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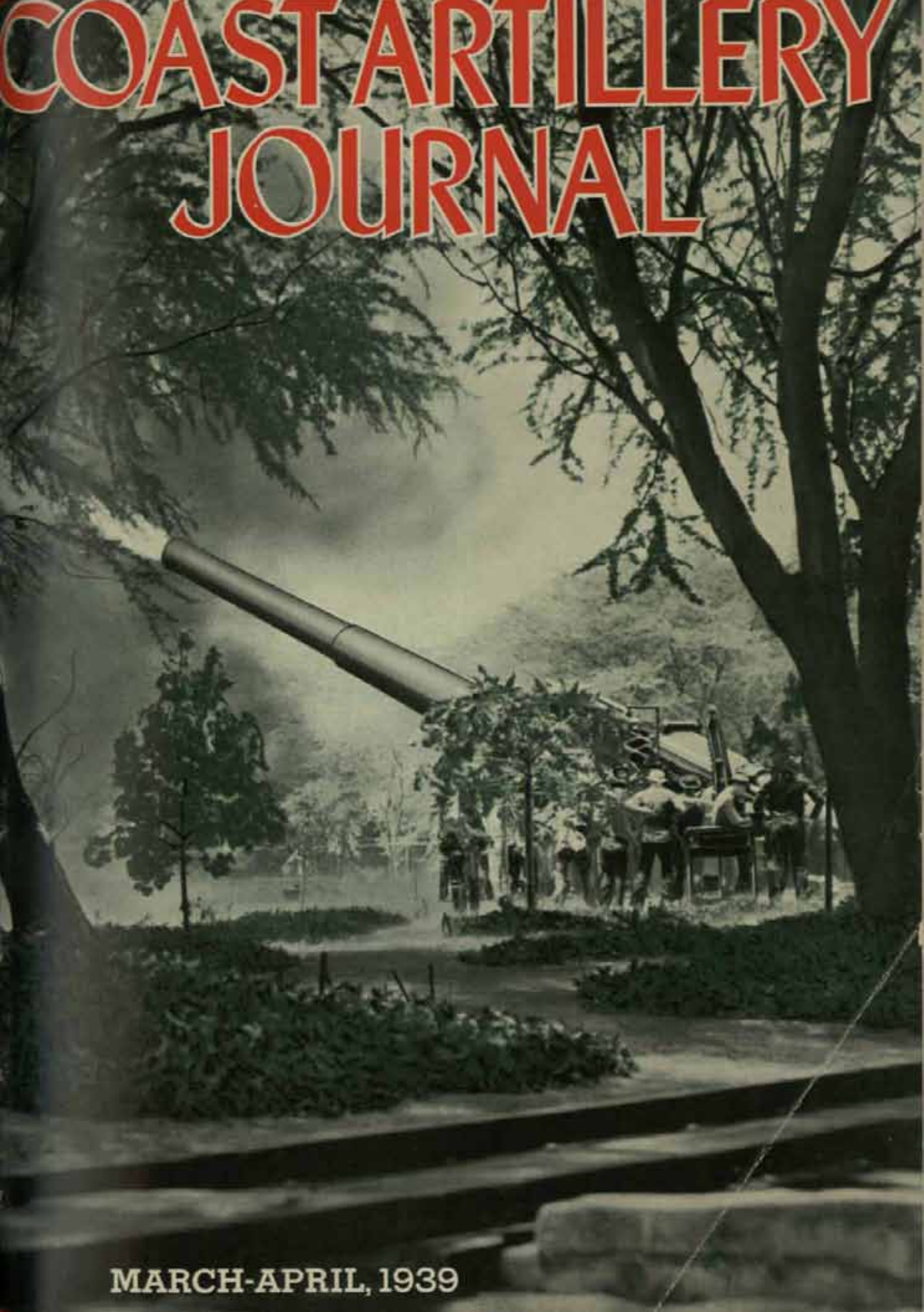

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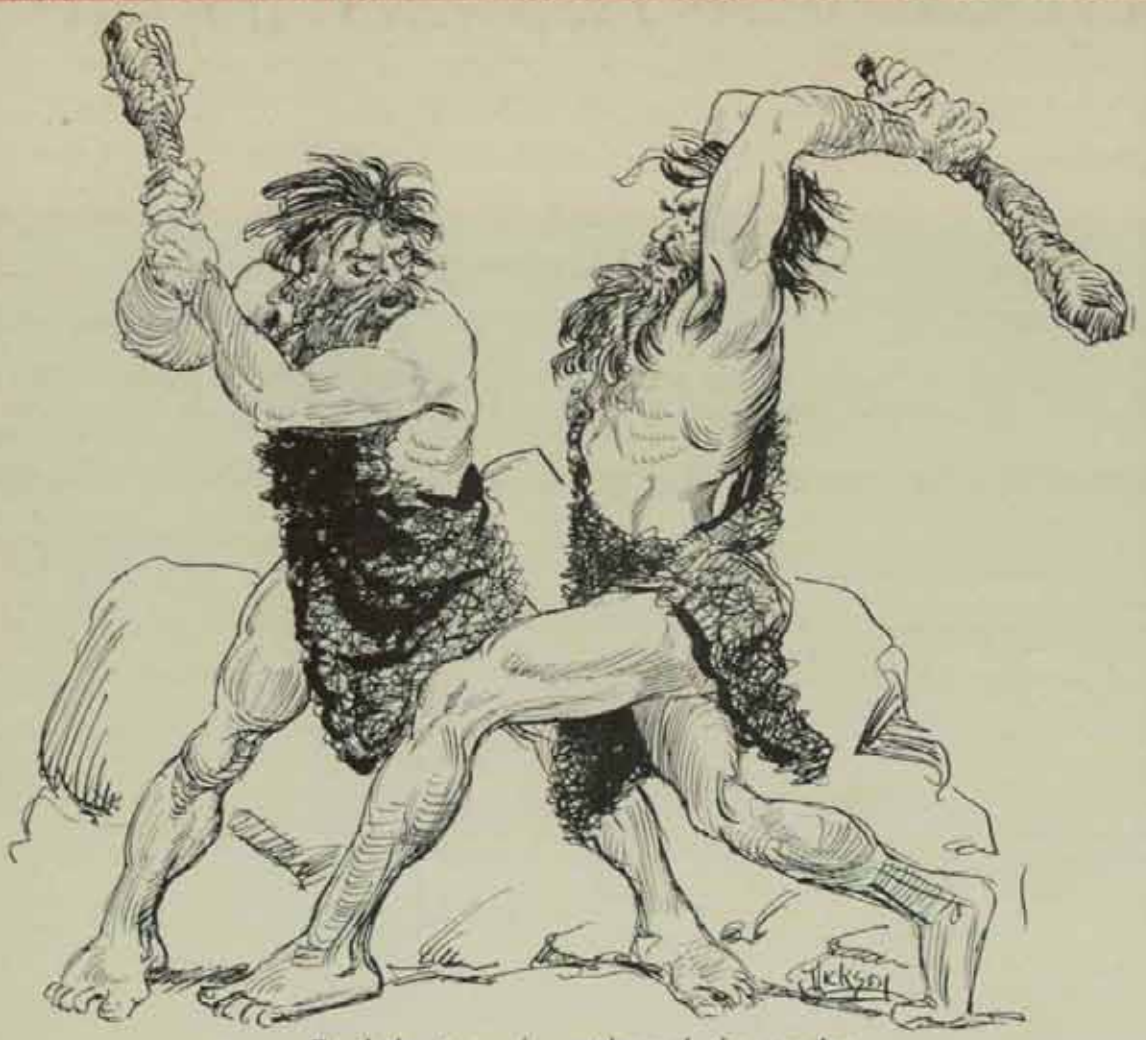

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THE CAMPAIGN OF

Bonaparte

He made a triumphal entry into Milan through flowers and a cheering crowd.

SURPRISE

in Italy

To the Roots of the Mountains

I

North Italy, Prairial and Messidor, An IV (June and July, 1796)

Lake Garda fills the mouth of the pass of Trent. On either side the roads flow down to the Italian plain, meeting at Peschiera on its southern tip. There Mincio River oozes out through sluggish marshes, twenty miles to join the Po; and near the junction point the slow stream splits in two. On that island stands Mantua, city of fevers, beauty and gloom, ringed with quagmires, set with redans mounting three hundred guns, the Austrian fetter of Italy, Virgil's town.

Beaulieu could not bring together his shattered divisions short of the Mincio line, but in the respite granted by Bonaparte's necessity to settle the civil administration of the Milanese, prepared at the end of May to dispute a passage. Army and officers were in no good mood, the first bewildered and fearful: "*Man kann es doch nicht verstehen,*" growled one old private. "These French have a young general who is ignorant of the rules of war. Today he is on your front, tomorrow on your rear. Such violation of the principles is intolerable." Intolerable, too, the commanders found it:

"The General from personal intrepidity seems to expect too much from troops in the state of minds his are now, and his Language (publicly) is not conciliatory or encouraging to officers or soldiers. His temper naturally firm, seems irritated by disappointment; on the other hand, if I may judge from the very improper language held by the officers I have conversed with, the army has no confidence in him" [says the English agent].

Yet lake and Po covered Beaulieu perfectly on his flanks; his front was fordless river with strong places to hold the issues of the bridges. His cavalry he fanned out west beyond the stream to spy which way the French were coming; then formed his cordon, heaviest at the extremities—Liptai at Peschiera with 5,000 men, Sardinian Colli, now in his service, at Roverbella with 3,000, himself at Villafranca with 8,000, 11,000 in Mantua itself. Only twenty miles for these detachments to hold; even the lightning Bonaparte would find it hard to force a crossing before they could work up a battle concentration against him.

II

On the 14th of May Bonaparte wrote:

> Kellermann will command the army as well as I; for no one could be more convinced than I that its victories are due to its own audacity. But I believe that to unite Kellermann and myself in the command is a counsel of defeat. I will not willingly serve with a man who believes himself the first general of Europe; and moreover I believe that one bad commander is worth two good ones.

On the 15th he made a triumphal entry into Milan under a plaster arch, through flowers and cheering crowds. That night came a state dinner—"to cost not over four francs the plate"—at which announcement was made that the high magistracies of Lombardy were now suppressed in favor of a three-headed French Military Commission. Its mouthpiece would be a council composed of a count, a duke, and the Archbishop Visconti; a contribution of 20 millions was levied on the banks and treasury of the duchy; a police force decreed, to wear the red-white-green of Italy. "You will be free and in safety. Your state will have five millions of people, with Milan as its capital, and you will possess five hundred cannon and the friendship of France. Be true, be united, and all will be well." The band played *ça ira* and the *Carmagnole*.

General Despinoy, with the first division of the Army of the Alps, came streaming across the lowlands during the next day; Bonaparte set him to besiege the citadel at Milan, where 1,500 Austrians still held out. That same night came an emissary from Hercules III, Duke of Modena, next territory on the south, a toothless storybook miser, who spent his time in Venice and his energy in piling pretty pieces-of-eight. The man asked a private interview, which not being granted, was forced to say out loud that he had a mule at the door loaded with caskets which held four millions in gold.

"I shall not for that sum place myself in the power of the Duke of Modena," replied Bonaparte, and levied on the duchy for seven and a half millions in cash, with two and a half more in kind, 9,000 new muskets, and

By FLETCHER PRATT

Illustrated by Howard Williamson

forty-nine pieces of artillery—"a pretty little find!" Milan had given up more guns, 2,000 horses and 50,000 uniforms, Parma more of all. The army was fed, reorganized, rested, and on the 23d May, it began to push toward the Mincio behind the screen of Kilmaine's cavalry. There were three divisions active now—Masséna, Augereau, Serrurier—with Dallemagne's special storm-troop following the horse, 30,000 men in the striking force, and two more Alpine divisions, Sauret and Vaubois, in close reserve.

At the bridge of the Oglio River a courier caught up with the general; the Lombard plain had suddenly flamed into revolt behind the army, bands of peasants on the march with cross and sword, Milan in the hands of rioters, Pavia taken where all the French sick lay in hospital. Bonaparte turned with the headquarters troops—300 cavalry and Lannes' brigade of Dallemagne—marching at such a pace as even they had never marched before. At Milan in the evening he found the city already calm; Despinoy had repulsed a sortie from the citadel, his grenadiers were patrolling the streets. He reported priests leading the rising and the key of it fear that the French would take away the people's old gods.

Bonaparte routed the Archbishop Visconti from his bed and started with him for Pavia, where the center of the trouble lay, that same night. In the morning there was a brush with peasant bands at Binasco, whom Lannes beat; the town was burned, and Bonaparte sent the archbishop in ahead of him to promise Pavia the same fate unless it surrendered.

Visconti was so old he could only mouth vague beatitudes at the rioters and accomplished nothing. At noon Bonaparte flung his 2,000 against the walls, carried them by storm, and to prevent further troubles along his communications, gave the town over to pillage. The result was so unpleasant that he stopped the work after a couple of hours and before anyone had been much hurt but the jewelers and the local tax-gatherer, who had conceived the brilliant idea of keeping the soldiers away from his house by throwing money to them from the upper windows. The captain who had surrendered the Pavia detachment was shot; the general turned back to his army, which had lost only a single day.

Kilmaine was then on the outskirts of Brescia, with Augereau and Masséna less than ten miles behind, Serrurier considerably farther back and to the south. On May 28th Bonaparte sent Kilmaine out beyond the Chiese river to Lonato, where he skirmished with the Austrian horse; one of Augereau's half-brigades was thrust far up Lake Garda to Salo, and another went to Desenzano on its southern limb—both begging, buying, and confiscating boats. Then suddenly, he ordered all the movements but Serrurier's frozen in their tracks for twenty-four hours.

III

He had calculated justly; the time was exactly sufficient for Beaulieu to riddle out a meaning to these moves, of which cavalry, peasants, and spies brought him word. The collection of boats, big Division Masséna (thrice the size of the others) far north at Brescia, Division Augereau farther north still, along the lake—all hung together and together spelled another of those fast sweeps around the ultimate flank of his line, this time by boat across the lake or even around it; Serrurier's drive toward his center must be a feint.

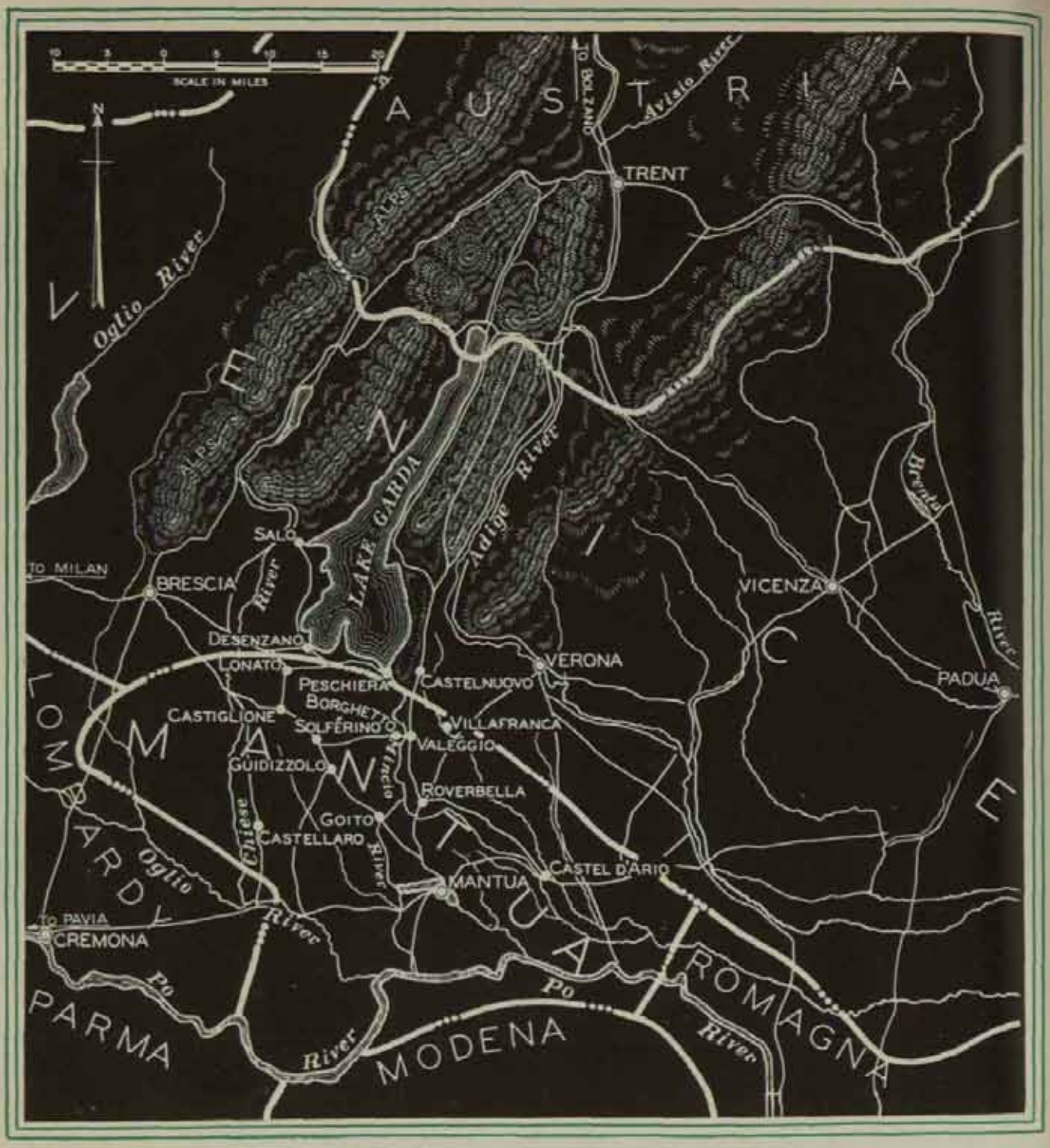
The Austrian dared not lose his grip on Mantua, the anchor of his empire's power, but the river detachments he could and did pull north toward the Peschiera region to save his communications through Trent with home, leaving only a screen along the stream.

At two in the morning of the 30th of May the villages where the French were cantoned suddenly woke to hear them beat quick-step on the tambours, then the tramp of marching men, faint clash of metal, and snatch of song. Division Serrurier switched sharply southward through Guidizzolo toward Goito to make flank-guard against any Austrian counter-stroke from Mantua. Kilmaine, with Augereau pounding along behind, went through Castellaro toward Borghetto, Masséna through Castiglione and Solférino for the same point, three-fourths of the French army concentrating on a pinhead and that pinhead on the river. Kilmaine reached it by seven in the morning and broke the Austrian outer guard; at ten Augereau's head of column came up, under a Colonel Gardanne who had stood with Bonaparte against the sections.

The bridge was afire and some Austrian guns were banging from the heights beyond; Gardanne flung himself unhesitatingly into the stream with his grenadiers behind. They had been chosen for their stature; the water came to their necks but not beyond, and with muskets held aloft they made it, charged the batteries, and captured them. Before noon the bridge was repaired, Kilmaine across and fighting a cavalry action in the plain beyond, Augereau's division passing, and Masséna waiting for him to clear.

At midday Bonaparte himself came up and directed Division Augereau northward along the east bank toward Peschiera, to break the right flank of the line between that point and Castelnuovo which Beaulieu should by now have formed. He himself lay down at an inn in Valeggio, with hot compresses on the back of his neck to relieve a nagging headache. He had miscalculated Austrian languor; Beaulieu had indeed issued orders for the formation of the Peschiera—Castelnuovo line, but only a day and a half before, so that the movements were still in progress. Sebottendorf, with part of Colli's men, had been bound north from Roverbella when guns began to boom that morning. Like a good soldier he moved toward the cannon, but like an Austrian soldier, at a crawl; his head of column came into Valeggio just after Bonaparte got to bed. The staff gave a whoop as the whitecoat column came down the street and ran down to pull the shutters; Bonaparte, with a boot in one hand, jumped out a back window, over a wall, and fled to the head of the bridge, where Masséna's men stood round their noon soup-kettles.

Map 1: The First Bite. The green area shows Bonaparte's progress prior to the opening of the Campaign of Surprise



Map 2: The Lake Garda region

Sebottendorf's weak detachment was almost wiped out when Masséna struck it; Kilmaine won his cavalry fight out eastward, with the capture of a gold-laced prince of Naples; and all day long the hammerhead of the French drive struck at and pulverized scattered Austrian bands breaking south and north from the contact. But Augereau found Peschiera empty when he reached it in the evening, and dawn brought news Beaulieu would not stand at Castelnuovo either. Completely demoralized, he had gone flying up the passes out of Italy.

IV

Milan citadel fell on the 27th of June, a month later; the big guns in storage there came down to join the others, croaking from the marshes round Mantua. Old Serrurier was commander of the siege, with 7,000 men (all that could be spared him) against 13,000 inside. His chief of engineers was a man just from the Rhine in time to repair the Borghetto bridge. Chasseloup-Laubat, uneven character, hard drinker, wild temper, but full of drive and a man who could do trigonometry in his head, set

up a battery where the fortress guns could not bear on it, less than 200 yards from the palisade, on the very night of his arrival.

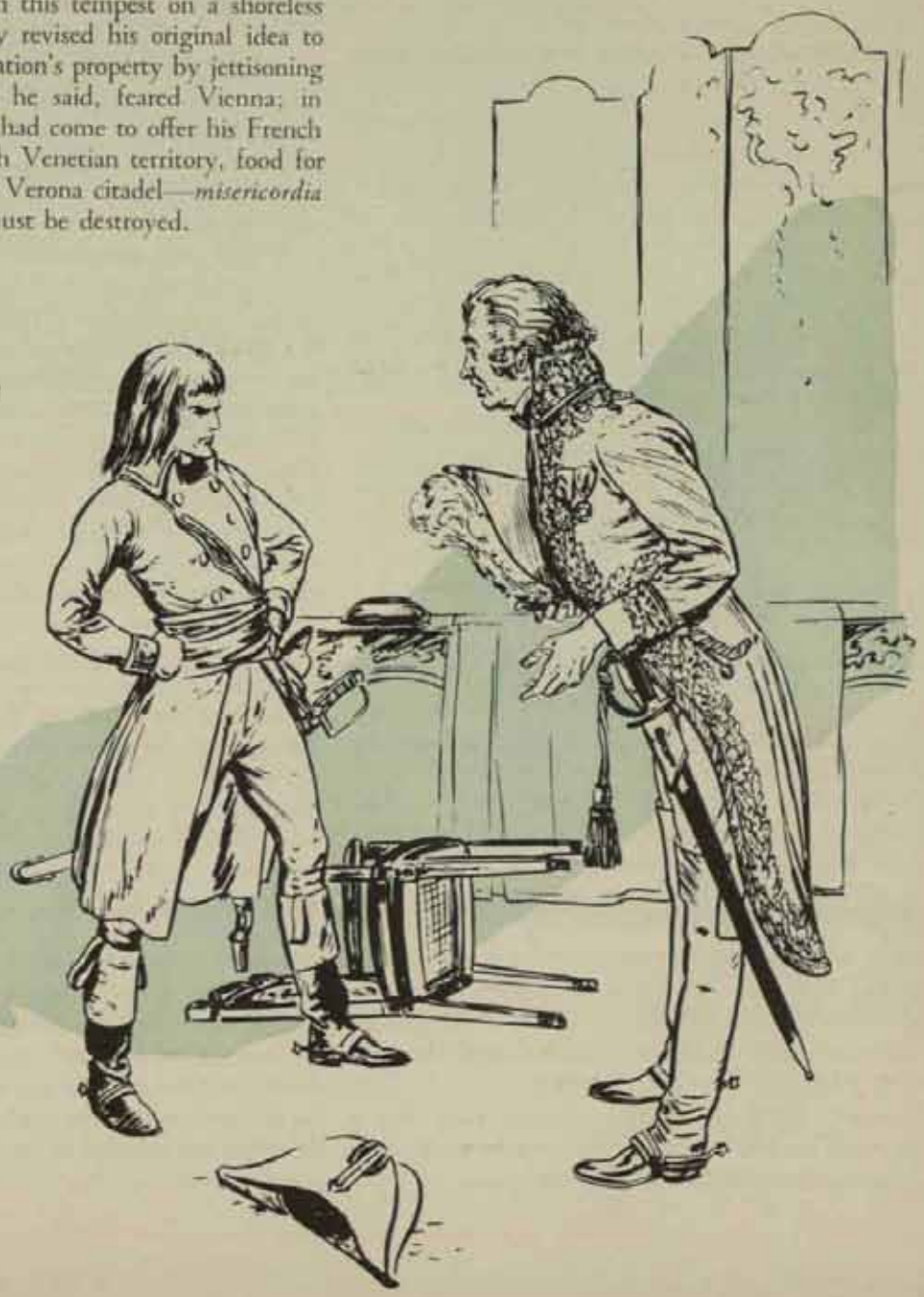
Masséna had the covering force, his own triple division and the Alpine one under Sauret; headquarters at Verona, whence he could watch the main Austrian line down the Adige river from Trent, swing onto the flank of an advance through Vicenza and the waters of the Brenta, onto the rear of one by Salo and the western lake.

Verona was Venetian land; the Most Serene Republic had sent an old syndic named Foscarini, armed with argument and diplomatic skill, to hold the French at arm's length from it after Borghetto. Bonaparte received him with a gust of fury—how had Venice dared let Beaulieu through the pass at Peschiera? Evidently she had a secret Austrian alliance. He had received orders from the Directory to treat her as a foe; burn Verona, seize all Venetian property, loot Padua; at that moment Masséna was on the march to execute them.

Poor Foscarini, tossing in this tempest on a shoreless sea of absolute war, hastily revised his original idea to that of saving part of his nation's property by jettisoning the rest. The Serenissima, he said, feared Vienna; in the name of the Senate he had come to offer his French friends free passage through Venetian territory, food for their men, and the keys of Verona citadel—*misericordia* that now so fine a place must be destroyed.

Bonaparte hesitated, appeared to ponder, accepted the gift with the air of conferring a favor, and next morning marched for central Italy with Dallemagne and Division Augereau, while Division Vaubois was shunted south through Piacenza to join him at Florence or Leghorn.

On June 20th the flying column reached Bologna in the states of the church, where a warlike cardinal was taken with 400 men. (He gave parole, then got an absolution from the Pope to break it.) Bonaparte rode into the city first, among the new corps of Guides he had formed to prevent accidents like that at Valeggio. They were men picked for hardihood under a captain it will do well to remember—Jean Baptiste Bessières, who had been a Provençal wigmaker till the Revolution rooted him up—big, handsome, slow, as fantastic in his ability to foresee small details of things to come as Berthier was in his memory for them when past.



Bonaparte received Foscarini with a gust of fury

An ambassador of Spain came up to Bologna to make a peace for the Pope, and there was an intricate triangular negotiation—Bonaparte, trying to cripple the temporal power, enlist the spiritual as his friend (it would be most useful along his line of communication); commissioners from the Directory, under La Revellière's spell, trying to break the spiritual power; and the adroit foreign diplomat playing one against the other. The peace came off at a price of thirty millions, with four more raided from the banks; and Bonaparte sent the Directory a bitter letter on the value of his camp followers:

> As to the administrations in the rear, nothing is accomplished; no order, no work, no activity. I don't know how the money from the contributions is being distributed; or even whether the contributions are being raised. The army is in the most miserable penury; even the two sous apiece for the soldiers are wanting, and lack of everything drives them to excesses that make me blush to be a man. Soon or late, there must be *unity* of thought here; military, diplomatic, and financial matters under one head.

He could afford to take a strong line; the Directory had knuckled under in the matter of Kellermann's joint command, and Division Augereau was driving through the Apennines. In Naples the alarm bells rang and the King ordered public prayers to St. Januarius for 60,000 volunteers, and when they were not forthcoming, sent a prince to make peace. In Tuscany the Grand Duke laid tables for a sumptuous dinner and the English merchants of Leghorn packed their baggage. On the 27th of June their ships flew down the harbor, ropes dragging disorderly; half an hour later came the French "with their pattycake cockades in their hats, and at their head the most magnificent rider even seen."

It was Murat; and he had returned from Paris without *her*. "She is either ill or unfaithful!" Bonaparte had cried a day or two before when he drew from his pocket to kiss her miniature and found the glass broken. Murat's report must have told him which, for he began putting the screws on the Directory, who sent Mme. Bonaparte a passport for Italy, with positive orders to use it.

On the 13th of July, at last, at last, she reached Milan; her husband dropped everything and raced to the cathedral city, where he found her desperately bored and more than a little frightened. She did not understand the language of these Italians, who treated her like an impossible demigoddess and teased for favors from her husband; she did not understand the mentality of the fierce and solemn boy-generals—Lannes, Joubert, Victor, Bessières—who treated her like a piece of *bric-à-brac*, talked of fighting and philosophy. She wanted only to escape adulation, enjoy a dance and the society of a young lieutenant who had come down from Paris with her—Hippolyte Charles, a perfect boudoir ape, who could walk on his hands, jump over chairs, lard his speech with the most ridiculous puns and hyperbolic expressions.

Fortunately, Bonaparte could spend only three days in the city with her. He was up to his neck in work at his headquarters, Roverbella—studying the theory of credit under an old Genoese banker named Balbi, so that he might finance his own campaigns without the dangerous necessity of carrying cash treasure at the fighting front, and at the same time avoid the reprisals of the international bankers—studying the ground and his forces before the summer fighting should begin. North among the Alps a stormcloud gathered; Austrian Marshal Wurmser, the best man in the empire, was already thundering through the passes with fifty thousand men.

* * *

The Campaign of Five Days

I

The Lake Garda Country, 12-18 Thermidor, An IV (July 30-August 5, 1796)

Both armies felt unsure. Under the double eagle fear rose from below, through men who bore the scars of French lightning, officers now chiefly ambitious of avoiding responsibility for decisions that might turn sour. "Many comfort themselves with thinking defeat must force peace," wrote the English agent from Trent, and even after Marshal Wurmser arrived with the Rhenish divisions, "The zeal of this good old man is not enough & there is nothing else."

Nothing else of spiritual resource; of material, 47,000 strong, trained men with 98 cannon (13,000 more in Mantua), and a plan drawn by Franz von Weyrother, the staff expert who had come down from the Rhine with his arm in a sling after noble work there. Three passes admitting artillery led to the plain from Trent. General Mészáros with 5,000 men shall take that by the Brenta Valley, Vicenza and Verona, going early to draw the French strength east; General Quasdanovich with another 5,000 shall come down the road west of Lake Garda to fall on the enemy's communications through Brescia, while Wurmser himself leads the main attack through Rivoli and Castelnuovo. . . .

No! In Germanic armies the quartermaster is not a mere grocery clerk, but high on the staff. Peter, Freiherr Duka held that post at Trent, and here interposed a change. All the passes were strait; an army could move through them only slowly, in snake-like column; might be gripped by the throat in the process. Our object must be to place the main strength in open country as early as possible. Let Quasdanovich have 16,000 men; in addition to bringing the men early through the narrow ways, this will give an opportunity to throw a net, a cordon, round Bonaparte if he stands his ground, though he will more likely retreat to the Milanese. Should he not, even Wurmser alone can bring more men to the battlefield. With Quasdanovich deducted we will still have 26,000; we know the French are but 42,000 strong all told, of which 15,000 at least must be checked off to hold our 13,000 in Mantua and half as many more for the lines of communication.

Map 3: The Campaign of Five Days

On July 28 the march began. Next day at earliest dawn, Wurmser's vanguard struck and turned Masséna near Rivoli, inflicting 1,600 casualties, and that night a French scout marked how the mountain country between the Adige and the lake was all one sea of Imperial campfires.

News of Mészáros's coming had reached Bonaparte earlier in the day. As Weyrother predicted, he took that force for the main maneuver and ordered Division Augereau out to attack it; but Masséna's report and one from Salo, where Quasdanovich had broken through, made him pull Augereau in again and call a council of war for the night of the 30th, Thermidor 12. It was a curious gathering, melancholy in tone, with old Serrurier croaking disaster and Bonaparte doleful as an undertaker's mute, full of terrifying phrases about retreat. It was the first time he had been confronted by a driving instead of a passive enemy, and the blow found him emotionally drained, no plans flowing from his fingertips.

He had made arrangements for his wife to meet him in Brescia. She refused, and at the crucial moment, with Austrian trumpets already echoing through the passes, he had stolen two days from his campaign to be with her in

Masséna: A stocky man with bright beady eyes

Milan—days spent, not alas, in that sweet amorous meeting of souls he had hoped and anticipated, but in playing second fiddle to Fortuné the poodle. He went back to headquarters, wrote bitter, despairing, pleading letters, and talked of retreat.

Retreat—retreat—retreat. Berthier clicked agreement like a metronome; Kilmaine, Despinoy, the other educated officers, said it was the only sensible thing. Murat, who might have turned them, was chasing a woman in Brescia, Masséna and the remaining inspirationalists were engulfed in the rising tide of despair. All but one, Pierre Augereau, the gigantic gutter-snipe rascal. He had been in pinches twice as tight before—when he dueled down the reputed best blade in France, fought the Turks for the Tsar, deserted from the Prussian army and with sixty other desperados cut his way to the frontier through the king's bailiffs and soldiers, broken from a prison in Portugal, eloped with a fair Greek girl, or escaped trial for embezzling the watches he was supposed to sell. He rapped out an oath and a shout.

"Attack first! If we are beaten it will be time to think of retreat."

"How would you support the right wing?" asked Despinoy.

"With bayonets." He turned to Bonaparte. "We shall be attacked tomorrow—by thousands of Austrians. That makes no difference; I only want to see you a bit calmer. Fight here, and I'll be your surety for victory." He grinned. "Besides, if we lose, I'll be a corpse, so I'll be right either way. Dead men are always reasonable."

II

Serrurier had no transport; must spike his siege guns, blow up Chasseloup-Laubat's careful parallels, throw the powder in the river, let Mantua go and fall back toward Cremona. His soldiers adored the old man, who worked himself deaf, dumb, and blind keeping them comfortable; if things came to disaster none better than he could keep them together along that only line of retirement. The mobile force was four divisions—Masséna, Augereau, Despinoy, Sauret—the first two now east of the Mincio, the two latter swung back round Desenzano when Quasdanovich shouldered past them to take Brescia, with the French sick, and Murat, caught in his bed. A report by boat down the lake said Brigadier Guyeux, of Sauret's had been cut off in Salo, but was holding out in a big grange with four hundred men against ten times as many Austrians. Bonaparte hurried both Sauret and Despinoy back up the lake road to rescue the brigadier, "a mediocre man, but a brave and valuable officer," and to draw Quasdanovich more toward the lake, where his head of column could be circled and crushed.

Masséna was to march through Peschiera on Lonato, dropping rear guards to detain the Austrians at the river; Augereau to go back more slowly through Goito and Castellaro, bringing the whole striking force together in the quadrangle Lonato — Castiglione — Montechiaro— Ponte San Marco, whence they could knock out Quasdanovich, then turn on Wurmser, whose plan had now become clear.

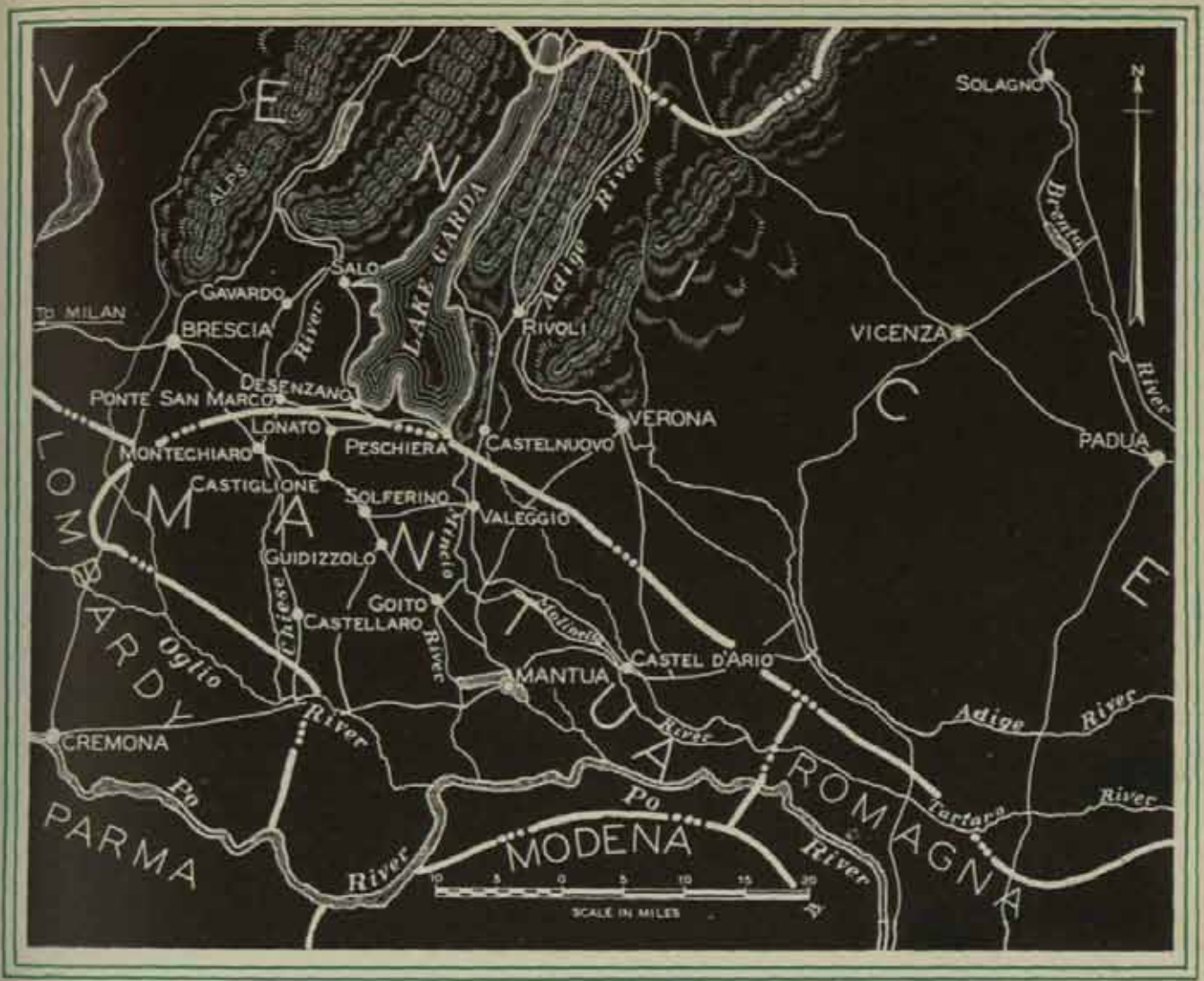
The 31st of July saw cavalry skirmishing all down the left bank of the Mincio, and hard fighting near Salo, where Sauret got through to save his brigadier and 400. That night the quagmires of Mantua trembled with explosion shocks; the sky was red with burning French barracks and the defenders clapped each other on the back for joy. Wurmser slept in Valeggio after writing to Vienna a happy dispatch saying he had driven the French away, and next morning made a triumphal entry into the besieged fortress, with all the bands playing the *Racôczy* and a long train of food and munitions rolling along behind.

Bonaparte had not slept at all; had been with Masséna's head of column, marching through the night for Lonato, which they reached with the day, tumbling Quasdanovich's outguards through the streets. Augereau, who seemed possessed of a fiery devil, had moved at an even more killing pace, forty miles since the previous afternoon, burst into Brescia just as Wurmser was following the flags and cheers along the Mantuan streets. By noon of that day, August 1, Quasdanovich had been struck in three places; he perceived that the whole French army was coming down on him, ordered a retreat on Gavardo, and sent off an express to beg Wurmser to fall on Bonaparte's rear.

It never arrived; but that hardly mattered, as Wurmser thought of the idea for himself and came up through Goito in a long column with Division Liptai leading, while his Division Bajalich, which had come by the Peschiera route, moved on Desenzano to cover his right flank. Bonaparte had foreseen all that; called Augereau back from Brescia to Castiglione, where a brigade of his had been left to make a defense on some jutting heights, turned Messéna round to face back east as soon as his division had driven the Austrians out of Lonato, and flung Sauret and Despinoy onto Quasdanovich at Gavardo, with Dallemagne's storm-troop in support of the latter. Date and hour for the attacks to begin were set at morning, 3 August.

III

Nearly everything went wrong that possibly could. The heat turned grilling, harder on the quick-stepping French and their artillery horses, than on the Austrians. At Castiglione, Augereau's brigadier, Valette, defended only *pro forma* and lost the heights that protected the French flank. In the north Quasdanovich had been granted twenty-four hours' respite; he recovered balance enough to attack, fanning his divisions out, with the heaviest, Ocskay's, along the lake road toward Desenzano. Sauret's column should have fronted and clashed with Ocskay, but Sauret, after receiving his orders verbally, had been heavily wounded during a reconnaissance the night before. Guyeux succeeded to the command, but he had not heard the orders, and Berthier, who had the bad taste to fall in love at this particular moment, spent the night mooning



Map 4: Castiglione

over his lady's eyelash instead of making written orders for Guyeux.

The total was that this last division started late and by the wrong road. Ocskay got clear round outside him down to Lonato, where he joined hands with Division Bajalich of Wurmser and attacked Masséna. At Gavardo Despinoy's attack met Quasdanovich's; the French were outnumbered, beaten, and driven back to Brescia in a panic rout which their commander did nothing to stay. Guyeux, coming on the field late, got the full force of the victorious Austrian drive and was thrown back into Salo.

Fortunately, his hard fighting and that of Dallemagne, with the heat and the mysterious disappearance of Division Ocskay, left Quasdanovich utterly bewildered; instead of pursuing he went into camp round Gavardo to wait what the morning would bring. On the south wing Bonaparte met Brigadier Valette coming back from having yielded Castiglione, and in a tempest of fury broke him before the paraded troops, then gave Augereau direction to retake the place at any cost.

"Ah, that was the best day of Augereau's life!" said his commander long later. Liptai's defense was obstinate to the last degree, and more troops kept coming in behind him, but the giant swordsman's push was as furious, and he had more soldiers, better arranged. He led the charges in person, black with powder-smoke, and shouting; at the third a force he had placed for the purpose broke from cover on Liptai's flank, and the Austrians went tumbling back, just as the rest of Wurmser's men came plodding up—too late to do anything that night but find a good position.

Lonato had gone to the whitecoats in the morning; by noon Bonaparte himself rode onto the field there to find Ocskay on the enemy's right, Bajalich on their left, extending to lap round both his flanks. There were plenty of light infantry at hand; he put them out in clouds of skirmishers to delay the advance of the Austrian columns through the wings, which, given the heat and the fact they came on in massed tight ranks, was not too difficult. In the center Bonaparte formed two demi-brigades into heavy column, with a regiment of horse behind, and

launched a furious charge, at the run. The infantry broke through the Austrian first line, the cavalry their second; Ocskay naturally fell back northward toward his chief, Bajalich as obviously south toward his, and the Austrian main forces were split again.

They had lost four thousand at Castiglione, three thousand more at Lonato, and the end was not yet; for half of Messéna's big division hustled Ocskay through the fading light with artillery baying from every turn, and big-jawed Junot leading cavalry charges on their rear. As the beaten, downhearted whitecoats broke up the lake road, they ran head-on into Guyeux's returning men, who had recovered morale after their early-day defeat but were feeling thoroughly sullen about it. They fell on Ocskay's front in a vengeful fury, Masséna's guns never stopped pounding his rear; the dismayed Austrian beat a chamade and surrendered with his whole division.

That might partly be called fortune, but the Austrians had felt the sunlight of good hap and made no use of it, while now Bonaparte spurred the fickle jade hard. He worked all night, reinforcing Guyeux with a brigade of Masséna's, Despinoy with a fresh one from Milan, and arranged that both should strike Quasdanovich in the morning, wiping out what remained of his 16,000, hardly more than half. But there was no fight, not even a rear-guard fight; Quasdanovich had decamped north when they arrived, headed around the lake, trying to reach Wurmser by that long circuit.

IV

The marshal spent the next day, August 4, welding a line of battle with the badly hammered division of Liptai, Bajalich's sound but shaken men, and fresh troops up from the rear. His left, in the plain, he sustained with a big redoubt; the center with the houses and church of Solférino. With the right he meant to swing high and wide through the broken ground around the French left flank, reaching toward Quasdanovich, from whom for a week there had been no word but that momentary contact with Division Ocskay on the day before. That rightward extension (he reasoned) could not fail, must meet his lieutenant. The two together would roll down on the French from the hills in an overpowering avalanche of numbers.

His light threw its beams not far enough. Against some 20,000 Austrians Bonaparte had already that morning sent to the field Kilmaine's cavalry, Augereau, and Masséna, who had marched half the night to Castiglione—22,000. Despinoy and Guyeux had been ordered in from the north by forced marches to stand on Masséna's left with their 11,000; Serrurier and 7,000 more, up from the south through Guidizzolo to fall on the Austrian rear.

Bonaparte was at the inn in Lonato working out these assignments with Bethier when a flag of truce was announced by a horrified orderly, who whispered that there were two thousand Austrians in column behind—Quasdanovich's rear guard, whom Guyeux had cut off and who had rambled vaguely south to this remarkable contact. "The circumstances were rather embarrassing. I had at Lonato only about 1,200 men. I had the numerous officers of my staff get to horse, then sent for the parliamentary and unbandaged his eyes in the presence of all the movement of a big headquarters. I told him that if his general had the presumption to capture the commander of the Army of Italy, he had only to come forward in order to do so. I declared that if in eight minutes his division had not laid down its arms, I would not pardon a single one for the personal insult of which they had been guilty. The parliamentary appeared astonished, and within a few minutes the whole division surrendered."

. . . and toward evening, riding down to Castiglione, Bonaparte looked over the Austrian position and made his plan. That redoubt, where fresh earth shows on their left, is not too formidable; but its presence indicates they mean an attack by the right. Masséna shall hold our position against that drive, no man better for fighting among the rocks and screes there. Let Marmont take all the artillery of Augereau's division, with some of Masséna's, and bury the redoubt in fire, while Augereau, the tactician and battle captain makes the grand attack—direction, the clock-tower of Solférino. Kilmaine shall ride behind the last, circle round to the Austrian rear, when their wing has been broken.

Soit! The Frenchmen had a good night's rest and food; the morning woke clear and hot, with the drumming of Marmont's cannon. Under that concentration, the fire of the redoubt withered. Augereau rushed; the Austrian first line was broken. But one did not beat a veteran of Maria Teresa so easily. Wurmser coolly drew back his left at an angle, put in the reserve and stopped Augereau, while his strong right wing drove Masséna slowly backward.

But at noon, Despinoy's columns came trotting through the heat-haze and reëstablished the flank there; on the other, Division Serrurier flooded the road from Guidizzolo, encircling the Austrian flank and rear, and Augereau who all day fought like a demon, headed another attack just as Kilmaine came riding down. The triple pressure was too much; Austria's whole line went to pieces. Only old Wurmser in person saved his army from utter rout, riding at the head of his last squadron of horse in desperate counter-charges with naked sword and the flowing white hair of seventy years, till the staff pulled him away by main force.

