CHAPTER IV

TACTICS

Section I. GENERAL TACTICAL DOCTRINES

1. Basic Doctrines

An outstanding characteristic of the German nation is its fondness for everything connected with militarism. This is based not only on traditional sentiment but also on long-range and intense education that glorifies the military spirit. This gives the German military leaders the essential foundation for aggressive military operations.

The Germans believe that only the offensive can achieve success on the field, particularly when combined with the element of surprise. German military literature, for the past century, has emphasized the need for aggressiveness in all military operations.

The Germans have been thoroughly aware of the psychological component in warfare and have developed systematic terrorization to a high degree.

At the same time they have placed considerable reliance on novel and sensational weapons such as the mass use of armor, the robot bomb, and the super-heavy tank. Their principal weaknesses in this regard have been their failure to integrate these new techniques with established arms and tactics—German field artillery, for example, did not maintain pace with German armor—and their devotion to automatic weapons at the expense of accuracy.

A highly trained officer corps and a thoroughly disciplined army are the necessary elements to implement this aggressive philosophy. German tactical doctrines stress the responsibility and the initiative of subordinates. The belief of former years that the German Army was inflexible and lacking in initiative has been completely destroyed in this war, in which aggressive and daring leadership has been responsible for many bold decisions. Yet, while the Germans have many excellent tacticians, they tend to repeat the same type of maneuvers, a fact which has been fully exploited by Allied commanders.

The German specialization in particular types of warfare such as mountain, desert, winter, or the attack on fortified positions, showed thorough preparation and ingenuity. At the same time the Germans had been quite willing to learn from their opponents and on numerous occasions have copied Allied tactics and weapons.

2. Recent Tactical Trends

From the time when the German Army was forced on the defensive by the Allied armies, German tactical doctrines have undergone modifications such as renunciation (except in unstated instances) of air support, and the substitution of linear defense for elastic offensive defense.

The primary goal of Germany today is to gain time and to achieve victory in a political sense, since the Germans are no longer capable of a military victory. Of necessity their military operations now supplement this effort and have become a large-scale delaying action.

3. Exercise of Command

The U. S. and German doctrines applied in exercise of the command are virtually identical. The Germans stress the necessity of the staff in assisting the commander to evaluate the situation and in preparing and disseminating orders to the lower units. They emphasize that the commander should be well forward with his units not only for the purpose of facilitating communication, but also because his presence has a salutary effect on the troops.

Section II. RECONNAISSANCE

1. General

a. PURPOSE. The purpose of reconnaissance and the types of units employed to obtain information are similar in the U. S. and the German Armies. German tactical principles of reconnaissance, however, diverge somewhat from those of the U. S. The Germans stress aggressiveness, attempt to obtain superiority in the area to be reconnoitered, and strive for continuous observation of the enemy. They believe in employing reconnaissance units in force as a rule. They expect and are prepared to fight to obtain the desired information. Often they assign supplementary tasks to their reconnaissance units, such as sabotage behind enemy lines, harassment, or counter-reconnaissance.

b. TECHNIQUE. Only enough reconnaissance troops are sent on a mission to assure superiority in the area to be reconnoitered. Reserves are kept on hand to be committed when the reconnaissance must be intensified, when the original force meets strong enemy opposition, or when the direction and area to be reconnoitered are changed. The Germans encourage aggressive action against enemy security forces. When their reconnaissance units meet superior enemy forces, they fight a delaying action while other units attempt to flank the enemy.

c. CLASSIFICATION. Reconnaissance is classified by the Germans as operational, tactical, and battle reconnaissance—corresponding to the U. S. distant, close, and battle reconnaissance.

2. Operational Reconnaissance *(Operative Aufklarung)*

Operational reconnaissance, penetrating over a large area in great depth, provides the basis for strategic planning and action. This type of reconnaissance is intended to determine the location and activities of enemy forces, particularly localities of rail concentrations, forward or rearward displacements of personnel, loading or unloading areas of army elements, the construction of field or permanent fortifications, and hostile air force concentrations. Identification of large enemy motorized elements, especially on an open flank, is important. Operational reconnaissance is carried out by the Air Force and by motorized units. Aerial photography units operate at altitudes of 16,500 to 26,500 feet. Since missions assigned to operational air reconnaissance units are generally limited to the observation of important roads and railroads, reconnaissance sectors and areas normally are not assigned. The motorized units employed for operational reconnaissance have only directions and objectives assigned.

3. Tactical Reconnaissance *(Taktische Aufklarung)*

a. PURPOSE. Tactical reconnaissance, carried out in the area behind the operational reconnaissance, provides the basis for the commitment of troops. Its mission embraces identification of the enemy's organization, disposition, strength, and antiaircraft defense; determination of the enemy's reinforcement capabilities; and terrain reconnaissance of advanced sectors. Air Force reconnaissance units and motorized and mounted reconnaissance battalions are employed for tactical reconnaissance. Their direction and radius of employment are based upon the results of the operational reconnaissance.

b. AIR RECONNAISSANCE. Tactical air reconnaissance is normally made from altitudes of 6,500 to 16,000 feet. As a rule, air reconnaissance units are assigned specific reconnaissance areas, the boundaries of which normally do not coincide with sectors assigned to ground units. Reconnaissance planes generally are employed singly.

c. GROUND RECONNAISSANCE. Sectors of responsibility are assigned to ground tactical reconnaissance battalions. In order to make them independent or to facilitate their change of direction, battalions may be assigned only reconnaissance objectives. In such instances, boundary lines separate adjacent units. The Germans avoid using main roads as boundary lines, defining the sectors in such a way that main roads fall within the reconnaissance sectors. The width of a sector is determined by the situation, the type and strength of the reconnaissance battalion, the road net, and the terrain. In general, the width of a sector assigned to a motorized reconnaissance battalion does not exceed 30 miles.

d. ORDERS FOR TACTICAL RECONNAISSANCE. Orders issued to a reconnaissance battalion or its patrols normally contain, in addition to the mission, the following:

(1) Line of departure.

(2) Information concerning adjacent reconnaissance units.

(3) Sector boundaries or direction of operation.

(4) Objectives.

(5) Phase lines.

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(6) Instructions for transmission of reports.

(7) Location of immediate objectives whose attainment is to be reported.

(8) Instructions regarding air-ground liaison.

(9) Time of departure, route, and objective of the main force.

e. TACTICAL RECONNAISSANCE PROCEDURES. When a motorized reconnaissance column expects contact with the enemy, it advances by bounds. The length of bounds depends on the cover the terrain offers as well as on the road net. As the distance from the enemy decreases, the bounds are shortened. The Germans utilize roads as long as possible and usually use different routes for the advance and the return.

The reconnaissance battalion commander normally sends out patrols which advance by bounds. Their distance in front of the battalion depends on the situation, the terrain, and the range of the signal equipment, but as a rule they are not more than an hour's traveling distance (about 25 miles) ahead of the battalion. The battalion serves as the reserve for the patrols and as an advance message center (*Meldekopf*), collecting the messages and relaying them to the rear. Armored reconnaissance cars, armored half-tracks, or motorcycles compose the motorized reconnaissance patrols, whose exact composition depends on their mission and on the situation. Motorcycles are used to fill in gaps and intervals, thereby thickening the reconnaissance net.

When the proximity of the enemy does not permit profitable employment of the motorized reconnaissance battalion, it is withdrawn and the motorized elements of the divisional reconnaissance battalion take over.

Divisional reconnaissance battalions seldom operate more than one day's march (18 miles) in front of the division, covering an area approximately 6 miles wide.

4. Battle Reconnaissance *(Gefechtsaufklarung)*

a. GENERAL. Battle reconnaissance as a rule is begun when the opposing forces begin to deploy. All troops participating in battle carry out battle reconnaissance through patrols, artillery observation posts, observation battalions, and air reconnaissance units. The information obtained on the organization and strength of the enemy provides the basis for the conduct of the battle.

b. ARMORED CAR PATROLS. The *Panzer* division dispatches armored reconnaissance units equipped with armored vehicles and numerous automatic weapons. The armored reconnaissance unit is fast and has a wide radius of action.

Armored car patrols normally are composed of three armored reconnaissance cars, one of which is equipped with radio. An artillery observer often accompanies the patrol so that in an emergency fire can be brought down quickly. This type of patrol usually is organized for missions lasting one to two days. Tasks are defined clearly, and nothing is allowed to interfere with the patrol's main objective. If enemy forces are met, action is avoided unless the force is so weak that it can be destroyed without diverting the patrol from its main task. If enemy action is anticipated, the patrol is reinforced with self-propelled guns and occasionally with tanks. Engineers and motorcyclists are often attached to the patrol to deal with road blocks and demolitions.

While scouting a woods, a favorite German ruse is to drive the leading car toward its edge, halt briefly to observe, and then drive off rapidly, hoping to draw fire that will disclose the enemy positions.

At road blocks, the leading car opens fire. If fire is not returned, men dismount and go forward to attach tow ropes to the road block. If necessary, the patrol dismounts and proceeds with machine guns to reconnoiter on foot.

A patrol is never split up, but in open country distances between cars may be as much as 200 to 300 yards.

c. OBSERVATION BATTALION AND AIR RECONNAISSANCE. The German observation battalion locates enemy artillery and heavy weapons positions by sound and flash ranging and evaluated aerial photographs. The Air Force assists in battle reconnaissance by observing the distribution of the enemy's forces, his artillery, bivouac and movements, reserves, tank assemblies, and any other special occurrences behind the front. In general, air battle reconnaissance is executed under 6,000 feet.

d. BATTLE RECONNAISSANCE PATROLS (*Spähtruppen*). The Germans send out reconnaissance patrols, consisting of a noncommissioned officer and three or four men, to get such information as the location of enemy positions and minefields. They generally avoid contact and retreat when fired on.

e. COMBAT PATROLS (*Gefechtsspähtruppen* or *Stosstruppen*). These consist of at least one noncommissioned officer and eight men, but are usually much stronger. As a rule the combat

patrol is commanded by a sergeant who has under him 15 to 20 men, organized in two equal sections, each commanded by a section leader. These are raiding patrols, and their mission often includes bringing back prisoners of war. Since Allied air supremacy has neutralized German air reconnaisance to a great extent, the Germans have placed increased importance on prisoners of war, especially officers, as a source of information on enemy strength, dispositions, and intentions.

Combat or other types of patrols are often sent out to test the strength of enemy outposts. If an outpost proves to be weakly held, the patrol attacks, occupies the position, and remains there until relieved by troops from the rear. If the patrol is strongly garrisoned, the patrol attempts to return with a prisoner of war.

f. SPECIAL PATROLS (*Spähtruppen mit besonderen Aufgaben*). These vary in strength in accordance with their special mission. Special patrols are sent out to carry out such tasks as demolitions, engaging of enemy patrols that have penetrated German positions, and ambushing enemy supply columns.

g. MISCELLANEOUS PATROLS. Engineer patrols are employed to reconnoiter approaches to fortified areas, defiles, or rivers. Artillery patrols, usually consisting of an officer and a few mounted men, reconnoiter routes of approach, observation posts, and firing positions.

h. TERRAIN RECONNAISSANCE (*Geländeerkundung*). The Germans place great emphasis on terrain reconnaissance, realizing the influence terrain has upon the conduct of operations. Most of their usual reconnaissance missions include terrain reconnaissance tasks. Terrain may be so important at times as to require reconnaissance by special units. Ground and air reconnaissance units give special attention to the road net—its density, condition, road blocks, mines, and demolitions—as well as to the terrain itself, particularly tank country.

i. EQUIPMENT AND SUPPORT. The Germans equip their ground battle-reconnaissance patrols with machine pistols and one or two light machine guns that are used to cover the patrol's approach or withdrawal. Engineers often are attached to guide a patrol through German minefields and to clear a way through enemy wire or mines. Artillery support is given in the form of harassing fire put down just before the patrol reaches its objective. Sometimes the artillery fires into adjacent sectors to mislead the enemy as to the actual area to be reconnoitered. In other instances, artillery and mortars that have registered during the previous day shell during the night the area to be reconnoitered. As soon as the barrage is lifted, the patrol advances under cover of machine-gun fire from flanking positions.

Section III. MARCHES

1. General

The formations and the organizations of the march column in day or night advances are the same in the German Army as in the U. S. Army and are governed by the same principles. For a smooth functioning of the march the Germans stress: systematic training and practice; attention to physical welfare; care of vehicles and equipment; previous reconnaissance of routes; warning orders; and the issue of detailed march orders.

2. Organization and Control of the March Column

In order to secure the march column against enemy attacks, the Germans divide the column in the same manner as U. S. doctrine prescribes, namely into Advance Guard (*Vorhut*), Main Body (*Gros*), and Rear Guard (*Nachhut*). German equivalents for the U. S. terms are:

Advance Guard

Spitze ..... Point
Spitzenkompanie ..... Advance party
Vortrupp ..... Support
Haupttrupp ..... Reserve

Rear Guard

Nachspitze ..... Rear point
Nachspitzenkompanie ..... Rear party
Nachtrupp ..... Support
Haupttrupp ..... Reserve

The issue of orders for march and traffic control is the responsibility of the higher command. Movement by road of formations from battalion strength upwards is carried out in the Zone of the Interior at the orders of the Army High Command (*OKH*) or a headquarters acting on the orders of the Army High Command. In the Theater of War such movements are controlled by Army Headquarters, which issues orders in accordance with instructions from Army High Command or the Army Group. Movements in the areas of military commanders of line-of-com-

munication areas are controlled by orders of the commanders of such areas.

Orders for movement are issued to the formations of fighting troops by the operations group of headquarters; those to supply services and units in the line-of-communication area emanate from the supply and administrative group.

The Germans set up a well organized traffic control service which is under the orders of the operations group. All traffic control services usually wear orange-red brassards, while the members of the military police are distinguished by metal gorgets.

The Germans allot to each front-line division its own road or sector of advance, usually marked by advance parties. General Headquarters or any other troops directed simultaneously on the same roads, are subordinated to the division for the duration of the move. All-weather roads usually are allotted to motorized or armored divisions, while subsidiary roads are assigned to infantry divisions.

3. Conduct of the March

When a German infantry division advances along several routes, an infantry element normally forms the head of each main body. The commander of the main body usually marches at or near the head of the main body. The motorized elements of the division, unless employed on reconnaissance or security missions, are organized into one or more motor echelons which follow the march column by bounds, or move in a column along a separate road. Before the march begins, the division signal battalion lays a trunk telephone line as far forward as the situation permits and extends this line while the march proceeds. The leading signal unit usually marches with the support of the advance guard and establishes telephone stations at important points. In a march along several roads the trunk line normally is laid along the route of the division commander and his staff. In addition to the construction of the trunk line, the Germans stress radio communications to the rear and flanks, as well as the use of messengers mounted on horses, bicycles, or motorcycles.

4. Security of March Columns

As a rule the Germans allot motorized units for the protection of the flanks and rear of march columns. However, a smaller unit, such as a battalion, may advance without flank security detachments.

The Germans are very much concerned about antiaircraft protective measures and often march in open columns (*Fliegermarschtiefe*); an advance in deployed formation (*Fliegermarschbreite*) is seldom practical. Antiaircraft defense is concentrated at important terrain features, such as bridges, crossroads, and defiles. Because of Allied air supremacy the Germans now instruct their troops to conduct movements and the transport of supplies only at night, and without lights. They also order their troops to leave burned out vehicles standing on the road to attract fresh attacks by enemy aircraft.

Section IV. OFFENSIVE

1. General

The fundamental principle of German offensive doctrine is to encircle and destroy the enemy. The objective of the combined arms in attack is to bring the armored forces and the infantry into decisive action against the enemy with sufficient fire power and shock. Superiority in force and fire power, the employment of armored forces, as well as the surprise element, play a great part in the offensive.

Coordination between the combined arms under a strong unified command is, the Germans emphasize, an absolute requisite to the success of these shock tactics. This has become more and more true as the Allies have developed effective antitank weapons and have adopted deeper defenses, limiting the self-sufficiency of German tanks. To counter these measures, the Germans have increased the mobility and armor protection of their motor-borne infantry, and have mounted a large proportion of both their direct and indirect heavy support weapons on self-propelled carriages.

In attempting thoroughly to paralyze the defender up to the moment of the tank-infantry assault, the Germans realize that even the most formidable forces are never sufficient for overwhelming superiority on the entire front. They therefore select a point of main effort (*Schwerpunkt*) for a breakthrough, allotting narrow sectors of attack (*Gefechtsstreifen*) to the troops committed at the decisive locality. There they also mass the bulk of their heavy weapons and reserves. The other sectors of the front are engaged by weaker, diversionary forces. In selecting the point of main effort, the Germans consider weaknesses in the

enemy's defensive position; suitability of the terrain, especially for tanks and for cooperation of all arms; approach routes; and possibilities for supporting fire, especially artillery. Although the Germans select a point of main effort in all attacks, they usually also make plans for shifting their main effort if they meet unexpected success elsewhere. To allow such shifts, sufficient reserves and a strong, unified command are organized.

An attack on a narrow front, according to German doctrine, must have sufficient forces at its disposal to widen the penetration while maintaining its impetus, and to protect the flanks of the penetration. Once the attack is launched, it must drive straight to its objective, regardless of opposition.

2. Types of Attack

a. FLANK ATTACK (*Flankenangriff*). The Germans consider that the most effective attack is against the enemy's flank. The flank attack develops either from the approach march—sometimes through a turning movement—or from flank marches. It attempts to surprise the enemy and permit him no time for countermeasures. Since mobility and the deception of the enemy at other positions are required, the flank attack is most successfully mounted from a distance; the troop movements necessary for the maneuver can be executed in close proximity to the enemy only with unusually favorable terrain or at night. Attacks are launched on both flanks only when the Germans consider their forces clearly superior.

b. ENVELOPMENT (*Umfassungsangriff*). The envelopment is a combination flank-and-frontal attack especially favored by the Germans. The envelopment may be directed on either or both the enemy's flanks, and is accompanied by a simultaneous frontal attack to fix the enemy's forces. The deeper the envelopment goes into the enemy's flanks, the greater becomes the danger of being enveloped oneself. The Germans therefore emphasize the necessity of strong reserves and organization of the enveloping forces in depth. Success of the envelopment depends on the extent to which the enemy is able to dispose his forces in the threatened direction.

c. ENCIRCLEMENT (*Einkreisung*). An encirclement, the Germans think, is a particularly decisive form of attack, but usually more difficult to execute than a flank attack or an envelopment. In an encirclement, the enemy is not attacked at all in front, or is attacked in front only by light forces, while the main attacking force passes entirely around him, with the objective of maneuvering him out of position. This requires extreme mobility and deception.

d. FRONTAL ATTACK (*Frontalangriff*). The Germans consider the frontal attack the most difficult of execution. It strikes the enemy at his strongest point, and therefore requires superiority of men and materiel. A frontal attack should be made only at a point where the infantry can break through into favorable terrain in the depth of the enemy position. The frontage of the attack should be wider than the actual area (*Schwerpunkt*) chosen for penetration, in order to tie down the enemy on the flanks of the breakthrough. Adequate reserves must be held ready to counter the employment of the enemy's reserves.

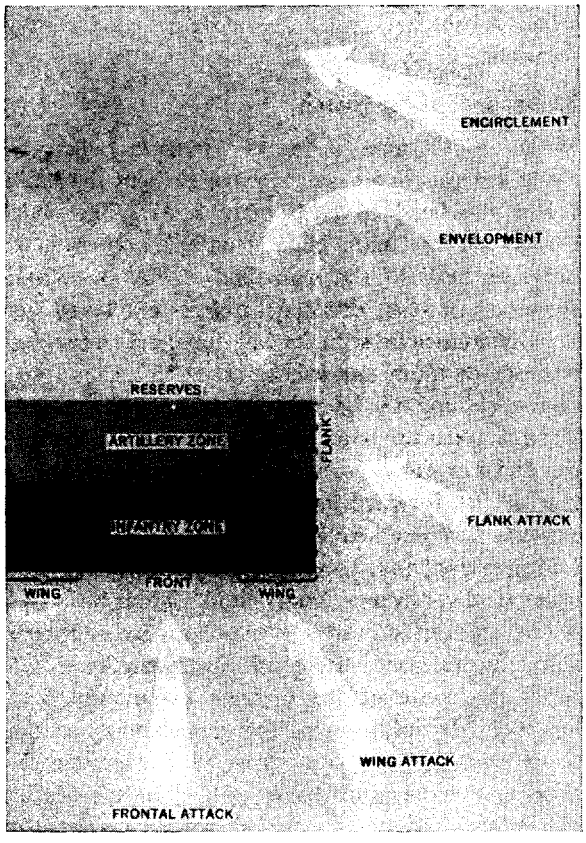


Figure 1.—Forms of attack.

e. WING ATTACK (*Flügelangriff*). An attack directed at one or both of the enemy's wings has, the Germans teach, a better chance of success than a central frontal attack, since only a part of the enemy's weapons are faced, and only one flank

of the attacking force or forces is exposed to enemy fire. Bending back one wing may give an opportunity for a flank attack, or for a single or double envelopment.

f. PENETRATION (*Einbruch*) AND BREAKTHROUGH (*Durchbruch*). These are not separate forms of attack, but rather the exploitation of a successful attack on the enemy's front, wing, or flank. The penetration destroys the continuity of the hostile front. The broader the penetration, the deeper can the penetration wedge be driven. Strong reserves throw back enemy counterattacks against the flanks of the penetration. German units are trained to exploit a penetration to the maximum so that it may develop into a complete breakthrough before hostile countermeasures can be launched on an effective scale. The deeper the attacker penetrates, the more effectively can he envelop and frustrate the attempts of the enemy to close his front again by withdrawal to the rear. The attacking forces attempt to reduce individual enemy positions by encircling and isolating them. The Germans do not consider a breakthrough successful until they overcome the enemy's artillery positions, which usually is the special task of tanks. Reserve units roll up the enemy's front from the newly created flanks.

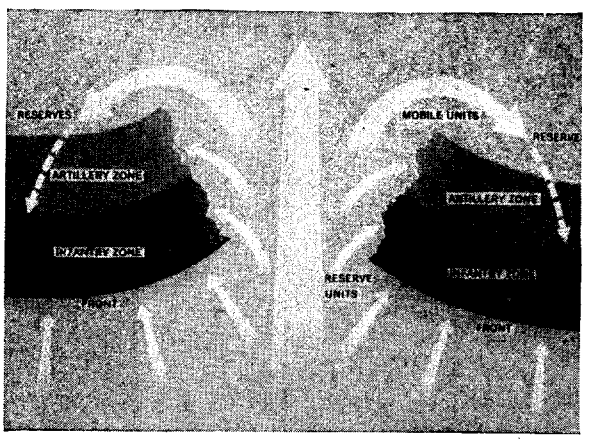


Figure 2.—Breakthrough.

The Germans often refer to this maneuver as *"Keil und Kessel"*.

3. Organization of the Attack

a. ATTACK ORDER. The attack order (*Angriffsbefehl*) generally contains the objective of the attack, the disposition of the infantry, unit sectors and boundaries, disposition and support missions of the artillery, location of reserves, and the time of attack. The order is not drawn up in accordance with any stereotyped form, but as a rule follows this pattern:

(1) Estimate of the situation (disposition of hostile and friendly troops).

(2) Mission.

(3) Assembly areas for the forward companies; objective; sector boundaries; orders for the continuation of combat reconnaissance.

(4) Instructions for the preparation of the heavy-weapons fire support, especially for massed fire.

(5) Orders to the artillery for fire preparation and coordination.

(6) Assembly areas for the reserves.

(7) Time of attack.

(8) Instructions for rear services (medical service and supplies).

(9) Location of command posts.

(10) Miscellaneous.

b. SECTORS OF ATTACK. The width of a sector assigned to an infantry unit in the attack depends on the unit's mission and battle strength, on terrain conditions, on the available fire support of all arms, and on the probable strength of enemy resistance. Normally the sector assigned to a platoon is between 165 and 220 yards. A company attack sector is about 330 to 550 yards. A battalion sector is 440 to 1,100 yards, while a division sector may be 4,400 to 5,500 yards. These sectors also provide the boundaries for the other arms, especially for the artillery in support of the infantry, although the artillery may utilize favorable observation positions in neighboring sectors. This also applies to the heavy infantry weapons.

For large units the sectors are determined from the map; for smaller units, from the terrain. These sectors extend as deep into enemy territory as the plan of battle may require. As the situation develops, changes are frequently made. Important points always lie within units' sectors, unless they are to be attacked by several units. The Germans do not consider it necessary to occupy the whole width of the sector with troops. Open flanks ordinarily are not bounded.

c. FIRE PLAN. Fire superiority is achieved through coordination of the infantry and artillery weapons. The basis for the fire plan (*Feuer-*

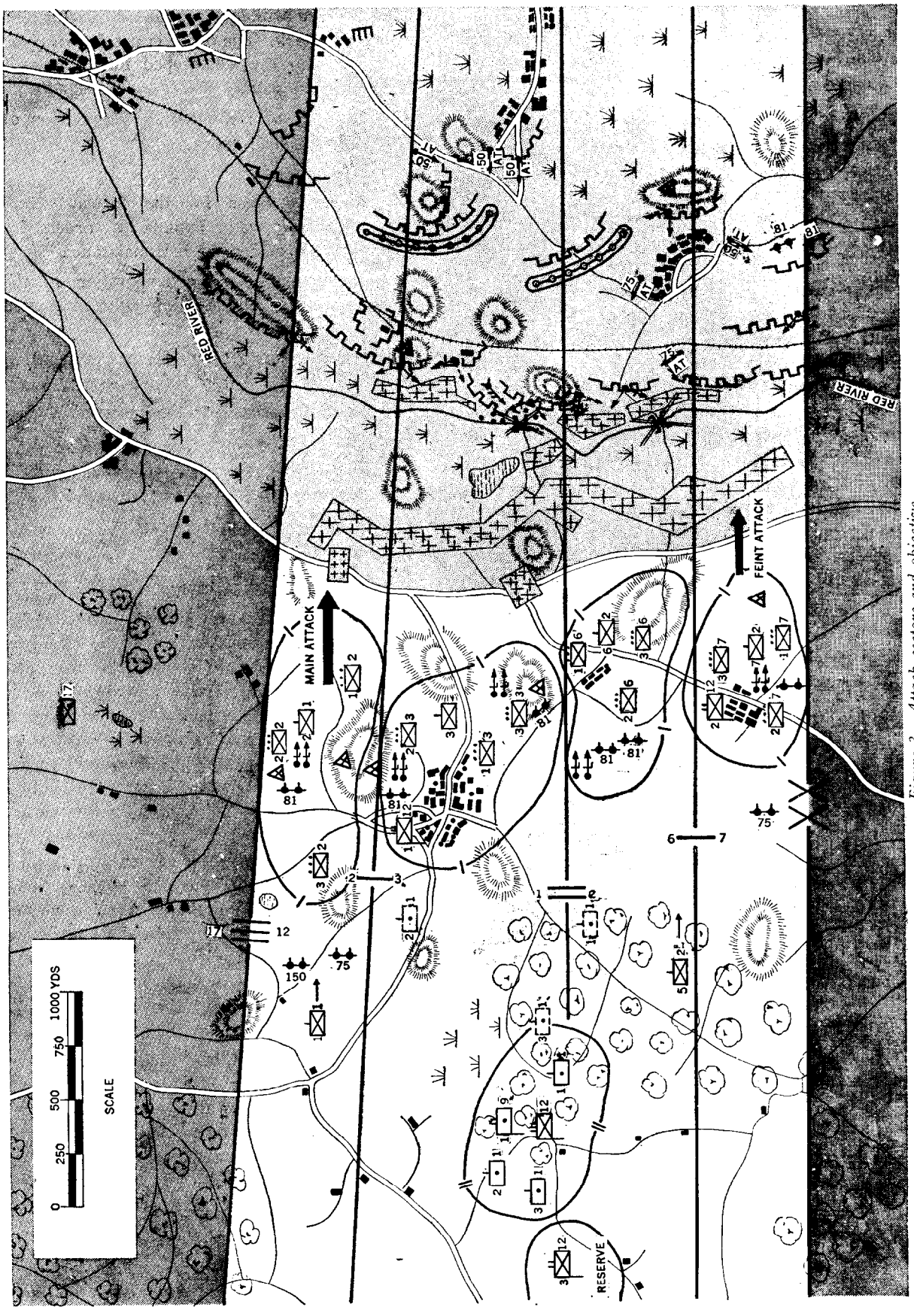


Figure 3.—Attack sectors and objective.

plan) is the regulation of the commitment of all weapons.

The fire plan includes the following:

(1) Assignment of combat missions.

(2) Distribution of observation sectors and fields of fire for the infantry and the artillery.

(3) An estimate of capabilities of the artillery for effective execution of the combat mission.

(4) Orders for the commencement of fire and fire schedules.

(5) Orders for the preparation for massed fire.

(6) Instructions for ammunition supply.

The Germans stress the coordination of flat and high trajectory weapons so that all dead spaces are covered by fire. Lack of signal equipment, however, often hinders the application of this principle.

4. Conduct of the Attack

a. General. Most of the German successes in the present war have been achieved with armored formations. Years of secret training and equipping were devoted to the development of the *Panzer* division. The original German *Blitzkrieg* tactics were based on the belief in the irresistible power of tank formations operating independently with the support of dive-bombers. Considerable modifications have taken place in this theory over the past few years. At the present time, the offensive tactics of the Germans are less spectacularly bold than they were in 1939, but the fundamental theory behind them has changed remarkably little, though in their armored tactics they stress more tank-infantry coordination since unlimited air support is no longer at their command.

The main weight of all major German attacks since 1939 was borne by the *Panzer* division. Where infantry divisions have been employed, they were limited to local attacks on a comparatively minor scale or to mopping up in rear of the *Panzer* divisions. The Germans never envisaged a full-scale attack by infantry formations on fixed defenses. German tactics have been to outflank or encircle the main area of the enemy defenses with tank formations and to have the infantry roll up the defenses from the rear, or to break frontally through the enemy defenses with massed tanks and develop the famous *"Keil und Kessel"* maneuver.

The Germans learned at heavy cost the futility of charging a hostile antitank defense with tank concentrations and of engaging in tank-versus-tank combat without having superiority in range and armament. They have learned that large formations of tanks cannot achieve a breakthrough, opposed by an effective screen of antitank guns, without the assistance of other arms. Therefore attention has to be given to the combined tactics of tanks and *Panzer Grenadiers,* the mechanized or motorized infantry who accompany the tanks.

Great emphasis in German offensive theory is laid on the role of the artillery, but in practice the artillery-support role has devolved to an ever-increasing degree on the tanks and assault guns. Nevertheless, the principle that the supporting fire should be concentrated on a narrow frontage where the tanks and infantry are most likely to achieve a breakthrough has been retained.

The fact that a part of the enemy resistance is likely to remain undisclosed until the attack has already begun has caused the Germans permanently to decentralize a portion of the field artillery. This tendency has led to the emergence and continual development of the assault guns, whose main function is the close support of infantry and tanks in the attack. Their armor and mobility allow them to operate much farther forward than the field artillery.

The tendency to detach field artillery battalions from their field artillery regiment remains strong. In fact, this tendency is so prevalent that a concentration of massed artillery preceding an attack seldom is achieved, necessitating, as it does, a great degree of centralized control. The Germans, however, replace the massed artillery fire to a large extent with the fire of multi-barreled mortars and rocket projectors, though these latter have not the accuracy of the former.

The Germans make a clear distinction between an attack made from movement and an attack from a prepared position, which is the more common of the two.

b. Attack by Mechanized and Motorized Forces. (1) *The attack.* In armored-force operations, the Germans stress the need for the concentrated employment, at the decisive place and time, of the entire combined command of tanks and other arms, less necessary reserves. The tanks constitute the striking force of such a command and normally advance as the first echelon of the attack. Their primary mission is to break through and attack the enemy artillery, rather than to seek out and destroy enemy tanks, which can be more effectively engaged by antitank units. The mission of the other arms is to assist the

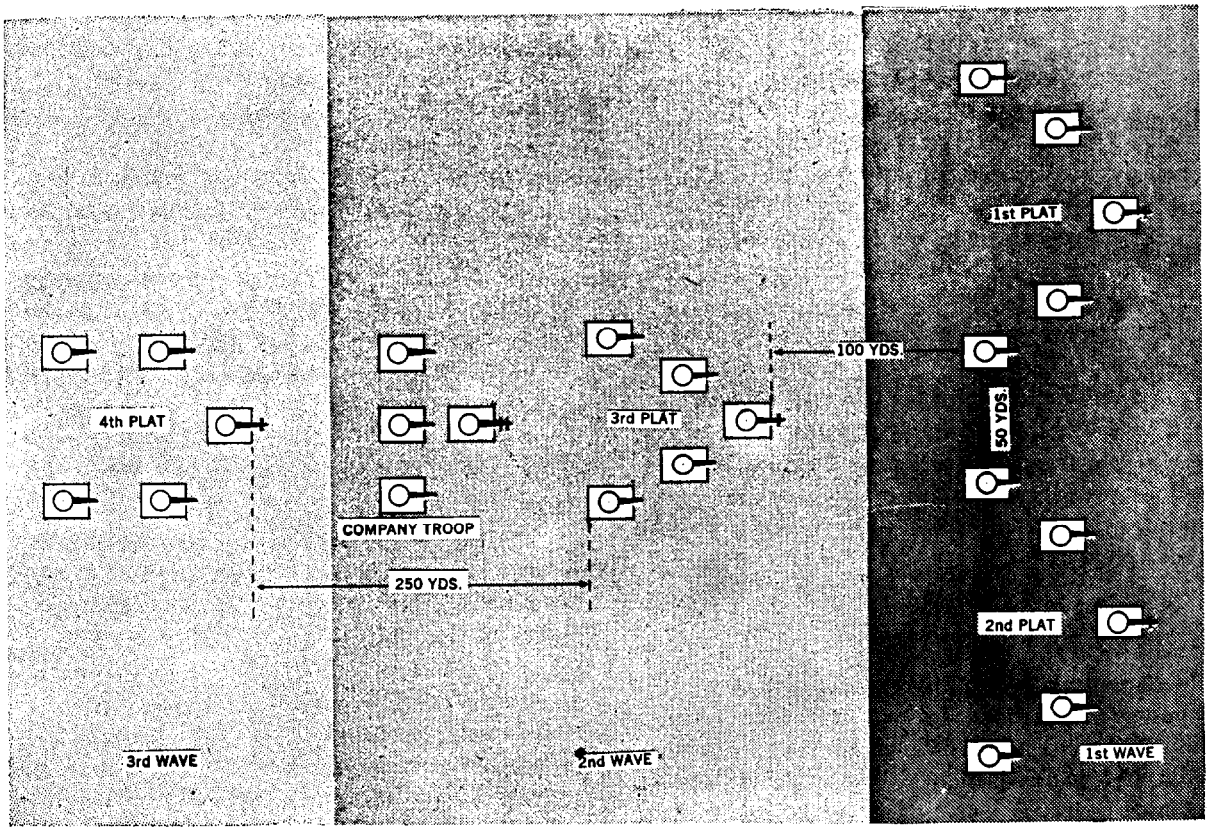


Figure 4.—German tank formation, battalion in "Blunt Wedge".

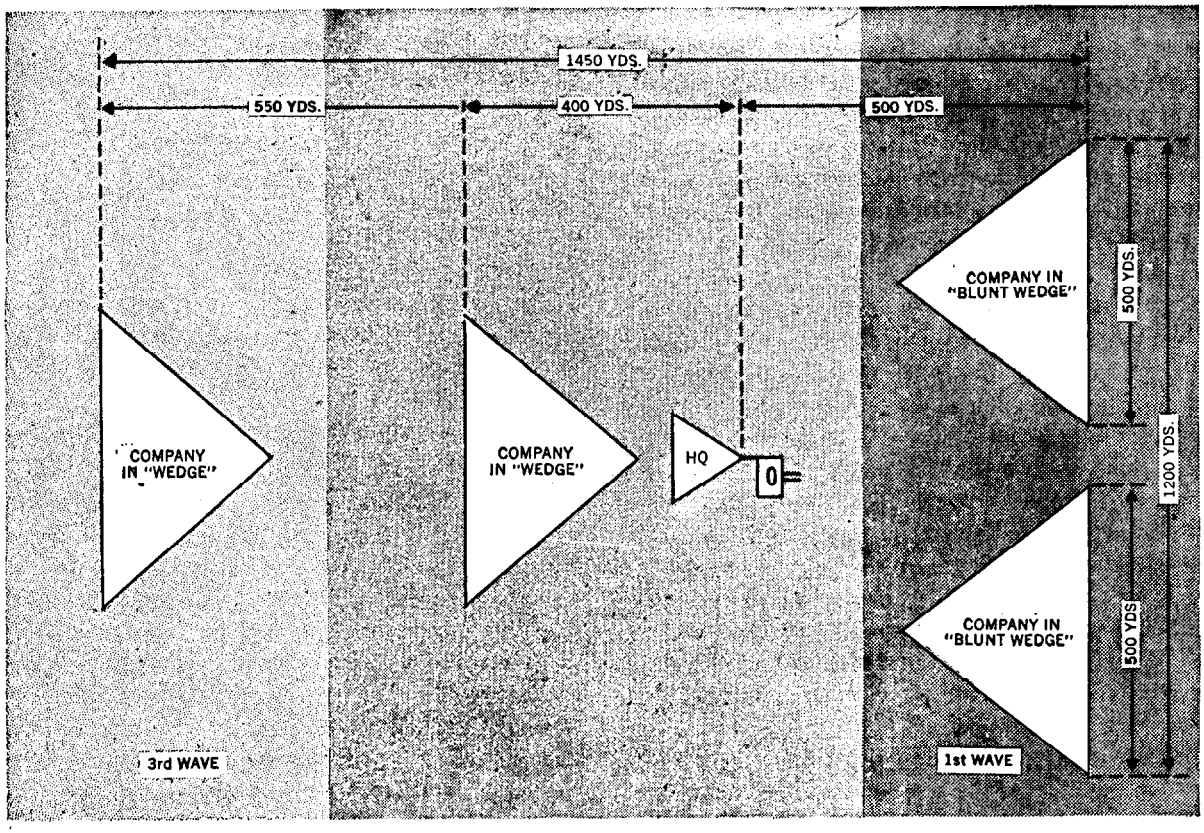


Figure 5.—German tank formation, company in "Blunt Wedge".

tanks in their advance, and particularly to eliminate antitank weapons. The smallest combat unit in such a force of combined arms is the company.

The basic formation for the tank platoon, company, and battalion are file, double file, wedge, and blunt wedge. The type of formation used for a specific task depends to a large extent on terrain conditions and the strength of enemy opposition. A German tank platoon normally consists of one command tank and two tank squads of two tanks each.

The tank regiment normally attacks in waves, in either of the following manners:

The tank regiment is echeloned in depth, one tank battalion following the other. The regimental commander's location is between the two battalions. This formation has the advantages of a sufficiently wide front (about 1,100 yards), and close contact by the commander of his units in the conduct of the attack. The normal depth of such a formation is about 3,000 yards. This is the usual form of the tank attack. When two tank battalions are attacking, one behind the other, it takes them about half an hour to pass their own infantry.

When the two-battalions-abreast formation is employed, it is almost essential that another tank regiment form the following wave. This formation usually has the disadvantage of being too wide. The regimental commander cannot observe his units, and he has no units of his own behind him which he can commit in a decisive moment. The attack normally proceeds in three waves.

The first wave thrusts to the enemy's antitank defense and artillery positions.

The second wave provides covering fire for the first wave, and then attacks the enemy's infantry positions, preceded, accompanied, or followed by part of the *Panzer Grenadiers,* who dismount as close as possible to the point where they must engage the enemy. The objectives of the second wave are the remaining antitank positions, positions of heavy infantry-support weapons, and machine-gun emplacements which hold up the advance of the infantry.

The third wave, accompanied by the remainder of the *Panzer Grenadiers,* mops up.

These three waves now often are telescoped into two, the first wave speeding through the enemy's position as far as his gun positions, the second crushing the enemy's forward positions in detail and mopping up the opposition not dealt with by the first wave or which has revived since the first wave passed through.

A typical attack formation of this type might be divided up among the *Panzer* division's units as follows: the first wave, on a frontage of about 2,000 to 3,000 yards, might consist of one tank battalion, two companies forward, supported on the flanks by elements of the assault gun battalion. Close to the rear of the first wave usually follow one or two *Panzer Grenadier* companies in armored half-tracks. About 150 yards to the rear of the first wave moves the second wave, formed of the second tank battalion in the same formation, closely followed by the remainder of the armored *Panzer Grenadiers,* who are in turn followed at some distance by the motorized *Panzer Grenadiers.* The flanks are protected by antitank guns which normally operate by platoons, moving by bounds. The artillery forward observer travels in his armored vehicles with the first wave, while the artillery commander of the supporting artillery units usually travels with the tank commander. Assault guns normally also accompany the second wave.

The tanks help each other forward by fire and movement, medium or heavy tanks taking up hull-down firing positions and giving covering fire while the faster tanks advance to the next commanding feature. Then the latter give covering fire to the former moving forward to their next bound.

Once the first wave has reached the rear of the enemy's forward defenses, it pushes straight on to attack the enemy's artillery. As soon as these positions have been neutralized, the tanks reform beyond the artillery positions and either prepare to exploit the attack or form an all-round defensive position on suitable ground.

The tank unit commander, as the leader of the strongest unit, is in most cases in command of the combat team, and all the other participating arms (*Panzer Grenadiers,* artillery, engineers, and antitank units) are placed under him. The Germans realize that a strong and unified command is an essential feature of any military operation. For certain missions, however, tank units are attached to another arm, in which case the tank commander is consulted before the final plans for the operations are made.

(2) *Infantry-tank cooperation.* When the enemy has well prepared positions with natural or constructed tank obstacles, the German infantry attacks before the tanks and clears the way. The

objective of the infantry is to penetrate into the enemy position and destroy enemy antitank weapons to the limit of its strength and the fire power of its own support weapons, augmented by additional support and covering fire from the tanks and self-propelled weapons sited in their rear.

Only after the destruction of the enemy antitank defense can the tanks be employed on the battle line to the fullest advantage.

When the tank obstacles in front of the enemy position already are destroyed, and no additional tank obstacles are expected in the depth of the enemy's main defensive position, the infantry breaks through simultaneously with the tank unit. The infantry attack is conducted in the same manner as it would be without the cooperation of tanks. Heavy infantry weapons are kept in readiness to fire at possible newly discovered antitank positions. Of particular importance is protection of the open flanks by echeloning the flank units and employing heavy weapons at the flanks.

In most cases, the infantry follows the tanks closely, taking advantage of the fire power and paralyzing effect of the tanks upon the enemy's defense. The Germans normally transport the infantry to the line of departure on tanks or troop-carrying vehicles in order to protect the infantry and to increase its speed. The infantry leaves the vehicles at the last possible moment, and goes into action mainly with light automatic weapons.

The tanks advance by bounds from cover to cover, reconnoitering the terrain ahead and providing protective fire for the dismounted *Panzer Grenadiers*. The tanks do not slow their advance to enable the infantry to keep continuous pace with them, but advance alone and wait under cover until the infantry catches up with the advance. Terrain that does not offer sufficient cover is crossed with the greatest possible speed.

The infantry attacks in small formations also by bounds under the fire cover of its own heavy weapons and of the tanks, staying away from individual tanks because they draw the strongest enemy fire.

When a tank company attacks with infantry, there are normally two platoons on the line, one platoon back, and the fourth platoon in reserve. The interval between tanks is usually 100 to 120 yards. The tank's machine guns usually engage

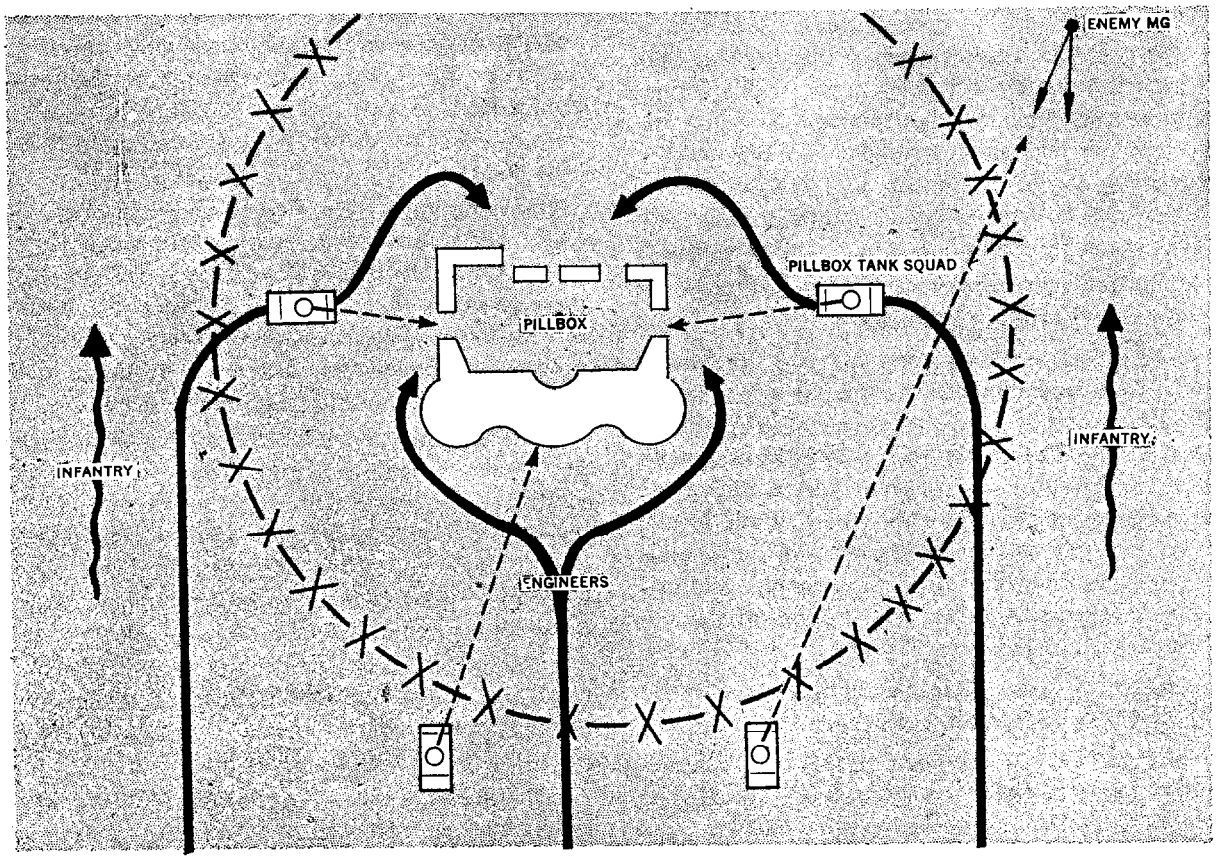


Figure 6.—Attack against an enemy pillbox.

infantry targets at about 1,000 yards range and under, while the tank guns engage targets at 2,000 to 2,500 yards.

The coordination between tanks and *Panzer Grenadiers* moving into combat on armored half-tracks is similar to the technique employed in a purely armored formation, since the armored half-tracks are not only troop-carrying vehicles but also combat vehicles. When the terrain is favorable for tank warfare, the *Panzer Grenadiers* in their armored half-tracks follow immediately with the second wave, after the first tank wave has overrun the opponent's position. A deep and narrow formation is employed. After the penetration, the main mission of the *Panzer Grenadiers* is to overcome the enemy positions which survived the first wave.

In attacking enemy pillboxes the Germans use combat groups consisting of tanks, infantry, and engineers, assisted by artillery. The normal composition of a combat group attacking one bunker is one platoon of tanks and one platoon of infantry reinforced by one squad of engineers. Before the combat group is committed against the enemy pillbox, artillery fires high explosives and smoke shells at the neighboring pillboxes to isolate them, shells the terrain between pillboxes, and conducts counterbattery fire. Under the protection of this fire, the combat group advances close to the pillbox while other infantry units attack the enemy in the terrain between the pillboxes.

One tank squad covers the advances of the other tank squads and the infantry platoon by direct fire against the pillbox, particularly against the observation and weapons' openings. The first tank squad halts under cover whenever possible and covers the advance of the second tank squad.

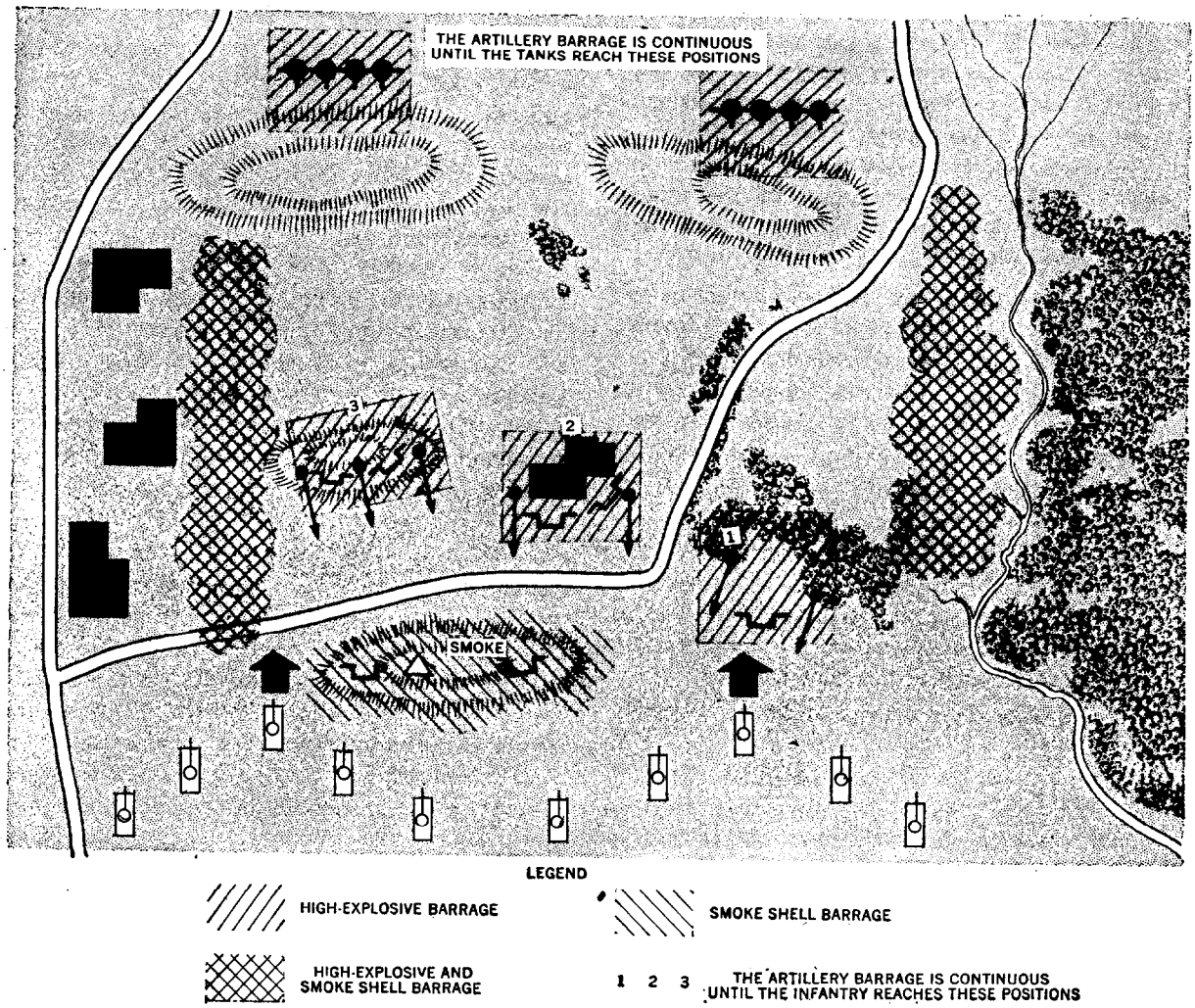


Figure 7.—Artillery support during a tank attack.

When the combat group reaches a barbed wire obstacle surrounding the pillbox, the two tank squads have different missions. One tank squad remains in front of the pillbox, and its tanks are driven into a position from which they can overlook the terrain, and watch out for antitank guns and machine gun emplacements, while the other tank squad (the pillbox tank squad) rolls across the obstacle to enable the infantry and engineers to get close to the pillbox. The pillbox tank squad then fires on the pillbox at close range. The infantry squad meanwhile takes the surrounding terrain and covers the engineers who blast the entrance of the pillbox with TNT.

(3) *Artillery-tank coordination.* Artillery support is of decisive importance for the preparation and the successful conduct of a tank attack. A unified command for the entire artillery controls the artillery fire as long as the infantry and tank units are fighting on the same line. When the tanks break through the enemy forward defense lines, the self-propelled artillery or any other artillery battalion designated for the support of the tank unit is placed under the command of the tank unit commander.

