

U
15
U635
no.21
c.3

UNCLASSIFIED
U. S. Army Military History Institute

SPECIAL SERIES, NO. 21

29 FEBRUARY 1944

**GERMAN
MOUNTAIN WARFARE**

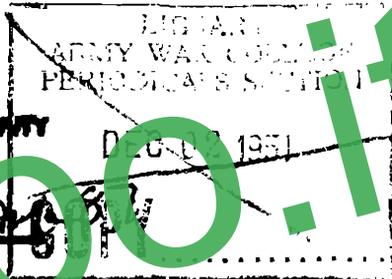
UNCLASSIFIED

REGRADED _____ BY AUTHORITY

OF E.O. 10501

BY

RAMS *12/28/83*



PREPARED BY

MILITARY INTELLIGENCE DIVISION

WAR DEPARTMENT.

PROPERTY OF US ARMY

UNCLASSIFIED

RESTRICTED

MILITARY INTELLIGENCE DIVISION
WAR DEPARTMENT
WASHINGTON 25, D. C. 29 February 1944

SPECIAL SERIES
No. 21
MID 461

NOTICE

1. *Special Series* is published for the purpose of providing officers with reasonably confirmed information from official and other reliable sources.
2. By arrangement with The Adjutant General the following three publications of the Military Intelligence Division are distributed in the same manner as is prescribed for field manuals (see FM 21-6, *List of Publications for Training*, pars. 6-9 (23a)):

Intelligence Bulletin (commencing with March 1944 issue);

Special Series (commencing with No. 20);

Factual and Technical Trends (commencing with March 1944 issue).

Requests for copies of these publications should be made to the appropriate distributing agency of The Adjutant General. Requests for issues prior to those listed above should be forwarded through channels to the MID address below.

3. Distribution of this issue of *Special Series* is being made on the basis of two copies to each division and higher units, one copy to each brigade and one copy to each regiment. Every command should circulate available copies among its officers.

4. Reproduction within the military service is permitted provided that (1) the source is stated, (2) the classification is maintained, and (3) one copy of the publication in which the material is reproduced is forwarded to the Dissemination Unit, Military Intelligence Division, War Department, Washington 25, D. C.

RESTRICTED

LIBRARY

US ARMY WAR COLLEGE
CARLISLE BARRACKS, PA

talpo.it

talpo.it

PROPERTY OF U.S. ARMY

CONTENTS

	Page
INTRODUCTION.....	vii
Section I. GERMAN DOCTRINE OF MOUNTAIN WARFARE.....	1
1. COMBAT IN HIGH MOUNTAINS.....	1
a. General.....	1
b. Command.....	3
c. Effect on Firing.....	4
2. RECONNAISSANCE.....	4
3. MARCHING; SECURITY; SHELTER.....	6
a. Marches.....	6
(1) <i>General</i>	6
(2) <i>Order of march</i>	6
(3) <i>Time factors</i>	8
(4) <i>March discipline</i>	9
b. Security.....	10
c. Shelter.....	10
4. COMBAT IN LOW MOUNTAINS.....	12
a. General.....	12
b. Attack.....	12
(1) <i>Advance and deployment</i>	12
(2) <i>Selection of terrain</i>	13
(3) <i>Types of attack</i>	16
c. Defense and Withdrawal.....	17
5. MOTORIZED AND MECHANIZED OPERATIONS.....	20
6. AIR OPERATIONS.....	20
7. MOUNTAIN INFANTRY.....	26
a. Mountain Rifle Company.....	26
(1) <i>Squad</i>	26
(2) <i>Platoon</i>	27
(3) <i>Company</i>	28
b. Mountain Machine-gun Company.....	30
(1) <i>General</i>	30
(2) <i>Marches and reconnaissance</i>	32
(3) <i>Employment in combat</i>	33
c. Mountain Infantry Battalion.....	35
d. Mountain Antitank Company.....	37
8. MOUNTAIN ARTILLERY.....	39
a. General.....	39
b. Reconnaissance and Observation.....	40
c. Marches.....	40
d. Employment in Combat.....	43
9. MOUNTAIN ENGINEERS.....	48
a. Missions.....	48
b. Employment in Combat.....	48
10. MOUNTAIN SIGNAL AND COMMUNICATION TROOPS.....	51
a. Missions.....	51
b. Marches.....	51
c. Employment in Combat.....	52

Section I. GERMAN DOCTRINE OF MOUNTAIN WARFARE—Con.

	Page
10. MOUNTAIN SIGNAL AND COMMUNICATION TROOPS—Continued.	
d. Technical Considerations.....	54
(1) <i>Wire communication</i>	54
(2) <i>Radio communication</i>	56
(3) <i>Visual signal communication</i>	56
11. MOUNTAIN SERVICES.....	57
a. Mountain Medical Service.....	57
b. Mountain Veterinary Service.....	60
c. Mountain Supply.....	61
II. TRAINING.....	63
12. GENERAL.....	63
13. INDIVIDUAL AND UNIT TRAINING.....	65
14. MOUNTAINEERING.....	66
a. General.....	66
b. Scale of Requirements.....	66
c. Technique.....	68
(1) <i>Marching</i>	68
(2) <i>Climbing</i>	68
(3) <i>Special climbing equipment</i>	69
d. <i>Pivouacs</i>	74
e. <i>Self-protection; Orientation</i>	76
III. ARMY MOUNTAIN GUIDES.....	79
15. GENERAL.....	79
16. GUIDE TRAINING.....	79
17. MISSIONS OF GUIDES.....	82
IV. CLOTHING, IDENTIFICATION, INDIVIDUAL EQUIPMENT.....	84
18. CLOTHING.....	84
19. IDENTIFICATION.....	87
20. INDIVIDUAL EQUIPMENT.....	89
21. FOOD.....	90
V. ORGANIZATION, ARMAMENT, EQUIPMENT.....	91
22. GENERAL.....	91
23. MOUNTAIN INFANTRY REGIMENT.....	96
24. MOUNTAIN INFANTRY BATTALION.....	97
25. <i>Sniper-Weapon Company</i>	98
26. REINFORCED RIFLE COMPANY.....	101
27. MOUNTAIN ANTITANK BATTALION.....	101
28. RECONNAISSANCE BATTALION.....	103
29. MOUNTAIN ARTILLERY REGIMENT.....	104
30. MOUNTAIN ENGINEER BATTALION.....	108
31. MOUNTAIN SIGNAL BATTALION.....	108
32. MOUNTAIN SERVICES.....	108
33. REPLACEMENT BATTALION.....	110
Appendix. FIRING IN MOUNTAINS.....	111
34. PECULIARITIES OF FIRING.....	111
35. GRAPHIC FIRING TABLES.....	115
36. USE OF THE GRAPHIC FIRING TABLE.....	118
a. Determining Trajectory Values.....	118
(1) <i>Charge and elevation</i>	118
(2) <i>Masks</i>	119
b. Angle of Fall; Angle of Impact.....	119
c. Time of Flight; Drift; Fuze-setting.....	120

Appendix. FIRING IN MOUNTAINS—Continued.

36. USE OF GRAPHIC FIRING TABLES—Continued.		Page
d. Dispersion.....	-----	120
e. Metro Data and Masks.....	-----	121
f. Location of a Gun Position.....	-----	122
g. Special Firing Precautions.....	-----	123

ILLUSTRATIONS

Figure

1. Mountain patrol.....	-----	5
2. Mountain troops resting in a snow shelter.....	-----	11
3. Machine gun (<i>M.G. 34</i>) emplaced in snow.....	-----	15
4. Light tank (<i>Pz.Kw. I</i>) accompanying infantry in the Norwegian mountains (April 1940).....	-----	21
5. Captured German half-track vehicle (<i>Kammbrod</i>) frequently used for transport by mountain troops.....	-----	22
6. 88-mm heavy anti-aircraft gun (<i>8.8 cm Flak</i>) in position to cover Italian mountain communications.....	-----	25
7. Machine gun (<i>M.G. 34</i>) in anti-aircraft tripod.....	-----	31
8. Mountain artillery on the march.....	-----	42
9. Medium artillery (Skoda 150-mm howitzer) firing in the valley below Mount Olympus during the Greek Campaign (1941).....	-----	43
10. 150-mm howitzer (<i>s.F.H. 18</i>) on a mountain road.....	-----	44
11. Keeping an artillery piece down a cliff.....	-----	46
12. Bridging a mountain stream during the Norwegian Campaign (1940).....	-----	49
13. Mountain troops with a messenger dog.....	-----	54
14. Roping down a casualty.....	-----	58
15. Use of an aerial railway to move supplies.....	-----	62
16. Mountain riflemen firing under simulated combat conditions.....	-----	64
17. Basic knots used by German mountain troops.....	-----	70
18. Double over and noose.....	-----	71
19. Roping down a rock face.....	-----	72
20. German piton and snaplink ①, and ways of inserting pitons ②.....	-----	74
21. Rock climbing.....	-----	75
22. Badge of Army mountain guides.....	-----	82
23. Mountain cap with edelweiss badge.....	-----	84
24. Mountain soldier.....	-----	85
25. German ski-mountain boot and ankle-wrap puttees.....	-----	86
26. Edelweiss badge worn on the right sleeves of mountain troops' coats and overcoats.....	-----	87
27. Right-hand collar patches of SS units.....	-----	88
28. Organization of the regular mountain division.....	-----	92
29. Strength of units in the regular mountain division.....	-----	93

Figure	Page
30. Organization of the regular mountain infantry regiment.....	94
31. Strength of units in the regular mountain infantry regiment.....	95
32. 75-mm mountain infantry howitzer (<i>7.5 cm l.Geb.I.G. 18</i>).....	98
33. Group of captured Russian 120-mm mortars awaiting modification for German use.....	100
34. 20-mm mountain antiaircraft gun (<i>2 cm Geb.Flak 38</i>).....	103
35. 75-mm mountain howitzer (<i>7.5 cm Geb.G. 36</i>), without trail spades..	105
36. Effect of equal increases of elevation on range at various points on the trajectory.....	112
37. Effect of terrain on range for equal changes in elevation—descending branch of the trajectory.....	113
38. Effect of terrain on range for equal changes in elevation—ascending branch of the trajectory.....	113
39. Effect of change of deflection on range in terrain sloping across the line of fire.....	114
40. Example of a German graphic firing table.....	124

talpo.it

talpo.it

INTRODUCTION

The Germans believe that specially trained mountain troops (*Gebirgstruppen*) may influence decisively the outcome of a campaign, for mass armies must rely on specially trained small forces to secure their advance through the broader mountain valleys in order to reach the flat,¹ where the decision usually is sought. Small forces of mountain troops can prevent, impede, harass, or channel the movements of the main enemy force through the valleys, so that when the decisive battle takes place on the flat, the enemy's power is spent and he is compelled to fight under the most unfavorable conditions. When on the offensive, mountain troops can cover and protect the advance of their own main force, enabling it to reach terrain of its own choice in the highest state of readiness for combat. Thus their mission on the offensive is to secure the route for the advance of large units through the valleys, whereas their mission on the defensive is to deny the valleys to the mass of the enemy forces. In either case, mountain troops must gain control of the mountains.