Heat and exhaustion stopped the pursuit at the Mincio; Wurmser climbed back into his Tyrolean bird's nest with a third of his fine army gone, killed, or prisoners, the rest wrecked and demoralized.

V

After the battle, the officers came to headquarters to congratulate their general. He had a good word for everyone till he saw Despinoy, of whom it was remembered that he had failed to hold his men together in the panic at Gavardo. Bonaparte looked him from top to bottom like

a specimen, then pronounced, slowly and clearly, so the words would be remembered:

"General, during your command in Milan, I learned how much you love money and how little scruple you have about the means of getting it; but I did not know till day before yesterday that you were also a coward. Leave this army at once and never let me see you again."

* * *

The Great Circle

I

The Mantua Country, 15 Fructidor, An IV — New Year's Day, An V (September 1-17, 1796)

As summer climbed its hill and poised for the slide toward fall, France held gains on every front—Frankfürt, Stuttgart, Ulm, Belgium, Milan—Moreau and Jourdan marching on Vienna—the Teuton princelings swaying down—Spain about to bind herself to the Republic—Bonaparte riding through the smoky plain. All clocks struck negotiation; the Directory began to think of one more truce in the struggle of the ages against the enemy pushing west from beyond the Rhine. They named a secret envoy to Vienna, one Henri Jacques Guillaume Clarke, a son of the Wild Geese; like all his race, charming with a glass in his hand and a pipe in his mouth, but like many of them, a hopeless chatterbox.

He came through Italy during the month of August, stopping at Bonaparte's headquarters, where he had a nephew on the staff. It is certain he was there when the spies Pico and Toli came in with news that Austria was massing new strength behind Wurmser in Trent. It is probable that he babbled abroad whatever else he heard, for the Austrians learned more of Bonaparte's ground-plan for the coming campaign than he of theirs.

Castiglione had not been the little corporal's ideal victory; defensive fighting all the way, teetering on the brink of disaster, and the end exhaustion. Fast marches through ennervating heat had left him with many sick, including one of his best division leaders, Serrurier; among the flatlands the matchless Imperial horse would always keep his front half blind. No: he would fight henceforth in the hills, from which floweth strength, counter-attack this new drive there, burst through Trent and the Brenner Pass on Innsbruck, join hands with Moreau and strike for Vienna. There were 41,000 men fit for service, in four divisions. Of these, Sahuguet, *vice* Serrurier, had 8,000 conducting the renewed blockade of Mantua, and Kilmaine's cavalry was on patrol. Sauret had been sent back—a brave man, but lacking both education and the intelligence to make good the defect by force of reason, unlucky in all he did. His division lay at Salo, united with Vaubois's under command of the latter; Masséna was at Rivoli, Augereau in Verona. They would move together up the pass, with Masséna the mountain man leading.

This was the arrangement Wurmser learned. Vienna had given him 45,000 men and orders to drive the French in, lest they join with Moreau, on whom the Archduke had just turned his back. There was a new second in command—Milós Davidovich, who was rated one of the best strategists in Europe by virtue of achievements against the Turks, and who heartily shared this opinion of himself. In the new campaign his mission would be defensive, to hold the road of the Adige valley with 20,000 men. Let the French throw their heavy columns into this strait way; only so many abreast could come on, and there would be cannon to face them.

While Davidovich held, Wurmser himself, 25,000 strong, would move down the Brenta Valley, circle the hills unopposed, relieve Mantua, then bottle the French from behind. Should they turn against Wurmser, Davidovich would strike their rear and force a battle in the passes where there would be no room for the tricky maneuvering of Castiglione; for like the defeated everywhere, these Austrians held that an honest test of courage would prove them the better men. Most likely, the French would not dare stand when they found their cordon turned, but scramble back through Brescia toward Milan; Quartermaster Duka ordered provision convoys made up for the passage of the Mincio.

On September 1 Wurmser's column started. That day Moreau was in the Isar country, worrying about his flanks, while the Archduke's head of column poured dustily into Würzburg, far in the north. The same night at 10:30 Bonaparte, having made some arrangements about casuals, dictated to Berthier orders that would assemble the three mobile divisions beyond Lake Garda's head, eighteen miles south of Trent. Five days' biscuit; be sure to issue brandy. Kilmaine to patrol the south country. If the enemy be so stupid as to swing down the Brenta on Sahuguet, he will fall back north, garrison Peschiera and hold the Oglio crossings 1 September.

Outside it rained.

II

The first defile is at Marco, just south of the point where the road from the west lake falls into that along the Adige, and here Wukassovich waited for the French at the head of a brigade. Masséna touched his outposts at dusk on the 3d of September, and early next morning pounded the front of the position with artillery, while swarms of light riflemen under Brigadier Pijon, who had clambered the heights during the night, were picking off whitecoat officers. The Austrians in the front line were smothered, those in the rear were shot down without a chance to fight for their lives. Wukassovich was already finding it hard to keep them up to the mark when more cannon began to bark from his right rear, and the opposite bank of the stream was lined with thousands of Vaubois's men, who had broken through at Mori. At the same moment a bugle screamed shrill above the crash of guns; a dense column under Brigadier Victor of the 11th hurled through the smoke to close accompanied by a

squadron of hussars, whose commandant pitched dead from the saddle as they broke the line.

Wukassovich went back disorderly, with Victor clinging so hot on his heels he could not hold Roveredo, but Bonaparte came riding forward and said this was no victory at all—"Only three guns and about a thousand prisoners!" Masséna was rearranging his formations; had sent Brigadier Dommartin forward to get a battery of mountain guns into position at the next defile and sharpshooters to scale the heights, but it would be a tougher nut to crack than the first. Pillars of granite pinched the valley to within two hundred feet of the river edge; there was a wall and the bony old castle of La Pietra looming over it, with modern artillery sneering from the barbican—all so strong that Davidovich thought a few battalions would hold against an army. He was wrong; Dommartin's guns got an enfilade which so unsettled the defense they could not stop Victor as he rushed a column in for hand-to-hand hack, stab, and shot across the wall. At the heat of this wrangle fifty French horsemen sneaked past under the bank, stumbling and plashing among the wet rocks, and rose yelling on the Austrian rear like monsters from the pit.

Resistance collapsed, and when Colonel Bessiéres put the general's Guides in on the retreat there was a rout with a bag of 5,000 prisoners and twenty-five cannon,

Map 5: The pinwheel campaign in the Mantua country

That night the French bivouacked in sight of the red roofs of Trent under a drizzle, with the men of Division Vaubois filling their bellies with brandy instead of the bread which was now all gone, while in the city Davidovich tried to get his shaken ranks arranged. The place had stout defenses and well conceived, but too extensive for 10,000 discouraged men with such casualties among their minor officers that the organization was wrecked. Dawn of September 5 came too soon, bringing with it an avalanche of French from the mountains round the city, and Davidovich was forced into a fast, frantic retreat. He halted a few miles north, where the River Avisio flows into the River Adige at the narrow gap before the town of Lavis.

Four hours were granted him to set up a new position, while Bonaparte in Trent was issuing a manifesto to the people and cheering his troops with a bulletin from the captured Austrian records, showing their frightful casualties in the Castiglione campaign. A report from Kilmaine came in during the morning; his patrols had been driven back, the enemy were before Verona, apparently in force and with the intention of attacking the place, since a prisoner said he belonged to the Imperial storm-troop of General Mészáros. Bonaparte's own prisoners had explained his hitherto puzzlingly easy victory by the news that Wurmser had gone down the Brenta. That meant a change in the plan of striking for Innsbruck. While Division Vaubois shouldered through Trent to drive Davidovich out of the campaign, the other two should follow fast on the track of the Austrian main body. The general summoned Masséna and gave him orders for a forced march at utmost speed. "Can you start in an hour? If your men are tired and hungry, let them gorge themselves on the bread and brandy in the Austrian warehouses here. We must destroy everything not eaten."

By now it was afternoon, and a messenger said Vaubois had found it impossible to force Davidovich at Lavis. After dictating his report to the Director, Bonaparte himself rode to the front with the Guides and Dallemagne's attack specialists. Night was already falling when they arrived, the shadows stabbed with crisscrossing musket flashes. Bonaparte sent Dallemagne in against the bridge; Murat led the 25th Chasseurs across a ford higher up, with some infantry riding on their horses' rumps. At both places there were hot little combats, the last Austrian rally being a furious cavalry charge into the dark. It broke up in a spray of empty saddles, Dallemagne and Vaubois's whole division went pouring through the town, and drove what was left of the Austrian regiments clear to Bolzano, in no shape to continue operations.

Lannes
Sometime Marshal of France

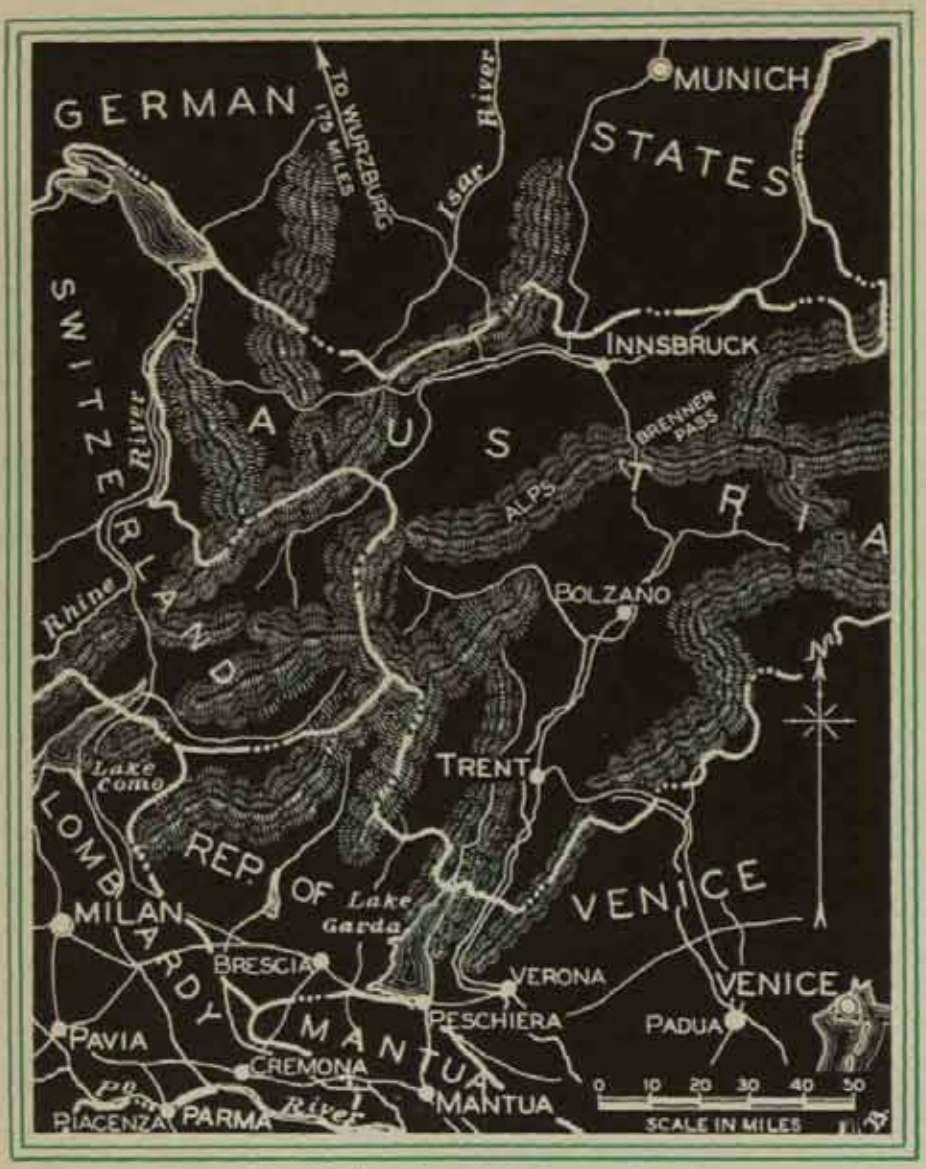
Bonaparte himself turned back as soon as he saw the spurts of flame that marked the center of the fight lodge among the houses on the far bank. That night he rode over thirty miles on Masséna's track, toward dawn coming on little parties of men, dead-drunk with fatigue, asleep or moving uneasily in the ditch beside the Brenta Valley road. A cold dawn mist hung in the valley, and an old mustachioed grenadier gnawing at a loaf of bread offered his commander half. "Where is the general?" the latter asked, and while being told Masséna was up ahead, caught the rattle of musketry echoing faint and far among the mountain walls. He spurred the tired horse on.

III. Division Mészáros of Wurmser's army had indeed gone on to attack Verona, though not as Bonaparte imagined, in character of vanguard for the whole force. He was merely a flying wing; and that day, September 7, found the Austrian leader at Bassano with the divisions of Sebottendorf and Quasdanovich, preparing the long slant across the lowlands to the relief of Mantua which stuck in his mind as the matter of first importance. The news he received during the day greatly puzzled and disturbed him, for the communication line with his base at Trent went dead, and then the survivors of three battalions he had dropped at the castle of Primolano brought word of the storming of that post by an immense number of French. The map showed Trent might be slipped by a steep and narrow hill-track leaping from above Roveredo on the Adige to Levico on the Brenta; and it fell in with his knowledge of Bonaparte's fondness for mountain maneuver to suppose the latter had blocked off Davidovich in Trent with some 23,000 men, shooting the rest down the Brenta track to menace his rear. Very well; he would ambush and destroy this audacious detachment which could not number over fourteen or fifteen thousand.

Mészáros was accordingly called back; Division Quasdanovich ranged on the left bank of the Brenta across a line of little humps north of Bassano town; Division Sebottendorf on the opposite side of the stream to protect the bridge by which Mészáros would come. A strong outer guard was sent forward to the defile of Solagno, where the hills break, to hold up the French—but not too long, for Wurmser wanted to get them down into the plain, where his 6,000 excellent cavalry could ride among the broken, flying enemy after the battle. It took a day of what the Austrians considered frantic effort to complete these arrangements. The fighting divisions bedded down on their arms for the night.

IV

At two in the morning, 8 September, the French were



Map 6: The region of the Brenner Pass

turned out by their sergeants and went streaming down the Brenta gorge, Augereau on the left bank of the stream, Masséna on the right. At six they reached Solagno, where the Austrians were just having breakfast; bayoneted their way through with hardly a check, and bearing the débris of the delaying force on the crest of their advance, rolled down on Bassano. Masséna made contact first, lapped round Sebottendorf's flank, submerged his front in an invincible storm of numbers. Colonel Lannes took two standards with his own hands and was promoted a general before sunset.

The bridge connecting the Austrian wings went; Bonaparte pushed a column over it onto Quasdanovich's rear just as Augereau struck him in front. The Austrian line rolled up, they lost contact with the river, were flung east and clear away into the sawtooth mountains beyond the Friuli, with Murat on their rear taking 3,000 of their number to add to the 2,000 and 35 cannon captured in Bassano.

Wurmser rallied on Division Mészáros at Vicenza in the evening. Of his fine army but 16,000 were left, and these without trains of communication with home, and almost without artillery. He saw only one chance—throw himself into Mantua; and toward Mantua he set his face, by way of Villanova, Ronco, and Legnago, clouding his movements front and rear with those horsemen who were now his last efficient arm.

"Plan for retreat," Bonaparte said once. "Victory will plan for itself." But now the hounds were at fault along the slot, Austrian light horse closing off the sources of information. Would Wurmser try to double back east and join Quasdanovich? There was only one possible passage of the Brenta, at Padua, and on the evening of the battle, before the men had supped, Division Augereau was in motion for that point. Would he try to storm Verona and bruise a passage up the Adige to Trent? Swing south toward Mantua? Two chances to one for the westward road; Division Masséna turned on the heels of the enemy toward Vicenza, Bonaparte riding with them.

In the morning at Vicenza the French general learned that Wurmser had reached Montebello and that Kilmaine had beaten Mészáros off at Verona. That made Wurmser's direction a certainty—Mantua. The net was instantly spread to catch him. Augereau was ordered to run west through Padua and hurry on to Legnago, the only place where there was a bridge across the Adige good enough for an army. Kilmaine with his horse and the garrison corps of Verona was brought down on Isola; Sahuguet and the Mantua blockaders called out to Castel d'Ario. Masséna's big division kept after the Austrians, and was less than a day behind them at Villanova and again at Ronco.

It would not do to catch up and fight before Legnago was reached, where Augereau, Sahuguet, and Kilmaine would fall in to give that superiority of force which was the guarantee of victory. Masséna was therefore passed across the Adige at Ronco by means of a ferry and a captured Austrian pontoon train, and came down its far bank, Murat with a little troop of horse and Pijon's light sharpshooters pushing on ahead to take position for the coming fight. A stupid or malicious guide led Murat down the wrong road, that to Cerea, and coming into that town on the morning of September 11th, he found a squadron of Uhlans in possession. He charged and scat-

tered them, but Pijon had hardly taken position before he was attacked by heavy columns of that Austrian foot which should have been on the other side of the Adige, facing Augereau.

The fault lay with one of Sahuguet's officers, a major who had been sent up with a battalion to break the Legnago bridge two days before. In the country between the rivers, one of the omnipresent Austrian cavalry parties had come suddenly on his little column, sabered a few men and clattered away. Peasants said Bonaparte had been heavily defeated among the hills and these were the outriders of a great army sweeping down on Mantua to eat the blockaders up. The major lost his nerve, retreated without finding out for himself; and next morning Wurmser's whole strength came pouring down on Pijon's sharpshooters. The French did their best to hold till Masséna's gross arrived, or Augereau should strike the enemy rear, but in both those divisions the men were now stumbling-tired and the fever fit of battle had left them. They did not come; Pijon was broken, losing a thousand men. Bonaparte, who had galloped to the cannon, had just time to get off a message bidding Sahuguet break the bridges at the next river, Molinella, before he was carried away in a stream of fugitives for the first time in his life, lips working dangerously.

But Sahuguet blundered too, forgetting a bridge at Villimpenta, well south of the main line. Of course Wurmser's cavalry found it; he made an all-night march on this slant and was in Mantua with 10,000 men before he could be interfered with again, though Bonaparte did get Masséna and Augereau up in time to fight an action under the walls, which spoiled the renascent Austrian confidence and deprived them of their forage ground.

V

The campaign closed out in an atmosphere of general bad temper and apprehension. It seems some hint of Hippolyte Charles and Josephine had leaked through to the latter's husband. The gilded youth found a trip to Genoa necessary, while Sahuguet received a tongue-lashing that would have blistered an iron bar and was demoted to a brigade under Masséna. Marmont of the staff was wrangling with Berthier who wanted to send his own aide, Dutallis, to Paris with the messages of victory and captured battle flags, a trip meant automatic promotion. "The man is excessively mediocre and not very brave," snapped Marmont, disagreeing with himself in his fury; when Bonaparte settled the matter by sending Marmont on the Paris trip, Berthier turned to vinegar and Murat glowered so jealously he had to be pacified with command of a brigade of cavalry. Clarke was fussing about an escort; he needed soothing before being dispatched through the lines to Vienna. Bonaparte wrote a personal letter for him to carry to the Emperor:

> Majesty, Europe wishes peace. This disastrous war has already lasted too long. I have the honor to inform Your Majesty that if plenipotentiaries are not sent to negotiate a peace, the Directory has ordered me to destroy the port of Trieste and the Imperial establishments on the Adriatic. I have delayed this step in the hope of not adding to the number of innocent victims of this war. I trust Your Majesty will take cognizance of the distress which menaces your subjects and will restore peace and tranquility to the world.

It was perhaps reasonable that the general should write such a letter. His army was worn, with many sick and wounded, not now much outnumbering the forces blockaded in Mantua, the Directory deaf to appeals for reinforcement, and Austria certain to come again, more violent than before.

The curious thing was that he should make this letter public.

Fire at Maneuvering Aircraft

By Captain G. A. Chester, Coast Artillery Corps

The mention of "maneuvering aircraft" generally brings to mind a picture of a pursuit plane doing barrel rolls, loops and spins. A reader hoping to find here a gunnery antidote for such radical stunting will be disappointed—nor will a remedy be given for the maneuver described by one writer on the war in Spain: "When the first antiaircraft bursts appeared, the . . . planes had one highly successful and novel maneuver—they made a rapid 180-degree turn to the right, abandoned their mission and headed for home." This article primarily concerns itself with maneuvers that can, and will, be performed by the multimotored heavy bomber. Maneuvers that take the bomber in a direction away from the objective, or that keep him under fire for a much longer time than is absolutely necessary, are ruled out as impracticable.

A discussion of fire at maneuvering aircraft divides into two general headings:

What can he (the pilot) do?
What can we (the antiaircraft) do, and
How can we do it?

First, then, exactly what can he (the pilot) do? Talks with military pilots show that practical maneuvers can be classified under a relatively few subdivisions:

1. Dives and climbs.
2. Changes in speed.
3. Turns and S curves.

Taking these possibilities in order, we start with dives and climbs. First we must define "diving" and "gliding." We define a glide as a descent in which the airspeed is *less* than the maximum in level flight, and a dive as a descent in which the airspeed is *greater* than the maximum in level flight. Two hundred miles per hour is assumed as the maximum speed in level flight, so all descents at an airspeed of over 200 mph are dives and all descents at 200 mph or less are glides.

The question naturally arises "Can the pilot climb or dive his bomber as he sees fit, or does the structural and aerodynamic design of the ship set definite limits on the maneuvers that may be performed?" To answer this question, it is necessary to go back a little. During and after the World War the standard military airplane—pursuit, observation, or bombardment—was a biplane. Its two-winged construction allowed an extremely strong, rigid truss to be set up, just as in a bridge. When, in order to achieve high speed, the biplane was superseded by the unbraced monoplane this trussing was no longer possible, and a wing had to depend on its internal strength to stand the stresses imposed by maneuvers. For this reason, the monoplane of today will not stand the rough handling of its two-winged predecessor. Therefore the cold facts of aeronautical engineering design become interesting to the antiaircraft officer as he seeks to find the limits imposed by design on the courses of action open to an enemy pilot.

In the process of speeding up modern aircraft, all excess struts, wires, and other air resistances were eliminated, so that the present wing designs are full cantilevers, as clean and unobstructed as the wing of a sea gull. With the older biplanes it was possible to dive at a steep angle before greatly increasing the speed, but with the modern "clean" ship a rather shallow dive causes a radical increase in velocity. As conservative design for a modern plane limits its maximum permissible velocity to about twenty-five per cent above its horizontal high speed, this "cleanness" of design limits the angle at which the bomber may glide or dive. Anyone with a rudimentary knowledge of aerodynamics can take an approximate formula and compute the limiting climbs and dives for an average modern bomber or commercial airliner. It may be stated that the average loaded heavy aircraft has a maximum limit to its climb of 5-10 degrees, with seven degrees a good average. If we take 200 mph as horizontal high speed, and 250 mph as maximum permissible speed without danger of "washing off" the wings, we find that the average large aircraft can only put its nose down about 10-15 degrees before achieving the maximum permissible speed. In other words, in steady flight, our average modern monoplane is limited by its structural and aerodynamic design to a climb of + 7 degrees and a dive of — 12 degrees.

Honorable mention prize essay, 1938

There is just one way that the pilot may increase his angle of glide—by using his flaps. To use them he must slow down to 130 mph or less—and by their use he may glide at an angle of as large as twenty degrees. Most pilots, when interviewed, believed the use of the flaps to be entirely impracticable.

From our study so far we can see that our problem of maneuver in the vertical plane is formidable enough, but at least we know what it is.

Turns are also limited by the aerodynamic and structural design of the airplane. Too sharp a turn throws too great a stress on the wing structure of the plane. The stress on the wing structure (in terms of g, the weight of the plane) is equal to $\frac{g}{\cos \Theta}$ or the weight of the plane divided by the cosine of the angle of bank. Numerically, g works out as follows:

Angle of Bank (Degrees)	Stress on Wings (g = Wt. of Plane)	If Plane Weighs 10,000 Pounds, Stress Equals
30	1.15g	11,500 lbs.
60	2.00g	20,000 lbs.
70	2.93g	29,300 lbs.
75	3.86g	38,600 lbs.
80	5.76g	57,600 lbs.
85	11.50g	115,000 lbs.

It is difficult to get definite performance data on turns, but it may be estimated that an angle of bank of 75 degrees with the horizontal is as steep as a loaded bomber should be banked, as this maneuver stresses the wings four times the weight of the loaded plane (4g). This should give a turn of radius approximately 1,000 yards, which for a right-angled turn would take about twenty seconds to complete.

The maximum and minimum *speeds* have certain definite limitations, too. If the maximum horizontal speed is 200 mph, we know that the maximum permissible speed is around 250 mph. From published performance data on commercial ships we can say that a modern plane will keep the air at about seventy-five miles per hour, but talks with pilots reveal that they prefer a comfortable margin for steady flight. The minimum speed may be set as something about 100 miles per hour. Our possible speeds for steady flight vary then from a low of 100 miles per hour (or 50 per cent of horizontal high speed) to a high of 250 mph (or 125 per cent of horizontal high speed).

In chatting with several bombardment pilots, the writer got the impression that one and all were extremely reluctant to indulge in any throttle closing when under antiaircraft fire, but favored flying with throttle wide open while under fire. They felt that high speed, with its consequent minimum time under fire, was their best protection.

It should be emphasized here that the limits just described on glide, dive, turn, and speed of the bomber are set by the aerodynamic and structural design of the plane, just as the design of a bridge limits the load that may be imposed on it, and are *entirely independent* of the desire and skill of the pilot. If the antiaircraft officer is familiar with the limitations of a particular airplane, he may plan his counter action to the maneuvers of that plane in perfect confidence that the enemy pilot must maneuver within these limitations, or face grave danger of "washing off" his wings while in flight.

SUMMARY—*Limits of Maneuver of Loaded Bombers*

Flying Level

1. A turn of 90 degrees in 20 seconds.
2. A minimum speed of 100 miles per hour.
3. A maximum speed of 200 miles per hour.

Climbing

1. A maximum climbing angle of 5-10 degrees.
2. A very small speed range at maximum climbing angle.
3. A turn of 90 degrees in somewhat less than 20 seconds (due to slower speed in climb).

Gliding—Without flaps.

1. A speed range of 100-200 miles per hour.
2. A maximum gliding angle of 10-15 degrees.
3. A turn of 90 degrees in 20 seconds.

Gliding—With flaps.

1. A speed range of 80-130 miles per hour.
2. A maximum gliding angle of — 20 degrees.

Diving

1. A speed range of 200-250 miles per hour.
2. A maximum diving angle of about — 5 degrees with power full on, and of — 15 degrees with power off.

MANEUVERS IN THE DECISIVE ZONE

Heretofore it has been regarded as gospel that the bomber must fly straight and level for a certain time in order to arm his bombsight. We call the zone traversed by the bomber during this "sighting" time the decisive zone, and here it is that antiaircraft hopes to get in its most accurate shooting.

Before being too sure about this "straight and level" axiom, let us examine the possibilities. We know the bombsight sets up its problem in much the same manner as does the antiaircraft director. The sight, to arm itself, must either follow the target on the ground with a telescope, thereby setting in the course and speed of the airplane relative to the objective (and this is present practice) —or a predetermined curved course may be set into the sight, and the plane flown exactly on this predetermined curved course. The variables introduced in trying to fly an airplane on an exactly predetermined curved course, at an exact speed so as to arrive at a certain point at a certain time, are so great as to make this curved course bombing seem definitely a development of the future.

Another possibility is glide bombing. In glide bombing, the procedure in approaching the target is the same as in horizontal bombing. The bombardier follows the target through the telescope on the bombsight, thereby setting into the sight the motion (course and speed) of the plane relative to the target. In horizontal bombing, the bombardier early sets in the altitude of the plane,

which does not change. In glide bombing, some form of computor would be necessary to determine the altitude at which the bomb would be released. Though it would be complicated, a computor to find "future altitude" for an airplane losing altitude at a definite measured rate is no more complicated than the mechanism that determines future altitude or future time of flight in an antiaircraft director. To review, the only new element of data needed in bombing from a glide is the "future" or "bomb release" altitude. As the rate of descent can be read exactly from a "rate of climb" meter furnished on all aircraft today, it is only a step to a bombsight complete with a "future altitude dial," with which precision in bombing from a glide would be normal. Logically, the bombsight for bombing from a curved course seems a thing of the distant future, while the glide bombsight seems just around the corner.

We may conclude then that in crossing the decisive zone, the bombardment pilot must fly a straight course —either horizontally, as at present, or in a steady glide (as seems likely in the near future).

Maneuvers Outside the Decisive Zone

Having explored the capabilities of the modern bomber, and having located the limits of performance set by its design, we are now interested in determining how the capabilities of the machine will be employed by its human controller, the pilot. Within the limits set up—limits of climb, glide, dive, and turn—how will the men in charge of a bomber, or a squadron of bombers, use them to attain their ends? And how can the antiaircraft officer, knowing these limits to maneuver, best apply his knowledge and his matériel to defeat the intentions of the enemy airman?

Put yourself in the place of the pilot. You know you are approaching an area reported to be defended by antiaircraft artillery, and you know the limitations of your ship. What are you going to do?

You may choose to maneuver in the vertical plane (diving, climbing, or porpoising); in the horizontal plane (some form of turn, or speed change caused by opening or closing the throttle); or a combination of the two. Thinking about vertical plane maneuvers, you realize that they all have certain disadvantages. First, a climb immediately slows down the ship, and keeps it longer under fire. With the most favorable angle of climb (plus 7 degrees) and a forward speed of 150 mph the rate of climb is only 9 yards per second—you are only leaving the line of bursts at 9 yards per second—or at the end of a time of flight of 15 seconds you are 135 yards away from bursts appearing on your old course. To do this you have sacrificed speed, and are travelling at 150 mph instead of the former 200 mph.

In a dive, you find conditions are more favorable. If you throttle your motors and dive at your maximum permissible speed of 250 mph, your rate of descent might be as great as 25 yards per second—in 15 seconds you are 375 yards from the line of bursts. But this advantage has been gained at the expense of altitude. Each foot lost brings you that much nearer the antiaircraft guns on the ground and the pursuit aviation climbing to meet you. In a minute of flight you would lose 4,500 precious feet of altitude.

Porpoising, a maneuver in which the plane alternately climbs and dives, making a sine wave course in the vertical plane, next comes to your attention. This maneuver (an S curve in the vertical plane) you decide, has certain advantages. It picks up speed in the dives to balance that lost in the climbs. It robs the antiaircraft of a target flying down the groove, and it only increases the time under fire about 10 per cent. You decide that porpoising is probably the best of the vertical plane maneuvers. What about those in the horizontal plane?

Here the problem would be easy if you were not headed for a definite objective. You could play tag with the antiaircraft and only a lucky hit would bring you down. But you have to face unpleasant facts and among them is the knowledge that the antiaircraft artillery probably know full well the objective you are stalking, and have sited their guns with your visit in view. You can still play a modified form of tag, keeping always in the general direction of this objective—and this is what you would probably do. Knowing that antiaircraft artillery directors predict at a tangent to your course at any one time, you decide that continuous curves, rather than sharp curves and straight lines, are better. You decide that S curves—making a sine wave in the horizontal plane—are probably your best bet.

What will an S curve in the horizontal plane do to the firing data furnished by a director? Let us take an S curve requiring a 60 degree angle of bank by an airplane—an S curve made up of sections of a circle of 1,200 yard radius. If we assume a time of flight for the projectile of 15 seconds, we find that our line of bursts will run along in the sky at an average distance of 400 yards from our ship. This relative immunity from antiaircraft fire is afforded at a cost of only 10 per cent longer time under fire. We may summarize in saying that horizontal S curves are one of the most efficient maneuvers in existence for throwing the antiaircraft off the target because they:

1. Allow continued progress toward the objective.
2. Increase the time under fire only about 10 per cent.
3. May be performed without violent stress to the plane.
4. Throw the antiaircraft director off the target's course a maximum distance.

Possible Changes In Antiaircraft Set-Up

Now we have had the story as to the maneuvers that antiaircraft will have to combat. What are the remedies, what can be done to meet these maneuvers? The possible plans for firing on maneuvering targets seem to fall naturally, under three heads: First, what changes can I make in my personnel? Secondly, what changes can I make in my equipment? Thirdly, what changes should be made in training?

The first change, and the easiest, is in personnel. The maneuver officer (whom we shall call the "maneuver adjusting officer" and who should have a knowledge of

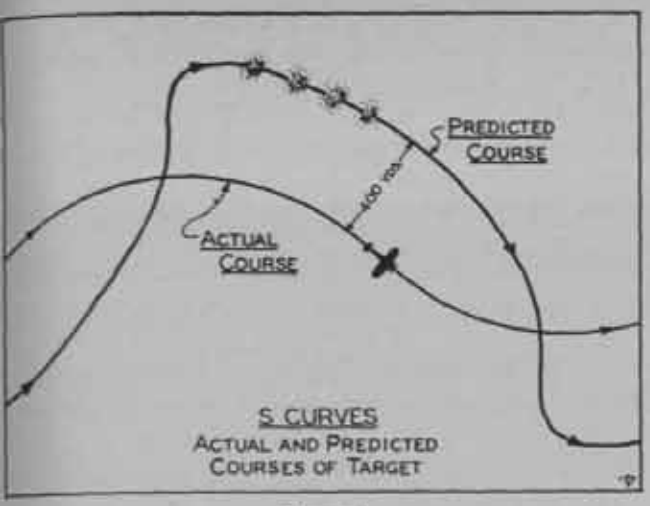


Figure 1

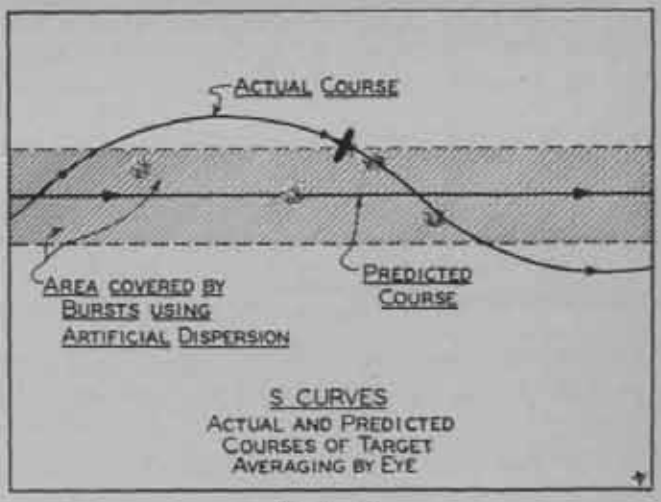


Figure 2

the capabilities and limitations of enemy aircraft) should be divorced from all routine duties during firing, so that he may devote his entire attention to observing the target and countering its maneuvers. This officer should possess a full knowledge of the capabilities, psychology and methods of the enemy aviation, and should devote his time to training a maneuvering target section, consisting of the lateral and vertical trackers, the present altitude setter, the lateral and vertical spotting dial operators, and the present and future altitude spotting dial operators. This section can work and train together as a unit, so that the instantaneous action necessary may be taken at one "canned" command.

It is essential that all routine corrections be made by individuals other than the maneuver officer. With a sufficient ammunition allowance, it should be possible to train suitable noncommissioned officers to adjust laterally, vertically and in present altitude.

With a well trained range section, it should be possible to feel confident that the center of impact will be close to the target at all times that the target is flying straight and level. Any large and sudden deviation of the line of bursts from the target's course is probably caused by some maneuver of the target (especially outside the decisive zone) and should be countered as maneuvers, and not as some error of the range section.

Secondly, what changes can be made in equipment? One piece of essential apparatus is an interphone system, connecting the maneuver team composed of:

1. Maneuver officer.
2. Lateral and vertical trackers.
3. Present altitude setter.
4. Lateral and vertical spotting dial operators.
5. Present and future altitude spotting dial operators.

Each member of the team could well be provided with an airplane headset in a flying helmet, and a breast transmitter.

Various gadgets would be necessary, depending on the director used. Some, like the M2, would require some means of setting in a steadily decreasing present altitude as the target dived, plus a means of determining and setting in a constantly varying future altitude spot. Other more modern machines would require fewer improvizations.

Another piece of equipment that seems to have possibilities is some form of "artificial dispersion machine" which will introduce artificial dispersion in the desired direction at the will of the maneuver adjusting officer.

Thirdly, what changes in training? The possible changes will be enumerated by describing definite means for meeting the various maneuvers: glides, S curves, 90 degree turns, etc.

Now imagine yourself back in the pilot's seat of this imaginary bombardment plane, about to start on a mission. You know that the objective itself will be defended by antiaircraft artillery, and you strongly suspect that you may encounter antiaircraft opposition any time within twenty miles of the target. You decide to take up horizontal S curves as soon as you are within twenty miles of the objective and to bomb from a glide.

Now, change again, and imagine yourself to be the antiaircraft officer on the ground. The target comes into your area travelling in wide S curves. As he approaches the decisive zone, he goes into a steady glide, straight for the objective. With a conventional director and conventional technique, what are you to do? How successful will you be in bringing down this bomber?

S Curves

We now come to the second part, "What can we do, and how can we do it?" We see this plane approaching, flying a wide S-curve course. As our directors predict tangentially, the path of the bursts in the sky will diverge considerably from the true path of the target. This divergence will be of a magnitude of about 400 yards, and is illustrated by Figure 1. It can be seen by reference to the illustration that it is not practicable to apply the conventional technique to the problem.

The first expedient that occurs is to freeze the rates—either at average rates, or at the rates set up before the S curve was started. However, we find that freezing the rates merely offsets the future position a fixed amount

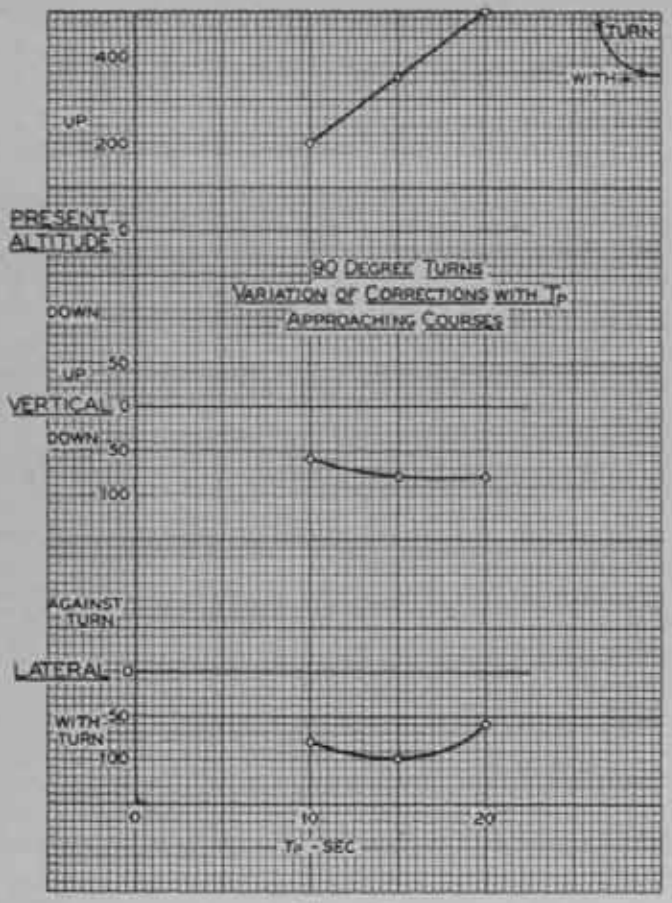


Figure 3

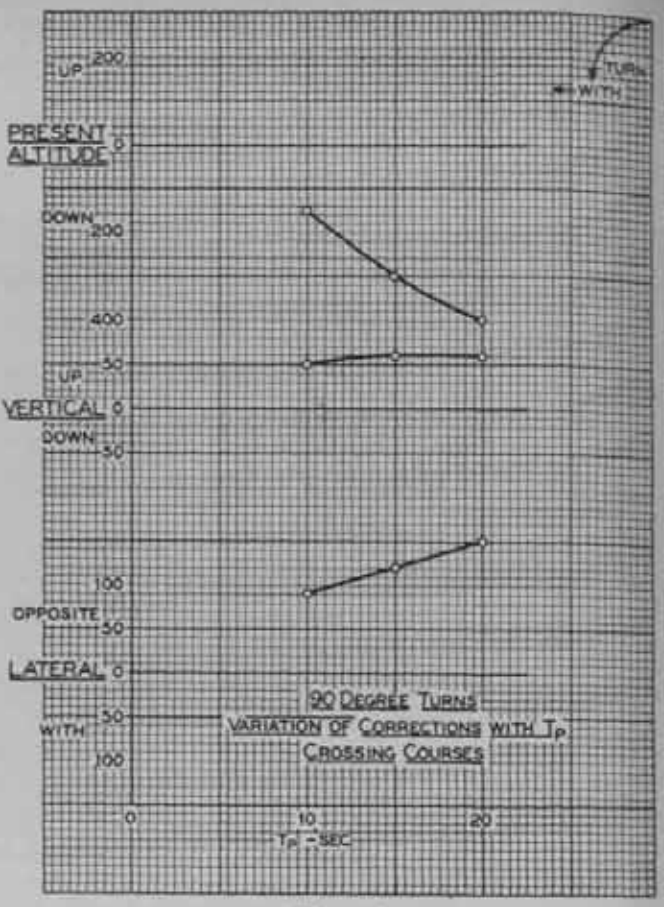


Figure 4

TABLE I

90° Turns. APPROACHING COURSES
CORRECTIONS TO APPLY

	LATERAL	VERTICAL	PRESENT ALTITUDE
tp=10	Apply lateral spot of *R or L 80* (in direction of turn) decreasing uniformly to 0 in about 6 sec.	Apply vertical spot of *Down 60*, decreasing uniformly to 0 at end of turn.	Apply pres. alt. spot of *Up 200*, keeping on for ⅔ of turn, then decreasing uniformly to 0 at end of turn.
tp=15	Apply lateral spot of *R or L 100* (in direction of turn) decreasing uniformly to 0 in about 6 sec.	Apply vertical spot of *Down 80*, decreasing uniformly to 0 at end of turn.	Apply pres. alt. spot of *Up 330*, keeping on for ⅔ of turn, then decreasing uniformly to 0 at end of turn.
tp=20	Apply lateral spot of *R or L 60* (in direction of turn) decreasing uniformly to 0 in about 6 sec.	Apply vertical spot of *Down 80*, decreasing uniformly to 0 at end of turn.	Apply pres. alt. spot of *Up 500*, decreasing uniformly to 0 at end of turn.

TABLE II

90° Turns. CROSSING COURSES
CORRECTIONS TO APPLY

	LATERAL	VERTICAL	PRESENT ALTITUDE
tp=10	Apply lateral spot of *R or L 90* (opposite to direction of flight) decreasing uniformly to 0 at end of turn.	Apply vertical spot of *Up 50*, decreasing uniformly to 0 at end of turn.	Apply pres. alt. spot of *Down 150*, decreasing uniformly to 0 at end of turn.
tp=15	Apply lateral spot of *R or L 120* (opposite to direction of flight) decreasing uniformly to 0 at end of turn.	Apply vertical spot of *Up 60*, decreasing uniformly to 0 at end of turn.	Apply pres. alt. spot of *Down 300*, decreasing uniformly to 0 at end of turn.
tp=20	Apply lateral spot of *R or L 150* (opposite to direction of flight) decreasing uniformly to 0 at end of turn.	Apply vertical spot of *Up 80*, decreasing uniformly to 0 at end of turn.	Apply pres. alt. spot of *Down 400*, decreasing uniformly to 0 at end of turn.

from the present position, and that the resulting path of the bursts is exactly similar to the course of the target. The situation is much like that in alternating current, where the current curve chases the voltage curve across the paper.

Another possible solution is to fire down the center of the S, as indicated by the center line of Figure 2. When we combine this burst path with a fanning out of the burst pattern of our battery (as shown by the cross-hatched area) we have a fifty-fifty chance to hit the target.

There are two general methods by which the path of the bursts may be made to follow the center line of the S curves.

1. By having the trackers follow the target exactly, and neutralize the wide sweeps of the S curves by using the spotting correction dials.
2. By having the trackers *average* the courses by *eye* (perhaps using the open sights), thus setting into the instrument a course that splits the S.

After considering the matter, the second solution seems the more workable. It is realized that any method that causes the trackers to "get off" the target at any time has its drawbacks, but it is believed to be the lesser of two evils. It is believed to be the better method because:

1. Use of the first method requires an accurate knowl-

edge of the constantly changing *time of flight* at all times, in order that the spotting corrections designed to neutralize the gyrations of the target may be properly timed.

2. Use of the first method requires an accurate knowledge of the *angle of approach* (which may be changing) at all times.

3. In the recommended method, both trackers halve, or average, the oscillations of the target by eye. In so doing they set up an approximately straight course that takes care of varying angles of approach, and allows usable rates to be set.

4. In the recommended method, the adjusting officer is not required to keep track of any element of present or future position data, but merely shifts the bursts right or left, up or down, in the conventional manner.

5. The same "averaging by eye" procedure works equally well whether the target is making the ordinary S curves in the horizontal plane, or is porpoising (making smaller S curves in the vertical plane).

Of course, some method of signalling the trackers when to "average by eye" is necessary, and probably would take the form of an interphone between the adjusting officer and the trackers.

It may be desirable at this point to analyze what happens when a target comes into view on a *crossing* course similar to that in Figure 1. In this case the battery will seem to be to the left of the paper. The motion of the target to the azimuth tracker will not appear uniform, but will approach simple harmonic motion. As the azimuth tracker follows the target, the north-south rate needle, or dial, will indicate a slightly varying rate (assuming that the target is going straight north). For those directors with manual rate matching, this varying rate may be averaged by the rate operator and thus a mean rate will be set in which will average the varying target speed in the N-S direction, and furnish a workable prediction in this direction. For those directors with automatic rate setting, no averaging can be done. The range problem is a little more difficult. To the vertical tracker, the target appears to rise and fall (about 25 mils above and 25 mils below) from the course established by a target in straight line flight. To make the present position path take up the straight line desired, it is necessary for the vertical tracker to average his apparent course. He must keep his crosswire moving along an approximately straight line, although the target is apparently rising and falling along a curved line which resembles a sine wave. This will cause the present angular height to vary uniformly, setting up a rectilinear course for the present position pin. With the rate set at the average value this procedure will give straight line prediction—the bursts will appear along the center line of the S curve in Figure 2.