The Germans believe that the artillery fire must not check the momentum of the attack. Consequently the heaviest fire must fall well ahead of the tanks or outside their sector.

The mission of the artillery preparation before the attack is to destroy, or at least to neutralize, the opponent's antitank defense in the area between the line of contact and the regimental reserve line. Continuous counterbattery fire prevents the enemy from shelling the tank assembly area and from breaking up the preparation of the tank attack.

The artillery has the following missions before the tank attack:

Counterbattery fire on enemy artillery located in positions which command the ground over which the tank attack is to be made.

Concentrations on enemy tanks in assembly areas.

Harassing fire on all areas in which the antitank units are located or suspected. Fire is heaviest on areas in which tanks cannot operate but from which they can be engaged effectively.

Adjusting fire with high explosives on probable enemy observation posts commanding the sector to be attacked. These observation posts are blinded with smoke as soon as the attack begins.

Experience has taught the Germans that the flanks of a tank attack are vulnerable. Therefore they assign to the artillery and the rocket projector units the task of protecting flanks by barrages using high explosives and smoke shells.

The artillery has the following missions during the tank attack:

Counterbattery fire.

Blinding enemy observation posts.

As the attack progresses, engaging successive lines of antitank defense, especially areas to the rear and flanks of the sector attacked.

Screening the flanks of the attack with smoke and neutralizing the enemy's infantry and rear areas.

Delaying the movement and deployment of enemy reserves, particularly tanks.

The Germans stress that this wide variety of tasks must not lead to the wholesale dispersal of effort. The main task of the artillery is at all times the destruction of the enemy's antitank weapons, tanks, and artillery.

Liaison between artillery and tanks during the attack is established by the commanding officers and the artillery liaison group, which normally moves with the first wave. Artillery forward observers, if possible in armored observation posts, ride with the most forward elements. A German field expedient is for the tank unit to take along a forward observer in one of its tanks. It often happens that the tankman himself has to take over the observation for the artillery. He himself can request artillery fire and shift concentrations when the situation requires such changes. Figure 10 represents a map with superimposed coordinate system and artillery reference points used by tank commanders to help them in this task.

c. THE INFANTRY DIVISION IN THE ATTACK. (1) *General principles for employment.* German teaching envisages infantry divisions being employed to make a penetration in the enemy defensive positions through which armored and mechanized formations can pass. During the course of this war, however, no major attack has been carried out by infantry divisions without the support of *Panzer* divisions. In fact, more major attacks have been carried out by *Panzer* divisions, with only a minimum of ordinary infantry elements. Infantry divisions have been employed almost entirely in a role of consolidation, following up the armored and mechanized formations, systematically eliminating centers of resistance by-passed by the latter, or exploiting the latter's

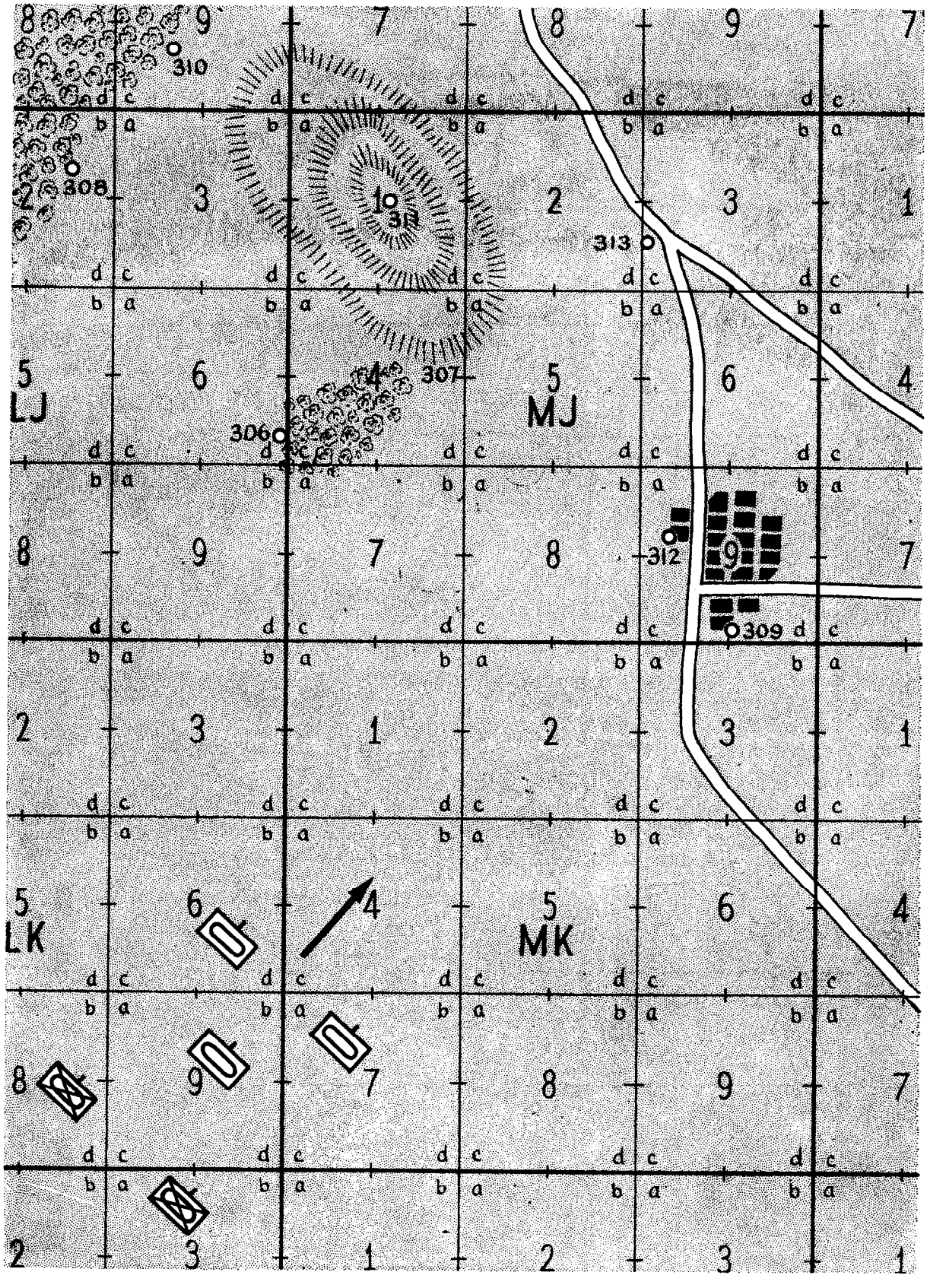


Figure 8.—Map with superimposed coordinate system and artillery reference points used by tank commanders.

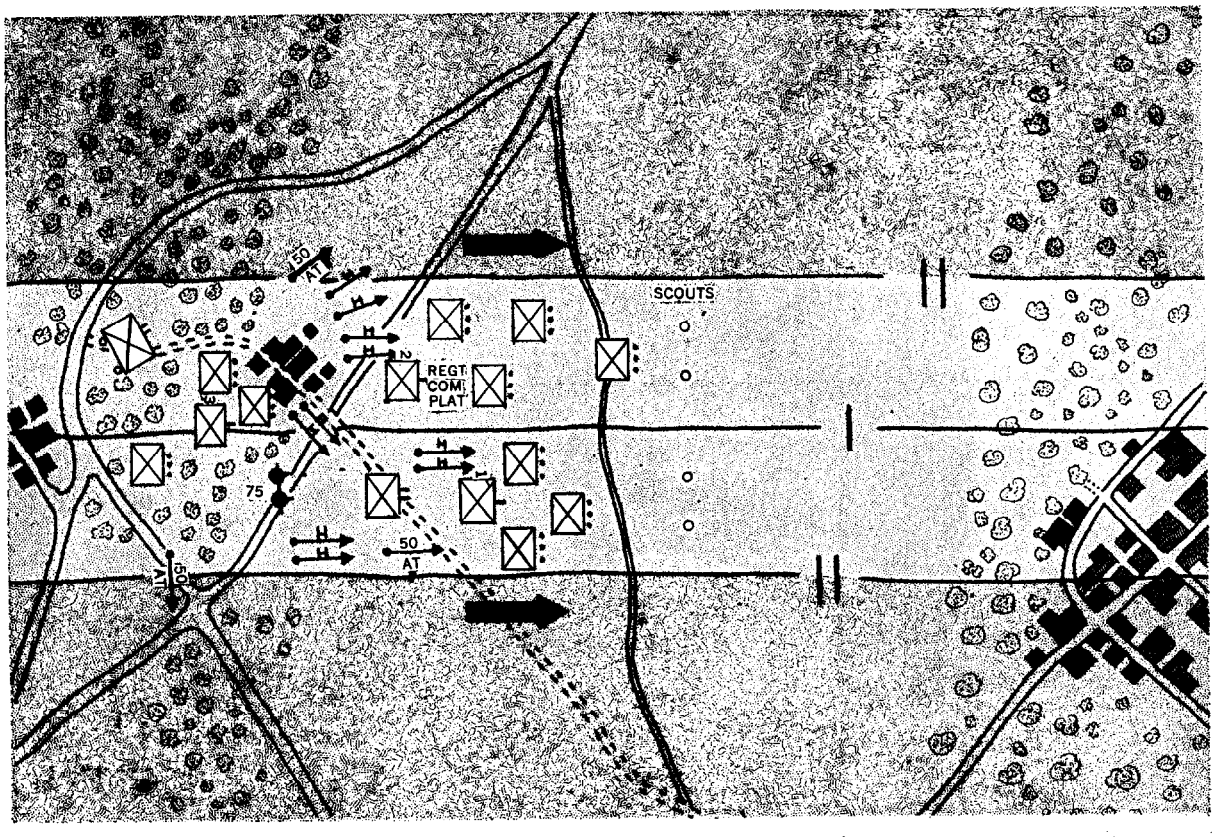


Figure 9.—Deployment of a German infantry battalion (1st stage).

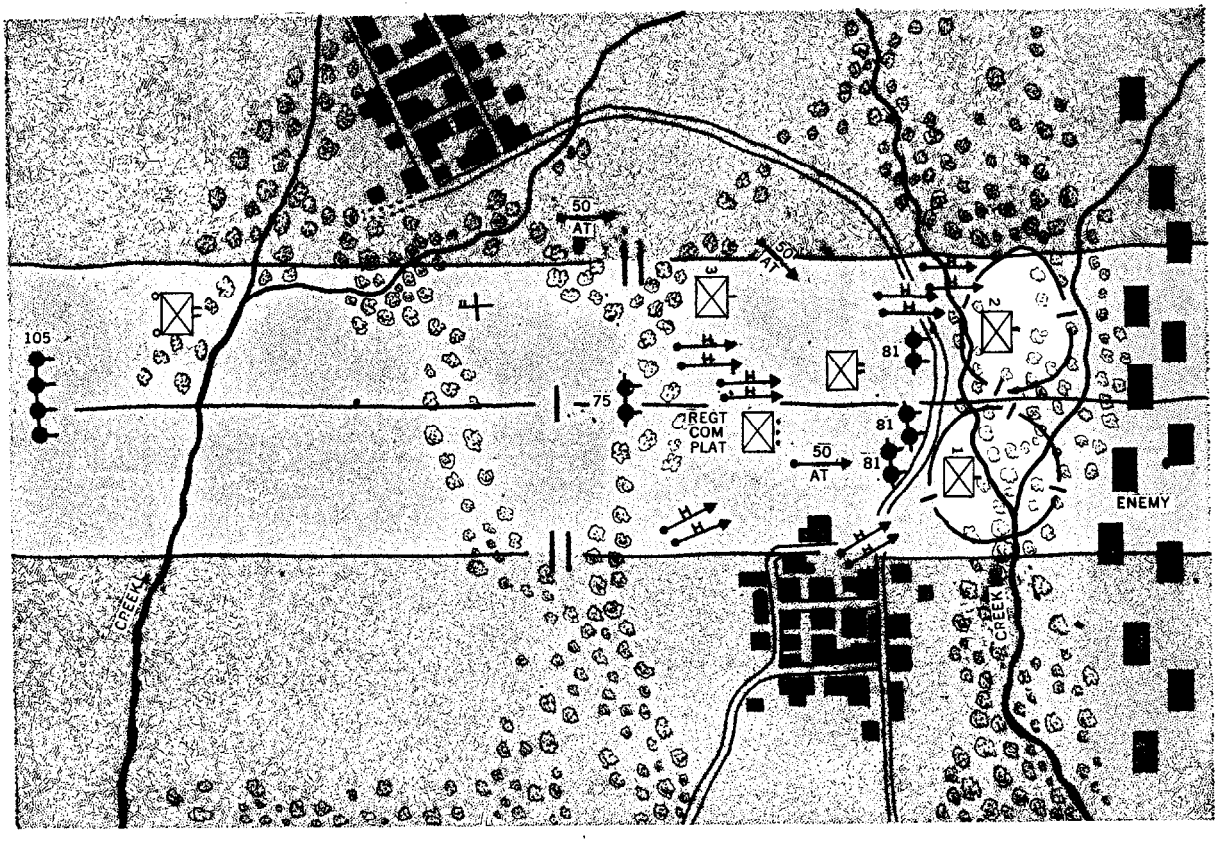


Figure 10.—Deployment of a German infantry battalion (2nd stage).

success by mopping up demoralized enemy defenses to the flanks of the armored breakthrough—in short, consolidating and holding the ground won by the mechanized formations.

In view of the unspectacular role allotted to the infantry division it is difficult to give information about other than minor infantry tactics, such as attacks on a small scale.

(2) *Preparation for the attack.* The method of forming up for an infantry assault on a prepared position is similar to that employed by the *Panzer* division. While the infantry is in assembly positions, the artillery makes all preparations for the support of the attack. It draws out hostile artillery fire and executes counterbattery fire against known enemy batteries. Large troop concentrations and especially-important targets are taken under fire at great ranges. In order not to betray their full strength and intentions, the Germans withhold a portion of their batteries from these missions. They also try to deceive the enemy as to their intentions by covering other sectors simultaneously with fire. When possible, preparation for an attack is avoided during the day in order to prevent Allied observation. Occasionally, to obtain a success by surprise, the Germans launch attacks without artillery preparation. Surprise attacks also are launched under cover of darkness or fog.

The Germans normally occupy their line of departure by means of infiltration in order to avoid losses. Their orders direct what actions have to be taken when companies run into enemy defenses; when enemy fire is opened from the flank; when an enemy counterattack is launched; when objectives are reached; when companies appear to be getting dispersed; when part of a company pushes too far ahead of neighboring units or is held up.

The heavy machine guns of the rearward company and some of the mortars and heavy mortars are assigned to deal with enemy flanking fire.

The commander of the heavy company is normally at the battalion headquarters, from which he can control the fire of the infantry heavy support weapons.

(3) *Deployment.* (a) *First stage.* The Germans carry out deployment in two stages. They call the first stage *Entfaltung* or "shaking out", which is equivalent to the development of a march column according to U. S. procedure. In the first stage (*Figure 9*), an infantry regiment normally deploys down to battalions, although the procedure may go down to companies if a high state of preparedness is necessary. Features of the first stage of deployment are as follows:

Companies retain their combat vehicles until their weapons and equipment arrive at the off-carrier position, which is located as far forward as the situation permits.

The Germans often place only one company forward, the main strength of the battalion being kept under control of the battalion commander as long as possible so that he may employ it in the most advantageous direction for attack.

If the condition of the terrain and enemy fire cause a change of intervals between units, the normal intervals are resumed as soon as possible.

Support weapons are used to cover the "shaking out" phase of deployment and the subsequent advance, the weapons being kept within the march column between the companies or behind the battalion.

After the first stage of deployment has been carried out, the leading elements of the battalion may be ordered to seize important tactical features.

When deploying by night or in woods, a careful reconnaissance is made, routes are marked, and strong protection is placed forward. Intervals between units are shorter.

After the first stage of deployment has been completed, the battalion commander marches with the leading elements and normally will send reconnaissance patrols ahead or reconnoiter the enemy position himself. The commanders of support weapons accompany him, reconnoitering for firing positions.

(b) *Second stage.* The second stage (*Figure 10*), called *Entwicklung* (development), is deployment in detail, which is the final action of the company extending itself down to platoons and squads. Features of the second stage of deployment are as follows:

The companies deploy in depth as soon as they come within range of artillery fire. An advance in columns of files is considered desirable because it affords a small target and the company is easier to control, but before adopting this formation the danger of enfilade fire is weighed.

If enemy fire and difficult terrain necessitate further deployment, the companies disperse in depth by sections. Reserves and support weapons also adopt open formations, but they remain

far enough behind to avoid coming under the fire directed at the leading elements.

When the rifle companies are deployed, they exploit all possible cover as they advance, employing column-of-file formations with irregular distances. The leading elements are not extended until they are to engage in a fire fight. The elements that follow continue advancing in file.

In determining when to deploy, the Germans take into consideration additional physical strain placed on men when they march cross-country.

(4) *Technique of attack.* The infantry attack on prepared positions is made in the same sequence as that of the *Panzer* division, namely penetration, breakthrough, exploitation by the reserves. In the infantry attack, however, the first phase is a series of local attacks by so-called assault detachments (*Stosstrupps*) with the aim of overcoming key points in the enemy defenses, so that wedges into the enemy's forward positions can be established from which the attack can be driven forward into the depth of the enemy position, or rolling up the positions on either flank of the wedge.

Assault detachments normally are composed of infantry with engineers attached. A typical assault detachment consists of the following: one officer; obstacle clearing party, consisting of two to six men for each lane to be cleared, equipped with small arms, wire-cutters, and bangalore torpedoes and other explosives; embrasure-blasting party consisting of three or four men equipped with grenades and demolition or pole charges. This party may also include, though it may work independently, a flame-thrower party, consisting normally of two men; covering parties, normally two or three parties of varying size from three men with one light machine gun to full platoons; smoke party consisting of two or three men equipped with smoke candles or grenades; supply party, carrying reserves of equipment and ammunition, their strength depending on the size of the assault detachment.

Attacks most often are made at dawn, and are preceded normally by heavy artillery preparation, one purpose of which is to make shell holes which afford cover for the advancing assault detachments as they move forward. When the latter reach the wire obstacles surrounding the enemy position, Very signals are fired, calling for available artillery fire to be brought on the position to seal it off from flanking positions. If, by reason of proximity of the assault detachment to the artillery's danger zone, the former cannot be protected by covering fire, the smoke party may lay a smoke screen. The obstacle-clearing party then cuts one or more lanes through the wire, using wire cutters or bangalore torpedoes. The embrasure-blasting party passes through and attacks the embrasures. Flame throwers, if employed, are not intended by themselves to cause the surrender of the position, but to cover the advance of the embrasure-blasting party with its explosive charges which are considered the decisive weapon.

Antitank guns may be used to give close support to the embrasure-blasting party, being manhandled from cover to cover. They will attack the embrasure with armor-piercing ammunition and also give protection against possible tank-supported counterattacks.

It is probable that several such operations will be in progress on any one sector at any one time before an attack, in the first place to probe for weak spots, and in the second place to keep the enemy in uncertainty as to the final point of main effort of the attack. German feint attacks have often been delivered in such strength or with such violence as to be indistinguishable from the main attack.

Once a wedge has been firmly established in the enemy positions, the second phase of the attack begins. Troops so far held in their assembly area, or slowly making headway under cover of the artillery fire supporting the first phase of the attack, advance to cut the enemy position in two and to roll up the positions flanking the wedge.

Because the Germans anticipate enemy defenses organized in depth, and because these are unlikely to be fully disclosed until after the beginning of the attack, they do not make detailed plans for close-support covering fire, which would be hard to work out in advance, but tend to decentralize their support weapons and artillery for the second phase of the assault, in which reinforced battalions, companies, or platoons fight their own way forward, independently of their flanking units, until they have gained their final objective.

Attack on lightly defended positions is more similar to the conduct of the attack by the *Panzer* division. The first phase is likely to be a deployed attack on a two-regiment front, the third regiment in reserve.

The Germans believe that in the advance ex-

tended formation of units is advantageous because it forces the enemy to scatter his fire.

To counteract the overwhelming Allied superiority in artillery and planes which frequently knock out the attack before it is under way, the Germans have been known to use the following method. Small groups of less than platoon size infiltrate mainly at night over a period of three to four days into the hostile battle position or at least well behind the advanced positions. During the day the infiltrated groups conceal themselves, but if caught pass themselves off as ordinary patrols to avoid raising suspicion. When the actual attack is launched these units try to give the impression that the defender is surrounded and often cause great confusion.

When the Germans go over from the attack to the defense, even if only temporarily, they concentrate the supporting weapons around the commander of the unit that is to be supported, so that he can control the fire plan.

(5) *Infantry-assault gun coordination.* The assault guns are organized in assault gun battalions and are under the control of the division commander.

The Germans regard their self-propelled assault guns as decisive weapons to be employed particularly at the point of main effort. In cooperation with infantry they facilitate the penetration and breakthrough. These weapons, the Germans believe, complement artillery fire by their ability to follow the infantry right up to an objective. Their use for small actions before an attack is forbidden so as not to betray their presence. Surprise is sought by bringing them into position by night and camouflaging their assembly area. Used primarily to neutralize enemy support weapons at short ranges over open sights, assault guns are preferably employed in concentrations; to employ them singly or in comparatively small number is frowned upon by the Germans.

German assault guns advance with or just behind the infantry; they never go ahead of the infantry. When an objective is reached, the assault guns do not remain with the infantry while the position is being consolidated but retire about 1,000 yards to await further assignment.

In close combat the assault guns are rather helpless and therefore it is the task of the infantry to keep the enemy away from the assault guns. Newly-organized assault-gun escort batteries have the same task.

(6) *Artillery.* The Germans employ their field artillery in general support (*Allgemeine Unterstützung*) or in direct support (*Unmittelbare Unterstützung*), in the same manner as the U. S. Army. The Germans consider the battalion as the firing unit. Splitting up an artillery battalion into batteries and placing batteries under an infantry battalion is the exception justified only when the infantry battalion has an independent mission (for example, flank protection) or when the terrain does not permit unified fire control by artillery battalion commanders. Single commitment of guns is against German tactical doctrine. Various recent reports, however, describe deviations from the prescribed practice. Normally the Germans do not employ single field artillery pieces for direct fire, as, for instance, the Russians do. But much use is made of roving guns (*Arbeitsgeschütz*), and of guns firing from alternate positions to make identification more difficult. Standing German orders call for the preparation of alternate firing positions, which, however, are used now only in cases of very heavy counterbattery fire, as the gasoline shortage keeps all movements to a minimum. The Germans often designate the number two piece as the roving gun, and, unlike the other pieces, it normally is not dug in. It frequently changes its position, which is about 250 to 300 yards from the rest of the battery.

The German artillery often engages a target from a lateral position. This deception, particularly identified with longer range weapons, is extended by employing another gun, often of lighter caliber, in a carefully coordinated attack on the same target. Flash simulators also increase the difficulty of visual location of active guns.

The first step to obtain infantry-artillery coordination is taken in the attack order and is assured by direct contact between the commanders, artillery liaison units (*Artillerieverbindungskommando*), and direct contact between artillery observers and infantry units.

The Germans also employ forward observers (*Vorgeschobene Beobachter*), who have the same task as their U. S. counterpart.

The signal equipment necessary for communication between units, liaison units, and observers is only partly organic. The Germans keep most of the signal equipment centralized in the division signal battalion, which allots equipment as needed to the various units.

In the attack the greater part of the artillery

supports the main effort. The remainder of the artillery is assigned the mission of flank protection against possible enemy counterattacks.

5. Meeting Engagement *(Begegnungsgefecht)*

In the meeting engagement the Germans believe that the advantage lies with the side which succeeds first in making effective preparation for the attack and thereby deprives the enemy of his freedom of action. When both adversaries attack immediately from march columns, the decisive factors are the initiative of the junior officers and the efficiency of the troops. The senior commander quickly coordinates the functions of the various officers, while the advance guard secures for him freedom of action and the opportunity for a speedy deployment of his troops.

6. Pursuit

U. S. and German tactical doctrines on pursuit are very much alike. Pursuit begins when the enemy is no longer able to maintain his position and abandons the combat area with the bulk of his forces. The object of the pursuit is the complete annihilation of the retreating or routed enemy. Effective pursuit requires great initiative from commanders of all echelons of command, who must not hesitate to start pursuit immediately, even when their troops are exhausted. The enemy must be given no time to pause to reorganize his forces and reconstitute his defense.

The pursuit is conducted on a broad front by means of fire and movement. When making for distant objectives every effort is made to get around the enemy's flanks and effect a surprise attack in his rear. However, care must be taken that enemy attack on one's own flank does not cause deflection from the original direction.

Fast-moving troops are used in the pursuit. These troops often are organized into pursuit or advance sections. The infantry scatters the enemy and by-passes resisting enemy strongpoints, leaving their destruction to units following in the rear. Part of the artillery places concentrations at the avenues of retreat, while the remainder displaces forward in echelon, providing continuous support for the units in front. The Germans emphasize that a pursuit without the necessary artillery support may lead to disaster. Assault guns travel well forward with the rapidly advancing infantry, their comparatively heavy armament enabling them to crush quickly and decisively any enemy forces attempting to make a stand. Combat aviation bombs routes of retreat and strafes the hostile forces in direct support of the ground attack. Combat engineers repair damaged roads, facilitating the continuous flow of supply and troops.

Pursuit, after a successful breakthrough, is regarded by the Germans as an ideal mission for the *Panzer* division. *Panzer Grenadiers* in armored half-tracks or in unarmored vehicles and tanks supplement each other in pursuing the enemy. During the advance on roads, the tanks form the point. However, through wooded areas or larger villages the *Panzer Grenadiers* take over the point. Tanks and *Panzer Grenadiers* stay close together so that either, according to the situation, can be committed as soon as enemy resistance is encountered. Tanks are normally not used in units of less than company strength.

Section V. DEFENSIVE

1. General

In German doctrine the object of the defense (*Verteidigung,* or *Abwehr*) is to halt the hostile attack, or to gain time pending development of a more favorable situation for resumption of the offensive. Thus German and U. S. doctrine are essentially the same: only the offensive leads to decisive successes.

In the last two years German defensive operations have become increasingly passive in nature. The Germans formerly placed the greatest stress on immediate and violent counterattacks as effective means of destroying the attacking enemy. This required great mobility and large reserves. At present more emphasis is placed on the construction of defensive positions, and counterattacks are frequently local in character. It is most likely that this passive type of defense is only an expedient due to German shortages of mobile equipment and manpower.

2. Organization for Defense

a. GENERAL. The Germans attempt to break a hostile attack in front of the main line of resistance (*Hauptkampflinie*), at the forward limit of the battle position (*Hauptkampffeld*), or to force the enemy to abandon his attack.

As in U. S. practice, the commander usually determines from the map the main battlefield and assigns a general line as guide for the location of the main line of resistance, to ensure continuity

of the defensive position. Lower echelon commanders fix the main line of resistance on the ground, since only on the terrain, after thorough reconnaissance, can the details of the defense be decided. A recent official German directive states, however, that reconnaissance must not delay the construction of defensive positions.

Organization of the defensive position follows a conventional pattern and includes an advanced position (*Vorgeschobene Stellung*), and an outpost position (*Gefechtsvorposten*), both of which usually are under immediate command of the area commander. A reserve position may also be provided.

The width and depth of a German defense area depend upon the terrain and the proportional strength of friendly and hostile forces. In general, however, the width of a defensive sector assigned to a unit is approximately twice the width of the sector when the same unit attacks. Normal sectors are: platoon, 220 to 550 yards; company, 440 to 1,100 yards; battalion, 880 to 2,200 yards; regiment, 2,200 to 3,300 yards; division, 6,600 to 11,000 yards.

b. Advanced Position. The Germans organize the advanced position 5,000 to 7,000 yards in front of the main line of resistance, within the range of their medium artillery. A position is selected which will prevent seizure by the enemy of important terrain features, provide good observation points for friendly artillery, and, if possible, deceive the enemy as to the location of the main line of resistance. Troops manning these positions attempt to make the enemy deploy his forces prematurely and, if possible, in the wrong direction.

The forces in the advanced position are usually reconnaissance detachments, which include machine-gun, armored-car, and antitank-gun units, the fire power and mobility of which make them suitable for this type of employment. In general they occupy important features, such as railroads, river crossings, cross-roads, and commanding ground. Forces in advanced positions are not expected to hold at all cost; in the face of superior enemy fire they retire along predetermined routes under over of their medium artillery.

c. Outpost Positions. Outpost positions normally are established 2,000 to 5,000 yards in front of the main line of resistance. When the fronts are stabilized, the outpost position is the only position forward of the main line of resistance. The location, which depends upon the terrain, is always within range of friendly light artillery.

German outpost positions are occupied in strength varying from platoons to companies, depending upon the mission, terrain, width of the sector, and the number of troops available. Often they are only weakly occupied as long as the advanced positions are in front of them. Ordinarily outposts are established by infantry units drawn from the main battle position, supported by the fire of close-support weapons, such as mortars and infantry guns. Antitank guns often are attached to these outpost units to repel hostile armored reconnaissance units. The main weapon, however, is the light machine gun which opens fire at ranges of about 1,300 yards, while riflemen commence fire at about 850 yards.

Firing positions are selected by the Germans to facilitate unobserved withdrawal of the outposts to the main battle position when hostile pressure becomes too strong. Several alternate positions are prepared for each weapon, and shifts are made by day and night to make it difficult for the opponent to detect and dislodge the outpost troops. Positions normally are selected at the edges of woods, villages, hedgerows, or hills. A good field of fire is considered mandatory, and the organization of firing positions is simple. Numerous dummy positions are constructed, including knee-deep trenches filled with leaves to simulate depth and occupancy. During the day, positions are manned by guards; at night, advanced listening posts, particularly alert at dusk and dawn, warn the troops of the enemy's approach. Small, prepared attacks with limited objectives under the protection of the outposts are utilized to interfere with the hostile preparations and secure information.

Withdrawal of the outposts is conducted so as not to hinder the fire of the main battle position. After the outposts are abandoned, they are likely to be covered by carefully registered fire of heavy weapons in order to prevent their occupation by the enemy.

d. Main Line of Resistance. The Germans organize their battle position in depth, with individual strongpoints connected to form an uninterrupted belt. The strongpoints, constructed for all-around defense, and surrounded by barbed-wire obstacles and mine belts, contain one or more heavy weapons supplemented by machine guns, mortars, and riflemen. The smallest strongpoint is occupied by a reinforced squad. Squad

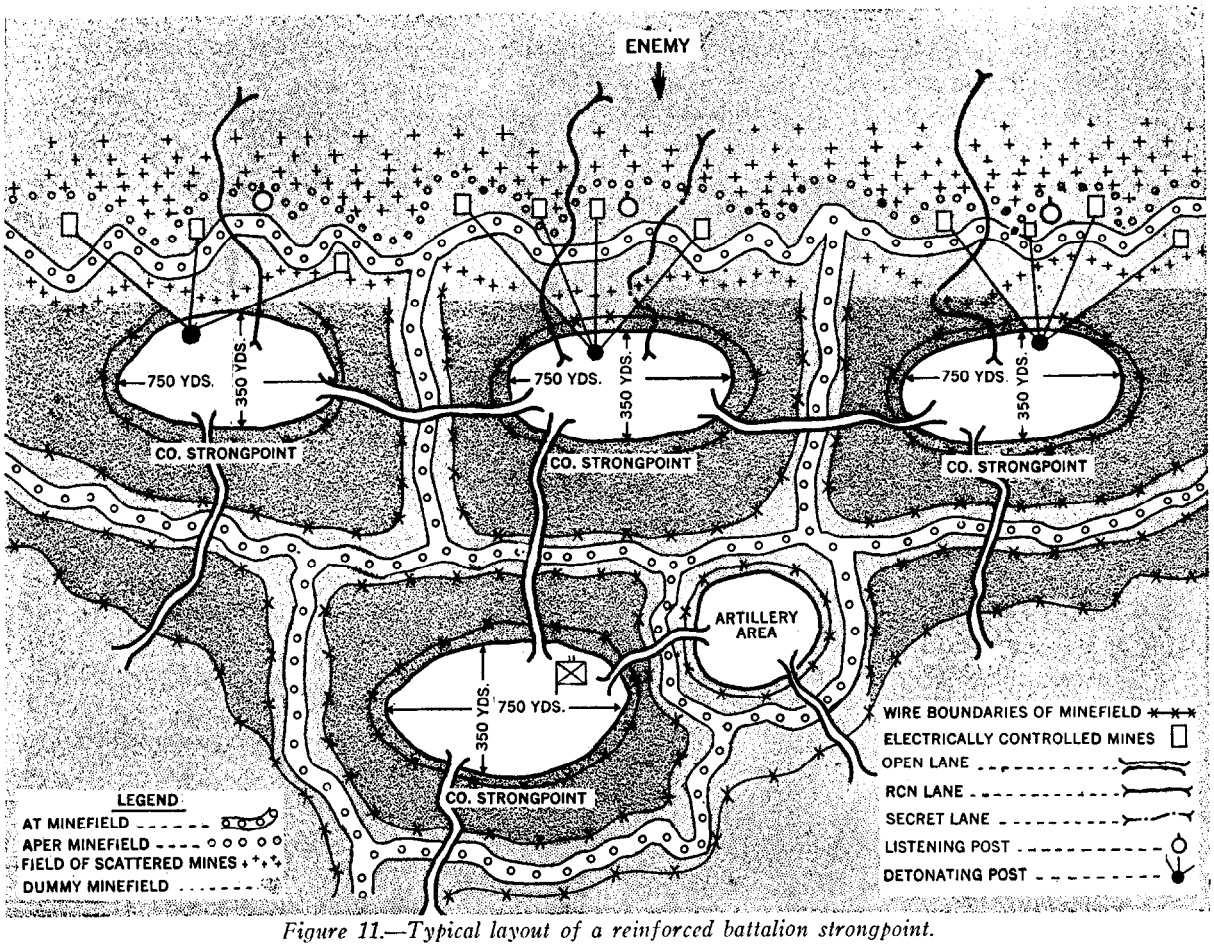


Figure 11.—Typical layout of a reinforced battalion strongpoint.

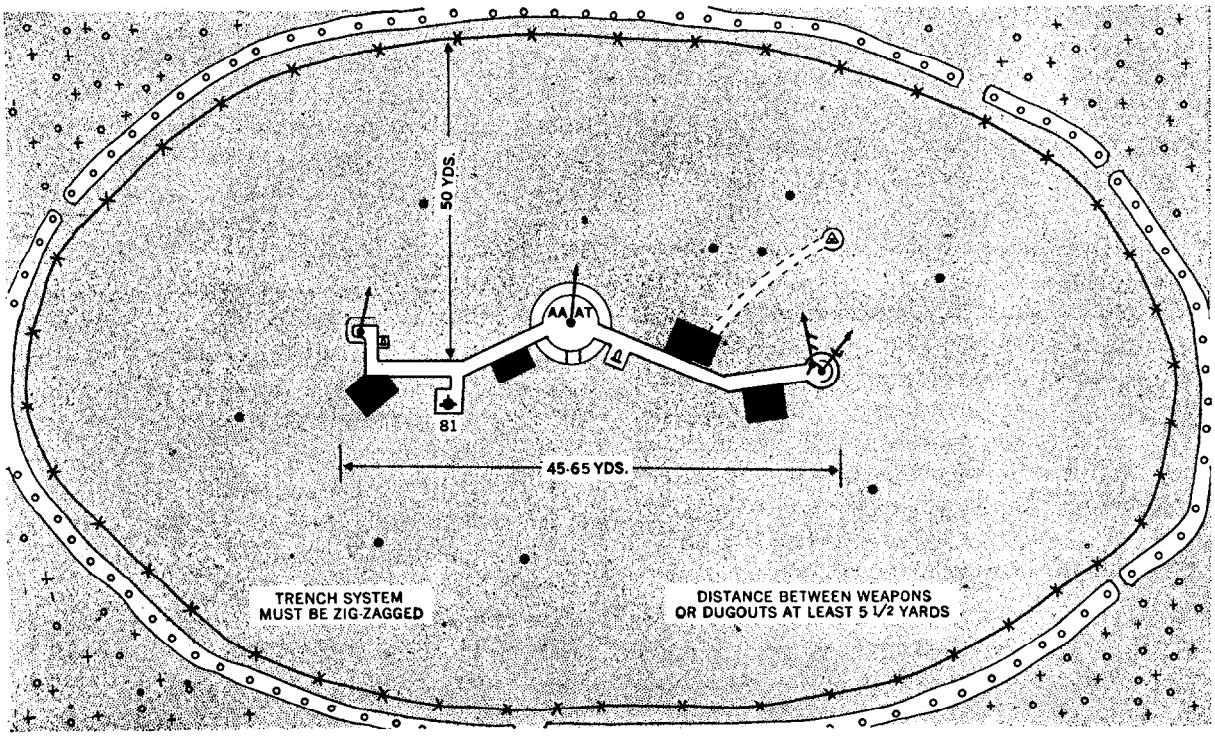


Figure 12.—Typical layout of a reinforced squad strongpoint.

strongpoints normally are incorporated into platoon strongpoints, and the latter into company strongpoints, etc.

The Germans make the maximum use of reverse slopes in their defensive positions. Forward-slope positions are usually avoided as they are detected too early by the enemy and are likely to be destroyed by massed fire. Since organization of a position in woods requires much time and labor, and strong occupation is requisite to compensate for poor observation, the Germans also avoid woods when time is short and labor scarce. Battle positions are laid out so that woods are neither in, nor directly in front or in rear of, defense installations. The Germans believe, however, that when it is possible to establish a well prepared position in a woods, a position so located offers the same advantages as a reverse slope.

When the Germans decide to construct defensive positions on terrain divided by a stream, they organize bridgeheads on the bank on the hostile side where the terrain facilitates crossings. Where the river forms a re-entrant bend into enemy-held terrain, a second position is constructed at the base of the bend. On narrow rivers and creeks, the entire German main line of resistance is on the hostile side of the river, and the stream becomes the tank obstacle of the position. (See antimechanized defense.) When the friendly side of the river consists of swampland, it is used as an obstacle, and the hostile bank is not included in the defense system.

The Germans endeavor to provide all parts of their position with strong support from artillery and heavy infantry weapons. A detailed fire plan is prepared in advance by the infantry and coordinated with the artillery plan. Provision is made for fire in front of the forward limit of the battle position, which is partly protected by minefields and other obstacles. Alternate positions are dug so that support weapons may be shifted and fired rapidly. The mass of the artillery lays concentrated fire both close to and well in front of the main line of resistance, and is sited to cover the spaces between the effective fire zones of front-line units.

The Germans in general adhere to the principle of "effect before cover" in determining priorities for constructing the various installations in a defense position. First they build combat trenches; erect infantry obstacles such as barbed-wire fences; and construct machine-gun positions, dugouts, foxholes, and antitank positions. They clear fields of fire by careful cutting of underbrush but try to avoid cutting down trees in order to preserve concealment of the position. The underbrush is left in front of the position as far as 1 to 3 yards. They organize observation posts for artillery and heavy infantry weapons, increase the depth of the battle position, dig communication trenches and emplacements for the heavy infantry weapons, and build command posts. Finally, they construct emplacements for the artillery, dig antitank ditches within the battle position, and build dummy positions.

The Germans insist on thorough camouflage. Whenever practicable, trenches and wire obstacles are placed along natural terrain lines such as rows of brush or edges of fields. Trenches are dug zig-zag at obtuse angles, 330 to 660 yards long, depending on the terrain. Machine-guns are emplaced in trenches 1 to 3 yards in length. To avoid silhouettes, the Germans heap more earth behind the trenches than in front. Dugouts for riflemen and for machine-gun positions normally provide sufficient protection against enemy artillery and mortar fire. Whenever possible, three layers of logs and earth are used as cover.

e. Reserve Position. Occasionally a reserve position is organized and troops in the main battle position retire to it, but only under heavy pressure. This reserve position is constructed far enough to the rear to compel hostile artillery to displace forward in order to bring it under fire. Motorized reserve units normally are kept there for counterattacks which are planned in advance.

f. Antimechanized Defense. In constructing a defensive position the Germans stress construction of obstacles and antitank defenses. If possible they select tank-proof terrain, and natural tank obstacles, such as steep slopes, are improved. Very steep forward slopes are made at least 8 yards deep, while uphill slopes are made 2 to 3 yards high. Originally the Germans constructed antitank ditches well forward of the main line of resistance, but experience taught them that such ditches offered favorable jumping-off positions for hostile infantry and also revealed the location of the main line of resistance. At the present time, therefore, antitank ditches normally are dug in the area between the main line of resistance and the artillery positions. They are built in an uninterrupted line to avoid leaving passages that can be exploited by the enemy.

All crossings essential to assure the maneuver-

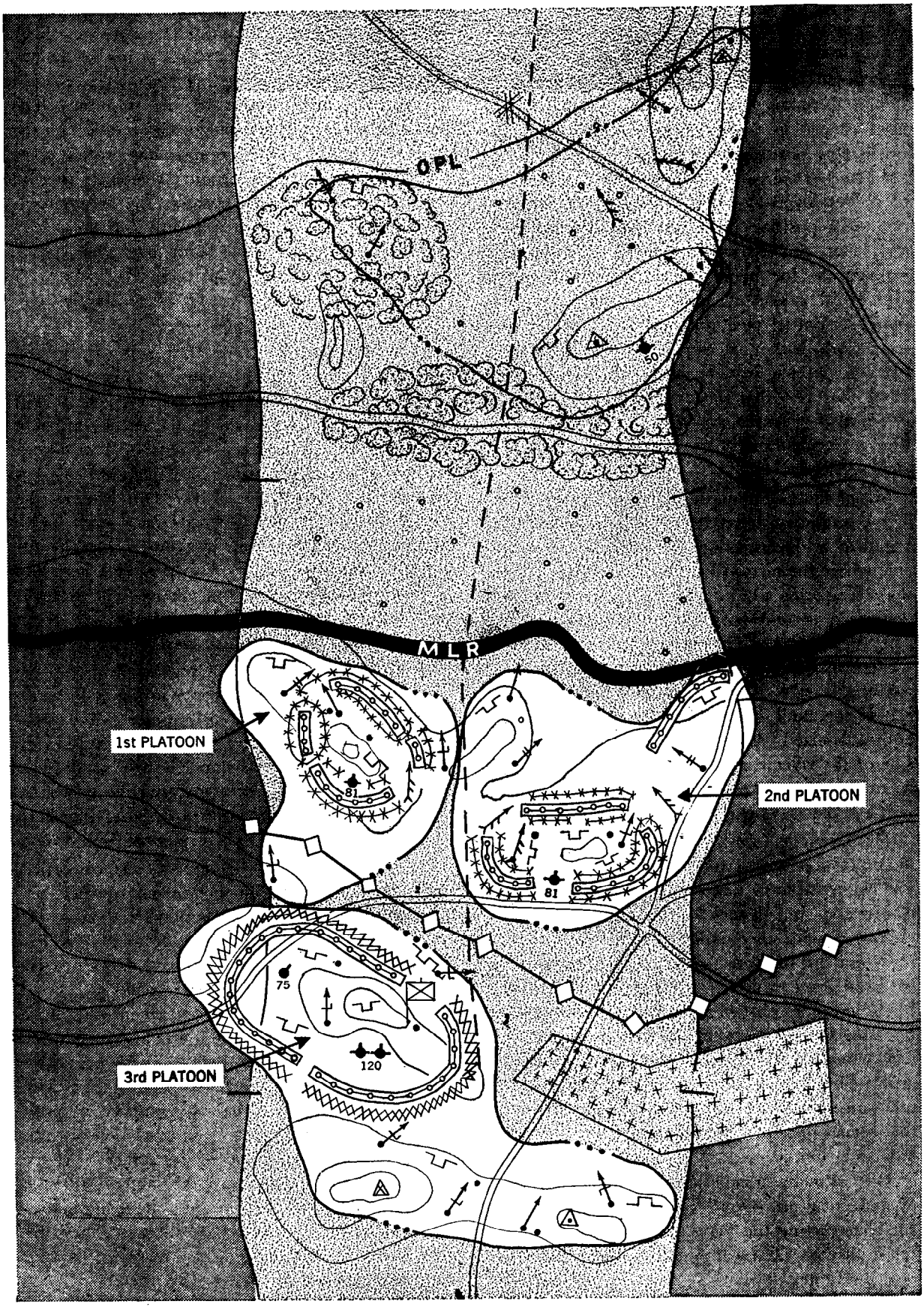


Figure 13.—German company in a defensive position.

ability of friendly troops are built so that they can be blown up on the shortest notice.

The Germans are aware that obstacles of any kind are effective only when covered by fire from various weapons. Consequently, there usually are trenches behind the antitank ditches from which machine-gun and antitank-gun fire can cover the entire length of the tank obstacle.

The Germans learned that dense minefields in front of their positions were an inadequate tank obstacle, because the enemy usually neutralized them by massed artillery fire or by concentrated air bombardment before launching a large-scale attack. Now German minefields normally are laid within the main battle position, and only single mines are dispersed in pattern at wide intervals in front of the main line of resistance. Particular stress is placed on the mining of roads. Routes of withdrawal which have to be left open are prepared for mining, and, if time does not permit placing of actual mines, dummy mines are installed.

The Germans employ many kinds of tank obstacles. They recently have used static flame throwers dug into the ground. Usually sited in pairs and in conjunction with other tank obstacles, they are fired by well concealed personnel as soon as hostile tanks come within range.

German antitank guns are disposed in depth, with some well forward. They often are dug in and carefully concealed to prevent the enemy from discovering the location and strength of the antitank defenses prior to attack. In emplacing antitank guns, the Germans prefer positions in enfilade or on reverse slopes. They normally employ two to three antitank guns in each position, protecting them from infantry attacks with light machine guns. Ranges at which the Germans open fire upon hostile tanks vary according to the caliber of the gun and its position. Although single antitank guns sometimes engage enemy tanks at ranges up to 1,000 yards, main antitank defenses usually hold their fire until the range is reduced to about 150 to 300 yards. The employment of close-combat antitank teams supplements the antitank defense. When the hostile tank attack is repulsed, the antitank guns move to alternate positions.

The Germans emphasize that the use of smoke can be of great assistance in defeating enemy tank attacks. Smoke shells are fired into the attacking formation about one-third the distance back from the leading echelon. Thus the Germans avoid blinding their own antitank gunners, and leading hostile tanks not only are left without adequate support but are silhouetted against the smoke. The Germans also rely on the smoke being sucked into the tanks and forcing the crews to dismount.

3. Conduct of the Defense

German defense of a position, whether hastily prepared or complete in all details, is conducted on the same principles. Unless they are compelled by manpower and materiel shortages to rely on the strength of their positions, the Germans prefer heavy concentrations of fire and powerful, coordinated counterattacks by mobile reserves of all arms. They apply the principle of selecting a point of main effort (*Schwerpunkt*) to the defense as well as to the attack. This principle necessarily is applied in reverse order in the defensive, the main effort being made opposite the point where the enemy is making his main attack.

German artillery attempts to disrupt a hostile attack before it reaches the defensive positions. The Germans state that it is invaluable to install observation posts simultaneously in the main line of resistance, in the advanced position, and in the immediate vicinity of the gun position. Thus they try to keep a hostile force constantly under observation and fire even when it achieves a penetration. The artillery regiment commander controls the fire as long as possible, although requests for artillery barrages may be made by unit commanders as low as platoon leaders. Capabilities of German heavy mortars, which like all other support weapons usually are sited on reverse slopes, are exploited, with a present trend toward mortar-fire concentration.

When a part of the battle position is lost, the area is taken under artillery fire to annihilate enemy forces which have penetrated it. The Germans normally organize reserve units, even when only relatively few troops are available. Immediate local counterthrusts by infantry elements and support weapons near the penetration endeavor to hurl back the enemy before he has an opportunity to establish himself. These small counterthrusts, which normally closely follow the artillery fire, preferably are directed at the flanks of the penetrations.

When the enemy succeeds in making a large penetration or breakthrough, the German higher echelon commander decides whether a general counterattack should be launched to restore the position or whether the main battle position

should be reestablished farther to the rear. The counterattack is directed against the hostile flank, where possible, and is prepared thoroughly. Assembly area, time, objective, zone, artillery support, and employment of tanks, self-propelled artillery, assault guns, and air units are controlled by one commander.

German antiaircraft defense, which is unable to give adequate protection everywhere because of Allied air supremacy, is concentrated at important points. The main mission of the light and medium antiaircraft artillery is the protection of roads. Accuracy of Allied air reconnaissance compels the German antiaircraft artillery to change positions from day to day, the changeover being made during the night. The Germans also enforce a preliminary two-hour fire silence in the new position to try to trap enemy fighter-bombers. Searchlights often are placed parallel to a protected road to prevent enemy aircraft from illuminating the road by flares. This is particularly important since the Germans normally bring forward their relief troops, rations, and ammunition during the night.

4. Defense of Towns

The Germans regard towns and villages as excellent strongpoints, particularly if the buildings are of masonry. Towns also are regarded as excellent antitank positions because of the considerable infantry-artillery effort necessary to neutralize them.

In defending a town or village, the Germans locate their main line of resistance well within the built-up portion; the edges of the town, which provide easy targets for artillery fire, are believed to be too vulnerable. The main line of resistance is laid out irregularly in order to develop flanking fire, and every effort is made to conceal its location until the last possible moment. Minor strongpoints are maintained forward of the line in order to break up attacks and provide additional flanking fire. Cul-de-sacs are organized and attempts made to trap attacking forces in them for destruction by counterattacking mobile reserves. These reserves are kept in readiness within the town itself, but other reserve forces are held outside the town to prevent hostile flanking maneuvers.

Both occupied and unoccupied buildings are booby-trapped in organizing the defended positions. Entrances to buildings are blocked, and all windows opened so as not to disclose those from which fire is maintained. Rooms are darkened, and passages are cut in the walls between buildings. To avoid detection, the Germans fire from the middle of the rooms, and frequently change their positions, while communication is maintained through cellars and over roofs. Machine guns are sited low, usually in basements, to provide better grazing fire. Chimneys and cornices are used as cover for men on roofs; tiles may be removed to provide loopholes. Searchlights are mounted to illuminate fields of fire; in their absence vehicle headlights may be used as substitutes. When houses collapse, the defense is carried on from cellars, and rubble heaps of destroyed areas are organized into strongpoints.

Tanks are considered to be ineffective within a defended town, although the Germans have used them in static, dug-in positions at cross-roads and squares. As a result of their experiences on the Eastern Front, the Germans believe single tanks are too vulnerable to Molotov cocktails, magnetic mines, and explosive charges. When the Germans themselves use these antitank weapons, they employ them from foxholes dug outside the perimeter of the town. Efforts are made to destroy enemy tanks immobilized by antitank action, either within or outside the town, in order to prevent their recovery or use as artillery observation posts and machine-gun nests. Antipersonnel mines are interspersed in antitank minefields because the attacking infantry are considered the chief menace.

Assault guns may provide direct defensive support fire if attacking forces break through and disorganize the German position. To secure the added protection afforded by masonry walls, the Germans may locate assault guns or tanks within buildings and use them against hostile armored vehicles and infantry. Counterattacks, supported by assault guns or tanks, will not be withheld until the situation has become desperate; indeed, surprise counterattacks may be launched at any time.

For the defense of village strongpoints special battle commandants (*Kampfkommandanten*) are appointed. The battle commandant is usually the senior officer and the tactical commander of all military forces, emergency units, and civil organizations in his area. He has the disciplinary power of a regimental commander.