The Germans hold that the basic tactics of warfare in mountains are the same as in the flat, but that the application of the principles must be modified to fit the high and rugged terrain. In mountainous terrain the movement of troops and the employment of heavy equipment are limited, and deployment is restricted to such an extent that only comparatively small forces can operate. Soldiers must be prepared to advance over narrow roads, tortuous paths, trackless terrain, steep and slippery slopes, ravines, precipices, and glaciers. Movement frequently is threatened by avalanches, rockfalls, landslides, and cornice fractures. Besides these special terrain factors, the weather also exerts a

¹ The "flat" (*Flachland*) does not necessarily mean plains. This term also denotes low, rolling country or any terrain in which troops may normally be employed without special training or equipment and without modification of general tactical principles.

great influence on mountain fighting. Meteorological phenomena, such as burning sun, heavy rain, and blinding snow coupled with intense cold, may occur in swift sequences.

In mountains, the Germans believe, the infantry-artillery team retains the ascendancy which on other fields of battle it yields in part to armor and air power. Relatively unimportant roles are played in mountain warfare by the tank and the airplane. The employment of heavy infantry weapons and artillery is hampered by their bulk and weight, by the considerable dead space, and by the difficulties of observation due to weather and intervening terrain features. It is the infantry, above all, that must bear the brunt of the battle. Consequently, the Germans stress the principle that the importance of shock action and close combat increases as the efficiency of other methods of fighting decreases, and that in some respects mountain fighting resembles guerrilla warfare.

Because of the narrow terrain compartments in mountains, unified control is possible only over small units. The Germans believe that the reinforced battalion is ordinarily the largest tactical unit whose movements a commander can effectively control during combat. In unusually rugged terrain the task unit must be even smaller. Therefore, greater responsibility is placed on officers of lower rank.

The focal points of mountain combat are the heights. Gun emplacements and observation posts on commanding heights can dominate the foreground and valley, making the task of the advancing infantry relatively easy. But of all mountain operations the seizure of heights is the most difficult. A well-defended height must be taken by surprise to avoid great losses. Only men skilled in mountaineering, who have developed stamina through long conditioning, who have the ability to maintain direction, and who have been thoroughly trained for combat, can effectively carry through an attack on a height in high mountains. This is a cardinal principle of mountain warfare which the Germans emphasize.

The following is a summary of basic characteristics of mountain warfare which are stressed in training by the Germans:

(1) Movement is much slower than in the flat, for it takes a long time to bring troops into position. Artillery and heavy weapons, particularly, move slowly. The deployment of infantry, especially units with heavy weapons, requires much time. The attack itself proceeds slowly, and the terrain prevents it from gaining the momentum that is possible in the flat; on the other hand, the large number of good defensive positions and the scarcity of roads facilitate delaying actions. Reserves have to be held very close to the front lines; otherwise, unpredictable conditions of terrain and weather may delay their arrival for the crucial phase of battle.

(2) Signal communication is less reliable than in the flat. The weather sometimes weakens the reliability of messages transmitted by wire or radio. Radio is faster than wire communication, but even less reliable. Reception may be affected by the weather and by the configuration of the mountains. Laying lines is a slow, arduous process, and maintenance and servicing of wire are difficult. Control of the battle by the higher commander is limited largely to a preconceived and thorough plan, since the uncertain channels of signal communication usually prevent him from intervening effectively in operations once the battle has begun. Consequently, the responsibility of subordinate commanders for independent action is greater than in the flat. Rarely can they expect aid from reserves, as the full force is likely to be committed all at once.

(3) The problem of supply becomes extremely acute in mountains, and the proportion of supply troops to combat troops increases. Supply routes are few; food, forage, and ammunition must be carried over narrow roads and mountain trails as far as possible by motor transport, then on mules and mountain horses, and finally on the backs of the soldiers. Economy of supplies is necessary because the danger of extending a unit beyond reach of its supply column is great, and, furthermore, it is impossible for an over-extended unit to live off the country in mountains.

talpo.it

talpo.it

Section I. GERMAN DOCTRINE OF MOUNTAIN WARFARE

*This section is an edited translation of part of a German manual entitled **Vorläufige Ausbildungsanweisung für die Gebirgstruppen (Provisional Training Instructions for Mountain Troops)**. Although the manual is dated 1935, the fundamental German principles of combat in mountains have changed little in the interim. The German manual is not illustrated; the illustrations that appear in this section have been added by the editor.*

I. COMBAT IN HIGH MOUNTAINS

a. General

In high mountains officers and enlisted men have to overcome difficulties that are different from and generally greater than those encountered in the flat. More time is required to execute all movements, and plans for the disposition and commitment of forces must be adapted to the special problems of warfare in rugged terrain. The terrain limits the usefulness of some weapons, and the problem of supply is continuously critical. In general, the difficulties are caused by the steep terrain, the great variations in altitude in different parts of the mountains, the small number of roads and paths and their narrowness, the limited possibilities for movement off roads and paths, and the character and condition of the ground surface. Time of day, season, and weather also create special problems. Account must also be taken of the influence of terrain on the effectiveness of enemy weapons.

Difficulties presented by high mountains are most acute in areas of rock, cliff, and glacier. To overcome them, the officers must have mountain experience, and the troops must be care-

fully selected, specially equipped, and thoroughly trained in mountain operations. Even peacetime service in mountains requires great tenacity, strength, will, and courage; its conditions and dangers are often comparable to those of actual warfare.

The difficulties encountered in medium mountains are less than those in high mountains; nevertheless they are considerable, and they increase in winter. Even in medium mountains, a soldier cannot be fully effective unless he has proper training, clothing, and equipment. Inexperienced men will have great difficulty in effecting cooperation between the infantry and the heavy infantry weapons and artillery because of the difficulties of observation and the many unusual ballistic problems.

Winter, and the thaws before and after, greatly alter the conditions of march and combat in high mountains. During this time the activity even of excellently trained mountain troops is limited by the cold, new snow, snow storms, clouds, avalanches, and the increased difficulties of bringing up supplies and quartering troops. Consequently, important operations are exceptional in winter. Since frequent great and sudden changes in the weather affect the performance of troops in high mountains, mountain troops must learn in training how to protect themselves against the effects of weather; they must know how to make use quickly of all means of protection against cold, rain, and storms, especially at night, and when they are fired.

In high mountains, only mountain troops can be used in all situations. For maximum combat efficiency, they must be trained to move with heavy weapons over any kind of terrain that is negotiable by highly skilled mountain climbers. The better trained and the more effective they are, the greater will be their prospects of surprise and decisive success. They must be able to move over difficult terrain surely and easily, even on moonless nights and in rain, fog, or heavy snowfall.

For bringing up supplies over valley highways, motor vehicles are preferable to animal columns because their capacity and speed

are greater and because they occupy less of the limited road space. Mules are the most useful pack animals; small horses are much inferior and fail even in the higher reaches of medium mountains.

b. Command

High mountains limit the use of large forces and greatly restrict deployment. Because access to some positions is difficult, adjacent units often cannot support each other, and reserves cannot be shifted rapidly. However, through deception and bold surprise action, the attacker often can gain success with smaller forces than the defender. In mountains the commander should not hesitate to put troops into action over a wide front in order to deceive the enemy into dispersing his forces and to achieve surprise by concentrating the bulk of his own troops at points favorable for attack. Such maneuvers necessitate careful planning and prompt decisions by the commander.

Mountains themselves are great obstacles to the quick personal intervention of the higher commanders because march columns, even of the smaller units, are extremely long, and combat generally takes place over a wide front and consists of many isolated engagements. For this reason, higher commanders, to carry out their plans, must depend to a great extent on subordinates of all grades, including the best trusted men. Only if missions are assigned in detail and sufficient forces are allotted to carry out each mission can the various combat groups work together toward a common objective. Combat in high mountains demands absolute thoroughness in preparation; superficial knowledge and ignorance or underestimation of mountain dangers may result in catastrophe. The commander, conscious of his well-considered plans, should remain calm and assured even in the face of the greatest difficulties and thus set an example for his subordinates. He must be tenacious in carrying out his mission and he must insist that his subordinates follow his orders strictly.

c. Effect on Firing

When there are great differences in altitude between the gun position and the target, firing is subject to special conditions, and the obstacles to consistent cooperation between the heavy weapons and infantry are more numerous than those met with in flat terrain. The mountain infantryman must be specially trained to fire his rifle and light and heavy machine guns both upward and downward in areas with steep slopes, to camouflage open fire positions, to occupy them rapidly, and to open fire at once. In high, open regions, however, firing presents fewer problems than in forested areas of low and middle altitude, where observation is difficult.