When the target is *approaching* the battery the conditions are reversed—the lateral tracker has the difficult job. In order that the path of the present position pin on the present position disc be a straight line, the lateral tracker must average the rights and lefts of his target's course. The vertical tracker follows the target exactly. As

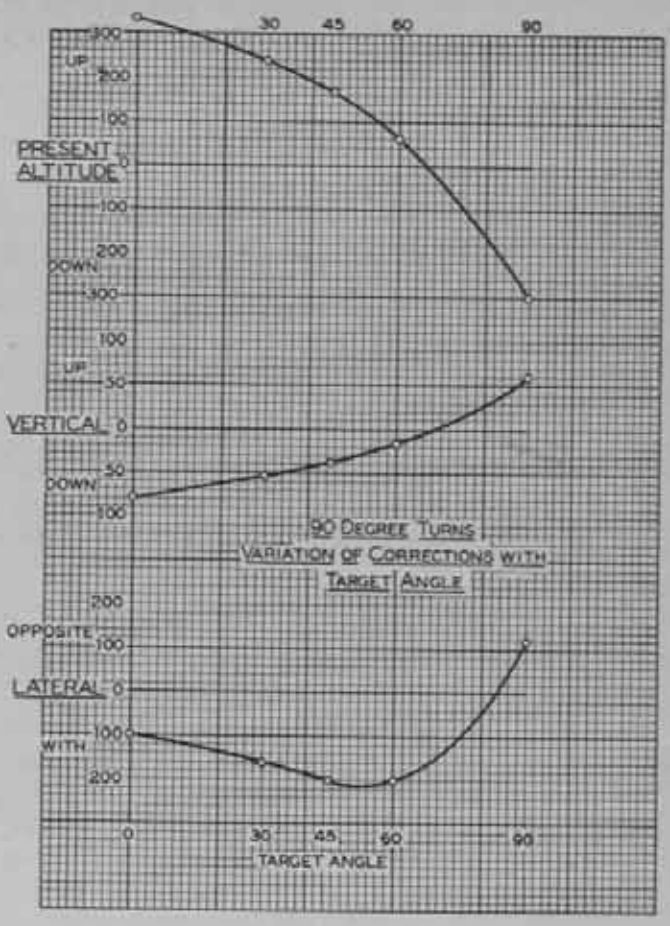


Figure 5

TABLE III
COMPARISON OF PROCEDURE
CORRECTIONS TO APPLY AT VARIOUS TARGET ANGLES

t_p = 15 sec.

Assuming 6 sec. for the maneuver officer to diagnose maneuver and apply correction, and for rates to settle down.

Target Angle	LATERAL	VERTICAL	PRESENT ALTITUDE
0° (Approach)	Apply lat. spot of *R or L 100* (in direction of turn) decreasing uniformly to 0 in about 6 sec.	Apply vert. spot of *Down 80*, decreasing uniformly to 0 at end of turn.	Apply pres. alt. spot of *Up 250*, keeping on for ⅝ of turn, and then decreasing uniformly to 0 at end of turn.
30°	Apply lat. spot of *R or L 160* (in direction of turn) decreasing uniformly to 0 at end of turn.	Apply vert. spot of *Down 50*, decreasing uniformly to 0 at end of turn.	Apply pres. alt. spot of *Up 240*, decreasing uniformly to 0 at end of turn.
45°	Apply lat. spot of *R or L 200* (in direction of turn) decreasing uniformly to 0 at end of turn.	Apply vert. spot of *Down 40*, decreasing uniformly to 0 at end of turn.	Apply pres. alt. spot of *Up 150*, decreasing uniformly to 0 at end of turn.
60°	Apply lat. spot of *R or L 200* (in direction of turn) decreasing uniformly to 0 at end of turn.	Apply vert. spot of *Down 13*, decreasing uniformly to 0 at end of turn.	Apply pres. alt. spot of *Up 60*, decreasing uniformly to 0 at end of turn.
90°	Apply lat. spot of *R or L 120* (opposite to direction of flight) decreasing uniformly to 0 at end of turn.	Apply vert. spot of *Up 60*, decreasing uniformly to 0 at end of turn.	Apply pres. alt. spot of *Down 300*, decreasing uniformly to 0 at end of turn.

the largest errors are to be expected in azimuth, the burst pattern should be spread in azimuth.

If the course is a combination crossing and approaching course, both trackers must average their apparent sine curves in order to get a rectilinear path for the present position pin, and straight line prediction for the future position.

If the pilot chooses to *porpoise* (to fly vertical S curves by alternately climbing and diving) we can use the same technique as we used on the crossing course S curve maneuver. Here the lateral tracker follows the target in the conventional manner, while the vertical tracker averages the sine wave course by eye.

We are deliberately throwing aside any attempt to follow the target through its gyrations, and instead we try to fire down the center line of the wavy course. By combining this with artificial dispersion, we have the best chance of getting hits.

Gliding and Diving Targets

Supposing that we are firing on a plane in level flight. What happens in the *sky* when the target starts to glide? When we apply conventional technique, the bursts will continue to burst along in continuation of the old horizontal course. This condition will continue during the time of flight, plus the time it takes for the heightfinder to obtain and apply a new altitude. If we assume a time of flight of fifteen seconds, and that it takes fifteen seconds for the heightfinder crew to determine that the target has started to glide and to obtain a new altitude, we find that we have frittered away at least half of the time it takes for the plane to cross the decisive zone. With this thirty-second lag we find that although the target started to glide at a certain point, the bursts continued along the old horizontal line for thirty seconds more. During this thirty seconds the shells have been bursting an average of 400 yards from the target. Clearly the conventional horizontal prediction will not work, and something else must be done.

What happens in the *director* when the target starts to glide? The director locates the present position in the vertical plane by means of the angular height and altitude. The angular height will always be correct and up-to-date, as it is obtained by tracking the target. The altitude will lag most of the time, catching up from time to time as the stereo-observer reads. The combination of a decreasing angular height with a stationary altitude gives a fictitiously large horizontal range—and the director computes a fictitious saw-edged course for the present position. This is immediately reflected in the motion of the future position which generates a similar saw-edged path. At a time of flight of fifteen seconds, and with the altitude as much as ten seconds late, we can have an error of 350 yards in horizontal range.

For accurate shooting at conventional horizontal bombers flying straight and level there is one prime essential—correct altitudes. For fire at gliding, climbing and diving targets correct altitudes are even more important, as there is no such opportunity to average several readings as exists when the target flies horizontally.

We have two distinct parts to our problem: how to keep our present altitude always up to the second; and how to compute and apply a future altitude spot of proper size. Even with an accurate stereo-crew, it is a task to continuously supply up-to-the-second altitudes. The first step taken by the maneuver adjusting officer after he notices a climb or glide, is to estimate the rate of climb or glide, and announce this to his present altitude setter and his future altitude spotting dial operator. Here is where a detailed knowledge of the climb and glide characteristics of enemy aircraft comes in, as it is almost certain that the pilot will use the steepest maneuver possible in order to place the greatest possible distance between himself and those bursts. With this knowledge in mind, the maneuver adjusting officer can make a very shrewd estimate of the rate of descent of the gliding aircraft.

With the earlier type directors, the present altitude setter must begin to "creep" the present altitude dial at the announced rate, checking his creep at intervals as new readings come in from the heightfinder. This is a rough and ready means of keeping present altitude always up to date. In the later directors this rate of descent may be set in on a dial, and the machine then automatically sets in the steadily decreasing altitude necessary.

Getting the future altitude spot is a little more complicated. If no future altitude spot is applied, the director will predict horizontally out to a point at the same altitude as the present position. As the target is losing altitude, it will actually be many yards lower at the future position than it was at the present. Given a correct estimate of the target's rate of descent, the future altitude spot will equal this rate multiplied by the future time of flight.

It is necessary for the future altitude spotting dial operator to keep track of the future time of flight (or fuze range) at all times, multiply this by the rate of descent, and apply it continually to the future altitude spotting dial. We may say that if the rate of descent has been correctly estimated and applied to the present altitude—and if this rate has been multiplied by the future time of flight to get the future altitude spot—if this has been done our fire will be as accurate against glide bombers as it is against those that fly level.

Neutralizing Turns Using Spotting Corrections

The most practical means of neutralizing the effect of ordinary turns is by the use of spotting corrections. In order to give a maneuver adjusting officer some idea of the corrections required, graphical solutions have been made of an average turn at various times of flight, and at various angles of approach. Corrections called for as the result of turns are shown graphically in Figures 3, 4, and 5, and directions for application on Tables *I*, *II*, and *III*.

Certain assumptions have been made to simplify computations. The time of flight was assumed to stay constant throughout the turn. One altitude (3,500 yards) was used. It is believed that the computed corrections are ac-

TABLE IV

MANEUVER	MINIMUM LIMIT	MAXIMUM LIMIT	REASONABLE LIMITS	REASONABLE AVERAGE	PRESENT ALTITUDE	FUTURE ALTITUDE
Steady Glide or Dive	Level Flight	— 12° dive Descent 25 yds./sec. at 250 mph	0-15 yds./sec.	10 yds./sec. 1,800′ per min.	Present altitude setter creeps present altitude dial at assumed rate of descent, called off by maneuver officer. Improves assumed rate by checking with altitude from height finder when it comes in on inner (electrical) dial.	Future altitude spotter mentally multiplies assumed rate of descent by the reading on fuze dial, and applies product to future altitude spot. He then changes future altitude spot as (1) Fuze changes (apply continuously). (2) More accurate rate of descent is determined. (Apply as determined.)

curate enough to give the maneuver adjusting officer a guide as to the size and sense of corrections to apply.

Referring to Figure 5, we see that corrections for 90 degree turns follow certain general laws for target angles from 0° to 60°—that there is a critical point somewhere between 60 degrees and 90 degrees—and that between this critical point and 90° there is a complete reversal of the sense of corrections. With this in mind, the maneuver adjusting officer can familiarize himself with the general size and direction of corrections necessary to meet the various turns.

As a result of his study he can prepare a series of "canned" spots (take a 90° average turn at tp = 15 seconds as Maneuver 1, for instance). At Command Spot 1—the lateral spotter would go right 100 mils., the vertical spotter would go down 80 mils., the altitude spotter would go up 350 yards. At command Spot 2 they would each do what had been agreed upon to neutralize Maneuver 2, etc. After giving the canned command, the maneuver adjusting officer would be free to observe the target, and to make any modifications called for.

It is believed that with considerable practice, maneuver adjusting officers would be able to diagnose the maneuver in two seconds—the spotting correction operators apply the canned correction ordered in two seconds—and the director rates settle down in two seconds more—making a total of six seconds for corrected data to get to the guns. This six-second lag is the lag figured in "doping out" definite corrections.

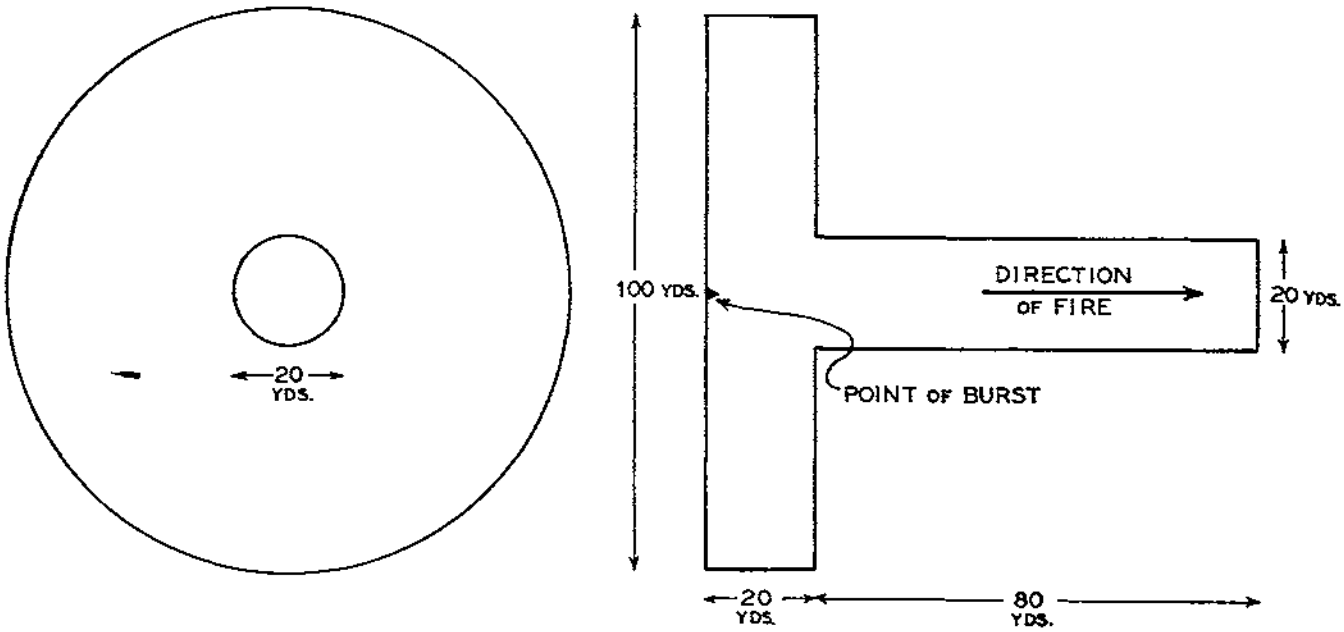
Here, also, we will give the actions necessary to counter a glide or an S curve maneuver, including the maximum limits to the maneuver, reasonable limits, and a *reasonable* average to be expected.

Change In Speed

One of the simplest forms of maneuver is a change in speed. By keeping in mind the performance data on the particular bomber being fired upon, the maneuver adjusting officer can eliminate some possible changes, i.e., if the bomber is already flying at his maximum speed, he cannot increase this speed and remain in level flight. If his speed increases, he is diving. As the pilot will not want to lose altitude outside the decisive zone, he will probably elect to fly level and thereby make a change of speed possible in one direction—a decrease. On the other hand, if the target is flying slower than his maximum speed (which would be unusual) the maneuver adjusting officer must be prepared to counter either an increase or a decrease. An increase in speed on a crossing course should be countered by an immediate and bold correction on the lateral spotting dial in the direction of flight, which should be kept on only for the time necessary for the rates to catch up with the increase in target speed. As soon as the rates are reflecting the increased speed of the target, the correction is tapered off to zero. If the target is continually altering his speed the remedy probably lies in averaging his changes, and introducing artificial dispersion in the direction of flight. For approaching courses the technique is

TABLE V

MANEUVER	MINIMUM LIMIT	MAXIMUM LIMIT	REASONABLE LIMITS	REASONABLE AVERAGE	AZIMUTH TRACKER	VERTICAL TRACKER
S CURVE	Curve Rad = 900 yds.	As large circle as desired.	Curve between Rad = 900, time = 18 sec. and Rad = 1,400, time = 25 sec.	Radius = 1,000 yards. Time = 20 sec.	*Crossing Course* Azimuth tracker follows target in glass, averaging if he can discover enough change to average.	Vertical tracker follows target in glass, averaging by eye the upward and downward (±25m) motions of the target as illustrated in Figure 9.
					Approaching Course Azimuth tracker follows target in glass, averaging by eye the left and right (±60m) gyrations.	Vertical tracker follows target in glass, averaging if he can discover enough change to average.
					45° Course Azimuth tracker follows target in glass, averaging by eye the left and right gyrations.	Vertical tracker follows target in glass, averaging by eye the above and below gyrations.



A.A. BURST
CONVENTIONALIZED

Figure 6

the same, except that here the correction is made to the vertical spotting dial.

A Study of Burst Patterns

When a 3-inch high explosive shell detonates, its fragments cover approximately the solid illustrated in Figure 6. The destructive force possessed by a battery in one salvo consists of four of these bursts, and we destroy the target by placing one of these bursts on or near the aircraft.

In firing at non-maneuvering targets in level flight, where the probable error of our position finding system is small, we sight our guns to fire parallel to each other, or converge our fire so that all four guns are firing at the same point—the target. Normal dispersion then covers any minor errors in target location. When we fire at maneuvering targets, our errors in position finding become much larger, and we can no longer depend on normal dispersion to correct for our errors. Some causes of this increased error are:

1. Increased error in determining present position data, due to difficulty in supplying accurate, up-to-date, altitudes at all times.
2. Difficulty in determining true rates, or of determining an average value for freezing rates.
3. Non-rectilinear motion of the target during time of flight.

In view of the above, it seems reasonable that we depart from point fire, introducing artificial dispersion as the occasion demands. This means that we are deliberately spreading our fire thinner in order to increase the volume covered by our bursts. The following is an attempt to analyze various maneuvers, and to determine a burst pattern that will, *under average conditions,* be most efficient in countering the maneuver.

Four basic means of altering the burst pattern are illustrated in Figure 7. These four seem able to cover the most likely maneuvers. In Burst Pattern A we have a pattern suitable for courses where the principal error is in present altitude. Burst Pattern B is suitable for courses where the principal error is in vertical deflection. Burst Pattern C is most valuable when the principal error is in lateral deflection and Burst Pattern D when the error is in horizontal range.

For purposes of study let us conventionalize our patterns still further, until we have the dotted rectangles shown in Figure 7. It is true that this leaves some areas theoretically uncovered by fragments, but this is balanced by the fact that the normal dispersion of the guns will produce a fairly even distribution through the entire area. Instead of trying to visualize four separate bursts in space, we can now visualize one rectangular pattern.

Burst Pattern for Approaching Courses

In a *glide* the principal error in our target location is in present altitude. For combating this error we spread our bursts along the trajectory by applying individual corrections to the fuze, and make Burst Pattern A in the sky. This pattern will take care of errors of ± 200 yards in slant range, or of altitude errors of ± 140 at an angular height of 800 mils.

In a maneuver on an approaching course in which the pilot *changes his speed,* the principal error will occur in horizontal range, so we apply Burst Pattern D to counter this maneuver. By so doing we cover errors in prediction in horizontal range up to ± 250 yards.

If the pilot chooses to maneuver in *S curves* while on an

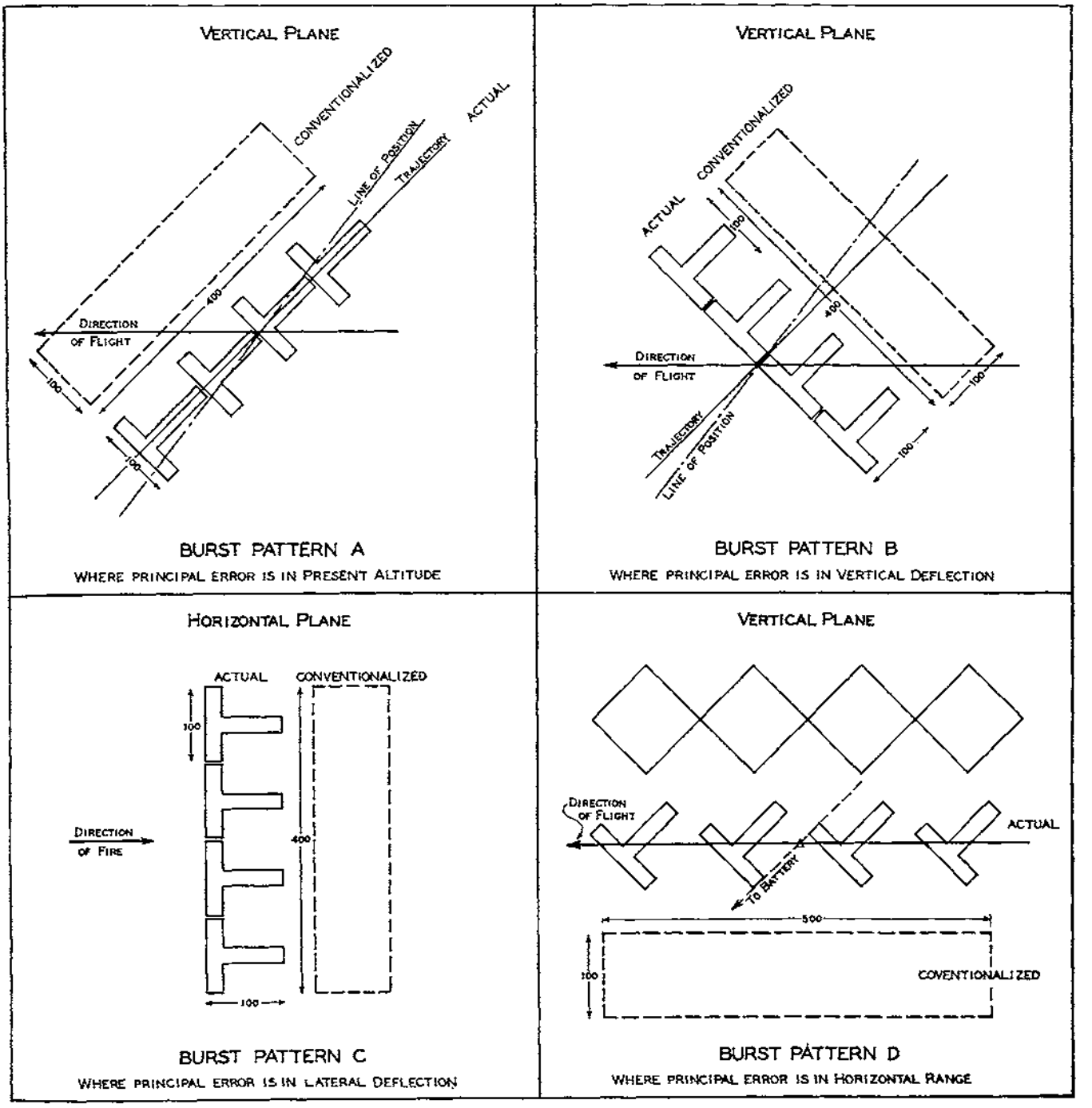


Figure 7

TABLE VI—CHANGES IN DATA TO ACHIEVE BURST PATTERNS

Burst Pattern	Data Receiver	Gun No. 1	Gun No. 2	Gun No. 3	Gun No. 4	For error in	Color
A	Elev	0	0	0	0	H_o	Red
	Az	0	0	0	0		
	Fuze	— 0.5	— 0.3	0	+0.3		
B	Elev	+40	+10	— 10	— 40	O	Blue
	Az	0	0	0	0		
	Fuze	0	0	0	0		
C	Elev	0	0	0	0	Ap	Yellow
	Az	L40	L10	R10	R40		
	Fuze	0	0	0	0		
D	Elev	+30	+10	— 10	— 30	Ro	Green
	Az	0	0	0	0		
	Fuze	— 0.5	— 0.2	0	+0.3		

Changes in Elevation and Azimuth are in Mils.

approaching course, the maximum errors in prediction occur in lateral deflection. To cover this possible error, we distribute our fire as in Burst Pattern C, which spreads the bursts laterally to take care of errors up to right or left 200 yards. If we use this pattern on the type S curve we have been investigating, we cover the cross-hatched area shown in Figure 2.

If, on an approaching course, the pilot maneuvers by porpoising (alternately diving and climbing at frequent intervals) our principal error will be in vertical deflection, and we use Burst Pattern B to compensate for this error.

Burst Patterns for Crossing Courses

If our target *glides*, we have the same basic error as we had on the approaching courses—error in altitude. Therefore we use the same burst pattern, Burst Pattern A, in order to include the target within the burst area.

On the other hand, a *change in speed* on a crossing course causes an error in azimuth. This error we counter by applying Burst Pattern C, which spreads our bursts laterally to include locations right or left 200 yards from the computed position.

On an *S curve* maneuver by a crossing target, we find that our principal error is in horizontal range, so we use Burst Pattern D. If our trackers are splitting the oscillations of the course, this will enable us to cover approximately the dotted rectangle Burst Pattern D.

If our pilot chooses to *porpoise* (to alternately climb and dive at frequent intervals so as to make vertical sine curves in the sky) our principal error will be in vertical deflection, and we use Burst Pattern B to spread our bursts vertically. This pattern enables us to cover a zone of ± 40 mils at a range of 5,000 yards.

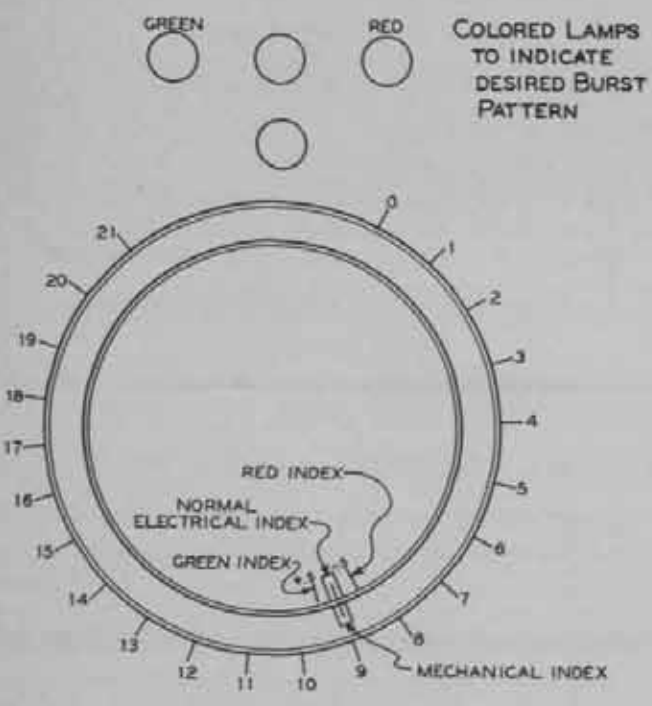


Figure 8

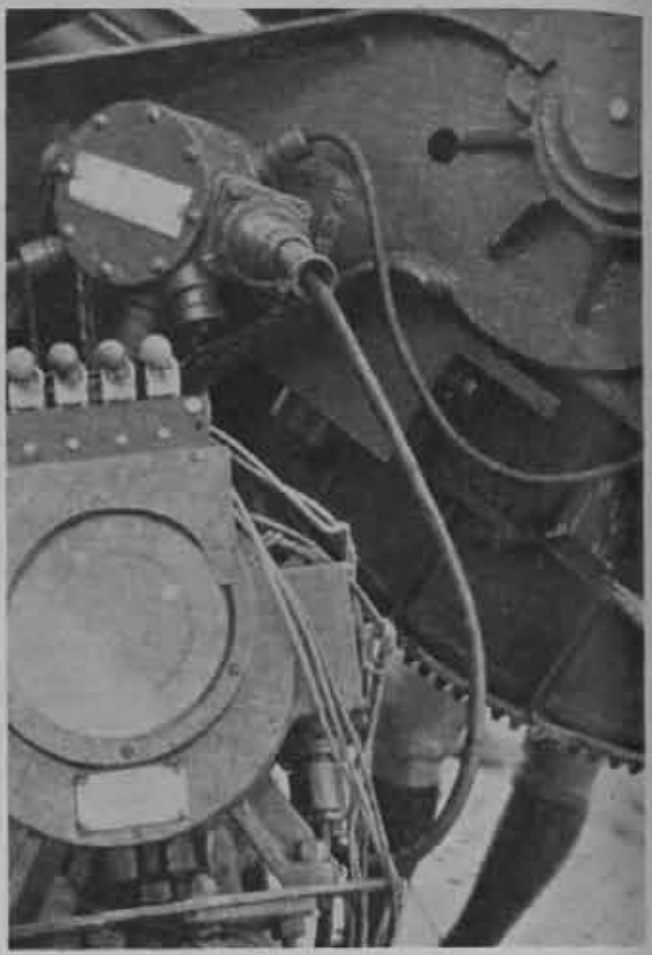


Figure 9: Colored lamp indicators on fuze receiver

Practical Means of Achieving Desired Burst Patterns

The ultimate in flexible burst pattern control would be a set of twelve electrical differentials, controlling each element of data to each gun.

A solution suggested herewith makes use of colored indices on the data receivers on the guns. Referring to Figure 8, we see a fuze range receiver. The regular (white) index is shown matched at a reading of 9.0. If instead we matched the *red* index, we set 8.5 on the fuze cutter, although the director is transmitting 9.0. If we match the *green* index we set 9.5 on the cutter. We now have a method of offsetting individual fuze cutters. By assigning a certain color, say red, to Burst Pattern A, and placing red indices correctly on the four fuze receiver dials, we can make Burst Pattern A appear in the sky by training our fuze receiver operators to match the red index (instead of the conventional white).

Similarly, for Burst Pattern B the quadrant elevation receivers are given offset indices of another color, it being

unnecessary to alter either fuze or azimuth. Burst Pattern D is the only pattern requiring changes in two elements of data—quadrant elevation and fuze range. Numerical values of the proper index displacements are given in Table VI for all four burst patterns.

To indicate to the receiver operator the index it is desired to use, some form of signalling must be provided. One possible solution uses colored lamps to indicate the proper index—each receiver being equipped with four colored lamps controlled by a circular switch at the director. As actually tried out, the colored light installation on a fuze receiver is shown in Figure 9. The same type of colored light installation is placed on the quadrant elevation and the azimuth receivers.

By moving his circular switch at the director, the maneuver adjusting officer can change from standard fire to Burst Patterns A, B, C, or D at will, according to the actions of the target then under fire.

Conclusions

1. That there are certain definite limits of maneuver, set by the aerodynamic and structural design of the airplane, and wholly independent of the desire or skill of the pilot; that the existence of these limits simplify the problem of firing against maneuvering aircraft; that a knowledge of these limits is of great value to a maneuver adjusting officer attempting to fire effectively on a maneuvering target.

2. That bombsights are likely to appear in the near future that will make it practical to bomb from a steady glide; that present directors are not designed to fire automatically on gliding targets; and that firing effectively with present directors requires a specialized technique and organization.

3. That freezing the rates merely effects the present from the future position a fixed amount and does little toward making effective fire possible.

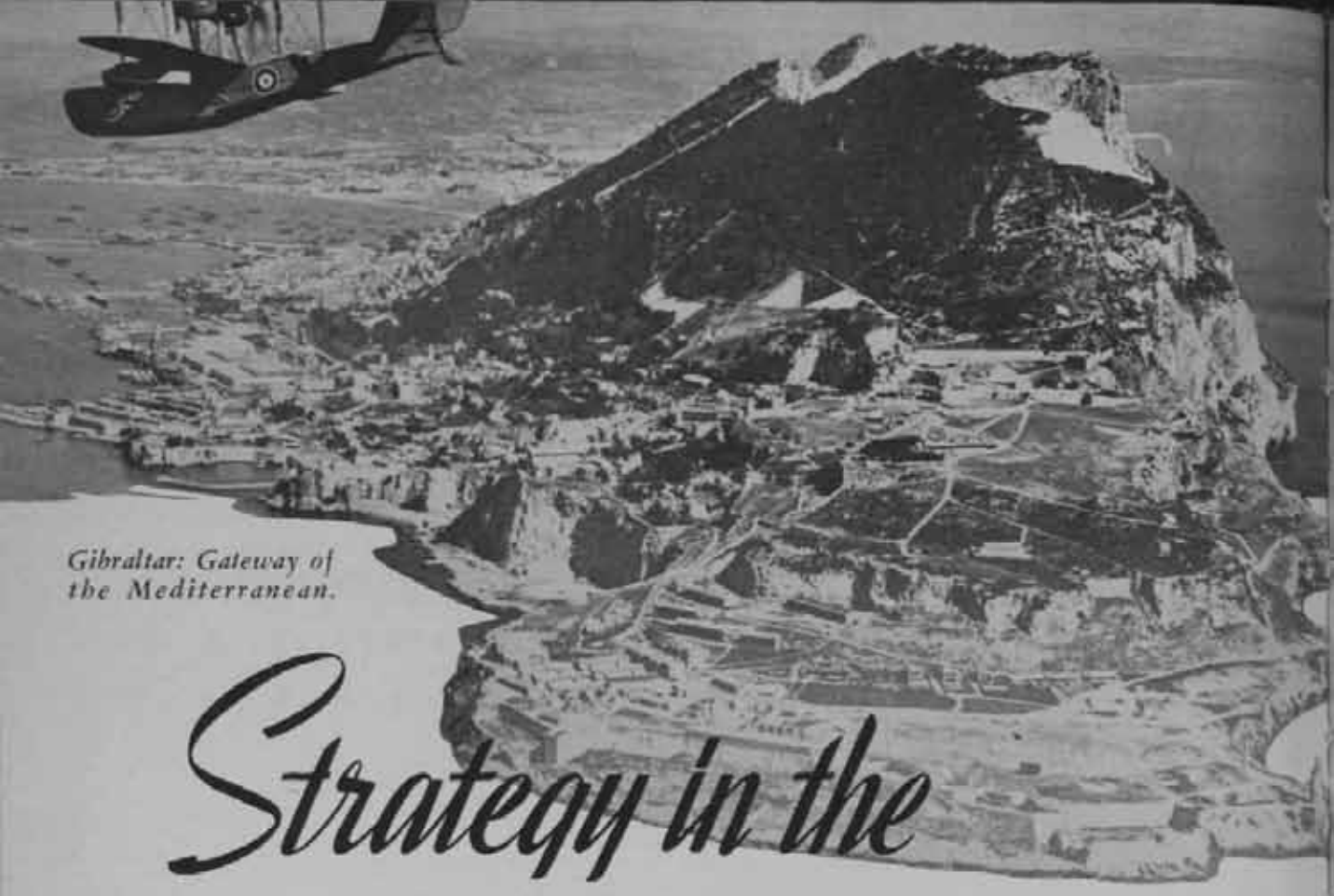
4. That under zigzag, repetitive maneuvers (of which the S curve is an example) it may be desirable to have the trackers average the course by eye and fire down its center.

5. That artificial dispersion is desirable when firing on certain types of maneuvers; that most maneuvers can be countered by one of four burst patterns; that some means of producing these burst patterns is desirable.

6. That the "Maneuver Team" composed of the maneuver adjusting officer, the two trackers, the present altitude setter, and the four spotting correction operators must be indoctrinated and trained as a unit, so that at one "canned" command each will do his separate job instantly.

The man *who is self seeking never becomes a real leader. The time inevitably comes when the self seeking leader fails to inspire confidence, and the moment a leader fails to inspire confidence he ceases to be a leader.*

If I should attempt to include in one word the most valuable quality of the Army officer I would select dependability as that word. A man may be ever so bright, he may have excellent judgment, and good common sense, but if he is not thoroughly dependable he is dangerous. And the more brilliant, the more dangerous he is.—Brigadier General A. L. Singleton.



Gibraltar: Gateway of the Mediterranean.

Strategy in the MEDITERRANEAN

By Major-General H. Rowan-Robinson, British Army

The Mediterranean Sea, thrust forward like a tongue from the Atlantic, has always been a source of refreshment, a means of communication, and an arena of conflict for nations of three continents. Its shores have been the scene of mighty, unending, and varied drama. In early days, there were the Homeric contests for Troy, the voyages of the Phoenicians, the invasions of the Persians, and the colonization of the Greeks. Thereafter came the stupendous struggles of the Punic wars, at the close of which Carthage, once the commercial capital of the globe, was obliterated. The contested sea then became a Roman lake, and through Greek culture and Latin arms, the center of civilization. In the days of the decadence of the Empire, Roman maritime power succumbed to the successive assaults of Vandal, Saracen, and Turk. The corsairs of Algiers then dominated the sea for two centuries. Nevertheless, the chief cities of the littoral, largely through the intensive activities of the navies and merchant ships of Venice, Genoa, and Pisa, retained their pride of place until new worlds were discovered by Christopher Columbus and Vasco da Gama, when their preëminence was usurped by the Iberian, French, and English ports looking out into the Atlantic.

By the marriage of Ferdinand and Isabella, in 1469, the combination of the maritime strength of Aragon with the military strength of Castile made of Spain a great Mediterranean power. Unfortunately for her, instead of combining with the other Christian powers in preventing the depredations of the Algerian corsairs, she wasted her substance in fighting the French in Italy for sixty years. It was not for another twenty years that she joined with the Venetians to defeat the Turks at Lepanto; and, even then, she failed to deal adequately with the corsairs.

England figures first as an important factor in Europe's inland sea in the days of Cromwell. "With what prodigious *bravura* did she not make her début in this new rôle, when Blake's fleet, chasing Prince Rupert's privateers, called upon Tuscany and the Pope for indemnities, bombarded Tunis, and showed the flag at Malta and Venice, Toulon and Marseilles!"[1] It was then—1654—that Cromwell contracted the alliance with Portugal which is still valid, affording to Britain the use of the harbor of Lisbon—a boon which might, in view of the

[1] H. A. L. Fisher: *A History of Europe.*

menace to Gibraltar, be of even greater value today than it has been during the past three hundred years.

Marlborough, who "understood the strategy of world war and the way to combine land and sea power in successful operations better than any man who has succeeded him in control of England's destiny, with the possible exception of Chatham" established Britain firmly in the western Mediterranean with possession of Gibraltar and Minorca. In 1718, the Spanish navy, revived for the first time since the defeat of the Armada, did indeed attempt to dispute dominion, but it was destroyed by a British fleet at Cape Passaro.

Afterwards England's navy passed through a period of neglect, with the result that it entered the war of the French Revolution in a mutinous state, possessed of only one base in the Mediterranean, namely Gibraltar, Minorca having been lost in 1757. Britain began badly; her ships were excluded from that sea for a whole year by the combined French and Spanish fleets. The arrival of Nelson on the scene, the victory of the Nile, and the occupation of Malta restored her mastery. Trafalgar confirmed it.

Then for a hundred years (except for some anxiety in 1893, when France allied herself with Russia), British domination was practically unchallenged. With the growth of the German menace, however, and its threat to the North Sea, Britain handed over control of the Mediterranean to the French so that the Dreadnoughts might be able to meet in full strength the principal menace to their power.

In the Great War, the Allied fleets had no difficulty at first in controlling the Mediterranean in face of the weak forces of the Central Powers. But when the submarine came into play the situation changed. The Germans then, though they had only a few bases high up in the Adriatic and were never able to keep more than six of their submarines at sea at one time, took such toll of Allied shipping that the Admiralty would have diverted trade to the Cape route had not the Government objected. In spite of unobstructed surface-command, the Allies lost merchantmen in the Mediterranean to a tonnage of 5,000,000 against a total loss of 13,000,000 tons in all theatres, and in consequence, experienced considerable difficulty in supplying their large forces engaged in the Middle East.

The submarine was a weapon peculiarly suited to the particular task, for it could strike at short range in the narrow seas, it could find hiding places in the numer-

French submarines in the harbor of Marseilles.

ous islands in the Aegean, and it was preserved by the great depth of the sea from any serious suspension of its activities through mine-barrages. Submarine service in the Mediterranean was indeed regarded by the German sailors as an easy road to fame after their arduous and dangerous experiences in the North Sea and Channel. The submarines were ultimately defeated by the convoy-system. The British navy then reëntered its old haunts and has, except for a short period in 1935, of which more anon, been dominant there ever since.

From the battle of Salamis to that of Lepanto, for a spell of over 2,000 years, the instrument of naval warfare in the quiet seas of the Mediterranean was the oared galley with its tactics of "grapple and board"—an instrument which was slow of movement and had all the sea-room needed for the activities of its rowers. It is interesting at this point to note, in view of the existing conditions in the Mediterranean, that the triumphs of the corsairs in their galleys were due, not to superior numbers or superior size, but to a relatively high speed and capacity for maneuver. They were the forerunners in fact of the light sea-craft which we may see dominant in that sea in the near future. The discovery of new worlds, the destruction of the Armada (which owed its defeat largely to an attempt to perpetuate the system of "grapple and board" in unsuitable conditions), and the penetration of Blake's ships into the Mediterranean caused the trireme to disappear. It was replaced for nearly three hundred years by the corvette, the frigate, and the three-decker, whose special characteristics were that they required for their effective employment a high standard of seamanship and could keep the sea for periods up to six months in case of need. Like the galleys, they were slow in movement and had plenty of room to maneuver in the Mediterranean. The principal new factor which they introduced was the replacement of the tactics of "grapple and board" by those of the concentration of broadsides against an opponent.

The advent of steam speeded up and regularized the movement of fleets and accordingly contracted the possibilities of maneuver in narrow waters. It also demanded that warships should be well supplied with bases. Nevertheless, the escape of the *Goeben* and the *Breslau* in 1914 indicated that, although steam had by that year reached the peak of its efficiency, the conditions of naval warfare were substantially unchanged from those which enabled Napoleon to elude capture on his return journey from Egypt.

It was the submarine—a weapon, as indicated above, peculiarly effective in narrow waters—that caused the first real break in those conditions since the incursions of Xerxes. Opposed by vessels great and small and itself wholly unsupported, it was nevertheless able to inflict unparalleled destruction and came within an ace of proving decisive of the issue, not only in the Mediterranean but also of the best world conflict.

A second break has been caused by the aeroplane. During the War, the aircraft of the Central Powers were engaged up to the hilt in land operations, and such aircraft of the Allies as were employed on naval service had practically no targets except hostile submarines either at sea or in port. Moreover, the aerial strategy implicit in the employment of a great central force independently, and of much smaller forces attached more or less permanently to the navy and army, had not been seriously developed. The War did not, therefore, furnish much useful guidance as regards this new feature of maritime warfare.

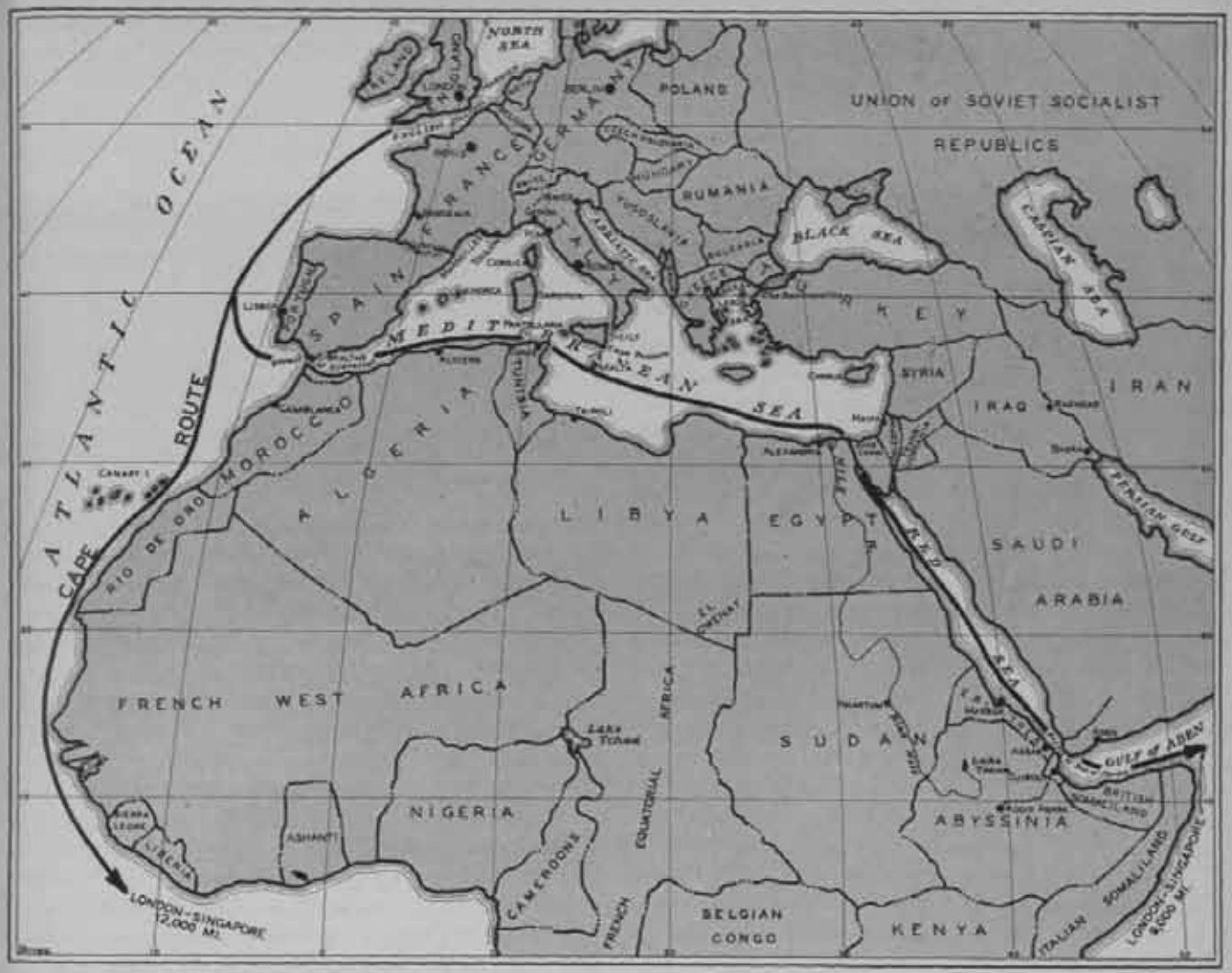
Since the Armistice, indeed, aircraft have been employed in extensive operations. In Japan and Abyssinia, however, they have been entirely at the disposal of the army and have had no naval duties to fulfill. The Spanish contest opened with the defeat by aircraft of the Government squadron, which was in maritime control of the Straits, and the transport by air to Spain of Franco's Moroccan army. Since that surprising feat, aircraft have been used on a comparatively modest scale over the Iberian peninsula; and Franco, who has been throughout in the ascendancy in the air, never seems to have aimed at the complete destruction of either great towns or ports. He has always had to bear in mind that he may shortly be ruling the country and will then be responsible for its government, its treasures, and its commerce. His aerial action, except in battle, seems to be not unlike that of the British on the North West Frontier of India[2] where endeavor is made to tire the tribesmen into submission by keeping them in a state of continual discomfort. Over the open sea, aerial action has on the whole been sporadic, spasmodic, and insignificant. The net result has been that aircraft have, except at the outset, proved of no serious effect in the minor maritime operations in question; and in so far as indications of their value in that sphere have been given, they have proved somewhat disappointing to the more ardent of their advocates.

Thus post-war experience has thrown but little light on the changed conditions of naval warfare. Resort must therefore be had to prophecy based on a study of recent improvements in weapons and of alterations in political geography.

In the first place, there has been, except in the case of the trade-ship, which is nearly as slow as ever, a marked all-round increase in speed and in consequence a further reduction of the time-space factor—a reduction which naturally exercises a much more potent influence in narrow waters than in the broad oceans. For, in the former, it denies both room for maneuver to fleets and evasive routing to commerce, and it lays ships of all kinds open to a succession of sudden, fierce attacks delivered at short range from convenient bases.

Then the submarine has grown in power and efficiency since 1918 while the trader has remained as vulnerable as ever. More important still, the submarine has become far more plentiful. Both French and Italians

[2]Except as regards giving warning to the inhabitants that the objective is about to be bombed.



The Inland Sea influences two continents.

now have some hundred of these vessels, and the Germans hope to have some seventy of them by 1940. Thus large numbers of them will be ready to come into action at the very outset of war, whereas at that hour the various antidotes may not have been fully developed. On the other hand, warships have been strengthened against the torpedo, the airplane is a fairly useful counter to the submarine, and the other anti-submarine instruments have been much improved. In general, however, it may safely be said that were fifty hostile submarines loose in the Mediterranean, no government would risk trade or transports upon its waters.

The airplane is, as has been shown, still a weapon of unknown potentialities in maritime warfare; but it may be confidently predicted that with its greatly enlarged powers and with the short range and good bases of the Mediterranean so strongly in its favor, it will prove immensely destructive both against ships and against the ports which maintain them. It is, however, owing to scarcity of bases, a weapon difficult for Britain to use effectively in the Mediterranean unless she is allied with France.