In the case of fairly small villages, consolidation of the place itself is usually deemed sufficient. For larger localities an outer defense

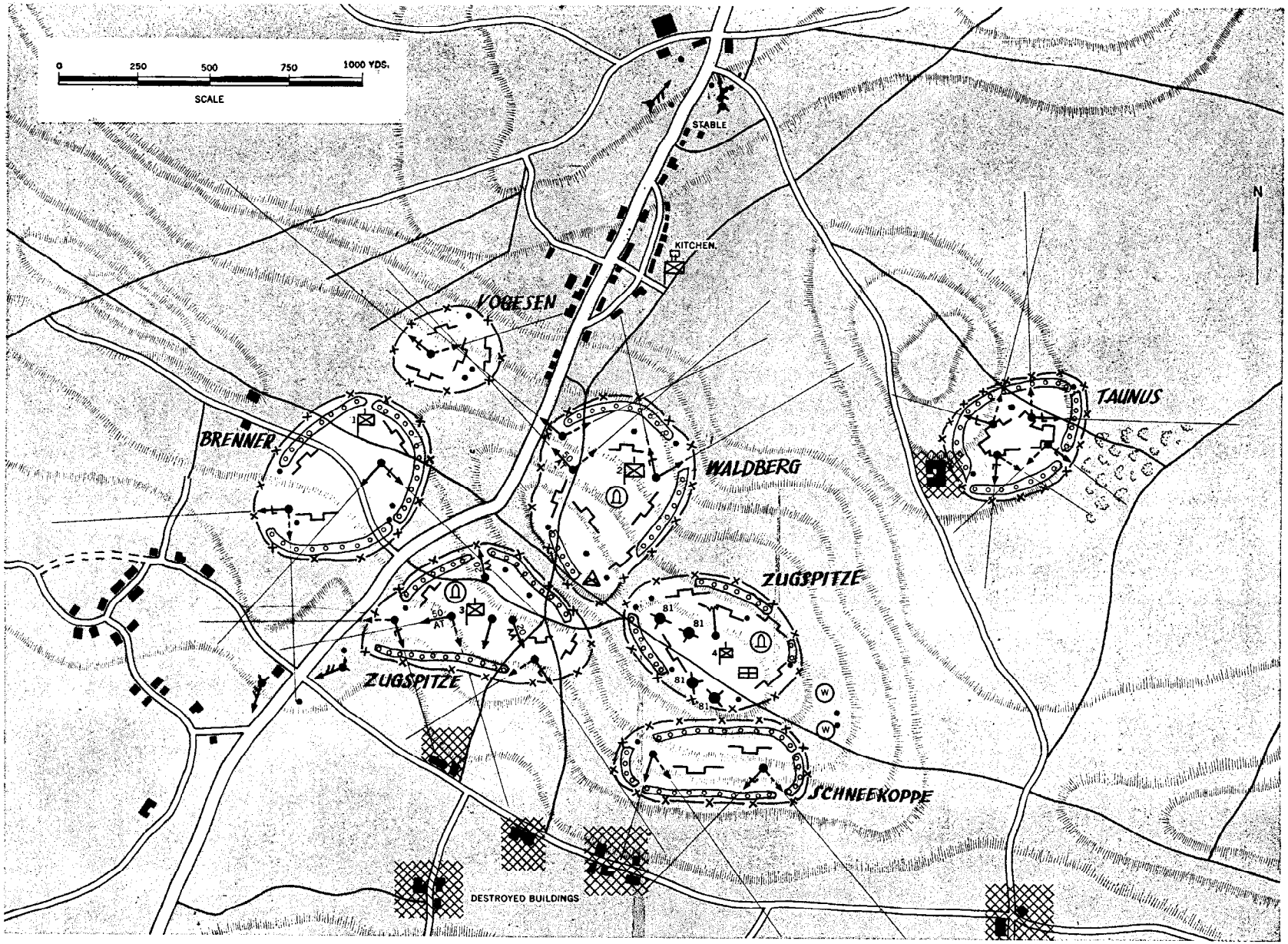


Figure 14.—Strongpoint manned by an infantry battalion.

system is constructed in addition to the inner defenses.

The inner defense system consists of a number of concentric positions which are broken down into perimeter positions, intermediate positions, and the inner ring position. The inner defense system is divided into sectors, each forming a strongpoint system in itself, with the strongpoints protected by all-around antitank and infantry obstacles and connected with each other by trenches.

The perimeter ring position is the most important part of the inner defenses and consists of one or more continuous trench systems, each with a deep main battle zone. The forward edge often is beyond the outskirts of the village, unless this creates unfavorable conditions for the antitank defense, in which case it is within the village itself. Artillery and heavy support weapons are employed as whole units in support of the perimeter ring position, although single guns may be detached for the defense of strongpoints and roads. The nearer the fighting approaches the inner ring, the more likely it will be that the Germans will split up the support weapons units for close cooperation with infantry assault groups.

The outer defense system likewise consists of a number of concentric positions, approximately 4 to 6 miles apart, so as to force the enemy artillery to displace to engage each one. For defense of larger towns the Germans organize the outside ring about 12½ to 18½ miles beyond the outskirts whenever feasible. Beyond this outside defense ring, about 2,200 yards forward, are the advanced positions, with covering units still further forward on main roads and railways.

Patrols of all types, including motorized and cyclist patrols, give early warning of the enemy's approach and keep him under continuous observation. Non-military outposts, such as police sentries, party officials, and local farmers also are used for these duties.

Sector boundaries for companies and battalions are defined from the outside defense ring to the center of the town or village. Usually they do not coincide with vital main roads, which always are defended by entire companies or battalions. Every strongpoint, defense block (combined adjacent buildings), and sector has local reserves; mobile reserves, consisting of combat groups comprised of infantry, tanks, assault and self-propelled guns, are employed for counterattacks of a larger scale.

In addition to regular military units the Germans employ emergency units, organized from personnel of Army, Navy, and Air Force in town defense. Besides these regularly organized emergency units, improvised emergency units are formed from stragglers, remnants of formations, and units in process of reorganization. Utilization of emergency units is only temporary. Their main tasks, of local nature, are protection of headquarters, supply points, airfields, etc., and garrison service in fortifications.

5. Doctrine of Westwall System

The Germans consider economy of force the fundamental principle in planning zones of permanent fortifications. They originally built the Westwall as a protective barrier along the French frontier to permit commitment of maximum forces offensively in the East. Thus, in 1939, they were able to hold in the West with approximately 20 divisions, while employing 40 to 50 divisions against Poland.

When Westwall construction ceased in 1940, German strategy in the West was offensive, envisioning an invasion of France by a wide envelopment, with the bulk of the German forces in the North, where the Westwall defenses were relatively weak. The pivot of maneuver was south of the Moselle River, where the Westwall defenses were strongest.

The Germans never have discarded the principle that offensive action is the best protection. When their armies were forced back to the Westwall in 1944, they used this defensive system as a base for offensive operations in selected areas, as in the Saar and the Eifel. Advantage also was taken of this protected zone for the free lateral movement of troops; shelters were utilized for the cover and concealment of reserve forces, weapons, and supplies.

German Westwall tactics are based on a stubborn defense of individual fortifications, local counterattacks against areas of penetration, and counterattack by general mobile reserves against areas of deep penetration. German troops are not permitted to develop a static-defense complex which might foster the idea that a position once surrounded is lost. Bunker garrisons are taught to continue resistance even though surrounded, because their perseverance impedes the attackers' advance and facilitates counterattacks. Troops are trained in the principle that the decision usually is achieved by the infantry in the open between bunkers. Organic heavy infantry weapons and artillery are the backbone of German defense

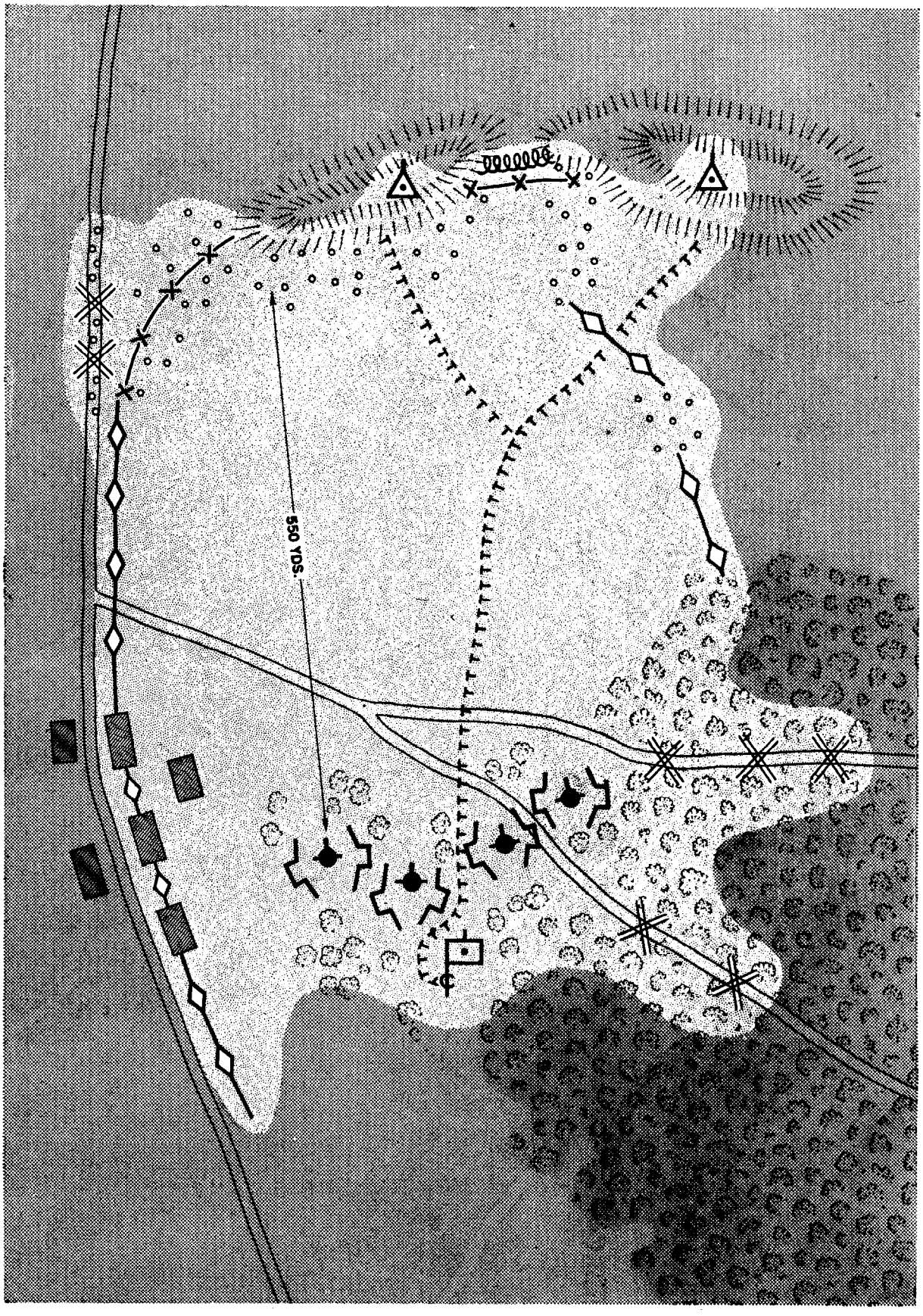


Figure 15.—Antitank defense of an artillery battery firing position.

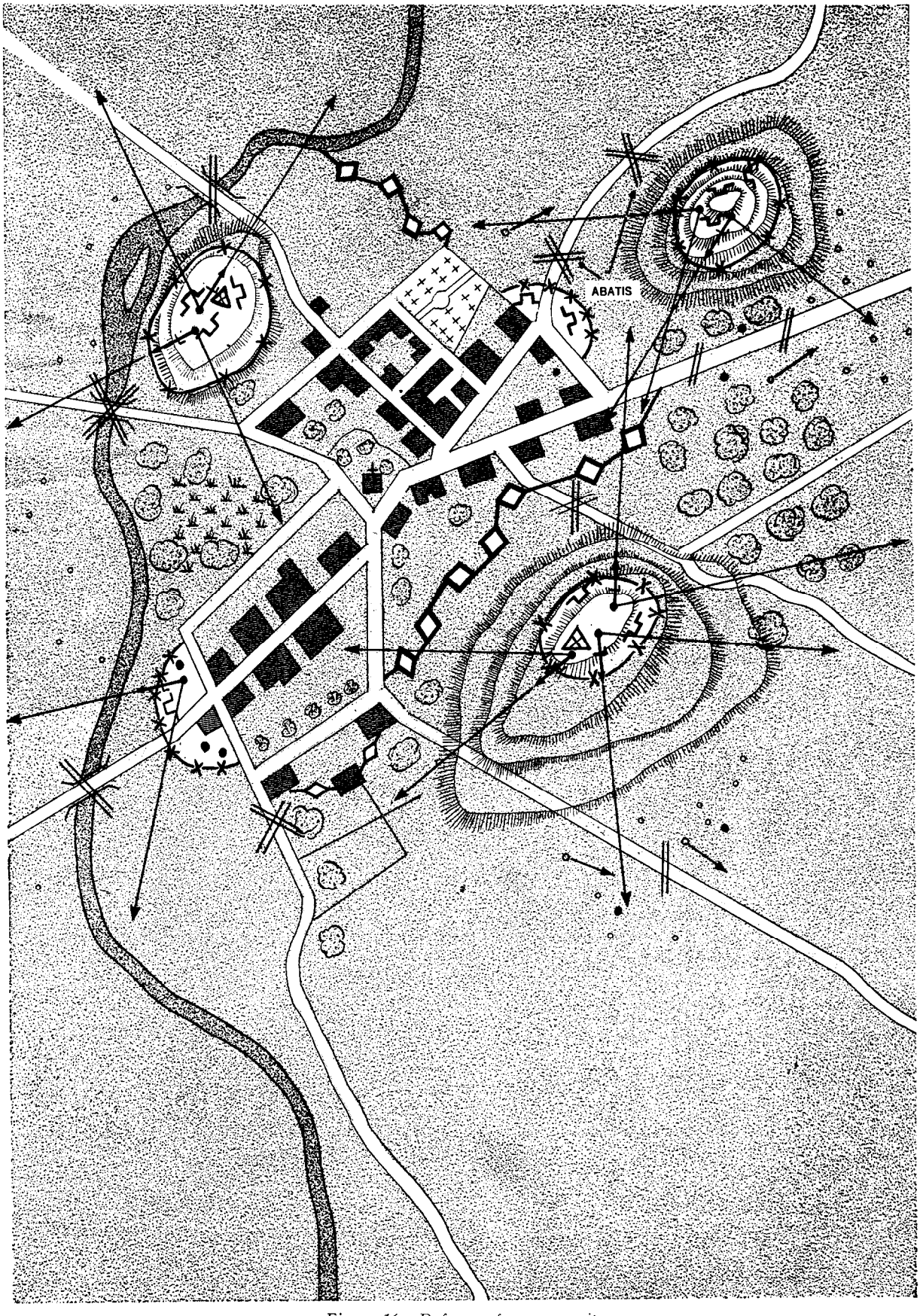


Figure 16.—Defense of a community.

in the Westwall, just as in mobile warfare. Reserves habitually are left under cover until the time for counterattack arrives.

Surprise is always attempted. For example, bunkers and heavy weapons frequently are sited on reverse slopes, not only for concealment and protection in defilade, but also to open fire suddenly upon the unwary attacker crossing the crest or moving around the nose of a hill. The attacker penetrating the Westwall defense system must be prepared to cope with unexpected resistance flaring up in his rear areas, surprise by accurate flanking and enfilade fire at short and medium ranges, sudden counterattacks by forces not known to be in the areas, and counterattacks in increasing strength as the penetration progresses.

German doctrine prescribes that the intact portion of the defenses must continue the battle, regardless of the situation at the penetrated area, until the appropriate command orders a readjustment of the line. Penetrations normally are dealt with as follows: by mobile reserves which seal them off frontally; by counterattack or counteroffensive from protected flanks to threaten the rear areas of the penetrating force; or by both, as in the Aachen area. At any rate, the Germans will attempt to destroy the penetration before the attacker has reorganized and consolidated his gains. Here again the principle of economy of force is generally followed. German troops may be taken from strongly protected and little threatened areas in order to concentrate on adequate counterattacking or counteroffensive force. Hence the attacker should have sufficient strength to ward off strong countermeasures and at the same time exploit the advantages gained by a penetration.

Section VI. RETROGRADE MOVEMENTS

1. Withdrawal from Action *(Abbrechen des Gefechts)*

a. GENERAL. The Germans break off an engagement for one or more of the following reasons: when it has served its purpose; when conditions require the employment of the troops, or part of them, on another front; when a continuation of the battle gives no promise of success; or when defeat is imminent.

When an attack exhausts itself without attaining its objective, the Germans assume the defensive as the first step in withdrawing from action. If the defense must be continued in a rearward position, the breaking of contact, the retirement, and the resumption of the defense are carefully planned beforehand. Positions in the rear are prepared for the reception of the troops, particularly if they have been engaged in heavy fighting. The retirement is made in conjunction with that of adjacent units, and stress is placed on maintaining the cohesiveness of the retiring forces.

By maintaining the usual fire of all arms, the Germans try to deceive their enemy as long as possible as to the continued occupation in force of their original position.

In view of the severe losses inflicted by Allied planes and armored forces on German troops during daylight disengagements, the Germans try to await darkness before withdrawing from action. At night they break off combat on a wide front and move back along routes as nearly perpendicular as possible to terrain features suitable for fighting delaying actions. When the situation forces them to withdraw during daylight, they do so by unit sectors, coordinating the movements of adjacent units.

b. ORDERS. The German company commander follows this outline in drafting his orders for breaking off an engagement:

General instructions. Rearward movement of supplies, ammunition-carrying vehicles, and equipment.

Reconnaissance and marking of routes of withdrawal.

Detailed instructions. Combat orders for the covering forces (reconnaissance units, heavy support weapons, medical personnel, infantry combat wagons, and infantry engineers).

Type, time, and march order for the withdrawal of the rifle platoons and heavy weapons.

Assembly areas.

Location of the company commander.

2. Retreat *(Ruckzug)*

a. GENERAL. Retreat is a forced retirement which is ordered by the Germans only when all possibilities for success are exhausted. The objective is to place enough distance between friendly and hostile forces to enable the former to conduct an orderly withdrawal and to occupy new positions to the rear.

b. COVERING FORCES. The German usually organize covering forces from troops in closest contact with the enemy—either whole tactical units or elements from several. These forces attempt to make the enemy believe that the position is still fully occupied. Engineers prepare additional ob-

stacles, minefields, and booby traps forward of and within the positions to be held. A portion of the artillery and heavy infantry weapons support the covering forces. They maintain as long as possible their former fire activity to deceive the enemy, even when fulfilment of their mission means the loss of individual guns. The sector assigned to a covering force is usually too wide to be under effective control of a single commander, but the actions of the various commanders are closely coordinated. Orders specify whether the covering forces are to remain in contact with the hostile forces until they begin to advance, or to follow the main body after a specified interval.

c. REAR GUARD (*Nachhut*). (1) As the distance from the enemy increases, the retiring troops form march columns. Where possible, a division's retirement takes place along two parallel routes. The freshest troops available are used as rear guards. Since the rear guard cannot expect support from the retreating main body, it must be relatively strong. It is composed of infantry units. Generally the divisional field artillery retires with the main body, none being assigned to the rear guard. Self-propelled and heavy infantry-support guns, and even howitzers, are frequently attached to the rear guard. Tanks also may be assigned. A typical rear guard for each route in a division retirement is one infantry battalion to which are attached elements of the reconnaissance unit, to protect the flanks, and of the engineer unit, to prepare demolitions.

(2) The rear guard infantry battalion normally employs only one of its rifle companies on active rear guard tasks. The three rifle companies perform this function in turn as long as their strength remains approximately even. If the terrain demands it, two companies are employed at a time. Two or more antitank guns and half of the self-propelled or heavy infantry guns allotted to the full rear guard support the rearmost rifle company or companies. When pressure becomes too strong, the single rifle company is withdrawn through the two remaining rifle companies which are supported by the remainder of the attached weapons. Variations of this leapfrogging progress are repeated until darkness, when a general disengagement takes place and the original formation is resumed.

(3) Rear guards withdraw by bounds to selected but not prepared positions. The extent to which positions eventually can be prepared depends on the proximity of the pursuing forces, the length of time each particular position is likely to be held, and the decision of the individual company and platoon commanders. During each stage of the retreat, the commander of the rear company can order a withdrawal to the main rear guard position, but withdrawal from each main rear guard position is ordered by the commander of the main body. Frequently the speed of withdrawal is based on a time-distance schedule. During the withdrawal from a certain town, rear guards were instructed to retire not more than 3,000 yards a day.

(4) Experience has shown that in certain types of country a reinforced rear guard company generally can hold up very superior forces on a front as wide as three miles. In one instance of a withdrawal from a defensive position along a river line, a German *Panzer* division, which had one *Panzer Grenadier* battalion and attached elements as its rear guard, was covered by one rifle company reinforced by a company of tanks, four infantry guns (including two self-propelled), and a battery of medium howitzers. The tanks were mainly used to cover the withdrawal of the rifle elements. On another occasion a similar rear party had a number of heavy mortars attached. These covered the infantry withdrawal with the help of four tanks, which also carried the mortars back to the next bound.

(5) Particularly suited for rear guard tasks, because of its armor and high fire power, is the armored reconnaissance battalion of the *Panzer* division. When employing the armored reconnaissance battalion in terrain that affords cover, the Germans site well camouflaged, armored half-tracks in wooded areas, flat reverse slopes, or high grain fields, and open fire with all weapons at very close range. The armored half-tracks then penetrate into the confused enemy and, after repulsing him, retreat to previously organized alternate positions.

3. Delaying Action

a. BASIC PRINCIPLES. The Germans make a distinction between "delaying engagements" (*Hinhaltendes Gefecht*) and "delaying action" (*Hinhaltender Widerstand*). A delaying engagement is primarily the general plan of the higher commander for holding back the enemy. Delaying actions are the measures taken by lower units to carry out the higher commander's plan.

The purpose of delaying actions is to enable the main German force to disengage itself from battle, retire in order, and establish a new defen-

sive position. Delaying actions therefore seek to deceive the enemy as to German strength, dispositions, and intentions; to prevent the enemy from committing the main German forces; and to prevent close pursuit of the main forces by the enemy. These measures are accomplished by rear guards, special battle groups, and strongpoints, all of which are characterized by high automatic fire power, mobility, and economy in numerical strength.

Delaying actions are organized not in a main defensive belt, but on lines of resistance (*Widerstandslinien*). The distance between such lines is great enough to prevent the enemy from engaging two of them from the same artillery position. He is compelled to displace and move up his artillery to engage each line. These lines of resistance are normally established along forward slopes to facilitate disengagement and withdrawal under cover. The delaying actions are fought forward of the lines of resistance with mobile forces. Furthermore, battle outposts are organized forward of each line.

The main delaying weapons are machine guns, mortars, and self-propelled weapons. Tanks are used in small groups.

Maintenance of contact is a most conspicuous principle in the Germans' conduct of a withdrawal and delaying action. The size, composition, direction, and intention of the attacking enemy force are observed at all times.

b. Conduct of the Delaying Action. During a delaying action, wide sectors are covered by artillery units widely deployed—guns are sited by sections if necessary—and by widely distributed infantry-support weapons. The defense is then further organized by establishing strongpoints manned by small groups.

The positions from which delaying actions are fought are characterized by very slight depth. As a general rule, a unit is responsible for double the front normally allocated in defensive fighting. A company sector is 650 to 1,300 yards; a battalion sector 1,750 to 4,400 yards; a regimental sector 4,400 to 6,600 yards; and a division sector 13,000 to 22,000 yards.

In leaving a line of resistance, German covering forces attempt to disengage by night. If that is not possible, their actions are governed by the following principle: the enemy is not allowed to come closer to them than they are from their next line of resistance. The troops must be able to reach the new position before the enemy reaches the old one, or their losses will be excessive.

The troops therefore do not retire in the face of enemy patrols—every effort is made to destroy such patrols—but only when the enemy mounts an attack. If it can be ascertained that the enemy is preparing for a massed attack, the Germans make a timely withdrawal to avoid exposing the troops to enemy artillery concentrations. Advance elements employ smoke to enable them to make a getaway in a critical situation. Riflemen cover the disengagement of heavy weapons, which move back by bounds. Every opportunity is taken to make limited counterattacks in order to inflict casualties on an enemy who advances recklessly.

Fire is opened at extreme ranges on an enemy advancing for a major attack. Enemy reconnaissance forces are allowed to approach, however, and then an effort is made to destroy them.

Counterattacks on a large scale are avoided, except when the enemy threatens to penetrate the line of resistance. When that occurs, the Germans counterattack with the main forces of the rear guard and seek to restore the situation in order that the program of staged withdrawal may be continued. Local counterattacks are made for the protection or retention of some feature essential to the safe conduct of the main withdrawal, or to gain time for the preparation of the line of resistance or phase line.

The area between the lines of resistance is called the intermediate area (*Zwischenfeld*). Explicit orders are given as to whether the intermediate area is to be covered in one bound or is to be fought over. The latter necessity arises especially when the next line of resistance has not been fully prepared and time must be gained. Detachments must reach the line of resistance early enough to insure that all the main positions are occupied in time.

The supply of ammunition is carefully organized. A great deal of ammunition is required for delaying actions because a few weapons on a broad front must do as much as or even more than the normal number of guns in a defensive position. When ammunition is scarce, the Germans specify, down to sections if necessary, the quantity of ammunition that may be used at each position. Every commander maintains a supply of ammunition for emergencies.

The Germans stress the importance of deceiving the enemy by every means. Artillery and

heavy weapons are moved continually to give an impression of greater strength. Dummy positions and camouflage are also widely used.

So that isolated groups may be adequately directed, signal communication receives special attention.

In delaying actions in mountainous terrain, the Germans make greater use of their reconnaisance and engineer units than of any other component. Reconnaisance units are almost continuously in contact with advance and flanking enemy elements, and participate in most rear-guard and battle-group engagements.

c. STRONGPOINTS IN DELAYING ACTION. The Germans cover the rear guard's resistance or phase lines by a system of strongpoints or defended localities. Just as it is a function of the rear guards to prevent a pursuing force from making contact with the main body while it is on the move, so it is the function of strongpoints to prevent the penetration of resistance or phase lines until the main body has withdrawn to its next position.

In manning strongpoints, the Germans show the same economy of force they show in forming rear guards. Typical fire power of a strongpoint in close country is one or two self-propelled guns, two heavy mortars, and up to six machine guns. In open country, one self-propelled gun is normally employed, supplemented by three tanks and a small party of infantry with mortars and machine guns in armored half-tracks.

Strongpoints generally are organized on the hedgehog principle. Provision is made for all-around fire, but the strongpoints are not necessarily mutually self-supporting. They are normally located on commanding features, and sometimes on the forward edges of villages or hamlets if these dominate road or terrain bottlenecks. In flat country, however, villages usually are not occupied except by snipers, but positions are occupied in the rear of the villages to engage enemy vanguards debouching from them. Weapons are not dug in, and positions are frequently changed. Counterbattery fire thereby is rendered very difficult as there are no prepared positions to be spotted from the air. The Germans thus force their enemy to launch a full-scale attack supported by artillery to dislodge the garrison of the strongpoint, which normally withdraws just before the attack can materialize. Approaches to strongpoints which cannot be covered by fire are frequently mined. Extensive minefields are frequently laid at the heads of re-entrants in hilly terrain.

d. BATTLE GROUPS IN DELAYING ACTION. Battle groups normally are organized for the execution of some specific task in the withdrawal, such as a local counterattack or the defense of some particular feature whose retention is necessary for the security of the main withdrawal.

Battle groups, which the Germans employ for offensive and defensive as well as delaying missions, vary in size from a company or two, with attached close support weapons, to a regiment or several battalions reinforced with tanks, artillery, antiaircraft, engineer, and reconnaissance elements. In all cases the Germans seek to make them as self-sufficient as possible in combat. In actual practice, however, the composition of German battle groups appears often to have been dictated less by the theory of what units should be put together to form a self-sufficient combat force, than by the demands of an emergency situation which commanders have been forced to meet with the insufficient and normally disassociated units at their disposal.

German battle groups may be organized for short, long, or changing missions. They are usually known by the name of their commander.

e. DEMOLITIONS AND OBSTACLES. To prevent the pursuing enemy columns from approaching close enough to engage even their rear guard elements, the Germans continually employ demolitions and obstacles of all kinds. The thoroughness with which engineer operations have been carried out has increased steadily throughout the war. Culverts and bridges are completely destroyed. Roads and all natural detours are mined, cratered, or blocked by felled trees; in streets and villages, streets are blocked by the wreckage of buildings. Vertical rail obstacles are placed to obstruct main routes; mines often are laid for 30 yards around the edge of the obstacle. Wooden box mines are used to a large extent as demolition charges, and aerial bombs and artillery shells are sometimes similarly employed.

Frequently rear parties are committed to a delaying engagement in order to cover the preparation of demolitions immediately behind them. During static periods in the general withdrawal, when the Germans occupy their line of resistance or phase line, engineer units prepare demolitions in the rear. After the withdrawal, these demolitions are covered by sniper fire, machine guns, and self-propelled weapons as long as possible.

Section VII. MINEFIELDS

1. General

The Germans make extensive use of mines which they consider a most effective defensive weapon. Minefields are utilized chiefly to cover defensive actions and retreats, although limited use is made of them in offensive actions for flank protection. In a static situation the Germans regard minefields as an element of the front-line position, laid out according to an over-all mine plan developed in close conjunction with that for the fields of fire of all weapons. Within recent months, standard German doctrine for minefield location has been modified. Instead of laying dense minefields in front of the main line of resistance, dispersed mines are laid there, while the minefields proper are sited within the main battle position.

2. Surveying of Minefields

The Germans consider it necessary to survey the location of minefields and individual mines within the minefields. German engineers are instructed to choose reference points (*Festpunkte or FP*) for minefields which easily can be identified. At a grade crossing, at the intersection of two improved roads, at the edge of a village, or some such favorable location, this can be done without any difficulty. In some instances, however, the Germans are forced to use "guide wire" and auxiliary fixed points (*Vermessungspunkte or VP*). A type of auxiliary fixed point that has proved practicable is the center of an equilateral triangle with sides 15 to 25 feet long. The corner points and the fixed point itself may be stakes, rails, or concrete or steel girders about 3 feet in length connected with barbed wire. Such a fixed point can be reestablished easily because even heavy shelling will rarely destroy more than one or two stakes.

A minefield is limited by the four corner points A_1, A_2, A_3, and A_4. The corner points are marked clockwise, A_1 and A_2 forming the base line on the German side. The survey of the field refers to one or both points of the base line. Auxiliary fixed points, called "mine stakes" (*Minenpfähle*), are used if necessary. Fixed points may be reference points found on the map or auxiliary fixed points established by the troops. Distances are measured in meters; azimuth readings are taken on the German issue compass—divided into 6,400 mils like the U. S. compass but read counterclockwise, and marked with the letters *KZ* (*Kompasszahl*). The new-type compass called "march compass" has clockwise graduation and is indicated with the letters *MKZ*. The Germans use the magnetic azimuth and always proceed in their survey from the friendly toward the enemy side.

The Germans believe that it is advantageous to lay a continuous chain of reference points 600 to 900 feet apart, through a division sector. This chain can be used to determine the location of ditches, trenches, obstacles, and pillboxes, as well as minefields. Individual points are designated with Roman numerals, starting on the right flank of the division sector.

3. Laying of Minefields

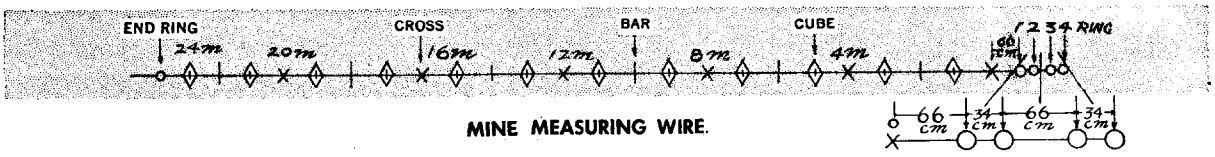
a. PATTERNS. To assure the greatest possible effect, minefields normally are laid out in definite patterns. The Germans make an exception to this practice, however, in sectors where they do not intend to undertake offensive actions. There they disperse the mines irregularly in the areas between defensive positions.

The main belts of a major antitank minefield laid in uniform pattern normally consist of antitank mines with a sprinkling of antipersonnel mines in the forward edge of the field. Both types may be fitted with anti-lifting devices, and some of the antipersonnel mines have trip wires attached. In some instances, these mines are placed in the intervals betwen the diagonal wires of a double-apron fence, with trip wires fastened to the diagonals.

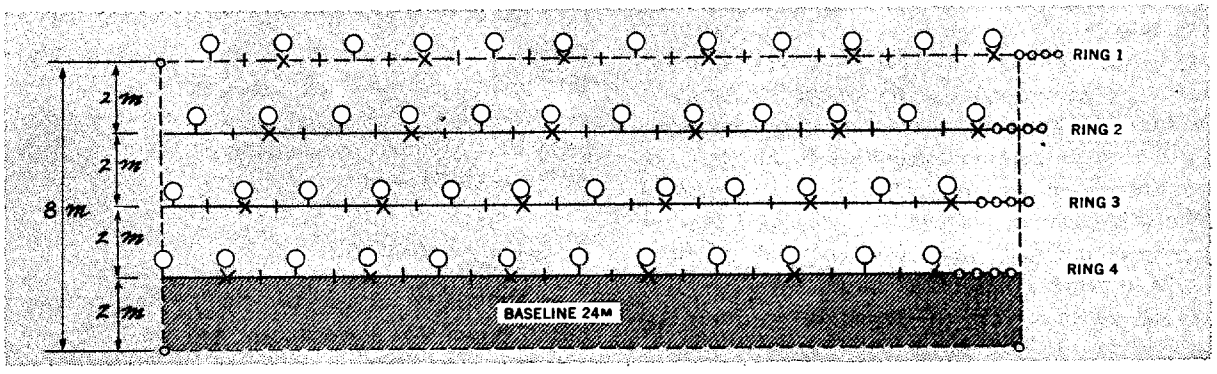
A number of antitank mines are laid in the forward edge of antipersonnel minefields to prevent armored vehicles from detonating the main belt of antipersonnel mines. The forward edges of minefields of all types often are sown with explosive charges placed in wooden boxes fitted with pressure fuzes. These act as both antitank and antipersonnel mines, and discourage the use of detectors to locate the mines.

Forward of most regular fields, and particularly in front of lanes, mines may be found widely spaced or scattered at random in unmarked groups. Mines also are laid in spaces running out at right angles from the forward edge of the minefield to damage vehicles moving along the field in search of lanes.

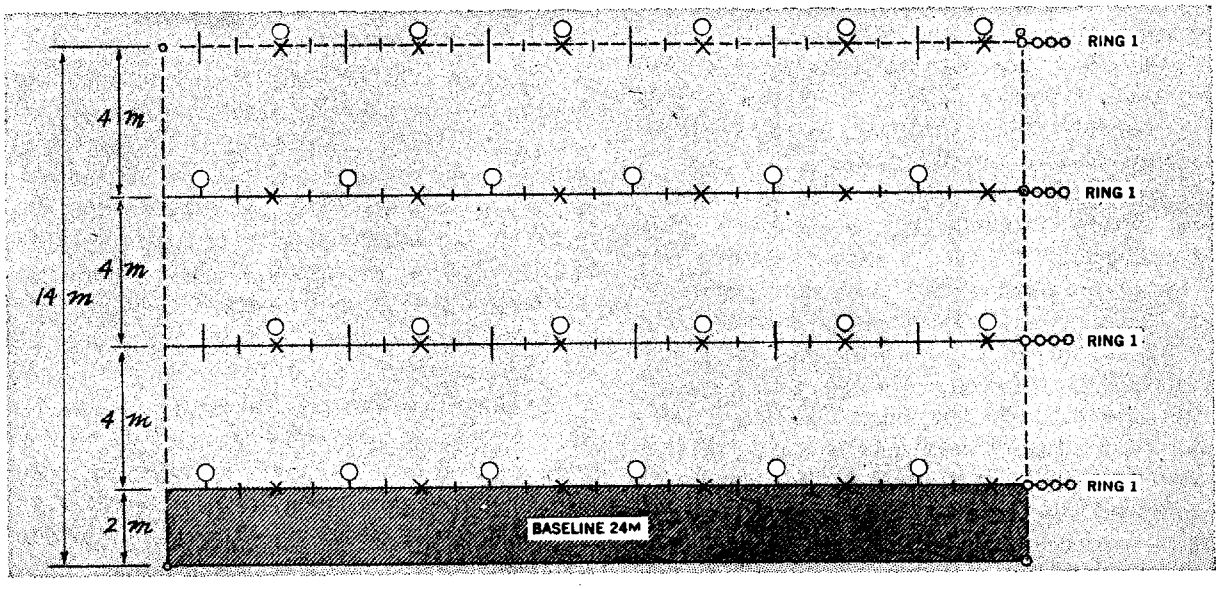
All pressure-type antitank and antipersonnel mines are laid in lines. For measuring distances and spaces, the troops use a mine-measuring wire (*Minenmessdraht*) which they themselves make



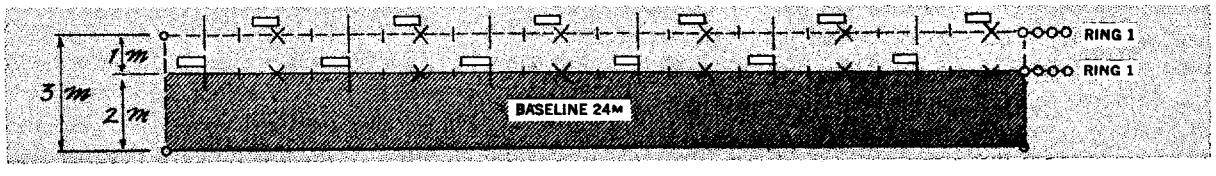
MINE MEASURING WIRE.



BURIED T-MINES (T-MINE 42 OR T-MINE 43), WITH 2-METER SPACING BOTH LATERALLY AND IN DEPTH.



T-MINES (T-MINE 42 OR T-MINE 43) LAID ON SURFACE, WITH 4-METER SPACING BOTH LATERALLY AND IN DEPTH.

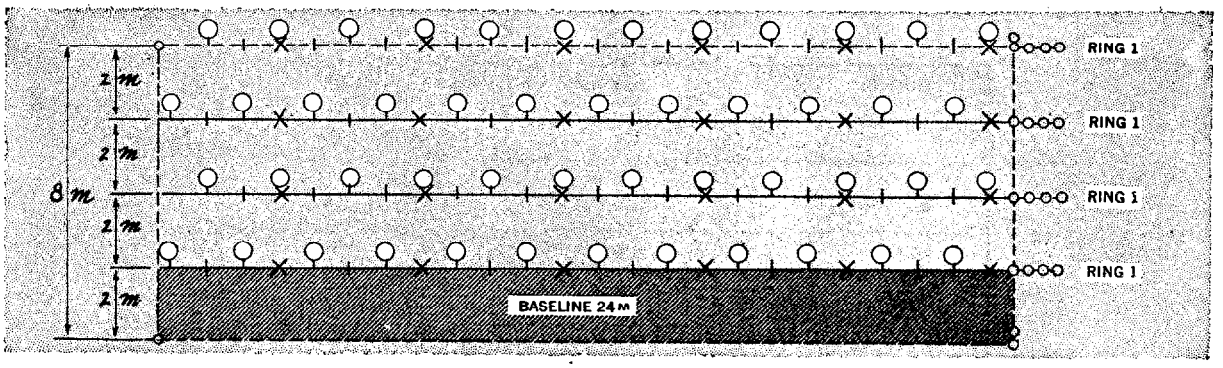


RIEGEL-MINES 43, BURIED OR LAID ON SURFACE.

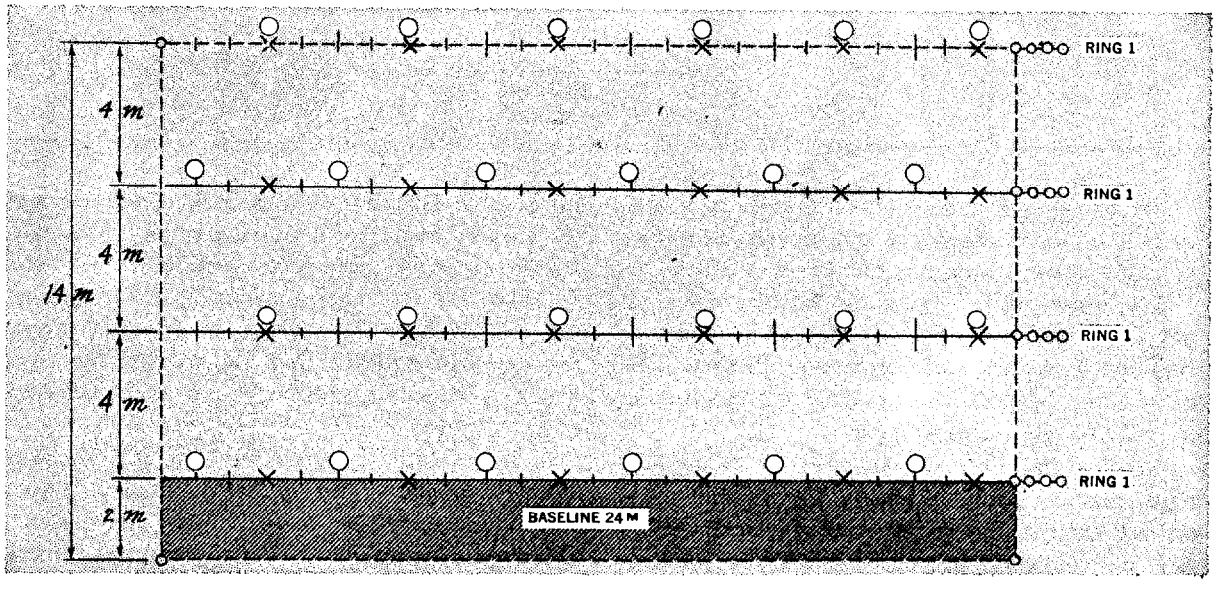
AS A RULE TWO ROWS OF MINES ARE USED, BUT FOR EXTRA PROTECTION IN SPECIAL SECTORS FOUR ROWS ARE LAID, WITH THE THIRD AND FOURTH ROWS MOVED TWO "RINGS" TO THE LEFT WITH REFERENCE TO THE FIRST AND SECOND LINES.

Figure 17.—Mine Measuring Wire and Minefield Patterns.

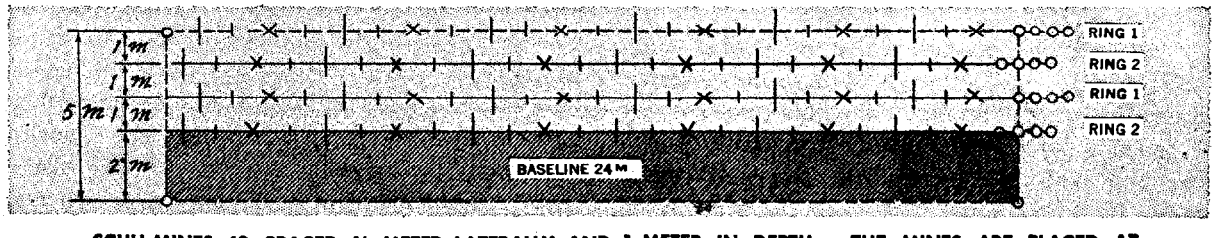
from old telephone wire. (See *Figure 15.*) The mine-measuring wire is 24 meters (about 25 yards) long, and every meter (3 feet 3 inches) is marked with a piece of wood. The rings on the ends are about 5 inches in diameter. The measuring wire, in addition to measuring the distance between fixed points, serves to lay out right angles by staking out a triangle with sides of 6, 8, and 10 meters respectively. Spaces between mines are determined by reference to the marks on wire; the four rings on one end are used to offset the rows.



S-MINES WITH 2-METER SPACING BOTH LATERALLY AND IN DEPTH.



S-MINES WITH 4-METER SPACING BOTH LATERALLY AND IN DEPTH.



SCHU-MINES 42, SPACED ½-METER LATERALLY AND 1-METER IN DEPTH. THE MINES ARE PLACED AT ½-METER INTERVALS ALONG THE MEASURING WIRE.

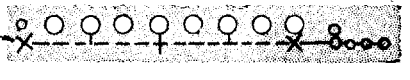


Figure 18.—Minefield Patterns.

Type of Mine	How Laid	Interval between Mines	Number of Rows	Density per 1 Meter of Front
T-Mine 35	Buried	4 m (4.4 yds)	8	2
			12	3
			16	4
T-Mine 42 T-Mine 43	Laid on surface	4 m (4.4 yds)	8	2
			12	3
			16	4
	Buried	2 m (2.2 yds)	4	2
			6	3
			8	4
R-Mine 43	Buried or laid on surface	about 4 m (4.4 yds)	2	½
			4	1
S-Mine 35	Buried	4 m (4.4 yds)	4	1
			8	2
			12	3
		2 m (2.2 yds)	2	1
			4	2
			6	3
Schü-Mine 42	Buried	1 m (1.1 yds)	1	1
			2	2
			3	3
		½ m (0.55 yd)	1	2
			2	4

The density of a minefield depends upon the interval between mines and the number of rows. The table above represents the density.

Mine lanes are left open for patrols, and passage lanes for assault troops. For permanent patrols new lanes are made from time to time, and the old ones closed. A mine-free safety strip is provided on the Germans' side.

The Germans normally lay mine belts in individual sections 80 by 105 feet. The sections usually are staggered, and, for extensive mine belts, they are combined in units of three or four to form forward or reverse arrowheads, or echelons. Minefields arranged in echelon are surveyed by using corner posts on the hostile side of intermediate minefields as survey points.

The Germans emphasize that minefields must be covered by fire, although during a hasty withdrawal they often do not follow this principle. It is common for a regular minefield to have a listening post with two men at the rearward edge; about 70 or 80 yards farther to the rear there usually is a covering party of four or five men armed with one or two light machine guns.

When the Germans are in hasty withdrawal, they usually lay a large number of small nuisance minefields. These fields contain many different types of mines, which often are unmarked and show every evidence of hurried laying. The consequent lack of pattern uniformity makes their detection and clearance a laborious and dangerous task. Though no consistency is noted in layout and types of mines used in such fields, the Germans show certain preferences in their choice of sites for them.

b. LOCATION. In general, mines are laid either close to, or on, roads; on airfields and railways; and along telegraph routes. Surfaced portions of roads usually are avoided by the hasty mine layer, but khaki-painted T-Mines sometimes are placed on the surface at dips in the road, in the hope that drivers will be unable to check their vehicles in time to avoid them. The Germans also place mines along the shoulders of the road opposite narrow places where drivers have to detour to pass, and at the entrances to defiles where they have to pull off the road to wait for vehicles moving in the opposite direction. Other places usually sown with antitank mines are turnouts, sharp bends, the unsurfaced islands sometimes found at crossroads, berms, and well worn wheel ruts.

c. CONCEALMENT. The Germans, with great ingenuity, attempt to make their mines difficult

to detect. They bury them as much as 24 inches below the surface where they explode only after passage of a number of vehicles has compacted the earth cover sufficiently to operate the fuze. They put explosives in wooden boxes to prevent the effective operation of ordinary mine detectors, and mark tire prints in the earth on top of the mine by drawing a detached axle and wheels over it.

The Germans also show considerable ingenuity in siting random antipersonnel mines on the line of the hostile advance. Road demolitions are plentifully sown with S-Mines, and kilometer posts at points where vehicular drivers have to dismount to read directions are similarly treated. S-Mines also are placed in ditches, often close to to the trip-wire peg of another mine.

Nuisance fields on lines of communication generally are closely spaced, occasionally so closely as to cause sympathetic detonation. This is particularly possible when mines are laid with their pressure plates almost flush with the surface of the ground and only lightly covered with earth.

German dummy minefields take various forms. In some cases a trip wire is laid to give the appearance of a minefield perimeter wire, with the usual lanes, and the ground is disturbed at regular intervals. Scrap metal, often dispersed with real mines, is placed in shallow holes to cause a reaction in the mine detector. Dummy mines often are wired in and connected with booby traps.

4. Marking of Minefields

The Germans stress the marking of minefields and attempt to mark them in such a manner that they cannot be recognized by the enemy but can easily be found by their own troops. Their methods of marking minefields are not uniform. The front edge of a field often is unmarked and unwired; the rear edge seldom so. Some fields have been found unmarked, but because of many accidents caused by their own minefields, the Germans issued orders within recent months making proper marking obligatory.

The following are typical examples of markings by the Germans, the type used depending on the situation and terrain: corner-post marking stakes; double-apron fence on the enemy side and a single trip wire on the friendly side, or the reverse; single knee-high wires; cattle fencing; empty mine crates; and signs.

The length of marking stakes varies with the terrain. They are flattened on one side for a length of about 8 inches. The flat surface is painted red, with the letter *M* (*Minen*) in black.

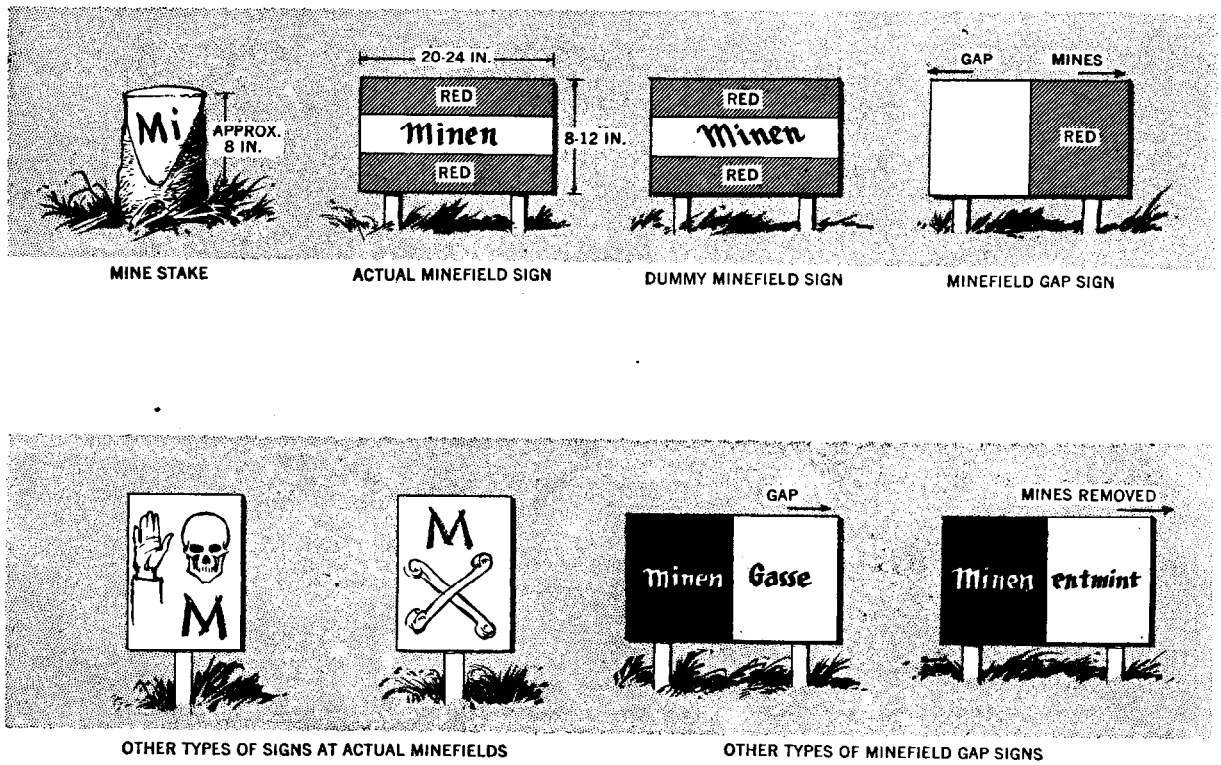
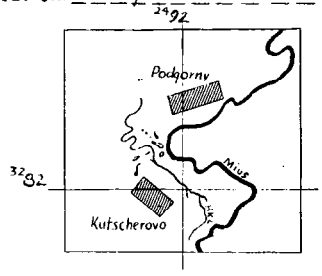


Figure 19.—Minefield signs.