2. RECONNAISSANCE

In mountains, reconnaissance of routes and terrain suitable for marching and for combat is by no means less important than tactical reconnaissance. Frequently the plan of maneuver and the number of men assigned to advance over each route depend on the results of this reconnaissance. The commanders themselves rarely can make personal reconnaissance; they must usually depend on general surveys, studies of maps, and tourist guide-books, but mainly on the information obtained by reconnaissance units.

Patrols reconnoitering routes and terrain follow close behind the scouts who are seeking the enemy. They mark the reconnoitered route and determine how far pack animals can march with heavy loads, and where they can march only without loads; they also determine where route improvement and security forces for men and animals are needed, where the troops must begin to manhandle heavy weapons, and what sections of the route can be seen by the enemy. Tactical reconnaissance of the terrain by scouts to find a way to carry out the commander's special instructions for disposition of the troops must go on at the same time as route reconnaissance. Only in urgent situations will the com-



Figure 1.—Mountain patrol. (The men are wearing two-piece white coveralls with recognition bands on their right arms.)

mander lead his men into enemy terrain without previous reconnaissance; when he must do so, he will try to send forward picked patrols without packs (fig 1).

The combat performance of the artillery and the heavy weapons of mountain infantry (*Gebirgsjäger*) will depend heavily on hard work, knowledge of firing, tactics, and mountaineering of the scouts. Reconnaissance by artillery, infantry-mortar, and heavy machine-gun units generally starts at the same time as tactical and route reconnaissance. The force commander should decide early whether to send officers equipped with radios to points which give a good view of the terrain over which he plans to make the approach march. Both he and the commanders of the heavy weapons may benefit greatly from the use of observers sent well forward.

3. MARCHING; SECURITY; SHELTER

a. Marches

(1) *General.*—During a march in mountains, a prime consideration is to save the soldier's strength while he is loaded with weapons and pack, for the troops must be fit for combat when they engage the enemy. Scout parties and small detachments, without packs, are required only in exceptional circumstances to perform missions in which they must strain their physical resources to the limit.

A force usually marches in several columns to make use of all available routes in high mountains and to induce the enemy air force to dissipate its effort. Thus the readiness of the units for combat is increased and there is a better possibility of quickly overcoming weak enemy resistance. The march is also expedited, and the troops are spared undue exertion. Furthermore, troops marching in several columns can make maximum use of the limited shelter available in mountains.

(2) *Order of march.*—The usual formation for marching in high mountains is mountain order, single file; the distance from man to man may increase from time to time, depending on the difficulties and the slope of the route, but there must be no relaxation of very strict march discipline. The road space of a unit is 4 to 6 times greater than in level country. Greater intervals are prescribed in places where there is danger of rock-falls and avalanches. Special measures and strict discipline are necessary in marches on moonless nights over difficult mountain terrain. Clouds or sudden storms affect marches in high regions very differently than in the flat,¹ and place a great burden on all personnel.

The ratio of strength between the advance guard and the main body, the distribution of weapons, and the order of march may vary greatly, depending on the situation of the enemy, the suit-

¹ In the German text, *Ebenc*, which has the same connotation as *Flachland* (see p. vii, note 1). The term "flat" has been used throughout this study in translating both words.—EDITOR.

ability of roads for movement of heavy weapons, and the possibilities for maneuver. In mountains the advance guard often must dispense wholly or in part with accompanying infantry mortars and artillery, for the guard must proceed before it is decided whether these weapons can be taken along. Under these circumstances it should be proportionately stronger in machine guns. In such a situation infantry mortars and artillery, first from the valley and then from the lower mountain slopes, should try to protect the forward movement of the advance guard and to give it at least some support in combat.

The march intervals of advance and rear guards depend entirely on the situation and the terrain, which often give the enemy better opportunities for observation and effective fire than he has in the flat. In advancing toward a commanding pass over narrow valley roads visible at a great distance, the advance guard, motorized and protected, if possible, by tanks and motorized artillery, should move out many hours ahead of the main body. The main body should not start up roads or paths when the slopes on either side are bare and difficult to climb, nor should it descend bare slopes visible to the enemy until ridges in the direction of the enemy are in the hands of the advance guard. Frequently the main body can move up only at night.

Rules for forming the advance guard and for the approach march of the main body cannot be given; the commander must issue special orders in each instance. When, for example, heavily forested regions with hidden and inconspicuous roads make it difficult for the enemy to interfere with the march, smaller march intervals will suffice. Or if, during the advance, increased readiness for action is necessary, the main body may advantageously march in deployed formation. Like considerations determine the march intervals between the rear guard and the main body. Orders for intervals generally give the time interval between units.

If the commander assigns infantry mortars and artillery to the advance guard, he should consult the commanders of these weapons

on the strength of the detachment and the order of march; but the less mobile units should not precede the more mobile without some special reason, since it is usually very difficult to move rear elements past other troops. As a rule, the "combat staff" (*Gefechtsstab*), or commander's party, and the "combat staff" of the artillery and of the infantry mortars march in the advance guard. The commander himself generally marches well forward in the advance guard, accompanied by the commanders of the machine guns, mortars, and artillery.² Some signal troops are assigned to the "combat staff" of the force commander, those not otherwise employed usually march at the end of the advance guard. The position of the engineers in the column depends on their missions. They may march with the stronger reconnaissance units, or, more often, ahead of the artillery, with a detachment for special road improvement immediately behind the point of the advance guard.

In an advance through a broad valley where conditions are like those on the flat, the commander may well assign a heavy force of artillery to the advance guard, especially if the main body has to proceed for some time without support. Likewise, an advance guard moving forward to occupy a mountain mass, since it cannot expect relief for a long time, should have as many heavy weapons as possible.

(5) *Time factors.*—For the calculation of march time, no fixed rules can be laid down. The time will vary with the route, the slope and the condition of the troops. It is well to add about 1 hour to the map distance for each 1,000 feet of ascent and 1,650

² The doctrine expressed in this sentence applied to German mountain-division organization at the time the manual was published. The infantry battalion then included a machine-gun company and a mortar company. With the inclusion of the 81-mm mortar platoon in the machine-gun company and the replacement of the mortar company by a heavy-weapons company (*schwere Kompanie*) (see par. 25, p. 98), the doctrine would read as follows: "The commander generally marches well forward in the advance guard, accompanied by the commanders of the machine-gun company, the heavy-weapons company, and the artillery."—EDITOR.

feet of descent. The selection of the hour of departure requires careful thought, account being taken of the situation, the time of year, the weather, the kind of terrain to be traversed, and the condition of the troops. When several columns advance into combat, cooperation should be assured by carefully scheduling the movement of each column. Columns moving over heights often depart 1 day or more ahead of those moving in a valley.

A 300-foot or 1-minute interval between companies and batteries will keep the column moving steadily. If several battalions move along the same mountain road, the distance between them should be determined by orders, with a 30-minute interval as the minimum. In deep snow, men with skis and snowshoes, who must be relieved frequently, go ahead to break trails.³ Loaded animals cannot walk through snow that is more than 16 inches deep.

Orders for rests should be given by the force commander before the troops set out. The schedule of rests depends on the mission, the duration of the march, the difficulty of the terrain, the weather, and the condition of the troops. Soon after the beginning of an ascent there should be a short halt for adjusting saddle straps. After this halt, fresh, well-trained mountain troops must be able to climb for 3 or 4 hours without resting; they then need a rest of at least 1 hour. Shorter rests are worthless, because they do not compensate for the work of unloading and reloading. By means of map and ground reconnaissance a resting place should be selected where pack animals may be unloaded and the men and animals can rest. At all halts the men should seek cover from air attacks and protection against strong wind. In long columns, orders must be distributed soon enough to allow for their transmission.

(4) *March discipline.*—Marching in mountains requires the strictest discipline. All superiors must give continuous attention to keeping march formations closed to the proper intervals, and

³ See "German Ski Training and Tactics," *Special Series*, No. 20 (31 Jan 1944), par. 14, p. 38.—EDITOR.

must enforce an even, rhythmical pace and a proper handling of the pack animals. Stragglers must not be tolerated. In ascent and descent it is forbidden to take short cuts or to stop for a drink or for any other reason, unless ordered. The troops must also be forbidden to eat snow or ice. When ascending they must not smoke, even when at ease. Every unit is responsible for maintaining contact with the unit marching ahead of it.

b. Security

To provide security for troops resting in a large mountain valley, the command first turns its attention to the roads and trails which the enemy has to use. Often the enemy can make use of observation posts and firing positions at points of vantage on flanking or frontal heights which friendly troops are unable to occupy; hence, to prevent surprises it may be necessary to organize protective fires with heavy arms. Obstacles and anti-tank weapons can always give protection against enemy tanks on wide valley roads.