The third new instrument is the motor torpedo boat (M.T.B.)—a vessel admirably suited to action in quiet and narrow waters. Cheap to build, and therefore likely to be numerous, armed with torpedoes and therefore of considerable power, and of a speed now of about forty-five knots, it will be excellent for reconnaissance, shadowing, and attack.

Thus, even granting that the submarine has not grown more menacing, two radical and dangerous changes have materialized since the Armistice in a sea which, right up to the moment of victory, imposed severe hazards upon those who travelled on its surface.

Naval opinion of sailors all over the world, as well as opinion in the British Admiralty, is that these matters are of minor importance, because ships, it is held, are adequately armed and protected against the new perils. This view is clearly expressed in the continued construction by all naval powers of great battleships and cruisers, even where these vessels are destined for service in narrow waters. If this view should prove mistaken, Britain might be the principal sufferer. She might lose at one stroke that large part of her naval strength which she keeps based on Malta.

Neither France nor Italy are so dangerously placed

in this respect, first because they have a higher ratio of light craft to capital ships and, secondly, because their battle fleets are less exposed. It seems probable, however, that the battleships of neither power would be of serious value in the Mediterranean except for the direct protection of trade and transports on voyages between the home countries and their respective African empires.

There have been many alterations in political geography since the Armistice apart from the new positions of Germany in Europe and Japan in Asia. In the first place, Italy has seceded from her ancient allies and now, strongly armed, is a member of an aggressive group of nations. She spends huge sums on propaganda, she has gained control of a large part of the Arab press, and she has regimented and made patriots of some 300,000 of her nationals who live in foreign countries along the southern and eastern littoral. Well covered by outposts in Albania, the Dodecanese, Abyssinia, Libya Pantelleria, and Sardinia, she is free to strike radially in almost any direction. In particular, she threatens at short range the British fleet at Malta, the British and French communications to the east, and French communications between Africa and south France. She has, however, given many hostages to fortune. By force she has acquired colonies with which connection must be maintained by force. The sea-routes are vital to her existence; yet she has challenged a maritime domination which has long had for an aim free trade and free traffic from the Straits of Gibraltar to the Red Sea. From being a passive element in power-politics, she has become an active and disturbing agent. Once started on a career of aggression it is not easy to call a halt. Even if she should desire to do so, she might find it difficult, since she is riveted to an axis turned mainly from Berlin. Yet she is utterly vulnerable. Her communications with her colonies can be severed, her whole overseas trade including much of her essential supplies destroyed, and her principal ports and industrial centers bombed at short range from France and Corsica. Thus she possesses neither endurance nor security, and therefore, unless she can improve her position or obtain strong support, will have to depend for the achievement of her aims on what must be a pure gamble—the attainment of decisive success through a sudden blow.

As a unit in a belligerent group, she has, however, a strong card to play in her colonies. Abyssinia constitutes at once a menace to Britain (or rather to Britain's communications with the East and Middle East) and a liability to Italy. She extends, as far as Aden, the canal which begins at Gibraltar. And with the assistance of the recently fortified island of Dumeira in the gut of the Bab el Mandeb and of her naval and aerial bases at Massaua and Assab, she presents a grave obstacle to the passage of British reinforcements to Palestine and Egypt, either from India or by the Cape route from England. This is a matter of the first importance in view of the probable closure of the Mediterranean to transports in war, and it will force Britain to develop alternative routes: by improving the communications in Kenya, by ensuring the connection through Basra and Bagdad to Haifa, and by building a road, in concert with the French, from Lake Tchad to Khartum. Abyssinia might well, however, prove a liability to Mussolini should faulty calculations on his part as to the duration of a war (and therefore as to the quantity of reserves to be maintained in the country) render it necessary for him to attempt to supply her by sea. He might also find it difficult to control a population encouraged and supported in hostility from the Sudan and Kenya.

He has another good card in Libya. The Italian army there—30,000 to 60,000 strong—can march east or west along roads well built and well supplied with water. It is likely at the moment, or in the near future, to be more powerful than any force that can be brought up to counter its immediate action. It may be expected to strike east against Alexandria and, as conditions now exist, would almost certainly achieve some preliminary success and might cause great inconvenience, even to the extent of reaching and blocking the Suez Canal. Such success without local allies could, however, hardly be of durable nature. For the Italian communications by sea would certainly be interrupted intermittently if not permanently; French, Tunisian, and Algerian forces would be striking at Tripoli; and aerial, and possibly ground forces from South Africa, India, and Australia would be arriving in Egypt. In the end, Italy might well lose both an army and a province. The appearance of the Germans at the Brenner makes it difficult for her to keep forces in Abyssinia and Libya really adequate for sustained offensive operations. The suggestion that she should apply a pair of pincers against the Sudan with one arm working from Abyssinia and the other from El Owenat at the southeast corner of Libya may, in view of the poverty of communications in the theatre in question, be omitted from serious consideration.

An old actor in the sphere under consideration is Turkey, now appearing in modern guise. In possession of the Dardanelles, she could allow or disallow the passage through the straits of the Soviet Black Sea fleet and of Russian and Rumanian oil—powers which alone make her a most important factor. She could play a part in the welfare of light craft in the Levant. She could, if opposed to Italy, render Leros untenable either as an aerial or a naval base. And her army might participate not only in a stemming of the *Drang nach Osten* but also in the struggle for the Holy Land and the Nile valley.

The effect of strategy in the Mediterranean of the new Spain will be determined largely by the outcome of the present conflict. Should the Government prove victorious, the *status quo* will remain unaltered except for a slight strengthening of the position of the democracies and of the U.S.S.R. Should Franco win, he may feel bound to requite his Fascist allies. He may not, however, find himself wholly a free agent. Spain, divided racially and topographically, individualistic and quarrelsome has seldom been long of one opinion either in domestic or foreign policy. Moreover she is dangerously exposed. On

The Grand Harbor, Malta, usually holds a large part of Britain's naval strength.

the one side of the Atlantic, she is confronted by the fleets of Britain and France, and conceivably of another great power; in the Mediterranean by the fleets of Britain and France. On her Pyrennean border, too, traffic would be closed so that she would be completely isolated except by air and might, therefore, be rendered impotent quite early in a war from lack of essential supplies such as oil. She would also be subject to invasion by British and Portuguese forces from the west. She would indeed afford very valuable aerial and naval bases to her allies and would gravely menace and perhaps capture Gibraltar. But she herself would appear to run dangerous risks without much probable compensatory benefit. On the other hand, there are no perils for her in the democratic orbit. Secured on three sides by sea, on the fourth by a friendly frontier distant from Fascist airdromes, she would in peace be free to develop her resources. In a general war, she could choose to participate or not according to prevailing circumstances. Franco would therefore be greatly torn in the event of victory as to choice of camp, and on this subject there might also be dissensions among his supporters from financial as well as strategic reasons. Granting, however, that the worst, as far as democracies are concerned, had happened; namely, that the dictator's victory had been complete and that even Portugal had become his vassal, it seems most unlikely that the democratic powers, who would still be in command of the sea round his entire coast, would allow the creation of hostile naval bases in Morocco, in the Canaries, in the Azores, whose only object could be the destruction of their own trade and naval power.

The independence of Egypt has raised new problems in the Middle East. She has now a treaty with Britain, with who she found much of common concern during the shocks of 1935. She is, however, subject to the threat of the diversion from the Blue Nile of the waters of Lake Tsana, and she has been bombarded ceaselessly by Italian anti-British, anti-Jew, and pro-Arab propaganda, which can hardly fail of effect upon oriental minds. Therefore, though she would still much prefer to remain a protégé of Britain than to become a Fascist colony, fear and doubt are now introducing a lack of unity and decision into her policy.

The last of the new geo-political questions is the situation in Palestine. Britain might quell the present rebellion. Thereby, she might drive underground, but she could not destroy, the motives that inspire it. Neither Palestine nor the other Arab states have any intention of allowing an immigration of Jews sufficient to give Hebrew domination to the Holy Land. Were such a situation forced upon them, the Arabs would bide their time and, in the event of a world conflagration, join the Fascist powers. They might then render the Middle East untenable by France and Britain, who would be engaged up to the hilt elsewhere, might raise North Africa against them, and might massacre the Jews. The pan-Arab, pan-Islam movement is alive from the Pillars of Hercules to the limits of the Indian Ocean. As it is inspired by ideals of liberty and individualism, it is not likely to turn against the democracies except under grave racial and religious provocation. It is to the interest therefore of all those immediately concerned that this thorny problem should be quickly settled. The only solution that has a chance of comparatively willing acceptance by both sides is that ultimate rule should be guaranteed to the Arab, to whom the country belongs, and that the Jew, who has brought such prosperity to the land, should be given a national headquarters and home in a considerable enclave contained within a Palestinian state, and should be allowed immigration up to a limit of forty per cent.

France is only in part a Mediterranean power and her situation in that sea, except for her mandate over Syria, has remained practically unchanged since the Armistice. She has the enormous advantage over Italy of an Atlantic seaboard, but she suffers considerably from the interposition of Spain between her southern and western coasts. She has an important trade with her North African colonies and protectorates and depends on them to redress

the adverse balance of man-power in a struggle with Germany. She is, however, mainly a continental power. For every thought that she gives to her overseas empire, she gives five to her eastern border. She might survive the loss of her colonies and of her power in the Mediterranean, but not another successful Teutonic invasion. Therefore, though absolutely reliable as an ally in a war in western Europe, it is possible that she might be disinclined, as in 1935, to engage herself *au fond* in any colonial Mediterranean struggle.

Great Britain is an intruder. She has no territorial possessions in the Mediterranean except her naval bases and Cyprus. From its shores her ships collect but a small percentage of her essential imports. She does indeed derive many and great benefits from its use, such as the power of quick reinforcement by sea and air of garrisons in India and the Middle East, an abundant supply of Iraqi oil at Haifa, and profits from her vast investments along its coasts, the sacrifice of which would entail serious military and financial loss. On the other hand, she has a secondary but sound connection with the east by the Cape route. Abandonment of the Mediterranean, therefore, in the face of fierce naval competition, would not bring in its train evils of the same magnitude as might afflict France and Italy were they to pursue such a policy.

The established history of submarines and the potentialities of aircraft and M.T.B's, as described above, and the immense strain that convoy duty would impose upon the navy in consequence, demand, almost without question, the diversion of British commerce and transports to the Cape route. There is much to be said also for abandonment of the Mediterranean by the British navy. In the first place, a fleet exists to protect communications and the trade which travels along them. Its *raison d'être* might seem therefore to vanish where these things are non-existent. In the second place, by far the greater part of Italy's overseas imports pass through the Straits of Gibraltar and the Suez Canal, and Britain could easily block both ends of the connecting channel without entering it herself. Under such an arrangement, large naval forces could be released for service on the approaches to home ports and on the long line of communication round the Cape.

There are, however, very strong objections to such a course. For one thing, the *mare clausum* would become an area of equally balanced forces, hostile to one another in intent if not in fact; and accordingly fear and mistrust, the generators of war, would run riot along its coasts. Moreover, France, as an ally of Britain, would be bitterly opposed to such a policy. For it might entail that she would have to hold her own, pinched between Spain and Italy, and would have to depend entirely on her Atlantic communications for connection with Africa. Again, Malta might be starved into surrender, Cyprus taken, the British power of protecting Egypt and Palestine gravely compromised, and any strategic reserve held in the Middle East to some extent marooned. Such a spectacle would have a deleterious effect on British prestige and might cause doubtful states along the littoral to join the hostile group. All these drawbacks show that abandonment would be a dangerous, if not fatal, policy to adopt. That statement requires, however, qualification in one respect.

At present a large part of the British battleships and cruisers are based on Malta. Sixty miles away, is an Italian airdrome where the latest Savoia-Marchettis, flying 200 miles an hour and carrying a load of ten tons, may be lying. In 1935, a British admiral realized this danger and left hurriedly for Alexandria. But Malta is still fleet-headquarters, and the great ships are still based upon it. Not only there but everywhere in the Mediterranean they are in grave danger from bombs and torpedoes; and their destruction might at one blow annul Britain's naval superiority in Europe. Any attempt to reinforce the fleet and relieve Malta would merely add to the length of the casualty list and to the gravity of the disaster. In a theatre utterly unsuited to its capabilities, Britain's greatest asset might be destroyed piecemeal. There are thus weighty reasons for not abandoning the Mediterranean and at the same time obvious perils in holding it by existing methods. What is the alternative?

All the dangers would disappear if the sea were to be held by light craft: destroyers, submarines, M.T.B's, and aircraft. In the absence of battleships, Malta would hardly be an objective worth bombing, and nowhere would there be any satisfactory target for the hostile aircraft and warships. The Italians would be thrown on the defensive, and their maritime communications would be everywhere threatened. Their position, far from being advantageous, as it is at the moment, would be one of hazard and perplexity. They could neither obtain supplies from overseas, nor dispatch expeditionary forces abroad, nor send reinforcements and material to their colonies. The effect of this situation on their trade would be a reduction of about 80 per cent against a reduction in the corresponding British trade of 15 per cent. They would thus become dependent to a great extent on supplies from Germany who herself would have no superabundance of them. Further to the advantage of Britain, Palestine and Egypt, given satisfactory relations with the Arabs, would be reasonably secure. And, finally, the British fleet, after relieving its capital ships from the narrow seas, would have plenty of these vessels available for ocean warfare.

There are objections naturally to every course. Those special to the delegation of the control of the Mediterranean to small craft are:

(a) A loss of prestige; for the big ship is much more imposing than the small.

On the other hand, a much greater loss of prestige is sustained when a battleship goes down than when several destroyers are sunk.

(b) The support which is thought to be essential for small ships would not be available.

But Germany nearly brought Britain to her knees without such support for her submarines; and British flotillas operating from Harwich were out of reach of immediate

This Italian motor torpedo boat is admirably suited for action in quiet and narrow waters. Its speed of 45 knots makes it excellent for reconnaissance, shadowing, and attack.

assistance from the Grand Fleet at Scapa Flow. Certainly aircraft do not require support except that of well found and conveniently placed bases.

(c) It might be difficult to prevent destruction by large warships of French convoys from Africa, especially since there is a considerable amount of sea-room between Algiers and Marseilles.

But it would in any case be no easy matter to protect them in view of the proximity to the route of Sardinia and other Italian islands. Consequently, inconvenient though it might be, the route from Casablanca to Bordeaux would have to be utilized.

In general, however, if Britain were allied with France and had French naval and aerial bases at her disposal, she could control the western Mediterranean. French battleships could execute any essential convoy duties.

(d) The scarcity of bases would operate more harmfully against small craft than against the larger vessels.

This would be a distinct weakness were Britain acting alone, especially as Malta and Gibraltar, more particularly the latter, are unsuitable air bases. In the unlikely event, however, of Britain being engaged in war without any ally among the Mediterranean powers she would be well advised to operate on a limited radius from both ends and from the center, thus rendering the movement of hostile traders almost impossible and that of hostile warships distinctly hazardous.

So here is a summary. It is very dangerous for Italy to undertake fresh adventures in maritime aggression, for she is exceedingly vulnerable and likely to remain so even should she win the alliance of Spain. Britain, for her part, is subject to a threat in Egypt, but any Italian success there would have no decisive value were the Arab nations backing the democracies. Aided by France, she should be able to control the Mediterranean, provided she were to discard it for her trade and larger warships, and to initiate at once a policy of building small craft in large numbers.

Were Italy to renounce her dreams of Roman Empire and come to the council table, she would gain the greater part of her needs without the danger of defeat, and peace would once more reign in the inland sea.

Soldiers of France

Gamelin, Chief of Staff (left), confers with Generals Garchery and Prioux (right)

Future soldiers arrive at railroad station and . . .

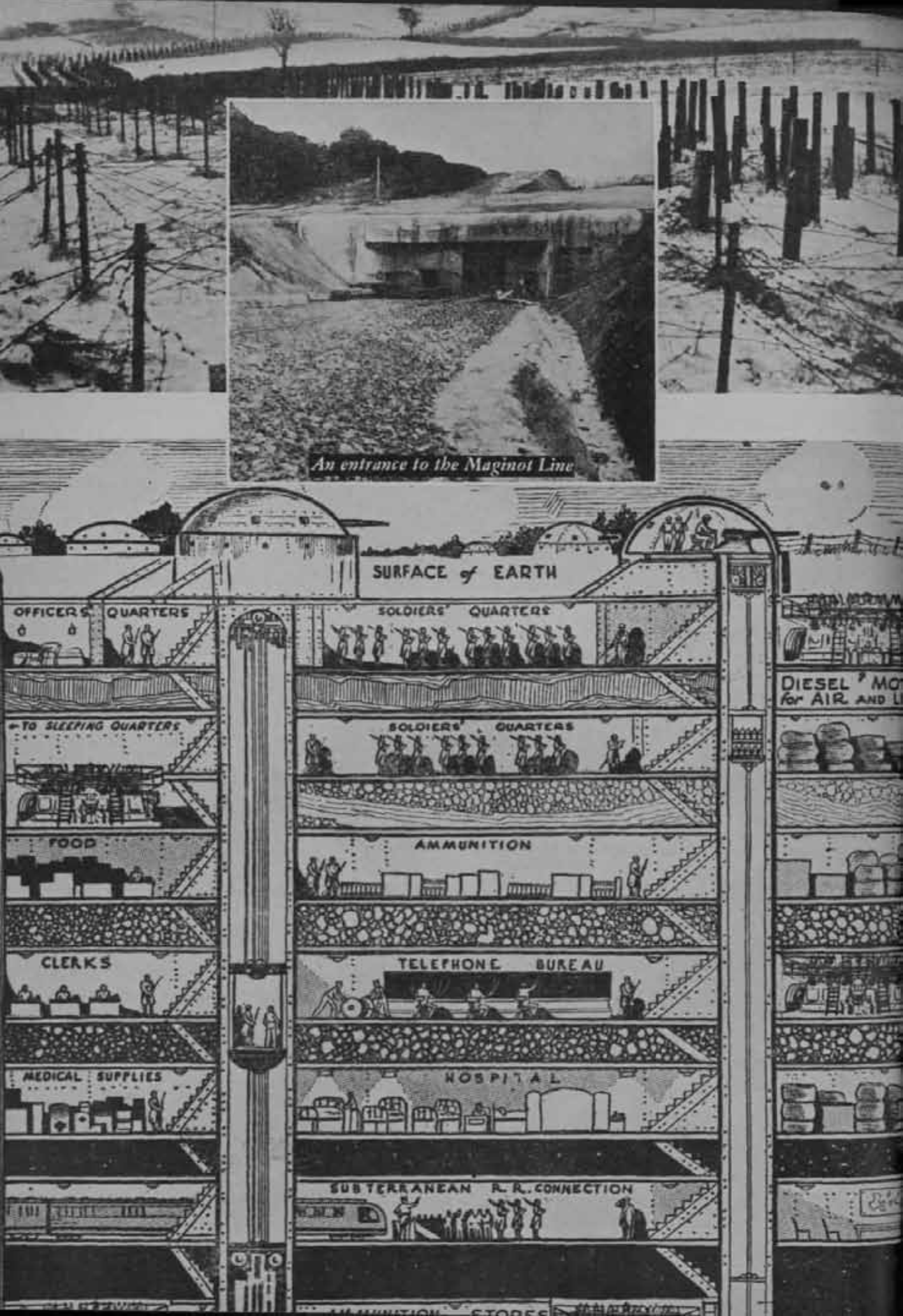
are later seen as infantrymen and . . .

crews of modern low-relief weapons carriers

Some become air infantry, *chief actors in the "vertical envelopment."*

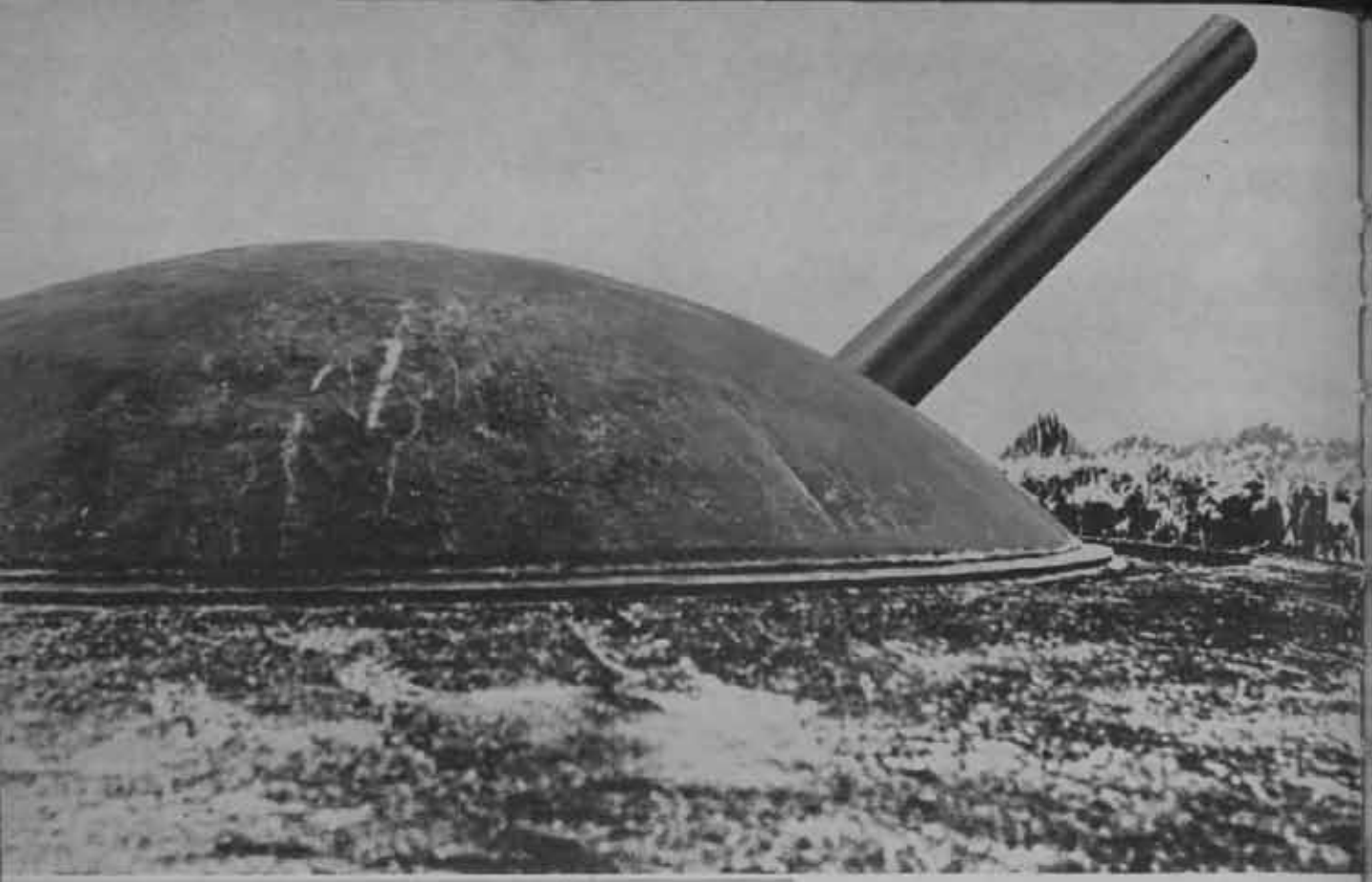
Others find in a r squad of an Alp regiment. Note the lig automatic rifle on bipod mou

This pair, now members of a motorcycle machine-gun unit, are engaged in AA fire against low-flying aircraft.


An entrance to the Maginot Line
SURFACE of EARTH
OFFICERS' QUARTERS
SOLDIERS' QUARTERS
DIESEL
for AIR AND
TO SLEEPING QUARTERS
SOLDIERS' QUARTERS
FOOD
AMMUNITION
CLERKS
TELEPHONE BUREAU
MEDICAL SUPPLIES
HOSPITAL
SUBTERRANEAN R. R. CONNECTION

A hundred feet below the earth an electric car carries troops to various stations

This is the comm post of an infantry ment functioning ing recent maneu



This piece of heavy artillery is mounted in a turret not far from the frontier

This AA truck mount resembles our 1917 White truck mount which has been displaced by more efficient equipment.

This is an antiaircraft gun on a fixed mount. Our latest fixed mounts appear to be far superior to this.

THE ROLE OF AA ARTILLERY

By General F. Culmann, French Army

From World War statistics it would appear that pursuit planes were then the most effective defense against aviation and that artillery played a somewhat secondary rôle. According to French statistics, out of 1,067 French planes brought down in 1918, 705 were brought down by German pursuit planes, 362 by artillery, and 540 by unknown causes. According to German figures, Allied pursuit planes killed or wounded a total of 3,096 aviators, while artillery accounted for only 837 casualties. These figures are World War statistics and this fact might well be borne in mind when we compare the two arms today in order to accurately define and evaluate their respective capabilities and limitations.

Although the pursuit plane has an extensive radius of action and penetrates far within the enemy's lines, it is unable to engage an enemy too far distant for it cannot fight while retreating. The pilot does not see his opponent until within a distance of four to five kilometers. Pursuit planes lose time in reforming after each engagement.

Artillery shows its superiority when it operates above the tactical zones of action of ground units. With the aid of listening devices and improved optical instruments, it can locate enemy planes at a distance of about ten kilometers. It can transfer its fire from one objective to another almost instantaneously and with much more rapidity than pursuit patrols. Moreover, artillery is always available. Aviation can exercise control of the air for only a short time and on a limited front, whereas artillery can act for longer periods, independent of weather. It can be relied upon by day and by night, in fair weather and foul.

General F. Culmann

The pursuit plane is costly both in men and matériel. In 1918 French pursuit aviation lost 658 planes and 900 pilots, at least half of whom were killed. Maintenance is expensive; repairs keep about a third of the flights on the ground. The pursuit plane wears out quickly; half the planes in use must be replaced every month; also they rapidly become obsolete due to continuous technical development. If an enemy attacks with a faster and better plane, air combat is impossible as the pilot of the poorer craft is sure to be killed.

Artillery, on the contrary, wins its successes with a minimum of casualties. There is little wear and tear on its matériel; this is attested by the fact that it has been unnecessary to replace the guns used during the World War, many of which are still in use. Artillery has not been immeasurably affected by the progress in aviation. The increases in speeds and ceilings of airplanes, so significant in aerial combat, have had no such great influence on artillery methods and have not seriously hindered the effectiveness of its fire.

Nevertheless, aviation has made great progress since 1930. Before that time the speeds and ceilings of airplanes had undergone only moderate increases, but the values of these characteristics have suddenly doubled in the last few years. This progress now seems to have been checked, at least as far as its military application is concerned. On the debit side, the speed and altitude of flight are rendering observation more difficult and bombardment less accurate, and are hampering the planes in maneuvering to evade the fire of the ground AA defense. Moreover, the pilot of a modern plane must possess a physical endurance

AA Artillery has overcome its limitations; it now offers the best protection to Infantry

approaching the limit of human strength.

Artillery has kept pace with the progress made by aviation. In this connection, let us review the progress artillery has made in the past. At first, it was necessary to fire 10,000 projectiles in order to bring down a plane—a number which fell to only 3,300 by the end of 1918. We may now venture to hope that 2,000 will suffice in the future, owing to improvements in methods of observation, preparation, conduct of fire, guns, projectiles and fuzes. Use of a somewhat complicated mechanism has materially simplified the service of the piece, has reduced by 50% the time required for computing firing data, and has shortened even more appreciably the time required for transmission of this data to the guns.

In summing up, we may say that despite its lower destructive power and limited radius of action, artillery has overcome its apparent technical and tactical limitations as compared to aviation and now offers the best protection to our infantry.

Altitude and Its Influence on AA Guns

In determining the matériel to be used in AA defense, it is obviously necessary to consider carefully the flight altitudes now contemplated. The 1933 German tactical regulations might wisely be consulted for this purpose, since the Reich Air Force is considered to be one of the finest in the world.

Articles 143 and 144 of this document define *strategic reconnaissance* as follows:

> It comprises surveillance of the concentration, advance, or retreat of the enemy; the arrival or withdrawal of his general reserves; the organization of his defensive works, and the concentration of his air forces. It is important to locate as quickly as possible the enemy's large mechanized units, especially those on his flanks. As a rule, this strategic reconnaissance will be effected by taking aerial photographs at altitudes of from 5,000 to 8,000 meters.

Article 150 prescribes that the *tactical reconnaissance shall take place at altitudes of from 2,000 to 5,000 meters.*

Article 176 reads as follows:

> The *air combat reconnaissance* should furnish information concerning the disposition of the enemy's forces *especially his artillery;* the position and displacement of his reserves and armored elements, as well as about anything else that is going on behind his front. The reconnaissance planes will watch the development of the combat. Such reconnaissance will usually be effective at an *altitude of less than 2,000 meters.* The planes must fly rather low in order to observe details and watch our advance and that of the enemy.
>
> *Bombardments* of ammunition dumps, artillery parks, depots, landing fields, railway stations, ports, industrial plants, etc., are now generally effected from *altitudes of 4,000 to 5,000 meters.*
>
> In connection with aircraft flight, it should be noted that planes fly above most of the large cloud masses when they reach altitudes of approximately 6,000 to 7,000 meters. At these altitudes, visibility is excellent, and there is no longer any water vapor or dust suspended in the atmosphere. However, after an altitude of 5,000 meters has been reached the air is not so dense, and superchargers must be connected with the engines in order to restore their power output.[1]
>
> It will be advantageous for the various flights to cruise at about 7,000 meters, where they will be screened generally from ground observation. Suddenly emerging from the clouds, they will descend to effect a surprise bombardment.

We may conclude that most planes will remain at an altitude of less than 2,000 meters over the combat zone. They can be hit by *accurate* fire at an altitude of 8,000 meters. Most armies deem it necessary to employ the following types of weapons:

1. The *machine gun,* against planes flying lower than 500 meters, when the weather is cloudy. This is a special, heavy weapon of 13-mm. caliber sometimes utilizing two barrels; it can be used *secondarily* against tanks; it is powerful enough to penetrate the light armor which protects the pilot's seat, fuel tanks, etc. But if these vital parts are not hit the plane will not be put out of action and in many cases will be able to continue its mission. Repairs will not be necessary until an airdrome is reached.

The irregular courses and speeds of planes seeking to evade fire by maneuver makes it difficult for the machine gunners to work in crews and concentrate their fire. The gun pointer's natural instincts then come into play and his fire resembles that of a hunter rather than of a gunner.

The machine gun is normally an infantry weapon and is served by infantrymen. Therefore it shall not be discussed further, except to point out that everything said later with regard to the general characteristics of low and medium caliber AA guns also applies to machine guns.

2. The *low caliber automatic cannon,* against aircraft flying at medium altitudes—usually less than 2,000 meters. This gun is designed to prevent close observation and to destroy attack planes.

It should be able to destroy an airplane, as well as the fast tank, with a single hit, for it is unwise to count upon getting repeated hits on fast moving vehicles of any type. In this connection, the 20-to-25-mm. caliber type gun should be powerful enough to force a plane to land or even completely disable it. Most efforts to cope with the attack plane rely on either of two weapons; the 20-to-25-mm. automatic cannon, or, better still, the 37-mm. gun, which has proved especially destructive in Spain and which is not automatic.[2]

These small guns are considerably more expensive than machine guns and are less commonly used. They deliver direct and group fire and are equipped for this purpose.

Their effective vertical range should reach 2,000 meters, but their zone of action should partially overlap that of the cannon say, between 2,000 and 3,000 meters. Moreover, the dispersion of all guns increases rapidly after two-thirds maximum range has been attained. It is therefore not too much to expect the small gun to have a vertical range of 4,000 to 5,000 meters. The 20-mm. gun, whose power is limited, has therefore been deemed inadequate. Although the 37-mm. gun is now considered the most desirable type, some manufacturers are already constructing a 47-mm. cannon.

[1] It should be noted that air density diminishes rapidly as altitude is gained. The first five kilometers contain half the atmospheric mass, and the first ten kilometers three-quarters of it.

[2] At present, the French Army uses only the 37-mm. gun. Hotchkiss 37-mm. guns, firing 110 rounds per minute, and Oerlikon 20-mm. guns, firing 280 rounds per minute, are installed in pairs on a single carriage provided with a central pivot.

3. *The 75-mm. gun* or preferably one of even greater caliber. These are designed to destroy planes flying at altitudes of from 2,000 to 8,000 meters. If their fire is to be accurate at the maximum altitudes for which it must be used it should have a vertical range of at least 11,000 meters.

General Characteristics of AA Guns and Shells

Plane speeds determine the technical characteristics of AA guns. The barrels of AA guns are the same as those used by guns firing upon ground objectives, but breeches, method of loading, aiming- and sighting-mechanisms and carriages are quite different.

Antiaircraft guns should:

1. *Have all-around and complete fields of fire in both elevation and direction.* This latter requirement makes it necessary to have a small carriage, turning on a vertical axis. Moreover, for convenience in loading, the pivots must be placed toward the rear, hence the necessity of balancing the front of the barrel by means of an equilibrating system;

2. *Be capable of being aimed very quickly.* That is, it must be equipped with hand-wheels that will turn easily and move the gun through large angles of azimuth or elevation at each turn—angles much more extensive than those normally obtained on guns designed to fire upon ground targets;

3. Have a *rate of fire as high as possible.* This necessitates that AA weapons *be automatic,* in the case of small cannon. The lower the caliber, the easier it is to secure automatic action. It is more difficult to obtain automatic fire with the 20- to 25-mm. cannon than with the machine gun; and the modern 37-mm. gun was incapable of automatic fire until only recently after long experimentation.

Medium caliber guns should be provided with *mechanical loading and ramming devices* permitting a rate of fire of twenty to thirty rounds per minute.

4. *Have high muzzle velocity* (at least 800 meters per second) so as to reduce the time of flight. To obtain high muzzle velocities, it is necessary, on the one hand, to allow an increase in the gas pressure developed by the propelling charge, and on the other, to use slow, *highly progressive* burning powders, and to lengthen the tubes so as to utilize all the power developed. An ideal powder—that is, a powder producing a constant maximum pressure throughout the process of combustion—would bring about an increase of eight to ten per cent in muzzle velocity while simultaneously increasing accuracy of fire.

5. Possess a *high degree of precision* (a probable error of less than 0.5% of range at altitudes of less than two-thirds the vertical range.) This would necessitate efforts to prevent erosion at the very beginning of the life of the tube because of the high muzzle velocities required. It would also call for removable liners or for replacement of the entire barrel. It should be practicable to perform these operations easily and quickly.

Turning now to the projectile, here are some of its requirements:

1. *It should be characterized by a good ballistic coefficient.* To secure this the French Army uses a spindle-shaped projectile or one pointed at both ends. However the shape of the projectiles can be further improved and a ten-to-fifteen per cent increase in range is not impossible;

2. *It should contain a heavy charge of explosive;*

3. *It must have a super-sensitive fuze* that will cause the shell to burst on contact with airplane fabric. This fuze should function perfectly even at high altitudes.

Percussion fuzes should be provided only for shells to be fired from low caliber arms. Shells for cannon, even for the 47-mm. Skoda to be described later, should be equipped with double-action fuzes.

Ordinarily guns designed to fire upon ground targets should suffice to destroy or force down *observation balloons.* Incendiary projectiles are indispensable. However, since balloons usually remain from six to eight kilometers behind the lines, the guns dealing with them must have long ranges. This necessitates higher caliber guns such as the model 105 L (seventeen kilometer) or 155 L (twenty-six kilometer). During the World War the Germans even employed a 21-cm. gun.

It is advisable to designate in advance those pieces that are to defend balloons. These weapons should be connected by telephone with the observer, who can designate the batteries dangerous to the various balloons.

Organization of AA Defense

It is evident from the foregoing that the tactics and technique relating to the use of automatic cannon of low (37-mm. and 47-mm.) and medium (75-mm. and upward) caliber are closely related. In most armies AA regiments do not have both classes of these guns. Whatever the type of matériel, each regiment has normally three batteries of four pieces each.

The regiment should be assigned to the *corps artillery,* because on the march and in combat, the corps front corresponds closely to the width of a regimental zone of action (about ten kilometers for a regiment of 75's). The number of such regiments available in time of peace should be at least two-thirds the number of divisions.

Since centralized command is necessary, it is advantageous to provide the *Army* with an antiaircraft artillery brigade staff.

Low Caliber Antiaircraft Guns

To illustrate and clarify the foregoing and show the tendencies that prevail in modern construction, we shall give a brief description of some recent AA guns. We shall deal first with those of low caliber that were not used during the World War.

The Schneider automatic 37-mm. cannon. (Figure 1.) The main characteristics of this weapon are as follows:

Caliber: 37-mm.
Weight of projectile: 0.900 kg.
Weight of cartridge complete: 1.930 kg.
Muzzle velocity: 800 meters.
Rate of fire: 180-200 shots per minute.
Fields of fire: {In elevation: from 0 to 85 degrees. In direction: 360 degrees.

Figure 1: The Schneider 37-mm. automatic cannon

Tracking speeds: In elevation: 6 degrees. In direction: 1st speed: 8 degrees; 2d speed: 16 degrees.

Weight in traveling position: 1,675 kg.

Tracking is effected by sighting the plane directly with the aid of the *collimators* of the sighting apparatus. This requires a crew of four men: one for pointing in direction; one for determining the course of the plane; one for aiming in elevation, and one for making the corrections for range and speed.

The flat loading trays each hold six cartridges. They rest and move on a supporting bracket over which they are drawn during action.

The firing mechanism permits multi-shot (sustained) and also single-shot fire.

The gun tube, which has been cold-worked, is in one piece, and has a muzzle brake.

The carriage is of the central pivot type. It is provided with three outriggers of steel plate. These spread out like a Y when the gun goes into battery; the wheels are then removable. At the end of each outrigger is an adjusting screw jack, bearing the supporting plate that forms the horizontal seat of the piece. The pivots are placed near the breech not far above the ground, and give complete stability in spite of the low weight of the piece.

In the traveling position the two forward outriggers are brought together and fastened directly to the tractor pintle. This gun is a trailer mount and cannot be moved under its own power.

The wheels, which are 87-cm. in diameter, are equipped with pneumatic tires 18-cm. in diameter.

A speed of 50 km. per hour on good roads can be maintained.

The 47-mm. Skoda gun.[*] (Figure 2.) This weapon which has considerably more power than the Schneider 37-mm. gun, can be used also as an antitank weapon and fires an armor-piercing shell when so used. The following are its principal characteristics:

Caliber: 47-mm.
Weight of explosive shell: 1.5 kg.; weight of explosive: 0.130 kg.; weight of cartridge: 2.95 kg.
Weight of armor-piercing shell: 1.65 kg.; weight of explosive: 0.015 kg.; weight of cartridge: 3.1 kg.
Muzzle velocity: 800 meters.
Maximum gas pressure in tube: 2,900 kg. per sq. cm.
Vertical range: 7,300 meters.
Horizontal range: 10,700 meters.
In elevation: —7 to 85 degrees.
Fields of fire:
In direction: 360 degrees.
Weight in traveling position: 1,670 kg.

The fire, which is direct, is not automatic, as in the case of the Schneider. This is a defect. The breech is called "*semi-automatic*." This appears to mean that it is loaded and fired by hand, while the breech is automatically opened at the end of the recoil and closed after the cartridge is inserted. Owing to the lightness of the cartridge and the moderate length of recoil (0.60 meter), the rate of fire is approximately forty shots per minute at quadrant angles of elevation of less than twenty-five degrees (antitank fire), and from twenty-five to thirty rounds at greater angles (AA fire).

The barrel has been cold-worked and has a removable liner and a muzzle brake.

The carriage has four outriggers (cruciform) and a base ring. It is equipped with a device for placing the gun in battery quickly.

The gun is either horse- or motor-drawn. The wheels are equipped with springs and have balloon tires.

[*] The plants of the old Skoda Co. are located in what was formerly Czechoslovakia.

The maximum speed on good roads is 60 kilometers per hour.

The Skoda seems more than adequate for antiaircraft fire and is capable of antitank use. Most armies that use the Skoda either mount it on tanks or use it in fixed antitank installations designed for action against *fast tanks* with armor as much as 30-mm. thick.[4] Although antiaircraft fire resembles antitank fire (especially as regards the high muzzle velocities required) it is preferable to provide two *different* weapons, each especially designed for use in accomplishing its own limited purpose. Since airplanes generally accompany tanks in the attack, the same gun can rarely be employed against both targets. However, it is believed that every AA gun, regardless of caliber, sooner or later will be constructed so that it can be employed *secondarily* against ground targets.

[4]However certain Russian tanks used in Spain were armed with 57-mm. guns.

MEDIUM CALIBER AA GUNS (75-mm. and upward)

Indirect (barrage) fire is the rule in using this type of gun. This makes it possible to select battery emplacements little exposed to the fire of enemy artillery, while the central fire control stations can be located to command an extensive field of fire.

In keeping with World War experiences, it is believed that at least three 4-gun batteries will be required to obtain good protection on a 10-kilometer front in width and depth. These batteries should be disposed in the form of a triangle with sides four to five kilometers long. They should not be located more than three to five kilometers from the front on which the barrage is to be laid.

As the air peril grows, the number of antiaircraft guns requires increases. Manufacturers have tried to meet the demand and have attempted to turn out guns capable of firing upon both ground and aerial targets. However, attempts to construct a universal cannon were made before

Figure 2: The 47-mm. Skoda AA gun

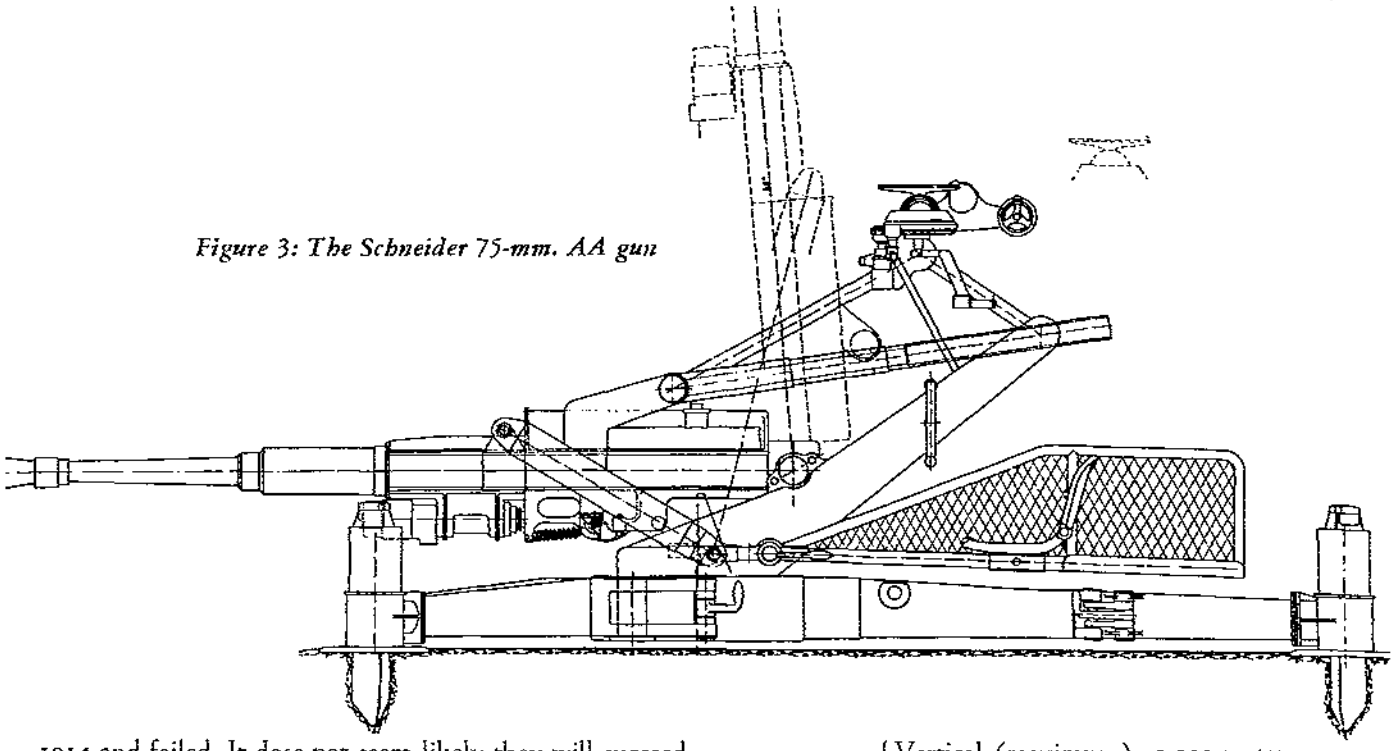


Figure 3: The Schneider 75-mm. AA gun

1914 and failed. It does not seem likely they will succeed now. An AA gun must be considerably heavier than a field piece of like caliber. Antiaircraft batteries are usually disposed in a special manner, require expensive devices, and need careful handling by experts. Therefore it seems expedient to stick to the French solution, consisting of a gun to fire only secondarily upon ground targets.

Moreover, the vertical range (5,500 meters) and muzzle velocity (550 meters) of every gun resembling the 75 used in the World War are inadequate for antiaircraft fire. A more powerful gun is absolutely necessary.

The powerful Schneider 75-mm. AA gun. (Figure 3.) The example described is a Schneider of the latest type, essentially similar to all other antiaircraft guns.

The designer of this gun tried, above all, to produce a powerful and effective weapon, capable of following the field forces anywhere, like medium caliber artillery. Moreover, he wanted this gun to be capable of firing, if necessary, upon ground targets with all the effectiveness of its wide field and high rate of fire. These characteristics are especially valuable in barrage work, for here a gun must be completely stable at all angles. It is therefore necessary to lower the center of gravity of the gun, which will reduce the overturning movement. It is also necessary to move the pivots toward the rear, thus necessitating the use of equilibrators to balance the oscillating mass.

The main characteristics of this gun are:

Caliber: 75 mm.
Weight of projectile: 6.5 kg; weight of explosive: 0.725 kg.
Muzzle velocity: 800 meters.
Rate of fire: 30 shots per minute.
Fields of fire: In elevation: from 0 to 85 degrees (two aiming speeds). In direction: 360 degrees (two aiming speeds).
Ranges: Vertical (maximum): 9,900 meters. Horizontal: 14,500 meters.
Weight: In battery (without wheels): 2,750 kg. Carriage and gun: 3,470 kg.

The recoil brake is characterized by a short and uniform course.

The breech operates automatically and the gun is fired in the same manner. The loader has but one movement to make. The breech can also be operated manually.

The fuze setter is of the automatic continuous-setting type, fed at the same rate as the gun; the dead time elapsing between the completion of the fuze-setting process and the discharge of the projectile being reduced to a minimum. In order to prevent waste of ammunition in case of an error, each period of fire is limited to a burst of three or four shots, which can be repeated at will.

For indirect fire it is possible to install receiving sets (fire control indicators) in the carriage, for messages electrically transmitted from a distant fire control station. It is also practicable to utilize apparatus for direct fire, or a combination of both mechanisms.

The tube is one piece, has been cold worked, and is equipped with a muzzle brake reducing the length of recoil by twenty-five per cent. It can be provided with a liner, but as this increases weight and cost somewhat, some of the guns are delivered with only one spare tube. It takes several minutes to replace a liner and this can be done at the battery. It takes longer to replace the tube; this operation must be executed in an ordnance park.