Mine Obstacle: "JoAnn" 1st Engr Co 53rd Engr Bn

Location: Miusfront



Map Reference: Captured Russian Map L-37-6

Scale: 1:100,000 3 June 1942

Mine Plan: 189

Restricted	Co	Bn	Regt	Div Engr
	1	74		

Mines: No. Types and Igniters

120 S-Mines with S-Mine Igniter 35

21 Stock-Mines Caution, only 30 meters distance

How laid: dug in

Mine Pattern: Pressure type minefield (A, B, C) *)

Warning Fence: on friendly side

Distinguishing Features: —

*) Trip wire field D

date mine field was laid 2 May 1943
by Sgt Krautkopf

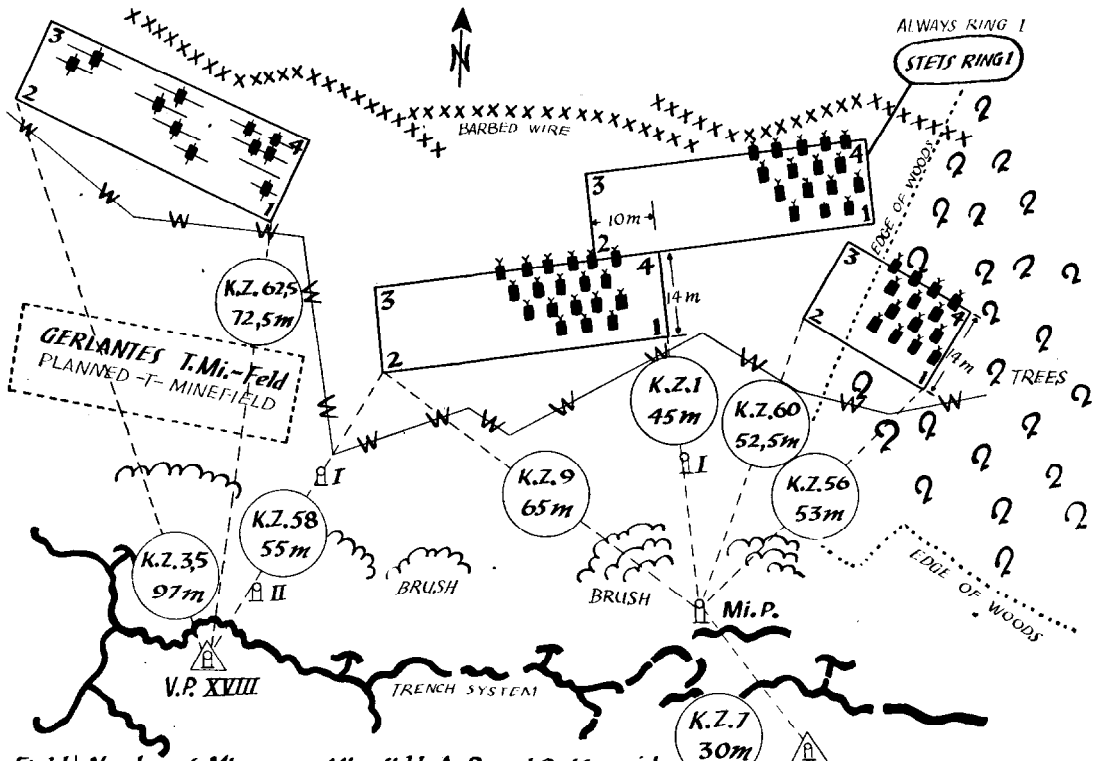
date drawn 4 May 1943
by Cpl Stumm

date surveyed on 4 May 1943 with March Compass
by Sgt Verloren

date checked 4 May 1943
by LT. Besserwisser

Scale: 1:1000

Distribution:



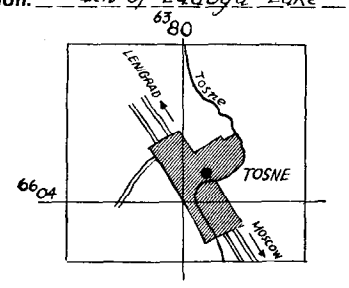
Mine Field	Number of Mines
A	24
B	48
C	48
Total	120 S-Mines
D	21 Stock Mines

Mine field A, B and C 14m wide, 4 lines with 4m interval and distance.

Mine field D 14m wide, 7 lines each line with 3 mines with trip wire.

Figure 20.—German mine plan.

Mine Obstacle: "Pauline"	Mine Plan:	578			
Location: South of Ladoga Lake	Restricted	Co 3	Bn 122	Regt	Div Engr



Map Reference: Russia 0-36-34
Scale: 1:100,000 July 1941

Mines: No. Types and Igniters
17 Concealed charges with 17 clockwork long delay igniters
How laid: —
Mine Pattern: —
Warning Fence: —
Distinguishing Features: —

YELLOW LINE →

date mine field was laid 26 and 27 August 43
by Capt. Wurst

date drawn 27 Aug 43
by Cpl Schlegel

date surveyed on 26 Aug 43 with —
by Capt. Wurst

date checked 28 Aug 43
by Maj. Knopf, Bn Co.

Scale: approx. 1:5000

Distribution:

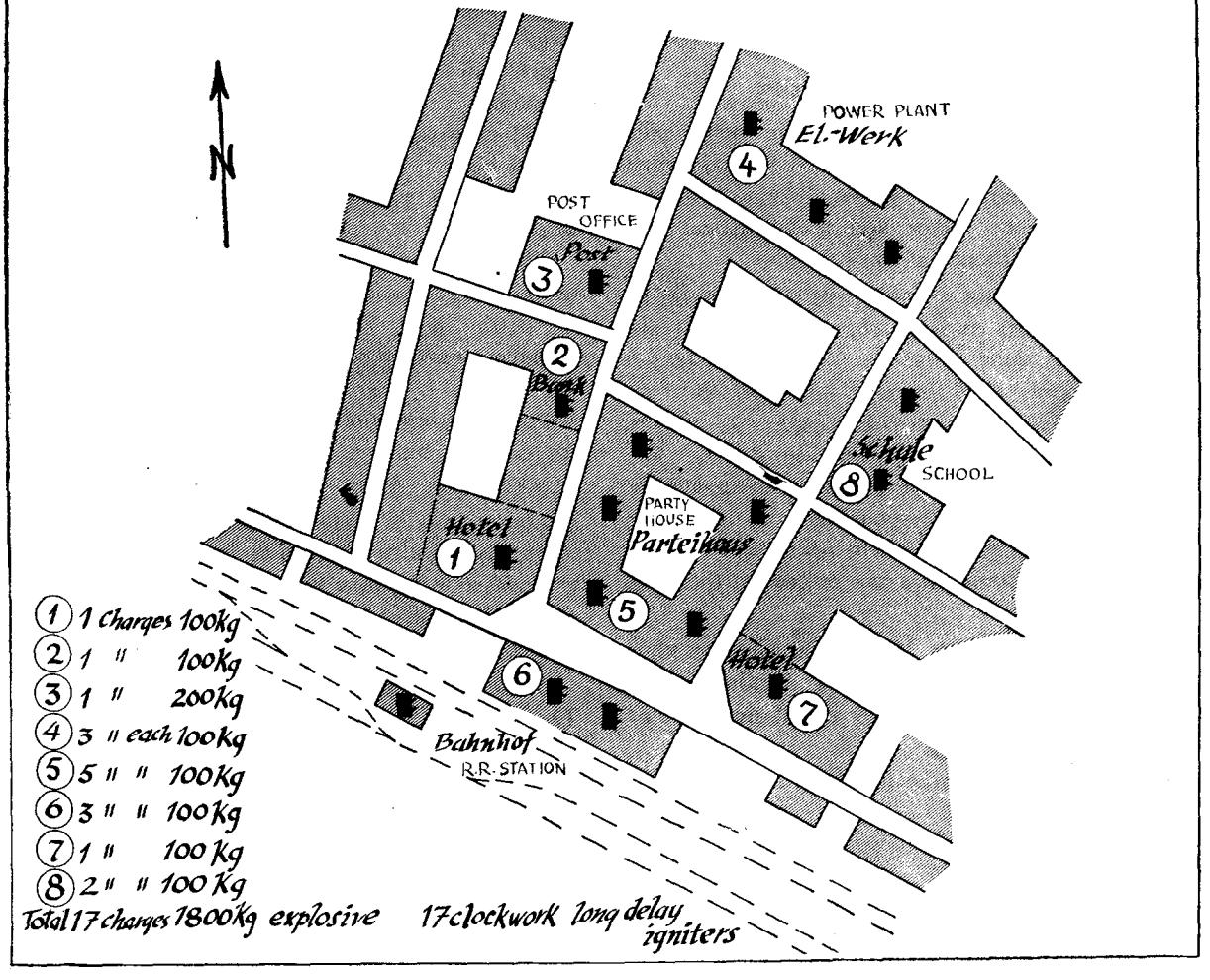


Figure 21.—German mine plan.

Such stakes are used only on the friendly edges of minefields.

Signs are painted in red and white on boards or pieces of sheet metal, and fastened to two stakes. The edges of minefields are marked with signs showing horizontal stripes. Edges of lanes through the fields are shown by vertically divided signs with the white portion on the side of the lane, and the red portion on the side of the minefield (danger). The reverse side of the signs (the side toward the enemy) is painted olive drab. If red paint is not available, the Germans substitute black-and-white signs. They are painted with the following words:

Minen—for mines
Gasse or *Gassen*—for mine lanes
Entimint—for an area cleared of mines.

Minefields are marked with vertical lettering, dummy minefields with slanting letters. This distinction, however, is supposed to be made known only to the German engineer troops because other troops may divulge the location of dummy minefields by crossing them.

5. Mine Plans, Sketches, and Reports

A German mine plan shows one or more fields in all necessary technical details. A German mine map, on the other hand, shows all mine obstacles within one front sector and their tactical significance, but without technical details.

The Germans use a number of different forms for their reports and sketches, although all are based on the same principle. Figure 17 shows a very commonly used form. The upper third of the mine map form provides space for written specifications and a small situation sketch. The drawing is made on the blank space provided. It is the engineers' responsibility to draw up mine maps, and to keep them up to date. Additional remarks sometimes are placed on the back of the sheet.

a. Details of Mine Map. The German mine map usually shows the following details:

(1) Name of the obstacle and designation of the unit which laid it.

(2) Name of the area in which the obstacle is located.

(3) Grid reference and particulars of the map sheet referred to.

(4) Obstacle shown in the little sketch in red.

(5) Date minefield was laid.

(6) Name and rank of officer or noncommissioned officer in charge of laying field.

(7) Day of survey and instrument used (old or new compass—German issue).

(8) Name and rank of officer or noncommissioned officer in charge of survey.

b. Mine Data in Map. The following data are given on the mines:

(1) Number, type and igniter. (Example: 72 T-Mine with *T-Mi.Z. 42*, booby-trapped.)

(2) Whether or not the mines are dug in.

(3) Number of rows, and number of mines per row.

(4) Fence (Example: warning fence on friendly side.)

(5) Special features (Example: destroyed enemy tank in center, on enemy side.)

c. Minefield-Type Identification in Map. Colored lines drawn diagonally across the upper right-hand field of the mine map identify the type of the minefield as follows:

(1) A red diagonal line designates fields which cannot be cleared because some or all mines are booby-trapped.

(2) A yellow diagonal line designates fields which can be cleared by using data from mine document.

(3) A green diagonal line designates dummy minefields.

(4) Mines taken up or exploded are marked in red.

The number of the minefield plan and unit designation appears on the upper right-hand corner of the sheet. Battalion, regiment, and division engineers make their notes in the space provided for them.

For S-Mines laid 50 meters (55 yards) from the German lines, a note is made in red letters: *VORSICHT, NUR 50 METER ABSTAND!* (Caution, only 50 meters distance!)

In case electrical ignition is provided, a note is made showing how the igniters will be disposed of, if the unit which has laid the minefield is relieved.

d. Information in Minefield Drawing. The drawing of the minefield is made in the blank space on the lower part of the sheet. The scale is from 1:500 to 1:2,000 whenever possible. The following information is included:

(1) Shape and size of minefield.

(2) Pattern.

(3) Location of booby-trapped mines.

(4) Location of survey points with azimuth and distances.

(5) Type and location of warning fence.

UNCLASSIFIED

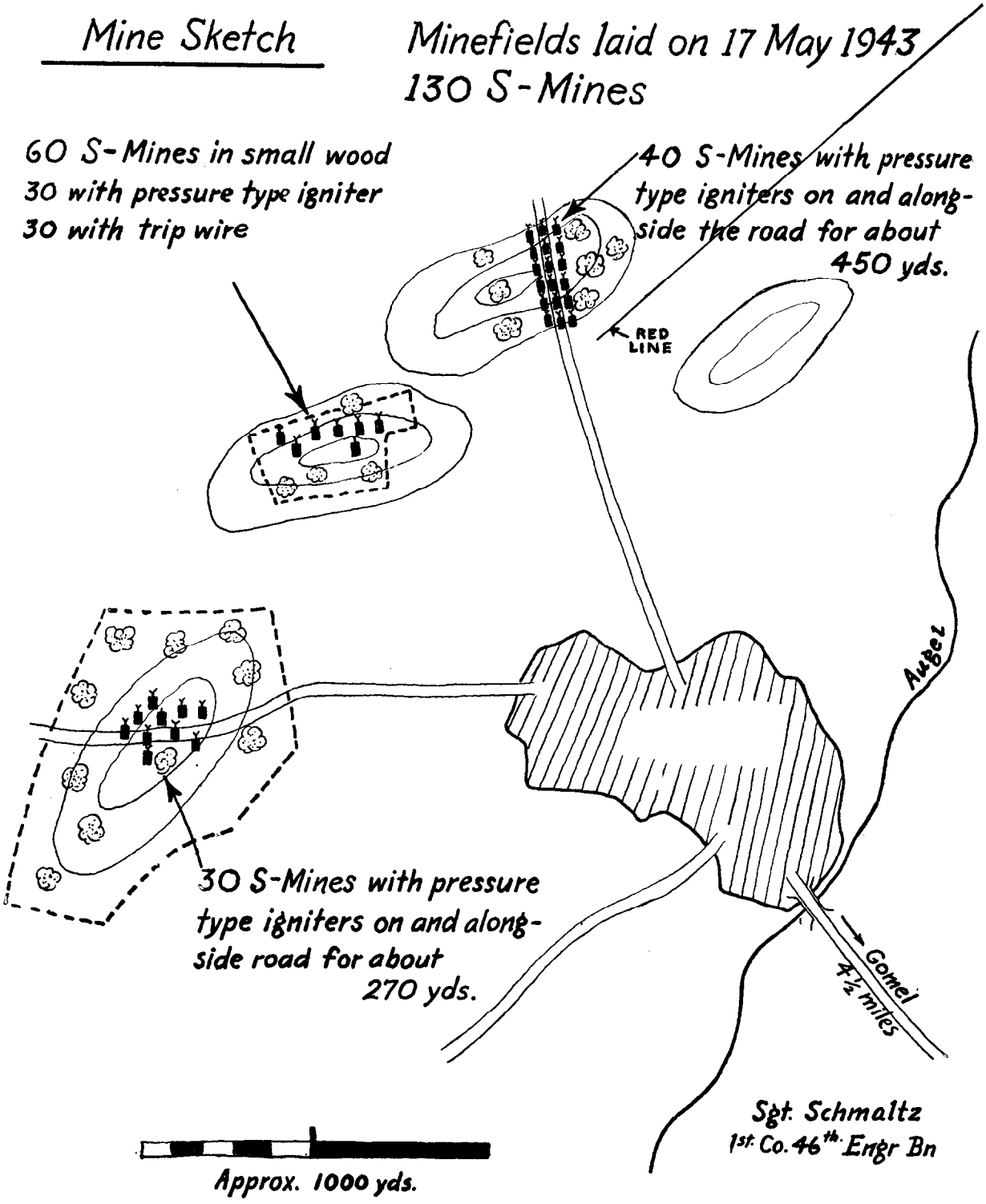
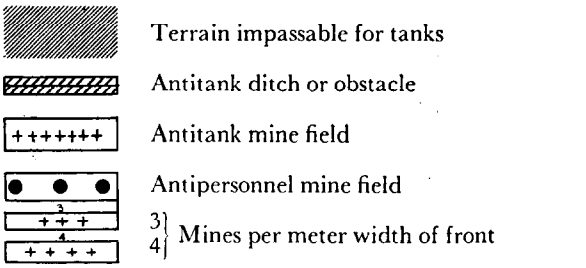
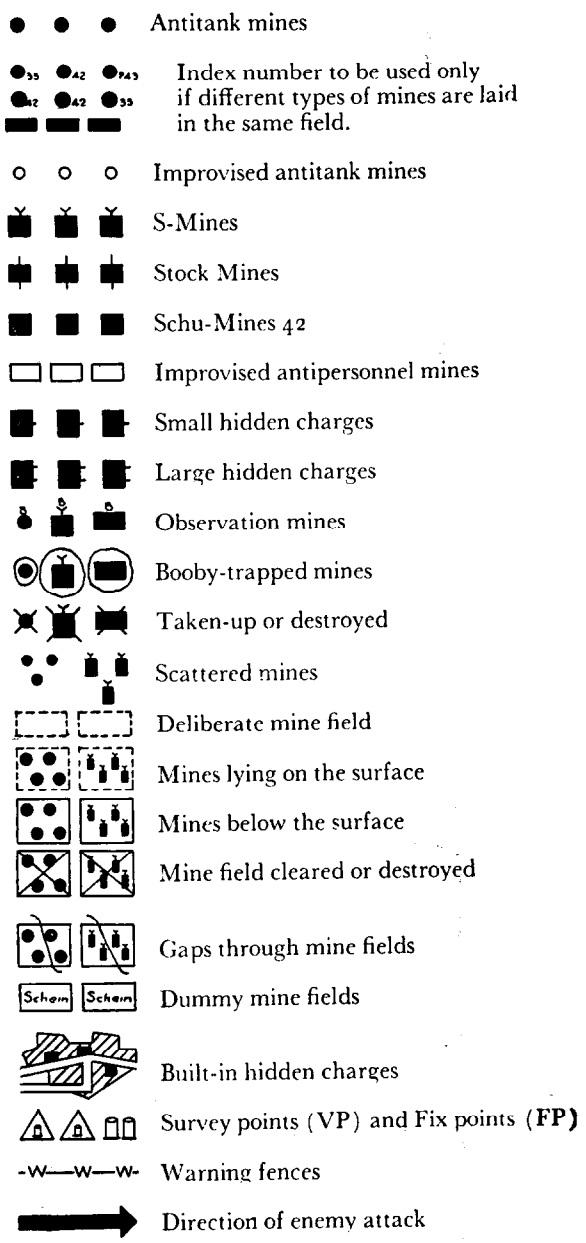


Figure 22.—German mine sketch.

CONVENTIONAL SIGNS FOR MINE MAPS



CONVENTIONAL SIGNS FOR MINE PLANS AND SKETCHES



(6) Location of the front lines and fortifications.

(7) Neighboring minefields, mine lanes, terrain features, special features.

The Germans believe that it is not necessary to mark on the minefield drawing the location of every single mine, if a partial drawing is sufficient. The German mine plans contain the detail symbols shown in Figure 18, while simple tactical signs are sufficient for minefield maps.

The Germans complete their mine plans at company or battalion command posts, based on sketches and data compiled while the field is being laid out. They make five copies of all mine plans and distribute them as follows: One for engineer company which is in charge of the minefield; two for division; one for army; one for central file in *Dessau-Rosslau*.

Changes in the minefield are recorded on the back of the mine plan. After three changes a new mine plan is drawn.

A mine sketch is a simplified mine plan used to transmit information on a minefield as rapidly as possible. It is not drawn to scale, and is drawn whenever the tactical situation, bad weather, or other circumstances prevent the preparation of mine plans.

Front-line troops receive from the engineers instructions or sketches showing the approximate location and extent of the minefield. These sketches, as a rule, do not contain details on types of mines or igniters, pattern, and survey points.

Engineer units in charge of minefields keep records of changes in minefields under their care and keep these records with their units, while mine plans are turned over to the relieving units.

e. MINE REPORTS. Armies generally designate certain areas for fields of scattered mines. In this case mine reports take the place of mine plans. Normally, mine reports contain:

(1) Number of the order authorizing scattering of mines.

(2) Designation of units scattering the mines.

(3) Name and number of field containing scattered mines.

(4) Map location of scattered minefield.

(5) Number of mines scattered, subdivided by types and igniters.

(6) Number and type of booby-trapped mines, kind of booby trap.

Section VIII. SPECIAL OPERATIONS

1. Town and Street Fighting

In attacking a town or village, the Germans employ flanking and encircling tactics. They attempt to cut off water, electricity, gas, and other utilities. While carrying out the flanking maneuver, they pin down the defenders with heavy artillery fire and aerial bombardment. When it is necessary to make a direct assault, the Germans concentrate all available heavy weapons, including artillery and air units, on one target. They favor as targets for their massed fire the forward edges of the community, especially detached groups of buildings and isolated houses. During the fire concentration the infantry assembles and attacks the objective immediately upon termination of artillery fire. Tanks and assault guns accompany the infantry, and with their fire immobilize any new enemy forces which may appear. They also support the infantry in sweeping away barricades, blasting passages through walls, and crushing wire obstacles. Guns and mortars are used against concealed positions, and antitank guns cover side streets against possible flanking operations. Machine guns engage snipers on roofs.

The immediate objective of the Germans is to divide the area occupied by the enemy. These areas then are isolated into as many smaller areas as possible, in order to deny the enemy freedom of movement.

Another form of attack employed by the Germans is to drive through a community and establish good positions beyond the town to block the retreat of the defender. Then they try to annihilate the enemy within the community.

The assaulting troops are divided into a number of columns and make a series of coordinated parallel attacks. Attacks from opposite directions and conflicting angles are avoided, since they lead to confusion and to firing on friendly troops. The columns are sub-divided into assault and mop-up groups. Assault detachments of engineers, equipped with demolition equipment, flame throwers, and grenades, accompany the infantry. Where possible, the Germans blast holes through the walls of rows of buildings along the route of advance in order to provide the infantry with covered approaches. These passages afford protection for bringing up supplies and evacuating casualties. Houses are cleared of defenders by small-arms fire. Streets are avoided as much as possible by the Germans who infiltrate simultaneously through back yards and over roofs. They attempt to further the advance by seizing high buildings which offer dominating positions and wide fields of fire.

When compelled to advance through streets, the Germans move in two files, one on each side of the thoroughfare. The left side is preferred as it is more advantageous for firing right-handed from doorways. Consideration is given to the problem of fighting against defenders organized not only in depth but in height. Consequently the men receive specific assignments to watch the rooms, the various floors of buildings, and cellar windows. Side streets are immediately blocked, and at night searchlights are kept ready to illuminate roofs.

As soon as a building is occupied, the Germans organize it into a strongpoint. Windows and other openings are converted into loopholes and embrasures. Cellars and attics are occupied first in organizing for defense.

Even buildings which have been completely destroyed are kept under constant observation to prevent their reoccupation by the enemy. From occupied buildings the Germans deliver continuous machine-gun and rifle fire with the object of denying the enemy the opportunity to occupy alternate positions.

Underground corridors and sewers, which provide excellent cover for defenders, are attacked with determination. When immediate clearance or smoking-out is not possible, the entrances are barricaded, blasted, or guarded.

Aware that their tanks and assault guns are vulnerable to attacks by tank-hunting units, the Germans assign infantry to protect them. Barricades and obstacles are cleared by infantry and engineers. All able-bodied civilians, regardless of danger, are summoned to clear the streets of debris.

When a section of a town is occupied, the Germans close up all side streets leading from the occupied area, block all exits of houses, and then begin a house-to-house search with details assigned to special tasks, such as mopping up roofs, attics, basements, courtyards, and staircases.

2. Attack on Fortified Positions

The Germans realize the difficulty of attacking a strongly fortified enemy position and prepare such an attack well in advance of the actual operation. Before attacking a large and intricately

fortified position covering a large area—a classical example was the assault on the Belgian Fortress Eben Emael—the Germans attempt to secure, in addition to information obtained through normal reconnaissance, its exact plan by the employment of agents and fifth columnists. When time permits, they construct a duplicate of the fortification on similar terrain well in the interior of Germany, as they did with Eben Emael. In building such installations for intensive rehearsal training of specially-organized combat teams, the Germans spare neither labor nor expense. These special combat teams usually consist of combat engineers, reinforced by infantry, antitank, and chemical warfare units.

The attack on the fortress usually is preceded by an intensive dive-bomber bombardment and long-range heavy-artillery fire. The purpose of these bombardments is to destroy obstacles and minefields, and to create bomb craters which not only provide cover for assaulting troops but also may be converted into firing positions. Often paratroopers land in close proximity to the fortification just prior to the assault, immediately establishing radio communication with the combat-team headquarters.

The climactic phase of the operation is the assault. Its primary objective is to get the engineers forward to certain selected works. During the approach, and until the engineers reach the fortifications, the artillery delivers fire of maximum intensity. Antitank guns lay direct fire against the embrasures, and chemical-warfare units employ smoke to blind forts and adjacent supporting works. The infantry covers the embrasures with rifle and machine-gun fire and remains in readiness to move forward and consolidate any success the engineers may gain. Engineers crawl forward, utilizing shell holes for cover. They are equipped with hand grenades, blocks of TNT, and submachine guns. Some groups use bangalore torpedoes, some pole-charges, while still others are armed with heavy flame throwers. With TNT and pole charges, they attempt to demolish systematically the weaker works, such as embrasures, ports, turrets, joints, and doors.

3. Combat in Woods

When attacking in woods, the Germans usually divide the area into company sectors. The Germans stress constant reconnaissance to discover the most weakly manned enemy position. This reconnaissance is carried out, even though company strength becomes temporarily reduced. Reconnaissance patrols usually move clockwise from their original position. The company commander reviews the reconnaissance reports in detail with his platoon and section leaders.

The company usually deploys in wedge formation when advancing. In order to achieve surprise, the Germans often leave the roads and advance cross-country.

As soon as the point of the wedge of the company is in sight of the enemy, the Germans creep forward to close-combat range, always keeping contact with adjacent and supporting units. The company then storms the enemy's position, using the greatest possible number of hand grenades, pole charges, and close-combat weapons. The advance elements attempt to break into the hostile position as deeply as possible, the body of the wedge widening the peneration on both sides. The company commander then decides whether to roll up the enemy position on the more important flank or to hold the ground until reinforcements arrive before continuing the attack.

Each platoon details at least one observer, armed with an automatic weapon, to neutralize enemy treetop snipers. The Germans believe that bursts of fire, rather than single shots, are necessary to deal effectively with such snipers.

The Germans consider fighting in wooded areas as the primary task of riflemen and machine gunners, since the employment of heavy-support weapons often is impossible. The Germans occasionally dismount heavy machine guns and use them as light machine guns. Antitank guns of small caliber and light infantry howitzers sometimes are brought forward manually, and when indirect fire is not possible they engage targets directly. Light mortars are employed individually. From Finnish troops, the Germans learned a successful method of using mortars in woods. The mortar observers, accompanied by a telephone operator, move with the advanced element. The line back to the mortar crew is exactly 200 yards long. One man is detailed to see that the line does not get hung on the way and as far as possible runs in a straight line. When the advanced element contacts the enemy, the observer judges the distance from himself to the target and adds the 200 yards to the mortar range. Bracketing of fire for adjustment is considered too dangerous because of the close proximity of friend and foe.

When the Germans leave a woods or have to cross a large clearing within the wooded area, the troops work themselves close to the edge of the woods. Then all the men leave the woods simultaneously, rushing at least 100 yards before seeking cover.

4. Combat in Mountains

a. General. The German principles of combat in mountain areas correspond in general to those employed on level terrain. The peculiarities of mountain terrain, such as limited routes, extreme weather conditions, and difficult communications, necessitate additional considerations in the tactics employed. The greatest differences occur in the higher mountains, where the Germans utilize specially trained mountain troops, which include the renowned Tyrolean and Bavarian mountaineers.

The Germans emphasize that all operations will be of longer duration in mountainous country than in lowlands, and therefore make proper allowance for the factors of time and space. For every 330 yards ascent or 550 yards descent they add 1 hour to the time estimate for covering a given distance on the map. Movements, command, and supply in mountain areas represent sources of difficulty, according to the Germans.

b. Tactical Characteristics of Mountain Warfare. The Germans divide their units into numerous marching groups, which normally consist of a reinforced infantry company, an artillery battery, and an engineer platoon. In this manner the Germans counteract the danger of ambush, since each group is able to fight independently. The Germans locate their engineer units well forward with the advance guard so that they may assist in road repairs. The Germans realize that small enemy forces can retard the advance of a whole column and therefore they have single guns sited well forward. They also organize stationary and mobile patrols for flank protection.

The skill and leadership of junior commanders are severely tested in mountain warfare, as forces generally are split into small groups, the efficient command of which requires a high standard of training and discipline. Columns often are separated by large areas and impassable country, and since lateral communication is often very difficult, command of deployed units becomes much more complicated than over level terrain.

Normally supplies are organized in two echelons, the mountain and valley echelon.

The Germans make extensive use of high-trajectory weapons in mountain fighting, although antitank guns and heavy machine guns are used for covering road blocks. The effectiveness of the mountain artillery depends on carefully selected observation posts which are in communication with the single gun positions.

Radio is the primary means of communication, since the laying of telephone wire is not considered feasible.

c. Mountain Tactics. Attacks across mountains are made to protect the flanks of the main attack, to work around the enemy rear, or to provide flanking fire for the main attack. The Germans attempt to seize commanding heights and mountain passes.

The Germans select their assembly areas as close to the enemy as possible to make possible a short assault. Supporting weapons are attached to companies, and where feasible, to platoons.

In defense, the Germans organize their advance positions on the forward slope, while the main battle position with heavy-support weapons is located on the reverse slope. The greater part of a unit often is held in reserve. This necessitates the organization of relatively narrow sectors, which, however, results in an organization of ground favorable for counterattacks.

5. Winter Warfare

Many of the techniques of German winter warfare were developed from those of the mountain troops, which were adapted easily to conditions of extreme cold.

Ski patrols are the chief means of reconnaissance in snow-covered terrain. As a rule, the strength of the patrol is a squad, reinforced by infantry soldiers trained as engineers, artillery observers, and a communication detachment. In addition to normal reconnaissance missions, patrols obtain information as to the depth of the snow, load capacity of ice surfaces, and danger of avalanches. These ski patrols normally blaze trails by marking trees or rocks and by erecting poles or flags. Stakes are used to indicate the extremities of roads.

Under winter conditions, German units keep support weapons and artillery well forward while on the march. Their antitank weapons are distributed throughout the entire column. Ski

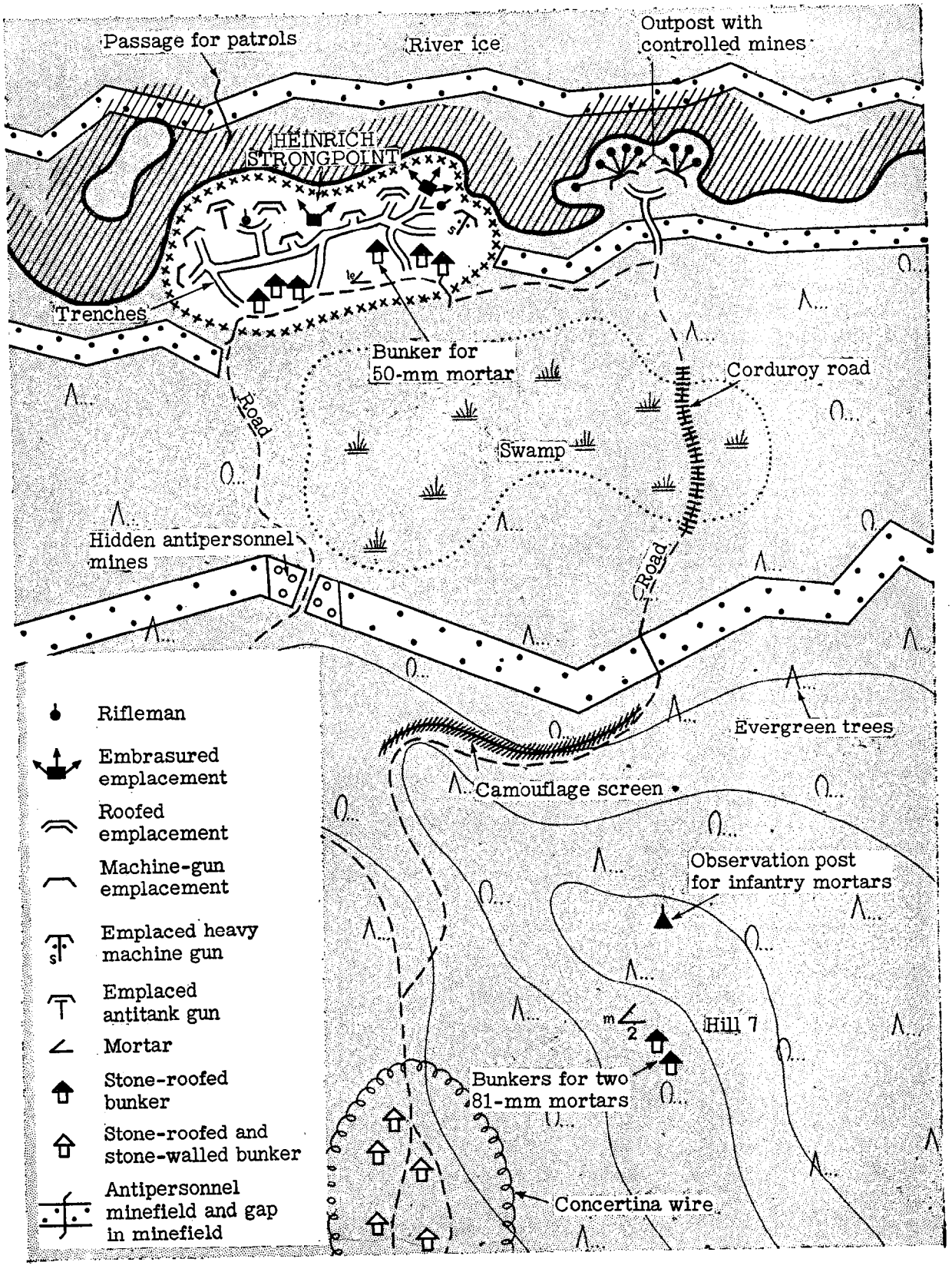


Figure 23.—Typical German winter position along a river in Karelia.

troops are organized to guard the flanks. Sleighs are added for the transport of weapons and supplies.

The Germans assign to trail units the task of cutting tracks for the formations that follow. The strength of the trail unit of a company is one or two squads; that of a battalion up to two platoons. In difficult terrain their strength may be doubled. Trail units are divided into a number of trail detachments consisting of six to ten men, echeloned behind the first of the trail units. The march formation of ski troops is generally single file; usually parallel trails are used to reduce the length of the column.

In winter warfare, attacks with limited objectives are the rule. The Germans attempt wherever possible to combine frontal and flank attacks under conditions of extreme cold and snow. They employ support weapons as far forward as practicable. Attacks often are made by ski troops; because of the difficulty of transporting artillery, ski troops frequently have to dispense with artillery support. For this reason the Germans consider it all the more necessary to concentrate heavy and light infantry weapons at points of main effort and to coordinate high and flat trajectory weapons. When pack howitzers are available, they can be dismantled and brought forward on sledges. Assault guns can effectively support ski troops in snow under 16 inches deep. They either accompany the attack as far as road conditions allow or move into positions at effective range, not exceeding 3,500 yards, on specially cleared paths away from roads. They occupy their positions just before the attack. As a rule attached assault guns are employed in platoon and company strength; single commitment is avoided. Tank units are attached only in exceptional circumstances.

Organization of a defensive position in deep snow or on frozen ground takes considerable time, for it is necessary to move weapons into position, lay out foot paths and roads, and build strong outposts and strongpoints with all-around defense. Camouflage is particularly stressed under such conditions. Since normal units used as reserves in deep snow have only limited mobility, the Germans employ ski troops for reserves wherever possible. These ski units are used for immediate counterattacks which are directed, where possible, against the flank of the attacking enemy. The Germans also use the ski troops as raiding parties to harass the enemy's front and rear.

6. Partisan Warfare

a. General. In order to understand German anti-partisan measures, it is necessary to discuss briefly the characteristics of Allied partisan organizations and their fighting techniques. The following discussion is based entirely on official German sources. The principles involved may be accepted by the Germans and find their way into actual practice in the near future.

b. Tasks of Partisan Warfare. The Germans consider that the strategic mission of the Allied partisans was to inflict maximum injury on the German Armies of Occupation. Means employed to accomplish this task were as follows:

Raids on individual drivers, resting places, troop and supply trains, headquarters, airfields, and ammunition and supply dumps.

Demolition of bridges, roads, and railway tracks.

Destruction of wire communications and railway systems.

Destruction of industrial installations and crops.

Terrorization of collaborators.

Undermining the morale of locally recruited auxiliary troops.

c. Organization of Partisans. (1) *General.* Allied partisan forces were organized partly prior to German occupation and partly during the occupation when dispersed army personnel and civilians rallied around a common leader. The Germans list the following elements as sources for the recruitment of Allied partisan units:

Remnants of Allied units which escaped destruction during military operations.

Individual stragglers.

Smaller units or individual members of Allied forces who infiltrated through the German lines.

Allied parachutists.

Escaped prisoners of war.

Deserters from locally recruited auxiliary services.

Civilian volunteers.

Terrorized civilians.

Women, who may be employed either as combatants or auxiliaries in the supply, medical, or signal services.

(2) *Russian partisan units.* The Germans outline the composition of Russian partisan units as follows:

Diversion groups of three to ten men.

Combat units of 75 to 100 men, divided into

two or three companies, each of two or three platoons.

Battalions.

Regiments, consisting of several battalions.

Brigades of several hundred men.

Units of several thousand men, of varying composition and fighting value.

Divisional headquarters in command of operational groups.

Corps headquarters controlling a certain number of brigades or regiments.

Scouting and reconnaissance detachments.

Higher intelligence headquarters.

In addition the Russians had signal organizations and special formations for demolition works and bridging, mounted detachments, and in some cases even artillery and antitank guns. A special ground organization was set up to serve the air forces which supplied the partisans.

(3) *French partisan units.* The composition of the French partisan forces, according to the Germans, is:

The squad consisted of four or five men.

The platoon consisted of approximately 30 men.

The company had approximately 100 men.

A battalion consisted of three or four companies.

(4) *Weapons.* The weapons of the partisans included rifles, light machine guns, light mortars, pistols, machine pistols, hand grenades, explosives and incendiary material. Battle units also had heavy machine guns, heavy mortars, and guns.

(5) *Uniforms.* Partisans had no standard uniform. They wore civilian dress and the most diverse uniforms of their own and enemy forces. Stocks of uniforms were maintained by raiding German supply depots.

(6) *Camps.* The partisans located their camping areas in inaccessible terrain such as dense forests, marshes, wooded mountains, and caves. The camps usually were fortified with field works, dugouts, tree platforms, and minefields. Normally a number of camps were set up in adjacent areas with alternate camp sites prepared. The camps were complete with dumps, slaughtering facilities, bakeries, dressing stations, and weapon repair shops. These camps were well guarded, the personnel of the guard being composed of partisans or of volunteers from nearby communities.

d. PARTISAN TACTICS. (1) *General.* Higher headquarters would issue directives of a general nature, and the leader of the smaller detachments would determine the method of execution. In accordance with their strategic function, partisans almost always avoided pitched battles. If trapped and forced to fight, they would follow different courses according to their strength. Large bands would fight it out, whereas smaller units endeavored to disperse by small groups, infiltrating through the lines of the attackers or disguising themselves as harmless and peaceful civilians. Defensively, partisans fought with determination, even ferocity, from behind well fortified and camouflaged positions, allowing the attackers to approach to close range and then delivering concentrated surprise fire. In Warsaw, Polish partisans fought in building areas for weeks with much skill, inflicting considerable losses on the Germans.

(2) *Fighting methods.* The partisans carried out guerrilla operations by conducting surprise raids against headquarters, camps, and weapon depots of the occupation army or by ambushing military transportation facilities, columns, or convoys.

When raiding columns, the partisans constructed obstacles along the route and then destroyed the first and last vehicle of the column. Railway trains were destroyed by exploding the roadbed or removing trackage. Troops tryirg to escape from trucks or trains were taken under fire. Before an attack partisans usually destroyed all telephone communications.

Partisan bands often changed their field of operations in order to carry out a given task, to secure supplies, or to evade discovery and prevent encirclement. Strict discipline on the march was maintained. Marches were generally at night, by routes known only to the local population. Partisan bands have marched 40 to 45 miles daily.

A common ruse was to give the appearance of greater strength by disseminating false information concerning partisan strength and armament. Partisans frequently used military uniforms of the occupation army for purposes of reconnaissance and requisitioning.

For successful operation the partisans needed secret agents who could be found in almost every village. The intelligence service of the partisans, of necessity, employed large numbers of women and children. In addition to collecting information, they were used as messengers between various partisan groups. (Local civilian populations

usually were summoned to give assistance to the partisans.)

e. GERMAN ANTI-PARTISAN MEASURES. (1) *General.* The Germans divide the measures to be adopted against partisans into offensive action and passive defense measures. Both constitute specialized types of activity, brought about by the particular methods employed by the opponent. Since the partisans are inferior in armament, regular troops are inclined to underrate them and to act without due care and precaution. According to German doctrine, dealing with partisans demands increased vigilance, boldness, and aggressiveness in order to meet their extraordinary cunning and cruelty. In addition, the Germans considered that special training was necessary for their own troops in order to overcome difficult types of terrain such as woods, marshes, mountains, and built-up areas as well as for fighting at night or under winter conditions. Experience taught the Germans that the success of their anti-partisan measures depended on proper coordination between the German Armed Forces, *SS*, police, and the civil administration, ignoring, when necessary, territorial boundaries.

(2) *Offensive action.* The Germans centralized the command and control of their anti-partisan measures and made arrangements in regard to the fields of responsibility between the supreme command of the armed forces, the *SS Reichsführer* and the Chief of Police. While in 1942-1943 the responsibility for the organization and direction of these measures rested with the supreme command in operational areas and with the *SS Reichsführer* in the so-called *Reichskommissariat,* the latter, upon acquiring increased powers, assumed complete responsibility.

Subordinate to the *SS Reichsführer* were the Chief in Command of Anti-partisan Formations (*Chef der Bandenkämpfverbande*) and the senior *SS* and police commanders, under whose command Army and Air Force units occasionally are attached.

All German troops and, in emergency, civilian establishments were prepared to engage partisans. The Germans employed the following army units in combat against partisans: divisions, independent task forces, cavalry units, motorized units, armored trains, service troops, emergency units, and locally recruited units. In addition to these organizations, the Germans employed Navy and Air Force units, as well as *SS* and police formations, including the security service (*Sicherheitsdienst*) and Secret Field Police (*Geheime Feldpolizei*).

The Germans emphasized the equipping of their anti-partisan units with easily transportable and quick-firing weapons, such as small arms, machine pistols, automatic rifles, rifles with telescopic sights, light and heavy machine guns, light and medium antitank guns, light infantry guns, light antiaircraft guns, and light flame throwers. Heavier artillery, antitank and antiaircaft guns, tanks, and armored cars, although they effectively strengthened the forces, could not be employed in all situations and terrain.

Clothing and equipage were designed to enable the unit to operate in all types of terrain and under all weather conditions.

The Germans realized the necessity of intensive intelligence work for successful anti-partisan measures. Higher commanders kept situation maps based on information concerning the partisans transmitted by all headquarters and units of the armed forces, and by civilian establishments. Systematic observations were made by security branches, such as the security service, the secret field police, and the military intelligence (*Abwehr*); information was disseminated and exchanged by adjacent establishments.

To provide all the necessary data for the tactical employment of anti-partisan forces, the Germans conducted intensive reconnaissance preceding their operations. This was carried out by collaborators, by mobile patrols, or by reconnaissance aircraft. Collaborators were the only means of reconnaissance employed when the projected operation had to be kept absolutely secret. The interrogation of prisoners was considered one of the best sources of information. The Germans therefore abandoned their original practice of shooting captured partisans on the spot.

When the Germans had adequate forces available they attempted to encircle and annihilate partisan units. The planning for this operation included the determination of the ground to be encircled, usually limited to the area actually known to be held by partisans. The assembly area was well removed from the areas to be encircled and was occupied in such a manner that the offensive intention was not disclosed. All forces taking part in the operation moved from the assembly area so that they reached the encircling lines at the same time. Lines were chosen which could be defended easily, such as lines of hills or forest paths across the direction of the advance.

The Germans normally kept sufficient local and mobile reserves armed with heavy support weapons. The consolidation of the encircling line was considered decisive for the outcome of the operation, because partisan fighting patrols tested the German lines with the object of breaking out through weak spots. The consolidation of the encircling line followed the usual principles for defense, such as disposing forward battle outposts, drawing up fire plans for light and heavy support weapons, fortifying strongpoints for all-around defense, and keeping mobile reserves in readiness. The precise method by which the encircled partisans were annihilated depended on the forces the Germans had available, on the terrain, and on the reaction of the trapped unit. One method employed was the gradual compressing of the encircled pocket, possible only in restricted areas, because in large areas the encircling forces could not advance at the same rate, thus creating gaps through which partisans could escape. Another method employed was to exert pressure from one side of the pocket while the troops on the opposite side confined themselves to defense. This method was used when the partisans held ground easy to defend, such as a river course, a ridge of hills, or edges of woods. The Germans also utilized powerful wedges and split up the defense pocket into several smaller pockets which were mopped up separately. Another method was to attack from the encircling line by strong assault groups formed from reserves, in cases where battle reconnaissance indicated that the partisans intended to defend their center position.

When time and forces for an encirclement were not available, the Germans attempted to defeat partisan bands by surprise attacks, intending to pursue and wipe out single detached groups. This method proved to be of value where a partisan formation had not been able to consolidate its position. The German actions therefore were dependent on the methods adopted by the partisans. When they committed their forces for battle, the German attack was carried out systematically with concentrated forces and fire. When the partisans attempted to avoid contact, the Germans pursued them frontally, while other units carried out enveloping movements. When the partisan formation dissolved, however, the Germans had to undertake reconnaissance to locate their new assembly area before a new action could begin. The primary target in such actions was the leader of the partisans, and the Germans usually placed a premium on the head of the leader to encourage his capture or death.

The Germans employed large numbers of heavy support weapons, tanks, assault guns, self-propelled antitank guns and heavy howitzers, when fighting the partisans in communities, and concentrated all available heavy weapons against a single objective. The tactics employed followed the German combat methods for street fighting and combat in towns.

The Germans also employed combat patrols against the partisans, copying the latter's methods with the object of harassing the bands and hindering their assembly and supply. Areas which were used regularly by the partisans for food requisitioning, or which they crossed on raids or sabotage expeditions, offered good opportunities for the deployment of German combat patrols. These patrols consisted of hand-picked, tough, well trained "Partisan Hunters" of platoon to company strength. They often wore civilian clothes or partisan uniforms.

(3) *Protection measures.* Offensive anti-partisan operations were supplemented by vigilant protective measures designed to safeguard troops; road, rail, and waterway communications and traffic; industrial, administrative, and signal installations; and growing crops and forest preserves.

The Germans designated the security of troops as a command responsibility. As a rule the Germans did not billet units of less then company strength in lonely districts. All billets and camps were organized for all-around defense, and all guard rooms were made into strongpoints. Maps showing the local partisan situation were consulted before the march.

To protect railway installations the Germans organized special protection forces whose task included patrolling in addition to the protection of communication centers. Strongpoints were constructed inside all installations and often along the tracks.

The Germans also organized special forces for the protection of roads and waterways. These forces, *"Sicherungstruppen"*, were supplemented by military police detachments on the roads and water police on the waterways.

The ruthless methods employed by the Germans to maintain law and order are too well known to be discussed in this book. From the killing of individual suspects to the wholesale

slaughter of whole communities and the burning of villages there is one long line of German atrocities and brutality.

f. German Preparation for Partisan Warfare. Beyond doubt the Germans prepared and are still preparing fanatical members of the National Socialist Party, *SS*, and armed forces for partisan activities as the territory occupied by the Allies increases. One of Heinrich Himmler's main duties as commander-in-chief of the Home Army is supervising the establishment of partisan organizations and stay-behind agents in areas about to be occupied by the Allies. The Germans have built up large stores of ammunition and supplies, particularly in the mountainous areas of the country, and have established at various localities training centers for future German *SS* Partisans. Women are included in this training program. As to the methods which the Germans are most likely to employ, no definite information can be revealed at this time. However, it is recommended that a study of the Allied partisan combat methods be made to obtain an approximate conception of possible German partisan activities.

7. Anti-Airborne Operations

The Germans consider the use of mines and wire obstacles particularly effective against enemy airborne operations. They block landing fields and areas where landings might be made with S-mines, stakes, ditches, piled earth, stone, and wood, nondescript vehicles without wheels, and other barricades. They also construct minefields and dummy minefields.

For the protection of important installations against airborne attack, the Germans organize an all-around defense, giving particular attention to covering avenues of approach with machine guns. Observation posts are set up on high points, such as church towers and terrain features to give early warning of hostile landings. Such posts are located also in rear areas, and are especially important in thinly populated localities, since wire communications are particular targets of enemy airborne troops. Special signals by church bells, drums, or bugles are arranged for alarming the German mobile reserve units. These units, specially organized for the task of counteracting enemy airborne invasions and partisan activities usually consist of motorized troops with machine guns and antitank guns mounted on their vehicles. Although the Germans consider it an error to delay in committing these units, they stress that care should be used to avoid enemy deceptive maneuvers such as the dropping of dummy parachutists.

The Germans usually withhold rifle fire until descending parachutists are at close range, using machine-gun fire at greater distance. They believe that fire is most effective immediately upon the landing of the hostile force, before a consolidation of position has been made. Enemy transport planes are considered particularly good targets since they must reduce speed just prior to the jump of the troops.

The Germans appreciate the importance of immediate action against airborne troops and when no alternative is possible they will commit inferior forces to combat the hostile aerial invasion, hoping to delay the attack until reserves can be brought up.

CHAPTER V

FORTIFICATIONS AND DEFENSES

Section I. DOCTRINE OF FORTIFICATIONS

1. Economy of Force

The Germans regard economy of force as a fundamental principle in designing fortifications. In conformity with this view, they employ defense works to permit a relatively smaller force to defend a line than otherwise would be required. German troops are taught that fortifications exist not for their personal safety but to enable them to fight more effectively, although fortified works, especially those of reinforced concrete, naturally make for a lower casualty rate. The German doctrine of offensive warfare therefore is not affected by the construction of strong systems of defense. Such systems in fact may be considered to be offensive rather than defensive in purpose, since they make it possible to concentrate a relatively large proportion of the field forces for action at any given point. In September 1939, the Westwall (Siegfried Line)[1] enabled the Germans to hold their Western Front with approximately 20 divisions, while employing 40 to 50 divisions against Poland. These latter troops, in turn, could be concentrated on the northern and southern parts of the Polish border for a double envelopment of the Polish forces, since the vulnerable central sector due east of Berlin was protected by the so-called Oder Quadrilateral, a zone of permanent defense works constructed between 1935 and 1939. Again, in May 1940, the Westwall played an important role—this time in the envelopment of the Maginot Line—for, while the French border was held with relatively weak forces, the bulk of the *Wehrmacht* wheeled through Belgium and Luxembourg.

2. Organization of Defenses

a. PRINCIPLE OF DEPTH. The Germans believe that a fortified line should consist of small works organized in great depth. This principle, embodied in the Westwall, is directly opposed to that of the French Maginot Line, which was a continuous wall of mammoth forts with little, if any, depth. The German idea is that a fortified line should not be employed to present an unyielding front to an attacker, but rather to act as a shock absorber and gradually slow down the advance. Then, when the attack has lost its momentum, counterattacks can be launched to destroy the penetration before the attacker has reorganized and consolidated his gains. The importance the Germans attach to counterattack is shown by the fact that they keep their best assault troops for this purpose and man the concrete positions with inferior soldiers. In order to impede the enemy's advance as much as possible and to facilitate the counterattack, troops manning the fortifications are taught to continue fighting even though their positions are overrun.

b. ZONES OF DEFENSE. The Germans achieve depth in a fortified line by constructing successive zones of defense. In a typical segment of the Westwall, there are three independent zones from front to rear.

(1) The Forward Zone (*Vorfeldzone*) contains field fortifications including trenches, barbed-wire entanglements, machine-gun emplacements, and observation posts.

(2) The Main Defense Zone (*Grosskampfzone*) comprises fortified structures such as pillboxes, casemates and shelters, and antitank obstacles covered by antitank guns. In addition, this zone has intermediate areas, front and rear, in which isolated works are placed at critical points along natural avenues of enemy approach.

(3) The Rear Defense Zone (*Rückwärtige Zone*) is much the same as (2), but is not as strong.

c. STRENGTH. It is the German practice to provide the weakest terrain with the strongest and

[1] The Germans do not employ the term "Siegfried Line".

most numerous defense works arranged in the greatest depth. But the defended zone is everywhere made as strong as the available resources permit, and no terrain is left entirely without the protecting fire of some permanent defense works.

d. SITING OF DEFENSE WORKS. Pillboxes and casemates in a fortified line are so spaced as to provide interlocking fields of fire between adjacent works, yet they are not so close together that hostile artillery fire which misses one structure will hit another.

In view of the German theory as to the purpose of fortifications, the principle of "effect before cover" is applicable; that is, a wide field of fire is considered more important in siting a position than cover or concealment. When possible, pillboxes and casemates may be sited to permit both frontal and flanking fire. This is particularly important since German doctrine directs that fortified positions be held even after the defensive line is overrun by the enemy. The fire plan of field artillery may be coordinated with the belts of fire from the fortifications so that concentrations can be laid on the areas where fire coverage from the fortifications is relatively weak.

e. FIELD WORKS. In accordance with German doctrine, concrete and steel pillboxes, and casemates are supplemented by extensive field fortifications to lend flexibility and mobility to the defense, to engage the enemy before he gets close enough to assault the main works, and to facilitate counterattack. Such field works are interspersed liberally throughout the Westwall and include minefields, obstacles, fire trenches for infantry weapons, and open emplacements for field artillery. Although open gun emplacements are intended to give supporting fire to pillboxes and casemates, they also can cover dead areas between the main works.

f. SHELTER. The German practice is to provide all troops with adequate shelter against weather and hostile fire. Concrete pillboxes and casemates often have accommodations for the gun crews, and open field works have underground shelters or dugouts adjacent to the firing positions. In a fortified line, underground shelters are provided in the rear of the battle zone for the reserves who are assigned to the counterattack. This is in accordance with the German doctrine that reserves should be committed as a unit, fresh, and without having had to sustain casualties or endure the strain of hostile aerial and artillery bombardment while waiting to attack. Personnel shelters enable the reserves to be kept close to the front so they can begin the counterattack with minimum delay.

g. COMMUNICATIONS. German fortified works commonly are linked together with communication trenches to facilitate relief of personnel, ammunition supply, and the care and evacuation of the wounded. In some cases a group of defense works is connected by a system of tunnels. Signal communication is provided by telephone cables buried in the earth, and often telephones communicate between the outside and the inside of a structure. Speaking tubes are installed in many of the works in case of failure of the telephone system.