In forested or rocky regions, trails and roads should be guarded first of all, and then, for the security of troops at rest, patrols should be sent out as far ahead as possible. When the enemy is near, the terrain between the opposing forces, even if apparently impassable, also should be watched carefully, especially at night. When terrain conditions are simple, the security elements are organized as they are in the flat. In broken terrain where observation is difficult, the security units for retreating forces should take their rest in, or directly behind, the position which is to be held in case of enemy attack; at night, the position should be protected by combat outposts and scout squads. Insufficient security, particularly when the troops are very tired, is a false and dangerous economy of forces. Protection against surprise air attacks must be given special attention.

c. Shelter

In high mountain country it is difficult, even in well-settled valleys, to find permanent shelters where large forces can quar-

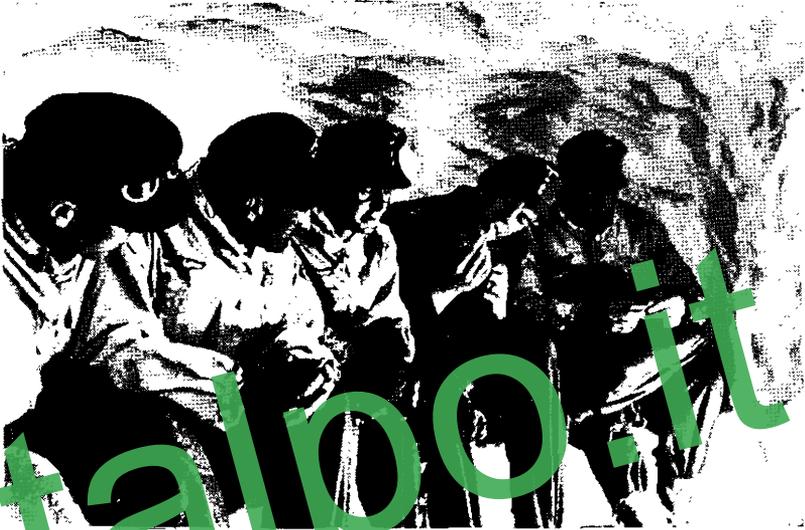


Figure 2.—Mountain troops resting in a snow shelter.

ter; outside the valleys the density of population and the amount of shelter available quickly decrease in inverse ratio to altitude. Huts in mountain pastures, hay sheds, and forest huts and shelters are a last resort, for they can accommodate only small units. Hence, especially in high places, the troops must know how to take advantage of the terrain so that by using their tents they can set up a weather-proof bivouac quickly. They must also know how to make shelters in deep snow as a protection against wind and cold (fig. 2). Mountain troops learn while in training to spend winter nights in bivouacs at high altitudes.

Commanders, however, should not overlook the fact that over a long period temporary bivouacs are not good shelters. The greater the physical demands upon the troops and the more severe the weather, the more necessary it is to replace the bivouacs by improvised shelters as soon as the situation permits. The comfort of the troops should be considered; tents, huts, and barracks ought to be heatable and windproof. So far as possible,

bivouacs and emergency shelters must be protected against enemy ground and air observation, enemy attack, and mountain dangers.

4. COMBAT

a. General

The significance of numbers should not be underestimated even in high mountains, but in such terrain superior leadership and morale, toughness, and mountain training will make themselves felt. With men able to move over all kinds of steep rock, snow, and ice, and adept at military skiing in high mountains even under the most difficult conditions, the command has a basis for remarkable achievements. The combat plan must always aim at surprise, but successful surprise action depends on efficient soldiers and a commander who knows how to use them. Although local superiority in numbers and matériel often suffices for small-scale attacks, an assault on well-prepared positions demands a considerable superiority of forces and a well-organized plan of supply.

b. Attack

(1) *Advance and Deployment.*—Combat in mountains, like combat in the flat, usually is fluid in its early stages. The advance guard secures time and space to enable the main body to deploy or to occupy positions from which it can attack most effectively. Usually it takes a long time in mountains for the attack really to get under way. Until it does, the commander must see to it that the advance guard is strong enough to bear the whole burden of the battle.

When the disposition of the enemy is uncertain and the terrain is difficult, the advance guard must often go forward by bounds; that is, it advances from point to point under the protection of the heavy weapons and artillery. In open terrain, where lateral movements are risky, the advance guard may have to ad

vance while deployed in order to be better prepared for action in case of a surprise encounter with the enemy.

It is difficult to withdraw the advance guard, even before the enemy has actually pinned it down, without subjecting it to heavy casualties. It is possible to withdraw it with moderate losses only if orders can be distributed quickly and the terrain is suitable for a withdrawal.

Mountain infantry moving up to the line of departure must take full advantage of the terrain and deploy as quietly as possible. In difficult terrain the reinforced battalion is generally the largest formation that can attack as a unit. When the operation takes place at night, the routes of approach must be frequently and carefully marked by conspicuous signs; the men may not use lights, and they must relay orders in whispers. In the daytime they must use hand signals whenever possible. Crossing even short stretches under enemy observation betrays the plan of operations. Everything depends on the conscientiousness and self-discipline of each individual. Every assault soldier must receive information concerning the enemy and know his situation accurately.

Systematic measures of deception should veil the occupation of the line of departure for the attack, as well as the main thrust, so that the time, place, and direction of the attack will completely surprise the enemy. These deceptive measures must be of many kinds, must cover several days if necessary, and, taken together, must show a definite trend. Even though they do not always draw the enemy reserves to the wrong flank, it is important to keep the enemy in a state of uncertainty until the battle has been in progress for a considerable time.

(2) *Effect of terrain.*—A unit moving downhill has the advantage of being able to go into action rapidly, but ascending units often have opportunities to use heavy weapons against an enemy descending into open terrain. When two adversaries are both moving uphill to seize a ridge lying between them, the heights themselves become the focal point of combat, and the commander must guide the action and influence its development by the capture

of decisive points. An energetic leader often does not wait for precise information from combat reconnaissance, but bases decisions on his general impression of the terrain, gained from the maps, and on preliminary reports. The rest can be done by troops fit for mountain operations. The artillery commander must see to it that fire is immediately laid down where the advancing infantry needs it.

In steeply rising terrain the attacking force may often have fire support for a long time. Good gunners manning heavy machine guns can hold down the defender until the moment before the attacking force penetrates the enemy positions. However, poorly placed fire which strikes friendly troops just before they reach the enemy positions leads to serious reverses. Support of the attack by heavy weapons requires careful liaison with the front line and strictest attention to the ballistic characteristics of the weapons and the effect of the rounds in the terrain. The cooperation of infantry, mortars and artillery in preparing the attack is particularly important when the terrain is difficult and the enemy has had time to organize his position and dispose favorably his heavy weapons. Troops threatened by the effects of the dispersion of artillery fire and the probable loosening of rocks must advance from the side so as to roll up the flank of the enemy thus held down by the artillery.

Often very small units succeed in penetrating the enemy position. The resolute exploitation of their success is a matter of great importance; but if, after a successful penetration, there are not enough forces to exploit the attack further, then the ground captured must be held. For this purpose all the heavy machine guns come up first and dig in (fig. 3). Support by artillery at this time will be more or less interrupted, because many of the batteries cannot reach beyond the newly occupied heights without displacing forward. Even though the forward artillery observers reach their new positions quickly, the changing of a battery position generally requires considerable time. Meanwhile the mortars can provide support.



Figure 3.—Machine gun (M.G. 34) emplaced in snow. (The long-legged antiaircraft tripod is used instead of the standard mount so that the gun may be firmly emplaced in the deep snow.)

In an attack over a downward slope without special terrain difficulties, movements are easier for the assault troops, and such an attack often has the advantages of good observation. Dead spaces and masks, however, may diminish the chances of putting artillery in position if the batteries are unable to find positions on a plateau but have to fire from a deeply cut transverse valley.

These unfavorable conditions are often encountered in combat around positions laid out on reverse slopes by a skillful enemy. Then only part of the artillery and the other heavy weapons of the attackers can reach the target area, and observation posts have to be placed on crests where they can easily be put out of action. The defender can take full advantage of the favorable terrain that he holds. In such a situation a bold surprise blow by

mountain infantry frequently offers the best chances of success, but the commander should first determine whether an assault can be made against another part of the position which is more vulnerable to attack.

(3) *Types of attack.*—Attack against an enemy organized for defense can succeed only after systematic reconnaissance and orderly preparation. The troops must come up to the assembly area by echelon. This sometimes takes several days because of the difficulties of the terrain and the activity of the enemy. Because the terrain between the line of departure and the enemy position often is difficult and sometimes is swept by enemy fire, troops must deploy for attack as near the enemy as possible, in order to cross the intervening ground rapidly. The heavy infantry weapons and the artillery must in this case take positions where they can protect the advance of shock troops and support the attack by directing the heaviest concentrations of fire at the point of penetration until a break-through occurs. As a rule, if the advancing troops deploy in several stages, some of the artillery cannot give them protection without a time-consuming change of positions and shift of observation posts.

Strong attacking forces usually advance simultaneously along a valley and over adjacent heights. Whether the main effort is through the valley or over the mountains depends on circumstances. In large-scale operations, however, the main attack must always follow the general course of the valleys, where large forces can deploy freely, where fire power can be used efficiently, and where supplies can be brought up in quantity. The accompanying attack over heights may have various purposes: to destroy the effect of enemy weapons, to occupy flanking heights, to hold down a possible enemy flank attack, or to support the attack in the valley by an attack on the flank and rear of the enemy forces in the valley. The attack over heights may be decisive when the attack in the valley no longer has any chance of success; it then becomes the direction of the main effort. If, on the other hand, the attack in the valley makes rapid headway, it is all the more

important that the forces sent over the ridges hold the enemy in the mountains and prevent him from acting against the column in the valley.

In small-scale operations it is of prime importance to occupy heights and thus increase the effectiveness of observation, use of fire power, and commitment of forces, but the lower terrain should not be neglected. In all mountain operations, the most effective attack is against the enemy's flank and rear. Although difficult terrain often limits its effectiveness, such an attack, if it reaches the rear communications of the enemy—who is usually dependent on only a few routes—may lead to his destruction. An attack against the flanks and rear may develop from a penetration of the enemy's front or from outflanking or encircling a wing; it always calls for bold and energetic leadership. When such an attack is on a large scale, strong forces with well-organized and well-protected supply lines must make a deep penetration, because a determined enemy will fight fiercely to keep open his lines of communication.