The carriage, which is of the central pivot type, has only three outriggers in spite of the gun's power (foreign carriages of this type have four outriggers). The French arrangement ensures a better support on uneven ground. At the end of each of the three outriggers is a screw-jack

terminating in a circular plate, to which is secured a triangular trail spade.

To place the gun in battery, the wheels are removed and the outriggers spread out like a Y (this operation takes one minute).

When the gun is to be placed in traveling position, the stationary outrigger is folded to reduce space; the other two outriggers are brought together and attached to the pintle of a tractor or limber (weight: 425 kg.); the latter is unnecessary for automotive traction. The wheels are mounted (this operation takes two to three minutes).

The wheels can be equipped with iron tires (when horse-drawn), solid rubber or pneumatic tires.

The speed on roads attains 40 (with solid rubber tires) or 60 (with pneumatic tires) kilometers per hour.

Although still used in most armies and powerful as it is, the 75 is inadequate.

A 76.5-mm. gun recently constructed by the Skoda plant is described below.

76.5-mm. Skoda AA gun, 1937 model. (Figure 4.) This gun is considerably heavier than the 75-mm. Its principal characteristics are:

Caliber: 76.5-mm.
Weight of projectile: 8 kg; weight of explosive: 0.634 kg; weight of cartridge: 14.6 kg.
Muzzle velocity: 800 meters.
Maximum gas pressure of gases in tube: 22,900 per sq. cm.
Vertical range: 11,470 meters.
Horizontal range: 17,200 meters.
Fields of fire: {In elevation: —1 to 85 degrees. / In direction: 360 degrees.
Weight: {In battery: 3,890 kg. / In traveling position: 5,370 kg.

The breech is "semi-automatic." The length of recoil is 90 or 50 cm. When a cartridge about a meter long and weighing 15 kg. is used, the rate of fire probably does not exceed twenty rounds per minute under the most favorable conditions.

The tube has been cold-worked and is equipped with a replaceable liner.

The carriage is equipped with four outriggers and a base-ring.

The gun is either motorized or horse-drawn. The maximum speed on roads is sixty kilometers per hour.

In view of its medium caliber, the great vertical and horizontal range of this gun is remarkable and shows that its construction has been influenced by the latest tendencies. Nevertheless, the gun is characterized by moderate muzzle velocity and maximum interior gas pressure.

The projectile is necessarily very heavy and has thick walls, so that the charge it contains must be rather light to compensate for the weight. A possibly advantageous result of this is that the shell bursts into unusually large and deadly fragments.

AA Guns of the Future

There are many ways in which antiaircraft guns can be improved—not only the gun itself but also the projectile and the fuze.

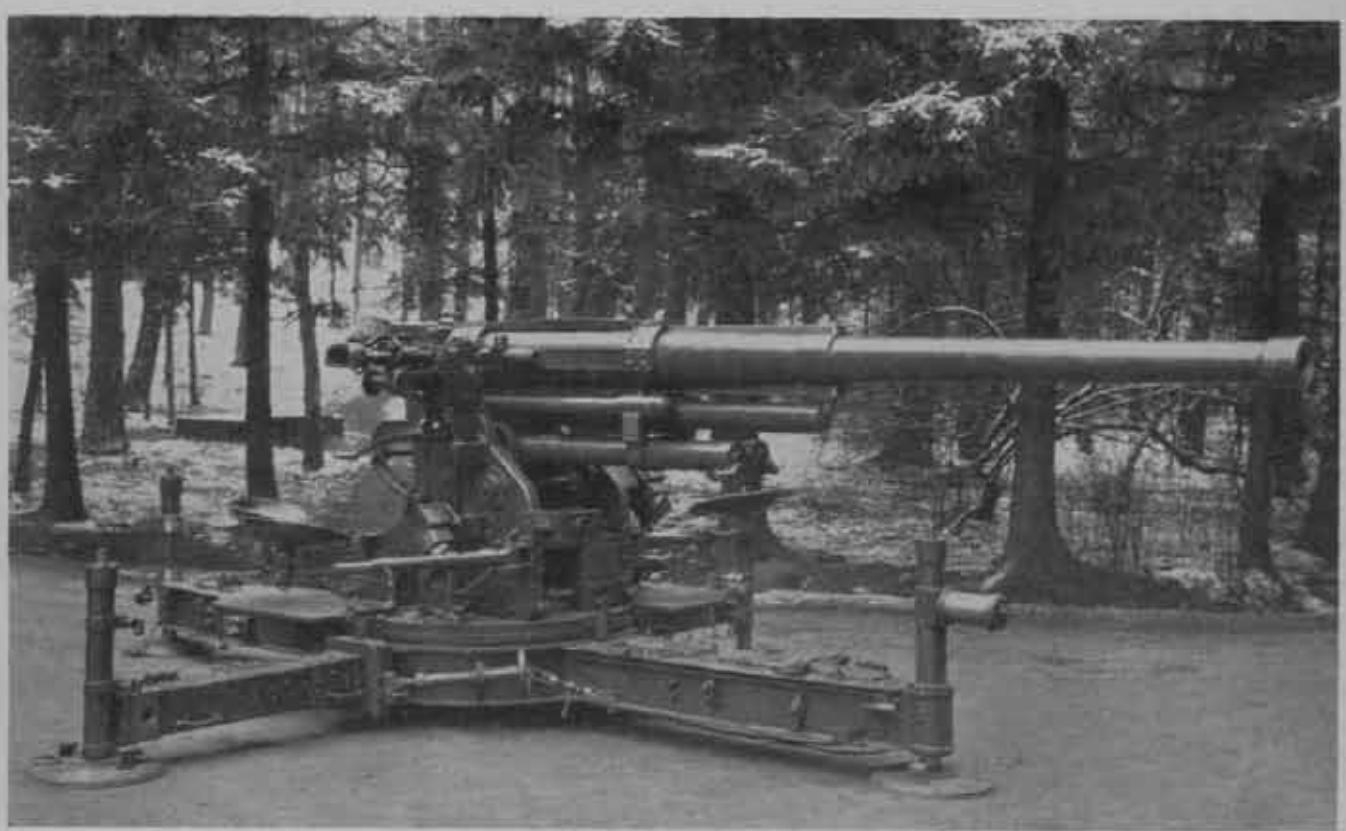


Figure 4: The Skoda 76.5-mm. AA gun, Model, 1937

Guns should be capable of firing as many shots as possible during the two minutes which constitute the average duration of antiaircraft fire. Bursts of from three to six shots should be maintained throughout this period at the maximum rate. To increase the rate of fire, two improvements are necessary:

1. *Automatic breeches and automatic fire.* It is sometimes difficult to accustom soldiers to the shock of handling automatic fire. The manufacturers of ground antiaircraft guns usually incorporate only the semi-automatic breech, but this causes the loss of several tenths of a second—a delay which is far from negligible when the target is moving at a speed of 80 to 100 meters per second. Automatic breeches and complete automatic fire are essential.

2. *Mechanization of loading and ramming.* Complete mechanization of loading and ramming is not only useful from the standpoint of gaining time, but is indispensable when heavy cartridges are used. The cartridge of a powerful 75-mm. gun weighs a dozen kilograms, and that of the Skoda 76.5-mm. gun nearly fifteen kilograms. Automatic loading and ramming devices are wisely used very extensively in America and in various navies. These are necessary for the 90-mm. gun, which takes a cartridge weighing approximately eighteen kilograms. Automatic devices are the only ones which permit maintaining a rate of fire of twenty to twenty-five shots per minute. They are also necessary to insure placing the cartridge in a fixed, uniform position in the bore of the piece.

As we have seen, manufacturers usually permit muzzle velocities of 800 meters per second and pressures of 3,000 kilograms per square centimeter. Nevertheless, they are not utilizing the full capabilities of metallurgy.

As the muzzle velocity increases, corrosion and erosion also increase. But these adverse effects can be countered if we use replaceable liners made of metals more heat resistant, and if we provide streamlined shells with rotating bands designed to reduce bore resistance to a minimum.

On the other hand, an increase in muzzle velocity and the adoption of a pointed streamlined projectile results in reducing the explosive content of the shell. This content should be as great as possible, for the most effective shells are those in which the weight of the explosive (to which the effectiveness of the single shot is roughly proportional) is as high as 20 to 25% of the total weight. In order to withstand the increased pressures in the bore resulting from increased muzzle velocity, the thickness of the shell walls must be constantly increased. A compromise must therefore be struck between two contradictory characteristics: first, the time of flight, and secondly the explosive content. A moderate increase in muzzle velocity is highly desirable.

Since the radius of action of a projectile increases as the cube of its diameter nothing can be done about the lack of power of the 75-mm. Various navies have employed 90-mm. and even 100-mm. guns for several years. The Germans have an 88-mm. gun, with a muzzle velocity of 820 meters per second—characteristics which enable it to cope with airplanes flying at altitudes of eight to nine kilometers and speeds of 400 kilometers per hour. This gun proved to be excellent in Spain. Then there is the American 105-mm. gun, first made several years ago, with a vertical range of twelve kilometers, a horizontal range of nineteen kilometers and rate of fire of twenty rounds per minute. This gun is necessarily very heavy. Its cartridge, weighing approximately 25 kilograms, has about reached the weight limit for handling. Men should always be able to carry cartridges in their arms from the ammunition dump to the loading device.

For the ordinary gun, of caliber of about 90-mm, a muzzle velocity of from 850 to 900 meters and a rate of fire of twenty-five to thirty shots per minute should be adequate.

Moreover, chemistry has not spoken its last word. The improvement of powders will bring increases in range and accuracy. The perfecting of explosives will result in more effective fragmentation of the shell.

Ultra-rapid photography (duration of exposure one hundred-millionth of a second) recently developed will permit proper study of trajectories and will facilitate research in the optimum external shapes of projectiles.

And, finally, we deal with the fuze—a most essential part of the ammunition. Fuzes utilizing the combustion of priming powder are rather sensitive to atmospheric variations and function irregularly at high altitudes. Clockwork fuzes are necessary. It should be noted, however, that clockwork fuses are veritable chronometers and are difficult to maintain in good condition if they remain unused a long time.

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Results vs. Training

By Lieutenant Commander Joel Newsom, U. S. Navy

Editor's Note: The admiral's headquarters in battle is bound to be near the front lines so we accept for the sake of argument, the author's assigning to an admiral a priority ahead of that of a general. It seems that no Coast Artilleryman could read the following article without having called to his mind certain analogies between the two services. How many regimental commanders clamor for experienced battery commanders instead of turning around and training some new battery commanders? The Coast Artillery like the Navy has complex duties, and one question is whether or not a soldier or sailor should be a jack of all trades at the risk of being master of none.

The discussion edges up to our much maligned target practice scoring formula, but no light is shed on another ever-present problem—shall we be gunners or cutters of grass and rakers of leaves?

The Constitution says, "The Congress shall have power to provide and maintain a navy." After many years of niggardly appropriations the Congress has finally provided us with one of which the whole nation is proud. The people know our ships are equal or superior to any. What they do not know is whether we are progressing as a fighting machine.

Ships are steaming more miles, firing more practices, engaging in more tactics and fleet problems than was thought possible a decade ago. In fact we are constantly "proving" the Navy by demonstrating that our ships can steam at high speeds for greater distances, that our aircraft can patrol the sea at night, hundreds of miles from their bases, and that our ships and men are able to stand a great deal of punishment. Does it necessarily follow that we are "improving" by all this, that the personnel are keeping pace with the ships and making the most of their opportunities? Isn't it possible that this which we consider improvement is nothing more than an increase in the number of modern ships and superior equipment provided by the Congress?

A navy may best be compared to a major league baseball team in which the players are the ships, the team is the fleet. Fleets and ball teams are costly, they manufacture nothing, they produce nothing, they justify their existence only when they are engaged with their opponents and *winning*.

Ball teams go south in the winter solely to enable them to play better ball when the season opens. Does the Navy train in peacetime solely to enable it to fight better when the day of real battle arrives? If your answer is "yes," answer these questions: A turret officer is soon to fire short range battle practice, a practice for the "preliminary training of officers and men." He has in his division the best gun pointer on the ship, a boatswain's mate of sixteen years' service, and very shortly to be retired. Does he use the boatswain's mate to fire or a promising young "boot," one who has many more years of potential service?

How many ship's officers other than the captain do you see handling the ship these days?

Why is the demand for junior officers on capital ships increasing yearly?

The answer: The Navy is demanding *results* in peacetime.

The division officer of course used the boatswain's mate. It's up to him to get *hits* and who will know or give him credit if he gives the young "boot" the chance? It's hits that count. Can a captain be blamed if he makes all the landings and conns during maneuvers? No. If his ship is handled in a slipshod manner, no one will ask him whether the conning officer has had previous experience. Capital ships have found that by utilizing junior officers in places formerly filled by enlisted men (and which would be filled by enlisted men in time of war) they can squeeze out a few more hits than the year before; hence the increasing demand for more Naval Academy graduates.

Even a little thought on the subject will convince the most skeptical that the prime objective of the U. S. Navy in this year of peace is *show results*. Actually, as individuals, we are striving largely to avoid criticisms whereas our function should be only to train. I contend, results *per se* have little bearing on our ability to wage successful warfare *unless the organization producing the results is maintained*. It is not what a navy did yesterday, it is what it can do *today and tomorrow* that is of consequence.

One of our ships fires a long-range battle practice in the spring and attains the highest score ever made. The officers and men participating are jubilant; the rest of the Navy rejoices because it proves we can shoot. What happens? Three months later probably half the officers and crew of that very efficient vessel are scattered to the four winds. What matters then the good score?

Every ship must complete its schedule. It starts off the gunnery year by firing the elementary practices. It continues throughout the year with increasingly difficult ones until the whole schedule of gun firings, torpedo firings, power runs, sound practices, division practices, force tactics, maneuvers, fleet problems, etc., is completed. By June 30 all reports must be in and filed, the slate wiped clean, so that it can fire another practice for "the elementary training of officers and men."

As a fighting unit of a fighting machine, that vessel should, the following year, show improvement over the year before. Does it? It usually does not, because a large percentage of those officers and men who as individuals received beneficial training are transferred to other ships and to other duties. The ship as a whole is not benefited and the cycle of training must be resumed. It is as if a ball team, upon reaching near perfection in the middle of a season, should shift the positions of half its players or replace them with players from other teams. Would that be conducive to good teamwork?

The reason for this frequent changing of personnel goes back to the days before the World War when the fleet

was small and scattered; when maneuvers consisted of a few "squads right and left"; when aircraft were nonexistent; when the master-key method was considered the last work in controlling fire; and when our newest ships were still propelled by reciprocating engines. Its personnel, while well grounded in the fundamentals of a seagoing profession, had relatively little need for the enormous technical knowledge required in so many subjects today.

In those days, war was considered improbable, and in the era of good feeling then existing between nations, units were sent throughout the world to show our flag. Crews were away from home for long periods of time. On their return it was considered fitting and necessary that they rotate with home-based ships and with billets ashore. It is true that in those days an officer or man was almost equally at home on any ship.

We find a different picture now. War is everywhere in the air. Our fleet is large and concentrated and never ventures far from its bases. Warships contain some of the most complicated mechanisms on earth. Aviation has become a considerable arm of the fleet. As a fleet is increased in size and types, the problems arising in maneuvering it increase proportionately. Time is required for any person to familiarize himself with his new duties unless he happens to be a specialist in his particular field. Yet, in spite of the enormous changes that have taken place, we shift our personnel between ships, and between sea and shore billets, as in the past. With what results?

It results in a fast tempo in the Navy. Fast because much must be accomplished by the individual during his brief tour of duty if his imprint is to be left behind. And how better show an imprint than to point to "results achieved"? It is far easier and more natural to focus attention on tangible items than to endeavor to bring to the seniors' notice merely a well-trained, properly-indoctrinated organization, but none the less intangible.

It results in our losing sight of the vital fact that training is paramount and substituting, for a sound program of training, a *schedule* heavier than the one of the year before.

It results in no individual being as thoroughly efficient in his job as he should be if the fleet were *suddenly* called on to do battle.

It results, unless the organization doing the training is to do the fighting, in a waste in ships, ammunition, fuel, money, and human endurance—at least some of which are not replaceable.

Is it possible to reduce the present fast pace and still keep the fleet at an equal or greater efficiency? It is. The remedy lies in permanency of personnel and herewith are submitted three suggested remedies.

First suggested remedy.—All type commanders and above remain at sea in the same billet for not less than four years, preferably for six years. Few, at first glance, will agree with this recommendation. But stop and consider for a moment the great responsibilities resting upon the commander in chief and of the fleet of a great power. No other position in the world is comparable. Certainly not that of a general of the armies who, through error, may lose tens of thousands of men. Men are replaceable, ships are not—in the time allowed. It is inconceivable a whole army could be suddenly wiped out; it is probable a whole fleet could be lost, thereby leaving the country open to invasion. Therefore, doesn't it follow that the Navy should give its commander in chief all aid possible? Certainly it should allow him time in office to study and digest all the multitudinous subjects of which a commander in chief must be cognizant, such as, the composition of the forces of the most probable enemy; personal characteristics of their high ranking officers; their language, religion, history, economic advantages or handicaps, merchant marine, trade routes, the relative tenacity of their people; the location of their bases and fortifications; weather likely to be encountered in the possible theatres of operation; the enemy's probable plans of operation; our own fleet's strength and fitness and methods of checkmating him; the likelihood of additional enemies or allies; and liaison with the Army. Most important of all, give the commander in chief time in office to learn the use of those magnificent weapons the Congress has furnished him; to learn not only the science but the *art of war* and not, because of lack of time, force him to follow in the footsteps of his predecessors.

One or two years is insufficient.

A fleet ready to do battle is a complex organization. In spite of great advances in communications, it is expected much will be left to the discretion of the type commanders. If so, it becomes imperative that they think along the same lines as the commander in chief, and that they be thoroughly conversant with the capabilities and limitations of the types they command. Hence the suggestion all type commanders and above remain at sea not only until they have become familiar with their new duties but until the fleet has had the opportunity of reaping the benefits of their increased proficiency.

A more smoothly running navy would result. Policy changing would become less frequent; the same mistakes would not be made twice, and those who are to carry the great responsibilities would be learning.

The present method is comparable to a ball team changing its coach every Monday morning.

It is true that fewer would be called, fewer could reach the supreme command, but the Navy would profit. After all, the Navy is not, or should not be, run for the benefit of any individual or individuals.

Second suggested remedy.—All other officers remain at sea for three years performing the same duty during that period. Officers below the executive officer of individual ships could be shifted as desired. This should not be difficult to obtain and is carried out by at least one other great naval power. All officers of a ship would arrive together and be detached together. Some will argue here that a vessel would be crippled unless we have an overlapping of officers. I, on the contrary, believe a ship manned by average officers would be fully ready to become an integral part of the fleet if it were given just two months to operate at the will of the commanding officer, provid-

ing the officer's time was not taken up with multitudinous reports and paper work. In that time all officers could become familiar with the ship and get her "feel" in handling. They could study reports and past performances, instruct the crew, test the organization, fire elementary practices, engage in minor tactics with other similar types, and try out all those things they would like to but seldom have the opportunity of accomplishing. Then for two years and ten months we would have a fighting unit better than any we possess today. This procedure, naturally, would require one-third of the ships to be "out of the fleet" for two months every year. But remember, two-thirds of the fleet would *always* be ready.

What changes actually occur among ships' officers? A certain vessel, after leaving the builders, joined the fleet on October 28, 1937. Within a period of eight months the following officers were detached and replaced out of an original complement of nine: the commanding officer, the engineering officer (twice), the first lieutenant, the torpedo officer, and the assistant engineering officer. Six changes in a complement of nine within eight months.

Third suggested remedy.—So far as possible, keep intact the entire crew of combatant ships for three years.

The present annual turnover is about eighty-five per cent. It is responsible for the necessity of continual reorganization; for crews being always in a state of flux and never attaining that degree of efficiency of which they may intrinsically be capable; for the blight of the "short-timer"; for the necessity of operating at times shorthanded in highly important ratings; for the natural tendency to transfer the undesirable rather than to train, disrate, or discharge him; for excessive and unnecessary drilling received by some while others receive too little; for a lowering of morale because men do not feel they are permanently attached; and finally for the necessity of beginning all over each year as if no member of the crew had ever engaged in a practice of any kind before.

It will be found that the outstanding ships of the past and present, the winners of the gunnery, engineering, and athletic trophies, the happy ships, have been those in which by some fortuitous circumstances the officers and crews have remained relatively intact for several years. To what heights might not a vessel reach if, from the Captain to M. Att.3c, all remained for three full years?

Remedies have been suggested; detailed plans to carry them out are beyond the scope of this article. As regards officer personnel, the problem is simple. Having no contacts with the government they can be detailed in any manner or method found to be most advantageous to the Navy as a whole. There will of course be more officers in the higher ranks than there are positions to be filled. Weeding out is necessary and is in conformity with the present drastic selection laws. What method could be more painless than one automatically retiring all those not obtaining commensurate commands within a specified time?

Greater difficulties can be foreseen with enlisted personnel because of short enlistments, changing rates, discharges, deaths, desertions, and new construction. A broad study of the problem is necessary. That great improvement over present methods could be made, no one will doubt.

If the proposed remedies were carried out, one can easily visualize a fleet in which the fundamental and, in fact, only reason for its existence has not become obscured; a fleet in which one will have time to learn, retain, and teach those practices of good seamanship which are the foundation of a naval profession; a fleet in which excuses are not required for failure to obtain a hit less than the year before, provided training and indoctrination were properly carried out; a fleet that receives maximum returns on energy expended; a fleet that puts training and learning on a higher plane than peacetime scores; a fleet in which the great majority of its personnel are not looking forward to the day of their detachment; and, finally, a fleet that is actually preparing for war.

When we entered the last war, kindly Britain kept the enemy from our shores while we prepared by making 90-day officers out of college boys, by recommissioning old ships, by building new ones, by a general exodus from the shore establishment and a resuffling of the forces afloat. It is a generally accepted belief some happy act will again occur while we make the necessary preparations. Perhaps so. Perhaps again, our first hint of impending hostilities will be in the form of a radio from the Army in Honolulu "Enemy attacking in force; can hold out no longer than ten days."

Such is the fashion, nowadays.

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Entraining an AA Regiment

By CAPTAIN H. T. BENZ, Coast Artillery Corps

Although antiaircraft artillery is mobile and can move on its own wheels there are times when it is more efficient to move by rail. In a long distance change of station the element of time may even make a rail movement imperative. Moreover, personnel arrives in better condition than after a forced road march; and wear and tear on material is avoided. This article is a study of train loading by elements of the 69th Coast Artillery in conjunction with personnel from the office of the District Engineer, Galveston, Texas, with the cooperation of the Galveston, Houston and Henderson Railroad.

A troop train, approximately one per battery, will consist principally of freight cars, both box and flat. The boxcars carry personnel, kitchen equipment and Class I supplies for the trip, while the flatcars carry vehicles loaded with organization equipment and baggage. The flatcars should be at least fifty feet long to avoid waste space, but the boxcars can be of any standard length. The train should be assembled with boxcars in one group and flatcars in another so that loading of each may be conducted simultaneously.

Loading of boxcars presents no special problem; but railroad experience in the loading of circus vehicles suggests end loading of flatcars. With the flatcars on a straight track, the vehicles move under their own power from car to car until they arrive at their assigned position. In actual tests by the 69th Coast Artillery the leading vehicle of a battery column was placed on the train twenty-five minutes after arrival at the railroad yards. An entire gun battery can be loaded and be ready to move in about four hours.

With the procedure suggested by personnel of the Galveston, Houston and Henderson Railroad no loading platforms are needed and special equipment is reduced to a minimum. A train can be loaded and unloaded anywhere that vehicles can be given access to the railroad roadbed.

A loading platform is improvised by converting the rearmost flatcar into a ramp. This is done by removing a set of wheels and lowering the end of the car until it rests on the rails. In unloading, the front of the leading flatcar is lowered and the vehicles are driven off. For this reason the lightest vehicles should be loaded first.

Here are the materials required: four railroad jacks, three sets of crossovers, two small ramps, chocking blocks, timbers, short pieces of rope or cable, spikes and shovels. The jacks are obtainable from the railroad company and should stay with the train. The remainder of the material can be improvised from salvaged iron and lumber. If a railroad repair shop is available the ramps and crossovers can be made in a few hours from old boiler plate or other scrap iron.

Upon arrival at the railroad yards a squad or a gun crew immediately begins lowering the end of the flatcar. Two jacks are placed in position on each side, one set for lifting and the other for lowering. The end of the flatcar is raised enough so that after the brakerod has been disconnected and the center pin removed the wheel truck is moved out. The end of the flatcar is then lowered until it rests on the rails. As a safety precaution the truck should not be moved from under the car until all personnel stand clear. Holes are dug in the road bed to accommodate the short iron ladders on each side of the car. The

Left: The ramp ready for use with short metal ramps of boiler plate in place. Note hole in roadbed to receive the short ladder on side of car. A plank, laid cross grain, acts as a cushion between car and rails. Right: A prime mover starts across the ramp.

Left: Putting the crossovers in place. Right: Illustrating one method of blocking and snubbing. Notice the crossovers.

deck of the flatcar now is resting about eighteen inches above the road bed so a small ramp is placed in position to bridge this gap. Planks or rock and soil may be used if other material is not on hand. The vehicles may now be driven aboard.

Hand brakes are removed from the flats by extracting a cotter pin and lifting them out. As there are no other obstructions the crossovers may then go into place and the vehicles driven from car to car. Three sets of crossovers will span four flats so it is necessary to shift them forward in order to drive the vehicles farther along the train. However, the loss of time is immaterial because the vehicles can be loaded faster than they can be made secure.

Methods of securing equipment can be obtained from *Rules Governing The Loading of Commodities on Open Top Cars*, published by the Association of American Railroads. However, since this booklet is not generally known in the service the methods used by the 69th Coast Artillery will be described.

As the flatcars are loaded, a separate detail of two or more gun crews secure the vehicles. Vehicles must be secured against movement fore, aft, and sideways. Blocks are placed against the front and rear of each wheel and are spiked to the car deck. The wheel side of these blocks should be shaped roughly to fit the wheels and a lip must be left on the opposite side so that the blocks may be firmly spiked. Longitudinal cleats are spiked along the interior sides of the wheels to prevent sideslip. Cross timbers laid laterally between the interior cleats are wedged and spiked to provide further resistance against side slipping. Sideslip can also be prevented by blocks placed against the exterior sides of the wheels and firmly spiked to the deck. All blocks, cleats and cross timbers should be at least eight inches high. In cutting blocks they must be shaped so that the long grain of the wood is on top to prevent cracking or chipping under strain. If time does not permit the cutting of blocks, railroad crossties bolted to the deck will serve the purpose.

The vehicle's brakes should be locked to avoid overriding the wheel blocks on sudden stops or starts. For added security a tie-down must be used to snub the vehicle's springs. A tie-down consists of a cable or bar from the corners of the vehicle body to the stake pockets of the flatcar. The tie-downs must be fastened to the vehicle body above the springs and must be drawn taut. Tautness can be best accomplished by deflating the tires, drawing the tie-down taut, and then reinflating. The tensile strength of each tie-down must be 15,000 pounds and the angularity to the stake pockets should be about forty-five degrees. When cables are used, secure both ends with two two-bolt cable clamps. All tie-downs should be securely wrapped with burlap or other material where in contact with the vehicle to prevent chafing and scarring the truck. The equipment must be secured to the satisfaction of a railroad official who will make an inspection.

When the last vehicle, usually the empty kitchen truck, is aboard, the rear flatcar is jacked up, the wheels are replaced and the brake rod is connected. All hand brakes are replaced and the flatcars are turned over to the yardmaster to be coupled to the boxcars. All holes are refilled and the roadbed is cleaned up. The organization is now ready to move.

Left: Gun and prime mover in place. Notice method of snubbing the gun and the cross brace between wheels to prevent sideslip. Right: Unloading a gun and prime mover.

Bridging the EXTENSION COURSE GAP

By

Major Paul L. Reed, Coast Artillery Corps Reserve

When the National Defense Act of 1920 set up an army of three components, Regular Army, National Guard, and Organized Reserve, little was said or could be said in that basic law about the methods of training the one new component, the Organized Reserve. Obviously it was not possible to set up any training procedure or program arbitrarily.

The Regular Army already had its carefully graduated educational system in which an officer advanced step by step as his experience and rank progressed. The methods of Guard training, although they needed revision at that time, were adequate as a basis for improvement. But no one had a clear idea as to how the Organized Reserve was to be trained. How that training has evolved and how the first crude methods have been succeeded by orderly, graduated schedules, it is not our purpose to discuss here, more than is necessary to indicate that the step proposed in this article is a logical one which will improve the existing training. The development of active training camps and the growth of the inactive status training, and specifically the Army Extension Courses, with which we shall mainly be concerned, are too well known to require preliminary elucidation.

The Army Extension Courses form the backbone of the inactive status training program for the Reserves. At the present time these courses are so complete that a Reserve officer of some intelligence and judgment can gain an excellent working knowledge of the subjects required for his assignment in a Reserve company, battery, or equivalent unit. They form, of course, no substitute for active duty or for experience in handling commands, but the correspondence subcourses of his arm or branch nevertheless help the Reserve officer greatly to prepare for active duty and give him most of the professional background he needs.

By using the term "professional background" I do not imply that the Reserve officer does, or wishes to, compete with the Regular officer. The professional career of the Regular officer is one thing; the attitude of the Reserve officer toward his volunteer military training is another. But since the Reserve officer is a part of the same team as the Regular, he must learn the same rules and think in the same terms as far as it is possible. At the present state of the Organized Reserve this means that company or battery, battalion and regimental officers need a more thorough training if the Reserve regiments are to continue to improve in the next five years as much as they have in the last five.

To that statement perhaps the bulk of Reserve officers will immediately say, "We give as much time now as we can. We may be willing, but how can we do it?"

A thorough study of the Army Extension Courses of one major arm and also a more limited study of the Command & General Staff School courses, convinces me that there is a practical, logical solution. This solution is a new series of sub-courses, which we will call the "45- Series." A main purpose of this new series is to fill the big gap which now exists between the present 40- Series and the 50- and 60- Series of the Command & General Staff Extension Course. Regular officers who have served as unit instructors, and senior Reserve officers, know best of all that the military progress of most Reserve officers stops abruptly after the 40- Series is finished. Senior Reserve officers in particular are keenly aware of the breadth and depth of this gap.

Perhaps we can see this situation better if we visualize the situation of the Reserve officer who stands facing the gap. The fact that he has finished the 40- Series is proof of his interest in his advancement in military knowledge. He is, let us say, a senior captain who takes a leading part in the active-status training of his regiment. He has arrived at the point where he is a valuable military asset to his country. Shall he be permitted to go on increasing this value, or shall he, as in many cases at present, be virtually stopped short by the formidable 50- Series?

Our average Reserve officer is between thirty-five and

The step from the 40- to the 50-series is too big

forty; he is married; and he is well occupied with his business or profession and his social life, and perhaps with a hobby in addition. The time he has available for military study or training activities is not great and he must budget it carefully. This officer, let us assume, sits down to face the 50- Series.

He finds first that the lessons are very long. He must spend three, four, or even six or eight evenings, or a large part of two or more week-ends, working out one complete lesson. These evenings can rarely be consecutive, and frequently his efforts must be spaced at considerable and irregular intervals. The continuity thread must be sought out again and again. This, in itself, is a very wasteful procedure and one that is not conducive to a normal zest for learning.

Another objection is that the material of the 50- Series is all in terms of a reinforced brigade or a division, quite outside his experience and beyond his normal expectancy in command. There is, to be sure, absolutely no argument that such studies are not necessary or that Reserve officers should not study them. But the step from the 40- to the 50- Series is often too great for the Reserve officer who probably will never go beyond a regimental assignment. What he needs and what he wants is a more thorough knowledge for his present or next assignment in his regiment.

There is also an impression among Reserve officers in field grade that the 50- and 60- Series are more of a preparation for the Command & General Staff School course in residence than a training that the Reserve officer needs for his present assignment or for one that he could reasonably expect in time of national emergency. Since only about fifty officers of Reserve regiments take the Special Course at Leavenworth each year, it is obvious that the average Reservist can never expect to receive this training. Hence he is liable to shy away from work that seems to him preparatory to a field he will never enter, though he may be willing enough to continue suitable work.

Another point is that ROTC and CMTC graduates are beginning to reach the field grades in Reserve regiments. World War veterans with Reserve commissions now number only 9,197—or about 9% of all eligible Reserve officers. Many Reserve regiments have no World War veterans at all. In others, ROTC graduates by consistent training have actually outranked the veterans. Lacking war experience, these younger Reserve officers need much more training in regimental organization, administration, and tactics before they are ready to go on to higher echelons—to the 50- and 60- Series.

Some Reserve officers may be prepared to pursue the 50- Series to advantage immediately after completing the 40- Series or receiving promotion to field grade. But a larger number find the 50- Series much too tough; they are beaten to a standstill by five or six lessons. Still more struggle along doing sporadic, uneven work that is hardly a credit to their intelligence or industry. But most serious of all is the fact that an even larger class simply does not tackle the 50- Series at all.

TABLE I

WHO DOES THE EXTENSION SCHOOL WORK?
(Based upon Extension work done in one Reserve military district for the school year 1937-1938)

	Officers	Per Cent
Total strength	1,116	100
Number enrolled	847	76
Number not enrolled	269	24
Number completing one or more lessons	719	64
Number completing no work	397	36
High 20% in hours of work	143	13
Part of total work done by 20%		47
Other 80% doing work	576	51
Part of total work done by 80%		53

Statistics of the Reserve extension work done in the past year in one district show that 25% of all assigned or attached Reserve officers were not even enrolled (Table I). Further, 15% of those who were enrolled did not submit a single lesson during the school year. Some 65% did all the work. No figures are available to indicate what part of the whole was struggling with the 50- Series, but it is probable that the same percentages hold for senior captains and majors thus engaged. It is interesting to note from the table that 13% of the total number of officers did nearly half of all Extension Course work.

Using the same data to get at the "achievement spread" by rank in this same group of officers, an analysis showed that approximately 20% of officers in all grades ranked high. In fact, the high 20% did over 40% of all Extension Course work (Table II). The work done by senior captains and majors is not entirely in the 50- Series. Some hours were earned in the 40- Series and some by contact camp and conference attendance, which is also true in other grades. This table seems to indicate that the logical 50- Series students are doing their share, but as noted above, this is not actually the case since senior captains and majors are actively engaged in other inactive-status training. It is estimated that at least a third and possibly a half of the senior captains and majors are not doing work in the 50- Series.

Since these figures cover between 1,100 and 1,200 Reserve officers, it is reasonable to assume that the conditions in this group are indicative of those among Reserve officers in general. The data show us that the actively engaged Reserve officer is, as a rule, doing his job and doing it well. It is also plain that there is a considerable number who are not keeping up. In some cases there are entirely valid reasons beyond an officer's control. But as a whole, those who are doing correspondence work along

TABLE II

ACHIEVEMENT SPREAD BY RANK, SAME GROUP AS IN TABLE I

	Highest 20% in Activity				Other 80% in Activity				
Rank	Officers	Hours	Average Hours	Per Cent Total	Officers	Hours	Average Hours	Per Cent Total	Average Hours for Each Rank
Colonel ...	1	64	64	33	5	131	26.2	67	32.5
Lt. Col. ...	2	297	148	63	7	178	28.3	37	52.8
Major	5	521	104	42	20	717	35.8	58	49.8
Captain ...	23	1,800	78	44	87	2,298	26.4	56	37.3
1st Lt.	63	4,788	78	44	253	5,096	20.1	56	34.4
2d Lt.	49	3,285	67	46	204	3,878	20.0	54	28.3
Total ...	143	10,755			576	12,298			

Summary: The high 20% of officers in activity do over three times as much work as the remaining 80% and over twice the average for the entire group.

Remaining 80% run consistently more than 20% behind the group average.

with other inactive-status training are those who are building up the Reserve *esprit de corps*.

There can also be no reason to doubt that the Reserve Corps is now of age and that it can look at itself with the honesty of maturity and spot its own weaknesses. Certainly one of its weaknesses is this tendency of many officers to reach a stagnation point in their inactive-status training. The present structure of the 50- Series is a barrier, and perhaps the most difficult one in the path of Reserve officers who are willing to go ahead with their military training. What, then, should a 45- Series cover, what can it offer that the 50- and 60- Series cannot, and how would it keep Reserve officers working?

The 45- Series, as the title suggests, would be an intermediate set of subcourses between the 40- and 50- Series. It would have two principal functions. First, it would serve as a background and refresher course for the senior Reserve officer. As a background course it should properly include material on the most closely related arms and services. For example, a Coast Artillery antiaircraft officer could be given subcourses on Air Corps subjects such as aerial map reading, bombing, and organization and identification of aircraft (this last in much more detail than in the present brief, inadequate subcourse). In the same way this officer could study Infantry subcourses to give him a good working knowledge of the problems he would have to face if his organization were ever called on for infantry supporting missions, whether on a front, along a line of march, or in a rear area. Officers of supporting arms or branches would gain particularly from such information. Such interchange of subcourses between arms and branches could well be on the level of the 30- or 40- Series. Either full subcourses or a specially designed refresher course should be made available.

As a refresher set of subcourses the 45- Series would review the most important subjects, with the material so drawn up that an officer could take the subcourses in any order or sequence. As the inactive-status training and conference work varies from year to year to fit the needs of Reserve units, the senior captains and majors could review those subcourses they needed at any particular time for their own parts in the regimental training. If a unit, for example, expected active duty the next summer, the subcourses studied could be those of most value for the coming work or those in which individual officers were rusty. This might properly involve a rotation of 45- Series subcourses for all unit commanders so as to fit the annual inactive-status training schedule as worked out by the regimental commander and his staff. In this way the original conception of the Reserve officer's function of doing one job adequately could develop into the broader one of training for several possible assignments both in present and in the next grade.

The 45- Series, being more flexible than either the 40- or 50- Series, would serve admirably as a place to introduce new material, and changes in policy, organization, or tactics. The lesson units, being for the most part shorter than corresponding subject coverages in the 40- or 50- Series, could be revised or replaced at the minimum of effort and cost.

Another suggestion—which might apply to all subcourses—and which would give the subcourses of the 45- Series a maximum of value—is this: A careful examination of the approved solution by the student should be given weight in arriving at the final rating on all lessons of a course. In the 40- and the 50- Series, particularly in the latter, the approved solution is not examined or studied as carefully as it should be. A student who has worked

TABLE III

FIVE-YEAR ENROLLMENT RECORD IN ARMY EXTENSION COURSES

School Year	Distribution								
	Regular Army		National Guard		Organized Reserves		Miscellaneous		
	Com.	Enl.	Com.	Enl.	Com.	Enl.	CMTC	Civ.	Total
1933-34	807	1,197	10,226	13,899	46,770	1,567	4,378	5,463	84,307
1934-35	1,103	1,285	10,743	15,824	50,503	1,260	3,886	4,305	88,909
1935-36	1,416	1,297	11,210	18,569	55,514	925	2,927	3,863	95,721
1936-37	1,457	1,245	11,811	18,729	56,109	862	2,824	3,684	96,621
1937-38	1,505	1,244	11,950	18,240	57,060	996	3,161	3,901	98,057

diligently to prepare a map problem may believe that his own solution is as good or even better than the approved solution. Or he simply (and more often this is the case) skims through the approved solution or neglects it entirely, to get on with the next lesson.

To remedy this the instructor could grade the solutions to a 45- Series map problem on the basis of a weight of 85. The instructor would then return the lesson and the approved solution to the student, who would go over the approved solution, check his own against it, and write out his comments on the differences. This he would send with his next lesson, or separately as he chose, to the instructor. The instructor would evaluate the comment of the student and give a final rating based on both the student's solution and his comment.

This would not only insure the study of approved solutions carefully, but would give the initiative and the skill of the student fuller play. A clearer understanding of the principles involved would be essential in commenting on the differences between an approved solution and his own. This method would be particularly valuable in the 45- Series because there the student would be handling material with which he was more or less familiar and which would call for a wider experience and a higher degree of skill than could be expected from a student handling new material. He would thus find the work more interesting.

The second function of the 45- Series would be to introduce the 50- Series. The 45- Series would not serve as a substitute for the Command & General Staff School course, but it would give enough work on the fundamentals of higher command to furnish a Reserve officer in a regimental assignment, a fairly complete military education without the 50- Series.

Thus the subcourses of the 45- Series would need be grouped in two sections, with the first of them on the level of the 30- and the 40- Series, prepared for the Reserve officer who did not have in mind pointing toward the 50- Series but who wanted merely to refresh himself on his basic training. The second section of subcourses in the 45- Series should follow in general the main divisions of the 50- Series—Tactics and Technique of the Separate Arms; Tactical Principles and Decisions; Troop Leading; and Command, Staff, and Logistics. But the treatment should be largely in terms of the company or battery, the battalion and the regiment, instead of the brigade and the division. These 45- Series subcourses should cover what regimental officers need to know about larger echelons, but by means of problems involving the functions of regimental and lower units. In this way regimental officers would gain some acquaintance with higher units and how they were handled, but they would still think largely in terms of their present or next higher assignments within the regiment. From the standpoint of developing Reserve efficiency, this part of the series migh well have its greatest value in the resulting continuation of study by many senior captains and majors.

It would be very important, in the 45- Series, to keep the lessons short—short enough to work out in two evenings. Since practically all correspondence study by Reserve officers is done in the evening, this means lessons that the avetage student can do in from six to eight hours. When a lesson has a reading assignment, or a combined reading and staking-out assignment that cannot be done conveniently in a single evening, the waste of time in picking up thoughts and points on a partly read assignment or an incompletely staked-out situation map is very considerable. Many lessons in the present 50- Series marked as six-, eight-, or ten-hour lessons, take the average Reserve officer at least twice as much time as that, and inconvenient, awkward breaks in continuity are inevitable. The discouragement that comes with such waste of time and effort is very real and is only too effective in keeping low the number of lessons complered and, correspondingly, the officer's sense of achievement. Shorter lessons in the 45- Series would encourage and build up a sense of achievement. Closely allied is the pleasure that the Reserve officer gets from his Extension School work. It is easy if it is fun, and it is fun when it comes in digestible doses.

The Reserve officer realizes, of course, that the Army Extension Courses were not constructed entirely for him. According to the latest available data (March 31, 1938,

from the office of the Executive for Reserve Affairs) 57,060 Reserve officers, or only 58% of a total of 98,057 Extension Course enrollments, completed a total of 35,628 subcourses for a total of 1,358,478 hours of instruction. This includes all hours earned in Extension school work. The National Guard in the same period enrolled 30,190 —11,950 of whom were National Guard officers. The remaining enrollees were scattered among enlisted Reservists, CMTC trainees, civilians, Regular Army officers and Regular Army enlisted men. The approximate grouping is now rather well established as can be seen from Tables III and IV.

The Command & General Staff School course (with no distinction made between the 50- and 60- Series) had an enrollment of 3,122 students. Of this total, 565 were officers of the Regular Army, 655 were National Guard officers, and 1,897 were Reserve officers. Only one out of thirty Reserve Extension Course students was enrolled in the Command & General Staff School course.

The advantages of a 45- Series, as suggested in this article, seem evident enough for the idea to take root and develop as the next logical step in Army Extension course development. To recapitulate, the series I have suggested is, first of all, flexible. Both sections of it—the refresher and the new subcourses—are short. The refresher subcourses can be taken in any sequence to fit the needs of individual officers and the annual inactive-status training schedule of units. The new advanced subcourses filling the big jump to the 50- Series, can be taken in a logical sequence, at any time, before, during, or after the refresher work. The needs of officers who wish merely to retain their present commissions and of those who wish to prepare for the next higher grade are both met. Senior captains who do not want to remain idle, and yet do not want to run the risk of having subcourses outlawed by the present five-year rule of limitations, will find the 45- Series an ideal bridge over one or more otherwise idle years.

The proposed 45- Series is in digestible units. The briefer treatment is ideal for the Reserve officer who is subject, as we all are, to the laws of forgetting. The units are in a form he can use quickly for instruction purposes. With the method of marking suggested, the lesson units will have an added interest through placing a premium on initiative.

The 45- Series is also adaptable for adding new material and replacing old, quickly and at low cost. Short lessons will reduce revision time and make modern material available in a shorter time for Reserve study. This is a particular advantage in those arms and services where technical advances are rapid.

The 45- Series makes a definite appeal to a group of Reserve officers not now working. To the large group of field officers and senior captains not now doing Extension work, or struggling unsuccessfully with the 50- Series, the 45- Series offers a logical means of renewing their interest in further military education. The graduated lessons bridging the gap between the 40- and the 50- Series, the two-evening lesson unit, the rotation plan for annual training schedules, and the fact that the 45- Series is a logical step to the 50- Series—all will invite a greater and more consistent participation.

TABLE IV

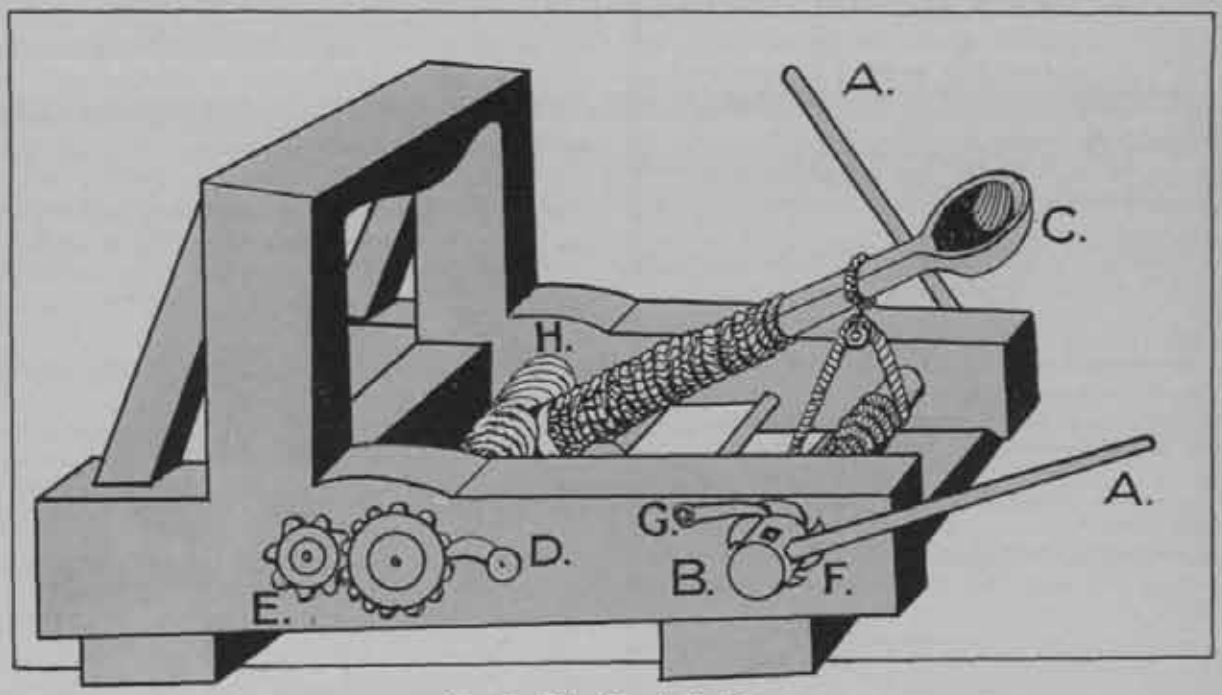
AEC Distribution by Arms, Services, Etc.
March 31, 1938

Adjutant General's Department	705
Air Corps	2,606
Cavalry	5,121
Chaplains	723
Chemical Warfare Service	1,653
Coast Artillery Corps	8,573
Corps of Engineers	5,216
Field Artillery	14,325
Finance Department	784
Infantry	32,891
Judge Advocate General's Department	702
Medical Department (including Aviation Medicine Course)	11,256
Military Intelligence Division, General Staff	546
Ordnance Department	1,688
Quartermaster Corps	5,436
Signal Corps	2,169
Command & General Staff Extension Course	3,122
Special Staff and Logistics Extension Course	541

The 45- Series might, in addition to these main points of advantage, provide a convenient means of inter-arm and inter-service exchange of information. At the present time policy does not permit a Reserve officer of one arm or service to enroll in a subcourse in another arm or service. The only apparent reason for this is to prevent confusion and to keep from imposing too great a burden on unit instructors. But many would like to take subcourses of other arms in which they were interested and which would have a direct military value for them in their present or next assignments. If some provision to this end could be made in the 45- Series, a great gain in understanding and a much closer coöperation between the arms would undoubtedly result.