Section II. CHARACTERISTICS OF FORTIFICATIONS

1. Principles of Design

The basic considerations in the design of German fortifications are fire effect, cover, and concealment. Fire effect has first priority; natural concealment is used as much as possible by blending positions with the surrounding terrain. Personnel and supply shelters, in the construction of which fire effect need not be taken into consideration, are completely below ground level, or as low as the water-table level permits. In order to present as small a target as possible to high-angle fire and bombing, emplacements, pillboxes, and casemates are built no larger than necessary to permit crews to operate their guns.

2. Construction

a. GENERAL. All permanent, fortress-type works and many field works are of concrete reinforced with steel. Some field works, however, are of masonry, brick, or timber. Steel also is used in concrete structures for beams, turrets, cupolas, gun shields, machine-gun loopholes, and doors. These installations are prefabricated and are assigned code or model numbers. The concrete works themselves are designated by type number and are constructed from plans prepared in the Army Ordnance Office.

b. THICKNESS OF CONCRETE. The usual thickness of concrete walls and roofs is 6 feet 6 inches (2 meters); smaller thicknesses are found as a rule only in the small field works. In casemates the minimum thickness of the walls and roof is 6 feet 6 inches, and generally increases commensurately with the caliber of the gun.

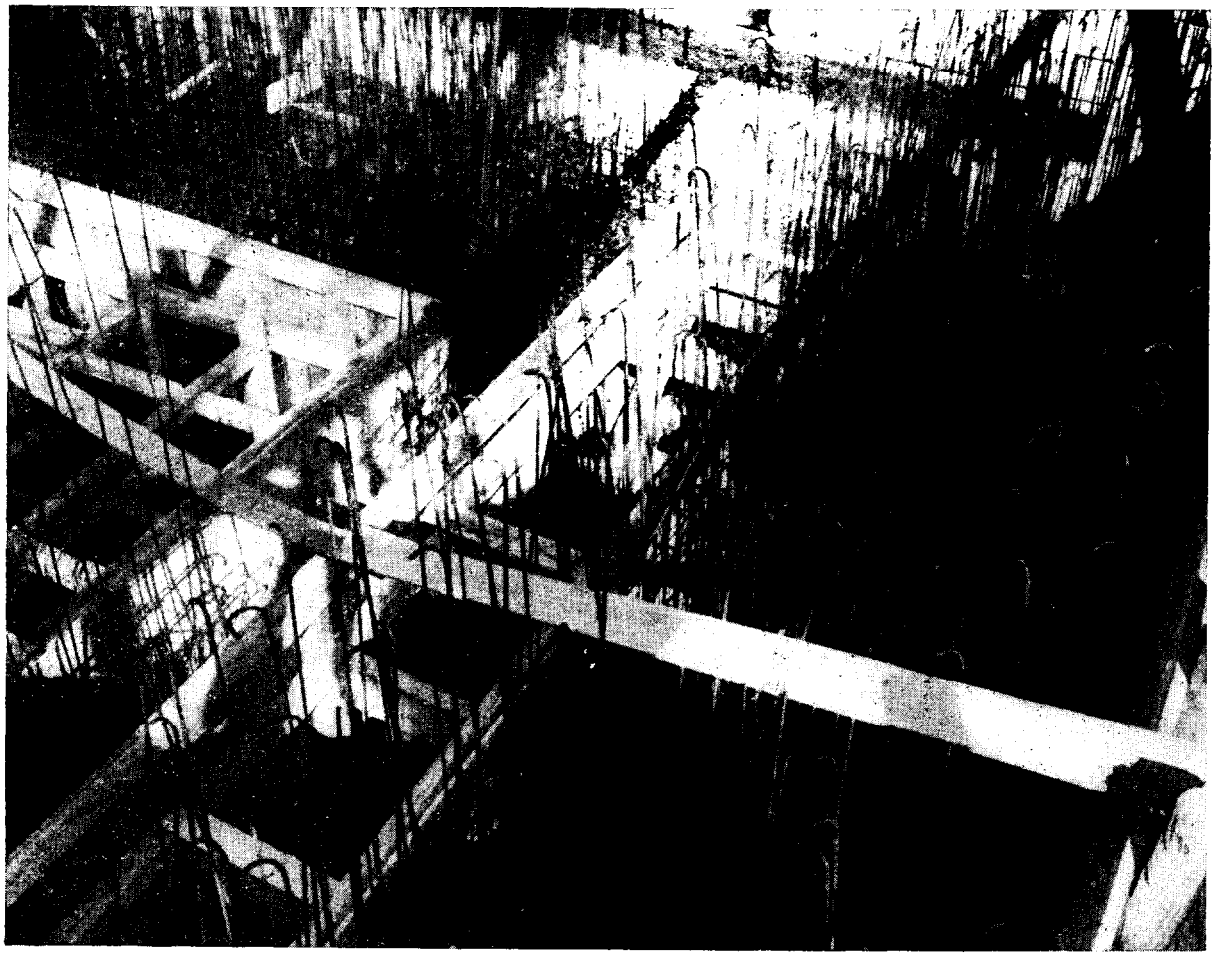


Figure 1—German three-way reinforcing rods and wooden forms ready for pouring in concrete.

c. Reinforcement of Concrete. Most German concrete fortifications are reinforced with steel bars running in three dimensions to form cubes of 10- or 12-inch sides. The diameter of the bars, which are hooked at both ends, varies from 3/8 inch to 5/8 inch, the most common size being 1/2 inch.

The roof over the interior compartments in most structures is supported by steel I-beams, encased in the concrete roof. The size of the beams depends on length of the span. Steel plates laid between the I-beams, and resting on the lower flanges, form the ceiling of the structure. These plates prevent the inside of the roof from spalling if the structure sustains a direct hit from artillery shells or aerial bombs. In some cases, the roof is supported by reinforced-concrete beams instead of the steel I-beams, apparently to save critical material.

3. Open Emplacements

a. "Tobruk" Type. From experience in the North African campaign the Germans derived a type of open, circular pit lined with concrete, which they called a "Tobruk". Hitler subsequently ordered Tobruk pits to be used as defense works in the field, and instructions for building them were distributed down to divisions. A Tobruk pit, which consists of a concrete weapon chamber with a neck-like opening at the top, is built entirely underground. The concrete usually is reinforced. Tobruks vary in size, depending on the weapon mounted in them, but the diameter of the neck is kept as small as possible to reduce the risk of direct hits. Instructions to German troops insist that a Tobruk should not have a concrete roof, since this would reveal the position to the enemy. A board of irregular shape, used as a lid, camouflages the circular opening and keeps out rain.

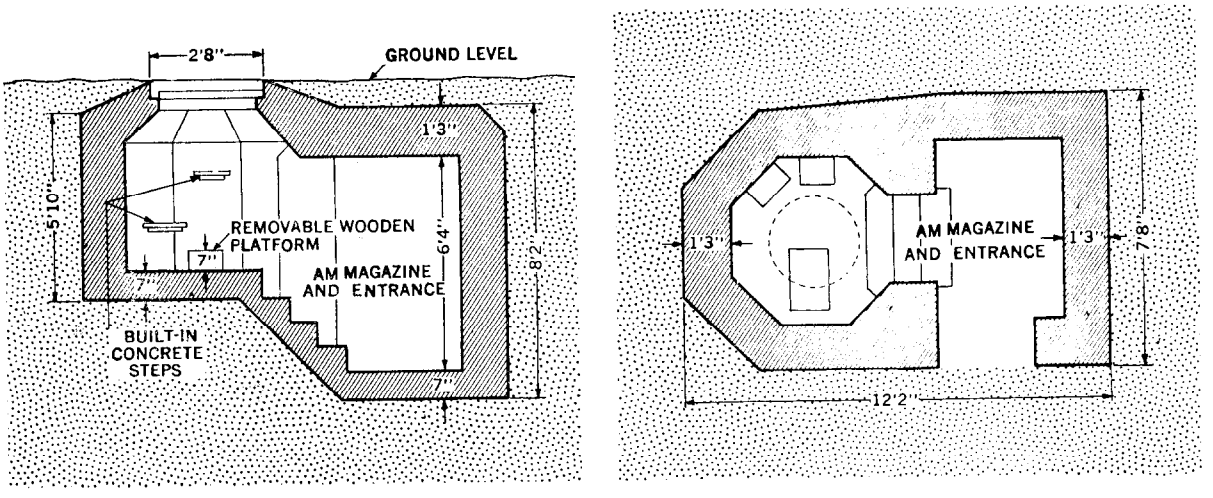


Figure 2.—Ringstand.

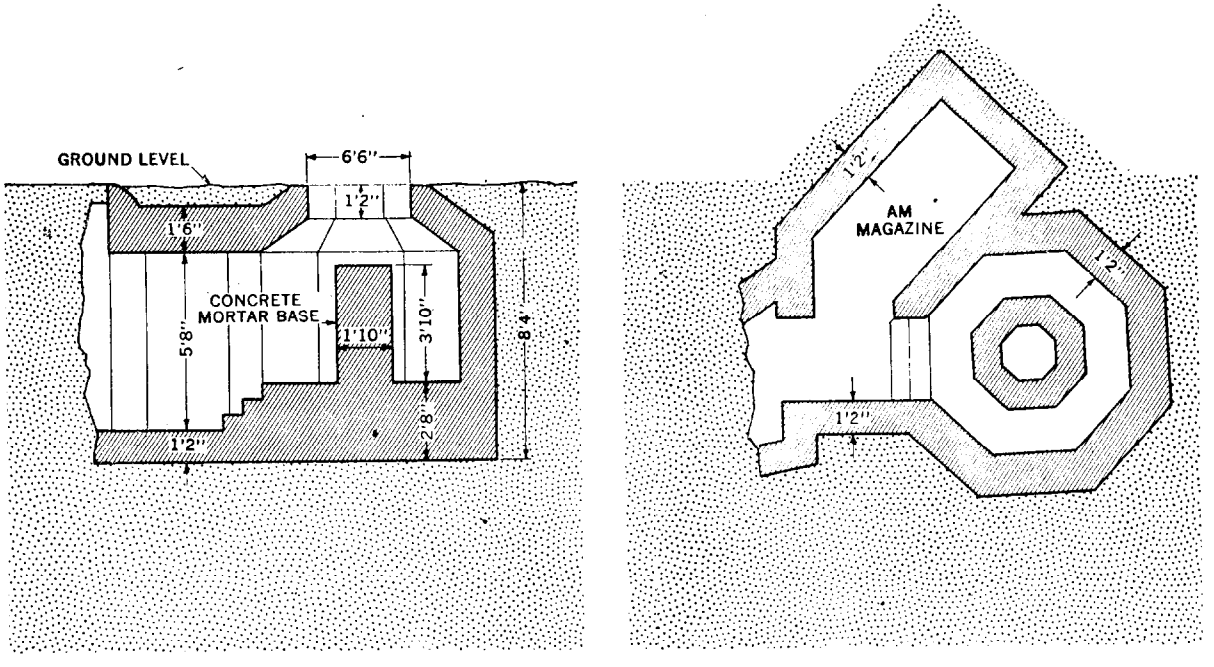


Figure 3.—Tobruk for 50-mm. mortar.

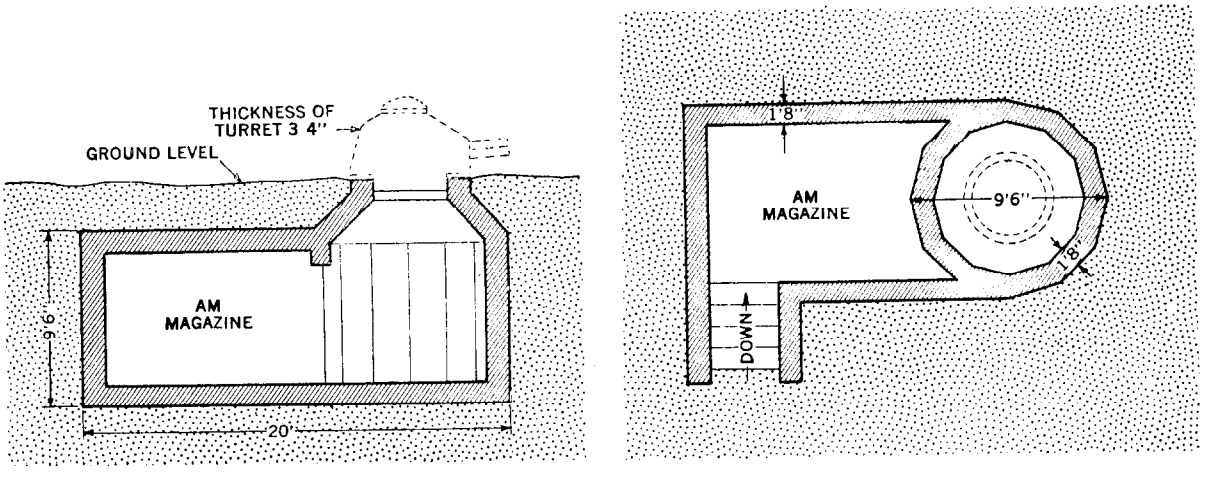


Figure 4.—Panzerstellung.

b. TOBRUK *58c*. The most common type of Tobruk is designated *58c* by the Germans (see *Figure 2*). It also is called a *Ringstand* from a rail that runs around the inside of the neck. The rail provides a track for rotating a machine-gun mount, thus giving the gun a 360-degree traverse. This type of Tobruk has an ammunition chamber, which also serves as an underground entrance.

c. MORTAR EMPLACEMENT. A Tobruk used as a mortar emplacement, such as Type *61a* (see *Figure 3*), is larger than a *Ringstand* and has a concrete base in the center of the pit for mounting the mortar. This type also is combined with an ammunition magazine.

d. *Panzerstellung*. The German also have used a Tobruk as a base for a tank turret, usually taken from a French *Renault 35* (see *Figure 4*). Such an installation, called a *Panzerstellung*, has a turret armed with an antitank gun and a machine gun coaxially mounted. The turret is bolted to a circular metal plate, which is rotated by hand on wheels around a track in the top of the pit affording a 360-degree arc of fire.

4. Pillboxes and Casemates

a. CONSTRUCTION. (1) *General*. Although the Germans have a number of types of pillboxes and casemates, most infantry and artillery weapons are installed in open rather than closed emplacements. In accordance with German doctrine, pillboxes and casemates are supported by open field works. Pillboxes may have wall and roof thicknesses of as little as 2 feet; indeed, some of the earliest examples built on the Westwall had thicknesses of only 1 foot. This was increased, however, until all pillboxes had at least the standard thickness of 6 feet 6 inches. Casemates, which house guns of large caliber, have at least the standard thickness of 6 feet 6 inches. Pillboxes and casemates usually have a stepped embrasure to prevent bullets from richocheting into the gun opening. In addition, a steel gun shield may close the opening.

(2) *Type 630 pillbox*. Figure 5 illustrates a newer type of pillbox for the light antitank gun, Type 630, which has 6 feet 6 inches of concrete in the roof, front wall, and side walls; and 6 feet 4 inches in the rear wall. A machine gun firing through a loophole in the rear provides close defense, and a loophole in the interior wall at the foot of the stairs has an opening for a machine gun to keep attackers from entering the pillbox. A Tobruk pit is built into the front wall as an observation or machine-gun post.

(3) *Local designs*. Some pillboxes are found which do not conform to standard types and are apparently of local design. The Germans often construct a pillbox by mounting a steel turret on an open emplacement, and many pillboxes along the French coast were built by mounting a tank turret over a pit in the sea wall.

(4) *Type 685 casemate*. Figure 6 illustrates a typical German casemate, Type 685, for the 210-mm or 128-mm antiaircraft guns. Most casemates are of this simple design, consisting of a gun room with recesses for ammunition, but some may provide quarters for the gun crew. The walls and roof of Type 685 are 11 feet 5 inches (3.5 meters) thick. The embrasure permits a traverse of 60 degrees and an elevation of 45 degrees. A number of similar casemates (Types 683, 684, 686, 688, 689, 690, 692, and 694) have embrasures for a traverse of 90 degrees or 120 degrees. Additional protection and camouflage are afforded by banking the sides and by covering the top with a 2-foot 6-inch layer of earth.

(5) *Type 677 casemate*. The Germans often site a casemate to deliver flanking fire. For this purpose, a wing wall is provided on the side toward the enemy to shield the embrasure from hostile fire, as in Type 677 for 8-cm gun (*Figure 7*). The length of this wing wall depends on local ground conditions. The casemate can be built to fire to the right flank by constructing the wing on the opposite wall.

b. CAMOUFLAGE. To camouflage pillboxes and casemates, earth is banked over the sides and top, the entrance in the rear is covered by a flat-top, and a camouflage net may be hung in front of the embrasure while the gun is not in action. In the case of small pillboxes, branches may be placed over the embrasure. The Germans also conceal pillboxes and casemates by enclosing them in wooden structures resembling ordinary houses. The guns then are fired through false doors or windows, or a section of the wall over the embrasure is made to drop out of the way. Pillboxes also are built into the cellars of existing buildings. German instructions to troops insist that no cover or concealment should obstruct the field of fire of the gun.

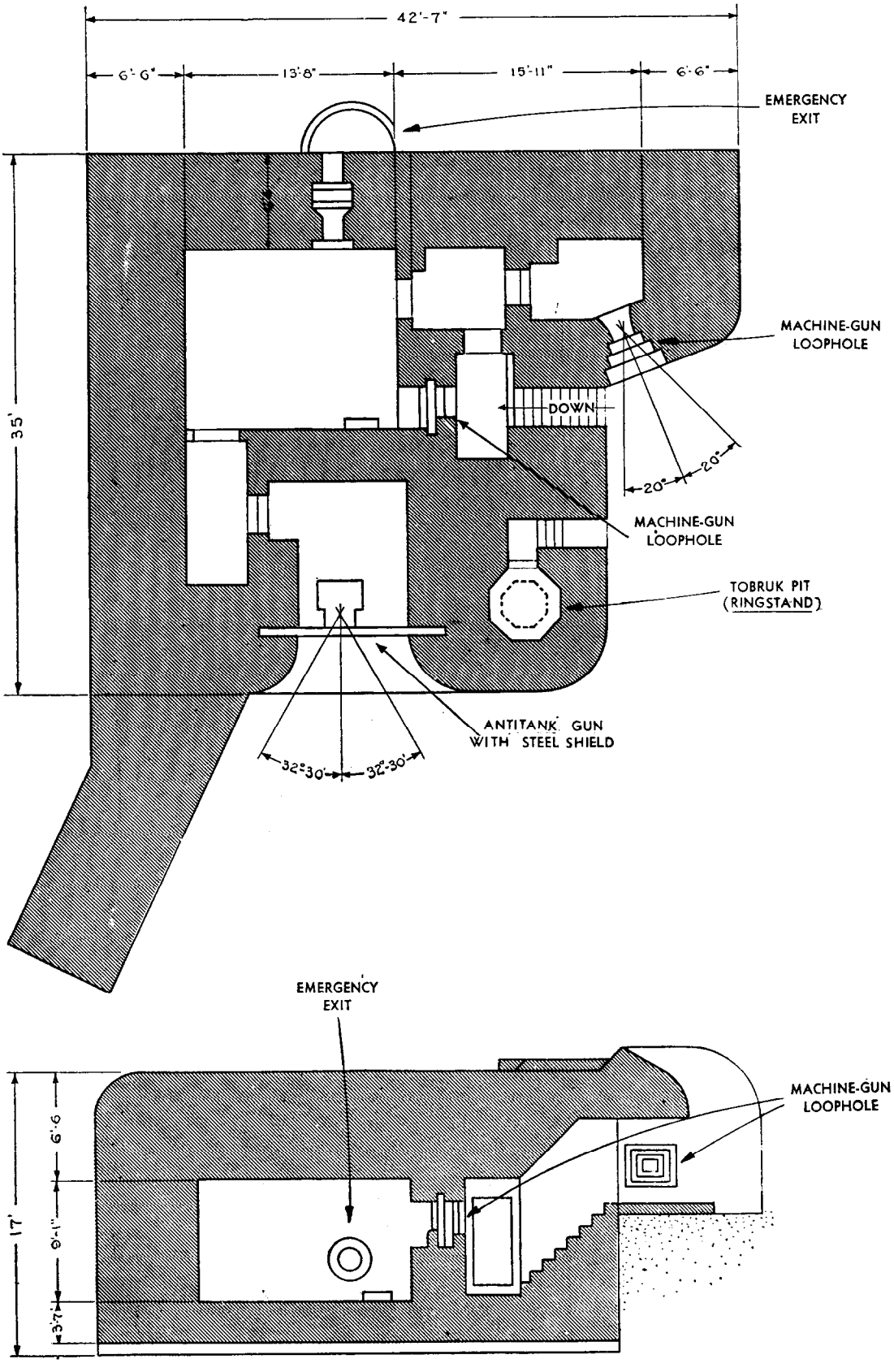
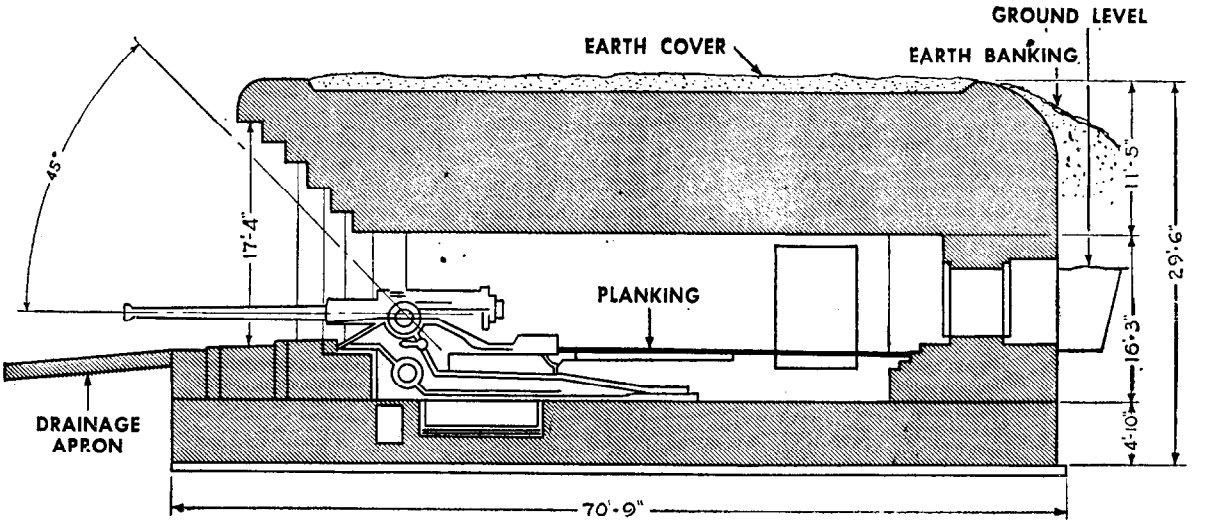


Figure 5.—Typical pillbox, Type 630 for light antitank gun.



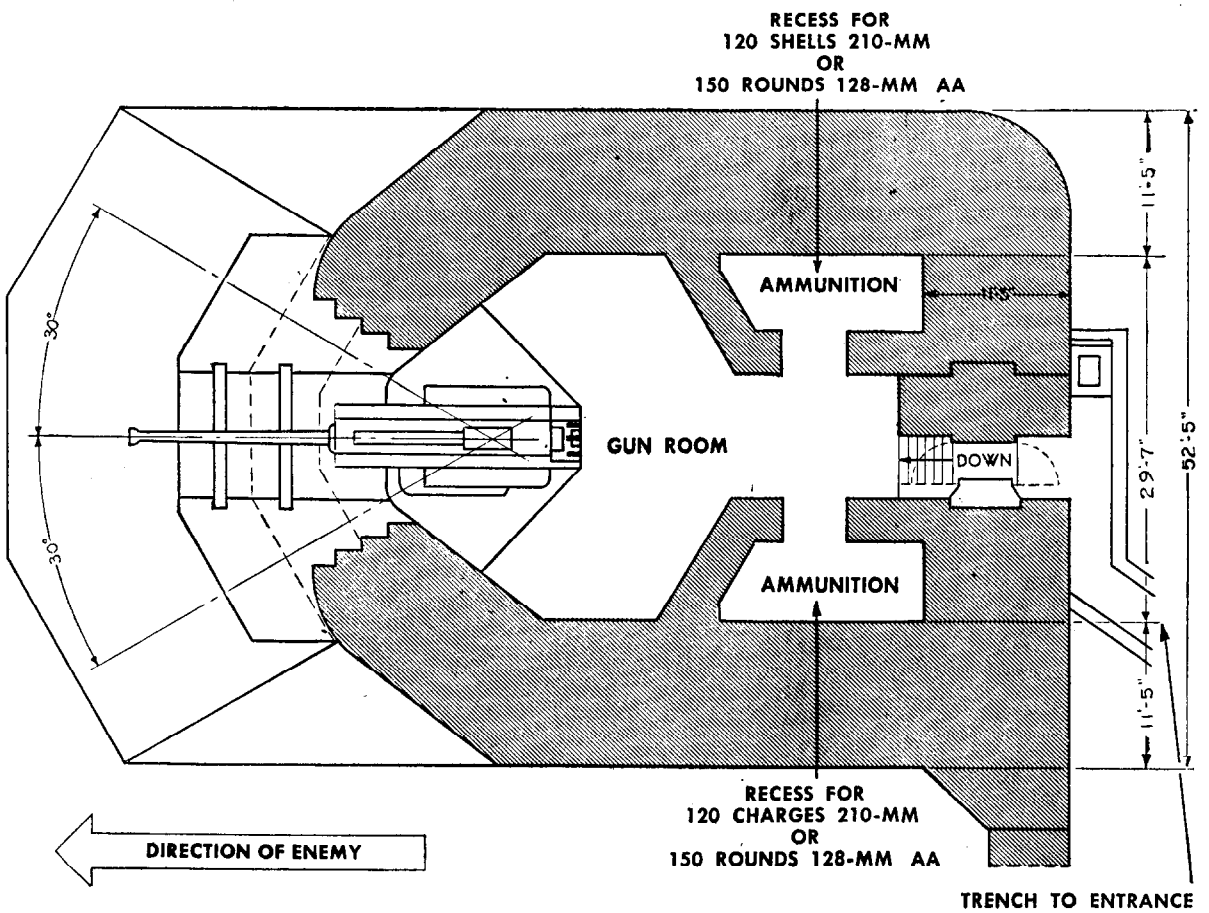


Figure 6.—Typical casemate, Type 685.

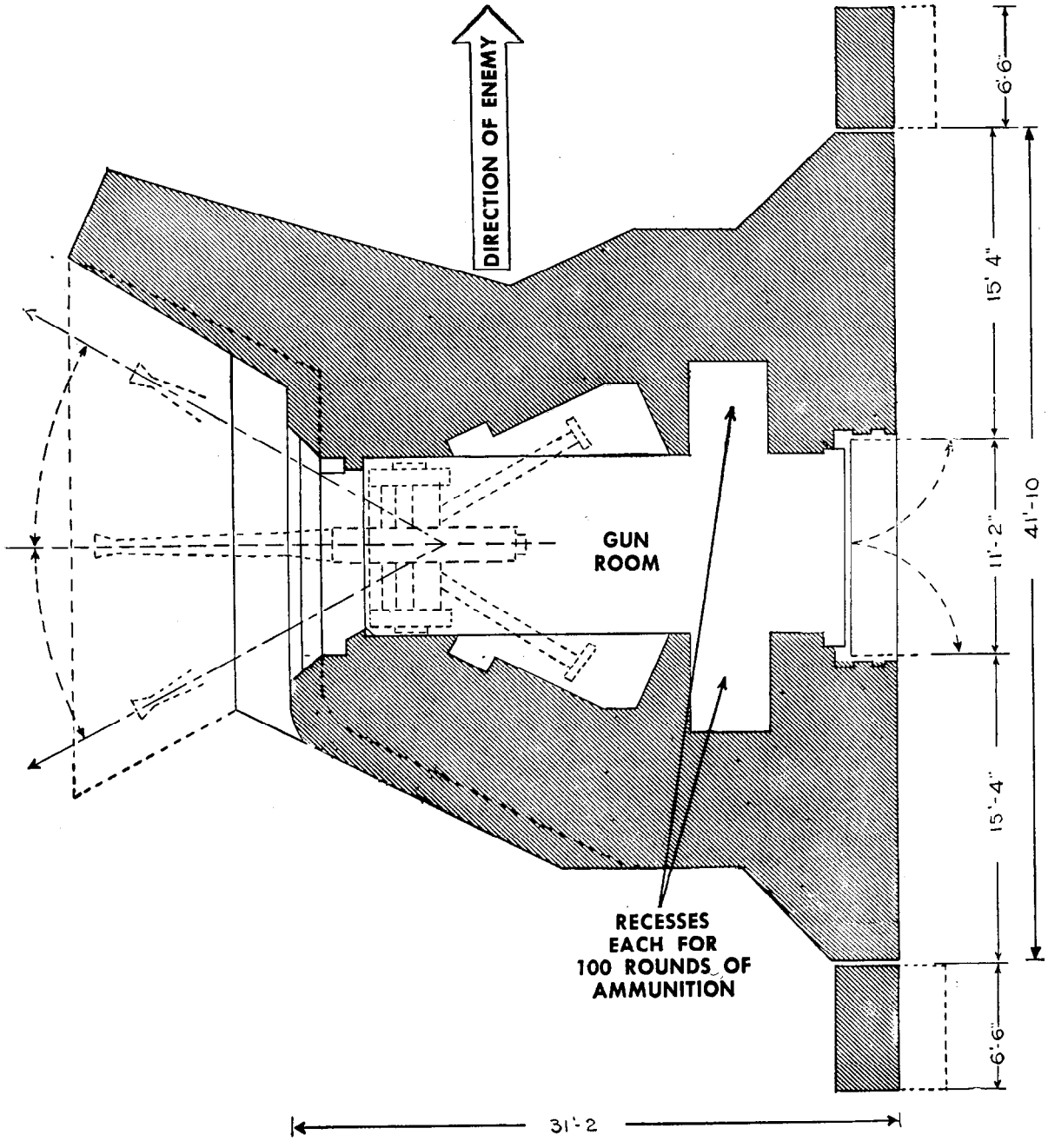


Figure 7.—Typical casemate, Type 677.

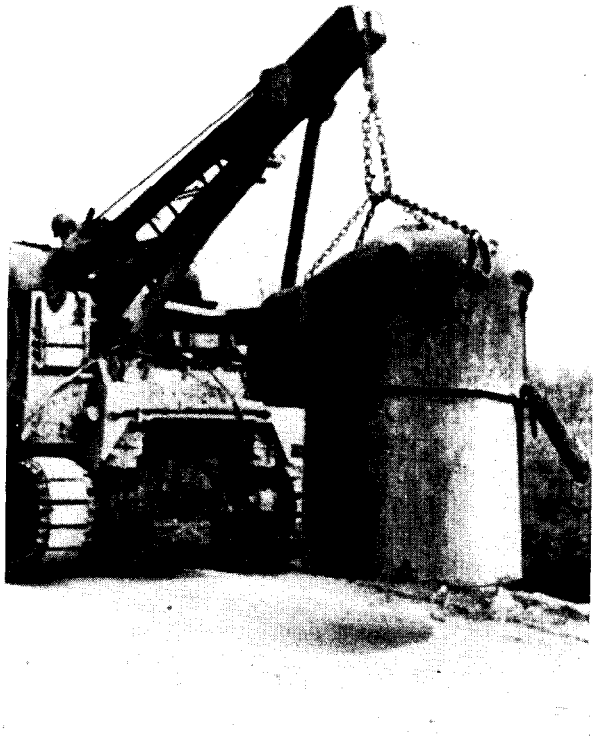


Figure 8.—Emplacing a mobile steel pillbox.

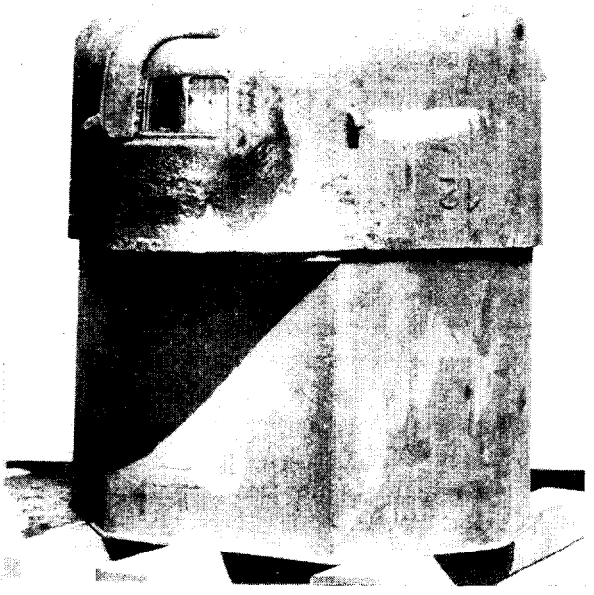


Figure 9.—German mobile steel pillbox.

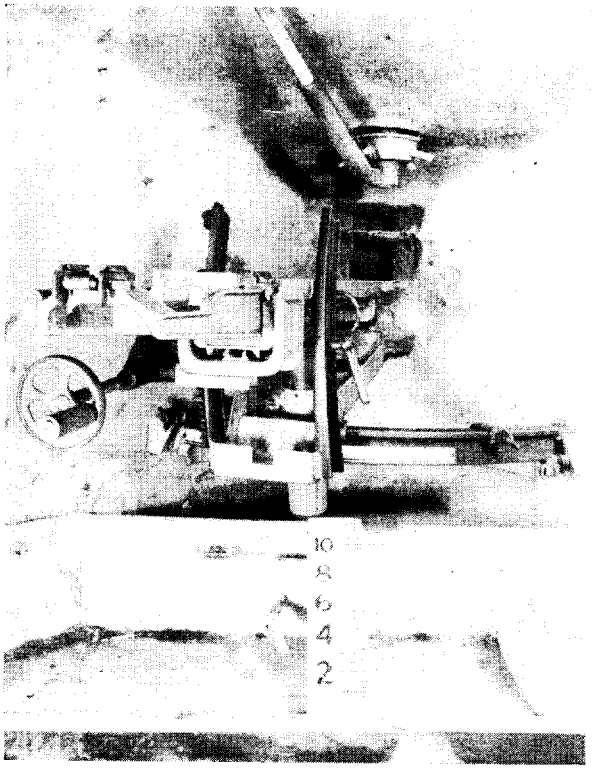


Figure 10.—Interior of mobile steel pillbox showing machine-gun mount.

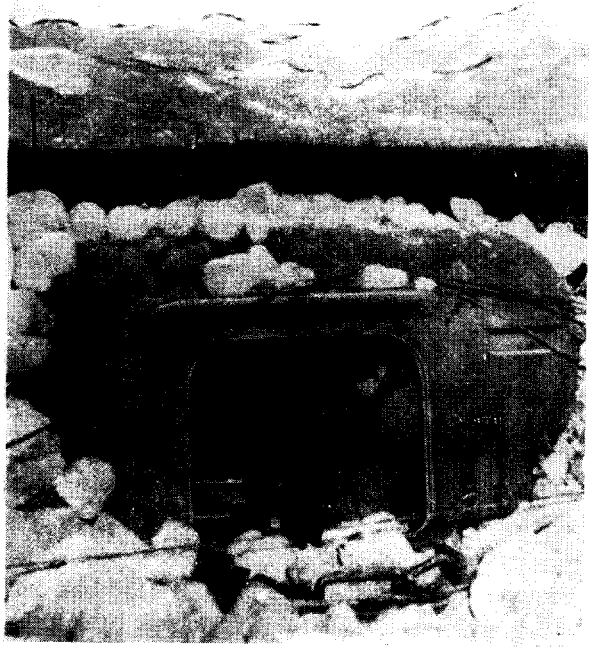


Figure 11.—View through loopholes of mobile steel pillbox.

c. Mobile Steel Pillbox. The Germans also have a mobile steel pillbox (*Figures 8, 9, 10, 11*) which is armed with a machine gun and manned by two men. The pillbox is constructed in two sections, a top half and a bottom half welded together. The top half contains the aperture, armament, air vents, and entrance door. Thickness of the armor varies from 5 inches at the aperture to 2 inches at the sides and top. The bottom half is only ¾ inch thick, but is entirely below ground level when the pillbox is in place.

The total weight of the pillbox without armament or ammunition is 6,955 pounds. The aperture, which is seen on the left side in the photograph, is divided into two parts: the lower part for the gun barrel; the upper for sighting. The machine gun has an arc of fire of approximately 45 degrees. The aperture cover is operated manually from the interior of the pillbox. Entry is through a door, 20 inches by 23 inches, in the back of the upper half. The door can be seen hanging open on the right in the photograph. There are two openings in the top for periscopes, one over each seat.

A blower operated by a pedal provides ventilation. The ventilation holes on both sides of the pillbox also enable an axle to be passed through the pillbox. Wheels are fitted to the ends of this axle and the pillbox can then be towed upside down. When installed for use, the sides and top are banked to blend with the surroundings.

5. Shelters

a. Personnel Shelters. (1) *Purposes.* The Germans stress the desirability of adequate shelter for all troops. Personnel shelters are built in the rear of a fortified line to house the reserves and also in individual defense positions for the troops who man the installation. Some personnel shelters have accommodation for two sections, or 20 men, but it is the usual German practice to house no more than ten men in one shelter. A personnel shelter also may serve as a headquarters, a command post, a medical station, or a signal center. Types provided for these purposes are similar in design and differ mainly in size and number of interior compartments.

(2) *Type 621 shelter.* One of the most common personnel shelters (Type 621, for one infantry section) is illustrated in Figure 12. It is constructed of reinforced concrete, with the standard wall and roof thickness of 6 feet 6 inches (2 meters). It is entirely underground, with an earth covering of 1 foot over the roof. Seventeen steel I-beams, 13 feet 2 inches long, support the ceiling over the interior compartment. Steel plates resting on the bottom flanges of the I-beams provide an all-steel ceiling. Shorter I-beams support the ceiling over the doors and entrance stairs. A camouflage flat-top is stretched over the trench in the rear, which gives access to the entrance stairs, to conceal it from air observation. To secure one side of the flat-top, a row of hooks is cast into the roof along the rear side of the shelter. A Tobruk pit is built into one of the wings in the rear for observation. Although the shelter accommodates only ten men, two entrances are provided to enable the section to deploy rapidly when they are to man their positions nearby or launch a counterattack. Each of the entrance stairs is covered by a machine gun firing through a loophole in the interior wall at the foot of the stairs. Both entrances converge into a gas lock, sealed by three steel doors each about 1 inch thick. All doors open out. To make the chimney grenade-proof, the vertical shaft is continued below the stovepipe and curved outward into the space used for the emergency exit. A grenade dropped into the chimney thus will not enter the shelter but will fall outside the sidewall and explode harmlessly. There are four ventilation shafts opening into the rear wall between the entrance stairs. Two of these are dummies to mislead attackers who try to introduce smoke into the ventilating system to drive out the occupants. The blower is driven by an electric motor, but the Germans usually make provision for manual operation as well, in case of power failure. To communicate with the interior of the shelter, there is a telephone at the head of one of the entrance stairs, and both a telephone and a speaking tube in the Tobruk. A telephone cable, buried deep in the earth, leads to neighboring installations.

(3) *Modifications in design.* Modifications may be made in the plans in order to adapt the shelter to the terrain; for example, the Tobruk may be built into the other rear wing, or the emergency exit may be installed in the opposite side wall. Such changes are at the discretion of the local construction authorities. Some types of personnel shelters have a steel turret built into the roof for observation, and sometimes a machine gun is mounted in the Tobruk. However, the Germans insist that troops are not to fight from shelters, but are to use them merely as protection while not engaged in combat.

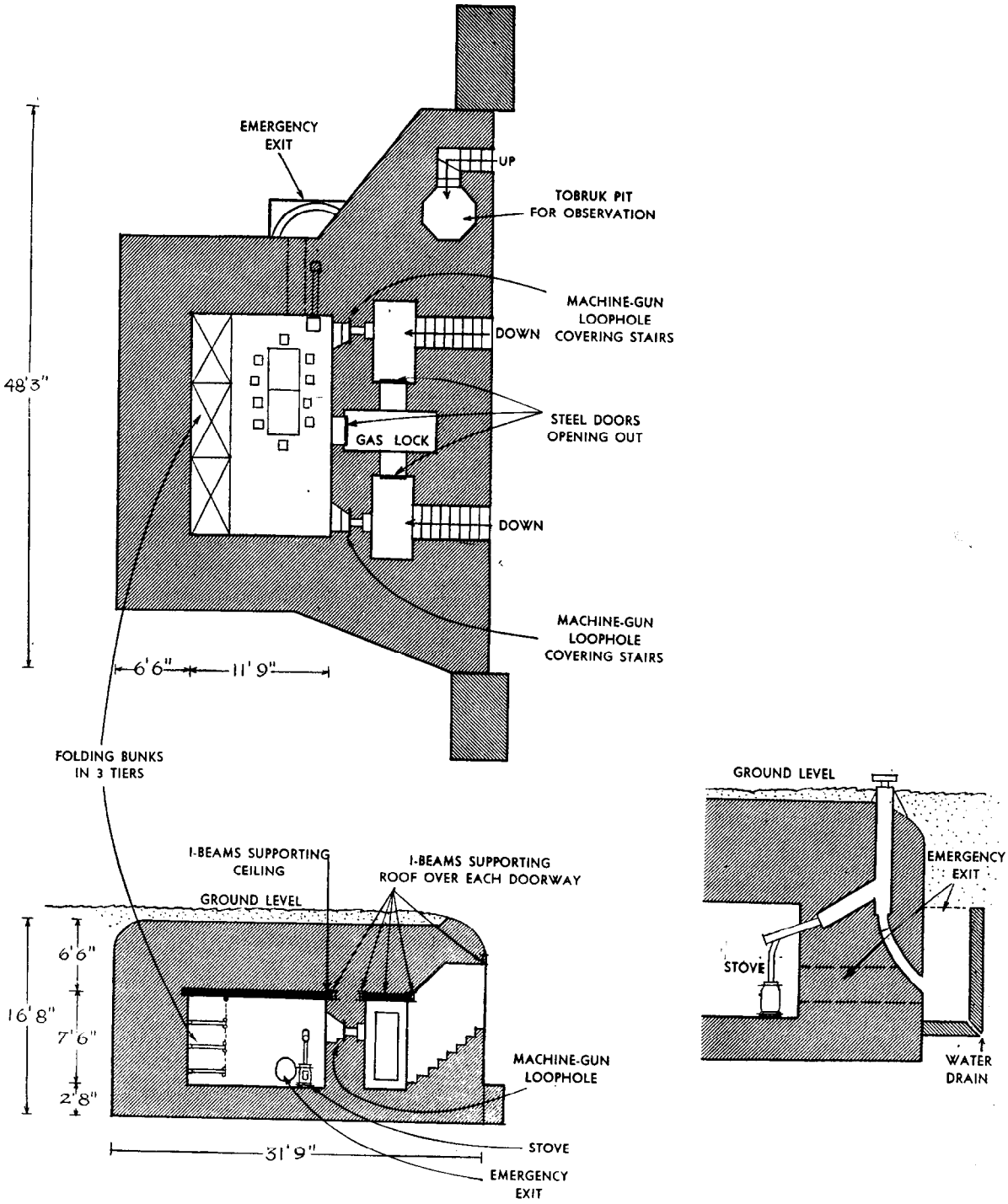


Figure 12.—Typical personnel shelter, Type 621.

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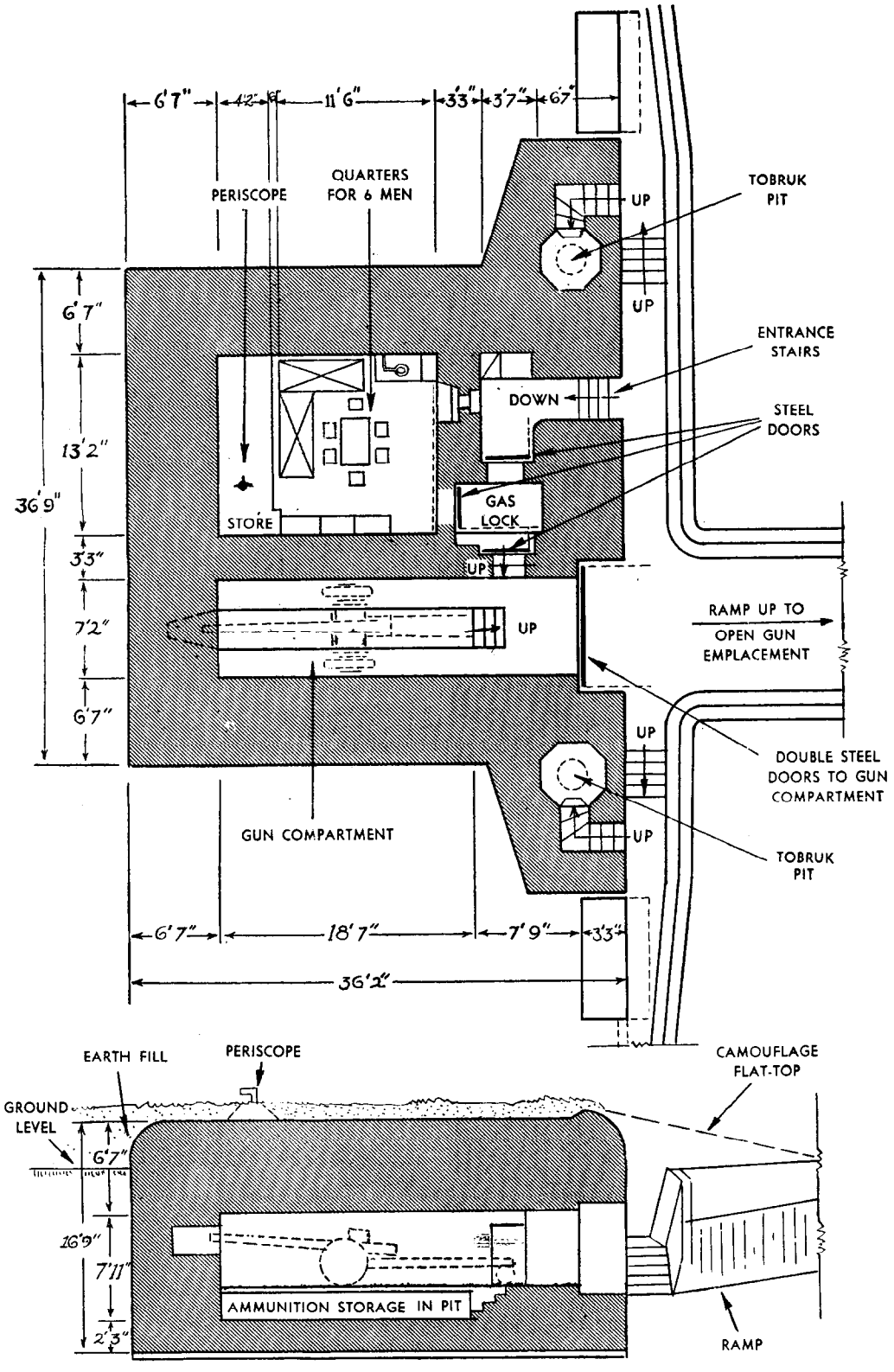

Figure 13.—Typical antitank-gun shelter, Type 629.

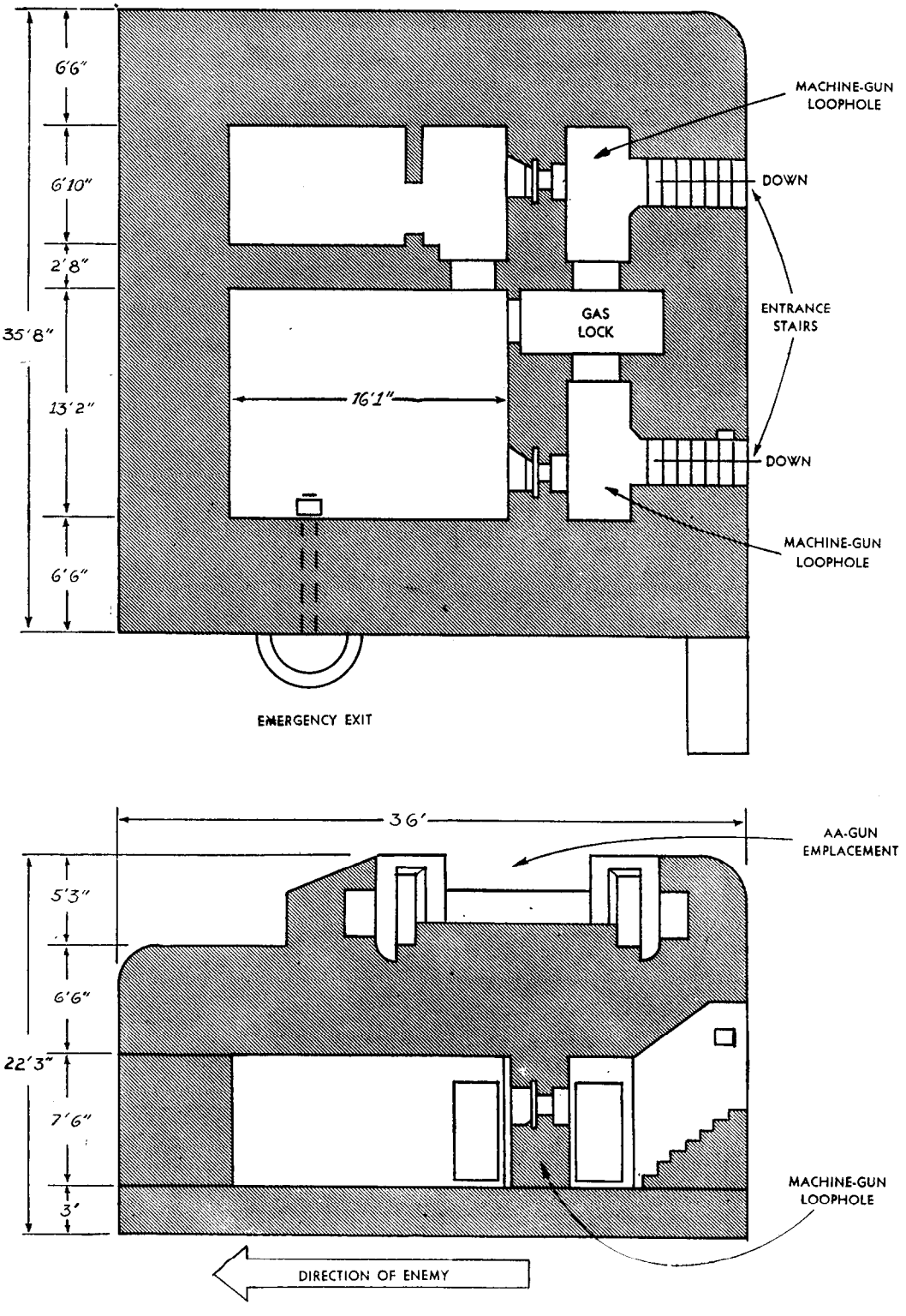

Figure 14.—Typical emplacement and shelter, Type L 409.