Fighting at a withdrawing enemy soon ceases to be effective, as does frontal pressure on him; the terrain always offers his rear guard favorable opportunities to resist and gain time. To be effective, pursuing forces must outstrip the enemy and, by attacking his route of retreat, quickly overcome rear-guard resistance.

c. Defense and Withdrawal

Defense demands a disproportionately large force, and in terrain where it is difficult to commit adequate reserves promptly at threatened places the defensive position must be made strong initially. High mountains with medium-mountain features such as wooded slopes and only moderately difficult cliffs call for a considerable defense force, because the enemy can make a decisive surprise attack at several points in such terrain. On the other hand, rifle units made up of skilled mountaineers can operate effectively in local defense, even with limited military training, although, as a rule, they cannot carry out even short counter-

thrusts except with further training and in combination with trained troops.

Small groups maintain the defense of the battle position. The points most threatened must be organized for all-around defense, and the groups must be so disposed that they can watch terrain that is apparently impassable, and, if necessary, cover it with fire. Commanders of heavy-weapons and artillery units make the careful reconnaissance needed to set boundaries within the main battle area and to work out a plan of combined defensive fires. The course of the main line of resistance will depend primarily on the tactical requirements of the mountain infantry and on the amount of cover it affords them.

All weapons should be organized in a unified fire plan to protect the front and to sweep with heavy and effective fire the areas in the foreground where the enemy is most likely to re-form before continuing the attack. Fire from the flank and rear must reach the gaps between the strongpoints on the main line of resistance. Sections hard to defend and particularly threatened must have support from reserves held nearby. Often the flank of the threatened sector offers protection against enemy fire for the reserve, as well as a favorable place for it to deploy. If for lack of a field of fire the defense of a narrow crest is difficult with the forces available, it may be best to leave only a line of battle outpost on or in front of the crest and place the main line of resistance on a favorable reverse slope. Such a location for the main line of resistance will put the enemy in an unfavorable position for observation, employment of heavy weapons, and deployment, and will give the defending weapons favorable positions in defilade and on the flanks.

The more difficult the defense of the battle position, the more important it is to have active patrols well forward to discover the disposition of enemy forces. If the defending forces are strong enough, their outposts block the enemy advance. The weaker the available forces, the more the combat outposts must rely on prepared positions, obstacles, and the denial of areas by

use of contaminating agents.⁴ If the enemy pushes into the main line of resistance and a quick counterattack by the reserves fails to drive him out, his penetration must be contained as much as possible. Even outflanked or surrounded elements must fight for each foot of ground to gain time. They have the advantage of terrain and observation, and usually they are fresher than the attacking forces.

The conditions of combat in mountains usually favor delaying actions. Withdrawing forces can establish numerous strong-points and firing positions on heights to enable them to withdraw to the next line of resistance unobserved by the enemy. The more difficult the terrain on which the enemy has to maneuver and use his weapons, the more effective the resistance can be. In operations on a larger scale, delaying actions will concentrate on the mountain depressions and valleys which are of particular importance to the enemy for his advance. By simulating occupation of heights, very weak forces, often mere patrols, can block roads and paths. As resistance becomes stiffer in the valley, stronger forces must be employed on the heights. Resistance in valleys may hold up strong forces for a long time, giving them no chance to deploy. During this time the main task of the force on the heights is to block the routes leading over the mountains to the flank and rear of the main body.

It is hard to maintain centralized command over forces retreating on a broad front on various roads and under widely different conditions of combat. To do so, the commander must be able to move about fairly freely, communications must be maintained and guarded, and subordinate commanders must be empowered to act independently for the good of the whole. To ensure this independence of action, missions must be assigned to the commanders of small units before the movement is attempted. Even

⁴The original text (sec. I. par. 35, p. 29) reads as follows: "Je schwächer die Kräfte sind, um so mehr ist von Geländeverstärkungen, Geländevertiefungen, Sperrern und Hindernissen Gebrauch zu machen, an die sich die Gefechtsvorposten anlehnen."—Editor.

if conditions are otherwise favorable, to break away from the enemy is difficult if the troops must be withdrawn in the daytime through a pass under fire of enemy artillery and airplanes. An alternate route should be chosen, if possible, but sometimes there is none.

Systematic withdrawal on a large scale must be masked and the enemy deceived; otherwise he may cut off large segments of the rear guard, particularly when the withdrawing elements are moving toward passes and defiles over difficult terrain. To prevent this, a strongpoint must be established in front of the pass or defile. Although in mountainous terrain the enemy cannot readily get a general view of the situation, withdrawal from combat in terrain under his observation should take place only after dark. Because of the limited road net it is important to withdraw trains promptly, leaving stores of food and ammunition behind along the route for the combat troops withdrawing later. After a successful disengagement, troops covered by even a weak but well-deployed rear guard can easily fall back on a satisfactory new position.

5. MOTORIZED AND MECHANIZED OPERATIONS

The development of mountain road nets and the reinforcement of heavy-duty motor vehicles make feasible the use of motor vehicles of all kinds in mountainous regions. Motorized units are used in mountains on the same principles as in the flat, but limited space, steepness of roads, and weather conditions restrict their employment. Most motor vehicles have to stay in the large valleys and on highways, but lighter cross-country vehicles with sufficient ground clearance may go into the mountains. Tank reconnaissance units may operate successfully in large valleys (fig. 4), and machine-gun carriers and motorcycle units can execute reconnaissance missions particularly well. They can approach the enemy fast, reach important sectors quickly, and report at once by radio and motorcycle. Their great speed makes them par-



Figure 4.—Light tank (Pz Kw.) accompanying infantry in the Norwegian mountains (April 1940).

ticularly effective for surprise and for employment against the flank and rear of the enemy.

Combat vehicles can rarely be used in mass for decisive action in mountains. Light combat vehicles in small units can be used more often in valleys and on plateaus, and in surprise action they can render excellent service in reconnaissance, screening, pursuit, and attack against enemy flanks. They can be sent cross-country off roads and highways in winter if the terrain is not too steep and has a packed snow cover.



Figure 5.—Captured German half-track vehicle (Kettenkrad) frequently used for transport by mountain troops.

If properly adapted to the characteristics of mountain terrain, cross-country trucks and tracked vehicles (fig. 5) can facilitate movements of troops and supplies in the valleys. Snow more than 1 foot deep, ice, and darkness may considerably limit or prevent the use of such vehicles; therefore, landing, unloading points, and by-passes have to be reconnoitered when weather conditions are adverse.

Neither tracked vehicles nor cross-country wheeled motor vehicles can negotiate steep slopes, and no vehicle should cross difficult terrain alone; help from other vehicles with tow ropes and winches must be available. Damage and rapid wear of matériel, delays due to motor stalling, and high fuel consumption result from cross-country operations. In winter special measures must be taken against severe cold. Motor units should avoid relatively long stops. There is more wear and tear and a higher fuel

consumption in mountains than in the flat; consequently, ample supplies of fuel and spare parts are needed for all vehicles, and time must be allowed for overhauling.

6. AIR OPERATIONS ⁵

The lack of suitable advanced and intermediate airfields may hinder the use of reconnaissance planes assigned to the Army for mountain operations; moreover, flying and observation of the enemy are difficult and special care is necessary in navigating over mountains. Observation often is made difficult by deep shadows in the valleys, low-hanging clouds, and, in the morning and evening hours, rising mist. Snow on the ground, however, facilitates reconnaissance.

Reconnaissance squadrons reconnoiter mainly rear communications. Major movements cannot escape detection from the air in fairly favorable weather. On clear nights reconnaissance over highways has a chance of success if flares are used, although balloon barrages in passes and valleys constitute a threat to such activity.

In addition to reconnoitering highways and valleys which are likely assembly areas for reserves, reconnaissance squadrons act as artillery observers for counterbattery missions for which the organic artillery reconnaissance units are inadequate. Because of the difficulty of observation squadrons for these missions require more airplanes than in the flat. The aerial observer must be able to determine the location of advanced friendly elements. Recognition, however, is particularly difficult in the mountains, and the ground troops must help by extensive use of air-ground liaison panels.

Attacks by air-combat units against the rear communications of the enemy can disorganize his supply system and thus destroy his

⁵The rapid development in air warfare since the publication of the German manual undoubtedly has resulted in changes in German doctrine.—EDITOR.

freedom of movement. Besides engaging enemy reconnaissance and bombing formations, air-combat planes make low-level attacks against troop columns more frequently than they do in the flat.

Antiaircraft artillery is most effective when used on heights. When bad weather forces planes to follow certain routes along passes and valleys, prospects for effective antiaircraft fire are particularly favorable, but it is always necessary to know whether planes can fly below the antiaircraft gun positions.

Heavy antiaircraft batteries and 150-cm antiaircraft searchlight batteries seldom can find good positions in the mountains, because the road net and the carrying capacity of bridges are limited, and because observation points and gun positions are few. These batteries (fig. 13) can be used on heights only if suitable highways or mountain railways are available. It takes a long time, however, to place heavy equipment, hauled by railway, in position. Consequently heavy antiaircraft batteries are employed mainly against enemy aerial reconnaissance, and protect important traffic centers, depots, and assembly areas for reserves in valleys and approaches to mountainous regions.

Light 20-mm and 37-mm antiaircraft batteries and the 60-cm antiaircraft-searchlight platoons can usually go into position on heights and side slopes and thus protect mountain troops in the front lines. In mountain warfare, command of antiaircraft artillery should be centralized, but because of the extensive dispersion of the combat elements of mountain troops, the direct subordination of some batteries to tactical units cannot always be avoided.

The same rules apply for Air Force signal units operating in high mountains as for Army signal units. Motorized air-raid warning companies and mountain air guards, trained in peacetime, comprise the air-raid warning service.

In mountains as elsewhere no plane may take off without a written forecast from the weather service. Motorized weather stations, which are subordinate to the Air Force commander with the Army command, provide weather reports, which are based



Figure 6.—88-mm heavy antiaircraft gun (8.8 cm Flak) in position to cover Italian mountain communications.

on data from the general meteorological service supplemented by local observation by the advanced weather sections of the Army and the Air Force. These stations are at the disposal of Army units in the mountains for information bearing on weather and road conditions.