A 45- Series should by all means be the next step in Extension Course growth. In the name of a better and more efficient Reserve Corps I suggest that immediate steps be taken by the proper authorities to study the need for and the possibilities of such a series. We in the Reserve need it and want it.

From Ballista to Breech Loader



No. 1—The Greek Ballista

The Story of Artillery Through the Ages

By W. A. WINDAS

As we look over the massive emplacements of a modern coast defense and note the ponderous guns, huge mounts, complicated breech mechanisms, delicate sights and mighty projectiles, we may regard artillery as one of the last words in warfare.

As a matter of fact, artillery is almost as old as warfare itself. The word "artillery," by the way, has no connection with gunpowder, and was used long before the quick-burning grains were even thought of—in Europe at least.

Before the advent of gunpowder, the word referred to various kinds of catapults, and even to battering rams. Because these old weapons would cut a poor figure alongside one of our own 16-inch guns, we are apt to think that they were a rather secondary consideration to the armies of antiquity. This assumption is incorrect.

Even in ancient times, artillery was just as important to a well equipped army as it is today, and lack of it often meant the failure of a campaign. Military progress has depended fully as much upon the artillery as any other branch of the armies which carved empires out of the wilderness and made order out of chaos.

When Phillip of Macedon undertook the unification of Greece, he saw at once that without artillery, the task bordered on the impossible, for each of the independent city states was surrounded by strong walls. Therefore, his first thought was to develop efficient siege-engines. Pre-gunpowder artillery consisted of various types of catapults, and some of these were capable of amazing performances. Although earlier peoples had siege equipment, their stone-throwing machines were not good. This art was practically created by the Greeks.

Take for example the ballista pictured above. It worked on the principle of a sling, the twisted rope skeins supplying throwing power. It was "cocked" by turning the levers A which revolved the spool B until the arm C was back. In this position the ratchet F was held by the pawl G. Tapping out this pawl discharged the piece. The cog-wheels and pawl at E and D are to adjust and tighten the rope-skein H should it become loose or soften by rain. The rope bound about the arm C was merely to act as a shock-absorber when the arm struck the cross-beam upon discharge. It is not to be confused with the tightly twisted rope-skein at H, which operated the piece by torsion.

Ancient accounts say that this machine would throw a stone weighing nearly 200 pounds to a distance of well over 600 yards. In modern times, imitations of this machine have been built, and though the art of properly curing the rope-skeins has been lost, experiments prove that those ancient figures are not exaggerated.

[*This is the first in a series of short articles dealing with the history of artillery.*]

64th C.A. (AA) Wins Association Trophy

The 64th Coast Artillery (AA), Fort Shafter, T.H. is the winner of the United States Coast Artillery Association Regular Army Trophy for outstanding performance during the past target practice year. The award which is based upon the highest percentage of firing batteries rated excellent, will be made on behalf of the Association by the Commanding General, Hawaiian Department.

Seven batteries of the 64th Coast Artillery were rated excellent for their fine work during the 1938 target practice year. The seven batteries achieving this rating are:

Battery	*Type Armament*
A	Searchlights
B	3-inch AA guns
C	3-inch AA guns
E	Searchlights
G	3-inch AA guns
I	.30- and .50-caliber machine guns
K	3-inch AA guns

At the time of firing, the 64th Coast Artillery was commanded by Colonel Ralph M. Mitchell, who is now on duty with Organized Reserves, Richmond, Virginia.

The following table lists all Regular Army batteries classified as excellent for the 1938 target practice year:

REGULAR ARMY BATTERIES CLASSIFIED EXCELLENT, C.Y. 1938

Corps Area or Department	*Regiment*	*Battery*	*Caliber*
I	8th	Hq.	Submarine mines
III	52d	F	8" Ry. Guns
IV	13th	A	12" BC Guns
IX	3d	D	12" SC Mortars
	6th	E	12" SC Mortars
	63d	A	AA Searchlights
		E	Cal. .30 & .50 M.G.
PANAMA	1st	E	105-mm. Guns
	4th	D*	Submarine mines
HAWAII	15th	C	155-mm. Guns
	55th	B	155-mm. Guns
	64th	A	AA Searchlights
		B	3" AA Guns
		C	3" AA Guns
		E	AA Searchlights
		G	3" AA Guns
		I	Cal. .30 & .50 M.G.
		K	3" AA Guns
PHILIPPINES	91st	A	Submarine mines & 155-mm. Guns
		D	14" DC Guns
	92d	A	3" SC Guns
		C	155-mm. Guns
	59th	C	12" DC Guns

*Winner, Knox Trophy, 1938.

The following U. S. Army Mine Planters have been classified Excellent:

General William M. Graham—T.P. Battery F, 1st C.A. and Battery D, 4th C.A.

General Absalom Baird—T.P. Headquarters Battery, 8th C.A. and Headquarters Battery, 9th C.A.

Honor Roll

1st Coast Artillery—Fort Randolph, Panama.
3d Coast Artillery—Fort Rosecrans, Cal.
5th Coast Artillery—Fort Hamilton, N. Y.
7th Coast Artillery—Fort Dupont, Del.
8th Coast Artillery—Fort Preble, Me.
9th Coast Artillery—Fort Banks, Mass.
11th Coast Artillery—Fort H. G. Wright, N. Y.
13th Coast Artillery—Key West Barracks, Florida.
60th Coast Artillery—Fort Mills, P. I.
64th Coast Artillery—Fort Shafter, T. H.
91st Coast Artillery—Fort Mills, P. I.
202d Coast Artillery—Illinois National Guard.
206th Coast Artillery—Arkansas National Guard.
213th Coast Artillery—Pennsylvania National Guard.
242d Coast Artillery—Connecticut National Guard.
243d Coast Artillery—Rhode Island National Guard.
245th Coast Artillery—New York National Guard.
248th Coast Artillery—Washington National Guard.
250th Coast Artillery—California National Guard.
260th Coast Artillery—District of Columbia National Guard.
Senior ROTC, University of California at Los Angeles.
Senior ROTC, University of Delaware.
Senior ROTC, University of Alabama.

In posting the current honor roll of those organizations that subscribe one hundred per cent to the COAST ARTILLERY JOURNAL we find that we have again made progress. For in spite of the loss of one regiment the honor roll has been increased by five units to make a net gain of four. Moreover, we hope to see the unit that lost its place back on the roll when next we publish it again.

The five new organizations posted on the roll are divided into four regular organizations and one National Guard regiment, the 260th Coast Artillery, District of Columbia National Guard, of whom we shall speak at greater length below.

The regular organizations are the 3d Coast Artillery, Fort Rosecrans, California, commanded by Colonel R. E. Guthrie; the 5th Coast Artillery, Fort Hamilton, New York, commanded by Major E. R. Barrows; the 11th Coast Artillery, Fort H. G. Wright, New York, commanded by Lieutenant Colonel W. C. Foote; and the 13th Coast Artillery, Key West Barracks, Florida, commanded by Lieutenant Colonel J. D. MacMullen.

The 260th Coast Artillery, District of Columbia National Guard has grown in the last twenty years from one company to its present regimental strength. Organized as the First Company, District of Columbia National Guard a year-and-a-half before we entered the World War, the unit entered the federal service as Battery D, 60th Artillery and as such served overseas in the St. Mihiel and Meuse Argonne offensives.

Of the sixty-three men who made up the strength of the original First Company all but one received commissions during the World War. The lone exception was under the age of twenty-one.

Shortly after the World War the First Company was reconstituted as a National Guard unit, now becoming Battery A, 260th Coast Artillery. From time to time the unit was increased until it reached its present regimental strength as the only antiaircraft unit to guard the nation's capital city. The regiment uses as an armory one of the oldest buildings in Washington—the ancient and tottering National Hotel; but although the quarters of the 260th may be old the spirit of the organization is young.

Colonel Walter William Burns, who commands our latest National Guard acquisition has the distinction of having commanded the District of Columbia Coast Artillery since its inception. As Captain Burns he organized the original First Company, mainly from employees of the Patent Office, and saw the unit through its subsequent war service and reorganization as an antiaircraft regiment. The family carries on the tradition—one son is a lieutenant, CA-Res., and has served in the 260th; another son who is a private in the 260th is also enrolled in the ROTC at Cornell University.

In the name of the Association we extend a hearty greeting to Colonel Burns and the men of the 260th. We feel sure that their service on our honor roll will be as outstanding as it has been in over twenty years of war and peace.

* * *

Battery G, 241st Coast Artillery Wins Knox Trophy

By Captain Edward B. Gallant

The much sought after Knox trophy, awarded to a Coast Artillery unit of the Massachusetts National Guard for general efficiency, has found a resting place for the next year in the quarters of Battery G, 241st Coast Artillery (HD), Boston, Massachusetts. This award perpetuates the memory of Major General Henry Knox, chief of artillery under General Washington and the father of American artillery.

Battery G is officered by Captain Edward B. Gallant, 1st Lieutenant John B. Bogan and Second Lieutenant Edwin A. Deagle. They attribute a large measure of their success to their excellent enlisted men and the diligence with which these men work and the splendid morale they possess. Not a single noncommissioned officer of the line has had more than three years of military experience. Four of the men are now enrolled at the Massachusetts Military Academy and twenty-five are taking extension courses in preparation for National Guard or Reserve commission.

Immediately after the present officers took over the battery in 1936 definite objectives were agreed upon, a program was established and reorganization began. Many young men were interviewed with the view to interesting them in a new outlook on National Guard activities. Certain requirements were insisted upon: (1) a high school education or its equivalent, (2) ages between eighteen and twenty-four, and (3) a willingness and de-

termination to do the work necessary to prepare for a commission.

Under this program the battery officers took direct control of all training and constantly supervised every man. Certain men responded more quickly than others and took their places as noncommissioned officer. NCO schools were established and are now held twice each month. These schools stress decentralized training and impose upon every student a responsibility which he alone must shoulder. He is taught to make his own decisions and he stands or falls on his performance.

The results of this training can best be appreciated by the response of the noncommissioned officers when in charge of the battery either for infantry or artillery drill. Each noncommissioned officer is trained to do a certain job and to be familiar with the general situation. Once the activity has begun the officers stand aside, their work has been done outside the drill periods. The drill serves only to furnish notes for the next school or material on which to talk with an individual in carrying out the instructor's job.

In 1936 the battery was assigned to 12-inch mortars. The annual target practice on this assignment was rated Excellent. In 1937, on the same assignment, a rating of Very Good was obtained. In 1938 on a new assignment, the 10-inch rifle, the battery recorded highest score yet made on these particular guns and the practice was rated excellent.

These achievements are the result of a rigid armory artillery program which has for its objective preparedness for service practice upon arrival at camp. The battery is fortunate in having a 10-inch gun on which to drill and a mechanical target which moves across the armory floor, thus permitting the gun pointer, observers and spotters to track on a small light. The program consists of a three-period artillery drill twice each month. During the first period the range officer and executive are in charge of their sections. The second period calls for simulated practice under the battery commander and the firing of four ranging shots and eight shots for record. The third period provides for an analysis of the drill and is held in the presence of all key men. The remainder of the battery is divided into groups for instruction in gunnery.

A most important factor in the conduct of drill is a device which makes possible the training of the gun pointer and the spotting section. This device consists of a lamp about twelve inches long and a twenty-four inch square board perforated with holes. The board is attached to the target. Each hole is numbered and by prearranged signal the operator inserts the lamp in one of the holes, lights it, holds it for three seconds and then extinguishes it. This serves as a splash which the gun pointer jumps to get a deviation correction. At the same time the spotters who have been tracking the target pick up the splash and report it to the spotting board where the range deviation is plotted and transmitted to the range adjustment board operator who orders range adjustments as they are necessary.

Our program has been quite successful, as the record shows, but to support further the good results of firing it is interesting to note that when the 1938 Knox Trophy year ended all but one member of the battery had qualified in gunnery. Incidentally, the battery won the Major Arthur L. Lavery Trophy, donated by Major Lavery of the Regular Army, a former instructor.

It may be said that success in winning the Knox and Lavery Trophies is attributed to a program with definite objectives, the high type of enlisted personnel, and to acceptance of responsibility by the noncommissioned officers.

Selecting and Training H.D. Artillery Spotters

By Captain C. H. Crim

The ability to read deviations of artillery fire from a target, can be developed in many men who have good vision. Yet, some men have a natural knack and need only a minimum of training to develop into good spotters, whereas others will never be able to spot well. Because accurate and reliable spotting is essential to fire adjustment, the time spent in selecting and training spotters will pay dividends.

By the method described in this paper it is possible to select men who have natural ability for spotting and to further develop their talent by a training system which is a competitive game.

In this system we set up an instrument equipped with a splash scale and have the observer look at a representation of a splash and a target, exposed to view for a very short time. The correct reading having been previously determined, and a series of representations of different magnitudes and senses having been exposed, a measure of the observer's ability can be determined from a compilation of the errors he makes.

A series of twenty cards was prepared to show the views of splash and target. Each card had a picture of a pyramidal target and a splash drawn to a scale on one side and on the other, the number of the card and the correct reading. In each case the correct reading was different. The observing instrument was set up in the battery emplacement and a receiver for the cards mounted on a convenient post about 50 feet away. After the cards had been carefully read and the correct readings recorded the position of the instrument was marked. A scoring sheet, which had spaces for the observer's name, the card number, the reading made and the error in hundredths of a degree was prepared for each observer. The receiver was marked with a line on which to focus the vertical cross-hair of the instrument. The cards were placed in the receiver so that the pyramidal target in the picture was centered on this line; the vertical cross-hair of the instrument would then be focused on the target when the deviations were read.

The man under test was instructed to focus the vertical cross-hair of the instrument on the centering mark. Thereafter, he was not to touch the instrument. When he was

ready to start the observations, another man placed a card in the receiver, called, waited two seconds and removed the card. The observer then called his reading, whereupon the man handling the cards announced the card number, and both were recorded. A series of twenty readings were recorded in the same fashion and the observer was scored for the series. He started with a score of 100 from which one point was deducted for each .01 degree of error. The errors were determined by comparing the observations with the correct readings for each card.

To get different readings for the card series it is only necessary to set up the observing instrument at various distances from the card receiver and determine the correct readings for that distance.

It is interesting to observe the difference in the abilities of the various men to spot and to see how some improve and others show that they will never make good spotters.

The method can be used in barracks during the indoor season, if a good light is provided over the card receiver.

It is painless training.

Try it!

Antiaircraft Sound Locators

Aviation progress and the rapid improvement of day and night bombers with respect to load, speed, and cruising range have, in the opinion of many, far outdistanced the progress in the development of sound locator devices. Some have apparently lost faith in the ability of mechanico-acoustic instruments to locate aircraft accurately and have advocated the scrapping of acoustical devices and replacing them with other devices employing strong night and day glasses or electro-acoustical instruments such as microphones. Those who have devoted time to this serious problem have been in no small measure influenced by the failure of the devices with which they have been forced to work.

The *Memorial de l'Artillerie Française* for 1938, contains an article entitled "Locating Aircraft with the Aid of Listening Devices," by M. D. Memmo, Major of Engineers in the Italian Army, which is most optimistic concerning the capabilities of properly designed mechanico-acoustical sound locating devices. Admitting that the great speed that we must expect from bombers in the future will weaken materially the normal powers of antiaircraft defense, he nevertheless, contends that "just as a blind person is aided by his keener hearing, so will the increased number and perfection of the acoustic instruments used come to the assistance of the weakened powers of the defense." The author is very positive in his belief that electro-acoustic devices do not hold the same promise as mechanico-acoustic instruments. It is his belief that the power of selection or separation which he states to be completely absent in microphones can best be provided with mechanico-acoustic instruments. Furthermore, he believes that the human auditory apparatus, normally aided by mechanico-acoustic instruments, is alone capable of selecting desired sound or noise from other parasitic noises such as are produced by wind, the sea, mechanical agencies and conversation. Major Memmo recommends that the technique to be employed be based mainly on the use of mechanico-acoustical instruments but that all possible solutions of this difficult problem through employment of most modern electro-acoustical devices be exhausted.

In this well illustrated article it is stated, in conclusion, that sound locators have obtained a high degree of technical perfection, and that they now constitute highly useful and effective means of antiaircraft defense. That antiaircraft guns can be fired to advantage on data supplied solely from sound locating devices.

Assuming that the contents of this article are accurate, foreign governments are ahead of us and we might well learn lessons from their developments and the results obtained by them.

"In Defense of Antiaircraft"

The March-April, 1939, *Army Ordnance*, carries an able discussion of antiaircraft measures during the World War, from the pen of Major Thomas R. Phillips, Coast Artillery Corps. Major Phillips will be recalled as the author of "Leader and Led" and "The New Face of War" in recent issues of the JOURNAL as well as for his writings in the civilian field on the art of war.

In his *Army Ordnance* article, "In Defense of Antiaircraft," Major Phillips presents an extract translation of the daily journal of General Mordacq who was one of the principal advisors to Prime Minister Clemenceau. The journal covers the AA defenses of Paris during the World War.

The editor of *Army Ordnance* remarks that we are indebted to Major Phillips for creating interest at this time in one of the salient features of the air defense record and that the article is timely, accurate and convincing. We may add to this that the article is well worth the attention of all interested in this important aspect of national defense.

History of the 51st Coast Artillery

The 51st Coast Artillery is assembling data to be incorporated in a revised history of the regiment. The regiment is particularly desirous of obtaining anecdotes, material bearing on the various World War engagements of the organization, and other factual data.

Any readers having historical material or documents that they would care to lend should communicate with the commanding officer, 51st Coast Artillery, Fort Monroe, Virginia.

The Trophy Goes West!

The 249th Coast Artillery (HD), Oregon National Guard, is proud to return the Coast Artillery Association Trophy to the Ninth Corps Area. To exceed or equal the brilliant record of last year's winner the 249th had a major difficulty to overcome — the problem of distance. For the five firing batteries of the regiment are distributed over the western half of the large State of Oregon. A brief summary of the units and their stations may be of interest.

Regimental Headquarters and Headquarers Battery (maintenance section), and the Medical Department Detachment are located in Salem (population 35,000).

Battery A, 12-inch mortars, is located in Albany (population 5,325), twenty-six miles from regimental headquarters.

Battery B, 6-inch D.C. guns, is located in Ashland (population 4,544), 270 miles from regimental headquarters.

Battery C, 10-inch D. C. guns and the band section of Headquarters Battery are located in Marshfield (population 5,287), 179 miles from regimental headquarters.

Battery D, 10-inch D.C. guns, is located in Klamath Falls (population 16,093), 333 miles from regimental headquarters.

Battery E, 6-inch D.C. guns, is located in Cottage Grove (population 2,475), ninety-three miles from regimental headquarters.

The problem of supervision by group and regimental commanders and of visits by the instructor presents obvious difficulties which are increased by limited State and Federal travel funds.

Supervision and instruction is conducted mainly by correspondence. The regiment operates its own short wave radio net which is of great value in this respect. Owing to a very complete camp schedule no time is available for schools during the field training period. Therefore a gunnery conference is arranged at the officers' mess following supper each evening, prior to target practice.

The widely separated units of the regiment bring another difficulty not encountered by regiments more centrally located. A commissioned vacancy in a firing battery must be filled from officer material available in the city in which the battery is located. N.G.U.S. officers from some other battery cannot be assigned to the vacancy. All batteries are not equally fortunate in having a reserve of N.G. U.S. officers. Although seven N.G.U.S. officers are available in Salem and three in Albany, other batteries have none. Obtaining suitable officers in a small community is sometimes quite difficult, particularly as our present regimental policy requires an unusually high standard. An average of eleven enlisted men in each battery now take the 10-series, Army Extension Courses, in preparation for N.G.U.S. examinations. Last year twenty-four officers and twenty-five enlisted men of the regiment completed 2,346 hours of extension school work.

Weather and shipping have been no more kind to the 249th Coast Artillery than to other regiments. The 1938 practices were held up three days from the scheduled time by bad weather. Two batteries fired trial and ranging shots on days preceding the practice, only to have the target obscured by low visibility before record fire could be started. On June 23d the regiment fired all five of its record practices. These consisted of two 6-inch D.C. practices at Fort Canby, and two 10-inch D.C. practices and one 12-inch mortar practice at Fort Stevens. Forts Canby and Stevens are about forty miles apart by road and ferry. Two hours were required to change the positions of the regimental data section. Only one tug was available for towing the service course and only right-to-left courses were fired. The last battery to fire, Battery

249th C.A. Wins Trophy

The United States Coast Artillery Association annually awards a trophy to the National Guard regiment rated as highest in general proficiency during the training year. The Chief of Coast Artillery has announced as the winner for 1938 the 249th Coast Artillery (HD), Oregon National Guard, with headquarters at Salem. In addition, four units were recommended for honorable mention.

The following list shows the winner and the units receiving honorable mention:

Winner

249th Coast Artillery (HD) Oregon National Guard

Honorable Mention

246th Coast Artillery (HD) Georgia National Guard

248th Coast Artillery (HD) Washington National Guard

198th Coast Artillery (AA) Delaware National Guard

244th Coast Artillery (TD) New York National Guard

D. was considerably handicapped by bad visibility and the poor condition of the targets which had been badly shot up by this time. All target practice reports were completed by batteries and turned over to a group of commanders for the critique which was held on the last day of camp.

In addition to target practices and other field instruction held last year, the regiment conducted a tactical exercise including an overnight bivouac at batteries and stations, and a night problem involving the searchlights of the harbor defense. Targets were represented by vessels of the Coast Guard which coöperated in every way. Meals were prepared on field ranges near the positions. The regiment is fortunate in having nine officer graduates of the Coast Artillery School. Of these, three graduated from the enlisted specialists' courses, while enlisted men and two field officers have attended both the battery commanders and field officers courses.

Colonel Clifton M. Irwin, who commands the 249th

The high state of training, discipline, and morale of the regiment is due chiefly to the leadership of the regimental commander, Lieutenant Colonel Clifton M. Irwin. His careful selection has assured the regiment of the best officers available. His supervision has developed them to a high degree. Their loyal coöperation has made an efficient regimental team.

Coast Artillery history in the Oregon National Guard began in 1908 when the First Company, Coast Artillery was organized at Astoria—the first National Guard Coast Artillery to be organized on the Pacific Coast.

The First Company was mustered out in 1910 but only a little more than a year later the organization of eight companies was undertaken. An order issued in 1911 provided for the organization of the Coast Artillery Corps, Oregon National Guard, and disbanded the Fourth Infantry to form the new organization. The first commander of the Coast Artillery was Colonel Creed C. Hammond and it was under his direction that the companies entered the World War. First to serve was Eighth Company (Portland), which was called out in state service March 23, 1917, to guard bridges in the vicinity of Portland. It was relieved of this duty April 23d by infantry troops called into federal service. All Coast Artillery was mobilized July 25, 1917, and sent to Fort Stevens for training in the use of heavy field artillery. Their original identity lost, most of the members were absorbed by units of the 65th and 69th Artillery regiments. Most of the Coast Artillery members of the Oregon National Guard went into the 65th and left early in 1918 for France. The remainder were principally absorbed by the 69th Artillery Regiment which left for overseas duty July 30, 1918.

In France the former Oregon Coast Artillery members manned heavy artillery or, as happened in many instances, were assigned to numerous other duties, including duty with ammunition trains, trench mortar batteries and field artillery.

After the World War the first reorganization of Coast Artillery took place at Ashland, where Company B, 3d

A hit during the 1938 target practice of the 249th.

A group from the 249th during target practice.

Infantry, was transferred to the Coast Artillery as the First Company on February 26, 1920. On the same date Company D, 3d Infantry, became the Second Company, Oregon Coast Artillery. The Third Company was organized at Newport, March 24, 1920, and on March 22, 1921, the Fifth Company was organized at Albany. A battalion organization was then authorized and Major Gjedsted was appointed battalion commander with headquarters at Salem. Organization of a headquarters detachment also began, and shortly afterwards the Medical Detachment was recognized at Albany. On December 12, 1923, the Coast Artillery companies became the 249th Coast Artillery. Lieutenant Colonel Clifton M. Irwin received federal recognition as commanding officer on February 6, 1930.

The 249th Coast Artillery is assigned to harbor defense. Its usual field training is conducted with the 6-inch and 10-inch rifles and 12-inch mortars at Forts Stevens and Canby at the mouth of the Columbia river, although the regiment has trained several times since the war at forts in Washington and California.

The record of the regiment in service practice with the big guns has been hardly short of remarkable. In 1932 the 249th Coast Artillery started the National Guard Trophy competition by taking fifth place in the national rankings. It won the trophy in 1933. Second place was taken in both 1934 and 1936; third place in 1937, and fifth in 1935.

Drill attendance of the regiment has been usually high since a regimental rating based on drill attendance was started in 1924. The regiment placed second for the years 1924, 1925, 1929, and 1930, and during the balance of the period has been in first place. During the years for which the Oregonian Trophy (donated by the *Morning Oregonian* of Portland) has been awarded to the unit possessing the highest annual drill attendance average, the trophy has been won by Coast Artillery units ten times out of fifteen awards.

A "Very Satisfactory" rating was received by every unit of the 249th Coast Artillery in 1938 following the annual federal inspection, and every unit in the regiment possesses the red guidon streamer awarded to units receiving this special rating for a minimum of five years since 1931.

This is a German heavy antiaircraft machine gun on a dual mount. The weapon is mounted on a trailer body that can be horse or motor drawn.

Coast Artillery Activities

OFFICE OF CHIEF OF COAST ARTILLERY

Chief of Coast Artillery
MAJOR GENERAL A. H. SUNDERLAND

Executive
COLONEL JOSEPH A. GREEN

Matériel and Finance Section
LIEUTENANT COLONEL H. B. HOLMES, JR.
MAJOR J. T. LEWIS
MAJOR S. L. MCCROSKEY

Organization and Training Section
LIEUTENANT COLONEL D. D. HINMAN
MAJOR AARON BRADSHAW, JR.
MAJOR W. H. WARREN

Plans and Projects Section
LIEUTENANT COLONEL A. G. STRONG

Personnel
LIEUTENANT COLONEL K. T. BLOOD

☆ ☆

Notes from the Chief's Office

Incident to the movement of certain War Department offices from the State and Winder buildings to the Munitions Building there will be changes in the location of some of the activities in the Munitions Building. These changes will affect the Office of the Chief of Coast Artillery. The exact date on which the moves will be made has not been determined. After the moves are made, all of the divisions of this office will be located on the third floor of the fifth wing of the Munitions Building.

* * *

In an effort to assist in the instruction of personnel using the new antiaircraft director and to obtain information concerning the difficulties encountered in the field, the Sperry Gyroscope Company is sending two of its representatives to visit the harbor defenses on the Pacific Coast. These visits should be of value to both the using service and the manufacturers.

* * *

EDITOR'S NOTE: This article should help clarify the minds of those Coast Artillery officers, who figure these reports and seem to think that scoring formulae are pulled out of a grab basket for the purpose of confusing otherwise good gunners.

As a result of many reports received by the Chief of Coast Artillery indicating dissatisfaction with the formula used heretofore in determining scores for antiaircraft gun target practices, he directed the President, Coast Artillery Board to study the antiaircraft gun scoring formula and determine if it was possible to evolve a simpler formula and one more nearly meeting service conditions. He was directed to consider the possibilities of modifying the existing scoring formula so that the important bonus given in the past for high altitude would be given in the future to slant ranges. It was believed that by giving the bonus for firing at long slant ranges battery commanders would not be penalized when weather conditions were such that they could not obtain high altitudes, and target practices could be fired under conditions approaching those of actual service.

As a result of these instructions the Coast Artillery Board recommended that a new scoring formula for antiaircraft guns be issued, and that the score be based on the ratio of hits per gun per minute attained to hits per gun per minute to be expected; that is, a battery which fires at the normal rate and attains the normal expectancy of hits considering the conditions under which it fires would have a par score. A score so based shows at a glance the performance attained by the battery, a statement not equally true with other types of scoring formulae; that is, if a battery exceeds the par score it is apparent at once that its performance has been better than that which could be expected in a long run under the conditions under which it fired. Conversely, if a battery fails to obtain a par score it is apparent that it did not do as well as it might be expected to do.

The scoring formula as recommended by the President, Coast Artillery Board was approved by the Secretary of War and published as Changes No. 1 to Training Memorandum No. 1, "Instructions for Coast Artillery Target Practice, 1939" dated December 1, 1938, as follows:

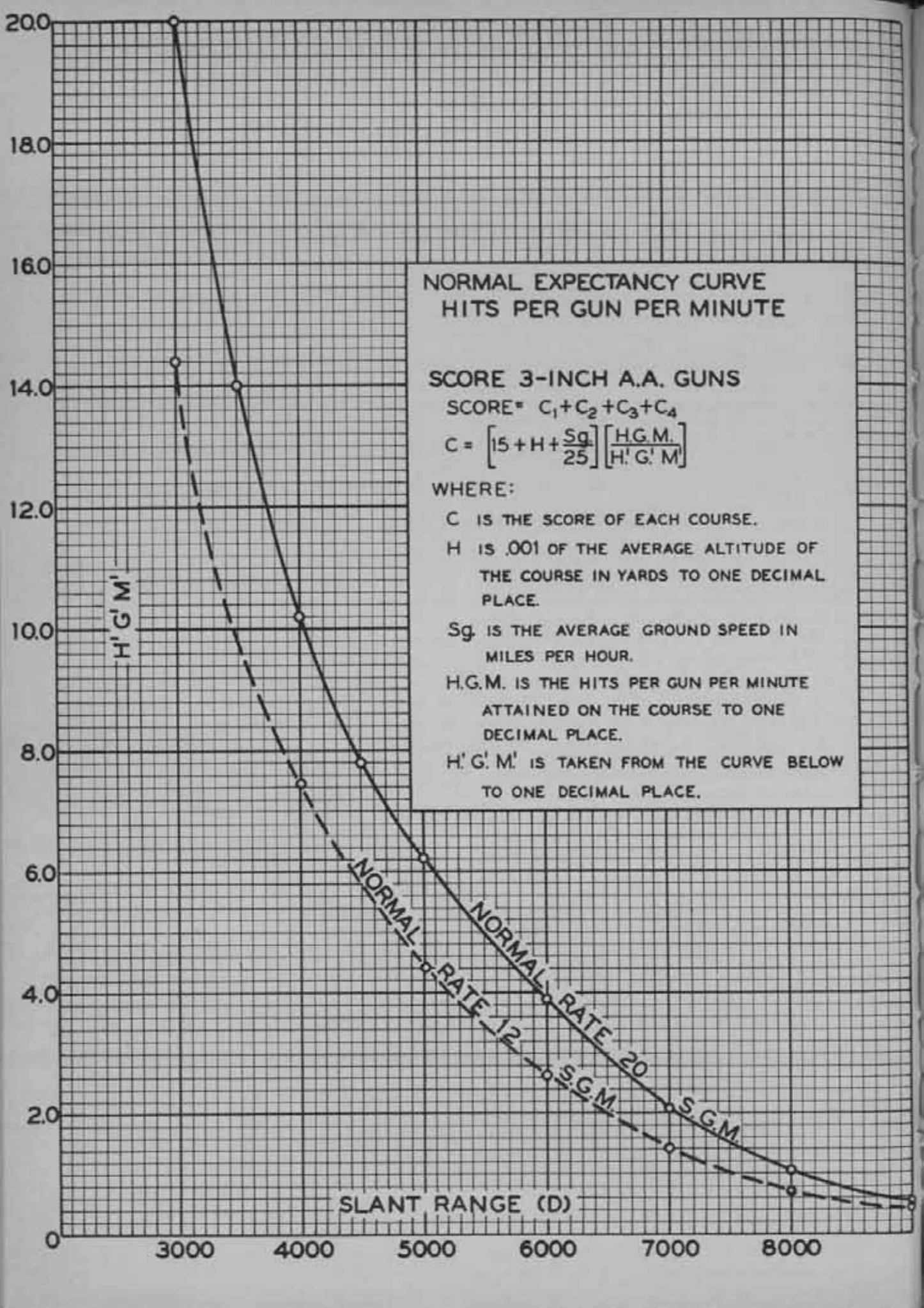
Paragraph 11 b, is rescinded and the following substituted therefor:

b. Firing phase.

(1) The score for each course is:

$$C = \left[\frac{15 + H + Sg}{25}\right]\left[\frac{HGM}{H'G'M'}\right]$$ where:

H — .001 of the average altitude of the course in yards taken to one decimal place.
Sg — the average ground speed of the course in


NORMAL EXPECTANCY CURVE
HITS PER GUN PER MINUTE
SCORE 3-INCH A.A. GUNS
SCORE = $C_1+C_2+C_3+C_4$
$C = \left[15+H+\frac{Sg.}{25}\right]\left[\frac{H.G.M.}{H'.G'.M'}\right]$
WHERE:
C IS THE SCORE OF EACH COURSE.
H IS .001 OF THE AVERAGE ALTITUDE OF THE COURSE IN YARDS TO ONE DECIMAL PLACE.
Sg. IS THE AVERAGE GROUND SPEED IN MILES PER HOUR.
H.G.M. IS THE HITS PER GUN PER MINUTE ATTAINED ON THE COURSE TO ONE DECIMAL PLACE.
H'.G'.M'. IS TAKEN FROM THE CURVE BELOW TO ONE DECIMAL PLACE.
H'G'M'
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0
NORMAL RATE 20
S.G.M.
NORMAL RATE 12
S.G.M.
SLANT RANGE (D)
3000
4000
5000
6000
7000
8000

miles per hour taken to the nearest mile per hour. The expression $\frac{Sg}{25}$ will be taken to one decimal place.

HGM — hits per gun per minute, attained on the course, computed to one decimal place from formula:

$HGM = \frac{60\,h}{gt_s}$ where

h — the number of hits

g — the maximum number of guns used during the course

t_s — firing time in seconds.

H'G'M' is taken to one decimal from Figure 1 attached hereto, using as arguments the normal rate of fire (as prescribed in TM 2160-35) and the average slant range of the course to the nearest hundred yards.

(2) The score of any course whose average slant range is less than 3,000 yards will be zero.

(3) For the target practice year of 1939 only, the provisions of paragraph 42 *a* (1) (*b*) 6, TM 2160-35, are suspended. In lieu thereof the following will govern: The initial altitude of each succeeding course of the four courses of a practice will vary from that of its predecessor by not less than 300 yards. If the altitude of any course does not so vary, the battalion commander will include the reason therefor in his indorsement on the target practice report.

(4) For the target practice year 1939 scores will not be computed for 105-mm. antiaircraft gun practices, but such firings will be classed as advanced practices.

For a more exhaustive treatment of this subject see "Coast Artillery Board Notes" on pages 177-180.

Recent Awards for AA Procurement

Antiaircraft matériel under current procurement is being manufactured by government agencies and commercial firms as follows:

Antiaircraft gun mounts by Ordnance Department and The York Safe & Lock Co., York, Pa.

Antiaircraft gun forgings by Camden Forge Co., Camden, N. J.; National Forge Co., Irvine, Pa.; and Pennsylvania Forge Co., Philadelphia, Pa.

Antiaircraft directors by Sperry Gyroscope Co., Brooklyn, N. Y.

Antiaircraft height finders by Keuffel & Esser Co., Hoboken, N. J.; and Bausch & Lomb Optical Co., Rochester, N. Y.

Antiaircraft searchlights by Sperry Gyroscope Co., Brooklyn, N. Y.

Sound locators by Sperry Gyroscope Co., Brooklyn, N. Y.

Antiaircraft fuze setters by Ordnance Department and General Electric Co., Schenectady, N. Y.

Antiaircraft transmission systems by Ordnance Department, and Eclipse Aviation Division of Bendix Corps., East Orange, N. J.

AA BC observing instruments by Bausch & Lomb Optical Co., Rochester, N. Y.

Stereoscopic testers by Keystone View Co., Meadville, Pa.

Automatic AA weapons by Colt Patent Fire Arms Co., Hartford, Conn.

Delivery of some of the equipment listed above is in progress. Shipping orders have been issued to date for thirty-four directors and eight height finders.

It is expected that the greater part of the equipment will be delivered prior to the end of the calendar year 1939.

These dual-mount heavy machine guns of the German Army are firing from a trailer mount, horse drawn. Note the infantrymen supplementing AA fire with rifle fire.

Fort Monroe

Brigadier General F. H. Smith, *Commanding*

Colonel Eugene B. Walker
Commanding Harbor Defenses of Chesapeake Bay and 2d Coast Artillery (HD)

Colonel F. P. Hardaway
Commanding 51st Coast Artillery (TD)

Captain Perry McC. Smith
Commanding 52d Coast Artillery (Ry)

By Major L. W. Goeppert and Lieutenant C. G. Dunn

Congressional Visit

Outstanding event of the mid-winter season at Fort Monroe was the visit on February 26th of a Congressional party, consisting of several senators and a large number of congressmen, including the majority of the House Military Affairs Committee. The party arrived early in the morning by plane and boat. After breakfast at the Coast Artillery Officers' Mess the party witnessed a bombing and machine-gun demonstration at Langley Field and then went to Fort Story. After lunch the party witnessed an antiaircraft demonstration of three-inch guns fired by Battery C, 2d Coast Artillery, and the new thirty-seven millimeter guns and fifty-caliber machine guns fired by Battery D, 2d Coast Artillery. During the course of the shoot the three-inch battery got two direct hits in the nose of the sleeve and shot off the tail, partially burning the remainder of the sleeve. After returning to Monroe, the party witnessed a twelve-inch firing by Battery De Russey manned by Battery A, 51st Coast Artillery and then attended a tea at the Officers' Casemate Club. An effective antiaircraft searchlight demonstration was put on by Battery A, 2d Coast Artillery as the Congressional boat pulled out into Hampton Roads that evening.

Personnel

Recent arrivals to the post have been, Captain Warren C. Rutter, who has assumed command of Battery C, 2d Coast Artillery; Lieutenant Edward S. Ehlen, Quartermaster Corps; Lieutenant Henry P. van Ormer, now attached to Battery B, 2d Coast Artillery; and Lieutenant Frank P. Pipia, Medical Corps.

Recently departed from the post and now en route to the Philippine Department are Lieutenant G. R. Ames, Lieutenant Lawrence G. Baldwin, and Lieutenant John D. Wood.

Fort Monroe Dramatic Club

The Fort Monroe Dramatic Club was reorganized in January. Under the direction of Lieutenant Colonel Paul French, President, Mrs. C. E. Shephard, 1st Vice-President, Major Porter Lowry, 2d Vice-President and several other enthusiasts, a very extensive program was launched for the months of February, March, and April. February 26th, two one-act plays, *Helena's Husband* by Philip Moller, and *A Wedding* by John Kirkpatrick, were presented to an enthusiastic audience. The two-act operetta, *Hearts and Blossoms*, by Lida L. Turner, is now occupying the attention of a large number of officers and ladies of the post and will be presented April 2d. The spring season will close on April 23d with the three-act comedy, *Petticoat Fever*.

New Construction

Those who have not seen Fort Monroe during the last few months will be greatly surprised at the changes that are taking place. The new Fort Monroe Theater, seating 900 people in air-conditioned comfort, was formally opened on November 20th. New Quartermaster Detachment barracks are fast nearing completion. Very extensive alterations to the old barracks facing the parade ground are well under way. These alterations include the construction of new and modern kitchens. The rear wing of the hospital has been razed and the steel work for a new wing is going up rapidly. When finished, the hospital, in addition to having had its face lifted, will be much larger and very modern. Masonry is being placed on the new Coast Artillery School Detachment mess and barracks addition, and ground has been broken for an addition to the Enlisted Specialists' School.

Athletics

Competition in the 1938-39 basketball, bowling, and boxing season has surpassed that of all past years.

Twelve organizations are participating in the inter-battery basketball league. The schedule has been increased from eleven to twenty-two playing games per team because of the great demand for games. First, second, and third places are at present held by Headquarters Battery, 51st Coast Artillery, the Coast Artillery School Detachment, and Headquarters Battery, 2d Coast Artillery, respectively.

The bowling league has thirteen contesting organizations. First, second, and third places are held by Battery B, 51st Coast Artillery, Headquarters Battery, 2d Coast Artillery, and Battery F, 52d Coast Artillery, respectively.

One hundred and sixteen men have participated in the inter-battery boxing tournament to date. Up to the present there have been four cards which have been very well attended by the officers and men of the post. Battery A, 51st Coast Artillery led by Private A. G. Forbes, amateur welterweight champion of Virginia, holds first place at this time, closely followed by Battery A, 2d Coast Artillery. Third place is held by Battery B, 51st Coast Artillery.

Hawaiian Separate Coast Artillery Brigade

BRIGADIER GENERAL FULTON Q. C. GARDNER, *Commanding*
COLONEL ROBERT ARTHUR, *Chief of Staff*
MAJOR F. A. MACON, *Adjutant General & S-1*

CAPTAIN W. H. DUNHAM, *S-2 & Gunnery* — LIEUTENANT COLONEL C. M. S. SKENE, *S-3*
LIEUTENANT COLONEL J. H. LINDT, *S-4 & War Plans*

CAPTAIN L. D. FLORY
Com. and Engineer Officer

CAPTAIN W. H. KENDALL
Sec. Ath. Officer

CAPTAIN S. E. WHITESIDES, JR.
Chemical Warfare Officer

LIEUTENANT W. A. CALL
Ordnance Officer

COLONEL H. C. MERRIAM
Commanding Harbor Defenses of Pearl Harbor

BRIGADIER GENERAL SANDERFORD JARMAN
Commanding 64th Coast Artillery (AA)

COLONEL W. D. FRAZER
Commanding Harbor Defenses of Honolulu

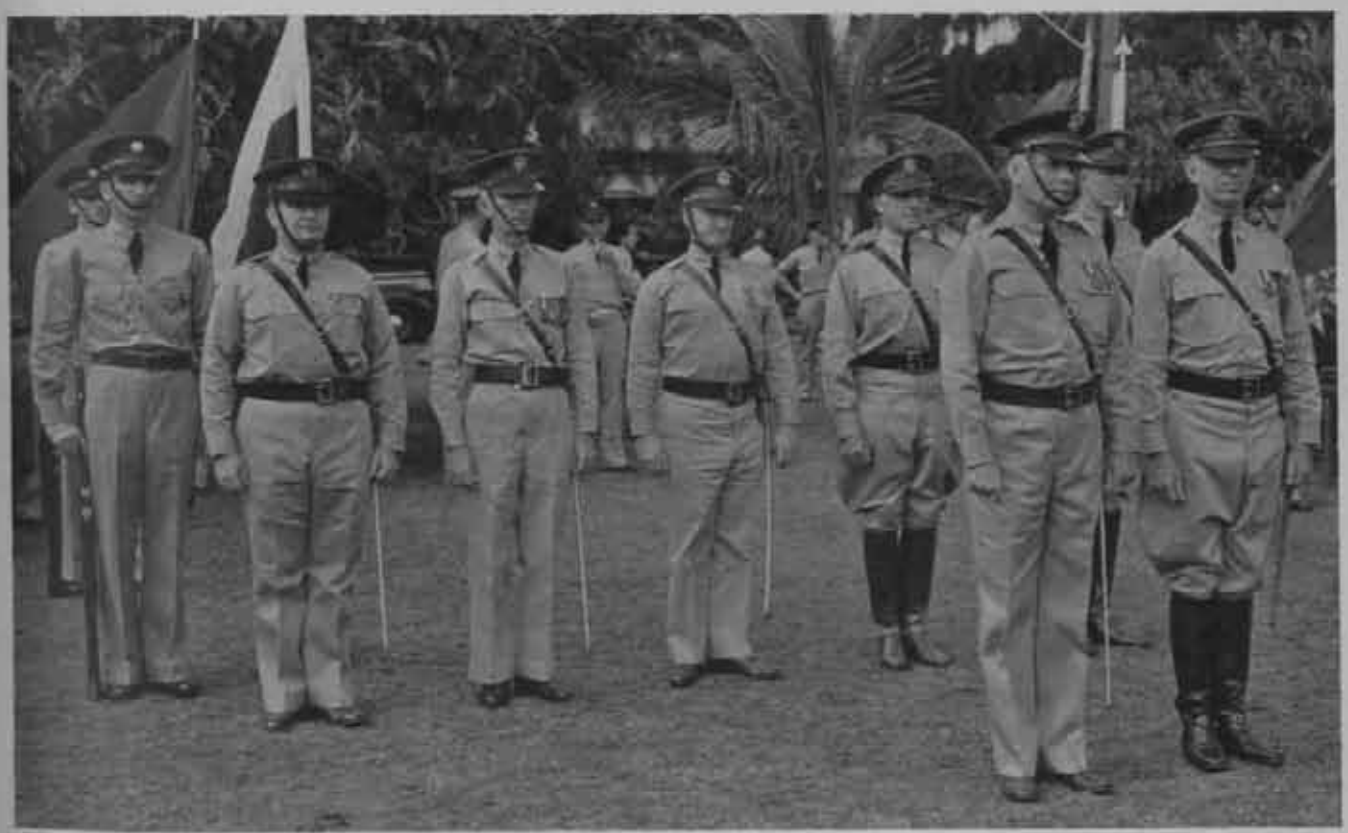
By Lieutenant Milan G. Weber

BRIGADE COMMMANDER'S INSPECTION

During the period covered by this letter, General Gardner conducted his annual administrative inspection. This inspection included all troops, materiel, and buildings of the Harbor Defenses of Pearl Harbor, the Harbor Defenses of Honolulu, and 64th Coast Artillery. After the inspection, which covered a period of twelve days, the brigade commander expressed himself well pleased with the excellent condition of the entire command.