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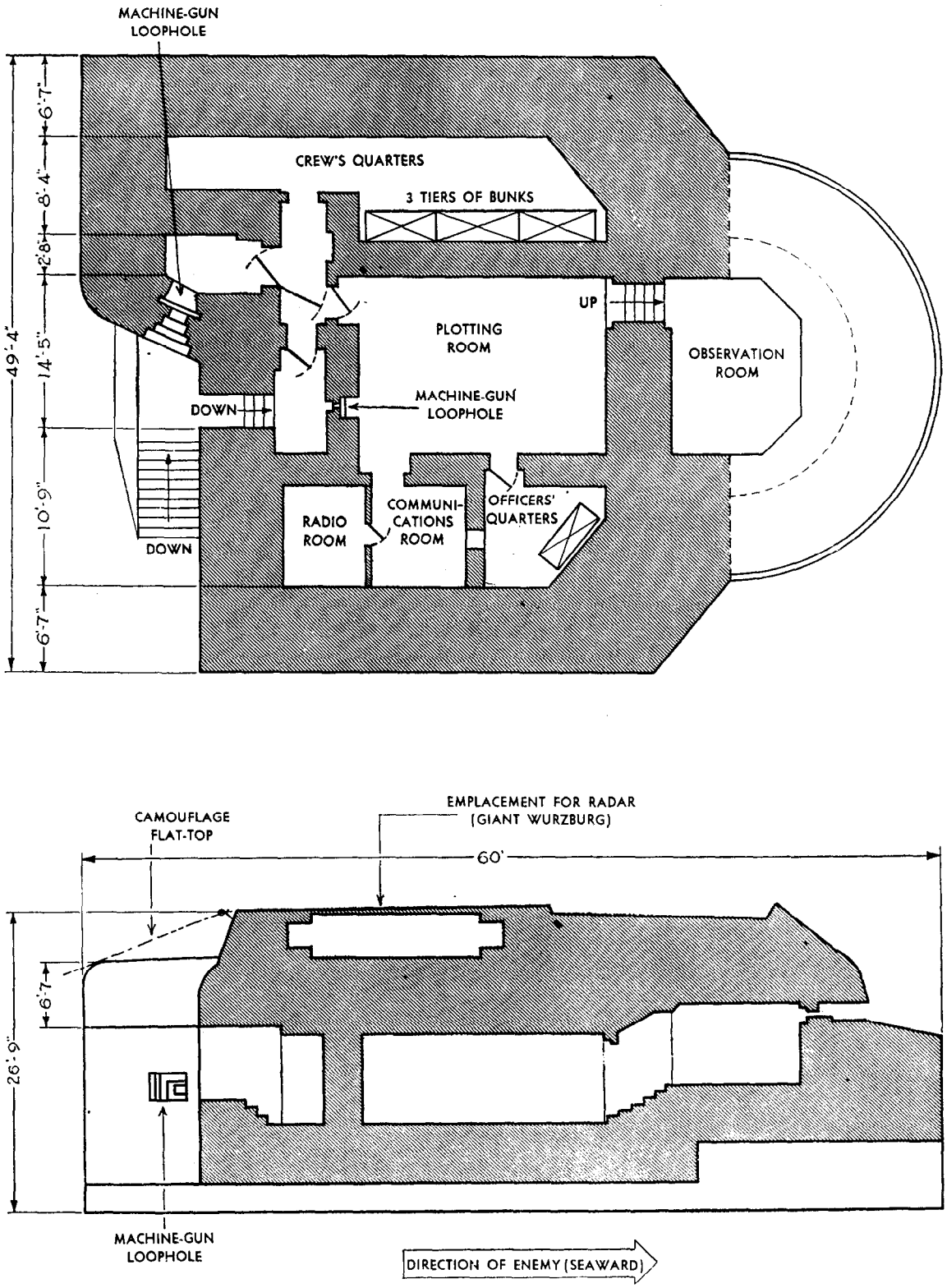


Figure 15.—Typical observation post, Type 636.

Figure 16.—Dragon's teeth showing concrete foundations.

b. ANTITANK-GUN SHELTERS. The Germans provide a special shelter for antitank guns and their crews. Figure 13 shows a typical antitank gun shelter, designated by the Germans as Type 629. Accommodation for the men is similar to that of other personnel shelters, but there is a separate compartment for the gun and ammunition. Double doors in this compartment enable the gun to be rolled out of the shelter and up a ramp (slope 1:6) to an open emplacement in the rear of the shelter from which it fires over the top of the shelter. The shelter has two Tobruk pits (*Ringstände*) in which machine guns appear to be installed to support the antitank gun. These Tobruks are connected by telephone and speaking tube to the crew's quarters. The shelter also is equipped with a periscope.

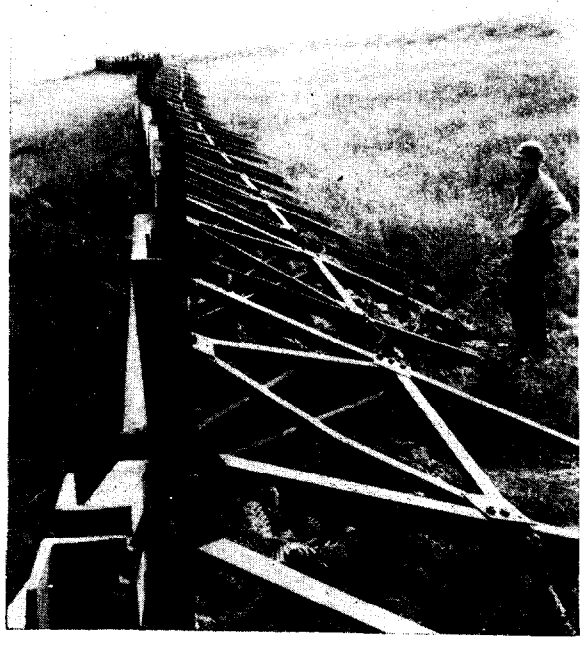


Figure 17.—German Elements "C" joined to form antitank obstacles.

c. Combined Shelter and Emplacement. Figure 14 shows a personnel shelter, with an open emplacement on the roof, known as Type L 409 ("L" stands for *Luftwaffe*). This type will accommodate nine men, and its details are similar to those of other personnel shelters. Type L 409 is for a light antiaircraft gun, but in others of the L 400 series the roof emplacement is used to mount a searchlight (L 411), or a radio direction finder (L 405). In some types, the shelter below the gun emplacement is used as a battalion command post (L 434) or an ammunition magazine (L 407).

d. Supply Shelters. The Germans have designed a number of shelters for the storage of supplies, ammunition, and drinking water. Such types usually are entirely underground and may have a wall and roof thicknesses less than the standard 6 feet 6 inches. Shelters designed for supplies may have only one entrance; they ordinarily have no emergency exit, machine-gun loopholes, or Tobruk.

6. Observation Posts

The Germans have constructed special works of reinforced concrete as coast artillery observation and command posts. A typical observation post, Type 636 (for Army Coast Artillery), is shown in Figure 15. Separate rooms are provided for observation, plotting, radar, officers' quarters, and enlisted men's quarters. A Giant *Würzburg* radio direction finder is mounted in

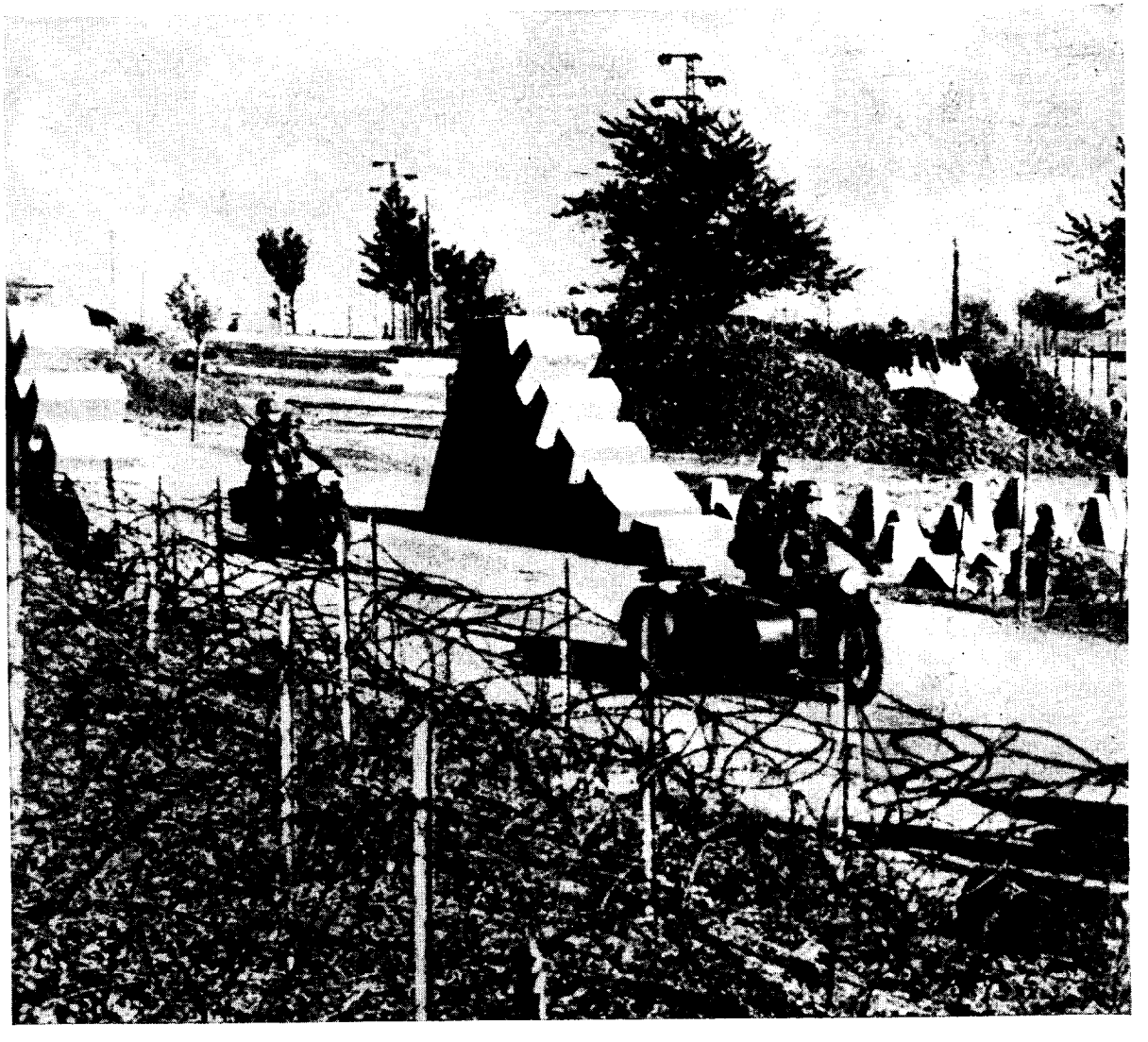


Figure 18.—Slots in the concrete pillars hold steel bars across the road to serve as a block.

the emplacement on the roof. For close defense, there are two machine-gun loopholes covering the rear entrance: one in the exterior wall, and one in the interior wall at the foot of the stairs. There are quarters for two officers and nine enlisted men, but since this does not accommodate all the personnel on duty at the observation post, a personnel shelter for one section is built nearby.

Field artillery observation posts in a permanent defense line are similar to personnel shelters, with the addition of a steel cupola for the observer.

7. Obstacles

The German tactical use of obstacles differs from the U. S. Army in that they install them within the main battle positions. Obstacles are covered by fire from concrete pillboxes and open emplacements. The Germans employ both fixed and movable permanent obstacles, constructed for the most part of steel, concrete, or both. The most common types are described below.

a. ANTITANK OBSTACLES. (1) *Dragon's teeth.* A prominent feature of the Westwall is the antitank obstacle called by the Germans "dragon's teeth". These are truncated pyramids of reinforced concrete, arranged in irregular rows of four or five. The height of the teeth varies successively from 2½ feet in the first row on the enemy side to 5 feet in the rear row, so that a tank is made to belly on the obstacle. The teeth are cast in a concrete foundation running from front to rear, and sometimes also along each row, to prevent the teeth from being toppled over.

Dragon's teeth are usually sited in long continuous lines, broken only where roads pass through the line of obstacles and where the terrain is considered unsuitable for tank activity.

(2) *Elements C.* The Germans adopted the Belgian de Cointet antitank obstacle, more often called "Elements C", which is illustrated in Figure 17. Here a number of units have been fastened together to form a continuous antitank wall, but since the units have rollers in the front

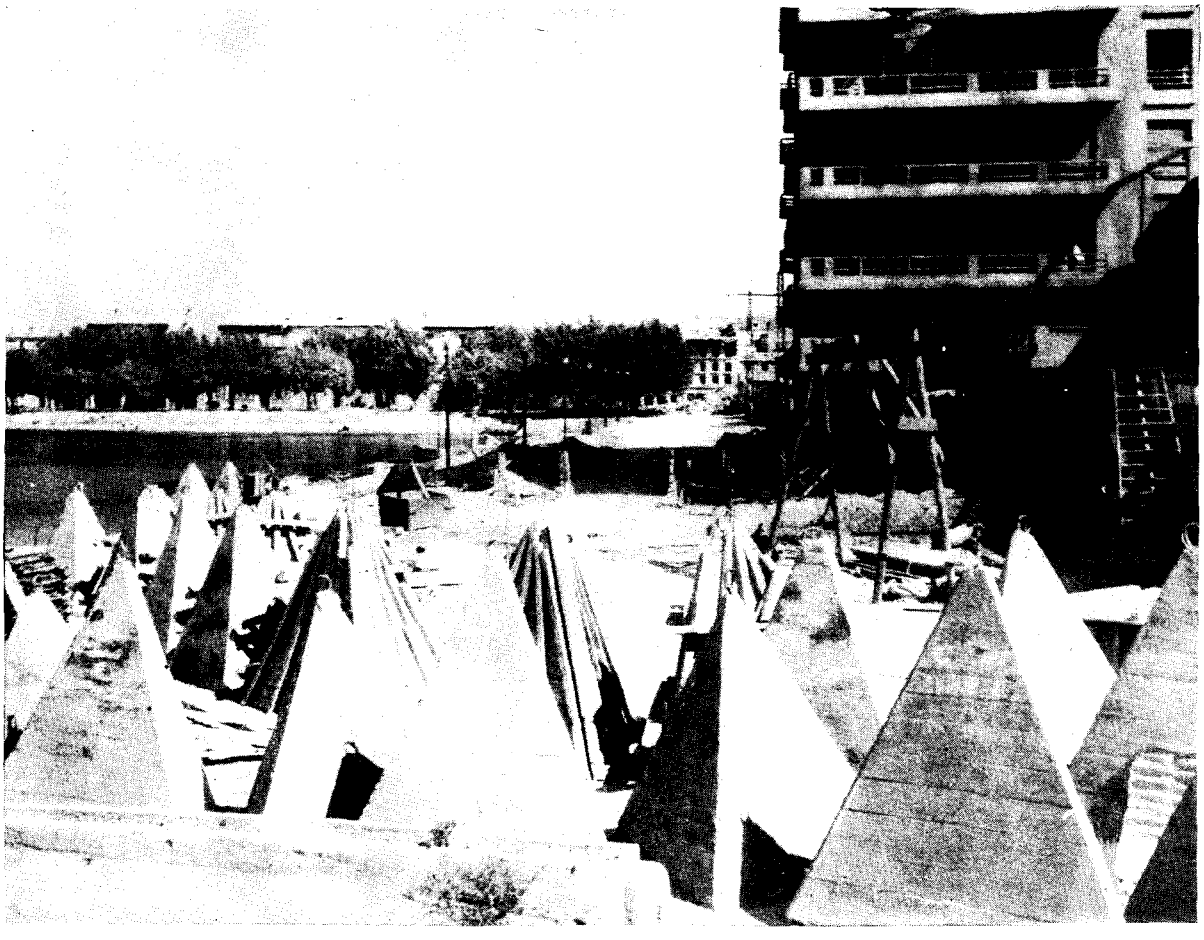


Figure 19.—Concrete tetrahedra used as antitank obstacles.

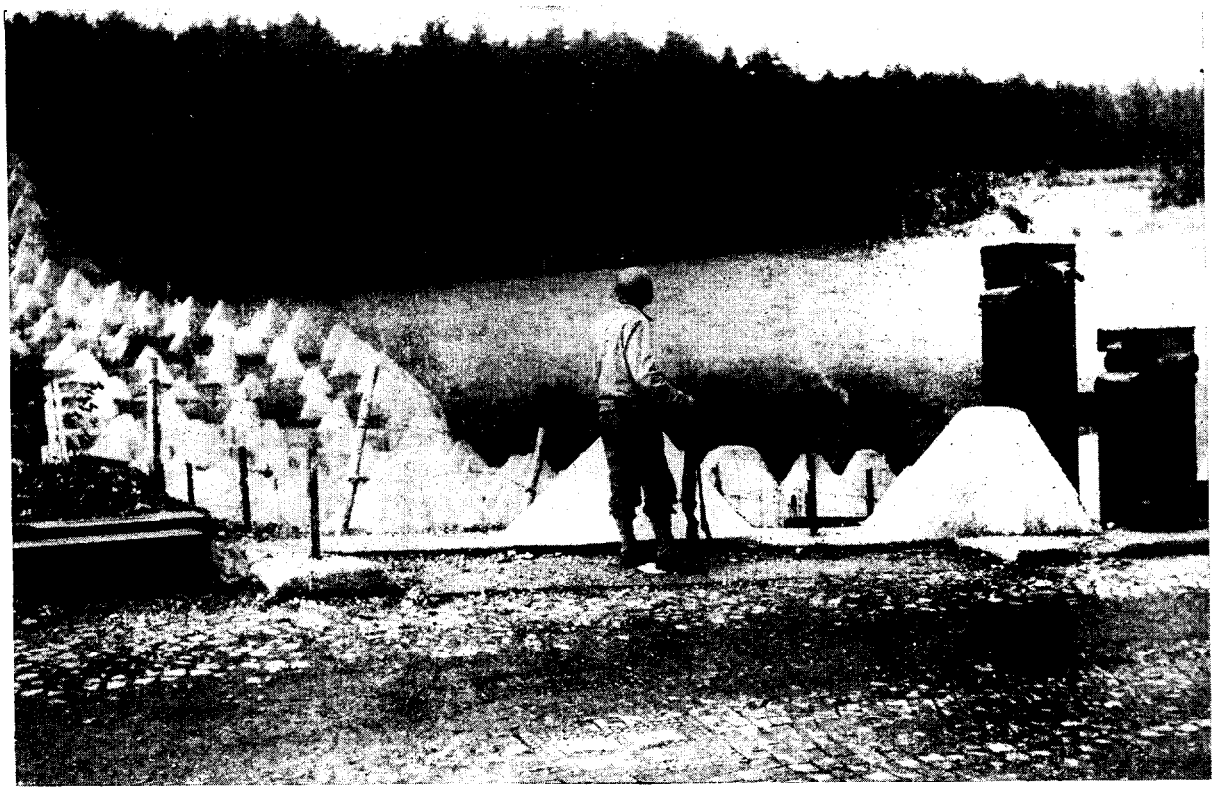


Figure 20.—Road passing through Westwall dragon's teeth. Note (right) uprights for horizontal steel bars which can be placed across the road as a block.

Figure 21.—Line of dragon's teeth of Westwall. Note steel antitank barrier set at an angle in the road.

and rear, the Germans also use them singly as movable blocks.

(3) *Curved-rail obstacle.* Similar to the "Elements C" is the curve-rail antitank obstacle, which the Germans used extensively along the Westwall. The curved rail, which slopes upward to a steep angle at the rear, faces the enemy, so that tanks attempting to climb over the obstacle tip over backward. It usually is made in sections 6 feet high, 3 feet wide, and 10 feet long.

b. ROAD BLOCKS. (1) *Steel bars.* A road passing through a barrier may be closed by horizontal steel bars arranged successively higher in reinforced concrete slots or by steel rails set upright into the road.

(2) *Tetrahedra.* The Germans also block roads with tetrahedra, which consist of steel frames or solid concrete blocks with four faces. The height of a tetrahedron varies from 2½ to 4½ feet, and its purpose is to belly a tank.

c. BARBED-WIRE OBSTACLES. (1) A German double-apron fence is illustrated in Figure 22. The fence is 4 to 5 feet high. (2) Knife rests, or *chevaux de frise*, strung with barbed wire, can be seen to the right of the fence where the road passes through the obstacles. The Germans call knife rests "Spanish riders" and use them as road blocks. German knife rests are about 4 feet high and have angle-iron or timber frames. (3) Concertina wire (*S-Rolle*) often is used by the Germans either in single, double, or triple coils. Sometimes it is wired to concrete posts, fixed on top of walls, and interwoven with double-apron fences or between concrete dragon's teeth. (4) The Germans also use an obstacle consisting of trip wires (*Stolperdraht*) arranged about 30 feet in depth. The wire is stretched from 4 to 8 inches above the ground on irregular rows of wooden pickets. The interval between pickets in rows is 10 to 13 feet and between rows 7 to 10 feet.

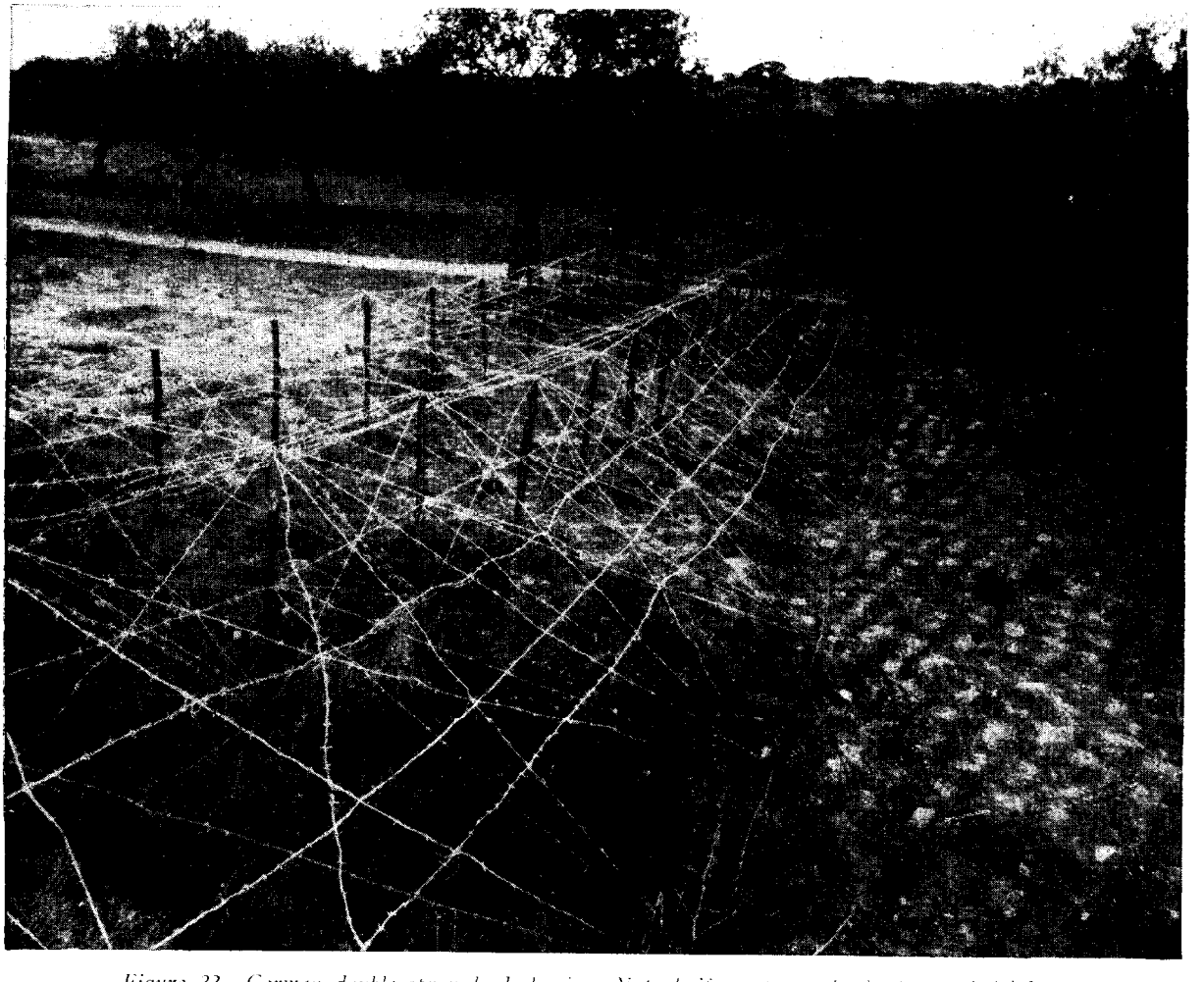


Figure 22.—German double-apron barbed wire. Note knife rests in the background (right).

CHAPTER VI

SUPPLY, EVACUATION, AND MOVEMENTS

Section I. HIGHER ORGANIZATION OF SUPPLY

1. Government Direction of Production

Economic production in Germany is highly centralized and under complete governmental control. The Ministry for Armament and War Production (*Reichsminsterium für Rüstung und Kriegsproduktion*) under Albert Speer controls production of war material and ammunition; the Ministry for Economic Affairs (*Reichswirtschaftsministerium*) controls all other industrial production; the Ministry for Food and Agriculture (*Reichsministerium für Ernährung und Landwirtschaft*) controls food production. Among them these three ministries control production of the supplies for the German Armed Forces and, within the limitations imposed upon Germany by the insufficiency of her natural resources and the effects of the Allied advances and bombings, they are able to gear the production to the needs of the war machine.

2. Estimate of Needs and Placing of Orders.

These are essentially General Staff functions, since they involve present and future operations and capabilities. On the basis of High Command directives, the detailed estimates of the number or quantity of each article of supply are worked out by the technical branches concerned; they must be adjusted to the industrial, labor, and raw material potentialities of the nation.

The three branches of the Armed Forces and the *Waffen-SS* establish their procurement policies on an interservice basis and coordinate the use of railways, canals, and roads for military traffic. In addition, for a number of particularly critical items, the Armed Forces High Command has created special depots which are at its exclusive disposal (*Verfügungsdepots*).

Within the Armed Forces the lines of distinction between the Armed Forces High Command and the Army High Command are not always clearly drawn as far as procurement is concerned. The Army being by far the largest branch of service, the Army High Command (*OKH*) may in certain cases act for the Armed Forces High Command (*OKW*). In addition, the Army procures a proportion of the materiel used by the *Waffen-SS*. The bulk of this materiel is transferred to the *Waffen-SS* through Army channels of supply and not through the system of depots maintained by the *SS* High Command.

3. The Army

The Army High Command (*OKH*) has the direct responsibility for a well functioning army supply system. Its wartime supply functions are divided into two distinct phases. The first phase, centering in the Zone of the Interior, is supervised by the Chief of Army Equipment and Commander of the Replacement Army (*Chef der Heeresrüstung and Befehlshaber des Ersatzheeres*) who organizes the procurement of supplies, their storage in suitably placed depots, and their distribution to home and field units. It is his duty to interpret high command directives on an over-all nationwide basis. He determines what proportion of supplies is essential for use by garrison and training units, what amount can be sent to the front, and which areas are in the best position to issue supplies. The second phase, the Field Army (*Feldheer*) supply system, is controlled by the Chief of Field Army Supply and Administration (*Generalquartiermeister* or *Gen. Qu*) who administers the sending of requisitions to depots established by the Chief of Army Equipment and the receipt, storage, and distribution of supplies in the field.

Section II. SYSTEM OF SUPPLY WITHIN GERMANY

1. Production, Acceptance, and Distribution of Equipment* and Ammunition

a. DESIGN AND DEVELOPMENT. This is primarily the responsibility of the Army Ordnance Office (*Heereswaffenamt*). In particular, its Weapons and Equipment Manufacture Group (*Amtsgruppe für Industrielle Rüstung*) includes ten sections dealing with the main categories of equipment and known as armament sections one to ten (*Waffenrüstungsabteilungen 1-10*). The Ordnance Office also has a Research Branch (*Forschungsabteilung*) and a Development and Testing Branch (*Amtsgruppe für Entwicklung und Prüfung*). In addition, the Ordnance officer coordinates the activities of numerous army-owned and semi-private research institutes and experimental stations throughout the country. Suggestions for design and development are also received from all the technical branches of the Army.

b. PRODUCTION. On the production side the Ministry for Armament and War Production has, through its regional Armament Inspectorates, a decisive influence on the selection of firms, coordination of armament orders with other orders, labor questions, and scheduling and supervision of production.

c. ACCEPTANCE. The testing of weapons, equipment, and ammunition, and their acceptance at the armament factory is the responsibility of the Army Acceptance Organization (*Heeresabnahmewesen*), which is a branch of the Army High Command/Army Ordnance Office (*OKH/Heereswaffenamt*). There is one Acceptance Inspector (*Abnahmeinspizient*) in each corps area who acts through acceptance commissions located at the factories.

d. DISTRIBUTION OF EQUIPMENT AND AMMUNITION TO ARMY UNITS. After acceptance at the factories, the flow of equipment and ammunition to field and home units may take a number of routes:

By way of equipment and ammunition depots.
By way of equipment parks.
Direct from the factory.
Through *SS* depots.
Through special Armed Forces High Command (*OKW*) depots.

* The term "equipment" refers to the group of materials handled by equipment depots and equipment parks, in contrast to the individual equipment (*Ausrüstung des Mannes*) and clothing handled by clothing depots.

2. Main Army Equipment and Ammunition Depot Organization

a. ORGANIZATION. The agencies responsible for most of the storage, issue, and repair of equipment and for the storage, issue, and salvaging of ammunition belong to a separate branch of the Army, the Ordnance Branch (*Feldzeugwesen*). The branch is headed by the Chief Army Ordnance Officer (*Feldzeugmeister*), who works through his staff, the Ordnance Inspectorate (*Feldzeuginspektion*) in the General Army Office (*Allgemeines Heeresamt*). From the Ordnance Inspectorate the chain of command leads through three regional commands, called Ordnance Groups (*Feldzeuggruppen*), with headquarters in Berlin, Kassel, and Munich, to the Ordnance Headquarters (*Feldzeugkommandos*) which are at the level of the corps areas but not affiliated with the latter. There is one Ordnance Headquarters in each corps area, where it controls a varying number of equipment and ammunition depots. The Ordnance Headquarters is the lowest controlling agency for the storage and issue of equipment and ammunition, and it is important to note that below this level equipment and ammunition are handled by two separate types of depots. The Ordnance Headquarters is designated by the number of the corps area. It and the depots it controls are not, however, part of the corps area organization, although the auditing of their books is done by the Corps Area Administration.

In addition to the Ordnance Headquarters designated by the corps area numbers, there exist an Ordnance Headquarters XXX, which is in charge of a great number of subterranean ammunition depots in central Germany, and a special Tank Ordnance Headquarters (*Panzer-Feldzeugkommando*), created in 1943 in order to centralize the supply of all types of armored fighting vehicles and their spare parts throughout Germany.

b. EQUIPMENT DEPOTS. Army Equipment Depots (*Heereszeugämter* or *HZa*) and Army Branch Equipment Depots (*Heeresnebenzeugämter* or *HNZa*), controlled by the Ordnance Headquarters, handle weapons, tanks, tank spare parts, motor transport, assault boats, radio apparatus, anti-gas equipment, bridge materials, special clothing, concrete mixers, and manuals, as well as many other articles. They do not furnish ammunition, fuel, rations, clothing (other than special types), medical and veterinary equipment, horses, or most types of individual equipment.

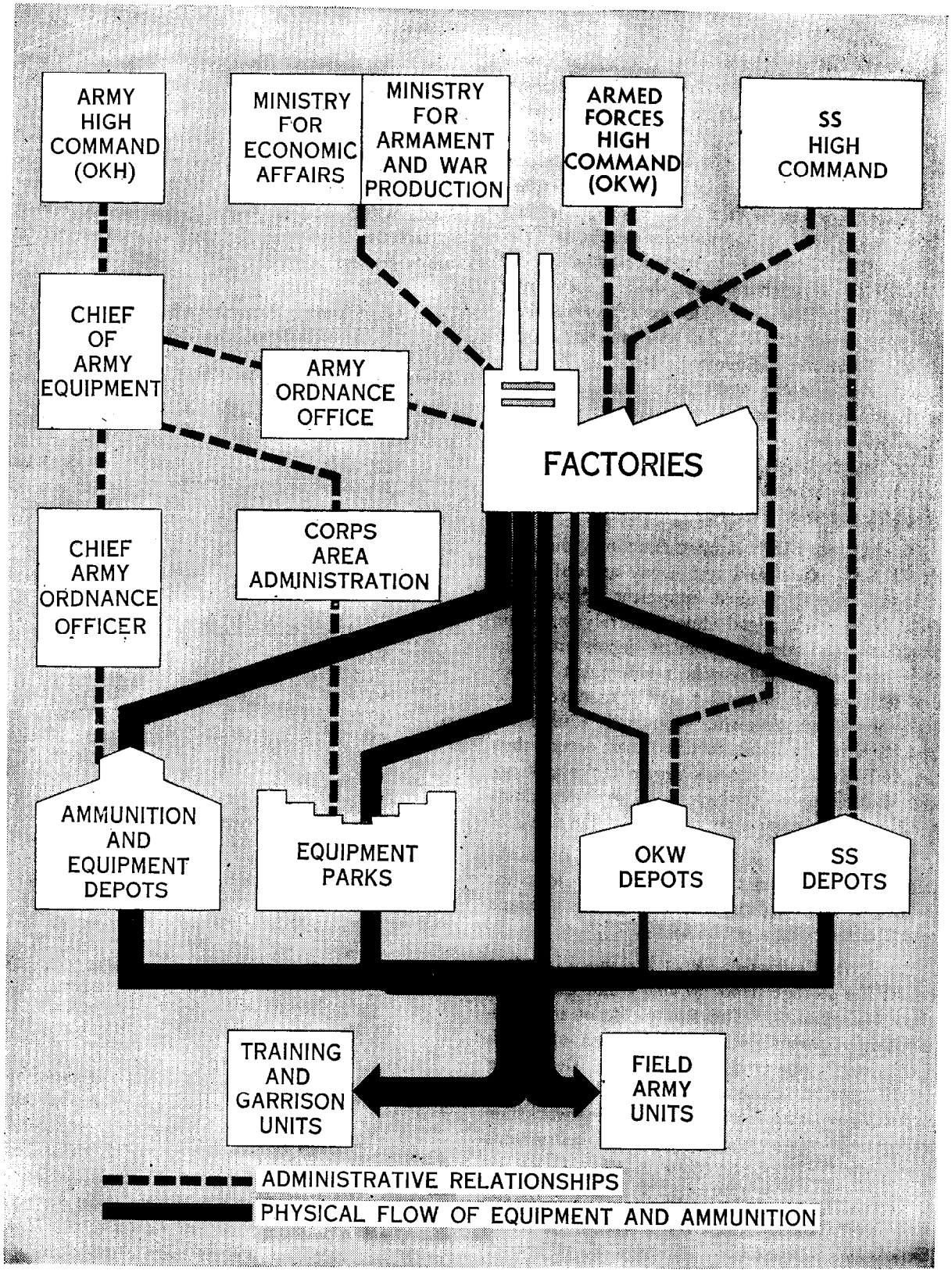


Figure 1.—Supply of equipment and ammunition.

Although the depots normally handle a great variety of items, they sometimes concentrate upon particular types. For example, air reconnaissance has revealed large concentrations of motor transport at the Chemnitz *HZa* and large artillery stores at the Berlin-Spandau *HZa*. It is known, however, that these centers also hold large stores of equipment which cannot be seen from the air. When depots specialize in only one type of equipment, they have their specialties incorporated into their names. This group includes the Army Tank Equipment Depot (*Heerespanzerzeugamt* or *HPZa*) at Magdeburg-Königsborn; the Army Branch Tank Equipment Depots (*Heerespanzernebenzeugämter* or *HPNZa*) at Frankfurt an der Oder, Naumburg, Bielefeld, Breslau, Oppeln, Kassel, Altengrabow, and Olmütz; the Army Signal Equipment Depot (*Heereszeugamtnachrichten* or *HZaNachr*) at Berlin-Schöneberg; and the Army Branch Signal Equipment Depot (*Heeresnebenzeugamtnachrichten* or *HNZaNachr*) at Wien-Strebersdorf (Vienna).

In addition to their storage functions, the *HZa* and *HNZa* adjust and test newly arrived materials and repair damaged equipment. Several of the *HNZa* are engaged almost entirely in repair functions, and most equipment depots maintain ordnance, signal, and engineer equipment servicing sections for inspecting newly manufactured equipment and repairing damaged equipment. Specialization in items repaired may occur: thus the tank equipment depots repair tanks and armored vehicles which have been so badly damaged that they cannot be repaired in the field.

The equipment depots are staffed by officers and noncommissioned officers of the Ordnance Branch who control the workers, usually civilians or soldiers serving a prison sentence.

An Army Equipment Depot is divided into two parts: the storage depot (*Lager*) and the workshop (*Werkstatt*). The storage depot is subdivided in departments (*Bezirke*), each of which specializes in one type of equipment. Depending on the type of equipment handled, the workshop will have separate sections like an arms workshop (*Waffen-Werkstatt*), an optical instruments workshop (*Optische-Werkstatt*), etc.

The Army Equipment Branch Depot is organized along the same lines as the Army Equipment Depot.

Associated with equipment depots are the Armed Forces depots attached to motor transport manufacturers. The main function of these is to facilitate transfer of vehicles from factories to equipment depots.

As the number of *HZa* is relatively limited and as they are perhaps the largest supply depots within Germany, they have been heavily bombed by Allied air forces. Despite much damage, the *HZa* have shown great recuperative powers. The importance of many *HZa*, however, has diminished, while that of the *HNZa* has increased through the dispersion of stores among the smaller supply centers.

List of known Army Equipment Depots (branch depots not included):

Corps Area	*Installation*	*Location*
I	*HZa*	Königsberg
II	*HZa*	Güstrow
II	*HZa*	Stettin
III	*HZa*	Berlin-Spandau
III	*HZaNachr*	Berlin-Schöneberg
IV	*HZa*	Chemnitz
IV	*HZa*	Naumburg
V	*HZa*	Ulm
VI	*HZa*	Unna
VII	*HZa*	Freilassing
VII	*HZa*	Ingolstadt
VII	*HZa*	München
VIII	*HZa*	Breslau
VIII	*HZa*	Brieg
VIII	*HZa*	Kotzenau
IX	*HZa*	Kassel
X	*HZa*	Hamburg-Glinde
XI	*HZa*	Hannover
XI	*HZa*	Magdeburg
XI	*HPZa*	Magdeburg-Königsborn
XII	*HZa*	Mainz-Kastel
XIII	*HZa*	Amberg
XVII	*HZa*	Wels
XVII	*HZa*	Wien
XVIII	*HZa*	Hall (in Tirol)
XVIII	*HZa*	Salzburg
XX	*HZa*	Graudenz
XXI	*HZa*	Posen

c. Ammunition Depots. Army Ammunition Depots (*Heeresmunitionsanstalten* or *HMa*) and Army Ammunition Branch Depots (*Heeresmunitionsnebenanstalten* or *HMNa*) are the main German centers for the storage and issue of ammunition. Frequently they concentrate upon particular types of ammunition; for example, the *HMa* at Münsterlager, Celle, Dessau, Augsburg, and Neu Ulm are probably principal centers for the storage of chemical warfare ammunition.

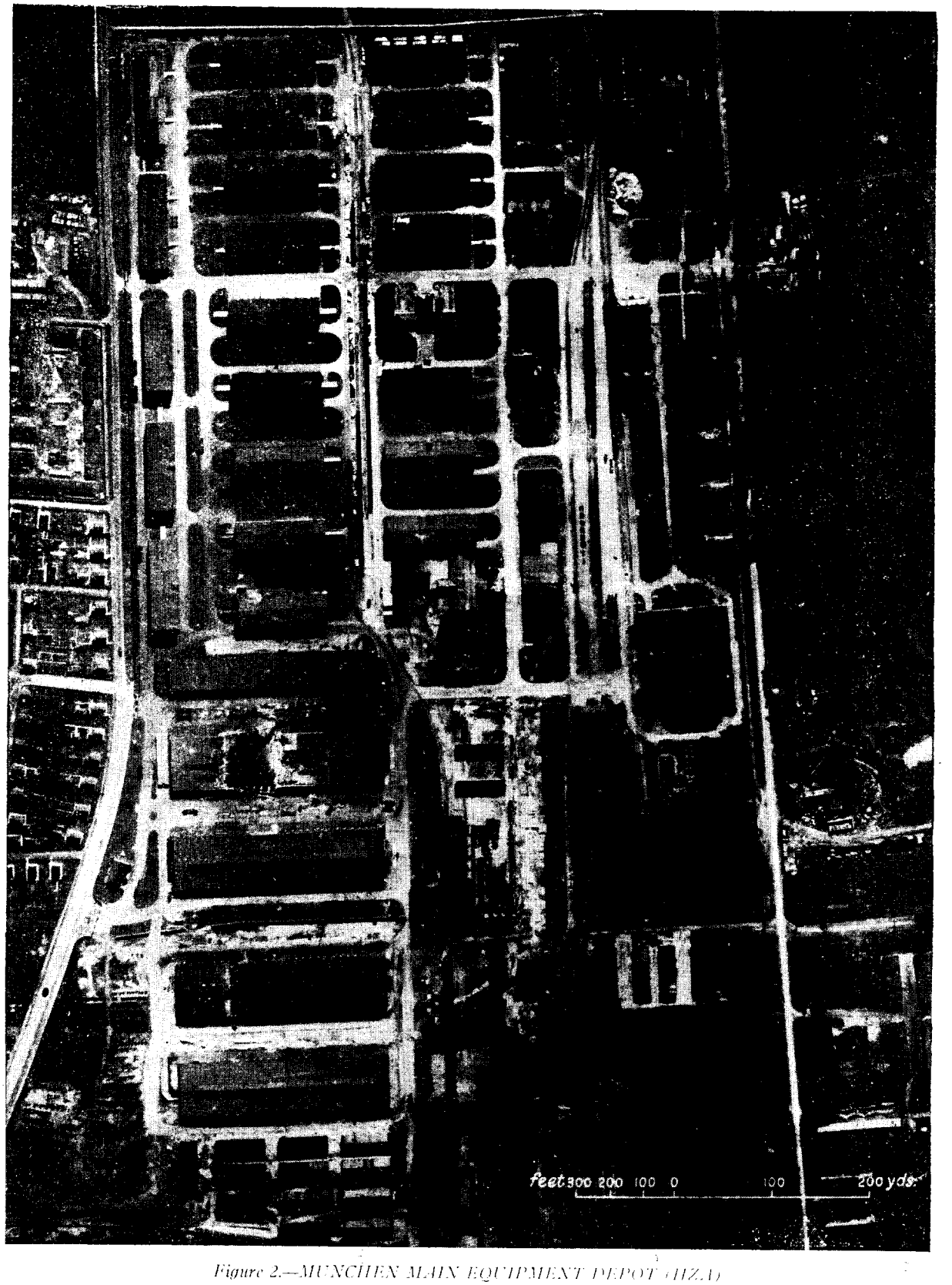


Figure 2.—MUNCHEN MAIN EQUIPMENT DEPOT (HZA)

Photographed early in 1943 after a bombing. Chief features are four very large standard equipment buildings (averaging 590' x 155') typical of Main Equipment Depots; 21 smaller standard equipment buildings (about 270' x 70'); a gun park containing about 300 guns; and about 55 miscellaneous buildings in the depot area.

In addition to storing and issuing ammunition, the *HMa* and *HMNa* participate in its production by assembling and filling shells and by manufacturing fuzes and other accessories.

Like the equipment depots, the ammunition depots are staffed by personnel of the Ordnance Branch. Employees include civilians, soldiers, prisoners of war, and large numbers of foreign laborers. An *HMa* usually has the following departments:

Administration
Manufacture (filling and packing of shells)
Shipping
Personnel administration
Motor pool

Because of the large number of well distributed ammunition depots, many of them underground, Allied air attacks have not interfered materially with their functioning. But the increased number of foreign laborers employed by these depots undoubtedly has lowered their productivity.

d. Area of Distribution. Generally a depot is allocated a definite geographical distribution area. The depot may be the exclusive German distributor of a particular item, or it may be merely the exclusive distributor within an allotted area. Thus the Ulm *HZa* distributes types of engineer equipment to all areas, while it issues Czech small arms to less than half of the corps areas. In addition, a depot may be assigned to a particular army for the supply of materiel replacements and the repair of its damaged materiel.

3. Corps Area Equipment Park Organization

a. General. The corps area parks complement the equipment depots in the handling of motor transport, engineer equipment, and anti-gas equipment, and form the principal centers for the distribution of horses, veterinary equipment, and medical equipment. Requisitions for repairs reach the parks from both home and field units. Primarily, a park is responsible for servicing its allotted area; usually it also is charged with the supply and maintenance of designated units of the Field Army.

b. Motor Transport Parks. The Home Motor Transport Parks (*Heimatkraftfahrparke* or *HKP*) received damaged or impounded vehicles such as motorcycles, trucks, and staff cars, but do not handle tanks and armored vehicles, or any newly manufactured vehicles. There are several such parks in each corps area, controlled by the Home Motor Maintenance District Headquarters (*Heimatkraftfahrbezirk*) of the corps area.

Most of the vehicles repaired belong to the *Wehrmacht* and the *SS*; but vehicles from semi-military and civilian agencies are also repaired. The *HKP* vary widely as to the number of vehicles repaired daily and the average number held. At Berlin, where there are three *HKP*, each may hold as many as 1,000 vehicles and repair 30 daily. Most *HKP*, however, hold 60 to 100 vehicles and have a daily repair average of probably less than ten vehicles. Since many of the vehicles received are damaged beyond repair and must be scrapped or cannibalized, the daily repair averages are not as inefficient as may appear upon initial glance.

A typical *HKP* includes a reception point where vehicle defects are inspected, a large number of workshops, and final inspection points where vehicles are either dispatched to units or sent back for further repair. Frequently there are branch administrative offices (*Zweigstellen*) and workshops located as far as 40 miles from the Main Office (*Hauptstelle*). The number of *HKP* in a corps area varies greatly: at one time Corps Area VI was known to have nine *HKP*, while Corps Area V had only four.

Supplies of spare parts and tires are procured from Central Spare Parts Depots (*Zentralersatzteillager* or *ZEL*) and Tire Depots (*Reifenlager*) which are controlled by the *HKP*, or direct from factories.

c. Medical Parks. The Berlin Main Medical Park (*Hauptsanitätspark*) and the Corps Area Medical Parks (*Wehrkreissanitätsparke*)—one per corps area—receive all types of surgical apparatus, drugs, bandages, and dispensing equipment from factories and hold them for distribution to hospitals within their corps areas and to Medical Collecting Parks (*Sammelsanitätsparke*). The latter are subsidiaries of the Corps Area Medical Parks and serve as collecting points for medical supplies to the field forces. In certain cases the Main Medical Park and Corps Area Medical Parks may deliver their supplies direct to the field forces.

The Main Medical Park in Berlin occupies a special position as it holds critical drugs and hospital supplies for distribution to Corps Area Medical Parks and Medical Collecting Parks. In addition it tests newly developed pharmaceutical preparations and medical equipment and furnishes the Corps Area Medical Parks with "standard" samples of medical equipment. The Main Medical Park is subordinate to the Chief Army Medi-

cal Inspector, and the Corps Area Medical Parks are subordinate to the Corps Area Surgeons; there is thus no chain of command leading from the Main Medical Park to the Corps Area Medical Parks.

There is also a group of Medical Booty Collecting Points (*Sanitätsbeutesammelstellen*) that are centers for the collection of captured medical equipment. This is sorted and tested prior to shipment to the medical parks for distribution.

Although the medical parks participate in the repair of damaged medical equipment, it is very likely that much of the recovery work is done by the manufacturers.

d. VETERINARY PARKS. Veterinary supplies are procured through veterinary parks. The Army Main Veterinary Park (*Heereshauptveterinärpark*) is directly subordinate to the Veterinary Inspector. It is the central procurement agency for veterinary equipment. Upon orders from the Veterinary Inspector the Army Main Veterinary Park will supply the Home Veterinary Parks (*Heimatveterinärparke*) with veterinary equipment either directly or by ordering it for these parks from commercial manufacturers. Horseshoeing equipment is always ordered from civilian factories.

The Home Veterinary Parks, numbering one in each corps area, and the Army Main Veterinary Park receive veterinary equipment such as shoeing equipment and veterinary medicines from the manufacturers and issue it to units and horse hospitals, besides repairing and salvaging damaged veterinary equipment received from units.

e. HORSE PARKS. Young horses purchased by the Army are sent to Army Remount Depots (*Heeresremonteämter*) for their maintenance and training until they are suited for field use. They are then delivered direct to corps area riding schools, to home units, or to Home Horse Parks (*Heimatpferdeparke*) which forward horses to Field Army units.

As the occupied territories formerly furnished most of the horse replacements for the German Army, their loss will greatly aggravate the already noticeable animal shortage at a time when the German Army is becoming increasingly dependent on horse transportation.

f. OTHER PARKS. A sizeable number of Home Engineer Parks (*Heimatpionierparke*) have been reported functioning within the corps areas, supplying home and field units with engineer equipment. In addition, there are at least five special Home Fortress Engineer Parks (*Heimatfestungspionierparke*), which supply fortress engineer units; a number of Home Railway Engineer Parks (*Heimateisenbahnpionierparke*); and a few Gas Defense Equipment Parks (*Gasschutzgeräteparke*).

4. Clothing and Individual Equipment* Supply Organization

a. PROCUREMENT AND ADMINISTRATION. Procurement of raw materials is the special function of the Armed Forces Clothing and Equipment Procurement Office (*Wehrmachtbeschaffungsamt Bekleidung und Ausrüstung*) at Berlin. The raw materials are then issued to the clothing depots of the three branches of the Armed Forces and the *SS* which manufacture, store, and issue clothing and various items of individual equipment. In addition, damaged, captured, or impounded clothing may be sent to the clothing depots for repair and reissue.

In the Army the highest administrative echelon is a section in the staff of the General Army Office (*Allgemeines Heeresamt/Stab/Bekleidung*) which issues all directives on clothing and equipment. It controls the work of the Army Clothing Depots (*Heeresbekleidungsämter* or *HBA*). Within each corps area the supply of clothing is directed by Section E (*Sachgebiet E*) of the Corps Area Administration (*Wehrkreisverwaltung*). Thus for all practical purposes the normal Army Clothing Depot is subject to a dual control.

b. CLOTHING DEPOTS. One or more Army Clothing Depots are generally found in each corps area. These *HBA* receive raw materials from which they manufacture clothing, insignia, shoes, tents, canteens, blankets, and other items of individual equipment. They exercise control over Testing and Repair Sections (*Verwaltungsund Instandsetzungabteilungen*), which repair damaged clothing, and Army Clothing Dumps and Branch Dumps (*Heeresbekleidungslager und Nebenlager*), which assist in the forwarding of clothing to the field forces.

Specialized types of clothing depots include Collecting Points for Winter Clothing (*Sammel-Stellen für Winterbekleidung*), Army Clothing Repair Workshops (*Heeresbekleidungsinstandsetzungswerkstätten*) which presumably do not handle newly manufactured clothing, and Clothing Processing Centers (*Durchschleusungsstel-*

* *Ausrüstung des Mannes.* See note on page 2.

len) which are believed to be centers to which reinforcements requiring refitting are routed before their departure for the front. In addition, rations depots may store and issue clothing for certain areas.

c. Area of Distribution. The *HBA* issues clothing and individual equipment to units within its assigned territorial area. Many *HBA* are also responsible for the supply of particular armies in the field; to facilitate the transfer of clothing to field units, issues may be made to Army Clothing Dumps and Branch Dumps which in turn issue clothing and individual equipment to field units.

5. Rations Supply Organization

a. General. The German Army depends for its transportation to a large extent on horse-drawn vehicles; forage is therefore considered to be of equal importance to human rations, and the supply of both is handled by the same agencies. In the following description of the supply organization the term rations includes forage as well.

b. Procurement and Administration. The over-all planning of rations and the laying down of policies for the procurement and organization of supplies is done for all branches of the Armed Forces at the Rations and Procurement Group (*Amtsgruppe Verpflegung und Beschaffung*) of the Army High Command/Administration Office (*OKH/Heeresverwaltungsamt*). At the same time the Rations and Procurement Group directs the supply of rations to the Field Army and to the Replacement Army. Regional control of supply is exercised by Section C (*Sachgebiet C*) of the Corps Area Administration.

Although all rations depots procure a proportion of their supplies direct from local producers, they draw most of them from the Higher Rations Stores (*Ersatzverpflegungsmagazine* or *EVM*) to which they are subordinate. In procuring rations for distribution, the *EVM* purchases food from all parts of the corps area in which it is located and arranges for the exchange of goods with other corps areas. In many instances procurement of a particular rations component, such as flour or fodder, may be delegated to one of the depots subsidiary to the *EVM*.

c. Rations Depots. While in peacetime the troops purchased their rations mostly through commercial channels and only bread and forage were procured from the Army bakeries and rations depots, in wartime the supply of rations from Army depots has become the rule. To fulfil this task, the Higher Rations Stores or *EVM* were formed at the outbreak of war from many of the already existent Army Rations Main Depots (*Heeresverpflegungshauptämter*) or (*HVHA*).

The most important type of rations depot is the *EVM*. The *EVM* control Army Rations Main Depots (*HVHA*) which in turn control Army Rations Depots (*Heeresverpflegungsämter* or *HVA*) and Army Garrison Rations Depots (*Heeresstandortverwaltung Verpflegungsabteilungen*). Although the number of such installations in a corps area varies, one corps area is known to have two *EVM*, three *HVHA*, nine *HVA* and at least 12 Army Garrison Ration Depots. There are probably 40 *EVM* in Germany, 36 of which are listed below.