7. MOUNTAIN INFANTRY

a. Mountain Rifle Company ⁶

(1) *Squad*.—On narrow mountain paths the squad of the mountain rifle company (*Gebirgsjägerkompanie*) marches in double or single file. In pathless terrain, it marches in single file only. The intervals from man to man depend on the terrain, and because of the strong tendency toward accordion movements in the column, enough distance must be allowed for each man to climb without causing the man following him to change his pace. Orders to slacken pace should be issued before the men start climbing. The men carry their rifles slung, and pack animals carry the light machine gun and its ammunition as long as the terrain and the situation permit. The soldier puts on special mountaineering equipment on order of the squad leader.

In situations where light machine guns can be employed effectively, a rifle squad working forward can provide itself with support by overhead fire from a flank or from a height. In an attack up a slope, however, overhead fire generally cannot come from within the squad, and supporting fire is feasible only from the flanks or through gaps between the men. The distance between the men in an attack changes as the character of the terrain changes; but the men must be close enough together to be able to work as a unit, and the squad leader must maintain control at all times. Especially in uphill attacks he must keep his squad fresh by resting it from time to time under cover. Often difficult terrain offers a better opportunity for surprise than easy ground, but a squad cannot climb difficult places under effective enemy fire. The closer the squad gets to the enemy, the more it should guard against counterthrusts. In mountains, a failure of the attack just short of the objective always leads to heavy losses and frequently to complete annihilation. Every man of the squad must be aware of this and carry out the attack and penetration with the utmost determination.

⁶ See par. 24, p. 97.—EDITOR.

In defense, a squad holding out to the last man and the last cartridge at times determines the fate of a whole sector. A favorable opportunity for a limited counterthrust presents itself when the attackers, exhausted by their advance and hampered in the use of their weapons, approach the defense positions. The leader uses as little of the strength of his squad as possible to cover approaches; he holds the main part of the squad together, ready for combat, in a favorable position which has flank protection.

(2) *Platoon.*—After making route and terrain reconnaissance with his platoon headquarters, the platoon commander brings up details from the platoon to make the necessary route repairs. Over difficult ground the platoon may have to increase the intervals between squads to counteract the effect of accordion movements. On good roads and over easy ground the pack animals follow the platoon in close order. When at times the men must remove and back-pack the loads of the animals and help them over difficult paths and difficult terrain, the pack animals march with the squads. If the platoon has to advance for any considerable time without its pack train, the commander of the platoon train receives orders for his subsequent movements from the platoon commander. Details from the squads reinforce the platoon train in order to provide the train with security against the enemy and to help bring up animals and supplies.

The fact that separate squads often have to attack over various kinds of terrain must be taken into account in planning the advance of the platoon. To hold the platoon together and assure control by the commander, it may be advisable to approach the enemy by stages, reorganizing several times. Reserves accompanying the attacking platoon follow closely over terrain offering the most cover, in order to exploit its success or to intercept enemy counterthrusts. If the heavy weapons can no longer support the attacking platoon and it needs fire at once, its own light machine guns must form a powerful fire echelon under a single leader. At an early stage the platoon commander should

designate his exact objective so that he will have the support of heavy weapons and artillery fire when he needs it. After a successful penetration, he decides on the next move of the elements which make the penetration. A bold advance by the platoon in a favorable direction can exploit the success of the unit to an extraordinary degree.

In defense, the platoon reserve waits in readiness just behind or on the flank of particularly threatened points of the defensive area. If the enemy penetrates the forward defense position, the reserve makes an independent surprise attack in accordance with the plans of the platoon commander. The reserve must maintain close signal communication with the engaged elements of the platoon and must have detailed knowledge of the terrain. For the execution of independent attack and defense missions in mountain terrain, machine guns, trench mortars, and artillery frequently are attached to the platoon. The platoon commander must know the use and effect of these weapons in combat and how to assign to them a definite mission.

(3) *Company*.—The rules for the platoon apply also to the company. Under ordinary circumstances the interval between platoons is 20 paces, but it may be changed when expedient. Under difficult conditions the company commander may order changes. If the combat unit is with the company, he assigns men from the platoons to help it in difficult places.

From the beginning of the attack the company commander must know whether he can employ his whole company effectively in the sector assigned him; crowding may well lead to heavy losses and reverses. Usually once his company has started to advance for an attack, the commander can change his plans only with a considerable loss of time, if at all. His influence is sharply limited because his men generally have to advance along a wide front over terrain which cannot be seen entirely from any one point. To coordinate the advance of units going forward separately requires careful planning and control; the battalion may

have to help out by assigning the company some of its communication personnel and equipment.

In attack, the company often moves forward by stages, reforming frequently and continuing reconnaissance as it advances. Surprise is the key to successful attack; the commander must make use of the terrain to deceive the enemy about his intentions and to direct his forces along lines and toward points where the enemy does not anticipate an assault. It is easier to make a surprise attack by night than by day, but such movements must be mastered by special training. Often the area suitable for combat widens considerably behind the point of a narrow penetration so that an increased number of the enemy can deploy effectively for defense. The attacker must take this possibility into account in his plan so that if his main effort is in the area of penetration, his reserves can follow through skillfully and promptly.

In defense, the breadth of the company sector and the varied nature of the terrain often necessitate the issuance of orders in advance and special arrangements for communication. If the company cannot organize its defense in depth, the commander must offset the danger of an enemy penetration by reinforcing the combat outposts, by increasing flanking fire, and by emplacing silent machine guns and artillery.⁷ Often he can provide an effective defense by putting the main line of resistance on a reverse slope. He can also set up strong points on heights and at points which the enemy must pass.

Under certain conditions the company may have to use a mobile defense, wholly or in part. It may be advisable, for example, to have only outposts at an important part of the company sector particularly exposed to observed fire from the enemy, and

⁷ A "silent" machine gun or "silent" artillery piece is a weapon placed in a well-concealed position close in to or on the flank of the main line of resistance. It holds its fire until the enemy is at point-blank range.—EDRROB.

to hold the main force under cover ready to attack the ascending enemy the moment that he penetrates the line. For this kind of defense the sector must not be too wide and the terrain must favor a counterthrust supported by heavy weapons, which nearly always will be attached to the company in defense as well as in attack. When the company commander has a broad front to defend, it will often be difficult for him to draw off a reserve and find a satisfactory position for it, but he should not be entirely without a final reserve.

b. Mountain Machine-gun Company⁸

(1) *General*.—The mountain machine-gun company (*Gebirgsmaschinengewehrkompanie*) is armed with heavy machine guns and mortars. The heavy machine gun, which can follow mountain infantry everywhere, is either transported on pack animals or carried by the crew (fig. 7). It often not merely complements, but replaces, the artillery. The terrain and the ballistic characteristics of the machine gun, which present more difficulties in mountains than in the flat, affect its employment in combat. The observation of the cone of fire in mountains is more important than in the flat because of the frequent contraction of the beaten zone. Firing in rocky and dry terrain makes observation easier, and making proper allowances for the effect

⁸ See par. 24, p. 97. The German manual anticipates the inclusion of a heavy weapons company (*Schwere Kompanie*) in the mountain infantry battalion (see par. 2, p. 93). At that time, 1935, German tables of organization called for a mortar company as well as a machine-gun company for the battalion. Tactical principles for the mortar company, however, apply equally well to the mortar platoon of the machine-gun company, and have been incorporated in the appropriate sections. The only exception follows: "On the march the commander of a mountain infantry mortar company is with the force commander, and in combat is with him or with one of the platoons. He supervises the firing of the mortars to see that they follow the tactical plan of the commander and controls supplies and replacements." To what extent this practice applies to the role of the present-day mortar-platoon commander is not known.—EDITOR.



Figure 7.—Machine gun (M.G. 34) on a standard tripod. (Heavy machine-gun squads are equipped with this mount as well as with the standard tripod.)

of wind and cold on the ballistic properties of the machine gun will speed the adjustment and improve the prospect of effective firing.⁹ Usually the heavy machine gun will use direct fire from

⁹ German rules for the care and use of machine guns and other weapons in conditions of extreme cold will be found in "German Winter Warfare," *Special Series*, No. 18 (15 Dec 1943), sec. XIII, p. 154.—EDITOR.

a concealed position. Alternate firing positions must be prepared, but in selecting them it must be kept in mind that a major change of position takes a great deal of time.

The mortar can follow mountain infantrymen off the road over easy ground, and because of its range and its high trajectory it can put fire on targets that other weapons can reach only with great difficulty, if at all. It can also occupy positions, defiladed from the enemy, from which artillery and other weapons cannot fire. The rules for artillery with respect to reconnaissance, marching, combat methods, and security apply also to mortars.

In mountain warfare, heavy machine guns generally are used by platoons, and even when all the guns of the company are used as a unit, the platoons will be allowed more initiative than in the flat. For this reason the platoon commander must have a thorough knowledge of battalion combat methods in mountains and be able to lead his men in accordance with sound tactics and firing principles. The same is true to an even greater degree for the company commander; the latter strives, even when the platoons are separated, to control the fire of the whole company in order to get a concentrated effect. He can thus prevent the scattering of fire on targets of minor importance. To be capable of independent action, the mortar-platoon commander also must know the principles of mountain combat and be able to deliver accurate fire with his weapons.

(2) *Marches and reconnaissance*.—The rules for march intervals are the same as for the mountain rifle company. To avoid tiring the men, pack animals carry the heavy machine guns as far as possible. Over long and very muddy stretches loads must be taken off the animals and manhauled. If speed is required and bad conditions force frequent unloading, the commander will order the men to carry the equipment and fix a moderate rate of march, particularly at the beginning. He will also take steps to prevent the men from falling down slopes and will arrange reliefs for men carrying heavy loads. The pack train left behind should receive definite orders. Often the unloaded animals must go over

detours and meet the company later at a rendezvous where they may be loaded again. The heavy machine guns always must have security against surprise attacks, for an encounter with enemy patrols may take place at any time.