BRIGADE REVIEW

A brigade review was held at Fort DeRussy on February 10th. At this review, the department commander Major General Charles D. Herron, presented the department commander's Coast Artillery cup and pennants for proficiency in the use of arms to the 64th Coast Artillery, commanded by Colonel Sanderford Jarman. Battery K, 64th Coast Artillery, commanded by Captain Pierre B. Denson, was awarded the department commander's



Review for presentation of trophies, Fort DeRussy, February 10th.
Front row, left to right: *Brigadier General Gardner, commanding HSCAB; Major General Herron, commanding Hawaiian Department.* Rear row, left to right: *Major Macon, Colonel Arthur, Colonel Skene, Colonel Hayes, Lieutenant Honeycutt.*

streamers for the highest rated Coast Artillery battery. Mr. Robert Sinclair presented the John D. Barrette trophy for general efficiency to Battery "B", 41st Coast Artillery, commanded by Captain Porter T. Gregory.

Pavilion Club

The Pavilion Club at Fort DeRussy gains rapidly in popularity for dining and dancing. During the past three months an average of 488 dinners per month were served at the Club. The Club's newly elected officers are now busy with plans to improve the dance floor.

The Club held its annual meeting on January 9th. At this meeting a new constitution was adopted. Officers elected were:

President: Brigadier General Fulton Q. C. Gardner.
Vice Presidents: Brigadier General Sanderford Jarman
Colonel Henry C. Merriam
Colonel William D. Frazer
Lieutenant Colonel James L. Frink
Secretary-Treasurer: Major Sam W. Anderson
Assistant Secretary-Treasurer:
Lieutenant Donald W. Shive

Changes in Brigade Staff

Colonel Robert Arthur, present chief of staff, has received orders placing him on duty with the Historical Section, Army War College, sailing March 13th. Lieutenant Colonel Cedric M. S. Skene has joined the staff and fills the S-3 position. Captain Isaac H. Ritchie has been assigned to the staff of the brigade as understudy to Captain Lester D. Flory who leaves for Fort Totten in March.

Brigade Athletics

Outstanding sports feature during the last two months has been the nip-and-tuck Honolulu Sector-Navy basketball race. With less than two weeks remaining to play, three teams have a fighting chance to win the title. The Fifth Bombardment Group, defending champions, have the inside track with twelve wins and no losses. Fort Kamehameha, the surprise team of the service league, coached by Lieutenant George V. Underwood, Jr., and 1st Sergeant Backes, is resting in second place with only one defeat. The third place team—Patrol Wing Two—has lost two games.

The Sector-Navy cage league is unique in that it is the only organization of its kind in the Hawaiian Islands that embraces all three branches of the service. Five Army teams, three Navy teams, and a squad representing the Pearl Harbor Marines, comprise the league. At the completion of play the top-ranking Army team will play the Hawaiian Division champions a three-game series to determine the Department championship. Last year the Fifth Bombardment Group, under the leadership of Lieutenant Dean C. Strother, a former West Point cage star, won the championship after a torrid series with the 3d Engineers.

Baseball and track enthusiasts have begun workouts in anticipation of the coming Sector season. Sector track meets will be held from April 22 to April 29, while baseball will enjoy its place in the athletic sun from June 3 to August 12.

64th Coast Artillery

The most exciting news of the past two months has been the appointment of the commanding officer to his new grade of brigadier general of the line. The stars seem to fit nicely on the broad shoulders of Brigadier General Sanderford Jarman. He is receiving the congratulations of the host of friends he has already made in his short stay of two months with the Aim-High Regiment.

This regiment has adopted the new policy of spreading its target practices over the year. This new method will keep all elements of the command in training for their wartime missions at all times. The first gun practice will be held in March. Battery I, commanded by Captain Ralph I. Glasgow, is now on the North Shore of Oahu engaged in intensive training for their first machine-gun practice of the year. Other officers with Battery I are Lieutenants Eugene H. Walter and Raymond W. Rumph. With Battery I for training are detachments of twelve men from each gun battery and four men from each searchlight battery.

Brigadier General Sanderford Jarman

Captain Pierre G. Denson is now on detached service at Schofield Barracks as AA instructor for the 11th Field Artillery. Lieutenant Peter Schmick has assumed command of Battery K.

Lieutenant Colonel Ferdinand F. Gallagher, in addition to his duties as executive, is also adjutant. Major William Q. Jeffords, Jr., is at the Kilauea Military Camp on Hawaii.

Harbor Defenses of Pearl Harbor

These harbor defenses were the first to open fire with target practices this year. First to order "Commence Firing" was Captain Sherman E. Willard, commanding Battery A, 41st Coast Artillery. This battery fired an 8-inch railway practice on February 16th, using a 40-second firing interval with a 20-second observing interval. Lieutenant William

G. Easton was range officer. The tentative score is 80.7. All of the other batteries are now conducting intensive training for their coming seacoast practices.

Lieutenant Howard W. Hunter now commands Battery B, 55th Coast Artillery; Lieutenant William W. Bailey has taken over the Fort Kamehameha post exchange.

A new bandstand was dedicated on December 29, 1938, on the site of what is locally known as the small parade ground.

Fort Kamehameha will be host at the first sector boxing bout on February 24. Some gruelling bouts are expected.

HARBOR DEFENSES OF HONOLULU

The troops are now engaged in intensive preparation for their antiaircraft target practices. Battery E, 55th Coast Artillery, commanded by Captain Harold P. Gard, and Battery F, 55th Coast Artillery, commanded by Captain William V. Davis, are now at Sand Island, ready to fire in the near future.

Batteries A and C, 16th Coast Artillery, commanded respectively by Captain Donald B. Herron and Lieutenant James T. Darrah, are training at Fort DeRussy. They will fire their practices on Sand Island.

Colonel William D. Frazer, has been designated grand marshal of the military participants in the Hoolaulea parade in Honolulu, on February 22. This year's Hoolaulea is the first of a series of annual celebrations which will resemble the New Orleans Mardi Gras. The celebration lasts five days.

With the transfer of Lieutenant Colonel Skene to the staff of the Hawaiian Brigade, there have been several changes in the staff at Fort Ruger. Major George Blaney is now plans and training officer; Captain Albert G. Franklin, Jr., is adjutant; Lieutenant William S. Coit is the motor transportation and supply officer.

Lieutenant James M. Donohue has relieved Lieutenant Benjamin M. Warfield, Jr., as the instructor of the motor transportation school at Fort Armstrong.

West Point

By Lieutenant L. M. Guyer

The most interesting Coast Artillery activities at West Point currently concern cadet instruction. Probably very few readers of the JOURNAL fully realize how intensive and thorough this instruction has become.

At present the Second Class of 450 cadets is taking a comprehensive course in seacoast and in antiaircraft. Instruction is under the direction of Captain D. McLean, and Lieutenant E. B. Hempstead, who handle the course entirely by the lecture method followed by written tests after each lesson. No important phase of Coast Artillery work has been omitted, and the written tests are detailed and exacting—not perfunctory general questions for the purpose of securing a grade.

The indoor lectures will be supplemented by films on submarine mining, the tractor-drawn regiment, and the antiaircraft regiment. Later the classes will move outdoors for practical work as well as further outdoor instruction. In antiaircraft cadets will operate a complete setup including guns and fire control equipment, the drills being conducted with an actual target on mission from Mitchel Field. Furthermore, every cadet will be given thorough instruction regarding that terror of every tyro—the director. From detailed charts the cadet is shown the *interior* design and operation of the director, and the manner by which it solves the antiaircraft problem. He is not taught simply to "match those pointers;" he is taught to know intelligently what happens inside the director at each and every stage of the solution. This instruction is given to all cadets regardless of whether or not he is finally commissioned in some other branch.

Seacoast work will also be given "on the shores" of old Lusk Reservoir, and cadets will operate a complete miniature layout, including tracking of an actual battleship (about two feet long, towed by rope from the shore!) and determination of all necessary firing data. For this particular outdoor work there will probably be detailed five assistant instructors from the academic departments. Lieutenant Hempstead denies that there will be "actual firing" and spotting at Lusk Reservoir, but we know how plentiful are stones in this rockbound port, and we can foresee the temptation of that two-foot battleship!

Meanwhile Major A. H. Campbell, who is in charge of Coast Artillery at the Academy, has been hustling the plans for the Coast Artillery trip of the First Class this summer. This year the First Class will not take the long trip to Fort Benning, Fort Monroe, etc. that it has in the past few years. Major Campbell tentatively plans to move the cadets to Fort Tilden or Fort Hancock, the class to go in three groups of about 150 cadets per group; each group to be absent from West Point for about four days. It is hoped to obtain drills on 3-inch antiaircraft, on antiaircraft machine guns, and on 155-mm. guns. With the limited time this summer, however, the cadets will probably fire only a few demonstration rounds, thereafter witnessing the detailed firing of this same equipment by Regular Army organizations.

We have received, too, one of the new portable searchlights, and we are hoping sometime this year to get some 37-mm. matériel.

The West Point Coast Artillery officers and ladies held another of the popular supper dances on February 21 at the Officers' Club. We are hoping to have one more get-together before June Week, when many tours will expire and about one-third of our group will depart permanently for new stations.

First Coast Artillery District

Brigadier General Edmund L. Daley, *Commanding*

Colonel Rodney H. Smith, *Executive*

Major Robert T. Chaplin, *Adjutant*

Colonel Otto H. Schrader
Commanding Harbor Defenses of Portland and Portsmouth

Colonel Monte J. Hickok
Commanding Harbor Defenses of Boston

Lieutenant Colonel William C. Foote
Commanding Harbor Defenses of Long Island Sound

Major Edward L. Supple
Commanding Harbor Defenses of Narragansett Bay

Captain Charles N. Branham
Commanding Harbor Defenses of New Bedford

On January 13 General Daley, commanding the First Coast Artillery District, entertained with a reception at the home of Colonel and Mrs. Rodney H. Smith in Wellesley Hills. Among those present were General Wilson, commanding the First Corps Area, Mrs. Wilson, Miss Wilson, General Cummings, commanding the 18th Infantry Brigade, Mrs. Cummings, numerous members of the corps staff and their wives, all of the district staff, and all of the harbor defense commanders in New England. There were also present many Coast Artillery officers on duty with the civilian components in New England. For the first time in history the officers of the First Coast Artillery District and their ladies were assembled for social entertainment as well as the professional opportunity to know their neighbors.

During the months of January and February General Daley has been most active. On January 10th he was guest speaker at a dinner of Coast Artillery Reserve officers in Providence. On the 11th he received a review of the 211th Coast Artillery (AA), Massachusetts National Guard, in Boston; and on the 14th he addressed members of the 197th Coast Artillery (AA), New Hampshire National Guard, in Concord.

As representative of the Chief of Coast Artillery, General Daley received the Knox Trophy awards, in the absence of the actual winners, at the annual banquet of the Sons of the Revolution in the Commonwealth of Massachusetts.

On February 13th the General was guest speaker at a joint meeting of Reserve and National Guard officers in Providence. The next day he filled two speaking engagements in Portland, Maine—one before the Sojourners' chapter luncheon and the other at a meeting of the Reserve Officers' Association. On the 17th, the General made two addresses in the interest of the Coast Artillery in New England, one at a luncheon of the Faculty Club of M.I.T. and the second at the City Club in Boston where Reserve officers assembled at 8 o'clock.

Harbor Defenses of Portland and Portsmouth

Major H. W. Lins has been relieved from duty with the 8th Coast Artillery and assigned to duty with the 240th Coast Artillery, Maine National Guard. The Lins have moved just across Fort Road from Fort Preble and are still close neighbors of the garrison.

Colonel O. H. Schrader, harbor defense commander, and Major Lins recently attended the first staff meeting of the 240th Coast Artillery in Portland. Also present were Lieutenant Colonel Willis Chapin, retiring instructor, and Major Vernon Hall, instructor at Rockland.

Captain L. S. Kirkpatrick and family have sailed for the Philippines and Captain G. W. Palmer and family have moved into quarters on the post. Major Reginald Imperatori has arrived and reported for duty.

General Edmund Daley was here for two days as the house guest of Colonel and Mrs. Schrader. The General was guest of honor at an informal tea to meet the Artillery officers and their families.

Harbor Defenses of Boston

By Lieutenant Norman A. Congdon

The defenders of the Hub are working mightily to fulfill the requirements of the winter training program. Gunners' instruction goes on apace but is frequently interrupted by demands for emergency snow removal.

Colonel Hickok has orders to sail for Panama in mid-June. Captain Ben E. Cordell, commanding Headquarters Battery, 9th Coast Artillery, has recently recovered from a long illness.

Social affairs locally were headed by a soldier's dance in the post gymnasium on February 18th. Meanwhile, in athletic fields, the bowling alleys now feature contests between the various detachments and civilian employees of the post as well as the Air Corps Detachment from East Boston Airport.

Harbor Defenses of Long Island Sound

By Lieutenant Charles L. Andrews

All batteries completed firing the newly prescribed .30-caliber course late in December with the following results:

Battery	*Per Cent Satisfactorily Completing the Course*	*Per Cent Qualified*
B	88.2	87.5
A	97.3	56.7
C	92.2	55.5
HQ	97.5	35.0

Sergeant Motejunas, Battery C, and First Sergeant Reedy, Headquarters Battery, tied for high score with

139 out of a possible 150. The former won the palm on his higher rapid-fire score.

The recent hurricane necessitated rebuilding the firing point and extensive repairs at the butts. Because of the delay it was necessary to fire in very bad weather.

Fort Wright enlisted men are now engaged in a small-bore rifle competition in the new range set up under Major Chesledon's direction in the balloon hangar. After the first round of firing, Headquarters Battery stood in first place, having reversed the outdoor standings:

Position	*Hq.*	*C*	*B*	*A*	*Possible*
Prone	480 (3)	490 (1)	470	482 (2)	500
Sitting	807 (1)	754 (3)	759 (2)	752	1000
Kneeling	727 (3)	809 (1)	779	689	1000
Off hand	575 (1)	514 (2)	427	442 (3)	1000
Totals	2589 (1)	2567 (2)	2435 (3)	2365	3500

This same course is now being fired a second time. A post small-bore team has been organized, but efforts to line up matches have proved fruitless. Of course the main effort during the indoor training period is toward the qualification of gunners.

The entire garrison was shocked and grieved to learn of the death of Sergeant Melvin H. Williams, Battery A, 11th Coast Artillery on February 2d. Sergeant and Mrs. Williams were well known to all who have served at Fort Wright during the past quarter century.

The Quartermaster is preparing bid proposals for the permanent reconstruction of part of the National Guard camp at Fort H. G. Wright. Thirty-one thousand dollars has been allotted for rebuilding lavatories and bathhouses, for the street lighting system and, it is hoped, for installing concrete tent floors. The concrete tent floors will eliminate the task of setting the old wooden floors in place before camp and putting them away after camp.

All officers and ladies of the post recently joined Captain and Mrs. McCarthy in a celebration of Captain "Mac's" completion of twenty-five years in the service.

The 11th Coast Artillery Band gave a concert at Westerly, Connecticut on February 15th in connection with a military exhibition sponsored by the Washington County Chapter, Reserve Officers' Association. Battery E, 243d Coast Artillery Rhode Island National Guard participated with demonstrations of recruit training and formal guard mount.

By virtue of two one-point victories over Battery B, Battery C's fast basketball aggregation has practically clinched the post basketball championship.

An exceptionally large number of Fort Wright personnel voyaged to New London on a rough sea the evening of February 18 to hear Professor J. Anton de Haas, Professor of International Relations, Harvard University, lecture on the Far East. This was one of a series of lectures being given at the United States Coast Guard Academy.

Harbor Defenses of Narragansett Bay

By Captain Virgil M. Kimm

On February 18, 1939, the 10th Coast Artillery had its mobilization test. The full field inspection was viewed by Colonel Baxter, Infantry, post commander. The alignment and precision displayed would have been a credit to any organization.

During the winter season the following Reserve officers were trained by the 10th Coast Artillery: Captain Paul H. Gates, A. H. Merrill, E. H. Sheridan and Lieutenant Carl R. Bohring. Each officer was given an opportunity to function as range officer, executive officer, and battery commander during the period of training. In addition, a number of Infantry Reserve officers came to Fort Adams for training with the 13th Infantry and were given instructional tours and talks on the mortar batteries and the installations in the redoubt tower. Officers who train at Fort Adams have a splendid opportunity to observe some of the problems of a branch of the service other than the one in which they are commissioned.

During the latter part of December the stone dock at Fort Wetherill was partially restored by a commercial dredge which was secured to pick up some of the huge granite blocks cast overboard by the hurricane. A WPA project has resurfaced the greater part of the dock with stone and gravel and is relaying the mine track.

On December 31, 1938, Staff Sergeant Phillip Turman, 10th Coast Artillery was retired after thirty years service. The entire post will miss Sergeant Turman.

It is with regret that we announce the death at Fort Adams of Technical Sergeant Albert McNair. Sergeant McNair was on duty as senior caretaker at Fort Wetherill. He is survived by his wife, a daughter Amy, and a son Albert, Jr., both living at home, and three married daughters. Mrs. McNair expects to make her home in Jamestown, Rhode Island.

Harbor Defenses of New Bedford

By Captain Charles N. Branham

The man who said "If you don't like New England weather, wait a minute!" must have lived in New Bedford. Blizzards, snow, hail, torrential rain, and tropical heat are only some of more interesting types of weather that Fort Rodman has experienced in the last two months.

But rehabilitation work—repairing hurricane damage—is progressing and every day shows improvement in equipment and post facilities. Thanks to a WPA project much needed work is being accomplished. Gunners' instruction, and all the other winter training and maintenance duties, familiar to all Coast Artillerymen, occupy the full time of the small garrison. Bowling is the principal recreation. Prospects are good for the installation of a small bore indoor rifle gallery in the near future.

The sudden death of Technical Sergeant William C. Hartley, 10th Coast Artillery, was a shock to the post. His many friends throughout the service will mourn the passing of a sincere and honest gentleman and an excellent soldier of great ability in his chosen profession.

Corregidor

Brigadier General Walter K. Wilson, *Commanding*
Colonel T. A. Terry, *Executive*

Colonel George Ruhlen
Commanding 59th Coast Artillery (HD)

Colonel William C. Koenig
Commanding 60th Coast Artillery (AA)

Colonel Frederic A. Price
Commanding 91st Coast Artillery (PS) (HD)

Lieutenant Colonel Albert H. Warren
Commanding 92d Coast Artillery (PS) (TD)

By Lieutenant Colonel R. E. Phillips

Our readers are reminded that the news period on which we are reporting covers the months of December, 1938, and January, 1939. Two principal training activities occupied the month of December. One involved interesting staff planning in preparation for the January department maneuvers in which the harbor defense commander participated as a commander of mobile troops units operating in the vicinity of the defenses. The other involved persistent but unsuccessful efforts to carry through the annual antiaircraft searchlight target practice of Battery A, 60th Coast Artillery (AA). Night after night the searchlight battery moved out to its positions with high hopes, only to find that night clouds had won a race with the airplane assigned to fly the training missions. A dependable weather predictor is one of our greatest needs in searchlight batteries.

General and Mrs. Wilson, Colonel and Mrs. Terry, Lieutenant Colonel and Mrs. W. R. Stewart, Major Gilbreth and Major and Mrs. J. B. Hafer and many people with the regiments spent part or all of the holidays in Baguio or touring on Luzon. The stay-at-homes were diverted as in former years with children's party, roaming carol singers, and other traditional festivities.

Several New Year's parties terminated the official holiday celebrations. Two days later intensive target practice preparations were in full swing.

During January the harbor defense commander and the bulk of the staff spent two active weeks on the maneuvers referred to above. The unanimous opinion was that the maneuvers were the best ever. The Navy is with us once again and thanks to their coöperation, we are to have eight high-speed target practices during February and March.

59th Coast Artillery

Sporadic solstitial rains, which prevented the dry season from really drying up, played havoc with training and athletic schedules until after the New Year. Since then sunny skies and clear atmosphere have lent their aid to the gun pointers and observers during the artillery drills in preparation for record practices. Check and double-check on the drills and subcaliber shoots have taken up the artillery periods for the last two months. Battery C is ready to lead off for the 59th, by firing the first record practice of the regiment, this year, on the 3d of February, at a high-speed target.

The inter-battery track meet was held on a wet track after two postponements due to rain. Captain Fonvielle sent his Battery G contenders in from their outpost to give Captain McNamee's Battery A a hard struggle for first place, finishing the meet with thirty-four points to the forty-four points for A Battery. Battery F placed third. The special duty boys from Headquarters Battery barely nosed out the other outpost, Battery E, by one point, to escape the cellar position.

Vowing that this was to be their year the regimental track team, under Captain "Sandy" Goodman, voluntarily gave up their Christmas holidays in order to train for the big meet on January 4, 1939, with the 60th Coast Artillery (AA). The whole regiment pushed hard; officers and men alike, volunteered to help coach, rub the athletes, and carry equipment in order to win the meet. With such regimental spirit there was no denying the team. In the first event of the day they took all places, one, two, three. With this beginning they went ahead in earnest, and when the smoke of the January 4th battle had blown away, it was found that the 59th had seventy-eight points to twenty-seven for the 60th; winning six first places and tying for a seventh in track and field, in addition to winning all three of the relays. It is interesting to note that all the organizations of the regiment including the outposts of Forts Hughes and Drum, were represented on the regimental team and all scored points to help win the meet. The times and distances were excellent under the conditions of the day of the meet. The team was so well balanced that to pick out individual heroes is an impossibility; however, the regiment considers all of the team heroes, for the way they worked for the victory they so richly deserved to win.

The inter-battery baseball league opened on December 12th when Battery D defeated Battery C in a game which was everything but a "no hit—no run—no error" game as the score ended 12-9. Very little baseball was played during the holidays but since then there have been at least three games played each week. Although only about one-third of the scheduled games have been played, Battery B, Battery G, and Headquarters Battery seem to have the stronger teams, as, to date, each has lost only one game. There seems to be no lack of excellent material for our regimental team which will be organized in March.

60th Coast Artillery

The crowning athletic achievement of the past two months was the winning of the Department Basketball Championship (American Division). The play-off of the first place tie with the 31st Infantry was settled in decisive fashion, the 60th winning two straight games. Great credit is due Lieutenant Ashman and his peppy team of basketballers.

In golf the 60th has gathered more than its share of laurels. In the Department Championship, First Lieutenant George E. Keeler, Jr., was runner up for the championship and Colonel Koenig won the second flight. In the Corregidor Club Championship Tournament, Lieutenant Keeler won with Captain Legare K. Tarrant runner up. Low medalist was taken by Major Allison W. Jones and net medalist by First Lieutenant Bernard S. Waterman. Captain Samuel H. Morrow won the second flight and First Lieutenant Franklin D. Rothwell won the third. The golf marathon found the 60th in second place and in the Caldwell Cup Matches our team came out third in spite of the absence on leave of one of our strongest players.

In the Battery League, Battery D won the track meet with A second. Baseball finds these two batteries just reversed, A leading without the loss of a game and D fighting hard in second place at the half-way mark. Indications are good for a strong regimental team.

December was a busy month for the searchlight battery, preparing for its service practice. However, in this case, hard work did not bring the usual reward for the weatherman stepped in. Heavy cloud formations at low altitudes were the rule rather than the exception and the service practice was finally called off.

The gun batteries have been pointing for their target practices and the New Year found them all set and r'aring to go. Department maneuvers brought a halt in the schedule for a time but everything is clicking at top speed once more. Preliminary practices have been started and the successful conclusion of the firing program by the middle of the month now looks certain.

91st Coast Artillery (PS)

Officers of 91st spent the Christmas holidays on the post with the exception of Captain Denson who spent the time at Baguio with his family.

Batteries C and E have finished their target practices with excellent results.

Battery C, Captain England commanding, Lieutenant Russell range officer, fired 6-inch DC battery and made a score of 156. Battery E, Captain Rousseau commanding, Lieutenant Davis emplacement officer, fired 10-inch DC battery and ended up with a score of 174. The two mine batteries are now in midst of the test phase of their mine practices which will be completed together with firing phase next month.

December was a glorious month for the athletes of the 91st Coast Artillery (PS). For during December the 91st annexed the post boxing and track championships (Scout Division).

The boxing bouts with the 92d were held on December 14th in the Athletic Arena. Championship bouts in seven weights were listed for the tournament but only five were fought because the 92d was unable to place a man in the middleweight and heavyweight divisions. The final score was four to three and the 91st won for the first time in several years.

On December 21st, the 91st dominated the Topside track. All its teams won by a good margin. The highlight of the meet was the tug of war which was won by the twenty strong men of the 91st headed by Master Sergeant Escueta and Sergeant Melliza. The 92d Guard Battalion tug-of-war team tasted defeat for the first time in about ten years. The final score was eighty to thirty-nine.

Inter-battery baseball started with one game in December and eleven games in January. The outcome is unpredictable as there are four strong teams pushing for the top berth. The wealth of baseball material looks promising for the post championship with the 59th and 60th Coast Artillery.

Battery G, Captain Hartman commanding, Lieutenant Miner battery athletic officer, won the coveted regimental athletic supremacy trophy for 1938. This was the first year that a trophy was offered to a battery that had shown all-around athletic ability. The trophies for individual sports are held until next season while the supremacy trophy becomes the property of the winning battery.

92d Coast Artillery (PS)

Captain Pacifico C. Sevilla, who has been on DS at the Baguio Military Academy, the West Point of the Philippines, reported for duty on January 20th, but was transferred to the 91st. Prior to his tour of duty with the Philippine Military Academy, Captain Sevilla commanded Battery C.

Major Robert M. Carswell, Commanding Officer, 3d (Guard) Battalion and the civil prisoner stockade, has been relieved from duty with the regiment and detailed for duty in the office of the Department Judge Advocate with station in Manila. On May 1st he becomes a member of the staff of the United States High Commissioner to the Philippines. Major Carswell will extend one year, returning to the United States, July, 1940 instead of July, 1939. The 3d (Guard) Battalion tendered him a review Friday afternoon, January 13th.

Target Practices: The first record target practice of target practice season was fired from the three-inch guns of Battery Maxwell Keyes by Battery A commanded by Second Lieutenant Cecil E. Spann, Jr. Results have not been determined. All other batteries are carrying on tracking and subcaliber missions.

Maneuvers: This regiment took only a small part in the recent maneuvers on the mainland of Luzon; railhead details were furnished, battery cadres selected and oriented positions, and one officer was detailed to command a searchlight section.

Athletics: Not so good during the past two months. The greater size of our friendly enemy the 91st has told against us in recent competitions, but we have held our own in the past and we are not through fighting by any means.

Panama Canal Department

COLONEL WILLIAM R. NICHOLS
Department Artillery Officer

COLONEL EDWARD W. PUTNEY
Commanding Harbor Defenses of Balboa and 4th Coast Artillery (AA & HD)

COLONEL WILLIAM T. CARPENTER
Commanding Harbor Defenses of Cristobal and 1st Coast Artillery (AA & HD)

LIEUTENANT COLONEL AVERY J. FRENCH
Commanding Fort Randolph

HARBOR DEFENSES OF CRISTOBAL

By Captain A. S. Baron

The advent of the dry season has heralded great activity throughout the department. The joys and play of the holiday season are quickly laid aside and everyone works overtime. These harbor defenses are no exception. With the last note of reveille on January 3d the lid blew off the training kettle. The searchlight batteries and our antiaircraft gun batteries hastened to catch up with the calendar to complete their 1938 target practices postponed because of weather. This was to be followed in quick succession by as many 1939 practices as could be completed before the department maneuvers scheduled for March. This ambitious program is progressing reasonably well in spite of setbacks by cloudy skies and other difficulties. The advice by radio of a new scoring formula for guns is now facilitating completion of the practices.

The quartermaster, not to be outdone in activity, is rushing to rehabilitate and rejuvenate all of the buildings at both Fort Sherman and Randolph during this dry season. The new green roofs and white exteriors give a most pleasant change from the drab brown of other days.

The social and recreational life at both posts in these defenses will soon be on the upswing. Fort Randolph soon christens a new Beer Garden, while Fort Sherman will mix exercise with refreshment in new bowling alleys.

On Washington's birthday eve, the enlisted personnel held a most successful dance at Fort Sherman. Although the pre-Lenten carnival was in full swing at the same time, all posts in the sector were well represented.

Reminiscent of the "Whiz Bangs"—the wartime minstrel troop of the 58th Artillery, commanded in France by Colonel Wm. T. Carpenter—the talent of these harbor defenses was assembled late last fall to provide entertainment for the garrison. Under the capable tutelage of Chaplain C. I. Carpenter they developed into worthy successors of the former troop. So well were they received on the Atlantic Side, that the harbor defense commander was asked if he permit them to exhibit their talents in the Pacific sector. So the "Whiz Bangs," consisting of forty-one men of the regiment including the dance band of the 1st Coast Artillery, journeyed to Cherrera and Balboa to play to capacity audiences.

Malaria is on the run at Sherman as a result of heroic attention these past two years to drainage, screening, use of headnets when out of doors after dark, and prophylaxis of personnel exposed to malaria. Only forty-two cases of malaria were treated in 1938 as compared with eighty in 1937 and 145 in 1936.

FORT AMADOR

By Captain John H. Kochevar

TRAINING

Since the weather is now favorable, the regiment is concentrating on an intensive firing program and preparing for annual maneuvers which begin in March.

Batteries D, G, and I have completed beach defense problems. These firings were conducted with improvised fire control devices with not more than four men in the range section. The results proved very satisfactory. Batteries C and I have also completed their secondary armament practices in antiaircraft with excellent results.

Batteries A, B, and F have completed regular 3-inch antiaircraft firings. These firings were conducted at maximum altitudes and fuse ranges. The scores for B Battery have not been completed, but the following are the scores for A and F:

A Battery

Day Problem	Angular Unit	125.9
Day Problem	Modified Bracket	155.9
Night Problem	Fuse Pattern	42.8

F Battery

Day Problem	Angular Unit	100.00
Night Problem	Modified Bracket	46.0
Day Problem	Fuse Pattern	190.9

Battery C has been working intensively with searchlights. In addition to their own training problems, Battery C has been illuminating the targets for the antiaircraft firings. With limited air missions, every advantage has been taken to obtain maximum training.

Battery E is working on plans for firing antiaircraft guns. They will conduct record practices as soon as C Battery completes its searchlight practice.

ATHLETICS

Battery A, commanded by Captain Hennig, won the battery baseball league. Battery G, commanded by Lieutenant Liwski, came in second.

The Fort Amador baseball team, coached by Major Joe Stiley, has won four games and lost none. It has defeated every team in the Sector League. The team has a "Murderers' Row," extending from the lead-off man to the ninth hitter, which has averaged two hits per game. With the type of baseball shown by the team so far, and barring accidents, Fort Amador should win the Sector championship.

The Fort Amador Golf Club won the Dunlop Golf Tournament, with scores as follows:

Fort Amador	3,401	Gatun	3,167
Panama	3,311	Pedro Miguel	3,091

Coast Artillery Board Notes

Any individual, whether or not he is a member of the service, is invited to submit constructive suggestions relating to problems under study by the Coast Artillery Board, or to present any new problems that properly may be considered by the Board. Communications should be addressed to the President, Coast Artillery Board, Fort Monroe, Virginia.

ANTIAIRCRAFT SCORING FORMULA (PROJECT 1139). *a.* During January the Coast Artillery Board was instructed by the Chief of Coast Artillery to study the feasibility of modifying the existing scoring formula for 3-inch antiaircraft gun practices. One of the chief objections to the old formula was that the emphasis placed upon high altitudes frequently caused long delays in conducting practices due to adverse weather conditions. Furthermore, all batteries were not able to obtain high altitude and high speed targets and hence were discriminated against to a certain extent since both of these factors carried considerable weight in the old scoring formula.

b. In order that the Coast Artillery as a whole may know how the new formula was derived and the reasons for such derivation pertinent parts of the Board's reply to the Chief of Coast Artillery are set forth below:

(1) The Coast Artillery Board concurs in the opinion that the present scoring formula for antiaircraft guns should be revised at this time. Studies concerning such revision have intermittently been in progress for some time at the Board but it has been felt that sweeping changes should not be made until sufficient data, obtained as a result of the use of the present scoring formula, had been collected to permit a reasonable test of that form of scoring formula. Most of the 1938 gun target practices have now been received and studied by the Board and, as a result of this study, it is felt a sweeping change in the scoring formula is warranted.

(2) As a result of the studies referred to above, the Coast Artillery Board has come to the conclusion that the ratio of hits per gun per minute to be expected is the most valid argument upon which scoring formulae can be based. A battery which attains the normal number of hits per gun per minute; i.e., one which fires at its normal rate and attains its normal expectancy of hits, considering the conditions under which it fires, should have a par score. A score so based shows at a glance the performance attained by the battery—a statement not equally true with other types of scoring formulae. That is, if a battery exceeds the par score, it is apparent at once that its performance has been better than that which could be expected in the long run under the conditions under which it fired; conversely, if a battery fails to attain a par score it is apparent that it did not do as well as it might be expected to do.

(3) In general, a score serves two purposes; i.e., it furnishes a means of comparing the results attained by different organizations and it causes all organizations, to a greater or less degree, to fire under certain conditions which are believed desirable from a training standpoint. In the case of the present score, for example, organizations are encouraged to fire at targets whose altitudes are high and whose slant ranges and ground speeds are large. In addition, it encourages the maintenance of not less than the normal rate of fire and the securing of some hits on the maximum number of courses rather than many hits on the minimum number of courses. All of these ends are desirable. Experience has shown, however, that the attainment of all of them is difficult and in the case of some organizations impracticable, high altitude and target speed being cases in point. Nevertheless, the Coast Artillery Board believes that it is possible to devise a scoring formula which will encourage the attainment of all of these ends without unduly penalizing batteries which cannot easily meet one or more of the present requirements due to local conditions over which they have no control. Such a scoring formula is discussed below.

(4) (*a*) The first measure of the effectiveness of a firing battery is whether or not it can obtain hits. However, the laws of gunnery follow the laws of probability, hence only a certain number of all shots fired in the long run can be hits. This number varies with the conditions under which the shots are fired; i.e., there is a certain hit expectancy for each possible condition under which the shot or shots were fired. While this hit expectancy is dependent on several variables, studies made at the Coast Artillery Board have indicated that the critical variable, as far as antiaircraft gun fire is concerned, is slant range and that a score based on this assumption is satisfactory for the purposes intended. It follows, then, that a convenient practical measure of the effectiveness of a firing battery may be based upon

the ratio of the hits attained to the hits which should have been attained at the slant range used.

(*b*) The characteristics of antiaircraft gun targets introduce another consideration, however. Effective fire against such targets requires that sufficient hits be obtained to disable, destroy or drive away the attacking aircraft in a minimum of time since the period in which a target will be in the field of fire is limited. An organization which can obtain the same number of hits as does another organization in, however, but half the time is obviously the more effective of the two. Therefore, hits per gun per minute furnish a better yardstick for measuring performance than do hits alone.

(*c*) Hit expectancy curves, based on slant range, may be determined. Similarly, normal rates of fire for the different types of antiaircraft guns are prescribed. From these data, curves for each type of gun may be plotted which will show the normal number of hits per gun per minute which may be expected for the slant ranges at which fire is conducted. Such curves, based on rates of fire of twenty and twelve shots per gun per minute are shown (dotted) in Figures 1 and 2.

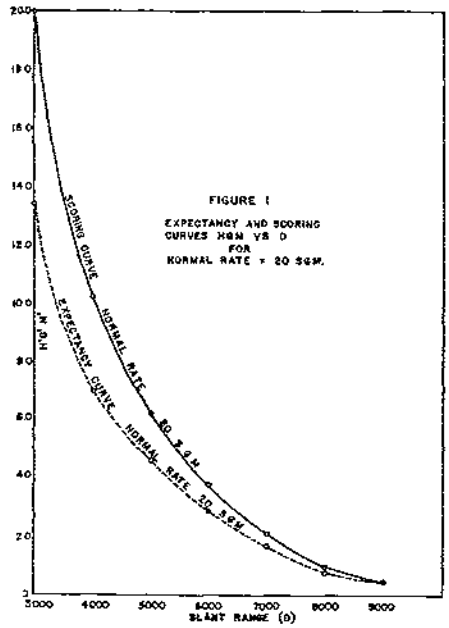
(*d*) If it were not desired to stress certain considerations and to insure that these considerations are given due weight in target practice, it is believed that an equitable scoring method could consist of no more than dividing the number of hits per gun per minute, actually obtained on each course, by the number of hits per gun per minute to be expected at the slant range fired at and multiplying the result by a constant to give a certain par value to the score. Thus, if the par value of the score was to be 100 (four courses being required for each practice), the scoring formula for each course would be C (the score for the course) $= 25 \frac{HGM}{H'G'M'}$

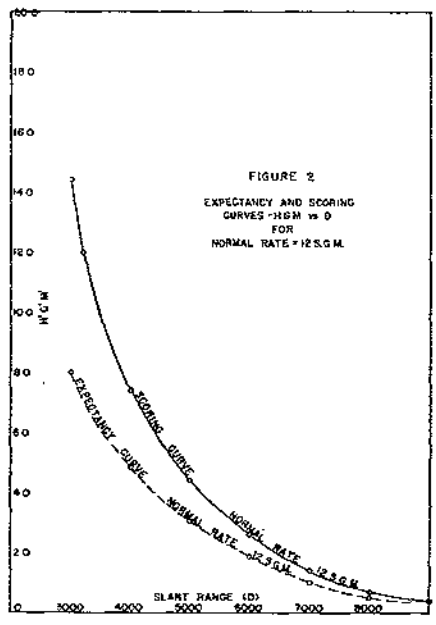
where H'G'M' is the expected number of hits per gun per minute as taken from the proper curve for the type of gun used.

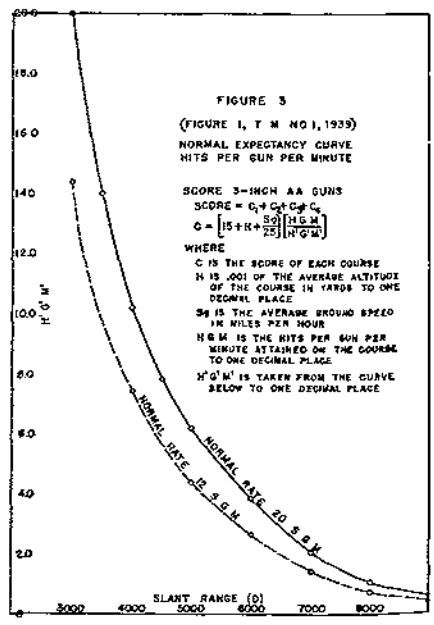
(*e*) 1. However, it appears that it would be wise to provide, in the score, incentive for conducting target practice against targets whose behavior will be nearly similar to that to be expected in time of war as possible. Hence, it is believed that the scoring formula should contain small bonuses which are dependent on target altitude and target speed and a considerable bonus for firing at long slant ranges. Since slant range is one of the arguments used in plotting the expectancy curve, a range bonus can simply and easily be injected by decreasing successive ordinates as range increases, thus providing an expectancy curve less exacting than is the actual one as range increases. The same result can be obtained conversely by increasing the ordinates as range decreases, thus providing an expectancy curve which is more exacting than is the actual one as range decreases. The latter method is favored since it has the effect of raising the ideal to be attained rather than lowering it. The solid curves in Figures 1 and 2 represent such arbitrary scoring curves. These curves are also shown on Figure 3.

2. The altitude and ground speed of the target are variables not generally under the control of the firing organization; i.e., although high altitudes and speeds may be desired they cannot always be obtained. For that reason the scoring formula should combine these variables in a manner which will provide sufficient incentive to fire at high target altitudes and speeds, when such are obtainable, but which will not act as a severe penalty when these high altitudes and speeds are not obtainable. It appears that the best method of introducing these factors, under the conditions stated, is in the arbitrary multiplier used to give a par value to the score.

3. In the formula $C = 25 \frac{HGM}{H'G'M'}$, the figure 25 is the multiplier used to give the par value to the score.







If, now, altitude and ground speed are combined with this multiplier in such a manner as to give both about the same weight, yet to keep the greater part of the multiplier independent of these variables, the desired end will be obtained. In order to do this both the altitude and ground speed factors must be independent of each other and the greater part of the multiplier, which will remain a constant, must be independent of both.

4. Inspection of 1938 target practice reports indicates that the average altitude of such target practices was approximately 5,000 yards and that the average ground speed was 125 miles per hour. These appear to be fair values for use in the scoring formula. If the multiplier is written in the form, $\left[15 + H + \frac{Sg}{25}\right]$ where H is .001 of the altitude in yards and Sg is the ground speed in miles per hour, the score for a course, where the average values for H and Sg are obtained and where the hits per gun per minute obtained equals the expected value from the curve, become $(15 + 5 + 5)\left[\frac{1}{1}\right]$ or 25 and the score for four such courses is par or 100.

c. (1) The Coast Artillery Board believes that a scoring formula for antiaircraft guns of the form of C (the score for each course) $= \left[15 + H + \frac{Sg}{25}\right]\left[\frac{HGM}{H'G'M'}\right]$ where H is .001 of the average altitude of the course in yards, Sg is the ground speed of the target in miles per hour, HGM is the number of hits per gun per minute actually obtained, and H′G′M′ is the expected number of hits per gun per minute, as determined from the proper curve on Figure 3, is equitable and will be a considerable improvement over the existing scoring formula. An analysis of this formula shows that it abandons none of the good features of the present formula, it corrects deficiencies in the present formula and it is considerably simpler in form and easier to use.

(2) The major effects that such a scoring formula should have on the conduct of antiaircraft gun practices are set forth below:

(*a*) It should encourage the firing of practices at long slant ranges. The following table shows the hits per gun per minute by which the normal expectancy curve must be exceeded at various slant ranges to attain a value of one for the ratio $\frac{HGM}{H'G'M'}$:

Slant Range	*HGM by which expectancy curve must not be exceeded*
3,000	6.6
4,000	3.2
5,000	1.5
6,000	0.9
7,000	0.4
8,000	0.2

(*b*) It should encourage the firing at the higher altitudes but should not unduly penalize batteries which cannot fire at high altitudes. Assuming that the ratio $\frac{HGM}{H'G'M'} = 1$ and that $\frac{Sg}{25} = 5$ an increase in H from 3 to 6 would increase the score 11.5 per cent, a worthwhile gain yet not one which is unduly penalizing if it cannot be obtained. A similar circumstance results from the method of applying the factor for ground speed.

(*c*) It should encourage a high rate of fire but will also encourage the balancing of rate of fire against accuracy. In this connection rate of fire, as such, ceases to be important inasmuch as there is no difference in effectiveness between batteries whose attained hits per gun per minute are the same despite the fact that their rates of fire vary widely.

(*d*) It should encourage the conduct of fire on the maximum number of courses authorized since the total score is the sum of the scores of each course.

d. The scoring curves, as proposed above, apply only to 3-inch guns. Special curves will be necessary for 105-mm. guns and 90-mm. guns when they are issued to the service. Due to the fact that, at present, but one battery fires practices on 105-mm. guns and the conditions under which 105-mm. practices are fired vary so widely from corresponding conditions under which 3-inch practices are fired, it is believed that 105-mm. gun practices should, for the present, be classified as are advanced practices, no score being required.

e. The Coast Artillery Board is also of the opinion that a paragraph should be added to Training Memorandum No. 1 requiring that the initial altitudes of successive courses of practices conducted by Regular Army antiaircraft regiments should vary by not less than 300 yards.

f. Based on the recommendations of the Coast Artillery Board, as approved by the Chief of Coast Artillery, the Secretary of War directed that paragraph 11 *b,* Training Memorandum No. 1, Instructions for Coast Artillery Target Practice—1939, be deleted and the following subparagraph substituted therefor:

"*b. Firing phase.*

(1) The score for each course is:

$$C = \left(15 + H + \frac{Sg}{25}\right)\left(\frac{HGM}{H'G'M'}\right)$$ where:

H = .001 of the average altitude of the course in yards taken to one decimal place.

Sg = the average ground speed of the course in miles per hour taken to the nearest mile per hour. The expression $\frac{Sg}{25}$ will be taken to one decimal place.

HGM = hits per gun per minute, attained on the course, computed to one decimal place from the formula:

$HGM = \frac{60\,h}{gt_a}$ where

h = the number of hits

g = the maximum number of

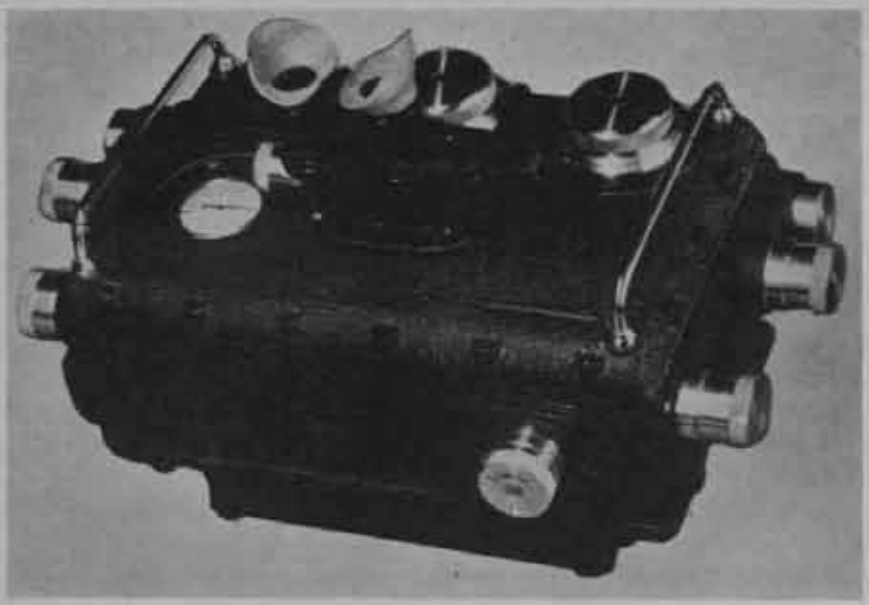


Figure 1: Stereoscopic Trainer T5

guns used during the course
t_s = firing time in seconds.

H'G'M' is taken to one decimal from Figure 3, "Normal Expectancy Curve" (Figure 1, T.M. No. 1, 1939), using as arguments the normal rate of fire (as prescribed in TM 2160-35) and the average slant range of the course to the nearest hundred yards.

(2) The score of any course whose average slant range is less than 3,000 yards will be zero.

(3) For the target practice year of 1939 only, the provisions of paragraph 42 *a* (1) (*b*) 6, TM 2160-35, are suspended. In lieu thereof the following will govern: The initial altitude of each succeeding course of the four courses of a practice will vary from that of its predecessor by not less than 300 yards. If the altitude of any course does not so vary, the battalion commander will include the reason therefor in his indorsement on the target practice report.