The echelon of the depot generally determines its size and stock. Each *EVM* is expected to maintain stock sufficient for one month's rations for 300,000 men; this would amount to over 10,000 tons of food. An *HVHA* retains food reserves of perhaps 3,000 tons, while an *HVA* usually stocks several hundred tons. An *EVM* almost invariably has a bakery and good rail facilities; lower echelon depots may lack bakeries and may have only road connections.

The rule as to size of depots is not inflexible. A large share of the stores normally retained by the *EVM* may be divided among *HVHA* and *HVA* for additional protection from air raids and to facilitate the loading of rations trains. In other instances, Army Garrison Rations Depots handle more stores than *HVHA* or *HVA* of the same corps area due to abnormal troop concentrations in their particular garrison areas.

While specialization is not typical of the rations depots, since both human and animal rations are found in all types, a limited number of *HVHA* and *HVA* tend to have concentrated stores of a particular rations component. As an example, one *HVHA*, now captured, maintained a reserve of thousands of tons of oats in addition to its stores of troop rations. In certain farming districts Fodder Collecting Points (*Rauhfuttersammelstellen*) specialize in the collection and storage of forage.

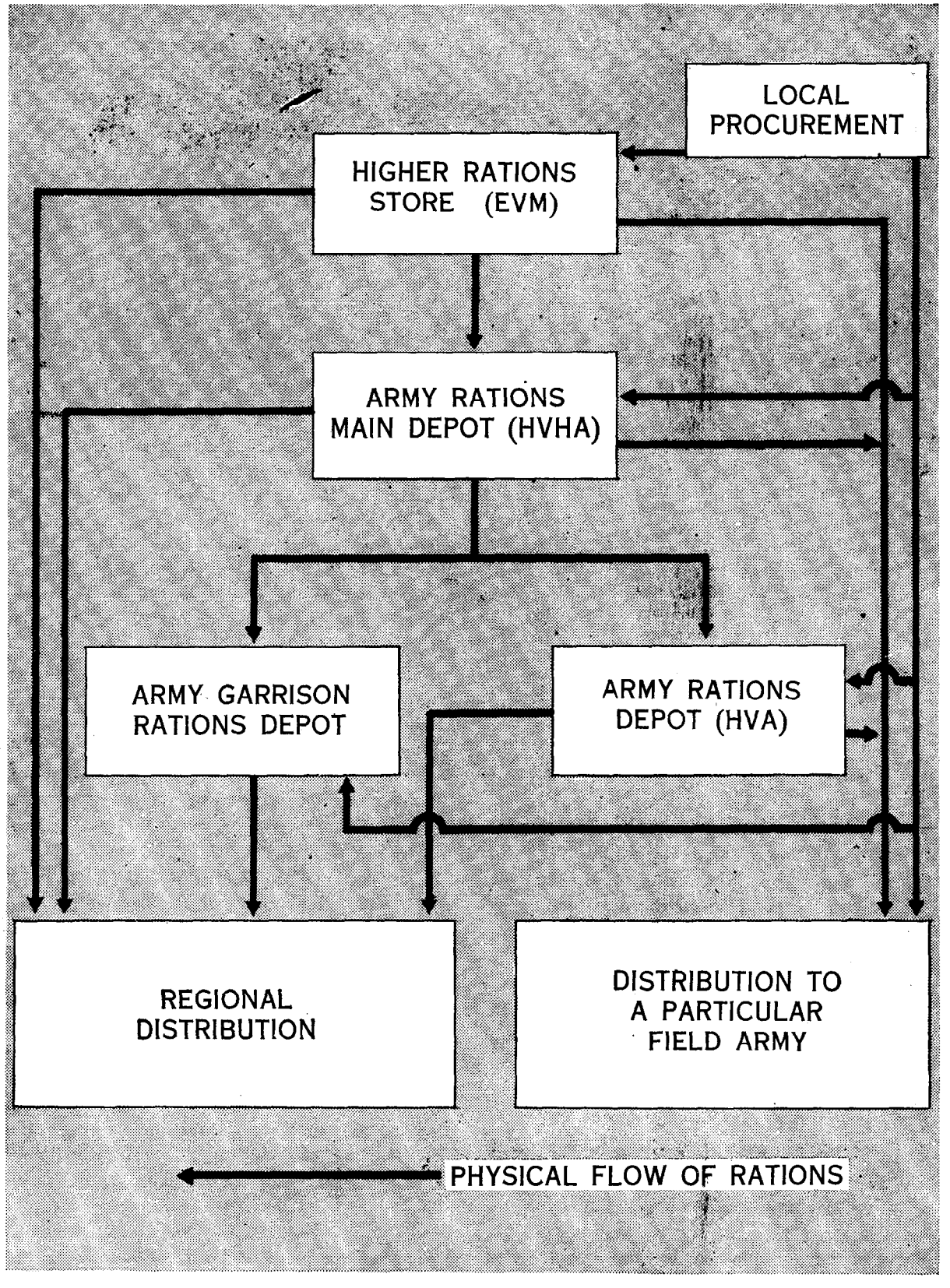


Figure 3.—Supply of rations.

List of known Higher Rations Stores (*EVM*):

Corps Area	*Location*
I	Insterburg
I	Königsberg
I	Lötzen
II	Stettin
III	Berlin
III	Potsdam
IV	Dresden
IV	Halle
IV	Leipzig
IV	Torgau
V	Aalen
V	Ulm
VI	Minden
VI	Münster
VII	München
VIII	Breslau
VIII	Liegnitz
VIII	Oppeln
IX	Erfurt
IX	Frankfurt am Main
IX	Kassel
X	Bremen
X	Hamburg
X	Rendsburg
XI	Hannover
XI	Magdeburg
XII	Mainz
XIII	Bamberg
XIII	Nürnberg
XVII	Linz
XVII	Wien
XVIII	Graz
XX	Danzig
XXI	Posen
B.u.M	Olmütz
B.u.M	Prag

d. Area of Distribution. The depots maintained by the Army supply food and forage to Army, *SS*, and Air Force units present in their localities. Naval units generally are supplied by Naval Rations Depots (*Marineverpflegungsämter*). The process of local supply is relatively simple, as units contact the nearest rations depot and thereafter automatically are attached to a depot for their supply of rations. If a depot finds itself unable to provide full rations to all units in its area, it receives assistance from other depots in the corps area.

In addition to supplying local needs, the *EVM* are the principal centers for the supply of rations to the Field Army. Ordinarily, a group of *EVM* becomes responsible for the rations supply of a particular army; then the *EVM* must make certain that the army has about 10 days' supply of rations on hand at all times, based upon an estimate of the probable rations strength prepared by the army 28 days in advance.

Lower echelon depots may become involved in the supply of the field armies in a number of ways:

(1) When an *HVA* or *HVHA* is delegated to assist the *EVM* in storage of field army rations.

(2) When an *HVHA* is assigned the function of procuring and storing a particular component of the ration for the entire corps area.

(3) When any of the depots located in the theater of operations are turned over to a field army to be used as an Army Rations Depot (*Armeeverpflegungslager*).

6. Fuels and Lubricants Supply Organization

a. General. Because of the critical condition of German fuel supply, the collection and distribution of fuel have largely been retained by the Ministry of Economic Affairs through its Central Petroleum Office. Both the Central Petroleum Office and the Armed Forces High Command exercise authority over the *WIFO* (Economic Research Company), which is the organization responsible for the administration of depots supplying fuel to the armed forces.

b. Procurement. The Ministry of Economic Affairs, in collaboration with the Armed Forces High Command, establishes the proportional allotment of fuel to the Armed Forces and to civilian users. The refineries, producers, and importers then are directed to ship supplies either to the *WIFO* Depots or to air force, naval or commercial storage depots.

c. Types of Depots. The main *WIFO* depots controlled by the Central Petroleum Office consist of Main Strategic Depots (*Zentralhauptlager*), which are usually underground, and of Main Transit Depots (*Zentralumschlaglager*), which store supplies for transshipment. In addition to supplying the largest share of fuel received by army fuel depots, these depots handle a portion of the fuel used by the Air Force and Navy. The Main Strategic Depots have storage capacities ranging into hundreds of thousands of tons of oil. For this reason the Allied air forces have bombed them with great consistency. The importance of the Main Transit Depots has decreased since the cutting off of Rumanian petroleum imports.

The smaller *WIFO* depots, controlled by the Armed Forces High Command, consist of Army High Command Fuel Supply Depots (*OKH*

Nachschubtanklager) and subsidiary Army Fuel Supply Depots (*Heeresnachschubtanklager*). These depots are directed solely to the supply of Army units. Very likely, commercial storage depots situated in the Theater of Operations have been converted into *WIFO* depots of this sort.

Not controlled by *WIFO* are the depots situated near the producing plants (*Marschtanklager* or Fuel Replacement Depots) which send fuel supplies to the depots mentioned above as well as direct to the Field Army.

7. *Waffen-SS* Supply Organization

a. Relation to Army Supply. While the *Waffen-SS* is generally self-sufficient in its Zone of the Interior supply, it depends upon the Chief of Army Equipment for most of its tanks, self-propelled guns, and other heavy equipment and for the repair of many of its vehicles. Indeed, *Waffen-SS* units have a higher priority on heavy equipment than do army units. To what extent the *SS* reciprocates by supplying army units has not been determined.

b. *SS* Depots. Of the *SS* depot centers, Oranienburg is the most important as it contains the Main *SS* Equipment Depot (*SS-Zeugamt*), the *SS* Central Distribution Center (*SS-Zentralzulassungstelle*), the *SS* Signal Equipment Depot (*SS-Nachrichtenzeugamt*), and an *SS* Motor Transport Depot (*SS-Kraftfahrzeugdepot*). Other important *SS* depot centers are Berlin, Dachau, and Prague. Since the *SS* depots supply the other branches of the *SS* as well as the *Waffen-SS* with rations, clothing, and certain types of equipment, they cannot be considered as purely military depots.

8. Transportation

All military transportation by rail or on inland waterways comes under the direction of the Chief of Transportation (*Chef des Transportwesens*) at the High Command of the Armed Forces (*OKW*). He works through a chain of transportation headquarters which are usually subordinate to the Army but act for the whole of the Armed Forces. The activities of the transportation headquarters cover the occupied territories as well as Germany.

The Transportation Headquarters (*Transport-Kommandanturen*) are regional liaison offices of the Armed Forces with the German State Railways (*Deutsche Reichsbahn*) and the authorities controlling the transportation on inland waterways. The Transportation Headquarters are located at the seat of a Railway Directorate (*Reichsbahndirektion*) and control the area of one or more Railway Directorates.

The Transportation Headquarters are the basic units through which all military agencies must deal if they require rail or water transportation for units, freight, or casualties. The Transportation Headquarters make the transportation facilities available and issue orders as to how and when they are to be used.

The staff of the Transportation Headquarters is organized into:

Section Ia: Troop movements for the Armed Forces
Auxiliaries of the Armed Forces
Transportation of prisoners of war

Section Ib: Freight for the Armed Forces
Armament goods
Armed Forces travel

Section IVb: Hospital and convalescent trains

Subordinate to the transportation headquarters are railway station headquarters (*Bahnhofskommandanturen*) and officers stationed at inland harbors (*Hafenoffiziere*). These headquarters and officers are stationed there for the maintenance of order and as liaison officers with the local railway and harbor officials.

Section III. SYSTEM OF SUPPLY OF THE FIELD ARMY

1. General

The supply system of the Field Army is simple and flexible. Its main objective during combat is to replace all supplies used during one day of combat by the beginning of the next day. Rules and regulations are not mandatory; much discretion therefore remains with the supply officers who are encouraged to move supplies as far forward as possible without reloading, to salvage all usable materiel, and to limit expenditure of supplies as far as possible.

2. Staff Control

a. Supply Directives. The commanders of Field Army units conduct supply within their commands in accordance with directives laid down by the Army High Command. For this purpose their general staffs are provided with staff officers, analogous to our G–4's, who are called *Ib* and

who are responsible for all matters of transport and supply. When the *Ib*, acting in the name of his commander, issues supply directives, their execution usually falls to the following:

(1) Arms and Equipment Section (*W* and *WuG*).

(2) Intendance Section (*IVa* or *Intendantur*), dealing with rations, clothing, and pay.

(3) Medical Section (*IVb*).

(4) Veterinary Section (*IVc*).

(5) Motor Transport Section (*V*).

(6) Supply Troop Commander (*Kommandeur der Nachschubtruppen*), commanding the organic or attached supply troops.

b. STAFF OFFICERS AND DUTIES. The staff officers concerned with supply in the Field Army and their duties are as follows:

(1) At Field Army headquarters, the Chief of Field Army Supply and Administration (*General Quartiermeister*) is directly responsible to the Chief of Staff of the Field Army and constantly is kept informed of the supply situation of the various armies. One of his main functions is forwarding the requirements of the armies to the Chief of Army Equipment. He regulates the evacuation of prisoners and wounded, and the use of communications in the theater of operations. Large stocks of materials, including captured materials and mobile supply trains, are under his control. Important repair centers are also maintained under his control.

(2) At army group headquarters, the Army Group *Ib* intervenes only when a critical situation requires action, since army groups are not in the normal chain of supply. Normally his most important function is the supervision of security units which safeguard supplies in the communications zones. Units attached to an army group are supplied through the army in whose area they are located.

(3) At army headquarters, the Army *Ib* (*Oberquartiermeister*) administers the collation and forwarding of requisitions, the receipt of supplies from Zone of the Interior depots, the distribution of supplies to lower echelons, and the maintenance of important dumps and repair centers.

(4) At corps headquarters, the Corps *Ib* (*Quartiermeister*), who always has been a link in the chain of requisitioning, recently has been assigned a role in the chain of supply, although the larger proportion of supplies still pass direct from army dumps to divisions. In addition to handling the supply of organic corps troops, the Corps *Ib* supervises the distribution of supplies from corps dumps to lower echelons.

(5) At division headquarters, the Division *Ib* makes his requisition to the Corps *Ib* on the basis of requisitions and reports from the troop units. He controls the division services of supply and provides a systematic supply of reserves of all kinds for the troops. Like the Army *Ib*, he is in the normal chain of supply.

3. Requisitioning and Procurement

a. REQUISITIONING. (1) The normal channel of requisitioning is from troop units through regiment, division, and corps to army.

(2) An army generally sends requisitions for ammunition, fuel, motor transport, horses, weapons, spare parts, and most other types of equipment to the Field Army, while requisitions for rations, clothing, medical equipment, and veterinary equipment go direct to home depots assigned to the army. While these are the usual channels, many variations are known to occur. For instance, an army may send a requisition for certain special weapons and chemical warfare equipment directly to the Chief of Army Equipment, or an army may send a rations requisition to the Field Army in addition to forwarding the requisition to a home depot.

(3) Requisitions arriving at the Field Army usually are forwarded to the Chief of Army Equipment, who passes them down to a designated home depot. In some cases, however, the Field Army may send requisitions directly to a home depot without routing them through the Chief of Army Equipment.

(4) A requisition may be filled at any level by the echelon which has the necessary supplies available in its storage centers.

b. PROCUREMENT. Requisitioning is supplemented by two methods of field procurement: living off the land and the use of captured materiel.

(1) Living off the land may be accomplished either by local purchase or by outright confiscation of local supplies. Such procedure seldom is sufficient to supply all the requirements of units. In some areas, nevertheless, it has considerably lessened the German supply problem, as in Italy where much food, clothing, ammunition, and equipment is locally procured.

(2) The employment of captured materiel has always been a favored practice in the German Army. In the offensive beginning in December

1944, directed against the Americans holding the St. Vith-Bastogne area, the Germans apparently expected to keep their tanks operating by the seizure of American fuel dumps. The German soldiers frequently were clothed with American uniforms and operated with liberal amounts of captured Czech, British, French, and Russian, as well as American weapons and equipment.

4. Principal Installations

a. REARWARD OF RAILHEADS. (1) *Collecting stations (Sammelbahnhöfe).* Shipments of less than a rail carload are sent to these stations and combined into carloads and train shipments before being routed to the railhead.

(2) *Forwarding stations (Weiterleitungstationen).* Rail shipments that are not unit-loaded for one organization may be forwarded to the army through one of these stations.

(3) *Distributing stations (Verteilerbahnhöfe).* When a large number of units are dependent upon a single railroad for their supply, a distributing station may be set up to regulate the dispatch of supplies to the proper railhead or unloading point; apparently the combined functions of the collecting, forwarding, and distributing stations approach the functions of the U. S. regulating station.

(4) *Supply collecting areas (Nachschubsammelgebiete).* Reserves of ammunition, fuel, and rations are kept loaded in trains in these areas subject to disposition by the Chief of Field Army Administration and Supply.

(5) *Field Army parks, bases, and depots (Heeres Parke, Stützpunkte, und Lager).* Primarily concerned with the maintenance, repair, and forwarding of vehicles, including tanks and armored vehicles, these Field Army installations may be located well to the rear of the railheads.

(6) *Army parks (Armee Parke).* Some of the army equipment parks may be located to the rear of the army railheads.

b. RAILHEADS (*Kopfbahnhöfe*). Railheads are located as far forward as possible. While this generally results in army (*Armee*) railheads, each of which supplies a number of divisions or a corps (in the latter case the railhead may be called a corps railhead), a division railhead for each division is established whenever possible. On the Western Front, depending on the nature of the terrain and the effectiveness of Allied bombings, the railhead is found from 10 to 50 miles—usually about 25 miles—from the front. This is a great improvement over the conditions that existed in the early stages of the Russian campaign, when German railheads were on an average from 90 to 120 miles behind the front troops.

c. FORWARD OF RAILHEADS. (1) *Army parks and dumps (Armee Parke und Lager).* Army fuel, rations, and ammunition dumps are almost invariably forward of army railheads, while army equipment parks generally are in the vicinity of the railheads.

(2) *Corps dumps (Korps Lager).* If army installations are far to the rear, corps dumps may be set up between army and division; in such cases the corps dumps function as advanced army dumps distributing to divisions.

(3) *Division dumps (Divisions Lager).* The dump system may be pushed forward even into the division area, but this is the exception rather than the rule.

(4) *Distributing points (Ausgabestellen).* These are maintained by divisions and possibly other echelons in their areas for the distribution of rations, fuel, and ammunition. While stores are not generally retained at these points, small accumulations may occur.

(5) *Collecting points (Sammelstellen).* Although called collecting points, these centers, which are maintained by army and division, serve as supply points for new and repaired equipment as well as collecting points for damaged and captured equipment.

(6) *Reloading points (Umschlagstellen).* When long road movements are involved, reloading points may be set up by army or corps to facilitate supply movements.

(7) *Supply points.* Units lower than divisions have points analogous to collecting and distributing points.

5. Distribution of Supplies to Field Units

a. GENERAL SCHEME OF DISTRIBUTION. (1) Supplies are transported by rail from home depots to army railheads where they are picked up by army supply columns and transported to army dumps and parks. Division supply columns receive rations, fuel, and ammunition at army dumps, and equipment at army parks. They carry the rations, fuel, and ammunition to division distributing points, and the equipment to division collecting points. At these points, supplies are transferred to battalion supply columns and carried to battalion or company supply points where the supplies are turned over to the troops.

(2) While this is the usual flow of supplies, it may be modified in a number of ways, most of which are shown in Figure 2. Operational conditions are the cause of most modifications of the usual system of distribution. Hence, if the army and divisions are short of trucks or gasoline, columns from units as low as companies may be forced to go as far as 20 miles to receive supplies from army railheads and dumps; if the lower echelons lack means of transportation, army supply columns may be used to bring supplies to the troops; if Allied strafing is expected, supply movements may be limited to the hours of darkness; if units are stationed in the near vicinity of army dumps, they may draw their supplies direct from the dumps.

b. DISTRIBUTION OF RATIONS. Normally home rations depots ship supplies direct to Army Rations Dumps (*Armeeverpflegungslager*). A number of such dumps may be set up, each with stores of less than 100 tons. In some cases, these dumps have been known to store small amounts of clothing, individual equipment, and office equipment. As they are not permanent installations, they may move from time to time. Forward army dumps sometimes are controlled by corps and called Corps Rations Dumps (*Korpsverpflegungslager*); in such cases, the corps dumps supply the division and corps troops, while army dumps supply units and individual detachments attached to army headquarters, and form a permanent organization for the support of future military operations. Rations supply within the division is handled through a rations distributing point (*Verpflegungsausgabestelle*). Supplies are received at this point and are distributed to division units. Usually livestock is sent to field butchery platoons for dressing, and flour to field bakeries for bread production.

(1) A butchery platoon can process the following number of animals per day:

40 beef cattle.....equal to 40,000 meat rations.
80 pigs .....equal to 24,000 meat rations.
240 sheep .....equal to 19,000 meat rations.

(2) A field bakery company can produce between 15,000 and 19,200 bread rations, according to the weather and the time of the year. After passing through the rations supply points of the division units, the supplies finally reach field kitchens and troops. Field kitchens of two types are found: large, with a capacity for supplying 125 to 225 men; and small, with a capacity for supplying 60 to 125 men.

c. DISTRIBUTION OF AMMUNITION. The home ammunition depots forward supplies to the Army Ammunition Dumps (*Armeemunitionslager*) which usually store from 3,000 to 6,000 tons. Any forward army dumps taken over by corps are called Corps Ammunition Dumps (*Korpsmunitionslager*). From these dumps, the ammunition is taken to Division Ammunition Distributing Points (*Divisionsausgabestellen*). One or more well camouflaged distributing points are established, located out of the effective range of Allied artillery and, if possible, on terrain protected from tank attacks. Ordinarily artillery ammunition and infantry ammunition are handled by different distributing points so as to facilitate the loading and unloading of supplies. In some cases Division Ammunition Dumps (*Divisionsmunitionslager*) are set up in the division area, especially if the front lines have been stabilized. From the divisions, ammunition is sent to infantry and artillery ammunition supply points maintained by regiments, battalions, and companies. As German regulations permit the setting up of temporary ammunition dumps at these points, small reserves may be present only a few miles behind the front lines.

Unused ammunition, empty shell cases, packing cases, and faulty ammunition must be returned by the troops to army dumps from where they are sent to the home areas. The rapid return of this material is considered as important as ammunition supply.

d. DISTRIBUTION OF FUELS AND LUBRICANTS. Fuel from home fuel depots or from Field Army mobile reserves is directed to the railheads. Sometimes the fuel is kept loaded in tanker trains (*Eisenbahntankstellen*) near the railhead and transferred from these directly to fuel columns, but preferably it is laid down in 20- and 200-liter containers in Army Fuel Dumps (*Armeebetriebesstofflager*) forward of the railhead. From these dumps the fuel is taken forward to Division Fuel Distributing Points (*Divisionsbetriebsstoffausgabestellen*) or, in the case of some motorized and armored divisions, to Division Fuel Dumps (*Divisionsbetriebsstofflager*). Fuel is forwarded from the division area to lower echelon supply points and to fuel points that are set aside for the use of single vehicles (*Tankstellen für Einzelkraftfahrzeuge*). The latter may also be supplied from the army fuel stores.

e. DISTRIBUTION OF CLOTHING AND INDIVIDUAL EQUIPMENT. Stores are dispatched from the Zone of the Interior to the field rations dumps

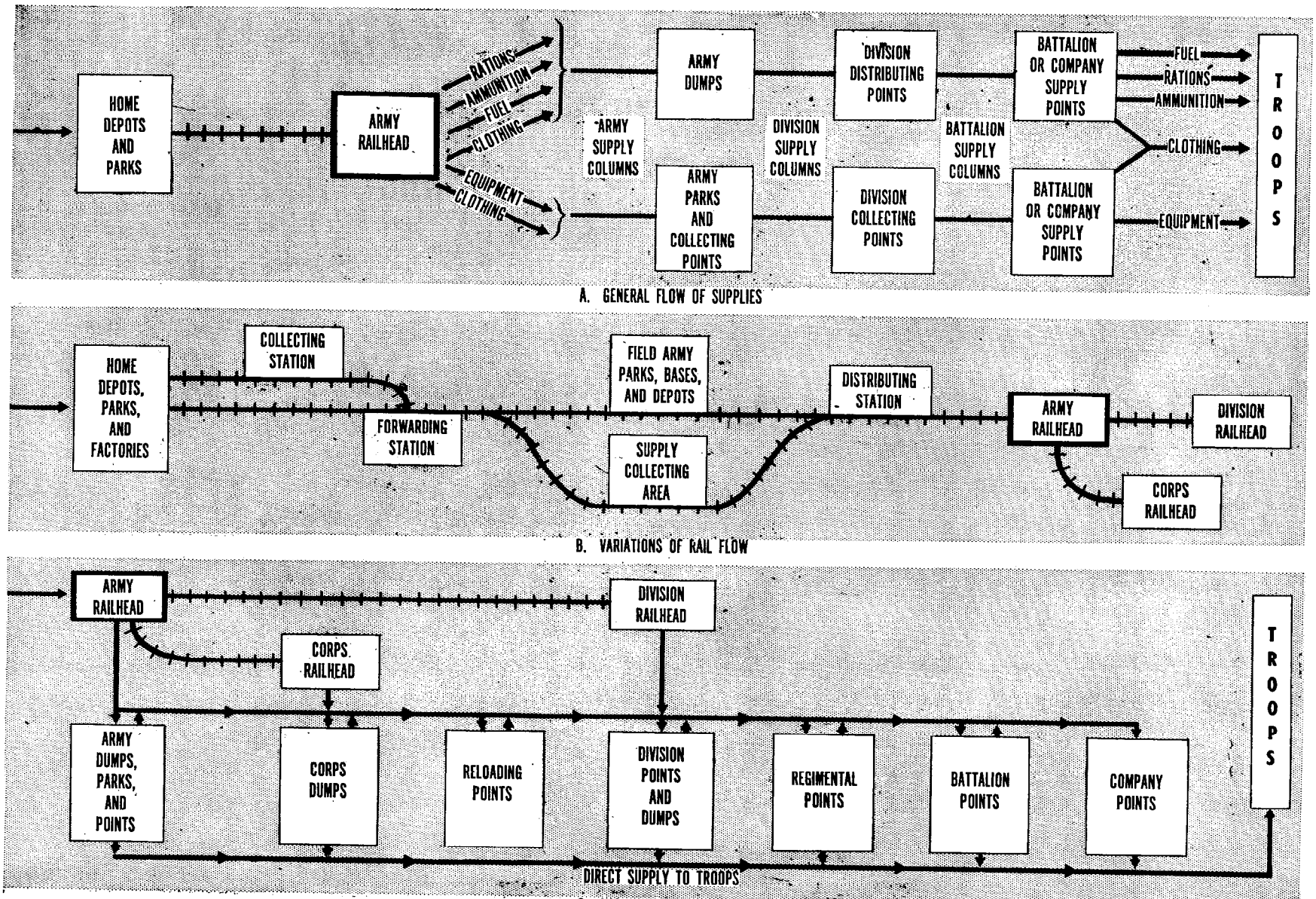


Figure 4.—Flow of supplies.

and to field equipment parks and collecting points, from which the stores are distributed to units.

f. DISTRIBUTION OF EQUIPMENT. (1) Equipment is handled by parks of two different categories: the *Herres,* or Field Army type, and the *Armee,* or army type. Although performing functions analogous to those of the Zone of the Interior Home (*Heimat*) and Corps Area (*Wehrkreis*) Equipment Parks, the field parks have a number of distinct characteristics. They are concerned only with military vehicles. Furthermore, they are dependent upon Zone of the Interior depots, parks, and factories for fifth echelon maintenance. Lastly, the field parks are responsible for the storage of reserve equipment as well as the distribution of new and repaired equipment.

(2) The most numerous *Heeres* type park is the Field Army Motor Transport Park (*Heereskraftfahrpark* or *HeKP*). Unlike the Home Motor Transport Park, the *HeKP* normally does all repairs itself, without farming vehicles out to workshops, with the already existing repair facilities which it customarily takes over. Usually a number of *HeKP* are established in each army group area. Each *HeKP* may hold a reserve of about 200 new vehicles in addition to vehicles arriving from home equipment parks and depots, and damaged vehicles coming from Army Motor Transport Parks (*Armeekraftfahrparke* or *AKP*). In conjunction with army parks, the *HeKP* establish and maintain gasoline stations at certain selected points, usually along important roads. Not ascertained are the functions of reported Motor Transport Repair Parks (*Kraftfahrinstandsetzungsparke*) and Winterization Parks (*Winterlager*) which may be specialized *HeKP* or *HeKP* branches.

(3) Perhaps even more important than the Field Army Motor Transport Parks are the Field Army Tank Parks or Bases (*Stützpunkte*). These presumably are established on the basis of one per army group. Their importance is increased by the fact that armies do not ordinarily maintain fixed installations for the repair of tanks, although armies may have semi-permanent tank workshops. The tank bases are reception or control centers from which tanks are dispatched to workshops in the near vicinity for repairs, or returned to home depots and factories for fifth echelon maintenance.

(4) Also under Field Army control are Spare Parts Depots (*Ersatzteillager*), Tire Depots (*Reifenlager*), Track Depots (*Gleiskettenlager*), Tank Spare Parts Depots (*Panzerersatzteillager*), Armored Car Spare Parts Depots (*Panzerspähwagenersatzteillager*), and Tractor Spare Parts Depots (*Zugkraftwagenersatzteillager*). The Depots furnish supplies to maintenance sections, workshop units, army parks, and Field Army parks.

(5) Army Parks (*Armee parke*) are primarily for repairs but they also are supposed to maintain a reserve of between 5 and 10 per cent of the arms and equipment of the army, and to forward equipment either directly or through collecting points to units. An army has the following parks:

(a) Infantry Park, for infantry weapons and trucks.

(b) Artillery Park, for artillery weapons and trucks.

(c) Anti-gas Equipment Park, for gas masks, decontamination suits, anti-gas clothing, and smoke equipment.

(d) Engineer Stores Park, for engineer materials.

(e) Signal Park, for radio and telephone materials.

(f) Motor Transport Park, for vehicles and spare parts.

(g) Army Equipment Park, for harness, horse carts, cooks equipment, and general items.

(h) Medical Park, for medical equipment.

(i) Veterinary Park, for veterinary equipment.

(j) Horse Park, for riding and draft horses.

(6) When equipment is forwarded from army to division, it passes either directly from the army parks to Division Equipment Collecting Points (*Divisionsgerätesammelstellen*) or through an Army Equipment Collecting Point (*Armeegerätesammelstelle*) to the division. In turn the division directs the equipment to the supply points maintained by its units. Equipment repaired by field maintenance sections and workshop units may be returned directly or through any of the collecting or supply points to the troops; because the procedure is greatly variant, Figure 6 pictures this latter flow as only direct to the troops.

6. Supply Movement

a. RAILROAD SUPPLY TRAINS. (1) *Standard supply trains.* German logistical manuals outline the use of standard rations, ammunition, and fuel supply trains with a maximum net load of 450 metric tons (or approximately 500 short tons),

on a standard gauge (4 feet 8½ inches) railway. The text-book theory has generally been followed out in practice, although in some cases two or more locomotives have been sighted pulling unusually long fuel trains, and in some areas standard rations trains seldom are used. Standard equipment supply trains, with great variations in net loading weights, also are employed. In most cases, however, equipment of all kinds is loaded on the same train.

(2) *Rations supply trains* (*Verpflegungszüge*), with an average of 40 cars per train may be composed as follows:

(a) Iron rations: 300,000 full and 300,000 half iron rations, totalling 442 metric tons.

(b) Full rations with fodder: 180,000 human and 40,000 animal rations, amounting to 454 metric tons. These may be loaded into three parts, each containing 3 days' supplies for 20,000 men and 4,000 animals.

(c) Full human rations with no bread but only baking materials: 300,000 rations, totaling 450 metric tons.

(d) Flour train (*Mehlzug*): 833,000 rations, amounting to 450 metric tons.

(e) Oat train (*Haferzug*): 90,000 rations, totaling 450 metric tons.

(f) Animal trains (*Viehzüge*): 360 cattle weighing 180 metric tons, 1200 pigs weighing 120 metric tons, or 1800 sheep weighing 72 metric tons.

(3) *Ammunition supply trains* (*Munitionszüge*), with an average of 30 cars per train, are of three types:

(a) Unit-loaded trains, loaded according to the proportion of different types of ammunition needed by a particular division.

(b) Caliber unit trains, in which each car is loaded with approximately 15 metric tons (16½ short tons) of ammunition of a specific caliber.

(c) Single caliber unit trains, in which all cars are loaded with ammunition of the same caliber.

(4) *Fuel supply trains* (*Betriebstoffzüge*) of two types are used:

(a) 20 gasoline tank cars, holding between 340 cubic meters (around 89,800 gallons) and 440 cubic meters (around 116,200 gallons) of fuel.

(b) 25 cars, holding gasoline in 200-liter (53-gallon) and 20-liter (5-gallon) cans and carrying 400 cubic meters (105,600 gallons) of gasoline, and five cars with oil, engine oil, gear oil, paraffin, and (in winter) anti-freeze barrels and cans.

(5) *Horse supply trains* (*Pferdersatzzüge*) consist of 55 cars, each holding eight riding or light draft horses per car or 440 horses per train; six heavy draft horses per car or 330 horses per train; or four very heavy horses per car or 220 horses per train.

(6) *Signals and engineer construction materials trains* (*Baustoffzüge*) average 40 cars, of which 39 are open cars, with a net tonnage of about 820 metric tons (900 short tons).

(7) *Tank trains* carrying up to 25 medium tanks or up to 8 heavy tanks have also been reported. The average number of cars per tank train is about 33, with widely varying net loads.

(8) *Mixed equipment trains* are very frequent and may contain from 25 to 60 cars with a total net tonnage of up to 850 metric tons.

b. Road Supply Columns and Trains. There are four types of road supply columns in the German Army:

(1) *Motorized columns* (*Kraftwagenkolonnen*) are, in general, employed on good roads. They can cover up to 125 miles per day. They are organized into very large, large, and small motor transport columns with a capacity of 120 metric tons, 60 tons, and 30 tons respectively for the transportation of supplies other than fuel. In addition, mountain divisions may have a special 10-ton capacity column. Fuel generally is transported in motorized fuel columns of two types —heavy columns with a minimum load of 50 cubic meters of fuel, and light columns with a minimum of 25 cubic meters. Motor transport columns are designated with reference to their employment as Field Army, army, corps, or division motor truck columns.

(2) *Animal-drawn columns* (*Fahrkolonnen*) normally have capacities of 30 or 17 metric tons, and mountain animal-drawn columns 15 metric tons. In general, they are equipped with one-team wagons; in cavalry units two-team wagons are used. According to German training instructions, well cared for and trained horses can cover 12 to 15 miles per day and under favorable conditions up to 20 miles, with a day of rest following. If oxen are employed, the rate of movement is slower. The Germans have been relying more and more upon animal-drawn columns for the movement of their supplies.

(3) *Pack trains* (*Tragtierkolonnen*), generally consisting of 40 mules or horses each, usually are employed in mountainous terrain. A pack train can carry up to 5 tons, but its capacity and speed

are dependent on the trails and grade. Even in level country, pack trains usually march more slowly than foot troops.

(4) *Mountain carrier units* (*Gebirgsträgereinheiten*) consist of mountain carrier battalions and companies whose men are employed in terrain where not even pack animals can be used effectively. Each man can carry between 45 and 75 pounds of materiel on his back.

SUPPLY COLUMNS AND TRAINS

	Capacity (metric tons)	*Capacity (short tons)*
Very Large Motorized Column	120	132
Large Motorized Column	60	66
Small Motorized Column	30	33
Large Animal-Drawn Column	30	33
Small Animal-Drawn Column	17	18½
Mountain Animal-Drawn Column	15	16½
Mountain Motorized Column	10	11
Pack Train	5	5½

	Minimum Amount (cubic meters)	*Minimum Amount (gallons)*
Large Motorized Fuel Column	50	13,200
Small Motorized Fuel Column	25	6,600

c. SUPPLY ROADS. Whenever possible a supply road is designated for each self-contained unit such as a division. In general, the main route of advance of the unit is designated as its supply road. This principal route may be called a *Rollbahn,* or rolling road, to distinguish it from any secondary supply roads. When the main supply route is used for troop movements as well as for supply purposes, it generally will be called a *Durchgangsstrasse,* or through road. Great importance is attached to the upkeep of these routes and the placing of gasoline stations (*Tankstellen*) at strategic points close by the routes.

Section IV. MAINTENANCE REQUIREMENTS

1. Total Requirements

a. VARIABLES INVOLVED. The determination of the over-all requirements necessary to maintain German troops presents a number of difficulties. This is best shown by a review of the German supply expenditures in Russia in 1941. Armored divisions averaged some 30 tons daily when inactive and about 700 tons a day when engaged in heavy fighting; infantry divisions required 80 tons a day when inactive and some 1,100 tons during a day of heavy fighting. When engaged in defensive, mopping-up, or minor offensive activities, the divisions required supplies in amounts somewhere between the two extremes. By far the most important variable in this campaign was the amount of ammunition expended; requirements of fuel and equipment also varied considerably, while rations and clothing consumption remained relatively static. Expenditures depended upon the nature of the action involved, the types of units engaged, the zone of action, the season of the year, the amount of materiel available for consumption, and the facility with which supply movements could be made.

b. ESTIMATES OF TOTAL REQUIREMENTS. When the variables evident in the 1941 Russian campaign have become relatively constant, as is the case at present, the German supply requirements can be estimated with some degree of accuracy. Under present conditions the average total supply requirements per German soldier are estimated to vary as follows:

Character of fighting in area	*Total pounds per man per day*
Inactivity	5-10
Mopping-up	15-20
Defensive fighting (but not against a major Allied push)	20-25
Heavy defensive fighting	25-50
Offensive fighting	25-50

2. Rations

a. HUMAN RATIONS SCALES. The daily ration quantity (*Portionsatz*) is the amount of food consumed by one man for one day. It consists of three meals, the noon meal amounting to one-half of the total, the evening meal to one-third, and the next morning's breakfast to one-sixth. The Armed Forces High Command has laid down an over-all plan specifying the maximum amount of any ration item that may be served. The amount depends upon two factors: the duty class of the man receiving the ration, and the component class of the particular item being served.

There are four main types of rations served to troops. Ration I (*Verpflegungssatz I*) is for troops committed to combat, for those that are recuperating from combat, and for troops stationed in Norway north of 66° N. Lat. Ration II is for occupation and line-of-communication troops. Ration III is for garrison troops within Germany. Ration IV goes to office workers and

REPRESENTATIVE BREAKDOWN OF MAXIMUM RATION ALLOWANCES IN GRAMS PER DAY

Item	*Component Class*	*Duty Class*			
		Ration I	*Ration II*	*Ration III*	*Ration IV*
Rye bread	(a)	700	700	700	600
Fresh meat with bones	(b)	136	107	90	56
Soy bean flour	(b)	7	7	7	7
Headless fish	(b)	30	30	30	30
Fresh vegetables and fruits	(c)	250	250	250	250
Potatoes	(c)	320	320	320	320
Legumes	(c)	80	80	80	80
Pudding powder	(d)	20	20	20	20
Sweetened condensed skim milk	(d)	25	25	25	25
Salt	(e)	15	15	15	15
Other seasonings	(e)	3	3	3	3
Spices	(f)	1	1	1	1
Fats and bread spreads	(g)	60	50	40	35
Coffee	(h)	9	9	9	9
Sugar	(i)	40	35	30	30
Supplementary allowances	(l)	2	2	2	2
Total Maximum Ration in grams		1,698	1,654	1,622	1,483
Total Maximum Ration in lbs.		3.74	3.64	3.57	3.26
Wine (in summer) (quarts)	(j)	.026	.026	.026	.026
Cigarettes (pieces)	(k)	7	6	3	2

nurses within Germany. Hospital cases may fall within any of these classes depending on the seriousness of the cases.

The most important items of the component classes are as follows: (a) bread; (b) meats, soy bean flour, cheese, fish, and eggs; (c) vegetables; (d) puddings and milk; (e) salt, mustard, vinegar, and other seasonings; (f) spices such as pepper, cinnamon, and cloves; (g) butter, lard, marmalades, fats, and bread spreads; (h) coffee and tea; (i) sugar; (j) spirits and wines; (k) tobacco.

Substitute issues may be made within a component class but not among different component classes. Thus the daily maximum allowance of vegetables for a soldier is 60 grams* of dried vegetables, or 1200 grams of kidney beans, or 400 grams of salted vegetables, or equivalent quantities of any of about 30 other substitutes. It is not possible to predict which items will be served on any given day. The following chart, however, sets forth a likely breakdown of these maximum ration allowances.

b. SPECIAL TYPES OF HUMAN RATIONS. (1) *March ration* (*Marschverpflegung*). The march ration is a cold food ration issued for not more than three or four consecutive days to units in transit either on carrier or by foot. It consists of approximately 700 grams of bread, 200 grams of cold meat or cheese, 60 grams of bread spreads, 9 grams of coffee (or 4 grams of tea), 10 grams of sugar, and six cigarettes. Thus it has a total weight of about 980 grams.

(2) *Iron ration* (*Eiserne Portion*). An iron ration consists of 250 grams of biscuits, 200 grams of cold meat, 150 of preserved vegetables, 25 of coffee, and 25 of salt. Total weight is 650 grams without packing and 825 grams with packing. An iron half-ration is composed of 250 grams of biscuits and 200 grams of preserved meat; thus its total weight is 450 grams without packing and 535 grams with packing.

(3) *Combat Package* (*Grosskampfpäcken*) and *Close Combat Package* (*Nahkampfpäcken*). The Germans have begun to use these types of rations for troops engaged in combat. They include chocolate bars, fruit bars, candies, cigarettes, and possibly biscuits.

c. ANIMAL RATIONS. An animal ration is the amount of food consumed by one horse, draft ox, dog, or carrier pigeon for one day. The quantity of an animal ration allowance (*Rationssatz*) depends on the type of animal, the area in which he is serving, and the content of the ration he is being fed. Horses, for instance, are divided into four groups: draft horses of the heaviest breed, draft horses of heavy breed, saddle-horses and light draft horses, and small horses. On the

* In dealing with captured German documents, the American soldier will invariably find the rations allowances computed in grams or kilograms. A gram equals .0353 ounce or .0022 pound. A kilogram (1000 grams) equals 35.3 ounces or 2.2 pounds.

Eastern front, draft horses of the heaviest breed receive a maximum ration allowance of 5650 grams of oats, 5300 grams of hay, and 5750 grams of straw (including 1500 grams of bedding straw). The allotments to other horse groups are proportionately less. On fronts other than the Eastern Front, the allotments for all horses are generally smaller. In addition, substitutes such as preserved forage, barley, corn, etc., may change the ration weight. If the horse is being fed an iron ration, he is given a single item such as oats or hay or straw.

d. RATIONS IN THE FIELD. Local stores obtained by purchase or confiscation play a greater part in the supply of rations in the field (*Feldportionen* for men and *Feldrationen* for animals) than is the case for any other class of supply. It is part of the German planning principle to live off the land as much as possible and to obtain only the remaining requirements from stocks procured through channels. The Germans fully appreciate the difficulty of employing such methods during periods of combat and do not count upon local stores during operative periods. Usually a normal reserve of about 10 days' rations for each man of an army is maintained within the army. The rations consist of full and iron rations, although the latter may be eaten only upon the receipt of special orders.

Rations carried in an army for each man:

	Full rations	*Iron rations*
With the man.....	—	1 (half)
On a combat vehicle	—	1
In the field kitchen..	1	1
In the unit ration train	2	—
In the division train.	1	—
In the army dumps and train	a total of about 3	

Ordinarily there are two full and two iron horse rations carried either on the horse or in unit supply columns. Other rations are carried by the army and the division.

For staff planning purposes, the weights of rations are computed by the Germans as follows:

Type of Rations	*Weight in grams*	*Weight in pounds*
Human rations:		
Standard ration with packing.	1,500	3.3
Iron ration with packing....	825	1.82
Iron half-ration with packing	535	1.18
Horse rations:		
Standard ration	10,000	22.
Iron oat ration.....	5,000	11.
Iron hay ration.....	5,000	11.
Iron straw ration.....	2,500	5.5

3. Fuels and Lubricants

Distribution of fuel is calculated in the consumption unit (*Verbrauchssatz*) which is the amount of fuel that will move each vehicle in a formation 100 kilometers or 62 miles. The allowance of consumption units per formation is systematically replaced as it is expended. Under normal conditions it was standard for German formations to maintain three consumption units at army dumps; in addition, armored formations carried four units, reconnaissance elements carried six and a half units, and all other formations carried five units. Because of present fuel shortages, the allowances of consumption units are now determined by the amount of fuel which the General Staff believes is the minimum necessary for the desired tactical uses.

4. Equipment and Clothing

The replacement of equipment and clothing is based upon the allowances authorized for units and individuals in the table of organization (*Kriegsstärenachweisung*), the table of basic allowances (*Kriegsausrüstungnachweisung*), and the various annexes (*Anlagen*) to these tables. When the materials allotted under the tables are destroyed, damaged, lost, or worn out, they are repaired or replaced as quickly as possible.

5. Ammunition

a. AMMUNITION ALLOWANCES. The initial issue (*erste Ausstattung*) of ammunition is the total ammunition carried by a formation in columns, in dumps, and with the troops. The initial issue is systematically replaced as it is expended, on the basis of reports of ammunition remaining on hand sent from the divisions through corps to army, except as operational conditions modify the system. The allowance per formation is based on the number of weapons called for in the table of organization of the unit. Each weapon, in turn, has a number of rounds which is allotted to it as an ammunition quota or unit of issue (*Munitionsausstattung*). Two units of issue for all weapons of the division are carried within the division, while another unit of issue for all weapons in the army is held on army columns or trains as an army reserve. Thus each army has three ammunition quotas or units of issue for all weapons of the army.

b. AMMUNITION ISSUES. Of the two ammunition units of issue that are found within the division, over one unit is found forward on the

men, with the guns, and as company and battalion reserves, while less than one full unit of issue is retained as a division reserve in division columns and dumps. The exact quantity issued to each man is largely determined by the amount held by the battalion and company as their reserves. The following charts exemplify the units of issue found in infantry and artillery units of an army.

Ammunition Issues (Rounds) for a Volks Grenadier Division:

*Weapon**	*Forward Issue*	*Division Reserve*	*Probable Army Reserve (Unit of Issue)*
9-mm automatic pistol...	18	16	17
9-mm machine pistol....	690	512	601
7.92-mm machine pistol..	720	540	630
7.92-mm rifle	99	75	87
7.92-mm rifle (for troops other than infantry troops)	25	20	22
7.92-mm semi-auto rifle.	159	135	147
Rifle grenade launcher...	75	70	70
7.92-mm LMG	3450	2505	2977
7.92-mm LMG (for arty and AT troops).....	1350	1020	1185
7.92-mm HvMG	6300	4750	5525
88-mm bazooka	5	5	5
81-mm mortar	150	126	138
120-mm mortar	150	90	120
37-mm AA	1200	none**	?**
75-mm inf how	192	151	171
75-mm AT (mtz).....	150	100	125
75-mm AT (SP).....	255	—	—
105-mm gun how.....	225	126	175
150-mm how	150	60	105

* Not included are 75-mm gun and flame thrower.

** AA ammunition reserves are usually kept by army and not by division.

Units of Issue for Artillery Units:

Weapon	*Number of Rounds*
37-mm AA	1,500
75-mm AA	300
88-mm AA	300
105-mm gun	125
150-mm how.	125
150-mm gun	75
210-mm how.	50

c. AMMUNITION EXPENDITURE. The unit of issue of ammunition is not to be confused with the daily expenditure amount of ammunition. The latter does not arrive at any constant figure, but varies with the type of action, the area of fighting, and the other factors mentioned in paragraph 1. By analogy with the reserve amounts of other expendable supplies, however, it is possible that three units of fire are judged by the Germans to be sufficient to maintain an army for a period of roughly eight to ten days.

Section V. EVACUATION

1. Maintenance and Repair of Equipment

a. GENERAL. Perhaps the fundamental German principle of repair and maintenance is that equipment should be repaired as far forward as possible.

Practically all the installations that deal with repair and maintenance of equipment also participate in the flow of supplies, both in transferring repaired equipment back to units and in moving newly manufactured equipment to units (see Sections II and III). In the following paragraphs, therefore, they will be treated solely from the point of view of rearward flow.

b. MOTOR TRANSPORT. Maintenance of an individual vehicle is the responsibility of the driver and the crew, but for repairs it is sent to one of a number of repair centers. While the procedure that determines which center shall undertake the repair has changed from time to time, it probably is determined by two factors: the number of working hours; and the facilities needed to effect the repair. Thus maintenance (*Instandsetzungs*) detachments and sections probably carry out repairs requiring less than four working hours with the tools at their disposal, while mobile field workshop (*Werkstatt*) units carry out repairs requiring less than 12 working hours. If the damage inflicted is too extensive for the facilities of the mobile workshops, the vehicle is sent to an Army Motor Transport Park (*AKP*) or to a Field Army Motor Transport Park (*HeKP*). The difference of functions between these two types of installations is not clear; it is likely, however, that the more difficult repair jobs are sent to the *HeKP*, while the *AKP* handle repairs that can be completed in less than 24 working hours. The disposition of the vehicle from these centers may be as follows: it may be repaired or scrapped; it may be forwarded to a Home Motor Transport Park (*HKP*), which is capable of carrying out all types of repairs; or, in the case of an *AKP*, the vehicle may be forwarded to a *HeKP*.

While the exact position of collecting points in the rearward movement of damaged vehicles is not certain, it is very likely that whenever possible

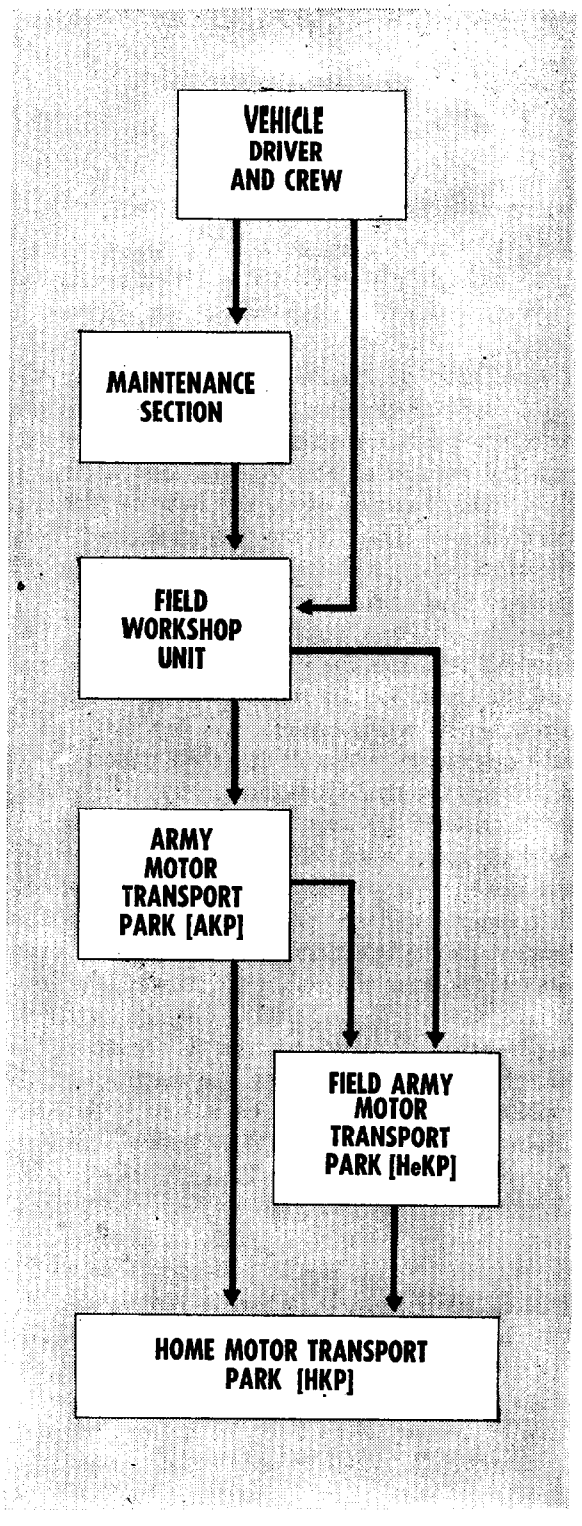


Figure 5.—Motor vehicle repair and maintenance.

vehicles move directly to repair and maintenance centers under their own power without passing through collecting points.

c. Tanks, Armored Vehicles, and Self-Propelled Weapons. Minor repairs to armored vehicles (including tanks, self-propelled weapons, and other armored vehicles) are made by unit mechanics and by mobile tank-workshop units. If the repairs cannot be completed in the division area within three days, the vehicles may be sent to semi-permanent army tank workshops or to Field Army Tank Parks or Bases. When armored vehicles are so badly damaged that they cannot be repaired in the field, they are cannibalized or forwarded to tank equipment depots or factories in the home area. In the latter case the vehicles are no longer under Field Army control and are not returned to the units to which they were originally assigned.