On the march, infantry mortars are generally attached to the advance guard. If at all possible, they should be carried into position on pack animals.

In mountains the reconnaissance of firing positions and observation posts takes a long time, if the combat zone is to be covered effectively. The platoons must have time to find positions from which they can carry out as many missions as possible. From well-located positions machine guns can deliver cross fires, while the forward and rear platoon positions provide mutual support. Lateral and forward posts must supplement the main observation post.

Hasty reconnaissance leads to an early change of position and to an unnecessary interruption of action—a serious matter, because the heavy machine gun is frequently the only heavy weapon available to support the rifle company. Men from the platoon headquarters and the company headquarters detachment with special training and much mountaineering experience should be used for route reconnaissance. Frequently they should be assigned an engineer section with pack animals to carry entrenching tools.

(3) *Employment in combat.*—If the heavy machine guns are in positions close to the forward elements of the rifle company, they will have close contact and good communications with them as well as a good field for effective flanking fire. If they are not disposed in depth, however, they may not be able to fire over the heads of the riflemen, to clear the masks close to their firing positions, or to repel an enemy penetration. Machine guns emplaced relatively far from the front line can deliver overhead fire and can operate from behind cover and at points beyond the effective range of rifles and light machine guns. Machine guns so emplaced can support riflemen attacking across a valley all the way

up to the enemy line, and can also provide covering fire if the riflemen are thrown back or enveloped. Crews of machine guns echeloned in depth, however, have a hard time observing targets and maintaining communications with the front line in an advance. They can rarely fire from defilade in high mountains, but will generally use direct fire from concealed positions, resorting to indirect laying only for distant targets.

In order to coordinate firing and change of firing positions so that the riflemen closing in on the enemy will get continuous support, machine guns must be displaced by echelon in defense, silent machine guns¹⁰ cover dead space and support defense at short range, from the flanks, if possible. The coordination of the heavy machine guns with the other heavy infantry weapons, particularly those with a high trajectory, and with artillery, is even more important in mountainous terrain than in the flat. To achieve the cooperation necessary for the utmost effectiveness of the few heavy weapons available for defense, fire plans must be prepared in advance. Heavy machine guns are well suited for delaying actions and withdrawals, but in mountainous terrain they often cannot be fired at their maximum range.

Because of limited visibility in mountainous terrain heavy machine guns are frequently attached to front-line companies, the smallest attached unit being generally half a platoon. Because the difficulty of supplying ammunition affects the operation of machine guns in mountains more than in the flat, commanders and gunners must be trained to economize on ammunition. They must also learn to recognize the most dangerous adversary quickly and must engage him at once.

Mortars may be used separately or as a unit, depending on the situation. In combat they supplement the artillery, and they are particularly suited for very close cooperation with units in the front line. Indirect firing is usually the rule, but frequently direct mortar fire will be very effective. After a rapid occupation

¹⁰ See p. 29, note 7.—EDITOR.

of a concealed position, the mortars can quickly fire on point targets and moving targets. Their fire is likely to be especially effective on targets that are higher than the firing positions.

c. Mountain Infantry Battalion¹¹

Usually the mountain infantry battalion (*Gebirgsjägerbattalion*) is the largest tactical unit which is employed for independent missions.¹² It may be reinforced with mountain artillery, heavy weapons, combat engineers, signal-communication troops, and supply columns.¹³ The personality of the commander, the example that he sets for his men, and his mountain experience must develop troops with spirit and an ability equal to the requirements of mountain warfare. He must have a well-developed understanding of terrain difficulties and a sense of timing troop movements.

The battalion usually marches in one column with advance, flank, and rear security units whose strength depends on the situation. It rarely marches in several columns; but if the situation requires more than one column, the separated units must know how to fight and maintain themselves independently. To achieve surprise, battalions may march at night and in fog, but only with good leadership and thorough advance reconnaissance.

To recognize and reconnoiter the key routes of approach over which attack is possible in the mountains is the task of combat reconnaissance; to exploit such routes tactically constitutes an art of command. Often the initial disposition for the attack is decisively important. To deploy heavy weapons takes a long

¹¹ See par. 24, p. 97.—EDITOR.

¹² The German mountain infantry regiment, for all practical purposes, is an administrative unit. The absence of a discussion on the tactical employment of the heavy-weapon company (*schwere Kompanie*) (see par. 25, p. 98) in the German manual is due to the fact that this organization was not a part of the battalion when the manual was published.—EDITOR.

¹³ The degree of reinforcement necessary may now be different because antitank and infantry guns, the 120-mm mortar, and an engineer platoon were made organic in the mountain infantry battalion after the German manual was published.—EDITOR.

time, and to change their position successfully without seriously interrupting protective fires calls for careful planning. The battalion commander detaches a reserve from the heavy-weapons company only to support a change in the battalion position. In attack, centralized fire control of the heavy machine guns and infantry mortars is a goal, although the terrain often demands the use of platoons, half platoons, and even single mortars. It is necessary to attach heavy infantry weapons to individual companies operating in mountains more frequently than in the flat.

The mountain artillery, which is nearly always under the control of the battalion commander, supports the attack as long as possible without displacing. Individual guns whose effectiveness can be increased by the allotment of additional ammunition may be brought well forward even at the beginning of the attack. By liaison with the artillery commander and by dependable signal communication with all of his heavy-weapons units, the battalion commander must try to have fire shifted where he needs it as the attack develops.

It is well to hold reserves near elevations and crests from which they can launch an attack downhill. Mobile mountain infantry is particularly well adapted to pursuit in mountainous terrain. By pressing on in a daring manner, often without artillery support and without stopping anxiously on lines where the enemy offers little or no resistance, the battalion renders its best service to the force of which it is a part.

Clear arrangements for the responsibility of command, for disposition of reserves, and for careful siting of the heavy weapons are of prime importance when the battalion is in a defensive position. The numerous dead spaces and angles nearly always found in front of mountain defense positions should receive special attention. Heavy machine guns, trench mortars, and, when necessary, individual cannon should protect its flanks. Alternate firing positions must be prepared in advance so that heavy weapons discovered by the enemy can be quickly shifted. A fast and dependable observation and liaison service must keep

a sharp lookout for the approach of the enemy. If it is not necessary to employ the whole force close to the main line of resistance, and if an easily accessible position is available, the commander creates a reserve. Sometimes a defensive disposition in small groups may be advantageous.

d. Mountain Antitank Company¹⁴

The limited cross-country mobility of its prime mover limits the antitank gun to the immediate vicinity of roads and highways of valleys and passes.¹⁵ Although it can reach the zone in which medium and heavy tanks can operate, it will often have trouble negotiating mountain slopes and high valleys where small tanks may appear. Off the road the piece nearly always has to be manhandled. The split rail of the gun requires a firing position as nearly level as possible. A slight difference of level between the wheels and the trails makes it hard to elevate and depress the tube.

The commander of the mountain antitank company (*Gebirgs-panzerjägerkompanie*) is the adviser of the regimental commander on all questions of defense against tanks. He, his headquarters detachment, and his communication section must master the technique of mountain climbing, but his command post must be accessible to motor vehicles.

The platoon commander must use his platoon to create unfavorable conditions for enemy movement and to develop favorable opportunities of action for himself. He must know the combat technique of tanks and be trained to build obstacles in a skillful manner. If his platoon is employed independently, he is responsible for the supply of ammunition, equipment, and food. The platoon commander and his headquarters detachment must

¹⁴ This antitank company of the mountain infantry regiment is not to be confused with the component companies of the mountain antitank battalion (see pars. 23, p. 96, and 27, p. 101).—EDITOR.

¹⁵ This would not be entirely true of an antitank gun on a self-propelled mount.—EDITOR.

be qualified as Army mountain guides¹⁶ so that they will be able to reach observation posts by climbing difficult slopes.

When advancing through narrow valleys, the guns should be distributed in the march column early, because, once the march has started, it may be impossible for them to pass other units. If enemy armored vehicles are reported when the march column is approaching a pass, it is advisable to manhandle the leading piece, tube forward, over short stretches. The platoon commander sees that the men moving the forward guns are properly relieved. Snow limits the movement of the platoons to cleared and packed roads, and ice on the roads frequently slows up the march.

The antitank company rarely fights as a unit; the platoon is the unit normally employed. In its area, which usually is very small, the platoon organizes gun positions that command the enemy's line of approach. Under the leadership of the chief of section the gun crews should be able to manhandle the gun up steep slopes for short distances and even in difficult terrain should be ready to fire quickly. They will do most of their firing by direct laying on fast-moving targets which are visible only momentarily. They also erect most of the antitank obstacles, but engineers are often attached to set up extensive obstacles at key points.

The mission of the light machine-gun party of the antitank platoon is mainly to protect the antitank guns, but it can also help defend the antitank obstacles. The platoon commander cannot always count on the assignment of mountain infantry for security of the gun position. Going into position requires so much time in mountainous terrain, and observation of the enemy line of approach is so difficult, that it is necessary to prepare to fire early. The antitank guns, therefore, cannot be kept coupled to their prime movers behind the obstacle. In broad valleys and on extensive plateaus the platoon operates as in the flat.

¹⁶ See sec. III, p. 79.—EDITOR.

Because the company commander can seldom set up a centralized warning service the platoons themselves must operate the warning service in their sectors. They are usually aided by personnel of the company headquarters detachment and of the communication section.

For attack in a valley the guns, after a reconnaissance, should be brought up to the rendezvous or firing position in echelons. Defense requires careful reconnaissance of the possible line of approach for enemy tanks and a sharp lookout for them in valleys on the flank and the rear. The difficulties of the terrain usually prevent a shift of the platoon during combat.

