, is not known. Still the somewhat mechanical conception of the material available appears to be given prominence, while the operative sides of the war of the future: outflanking, penetration, pursuit, lengthy duration of the fight, propaganda in the enemy field of action, and similar features, are omitted.*

Only great industrial states can equip their armies in accordance with the latest technical appliances. Air armaments, tanks, gas and submarines made their appearance in the World War as new implements. These weapons are also undergoing continual development. It will be very difficult to keep the equipments of armies in line with technical progress within the limit of available national savings. A nation will therefore frequently proceed to enter war to some extent with partially outworn and obsolete equipments and to attempt to replace them only during the war itself. The application of gas is still in its initial development notwithstanding the fact that 27 per cent of American casualties in the World War were caused by it. Napoleon was the first to announce the fundamental rule that one must make relentless use of all means available for destruction of an enemy. In the World War Germany acted on these fundamentals in its U-boat war, and in its attacks from the air on London. Only the

fear of retaliation will, in the future, prevent nations from taking advantage by like measures. In battle every means is permitted. A nation fighting for its existence will disregard paper convention when it considers it necessary. The opinion of the world counts for very little when victory is in sight.

England needs a land army, a fleet, and flying forces that must have proper relation to each other. In their application in a European war the present air fighting forces of England need material increase. The transposition of commercial into war air forces will, in future, become more and more difficult. Both types will, in future, differ as much, one from the other, as does a commercial from a war vessel. Each side will seek to gain dominance in the air.

The principal feature of a battle is the attack. Formerly the infantry was the first weapon employed in the attack. In future it will be infantry with tanks. When one side has a decided superiority in tanks it may be the cause of a decisive result. The battle of the future may become a demonstration of a tank combat for superiority.

The principal culmination of artillery effect lies *in the application of gases.* Modern chemistry will strive to bring it about that gas action will demand greater sacrifice of life than it has done heretofore. A number of tanks sent out against an enemy position covered with gas will have easy working there. Motor instead of animal draft for artillery will become of greater importance. On August 8, 1918, the English used 456 tanks, but notwithstanding that, the expenditure of ammunition was greater than ever before in any other battle.

Infantry only can gain terrain and hold it; tanks, artillery, pioneers, flyers, are at hand only to enable infantry to solve its problems. The vulnerability of advancing infantry has remained the same while the destructive power of modern mechanical weapons has been advancing. This has brought about strengthening infantry in greater measure with mechanical weapons. The armies of future wars will show up a greater measure of tanks, artillery, pioneers and mechanical transport service, improvements in machine guns and anti-tank guns with mechanical transport.

An Answer to the Attacking Airplane

Under cover of secrecy scientists of several nations have been seeking a way to cancel out the dreaded potentialities of the invading airplane.

Nations which have cut down on naval expenditure are spending heavily for immense swarms of airplanes. It is felt by many that the next war is to be fought largely in the air. The defense of navies against aerial attack is possible but difficult. Not only armies but whole cities and peoples are to be attacked and if possible destroyed, we are told. And the defense against invading hosts of winged attackers is inherently so difficult that war departments have been thrown into a state of uncertainty and frank worry. Now comes the announcement of the discovery of a method of transmitting energy in quantities sufficient to annul the action of the motors of airplanes or even to destroy the planes themselves through space without other conductors than a focused beam directed by human agency.

The inventor, Mr. H. Grindell-Matthews, is the same person to whom the British government is said to have made a grant of $125,000 for the discovery of a method of distant control of a motor boat by means of a searchlight beam.

There is no fundamental reason why the same energy that may easily be focused and projected in the form of heat by means of a reflector or in the form of light by similar means may not appear in some other form or frequency of ether vibration and be projected by other means. The fact that press stories have been surrounded with superadded and imagined conjectures on the part of irresponsible reporters should not confuse the reader nor cause him to scoff too quickly. The success of this invention would mean that one of the greatest menaces to the world's future peace, the invading airplane, had been at least temporarily countered.—*Outlook.*

New Naval Planes Light and Swift

The thirty-five new so-called "three-in-one" convertible type airplanes just ordered for the Navy, known as the "CS" type, designed for bombing, torpedo launching and long range scouting, resemble in some features the Douglas "round the world" cruisers now being utilized by the Army Air Service.

According to naval aviators the "CS" type plane is the lightest ship for its horsepower that has ever been built. The new planes will be constructed of steel and duralumin, except for the wings, of course, which are of fabric and wood, so designed that they can be folded back, thus affording a marked saving in space. They are designed to be launched into the air from the catapult mounted on the deck of battleships. They may also be operated from the flying deck of an aircraft carrier. They will have both radio sending and receiving apparatus, an earth inductor compass, two machine guns, camera equipment and lights that may be used for night flying.

One of the most important features of this new ship is the fact that it is able to fly with more than its own weight as a load. In fact, with its single engine it is able to carry a greater load than twin-motored bombers that have been used in past years.

Its weight is approximately 4000 pounds. The wing-spread is 56 feet, its height is 11 feet and the length 34 feet. It has a cruising radius of about 2200 miles. It has a landing speed of about 55 miles an hour with a maximum speed, when flown as a land plane, of 105 miles an hour.—*New York Times.*