(4) For the target practice year of 1939 scores will not be computed for 105-mm. antiaircraft gun practices, but such firings will be classed as advanced practices."

STEREOSCOPIC TRAINING INSTRUMENTS (PROJECT 1148). *a*. A preliminary study of the records of the antiaircraft firings held at Fort Bragg, North Carolina, in 1938, has indicated that errors in altitude determination attributable to stereoscopic height finder observers were abnormally large. Therefore it would appear that matériel and methods now employed by the service in the training of such observers are not producing the desired results. In an attempt to remedy this situation the Coast Artillery Board initiated the following measures:

(1) General distribution to all antiaircraft units of the Coast Artillery School text: *Stereoscopy and Stereoscopic Range Finding*, was recommended. This action received the approval of the Chief of Coast Artillery. The necessary copies of the text, revised to include instructions concerning the new standard Height Finder M1, are now being prepared.

(2) With the concurrence of the Commandant, Coast Artillery School, establishment of a school for the training of height finder observers was recommended. This action likewise was approved by the Chief of Coast Artillery and plans are now well under way for the establishment of such a school at Fort Monroe, Virginia, as a branch of the Coast Artillery School. It is planned to have selected observers from all antiaircraft gun batteries in the continental United States and, possibly, from Hawaii and Panama also, attend this school. The course will probably be of six weeks duration. It is hoped that the first course will be started in May or June of this year.

b. Representatives of the Coast Artillery Board and the Faculty, Coast Artillery School, have visited the Navy Fire Control School at the Washington Navy Yard and have secured complete information as to the details of the Navy's course for stereoscopic observers. One officer and two selected noncommissioned staff officers of the Coast Artillery have been detailed to this school, with the intention that they will later be assigned to organize and conduct the observers' course at Fort Monroe.

c. (1) The Coast Artillery Board resumed study of the subject of stereoscopic training devices with a view to obtaining a more satisfactory training instrument, both for use at the new height finder school and for issue to antiaircraft regiments. As a result of this study the Board recommended the adoption of the Stereoscopic Trainer T5 (see Figure 1), with minor modifications.

(2) This instrument is similar to the Stereoscopic Trainer Mark II, now used extensively for training purposes by the United States Navy. It is not intended as a replacement for the present Stereoscopic Tester M1, which is useful primarily in the initial selection of observer candidates, but rather for employment in the year-round training of experienced observers and of candidates who have already been carefully selected as promising observer material.

(3) Essentially, the Trainer T5 is a simple stereoscope employing two low-power microscopes and eyepieces. It provides for the following operations:

(*a*) Monocular or binocular view of reticles (three pairs provided).

(*b*) Monocular or binocular view of target (six target slides provided).

(*c*) The reticle may be moved to any portion of the field.

(*d*) The target may be moved to any portion of the field.

(*e*) Interpupillary distance and individual eye focus can be set and read.

(*f*) The rays of light emerging from each eyepiece can be converged or diverged, and the magnitude of this movement is indicated.

(*g*) The rays of light emerging from the right eyepiece can be displaced vertically (hyperphoric displacement).

(*h*) Ranges may be read stereoscopically on either fixed or moving targets, in terms of units of error (or seconds of arc).

(4) Training in maintaining stereoscopic fusion on moving targets is provided by slowly moving one range knob, while the operator uses the other range knob to keep the reticle at the apparent range of the target. A measure of the operator's ability is indicated on the range dial, on which the needle will remain stationary if both knobs are turned at the same rate.

(5) A number of exercises are possible for strengthening the eye muscles. An outstanding feature of the instrument is the fact that with all knobs set at zero, and with the eyes accommodated on a target set at infinity, the turning of the knob found to the left of the eyepiece will cause the rays of light emerging from the eyepieces to converge or diverge as desired, thus training the operator to break up the harmonious relation between convergence and accommodation. This training is essential to the use of a range or height finder wherein the reticles are set for zero convergence, and the target is caused to move beyond and short of the reticles, thus varying from convergence to divergence in each operation of range taking.

d. It is not to be expected that the provision of a suitable training instrument will obviate the necessity for intensive training of prospective observers on the actual height finders which they will operate in target practice. There is no doubt but that, given the necessary aerial targets and the facilities for checking observations, an hour's drill on the height finder is of considerably greater benefit to experienced observers than is a corresponding period spent on any training instrument. It is expected, however, that with a suitable trainer and a height finder both available, and with intelligent supervision throughout all periods of training, a well-rounded all-weather program of continuous instruction and training will be well within the capabilities of all organizations concerned. Such a program, conscientiously adhered to, should result in the attainment of an observer proficiency which heretofore but seldom has been reached and which will be somewhat commensurate with the inherent accuracy of the modern height finder itself.

e. The recommendations of the Coast Artillery Board have been approved by the Chief of Coast Artillery and action is now under way with a view to procuring an initial supply of these training instruments. It is contemplated that the trainers will eventually be allotted to antiaircraft organizations on a basis of one per gun battalion.

Bore Greasing Device (1048). *a*. One of the problems confronting the battery commander charged with the maintenance of Class B and C batteries will be simplified by the standardization of a special device for applying heavy rust preventive compound to the bores of guns. This device consists of three wooden discs mounted on a steel shaft about three feet long. Two adjacent discs are joined rigidly by a brass tube which slides over the shaft and have on their periphery three wooden studs each cushioned radially by springs. By exerting pressure against the interior walls of the gun, these studs cause the friction discs to oppose movement. In front of the friction discs is the third disc, called the greasing disc, which is provided with a stiff brush. In use, the space between the greasing disc and the friction disc unit is filled with heavy rust preventive compound. The device is then pulled through the gun from the muzzle end toward the breech. The friction of the friction discs forces the rust preventive compound over the greasing disc brush, smearing it evenly throughout the rifled portion of the gun. About eight men are required to pull the device through a 12-inch gun.

b. After conducting a preliminary test at Fort Monroe, four devices were constructed for a service test. Two 12-inch and two 10-inch bore greasing devices were supplied to four harbor defenses in the United States for actual use in connection with placing guns in an inactive status. The reports of this test were very favorable, all harbor defenses recommending its adoption as a standard device. As a result of these tests, the Coast Artillery Board recommended that the device be standardized and issued on the basis of one per fort for each caliber of gun, 6-inch or larger.

Loud-speaker Systems for Mine Work. *a*. Of interest to mine personnel of the Coast Artillery Corps is a loud-speaker system recently tested by the Coast Artillery Board. This is a voice amplification system which provides inter-communication between a central station of a vessel and a number of outside stations. Outwardly, it is similar to public address systems with which all are familiar. It differs, however, in the voice amplification obtainable and the fact that it is reversible; that is, the loud speakers are also microphones for reception.

b. For the test two demonstration units obtained by loan from a commercial concern were installed; one on the Mine Planter *Graham* and one on the Distribution Box Boat *L-53*. These systems were in use for about three months during which time approximately ten partial groups of mines were planted and picked up. By use of the loud speakers it was possible for the planting officials on either the D.B. boat or the mine planter to communicate with each other or with the mine yawls at considerable distances away. Under favorable conditions it was found possible to carry on communication between the mine planter, using the loud speaker and an unaided voice at 1,500 feet distance.

c. These tests indicated the desirability of the loud-speaker system for use in mine work and the Coast Artillery Board recommended that systems of this type be installed on all mine planters and L boats.

Coast Artillery Orders

(January 1 to February 28, 1939)

Colonel Robert Arthur, from Hawaii, to Historical Section, Army War College.

Colonel W. T. Carpenter, from Panama, to University of Alabama.

Colonel R. P. Glassburn, from Org. Res. 7th Corps Area, to the Philippines, sailing New York, June 1.

Colonel M. J. Hickok, from Ft. Banks, to Panama, sailing New York, June 14.

Colonel Sanderford Jarman appointed Brigadier General Feb. 18.

Colonel Franc Lecocq, from Inspector General's Department, Baltimore, to his home and await retirement.

Colonel A. L. Loustalot, from Org. Res. 9th Corps Area, to Hawaii, sailing San Francisco, March 1.

Colonel R. M. Mitchell assigned to commanding officer of troops on U. S. Army Transport *Republic*.

Colonel George Ruhlen, from the Philippines, to Org. Res. 7th Corps Area.

Colonel C. K. Wing, from Presidio of San Francisco, to Hawaii, sailing San Francisco, June 24.

Lieutenant Colonel H. C. Allen, from War Department General Staff, to office Chief of Coast Artillery, Washington, D. C.

Lieutenant Colonel R. W. Atwood, from Org. Res., Washington, D. C., to Inspector General's Department, Boston.

Lieutenant Colonel J. D. Brown, from Utah State Agric. College, to Hawaii, sailing San Francisco, June 24.

Lieutenant Colonel C. W. Bundy, from student, Naval War College, Newport, to Hawaii, sailing New York, June 1.

Lieutenant Colonel J. F. Cottrell promoted Colonel January 1.

Lieutenant Colonel R. F. Cox promoted Colonel February 1.

Lieutenant Colonel J. H. Hood promoted Colonel January 1.

Lieutenant Colonel D. S. Lenzner, from instructor, District of Columbia National Guard, to Submarine Mine Depot, Ft. Monroe.

Lieutenant Colonel C. D. Peirce promoted Colonel January 1.

Lieutenant Colonel R. E. Phillips, from the Philippines, to instructor, Connecticut National Guard, Bridgeport.

Lieutenant Colonel A. E. Rowland, from Hawaii, to Org. Res., San Francisco.

Lieutenant Colonel W. R. Stewart, from the Philippines, to Org. Res., 9th Corps Area.

Lieutenant Colonel E. W. Turner, from Ft. Hancock, to 2d C.A. District, New York.

Major S. W. Anderson, from Hawaii, to instructor, C.A. School.

Major C. E. Atkinson, from 52d, Ft. Monroe, to 2d.

Major W. C. Braly, from Univ. of California, Berkeley, to the Philippines, sailing San Francisco, June 23.

Major G. deL. Carrington promoted Lieutenant Colonel, January 1.

Major E. R. Crowell, from student, C. &G.S. School, Ft. Leavenworth, to 6th, Ft. Winfield Scott.

Major P. H. French promoted Lieutenant Colonel, January 1.

Major J. H. Harrington, from the Philippines, to St. Ignatius High School, San Francisco.

Major C. S. Harris, from student, C.& G.S. School, Ft. Leavenworth, to 61st, Ft. Sheridan.

Major H. P. Hennessy, from 52d, Ft. Hancock, to 7th.

Major W. D. Hohenthal, from student, C.&G.S. School, Ft. Leavenworth, to General Staff Corps, Berlin.

Major R. J. Imperatori, from Ft. Hancock, to 8th, Ft. Preble.

Major H. W. Lins, from Ft. Preble, to instructor, Maine National Guard, Portland.

Major LeRoy Lutes, from Washington, D. C., to 62d, Ft. Totten.

Major V. P. Foster, to the Philippines, sailing New York, June 1. Previous orders amended.

Major D. J. Rutherford, from Org. Res., 9th Corps Area, to the Philippines, sailing San Francisco, April 26.

Major F. S. Swett, from the Philippines, to University of California, Berkeley.

Major E. H. Taliaferro, Jr., from Ft. Totten, to Hawaii, sailing New York, June 1.

Captain A. D. Amoroso, to the Philippines, sailing April 26. Previous orders amended.

Captain G. B. Anderson, from Ft. Jay, to assistant to constructing quartermaster, New York City.

Captain A. H. Bender, from student, C&G.S. School, Ft. Leavenworth, to instructor, C.A. School.

Captain H. E. C. Breitung, from Utah Agric. College, to the Philippines, sailing San Francisco, June 23.

Captain P. W. Cole, Ft. MacArthur, to the Philippines, sailing San Francisco, April 26.

Captain E. E. Count, Jr., from Tokyo, to 62d, Ft. Totten.

Captain P. B. Denson, from Hawaii, to The Citadel, Charleston. Previous orders revoked.

Captain W. H. J. Dunham, from Hawaii, to 6th Ft. Winfield Scott.

Captain J. W. Dwyer, from Ft. Totten, to Panama, sailing New York, March 1. Previous orders revoked.

Captain G. L. Field, from Ft. Sheridan, to the Philippines, sailing New York, April 1.

Captain G. A. Ford, from Panama, to 52d, Ft. Hancock.

Captain O. T. Forman, from San Francisco, to Hawaii, sailing San Francisco, June 24.

Captain W. L. McCormick, from Ft. Worden, to Hawaii, sailing San Francisco, June 24.

Captain W. L. McNamee, from the Philippines, to instructor C. A. School.

Captain H. F. Meyers, from Ft. Crockett, to Hawaii, sailing San Francisco, June 24.

Captain S. H. Morrow, from the Philippines, to 61st, Ft. Sheridan.

Captain W. C. Rutter, from 52d, Ft. Monroe, to 2d.

Captain N. B. Simmonds, from Ft. H. G. Wright, to the Philippines, sailing New York, June 1.

Captain M. L. Skinner, from Hawaii, to 13th, Ft. Barrancas.

Captain Vern Walbridge, from Ft. Sheridan, to Hawaii, sailing New York, June 1.

Captain S. E. Willard, from Hawaii, to 62d, Ft. Totten.

Captain F. J. Woods, from 7th, Ft. Hancock, to 52d.

Captain N. D. Young, from Ft. Rosecrans, to Hawaii, revoked.

First Lieutenant John Alfrey, from Panama, to student, C. A. School.

First Lieutenant Alfred Ashman, to 62d Ft. Totten, upon completion of present tour. Previous orders amended.

First Lieutenant W. H. Baynes, from Ft. Monroe, to student, C. A. School.

First Lieutenant L. A. Bosworth, from Ord. Dept., to student, C. A. School.

First Lieutenant H. R. Boyd, from West Point, to student, C. A. School.

First Lieutenant L. H. Brownlee, from West Point to student, C. A. School.

First Lieutenant M. S. Carter, from West Point, to student, C. A. School.

First Lieutenant H. B. Cooper, Jr., from Ft. Monroe, to Panama, sailing New York, April 1.

First Lieutenant C. J. Diestel, from West Point, to student, C. A. School.

First Lieutenant C. B. Duff, from West Point, to student, C. A. School.

First Lieutenant W. F. Ellis, from West Point, to student, C. A. School.

First Lieutenant E. E. Farnsworth, Jr., from West Point, to student, C. A. School.

First Lieutenant S. W. Foote, from Ft. Monroe, to student, C. A. School.

First Lieutenant W. H. Francis, from Panama, to 63d, Ft. MacArthur.

First Lieutenant R. E. Frith, Jr., from Ft. Monroe, to student, C. A. School.

First Lieutenant H. R. Greenlee, Jr., from Ft. Monroe, to student, C. A. School.

First Lieutenant R. F. Haggerty, from Ord. Dept., to student, C. A. School.

First Lieutenant H. R. Hale, from Ft. Monroe, to student, C. A. School.

First Lieutenant W. A. Hampton, from Ft. MacArthur, to student, C. A. School.

First Lieutenant W. H. Harris, from Ft. H. G. Wright, to Hawaii, sailing New York, June 1.

First Lieutenant C. W. Hildebrandt, from the Philippines, to student, C. A. School.

First Lieutenant C. W. Hill, from Ft. Monroe, to student, C. A. School.

First Lieutenant J. N. Howell, from Hawaii, to student, C. A. School.

First Lieutenant R. J. Lawler, from U. S.A.M.P. *General J. Franklin Bell*, Ft. Worden, to student, C. A. School.

First Lieutenant C. R. Longanecker, from Ft. Crockett, to student, C. A. School.

First Lieutenant H. W. Mansfield, from Ord. Dept. to student, C. A. School.

First Lieutenant William Massello, Jr.,

from Ft. MacArthur, to student C. A. School.

First Lieutenant R. M. Miner, from Ft. Monroe, to student, C. A. School.

First Lieutenant J. C. Moore, from the Philippines, to student, C. A. School.

First Lieutenant J. B. Morgan, from the Philippines, to student, C. A. School.

First Lieutenant Robert Morris, from Ft. Monroe, to student, C. A. School.

First Lieutenant W. R. Murrin, from Ft. Monroe, to student, C. A. School.

First Lieutenant G. U. Porter, from Ft. Monroe, to student, C. A. School.

First Lieutenant W. G. Root, from Ft. Monroe, to student C. A. School.

First Lieutenant H. W. Schenck, from Ft. Rosecrans, to student, C. A. School.

First Lieutenant J. R. Seward, from Panama, to 63d, Ft. MacArthur.

First Lieutenant F. H. Shepardson, from Ft. Monroe, to student, C. A. School.

First Lieutenant N. A. Skinrood, from the Philippines, to 62d, Ft. Totten. Previous orders amended.

First Lieutenant E. C. Somerville, from Ft. Preble, to student, C. A. School.

First Lieutenant R. S. Spangler, from West Point, to student, C. A. School.

First Lieutenant W. F. Spurgin, from Ft. Monroe, to Panama, revoked.

First Lieutenant J. C. Steele, from West Point, to student, C. A. School.

First Lieutenant P. B. Stiness, from West Point, to student, C. A. School.

First Lieutenant H. P. VanOrmer, from Ft. Monroe, to student, C. A. School.

First Lieutenant B. S. Waterman, from Ft. Monroe, to student, C. A. School.

First Lieutenant W. H. Waugh, Jr., from Ft. Monroe, to student, C. A. School.

First Lieutenant S. L. Weld, Jr., from Hawaii, to student, C. A. School.

First Lieutenant R. J. Wood, from West Point, to student, C. A. School.

Second Lieutenant C. A. Cozart, from the Philippines, to the Ordnance Dept., Watertown Arsenal. Previous orders revoked.

Second Lieutenant A. J. D'Arezzo, from Ft. MacArthur, to the Philippines, sailing San Francisco, April 26.

Second Lieutenant W. J. Hodges, Jr., from Ft. Monroe, to Hawaii, sailing New York, June 1.

Second Lieutenant Arthur Kramer, from Ft. Monroe, to student, C. A. School.

Second Lieutenant H. E. Michelet, from Ft. Barrancas, to Panama, sailing Charleston, June 16.

Second Lieutenant E. S. Rosenstock, to the Philippines, sailing San Francisco, April 26. Previous orders amended.

Second Lieutenant C. E. Spann, Jr., from the Philippines, to student, C. A. School.

Second Lieutenant E. H. Walter, from Ft. Monroe, to student, C. A. School.

Second Lieutenant A. J. Weinnig, from Ft. Barrancas, to Hawaii, sailing New York, June 1.

Second Lieutenant W. J. Worcester, from Ft. Monroe, to Panama, sailing New York, June 14.

ADVANCED TECHNICAL CLASS, COAST ARTILLERY SCHOOL—1938-1939

Rear Row: *Lieutenants Stayton, Turner, and Vestal.*
Front Row: *Lieutenant Peterson, Captain Mortimer, and Lieutenant Skidmore.*

The Contributors

CAPTAIN H. T. BENZ, Coast Artillery Corps, a New Yorker by birth, graduated from the United States Military Academy with the class of 1924; and has served with the Coast Artillery Corps since that time. He is a graduate of the Coast Artillery School, Battery Officers' Course, 1933. Captain Benz is on duty with the 69th Coast Artillery, Fort Crockett, Texas.

✦ ✦ ✦

CAPTAIN G. A. CHESTER, Coast Artillery Corps, is a native of New Jersey. Originally appointed a second lieutenant, Field Artillery on September 11, 1925, he served only briefly with that arm, for he transferred to the Coast Artillery Corps on September 30, 1925. A graduate of the Coast Artillery School Regular Course and the Advanced Technical Course, he is now on duty as librarian, the Coast Artillery School, Fort Monroe.

✦ ✦ ✦

GENERAL F. CULMANN, French Army, recently completed a tour of duty as Chief of the Secretariat of the Commission for Fortification of the Maginot Line. Among his more important assignments was his detail in 1925 as Chief of Staff, Army of the Rhine. He is widely known as an outstanding artillerist and is the author of *Tactique D'artillerie*.

✦ ✦ ✦

FLETCHER PRATT, the New York historian, is well known to JOURNAL readers. His work on Napoleon now running serially in the JOURNAL will be published as a book next June by Doubleday, Doran and Co.

✦ ✦ ✦

MAJOR PAUL L. REED, Coast Artillery Corps Reserve, is one of the first of the post-war ROTC students to reach field grade. His school is Washington University (St. Louis) where he was a charter member of the ROTC upon its formation in 1919. He has contributed to several service journals. Major Reed lives in Cleveland where he edits a technical magazine.

✦ ✦ ✦

LIEUTENANT COMMANDER JOEL NEWSOM, a native of Arkansas, graduated from the United States Naval Academy with the class of 1921. During the past fifteen years he has had aviation duty, has commanded submarines, and has also served with the Battle Fleet. Commander Newsom has frequently contributed to the pages of our well known contemporary *The Naval Institute Proceedings*.

✦ ✦ ✦

MAJOR GENERAL HENRY ROWAN-ROBINSON, C.B., C.M.G., D.S.O., is the well known British soldier and author. His long military career began in 1892 and spans Empire history from the South African War of 1901-02 to field service in Kurdistan in 1932. During the World War he was twice wounded and six times mentioned in dispatches. Among his administrative assignments he has held the posts of chief artillery instructor and second in command The Royal Military Academy, Military Governor of Libau, and Inspector-General of the Iraq Army. Of his many literary works *The Infantry Experiment* is perhaps the best known to American readers. First published in 1934, this book received serious study and analysis by soldiers of every major army and his succeeding works have been read with like interest. His current book—*Imperial Defence: A Problem in Four Dimensions*—is reviewed in the book section of this number.

✦ ✦ ✦

W. A. WINDAS, a free-lance magazine writer, lives at Hollywood, California. He specializes in short feature articles.

Book Reviews

IMPERIAL DEFENCE. By Major General Henry Rowan-Robinson. London: Frederick Muller, Ltd., 1938. 342 pages; sketch-maps; appendix, bibliography; index; $3.50.

General Rowan-Robinson has turned out a workmanlike general survey of the art and problems of war today. Dealing with virtually every question in the military-naval-political world, he furnishes a handbook of great value not only to the soldier but also to the intelligent layman. Although he addresses himself to the people of the British Empire his work will hold interest on this side of the Atlantic, for many of the problems that afflict European armies beset us also.

The opening chapters treat of war as man knew it up to the end of the nineteenth century. That conception of war received some pretty rude shocks during the World War and may receive still ruder shocks in the next conflict. "The fate of armies will, owing to the increase in motorization and to the fire-power and mobility of the mechanized forces, depend more and more on a correct appreciation of the element of time."

Pointing out that Franco brought up 40,000 men for the Brunete counter-attack by driblets of motor vehicles, the author argues that strategically and tactically a road net is now fully as important as a railway net. For a commander utilizing highways can switch units to various routes at will, whereas a commander using a railroad is more or less tied down to his steel rails.

Though the tank has an important place on the battlefield of the future, Rowan-Robinson sees tank losses from AT fire as severe as those suffered by infantry from machine guns in 1914. But the tank does not have the infantry's ability to dig in—it must face its enemies in the open.

But the major problem that confronts the Imperial strategist today is not so much the immediate peril of a battlefield but the unknown perils that the first few days of a war with continental powers may hold for Britain. If the entire interior economy of Britain can be thrown into confusion by air raids on a scale vaster than heretofore imagined possible, then manifestly the first line of defense should be against the air menace. Obviously a "sound" tank doctrine or "correct" organization will boot little if Douhet is right and the British high command is wrong.

Rowan-Robinson does not believe that air raids stiffen a people's determination to fight. On the contrary he thinks that a people decimated by air raids will more than likely want to take it out on their government rather than call for reprisals.

He points out that 111 air attacks, with a maximum employment of 43 planes, during the World War brought approximately 5,000 casualties to Great Britain. These raids, scattered over years, brought enough public outcry to immobilize thousands of men on the home front, not to mention 376 planes, 468 antiaircraft guns, and a balloon-apron wing. Moreover, the raids aroused panic to such an extent that work usually stopped for twenty-four hours in the threatened areas after the raids were over.

But future planes are not likely to come in driblets; they may come in hordes. Moreover, a modern air fleet can drop in a single day more than twice the number and weight of bombs released over London during the entire period of the war—600 tons of bombs. And today these would undoubtedly include incendiary missiles—a type of aerial bomb not used during the last war, and one against which defenses are comparatively tentative and unorganized.

The incendiary bomb—a two-pound thermite affair—can produce incalculable confusion and disaster in an area the size of the city of London. One plane alone can carry enough bombs to start 150 fires; the London fire department is equipped to handle a peak load of fifteen fires a day. Consider then the havoc resulting from the bomb-loads of 600 planes.

In summing up, Rowan-Robinson offers a score or more proposals that he believes will put the British ship of state in such trim that it will have at least an even chance to weather the storm he sees coming. The following are among the more important of these proposals:

a. That a combined Ministry of Defense be formed incorporating the existing ministries (War, Navy, and Air) as sub-agencies.

b. That the defense of London be considered the principal mission and that an aerial fleet of fighters to cope with bombers be built up rather than a large fleet of bombers for "retaliation" missions.

c. That all civilians be charged with a part in antiaircraft defense.

d. That emphasis in naval construction be placed on lighter craft rather than on the battleship and cruiser.

e. That the battleship squadron at Malta be replaced by a light-craft flotilla.

f. That command of the air be regarded as the first aim of strategy.

g. That the aircraft assigned permanently to the army and navy be kept at a low figure.

h. That further trial be given to dirigibles and the development of parachute troops.

i. That tanks be deemed a weapon of opportunity rather than an instrument of assault and that they be

used against weakness rather than against strength and against troops in movement rather than troops in position.

j. That large reserves of oil, food, and other necessary raw materials be stocked and that British imports be carried in British bottoms.

k. That the government lend help to everything that tends to improve the physique and "adventurous spirit of the youth of the nation."

l. That the British Government adhere to the principle of entering into no foreign commitments it may not be able to fulfill. When necessary to enter into commitments, to so keep them flexible that as conditions change the commitments may be altered. R. J.

* * *

JAPAN — Government — Politics. By Robert K. Reischauer. New York: Thomas Nelson and Sons, 1939. 221 pages, $2.00.

Everyone who has lived in the East tries, with varying success, to interpret the Oriental mind to the Occidental. This is a good deal like explaining to a cat how it feels to be a fish. Professor Reischauer, after living, studying, and teaching for twenty years in Japan, undertook the preparation of this textbook for beginners in this field. Omitting all consideration of art, literature, and methods of life he sticks closely to the subjects indicated by his title.

Considering the present state of world-wide political unrest and the important rôle that Japan plays on the international stage, this book is particularly timely, in that it gives a reasonable explanation of how Japan "got that way."

The book is divided into two parts. The first deals with Japanese political theory and growth of government from about 600 A.D. to the arrival of Perry and the adoption of the Open Door policy in 1853. The second shows how the Japanese government works, and deals mainly with the period from 1889 to 1938.

The author explains that, although Japan has evolved through the same governmental processes as other nations —that is, from the Family through the Clan and Tribe to the State—this evolution has been greatly affected by religion, not only Shintoism but also Buddhism and Confucianism. The result is that the Japanese credo begins with the axiom that "All men are created unequal." The Emperor, being the Son of Heaven, is *ipso facto* supreme. Furthermore, any nation headed by a son of earth must necessarily be inferior to one headed by the Son of a God. Borrowing from Confucianism the idea that the Emperor is the repository of all virtue and righteousness, he is the Law and above all Law.

Professor Reischauer explains that, in so far as ordinary legal matters are concerned, laws are subordinate to the men who make them. Man is greater than Law. Laws are made primarily as guides for those who maintain law and order, indeed they need not even be published to the People. The proletariat is told to live rightly and humbly; if they do so, all will be well; if they do not, they are

punished according to the circumstances of the particular case.

Laws are passed to fit specific circumstances and hence, if circumstances change, the law (say the Japanese) is null and void. This thought may explain to Occidental nations what they claim is a peculiar Japanese attitude toward treaties.

In view of the religion of Japan it is not inexplicable that the aristocrats still hold the positions of power. Even in the days of the so-called "Commoners in Power" only two powerful Premiers were commoners—and both of them were assassinated in office.

Communism will never rule in Japan (according to the author) because the common herd realizes that it *is* the common herd and is ever subservient to the divine Emperor. Fascism and democracy too, will have but little effect on Japan because they conflict with the Japanese inherent belief that men are unequal.

The book suffers somewhat from the fact that Professor Reischauer left it unfinished. Ironically enough, considering the subject of his writings, he was killed by a Japanese aerial bomb in Shanghai in 1937. Three graphs and an extensive list of supplementary reading are valuable additions to the book. All in all, it forms an admirable textbook for those who wish to become posted on Japanese politics. P. D. B.

* * *

YOUR CHANCE TO WIN: THE LAWS OF CHANCE AND PROBABILITY. By Horace C. Levinson, Ph.D. New York: Farrar and Rinehart, Inc., 1938. 343 pages. $2.50.

Dr. Levinson has made a noteworthy contribution to the literature of probabilities. His splendid analyses of dice, roulette, poker, and bridge will appeal to all devotees of these pastimes. But real purpose and usefulness of the book is by no means limited to these subjects. They are used merely to lead up to the really important part—that of modern statistical methods and their proper use in science and business.

Frequently we read in the papers that someone is "testing" the laws of probabilities by tossing a coin 100,000 or so times and then analyzing the results. As Dr. Levinson points out, such procedure is in fact nothing but a test of the uniformity of the coin. The laws of probabilities are neither proved nor disproved by the results of such experiments.

The accuracy of the calculations presented in this book is extraordinary, considering the wealth of material presented. However, the reviewer is inclined to disagree with one statement in regard to lotteries. If the operators of a lottery return to the players in prizes only sixty per cent of the gross "take," it would seem that the odds against the purchasers of such chances were not six to four as stated, but rather *five to one*. Look at it this way: assume that the lottery consists of 100 chances at a dollar a chance, and a prize (or prizes) amounting to sixty dollars. Now, if one person were to take *half* the chances, he would win half of the time and lose half of the time. When he won, his net gain would be $10.00, whereas

when he lost, his loss would be $50.00, which certainly makes it look as though the odds were five to one against the players as a group. I believe that if this important fact were more generally known, the various "numbers games" would receive much less patronage than they now enjoy.

In a clear and definite style the author explains the difference between statistical methods and pure probabilities, and exposes many errors into which a beginner at statistics is apt to fall. Of special interest is the fact that faulty methods do not always produce erroneous results. Sooner or later, will come the inevitable day of reckoning. This is precisely what brought the *Literary Digest* poll to its inglorious end in 1936.

The average reader may find some parts of this book a little beyond him. This cannot be avoided when dealing with so complicated a topic. However, in the main the author has succeeded in presenting his subject matter in such manner as to make it intelligible to all and of interest to many. D. H.

* * *

ANNAPOLIS TODAY. By Kendall Banning. New York: Funk & Wagnalls Company, 1938. Illustrated. $2.50.

This is a worthy companion piece to Colonel Banning's previous book, *West Point Today*. It shows the same thorough preparation, for the author goes not only to documents but also to the subject itself for his information. Consequently, the book is unusually accurate, and thoroughly reflects the ideals and traditions of the officers and midshipmen of the Naval Academy.

There are chapters on all phases of the life of a midshipman from the day he "comes aboard" in the yard to the one four years later when he tosses his cap in Dahlgren Hall. Academic instruction, athletics, hops, and even life on the "Ship" (guardhouse to a soldier) are all discussed in colorful style.

The book is very easy reading and there is no doubt that it belongs in the hands of all who are interested in the Naval Academy. In giving us a modern and comprehensive view of Annapolis, Colonel Banning does valuable service to the public and the Academy. J. L. W.

* * *

WOODROW WILSON: LIFE AND LETTERS. APRIL 6, 1917-FEBRUARY 28, 1918. By Ray Stannard Baker. New York: Doubleday, Doran & Company, 1939. Volume VII, 604 Pages; Illustrated; Index; $5.00.

Fourteen years ago Mr. Baker received custody of Woodrow Wilson's papers and has been at work on the standard life of the President. In six volumes preceding this one he has traced his career through the declaration of war on Germany. The seventh volume endeavors to show Wilson as a great war leader. Mr. Baker supplies a short chronological account of the principal events of the war and attempts to let the documents speak for themselves. Unfortunately his method of quoting parts

of letters sent by the President confuses the reader, since there is no way of knowing just what the President is replying to. There is too much for the reader who wants merely a survey of the war years, and not enough to satisfy the really serious student of the war administration. Yet the failure to produce a complete picture of this hectic period is understandable, and the problem of choosing material to be included must have been very trying. The literary, political, and oratorical activities of the President were so manifold as to defy condensation.

The military reader will be disappointed at the infrequent references to military affairs. The President seemed to possess much stronger views on naval than military policies. He stoutly condemned the British Admiralty's policy of "heroic inactivity." We are accustomed to the spectacle of Civil War generals being urged to fight at the direction of authorities in Washington, but it is rather startling to find an American President in 1917 urging that British and American admirals should rush in and smash the German fleet and its bases. Otherwise the desperate clamor of war appears but faintly in these pages, chiefly as a background for the exquisite forensic, literary, and philosophical performances of the President.

One gains the impression that President Wilson did not relish outspoken and critical subordinates. He suffered as do most men in high places from too much agreement and praise. One example of this will suffice. Lord Reading was reported by Colonel House to have remarked about Wilson's speech of February 11, 1918: "I would have given a year of my life to have made the last half of that speech." When this was reported by the ever-laudatory Colonel, "the President was delighted." Instead of the confusion and hesitation incidental to a democracy at war, Mr. Baker makes the war administration seem a happy series of correct decisions made at precisely the correct time, to a chorus of hearty approval from the President's close advisers. Mr. Wilson's war administration does not need this type of defense. His record will stand on its own merit, especially by comparison to Civil War practice.

The book leaves a heightened impression of the President's human qualities, his intense desire to diminish suffering, his lofty idealism, and his ardent patriotism.

H. A. D.

* * *

JUDO, 30 Lessons in the Modern Science of Jiu-Jitsu. By T. Shozo Kuwashima and Ashbel R. Welch. New York: Prentice-Hall, Inc., 1938. 119 pages; 143 photographs. $2.50.

This is not exactly a book but rather a set of instructions on the gentle art of committing assault and battery; thirty methods of breaking arms and legs, all profusely illustrated. It appears to be a grown-up edition of what used to be included in A. G. Spalding's collection of paper-backed books, selling at twenty-five cents each. The art of Jiu-Jitsu may have advanced sufficiently to justify the present cost, as well as the alteration of its

Prize Essay Competition 1939

First Prize $200.00

Honorable Mention Prizes . 100.00

a. PERMISSIBLE COMPETITORS:

Any member of the Coast Artillery Association at date of submission of essay.

b. SUBJECT:

To be selected by the author. Appropriateness of subject for Coast Artillery readers is a point to be considered in awarding prize.

c. PRIZES:

(1) *Number:*

(*a*) One First Prize—$200.00. Not to be awarded if no essay submitted is outstanding.

(*b*) Not to exceed two Honorable Mention Prizes—$100.00 each.

(2) Awarded by Chief of Coast Artillery upon recommendation of Board of Officers appointed by him. *Membership of Committee to be published only after awards for the year have been made.*

(3) *Time limit.*

No essay received after September 30th will be awarded a prize.

(4) *Payments.*

Payments of prizes will be made immediately after awards are made. All essays submitted become the property of the COAST ARTILLERY JOURNAL. Any person receiving a prize for an essay will receive no other compensation. If any essay is published the author of which received no prize, such author will be paid at the usual rates.

d. HOW SUBMITTED:

Essays will be submitted to the Editor of the COAST ARTILLERY JOURNAL in a sealed envelope bearing the notation "Prize Essay Contest." The copy submitted will contain nothing to indicate its authorship, will be signed by a "nom de plume," and will be accompanied by a separate sealed envelope containing the nom de plume and also the name of the writer. This latter envelope will be delivered to the Chief of Coast Artillery when received and will be opened in the presence of the Editor of the COAST ARTILLERY JOURNAL after the relative merits of the essays have been determined.

e. FORM:

(1) Essays should be limited to approximately 8,000 words, but shorter articles will receive consideration.

(2) Three typewritten copies of each essay will be submitted on letter size paper (one original, two carbons) with double-spaced lines. At least one of any illustration will be a drawing, tracing, or photograph, not a blue print or brown print.

name to Judo, but it is still the Japanese conception of artful wrestling.

Many of the tricks described were taught in various police forces at one time or another but went into desuetude with the advent of the Tommy Gun. It is the candid opinion of this reader that the introduction or revival of any Japanese game is not likely to find favor with Americans under present conditions. E. D. C.

* * *

SECRET LIFE OF A SECRET AGENT. By Henry W. Lanier. New York: J. B. Lippincott Company, 1938, 307 pages; $2.50.

The first hundred pages of this book are consumed in describing the repressive influences on the youth and upbringing of the person who told this tale to the author. It is a dreary sort of biography, nor is there much in the later pages to entertain the reader. The military student learns nothing new; he already knows the "disclosures" contained in this book. The general reader who judges from the sensational title that he will find equally interesting and sensational reading is due for a disappointment. Lots more fun in one of E. Phillips Oppenheim's latest.

P. D. B.

* * *

A GERMAN CONSCRIPT WITH NAPOLEON: JAKOB WALTER'S RECOLLECTIONS OF THE CAMPAIGNS OF 1806-1807, 1809, and 1812-1813. Edited by Otto Springer, Lawrence, Kansas: University of Kansas, Department of Journalism Press, 1938. 231 Pages; Illustrated; Maps; Itineraries and Notes; $1.50.

This interesting document was discovered by Professor Frank E. Melvin who contributed voluminous critical notes to the text and was translated by Professor Springer. It gives the recollections of a Württemberg conscript in the Napoleonic armies. It is chiefly valuable as a record of the struggles and thoughts of a common soldier and of the hardships he underwent while serving the French Emperor. Like most common soldiers his thoughts were not on the lofty aims of the campaign, but on the problem of the next meal. He and his comrades were not motivated by any intense loyalty to the Emperor. Victories and defeats were alike to them since both involved suffering. The earlier campaigns (which appear last in the book) reveal a picture of Germany under French domination. The account of the campaign of 1812 presents a weird panorama of confusion, suffering, lack of transport and commissariat, and a complete collapse of discipline in the French army after the retreat from Moscow began. It is a harrowing record of suffering and privation. H. A. D.

* * *

GERMANY AND ENGLAND: BACKGROUND OF CONFLICT, 1848-1894. By Raymond James Sontag, Associate Professor of History in Princeton University. New York: D. Appleton-Century Company, 1938. 362 Pages; $3.50.

It has long been said that there are many reasons why

Germany and England can be thought of as natural allies. But long before the World War, and even well before the Kaiser "dropped his pilot," Bismarck, in 1894, strong rivalries began to grow. These the author of *Germany and England* traces in both countries.

In his preface he points out the parallel in the difficulties of negotiation with Germany which the Chamberlains, Joseph and Neville, father and son, encountered at a space of forty years. "William II, like Hitler, wished alliance with England, thought an Anglo-German alliance the inevitable expression of the interests of the two countries." Yet, continues Dr. Sontag, "The negotiations of forty years ago broke down." War came and after-the-war followed. And in 1938 "there were few to prophesy that the efforts of Neville Chamberlain would, over the long run, be more successful than those of Joseph Chamberlain."

In writing this deeply interesting study of the growth of enmity between the two countries, the author has sought out the life and thought of both. He has done much research in old newspapers, pamphlets, addresses, and documents, as well as examining the sources of history that are better known. His account sheds much light on the influence of leaders upon the feelings of a nation toward its greatest rival. *Germany and England* does much to make present-day history clear. L. T.

* * *

THE KING'S SERVICE. By Ian Hay. London: Methuen & Co., Ltd., 1938. 349 Pages. $2.50.

With the pendulum of public opinion swinging back towards rearmaments and military things in general, Ian Hay finds it a propitious time for calling attention to the traditions and deeds of valor appended to the service record of His Majesty's humble servant, one Thomas Atkins. And while he is about it, the author does a very good job, too.

Starting with a brief explanation of his own early experience in the King's service (not the least interesting part of the book, by the way), Ian Hay outlines the founding of the British Empire, the growth of its army, and the part played by that army—not only in laying the foundation but in erecting the edifice which stands today.

No doubt, Part Two of the book will appeal most to the military-minded. It deals entirely with stirring accounts of those deeds by which each British regiment won its most treasured battle honor. In this part is explained why the Duke of Cornwall's Light Infantry wear a piece of red cloth behind their cap badge; why the orderly officer of the East Yorkshire's always keeps his sword on in the mess at dinner; and why, ever since the battle of Corunna, drummers of the Royal Norfolk Regiment wear uniforms faced in black.

For each regiment in turn, from the Lancashire Fusiliers to the King's Own Scottish Borderers, there is described some custom, tradition, or distinctive decoration emanating from an outstanding feat of derring-do. The episodes are briefly and simply told—yet the account is long. And well it might be, for the British soldier has fought

in every part of the world, including our own. And seldom has he come off the battlefield without honor—at least, according to Mr. Hay.

We, who may have a story or two of our own to tell about a few of those engagements, can well afford to read this book, take it as written, and still say, "Hi there, Tommy; nice going!" And why not? Any time, any place that soldiers die heroically in battle, whether it be in our own or in The King's Service, their going calls for three volleys. So, with Ian Hay, we gladly recommend a salute—to Mr. Thomas Atkins. E. D. C.

* * *

GERMANS IN THE CAMEROONS. 1884-1914: A CASE STUDY IN MODERN IMPERIALISM. By Harry R. Rudin, Associate Professor of History, Yale University. New Haven: Yale University Press, 1938. 456 Pages; Maps; $4.00.

Professor Rudin's account of the colonization is exhaustive and unbiased. The pre-war Germany did a reasonably good job of military administration but lost money steadily on the colony. The Cameroons, of course, were lost to Germany in the World War, captured by a joint effort of the British, French, and Belgians in 1916. Part of the colony went to France and the rest is today a British mandated area.

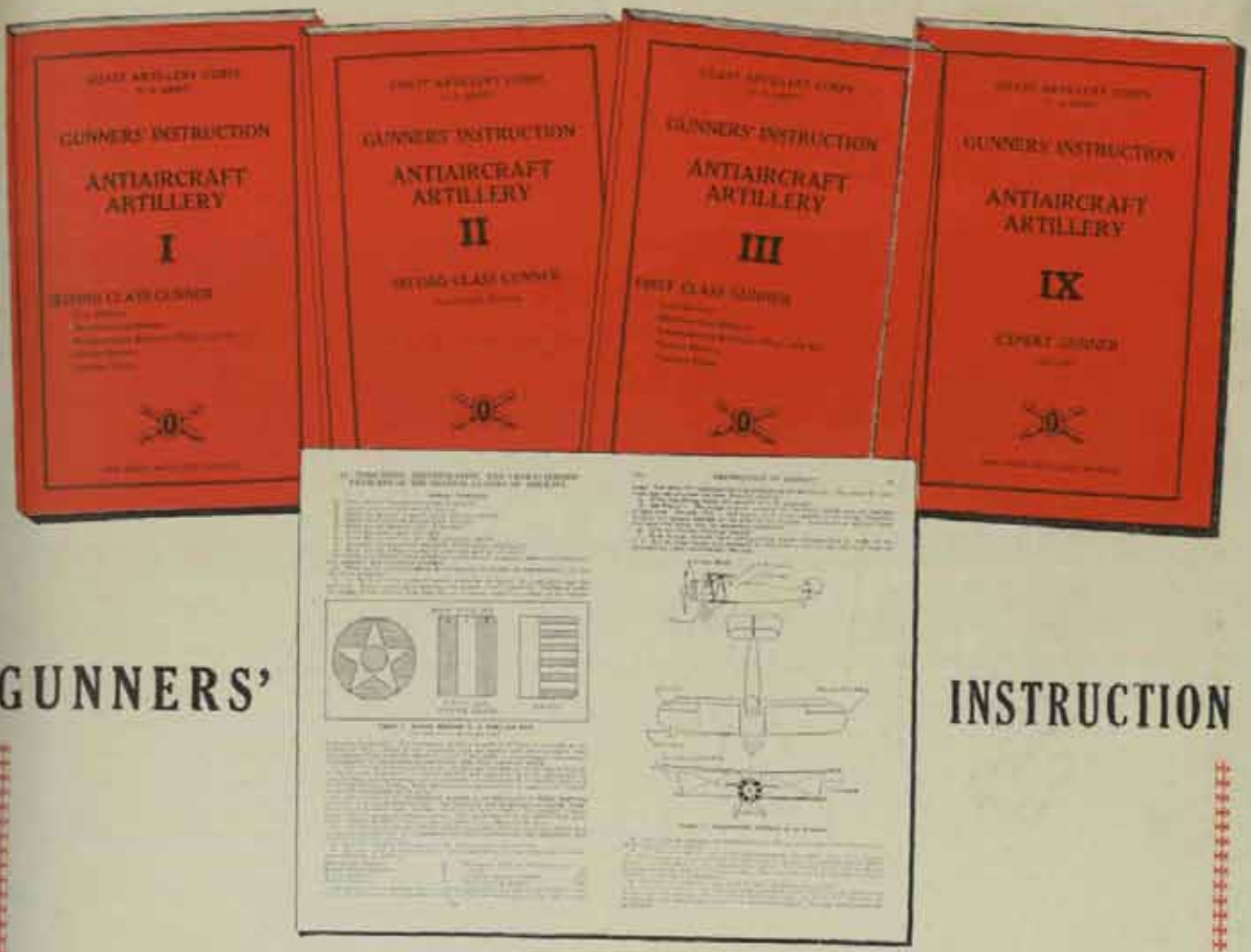
The author sticks to his inclusive dates—1884-1914—and makes no comment on the claims of Nazi Germany for the return of her colonies, and no conjectures on what might happen if she got the Cameroons back. M. O.

* * *

JUGHEADS BEHIND THE LINES. By Carl Noble (Edited by Grace Stone Coates). Caldwell, Idaho: The Caxton Printers, Ltd., 1938. 208 pages; 12 illustrations (all from U. S. Army Signal Corps); $2.50.

This is the self-told tale of an humble mule skinner in the World War. Carl Noble entered the Army from Montana and joined the 60th Infantry at Gettysburg, where his grandfather had been captured in the Civil War. Because of his inherent knowledge of animals, Noble was transferred to the Service Company and at once made a wagoner. And a wagoner he remained, hauling ammunition and rations through mud, muck, and high-explosive language; in the United States, France, and in Germany.

The account of his efforts is simply told and easily read. There is no attempt to instill horror, gain glory, nor arouse sympathy. An honest sincere man, Carl Noble wanted his story to be the same—and it is. However, without meaning to do so, Noble has recorded many lessons in how not to handle men and animals. Also, his description of stable politics is worth anybody's reading time. But perhaps the most vital military thought to be gleaned from a study of this whole book is: While motors go only when furnished gas and oil, animals, like men, can be driven on empty stomachs until they die on their feet. Not only can, but are! Mechanized experts please note. E. D. C.



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—General Sir John Monash