8. MOUNTAIN ARTILLERY

a. General

The basic tactical principles for artillery in the flat remain valid in mountains. In the approach march and in combat, horse-drawn and motorized artillery is limited to the roads and their immediate vicinity. The problem of clearing masks from mountain roads usually limits flat-trajectory guns to long-range missions, but there are many opportunities to use high-angle guns.

Mountain artillery (*Gebirgsartillerie*) can follow mountain infantry off the mountain trails over easy ground, but snow, bogs, or muddy roads, especially in the spring thaws, may seriously hinder its employment. Mountain artillery can rarely fire in groups or batteries, or even as single batteries, because of the limited space for gun positions and the difficulty of fire control; usually it is employed by platoons or individual guns. Occupation of positions and replacement of ammunition are much harder and more time-consuming than in level country. Firing in mountains differs from firing in the flat; the guns will usually make precision adjustments and fire planned concentrations.

¹⁷ See par. 29, p. 104.—EDITOR.

b. Reconnaissance and Observation

Successful and rapid employment of artillery in mountains requires careful and early reconnaissance of routes, gun positions, and observation posts. With the help of a map the artillery commander gets a general idea of where the guns may find good firing positions. Artillery reconnaissance units, sent out with those of the mountain infantry and assigned to definite artillery sectors, must determine the opportunities for firing which are open to the different types of artillery. The use of motor vehicles on roads and mountain horses on paths will speed up artillery reconnaissance considerably. In addition to the reconnaissance of the artillery commander every subordinate commander must make his own route reconnaissance and see that his approach route is passable and is marked.

The reconnaissance of heights for possible observation points must go on regardless of the difficulties of terrain. Because bad weather can prevent observation for long periods, and visibility and conditions of observation often change very quickly and unexpectedly, it is often necessary to install several auxiliary observation posts at different altitudes. They should be distributed as widely and as irregularly as possible over the terrain to decrease the effects of enemy fire and to provide several complementary fields of vision, especially for lateral observation. These posts should always be organized as small centers of defense, and, if possible, should not be placed on conspicuous points. They should have prompt and dependable communication with the firing positions by several independent means; lateral communication should be arranged between observation posts, and from observation posts to adjacent units. Artillery observers with signal communication accompany the assault troops and direct fire to keep pace with the infantry advance.

c. Marches

Mountain artillery marches in mountain order, closing up to regular march formation only on roads. To save the pack ani-

mals, the pieces, or at least the carriage alone, can be drawn along good roads. For local security, the light machine-gun section marches at the head of the battery in advance and at the rear in retreat.

The artillery commander and his staff march in the advance guard with the force commander. The attachment of individual guns or platoons well forward in the advance guard is often advantageous; but because mountain artillery moves slowly by comparison with the other weapons and requires numerous road improvements, most of the pieces have to march at the tail of the column.

The gun and its crew march in close formation. Between the men and animals the distance should be only great enough to allow for the recession action of the marching column (fig. 8). The distance between the sections changes according to the character of the terrain. The order is given for slackening the pace before the beginning of the ascent. The gun crew takes measures to prevent noises when near the enemy.

Inept saddling and loading may chafe and gall pack animals and greatly decrease the mobility of the battery. Commanders of all grades in mountain artillery must carefully supervise the animal drivers and inspect saddling and loading, for if one gun load drops out, a whole piece is put out of action.

At the beginning of a march it is better to move too slowly than too quickly. Later the rate of march will depend on the steepness of the slope; the pace should be steady and regular, both uphill and downhill. A quiet, willing pack animal should head each unit.

There should be a short rest for examining saddles and loads not later than an hour after the beginning of an ascent. Pauses for breathing spells for the animals should not be made on very steep places. The first rest lasting at least 1 hour, during which the men unload the animals, should come no later than 3 to 4 hours after the start. A level spot where men and mules will not block the route makes the best resting place. All the animals



Figure 8.—Mountain artillery on the march.

should be made as comfortable as possible. On comparatively wide level places they should be placed crosswise to the route with their heads toward the valley.¹⁸

¹⁸ If the animals are faced toward the valley, they are not likely to back over the edge of a cliff; this may happen if they are faced up the mountain.—EDITOR.

In a steep descent check cords are used because they relieve the pressure caused by the load slipping forward. They are also useful at danger points. Animals should be marched over unavoidable boggy places with great caution; at the narrowest point a crossing should be strengthened by stones, earth, or branches. If the ground is too soft, the men may have to unload the animals. If the commander so orders, the packs of the men may be placed on the backs of the pack animals when the animals are hauling the assembled guns on good roads.

d. Employment in Combat

The bulk of the field artillery can find its best positions in broad valley bottoms and on the gradual slopes of the foothills (fig. 9). Often field pieces can be brought into position only by manhandling and roping, and the crews must be trained for this expedient. Deployment on a broad front is best for field artillery, but conditions will frequently force it to echelon in depth.



Figure 9.—Medium artillery (Skoda 150-mm howitzer) firing in the valley below Mount Olympus during the Greek Campaign (1941).



Figure 10.—150-mm howitzer (s.F.H. 18) on a mountain road. (This gun was employed by the Leibstandarte-SS "Adolf Hitler" motorized division during the Greek Campaign, 1941.)

As a rule, flat-trajectory batteries will be in the rear and high-trajectory batteries in front. Officers, observation sections, and communication sections of field artillery employed in mountains must have mountaineering equipment and training.

Mountain artillery provides the only reliable artillery weapons in mountains, except in large valleys. Emplacing mountain guns and replacing ammunition are generally difficult and require considerable time. Pieces must have positions that enable the commander to adapt the plan of fire to the conduct of the battle and to concentrate fires in decisive places. The force commander needs information on the availability of the artillery for certain missions; he must know in particular how long the main elements of the artillery will take before they are ready to fire. With situations hard to evaluate, liaison with the force commander cannot be too close.

Field artillery, especially high-trajectory batteries, initially protect an advance into large valleys or mountainous terrain on either side of valleys (fig. 10). When a column expects to encounter the enemy at the very beginning of an ascent or descent, some artillery should protect the movement. The remainder of the artillery remains in the march column, sending out advance patrols to reconnoiter possible gun and observation posts.

Mountainous terrain often makes it difficult for the artillery to provide continuously the protection needed for an assault on an organized position; more frequently than on the flat it displaces forward by echelon. Under the protection of the artillery units in position, the other batteries follow the assault troops, and, by leapfrogging, keep up with the advancing infantry. In case of an encounter, the displaced echelon gives direct support to the forward units. Because of the time necessary in getting mountain artillery ready to fire (fig. 11, p. 46), the artillery commander should save time by advance planning.

Mountain artillery can rarely support an attack from all the positions from which it has covered the deployment and assembly; most of the observers and the pieces will have to have new and



Figure 11.—Roping an artillery piece down a cliff.

carefully reconnoitered positions. Because the field of vision from the observation post will often extend up to the point of penetration but not deep into enemy terrain, artillery observers must accompany the assault troops and further observation must be furnished by air units.

The communications of artillery with the assault troops and the coordination of its fire with those of other heavy weapons require special care. The assault troops need highly effective support up to the very point of penetration. Without such support they are likely to draw fire just before they reach their objective. An infantry attack over rising terrain is easier to support up to the moment of penetration than one over descending terrain but in the former case artillery fire may dislodge rocks which will endanger the advancing troops. Often in the last stage machine guns and mortars must take the place of artillery.

In a pursuit through mountains, artillery fire is needed to help overcome quickly the resistance of enemy rear guards taking advantage of cover, but getting enough ammunition forward in time becomes the critical problem. In such a situation it is hard to establish a balance between ammunition supply and food supply, even in broad valleys.

In mountain terrain, artillery defensive fires are hard to lay down, because the areas that the enemy uses for carrying out his attack are often masked, full of dead spaces, and widely separated. By means of well-placed observation posts, good communications with batteries, platoons, and individual guns, and an abundant ammunition supply, the commander must make up for limited fire power by greatly enhancing the flexibility of his defense. In many places the other heavy weapons supplement or replace artillery, and in others the pieces can be used only as silent guns¹⁹ far forward and on the flank. In sectors where only a mobile defense of counterthrusts is feasible, the artillery must adapt itself to the situation by echeloning in depth. The fewer the possibilities of frontal action, the more the batteries must be alert for surprises and be

¹⁹ See p. 29, note 7.—EDITOR.

ready to fire on an enemy that has penetrated the defense position. In case of a breakthrough, the batteries join with the centers of resistance in the front line and organize strongpoints which must fight, if necessary, until the guns are lost.

9. MOUNTAIN ENGINEERS²⁰

a. Missions

Mountain engineers (*Gebirgspioniere*) should not be assigned tasks of minor importance. If the roads are good, motorized engineers may well be assigned special missions on and near them.

The most important missions of the engineers in mountain combat are—

(1) Construction and removal of major obstacles. The destruction of bridges, tunnels, and embankments along major roads and railways in defense and retreat and the replacement of mountain bridges in an advance may be of utmost importance in combat.

(2) Bridging mountain streams. The bridging of torrential streams with steep banks and highly variable water levels, and the construction of light, emergency bridges require special skill (fig. 12).

(3) Improvement of supply routes in sectors of special importance by blasting routes and paths in rock and ice, building bridges, cable railways, and supply slides.

The commander of the mountain engineer battalion (*Gebirgspionierbataillon*) is the adviser of the force commander in all engineering matters. On extensive projects the battalion operates as a unit, but usually it is divided into smaller groups. Projects in the rear areas must be turned over as soon as possible to work battalions in order to release mountain engineers for combat missions.

b. Employment in Combat

Mountain engineers should be incorporated in the advance guard, far forward, if necessary, and the mountain reconnaissance detachments must often be reinforced with an engineer de-

²⁰ See par. 30, p. 108.—EDITOR.



Figure 12.—Bridging a mountain stream during the Norwegian Campaign (1940).