Armored vehicles are repaired on the spot if possible. Otherwise they are moved rearward under their own power. Tank transporters are used only when long movements are contemplated or when vehicles cannot move under their own power.

d. Other Equipment and Clothing. All types of equipment including weapons, signal equipment, bicycles, and clothing are repaired within the division area if possible. If the equipment (other than clothing and individual equipment) requires more specialized attention, it is forwarded either directly or through equipment collecting points or workshop units to one of the army parks. Equipment which cannot be repaired in the field is directed to a home equipment park, depot, or factory. Damaged clothing and individual equipment generally pass from collecting points direct to home clothing depots and dumps. Figure 6, which is largely compiled from German schematics, should be examined for other details of the German repair methods.

2. Evacuation of Installations

With the narrowing of the Zone of the Interior, the Germans have been faced with the problem of what to do with depots that were formerly part of the Zone of the Interior system of supply. Variant courses adopted have been the conversion of the installation into a field installation, the evacuation of the depot to the new Zone of the Interior, and the operation of the depot as though it were still within the Zone of the Interior.

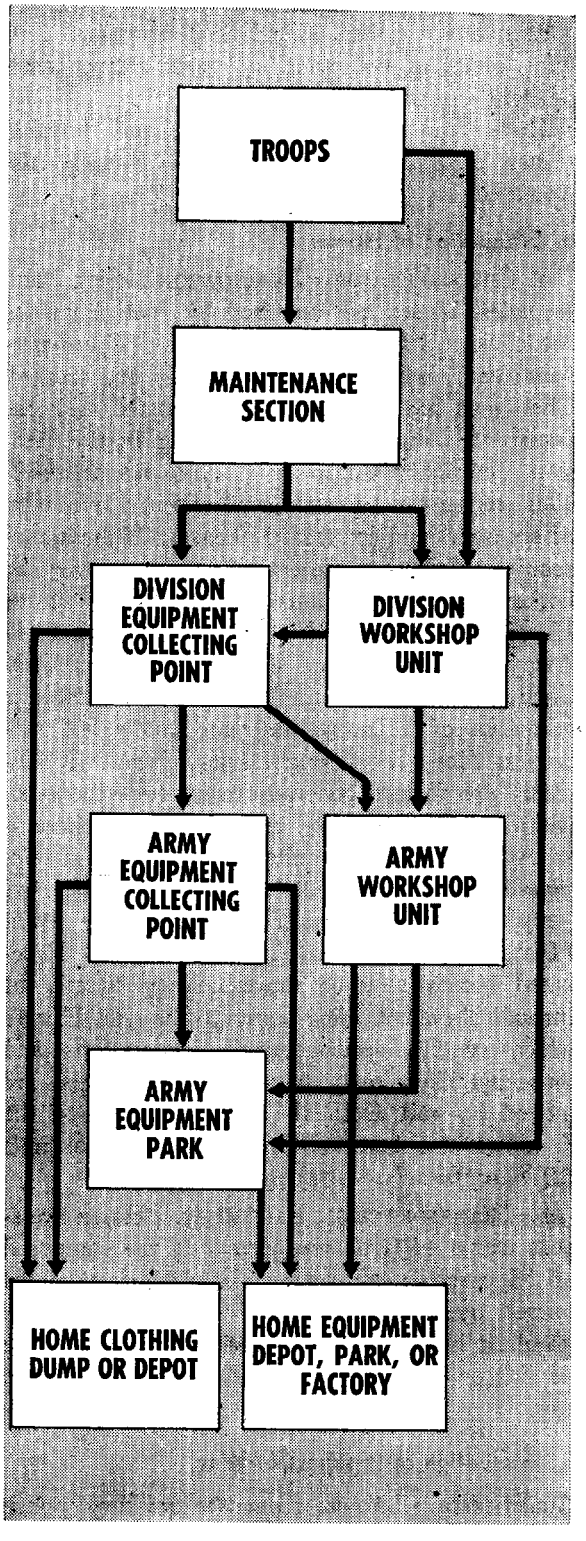


Figure 6.—Repair of equipment and clothing.

3. Evacuation of Wounded

a. General. The German system for the evacuation of casualties is based upon an immediate sorting of the wounded so that soldiers who are not seriously injured can be returned to their units as quickly as possible, and those who are severely wounded can receive medical care with maximum speed. Under combat conditions the accomplishment of these ends in many cases will cause deviations from the normal system. A good example of this was shown in the early part of the Russian campaign when the great distances between the combat zone and the Zone of the Interior forced the Germans to use a chain of Casualty Collecting Points to control and expedite the rearward movement of sick and wounded.

Now that the combat zone has moved into Germany proper, deviations of an integrating nature should be anticipated.

b. Channels of Evacuation. (1) Casualties unable to walk are carried from the battlefield by battalion stretcher bearers, while those still capable of walking are directed to the Battalion Aid Station (*Verwundetennest*) which is located as close to the front line as is practicable. The Battalion Aid Station gives first aid in emergency cases. As quickly as movements can be made, it passes the wounded to the Regimental Aid Station (*Truppenverbandplatz*), which is generally some 200 to 500 yards to the rear of the front line. At this station the wounded receive first aid and are sorted into ambulatory cases and stretcher cases. Stretcher cases are carried by litter to an Ambulance Loading Post (*Wagenhalteplatz*) for rearward movement, while ambulatory cases are instructed to make their way rearward on foot.

(2) Usually the stretcher cases are sent to a Main Dressing Station (*Hauptverbandplatz*), whereas the walking wounded move to a Collecting Point for the Slightly Wounded (*Leichtverwundetensammelplatz*). The latter two installations, both controlled by the regimental medical officer, sometimes operate as a combined unit, and in practically all cases are located reasonably close to each other. Their functions are as follows:

The Main Dressing Station attends the serious cases. It contains a surgical unit which performs amputations, applies dressings and splints, checks hemorrhages, gives blood transfusions, and administers sedatives and preventative injections. After treatment the casualties are evacuated further rearward.

The Collecting Point for the Slightly Wounded administers to casualties whose treatment requires only a few days. When the treatment is completed, the men are returned to combat. If, however, a case has taken a more serious turn, the wounded soldier is evacuated rearward.

(3) From the regimental area casualties may be taken to any of the various types of hospitals (*Lazarette*) found in the field or at home. Casualty Collecting Points (*Krankensammelstellen*) usually are set up along the line of evacuation to facilitate the grouping of casualties and their distribution to the rear. These points are generally established at railheads and other traffic centers by ambulance units. They do not handle casualties whose condition will not permit movement. Mobile Field Hospitals (*Feldlazarette*) serve as way stations for casualties who cannot be moved through the Casualty Collecting Points. They may be operated either by an army or by a division. Wherever possible, the Field Hospital is set up in available permanent buildings. It is equipped to handle any casualty and has a capacity of 200 beds.

(4) Casualties who are physically able to be evacuated after treatment at the Main Dressing Station or the Field Hospital are moved either directly, or via the Casualty Collecting Points, to a Base Hospital (*Kriegslazarett*) or sometimes to a General Hospital (*Reservelazarett*).

Base Hospitals are large and relatively permanent installations which may be established by an army or the Field Army well to the rear of the combat zone. These hospitals are of two types: General Base Hospitals (*Kriegslazarette*), with normal accommodations for 500 cases, for casualties who require up to eight weeks' treatment before being discharged and for those who require a period of convalescence before moved to Reserve Hospitals; and Base Hospitals for Minor Cases (*Leichtkrankenkriegslazarette*), with accommodations for 1,000 patients, for casualties who need up to four weeks' of treatment or convalescence prior to discharge.

General Hospitals are permanent installations located inside Germany and are supervised by the Chief of Army Equipment; they are dealt with at length in Chapter I.

(5) A man may be pronounced fit for duty by any hospital. If he is in a forward hospital, he will be returned to his unit. If he is in a General Hospital for more than eight weeks, he will be returned to the Replacement Army for reassignment.

c. Transportation Facilities. Hospital trains (*Lazarettzüge*) can carry between 358 and 386 lying cases or 920 sitting cases.

Standard German ambulances transport four lying cases, or two lying and four sitting cases, or eight sitting cases.

Horse-drawn vehicles, trucks, and hospital planes also may be used in evacuating the wounded.

4. Evacuation of Horses

a. Channels of Evacuation. Sick and wounded horses are marched by foot from the battlefield to a Horse Dressing Station (*Pferdeverbandplatz*), where emergency cases are treated. They then are marched or transported in horse transport columns to a station set up by the Division Veterinary Company (*Veterinärkompanie*). This station can be established within a minimum of six hours and can treat 150 cases. If the horses require further treatment, they are moved by horse transport columns to the Army Horse Hospital (*Armeepferdelazarett*) or to the Field Army Horse Hospital (*Heerespferdelazarett*). Such field hospitals can be established within a minimum of 12 hours and can handle 500 sick horses. Horse Collecting Points (*Pferdesammelplätz*) are formed generally to expedite the evacuation of horses to the rear. Normally there is an Army Horse Collecting Point (*Armeepferdesammelplatz*), intermediate between division and army, and a Division Horse Collecting Point (*Divisionspferdesammelplatz*) at division. Evacuated horses may be moved either directly or through these collecting points to the rear. Horses which require special surgical operations and those not likely to be fit again for army use are moved by rail from the field hospitals to the Zone of the Interior Home Horse Hospitals (*Heimatpferdelazarette*).

b. Transportation Facilities. Horse transport trains (*Pferdetransportzüge*) are composed of 55 cars, each carrying six sick or wounded horses, or a total of 350 horses per train. The standard horse transport road column can move 40 sick or wounded horses about 90 miles in one day.

5. Evacuation of Prisoners of War

Guard details drawn from the military police or from the combat unit itself take prisoners to the Division Prisoner of War Collecting Point (*Divisionsgefangenensammelstelle*). The Prisoners of War are next moved to the Army Pris-

oner of War Collecting Point (*Armeegefangenensammelstelle*), the guard details being drawn from military police, combat troops, or guard units. The Prisoners of War are lastly transferred from the jurisdiction of the Field Army to the Replacement Army Command. This is accomplished when the Prisoners of War are moved by rail to one of the Prisoner of War Camps within Germany. Officers are incarcerated in Officer Prisoner of War Camps (*Offizierlager* or *Oflag*); enlisted men are confined in Enlisted Men's Prisoner of War Camps (*Mannschafts-Stammlager* or *Stalag*).

Section VI. TROOP MOVEMENTS

1. Introduction

In movements of entire bodies of troops with their equipment, the space occupied, rather than the total weight, is the important factor. A very large proportion of the space is taken up by personnel, horses, and organic equipment; daily maintenance requirements that accompany the troops occupy much less space.

2. Rail Transportation

a. Main Military Routes. German railways generally are used jointly for military and civilian traffic, although military trains are given priority. Perhaps the only instances of railways designated solely for military uses are found in the combat zone, either on already existent railways or on railways constructed by the Army.

Normally double-track standard-gauge (4′ 8½″) railways have a daily capacity of 30 military trains in each direction, while single-track standard-gauge railways can move 10 trains a day in each direction. Air damage can materially decrease these capacity figures.

b. Standard Troop Trains. The Germans have found it desirable to use troop trains of a reasonably constant composition. The standard trains found in the Balkans, Italy, and Norway are composed of fewer cars than the base types in Germany, Denmark, and the Netherlands which are described below. All types are designed as far as possible to carry a self-contained unit such as a company or a battalion. Nonstandard trains also may be used for troop movements.

K-trains (*Kraftfahrzüge* or motor vehicle trains) average 51 cars per train and carry approximately 250 soldiers, 20 heavy vehicles (weighing up to 22 short tons per vehicle), and 20 light vehicles, plus other equipment. If lighter equipment is carried, the number of soldiers can be increased.

S-trains (*Sonderzüge*, or special trains) are made up for the movement of very heavy tanks and self-propelled guns. The number of men carried per train averages 125; the number of cars forming the train is between 30 and 35. An S-train usually carries from four to six Tiger tanks or from six to eight Panther tanks, interspersed with lighter equipment.

Sp-trains (*Sonderpanzerzüge*, or special tank trains) carry approximately 20 medium tanks together with personnel and other equipment. The standard Sp-train is composed of about 33 cars.

I-trains (*Infanteriezüge* or infantry trains) of about 55 cars per train hold some 350 officers and men, 10 light vehicles, 10 heavy vehicles of a maximum weight of 22 short tons per vehicle, and 70 horses, together with other equipment. If a minimum of equipment is carried, up to 800 troops can be moved. It is possible that the I-trains seldom are used by the Germans at present.

Replacement troop trains with 50 to 60 cars per train can hold over 2,000 replacements. The use of this type of train probably has been discontinued.

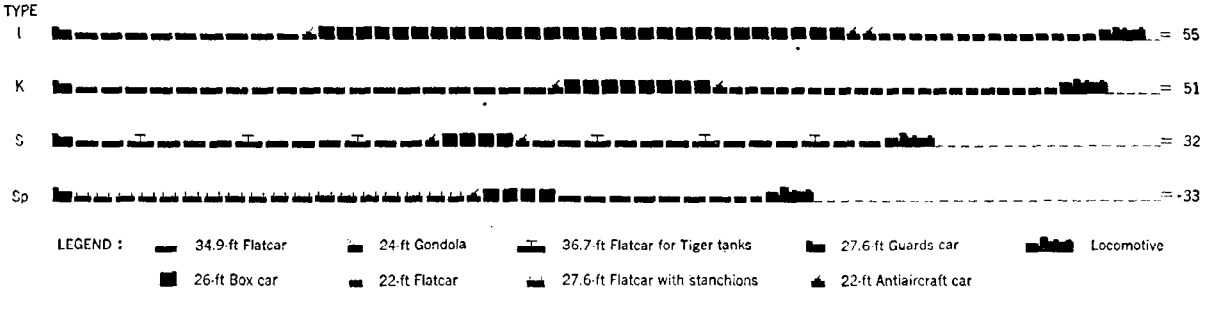


Figure 7.—German basic standard troop-train types.

c. ENTRAINMENT AND DETRAINMENT. Troop trains generally are formed at railroad stations. The speed with which entraining can be accomplished varies according to the number of units being loaded, the number of stations used, the facilities available at the stations, and the importance attached to speedy loading. Depending on these conditions, loading of a single train can be accomplished within 2 to 12 hours. If all the unit trains can be loaded simultaneously at the entraining stations, an entire division can be loaded within that time. In practice, however, the time taken to assemble trains and troops and the limited number of entraining stations will materially increase the loading time of divisions.

It is estimated that a troop train can be unloaded in about half the time taken to load. Detrainment of infantry units may occur far forward, while armored units usually are detrained in rear areas.

d. SPEED OF MOVEMENTS. The average German movement appears to average from 150 to 200 miles per day for long movements within Germany, and about 60 miles daily in areas near the combat zone.

e. TRAIN REQUIREMENTS. At present the number of trains required to transport an infantry division is about 35 to 40. An armored division needs about twice that number. If a large number of divisions are being moved, additional trains will be necessary for corps and army units.

3. Road Transportation

a. MAIN MILITARY ROUTES. Certain roads have been selected by the High Command to form a system of through routes (*Durchgangstrassen*) for military traffic in Germany and occupied areas. For the most part the through routes comprise the national highways and *Autobahnen*. In Denmark, however, the through routes more frequently consist of secondary roads than main arteries. Through routes generally run either east and west or north and south. When supply or troop movements are to be made over these roads, all civilian traffic is diverted to other roads.

b. MARCH SPEEDS. (1) The average speeds of division marches in miles per hour are as follows:

	By day	*By Night*
Infantry division	3	3
Motorized division	16	10
Armored division	12	7

(2) The average speeds of march columns in miles per hour are as follows:

Infantry (long marches)	3
Infantry (short marches)	4
Mounted troops	6
Cyclists	8
Motorcycles and cars	22
Trucks	22
Trucks with trailers	16
Half-track vehicles	16
Tanks	12

c. MARCH DISTANCES. The infantry division normally can march about 20 miles in a day; under adverse weather or road conditions the rate of march may fall to 10 miles a day. The motorized division can maintain an average daily march of between 90 and 150 miles; the armored division from 60 to 90 miles a day. In the near vicinity of the combat zone, road movements without motor transport average 10 to 15 miles a day, while movements by motor transport approximate 30 miles a day.

d. ROAD SPACES. While the road spaces occupied by divisions on the march are not constant, the road spaces of individual units may prove of some value. The following examples are from German sources and do not indicate the intervals maintained between elements:

INFANTRY DIVISION

(at 5 kilometers or approximately 3 miles per hour.)

	Yards	*Meters*
Inf Regt (each of three)	6,234	5,700
Ren Bn	3,116	2,850
AT Bn	2,734	2,500
Arty Regt	7,382	6,750
Sig Bn	3,193	2,920
Engr Bn	2,570	2,350
Div Serv	4,155	3,800
Div Hq	1,553	1,420
Total Inf Div (approx.; without intervals between elements)	43,405	39,690
Total converted to miles	24.7	

ARMORED DIVISION

(at 20 kilometers or approximately 12 miles per hour.)

	Yards	*Meters*
Tank Regt	21,325	19,500
Pz Gren Regt (each of two)	13,145	12,020
Pz Rcn Bn	9,154	8,370
AT Bn	3,838	3,510
Pz Arty Regt	14,458	13,220
Pz Sig Bn	3,762	3,440
Pz Engr Bn	6,365	5,820
Div Serv	11,702	10,700
Div Hq	1,444	1,320
Others	5,468	5,000
Total Armd Div (approx.; without intervals between elements)	103,806	94,920
Total converted to miles	59.0	

If distances between the individual units are included, the average length of the infantry division would be about 30 miles (at 3 miles per hour), of the armored division 70 miles (at 12 miles per hour), and of the motorized division 80 miles (at 16 miles per hour).

4. Sea Transportation

a. General. In the sea movements referred to in the following text, the basic shipping measurement is the gross registered ton (G/T), which is 100 cubic feet of the entire enclosed space of a ship.

The Germans use all types of cargo and passenger vessels for the transportation of troops. Generally the depth of water of the embarkation and debarkation ports determines the size of ship to be used. Thus many of the Baltic ports are limited to cargo ships up to 2,000 G/T. Cargo between Norway and Germany, on the other hand, ordinarily can be carried on much larger vessels.

The average speed of a ship is estimated at 200 nautical miles per day, although fast ships may average much more.

b. Loading and Unloading Times. The time required for the loading of a vessel varies with a number of factors, such as the size of the vessel, the plan of the vessel, the port facilities, and the efficiency with which loading is conducted. The following average loading times are based upon German estimates. They apply for loading during day and night; considerable delays, however, may occur on account of adverse weather conditions.

Classification	*Loading Time*
100 men	8 minutes.
100 horses (led over a ramp)	1 hour.
100 horses (lifted by cranes)	6 hours.
100 light motor vehicles (lifted by cranes)	6 hours.
Supplies sufficient to load a 2,000 G/T vessel	16 hours.

c. Tonnage Requirements. Among other factors, the amount of tonnage required to transport troops depends upon the type of unit being transported, the efficiency of loading, the types of ships used, and the amount of nonmilitary stowage transported. Hence the following figures give only a general indication of the amount of space which is occupied by items when efficiently loaded.

Classification	*Estimated G/T requirement*
1 man	2
1 horse	8
1 light motor vehicle	10
1 truck	20
1 heavy field gun	20
1 medium tank	25

It is likely that an infantry division requires between 50,000 and 70,000 gross registered tons for its movement, or a mean average of five or six gross registered tons per man. If loading is inefficient or if light loading is used, the G/T requirements per man will rise considerably. Thus in short movements such as ferry crossing, as much as 15 gross registered tons per man and equipment have been employed.

CHAPTER VII

WEAPONS

Section I. INTRODUCTION

1. General

Before and during the first years of the present war it was the policy of the German army to use the smallest variety of weapons consistent with meeting operational requirements, while emphasis was maintained on developing weapons with a high degree of fighting efficiency. Recent developments in warfare, however, particularly in the last year, gradually have forced the Germans to adopt the opposite policy of experimentation with many innovations in weapon design.

2. Recent Trends

Within the last 12 months distinct trends in the development of German weapons have become apparent.

a. TANKS AND TANK DESTROYERS. First, there has been a tendency for tanks and tank destroyers to become armed and armored more heavily at the expense to some extent of mobility and maneuverability. This is compensated for by the ability to open effective fire at very long ranges.

b. INFANTRY ANTITANK WEAPONS. Second, there has been a striking increase in the ability of the German infantry to combat Allied tanks. This has been accomplished by the development and constant improvement of close-range grenade and rocket launchers employing the hollow-charge principle.

c. ROCKET WEAPONS. Third, German experiments which began before the war have materialized into a comparatively wide range of rocket weapons used to supplement orthodox artillery. These experiments with rockets are being continued, and improvements in range and accuracy may be expected. In the event of the outbreak of chemical warfare, rocket weapons will assume a greater significance than at present. The German recoilless gun (originally developed as an airborne gun) comes close to combining the lightness and mobility of the rocket weapon with the range and accuracy of the standard type of howitzer.

d. ARTILLERY. There have been some belated attempts on the part of the Germans at improvements in their standard artillery, but no basic redesign appears contemplated at present.

Section II. SMALL ARMS

1. General

The general trends in German small arms have been an increase in production of semiautomatic and fully automatic weapons and an increase in the rate of fire of machine guns. During 1944, additional close-quarter antitank weapons have been included among German small arms.

2. Pistols

a. GENERAL. The two standard pistols now in use in the German Army are the Luger, which was used in the last war, and a more modern weapon, the Walther; neither German weapon has the shock effect of the U. S. M1911 or M1911 A1 Colt .45. The Mauser pistol is seldom encountered.

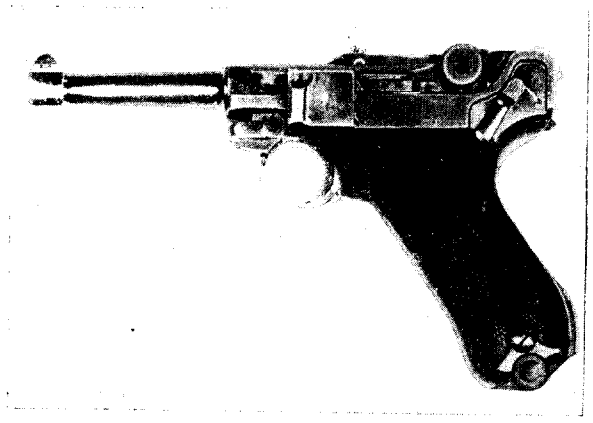


Figure 1.—Luger Pistole 08, caliber 9 mm.

b. LUGER PISTOL (*Pistole 08*). (1) *General description.* This is a semiautomatic, recoil-operated pistol with a toggle-joint breech action (*Fig.*

1). The safety is located on the left rear side of the body. The pistol is set on "safe" when "*Gesichert*" is showing. There is also a longer model of this pistol, provision being made on the rear side of the grip for a stock attachment. Construction is almost identical with the standard model except that the barrel is longer, and a leaf rear sight graduated up to 800 meters is attached.

(2) *Characteristics.*

Caliber .....9 mm (actually 0.347 inch).
Length of barrel.....4¼ inches.
Weight.....2 pounds.
Feed.....8-round grip magazine.

(3) *Ammunition.* The Luger pistol fires the standard German 9-mm Parabellum ammunition.

Figure 2.—Walther Pistole 38, caliber 9 mm.

c. WALTHER PISTOL (*Pistole 38*). (1) *General description.* The Walther weapon is a semiautomatic pistol with a grip magazine feed. It is recoil-operated, the breech mechanism sliding to the rear after each round has been fired. The pistol may be carried loaded with the hammer uncocked; the first shot may be fired by a double-action mechanism. The safety is a catch on the left-hand side of the body.

(2) *Characteristics.*

Caliber.....9 mm (actually 0.347 inch).
Length of barrel.....4¾ inches.
Weight, loaded.....2 pounds 5 ounces.
Feed.....8-round grip magazine.

(3) *Ammunition.* German or British 9-mm Parabellum ammunition may be used in this weapon.

d. MAUSER PISTOL. (1) *General description.* The Mauser can be used as a semiautomatic pistol or as a carbine when attached to its wooden holster, which is in the shape of a hollow stock. The safety is at the left rear above the trigger guard. The weapon is fed ammunition from a 10-round fixed magazine inserted forward of the trigger guard. Twenty-round magazines are used when the weapon is employed as a carbine.

(2) *Characteristics.*

Caliber.....9 mm (actually 0.347 inch).
Length without stock.....12 inches.
Length with stock.....25½ inches.
Weight without stock..2 pounds 8 ounces.
Feed.....10- or 20-round magazine.

(3) *Ammunition.* Standard 9-mm ammunition is used.

3. Signal Pistols

a. LIGHT SIGNAL PISTOL (*Leuchtpistole*). This is the standard German signal pistol; it is 26.7-mm caliber, has a smooth bore, and fires a series of colored signal cartridges, as well as a whistling cartridge (*Pfeifpatrone*) used as a gas warning signal.

Figure 3.—Kampfpistole (grenade and signal pistol).

b. MODIFIED SIGNAL PISTOL (*Kampfpistole*). The Germans have modified the *Leuchtpistole* by rifling the bore and providing a small sight to produce the *Kampfpistole* (*Fig. 3*). With these alterations a small, nose-fused HE grenade, a smoke grenade, and an orange smoke grenade are fired in addition to the standard signal cartridges. The pistol has a maximum range of about 100 yards, firing a 5-ounce HE round.

c. DOUBLE-BARRELED SIGNAL PISTOL. This pistol is similar to the standard *Leuchtpistole* but has a double barrel and trigger mechanism. At the rear of the hammer action, and above the pistol grip, is a change lever of the type used on double-

barreled shotguns. This may be set so either one or both of the barrels will fire when the trigger is squeezed. The standard signal cartridges are fired.

Figure 4.—Sturmpistole (modified light signal pistol).

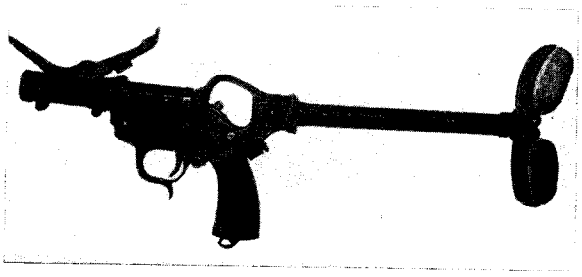


Figure 5.—Sturmpistole (modified light signal pistol).

d. GRENADE AND SIGNAL PISTOL (*Sturmpistole*). This weapon consists basically of the standard *Leuchtpistole* to which a loose steel liner is fitted (*Figs. 4* and *5*). This liner is rifled and fitted with a base, which prevents firing a standard round through the liner. A combined front and rear sight is clamped around the barrel, and a folding stock is attached above the pistol grip. The liner and the folding stock enable this pistol to fire a hollow-charge grenade as a close-quarter weapon against tanks (*Fig. 5*). With the steel liner removed this pistol will fire the standard signal cartridges fired from the *Leuchtpistole*.

4. Machine Pistols

a. M.P. (MASCHINENPISTOLE) 40. (1) *General description.* This blowback-operated machine pistol (*Fig. 6*) was developed from the *M.P. 38*, an earlier model designed for issue to parachute troops and still used. Distinctive features of both weapons are the folding stock and all metal and plastic construction. The safety recess at the rear of the cocking-handle stop is marked "S". To set the weapon on "safe", the operating handle is pulled back as far as it will go and then pushed upward into the safety notch. On later models, a safety stud is located on the cocking handle. The magazine is inserted in a vertical position on the underside of the receiver. The weapon has a 100-meter (109 yards) fixed rear sight and a 200-meter (219 yards) folding rear sight.

(2) *Characteristics.*

Caliber.....9 mm (actually 0.347 inch).
Length, over-all.....33½ inches.
Weight without magazine.....9 pounds.
Feed.....32-round magazine.
Rate of fire
(cyclic).....500 rounds per minute.
(practical).....180 rounds per minute.

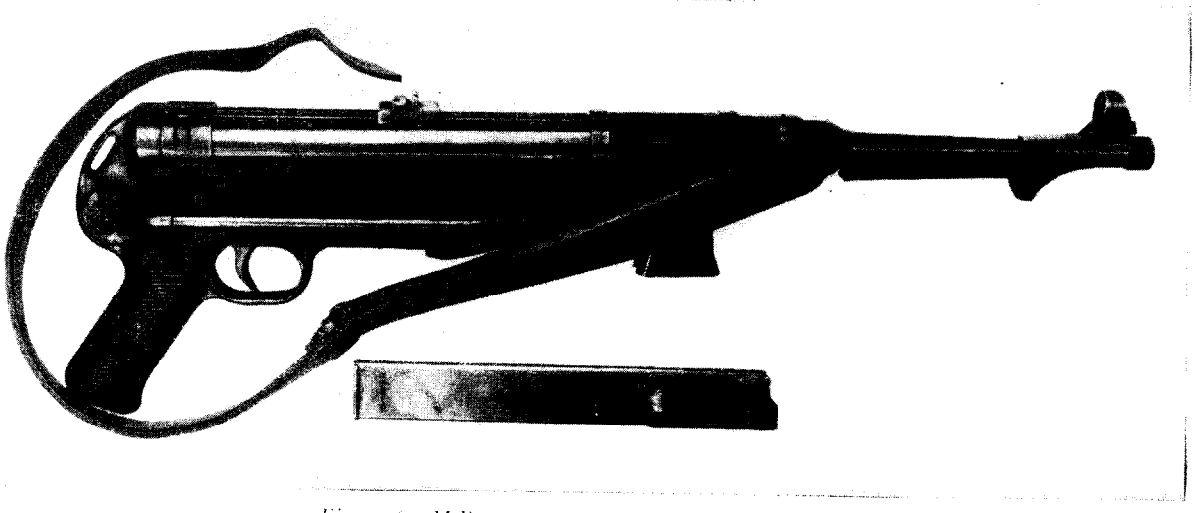


Figure 6.—M.P. 40, caliber 9 mm, showing magazine.

Figure 7.—M.P. 43/1, caliber 7.92 mm, showing magazine in place for firing.

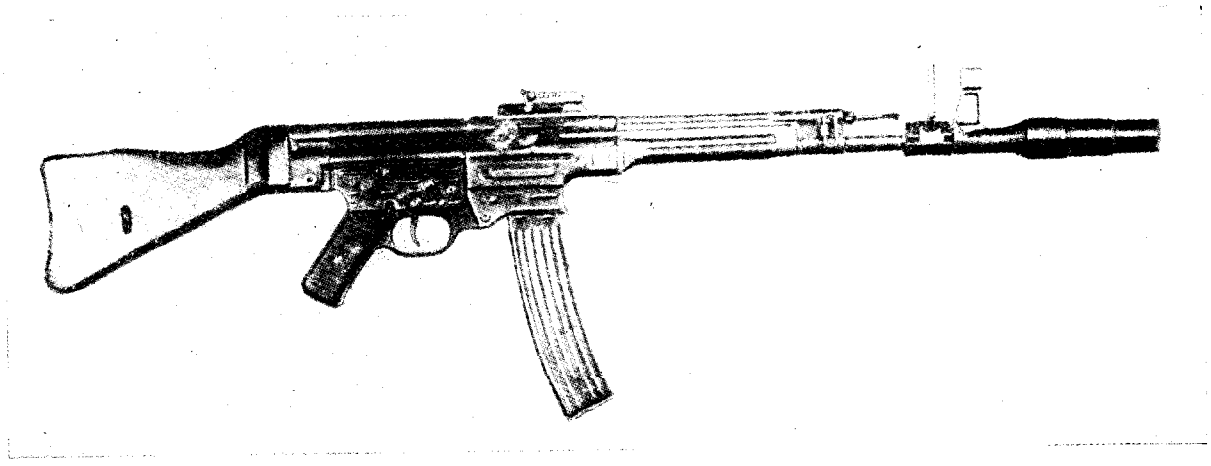


Figure 8.—M.P. 44, (modified M.P. 43), caliber 7.92 mm, with grenade launcher attached.

(3) *Ammunition.* This weapon uses the standard 9-mm Parabellum ammunition.

b. MODEL 43/1 MACHINE PISTOL (*M.P. (Maschinenpistole) 43/1*). (1) *General description.* This gas-operated machine pistol (*Fig. 7*) is constructed almost entirely of metal stampings and can be stripped only to a limited degree. Although provision is made for both single-shot and automatic fire, bursts of more than five rounds are not recommended, and the pistol is best used as a single-shot weapon. This weapon has not proved very successful because it is impossible to repair in the field and because of its poor firing characteristics. The stampings forming the gas cylinder and body casings are made of thin material and are very easily damaged. The weapon is fed by a curved magazine below the receiver and has an 800-meter (876 yards) leaf rear sight.

(2) *Characteristics.*

Caliber . . . . . 7.92 mm (0.312 inch).
Length. . . . . 37 inches.
Weight. . . . . 11 pounds.
Feed. . . . . 35- to 38-round magazine.
Muzzle velocity. . . . 2,200 feet per second.

(3) *Ammunition.* A special type of short rifle caliber ammunition is used in this machine pistol.

c. M.P. (MASCHINENPISTOLE) 44. This weapon is the *M.P. 43/1* slightly modified to accommodate the standard rifle grenade launcher cup (*Schiessbecher*). The barrel is machined down at the muzzle end and the front sight block is smaller and located farther forward to allow the launcher cup to be attached. Although it is presumed that the standard rifle grenades can be fired from the *M.P. 44*, it is not certain that this has yet become an operational practice.

5. Rifles and Automatic Rifles

a. MODEL 98 RIFLE AND CARBINE (*Gewehr 98* and *Karabiner 98*). (1) *General description.* The standard German rifles and carbines are all of the same basic bolt-operated Mauser design (*Figs. 9* and *10*), but may be divided into three distinct types. These are the rifle Model 98 (*Gewehr 98*) which is 49½ inches long and has the sling fitted underneath; the long barrel carbine Model 98 b (*Karabiner 98 b*) which is approximately the same length as the rifle; and the short carbine Model 98 k (*Karabiner 98 k*) which is 43½ inches long. Each weapon has a safety catch at the rear of the bolt similar to the safety on the U. S. rifle M1903 and a blade front sight and V rear sight graduated from 100 to 2,000 meters (109 to 2,190 yards). The *Gewehr 98* fires rifle grenades from a grenade launcher cup or from a spigot launcher.

(2) *Characteristics.*

Caliber.....7.92 mm (0.312 inch).
Weight (each type) .....9 pounds (approximately).
Feed. .....5-round clip.
Effective range.....800 yards.

(3) *Ammunition.* These weapons fire the standard German 7.92-mm rimless small-arms ammunition.

b. MODEL 33/40 RIFLE (*Gewehr 33/40*). The Germans have designed the *Gewehr 33/40* as a special short rifle for parachutists or for personnel carrying concealed arms. The weapon is fitted with a folding stock, hinged on the left and retained in position by a press catch on the right side. When the rifle is not in use, the stock can be folded along the left of the piece. Apart from the folding stock the rifle is normal in design and similar to the 98 models.

c. MODEL 41 RIFLE (*Gewehr 41*). (1) *General description.* This is a semiautomatic rifle (*Fig. 10*) which is made in two models, the *Gewehr 41 m* and *Gewehr 41 w*, similar in operation and differing only slightly in construction. Both models are gas-operated; the gases are compressed in a gas choke at the muzzle, forcing to the rear a floating piston mounted concentrically around the barrel. The movement of the piston is communicated to the bolt head, and the rifle is recocked automatically after each round has been fired. The weapon is fed through a magazine fixed in the receiver which holds two standard rifle clips. Both models have a blade front sight and leaf rear sight graduated from 100 to 1,200 meters (109 to 1,310 yards). When fitted with a telescopic sight this rifle can be used as a sniper's weapon.

(2) *Characteristics.*

Caliber .....7.92 mm (0.312 inch).
Length, over-all .....45 inches.
Weight .....10 pounds 14 ounces.
Feed.....Two 5-round clips.

(3) *Ammunition.* This weapon fires the 7.92-mm rimless ammunition.

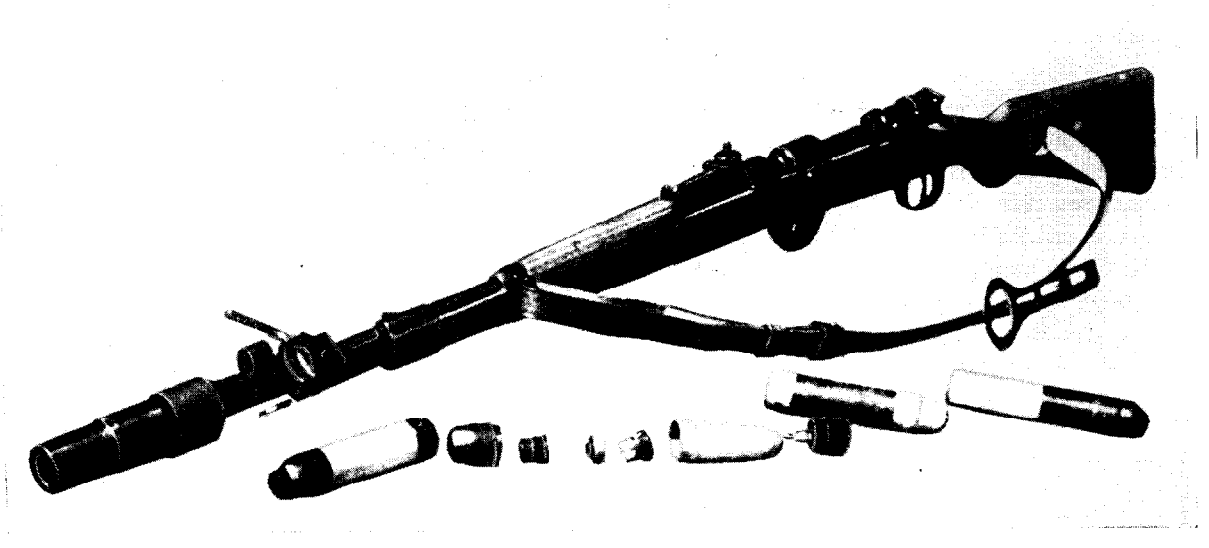


Figure 9.—Gewehr 98 with grenade launcher attached, showing rifle grenades.

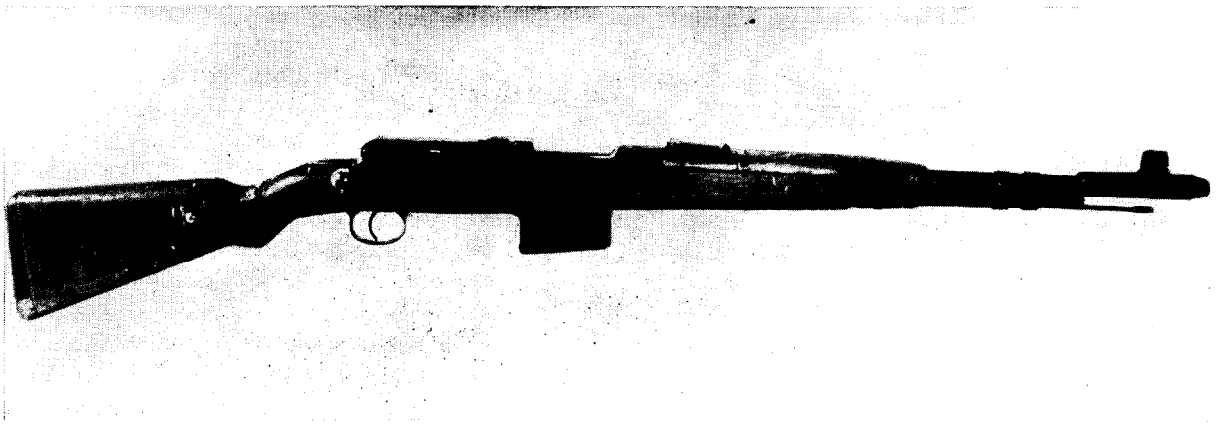


Figure 10.—Gewehr 41, caliber 7.92 mm semiautomatic rifle.

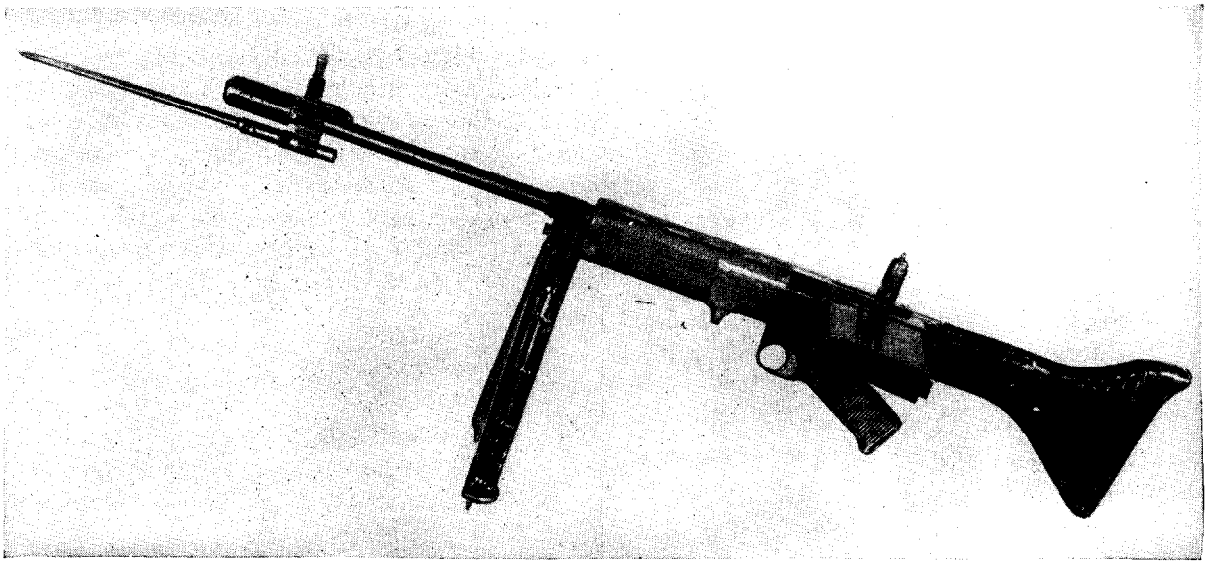


Figure 11.—Fallschirmjägergewehr 42, caliber 7.92 mm automatic rifle.

d. MODEL 42 AUTOMATIC RIFLE (*Fallschirmjägergewehr 42*). (1) *General description.* Although the German nomenclature indicates that this rifle (*Fig. 11*) is intended to be an automatic weapon for use by parachute troops, it also can be used as a light machine gun or a machine carbine. The weapon is designed more like a light machine gun than a rifle. It is gas-operated, fitted with a permanently attached folding bipod, and can be fired automatically or single shot. A compensator is attached to the muzzle, and provision is made for the attachment of a telescopic sight. A bayonet also is attached. The magazine is held in a horizontal position on the left of the receiver. The aperture rear sight is graduated from 100 to 1,200 meters (109 to 1,310 yards). The safety is located on the left side above the pistol grip, and the lever for selecting automatic or single-shot fire is placed above and to the rear of the trigger. A later model of this weapon, slightly heavier and more solidly constructed, has the bipod closer to the muzzle.

(2) *Characteristics.*

Caliber .....7.92 mm (0.312 inch).
Length with bayonet .....43¾ inches.
Weight .....9 pounds.
Feed .....20-round magazine.

(3) *Ammunition.* Standard 7.92-mm ammunition is used in this weapon.

e. MODEL 43 SEMIAUTOMATIC RIFLE (*Karabiner 43*). (1) *General description.* This weapon, originally known as the *Gewehr 43*, is a semiautomatic rifle and was developed from the *Gewehr 41*. The trigger and bolt mechanisms are the same as those used on the *Gewehr 41*, but the piston and gas cylinder are of different design. The piston group is located on top of the barrel

instead of concentrically. The rifle may be loaded by inserting either a fully loaded magazine or two cartridge clips into an empty magazine from the top. The leaf rear sight is graduated from 100 to 1,250 meters (109 to 1,365 yards).

(2) *Characteristics.*

Caliber .....7.92 mm (0.312 inch).
Length, over-all .....45 inches.
Weight .....10 pounds.

(3) *Ammunition.* Standard 7.92-mm ammunition is used in this weapon.

6. Machine Guns

a. Model 34 Machine Gun (*M.G. 34*). (1) *General description.* This weapon (*Figs. 12* and *13*) was the original standard German dual-purpose machine gun and is still used, although it has been replaced largely by the *M.G. 42*. (*M.G.* is the German abbreviation for *Maschinengewehr,* which means "machine gun".) It may be used on a bipod, on single or dual AA mounts, or mounted on a tripod as a heavy machine gun. It still is used as the subsidiary armament of all German tanks. It is operated by short recoil, assisted by muzzle blast, and has a standard Solothurn-type breech mechanism. The gun has a leaf rear sight graduated from 200 to 2,000 meters (219 to 2,190 yards), an AA ring sight, and an optical sight for use with the tripod mount. It is fed either by 50-round metallic-link belts, which may be connected together, or by drums. The weapon is air-cooled by a perforated barrel jacket.

(2) *Characteristics.*

Caliber .....7.92 mm (0.312 inch).
Length, over-all .....48 inches.
Weight with bipod .....26½ pounds.
Weight with tripod .....42 pounds.
Feed .....Belt or drum.
Rate of fire
(cyclic) .....900 rounds per minute.
(practical) .....As LMG 100 to 120 rounds per minute.
As Hv MG 300 rounds per minute.
Effective range.....As LMG 600 to 800 yards.
As Hv MG 2,000 to 2,500 yards.

(3) *Ammunition.* The *M.G. 34* fires 7.92-mm rimless small-arms ammunition.

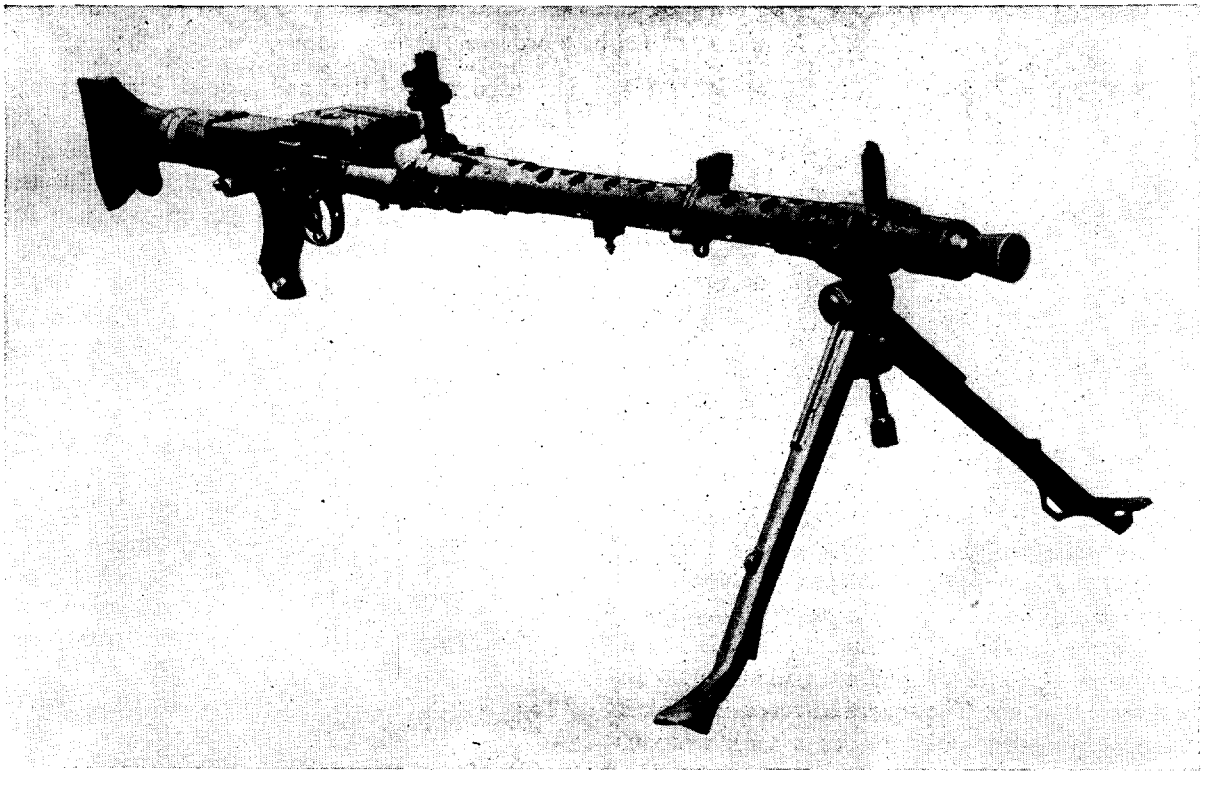


Figure 12.—M.G. 34, caliber 7.92 mm, on bipod mount as light machine gun.

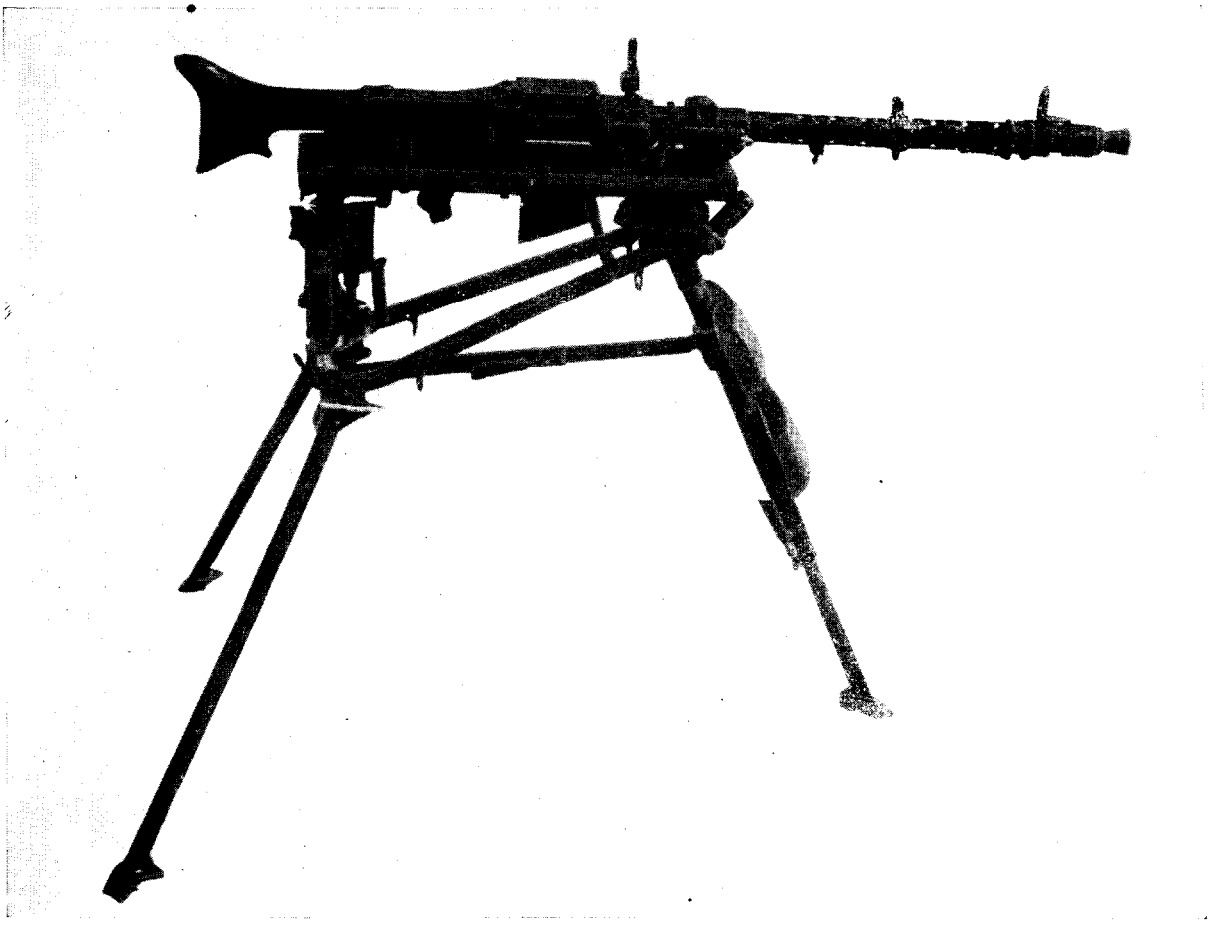


Figure 13.—M.G. 34, caliber 7.92 mm, on tripod mount as heavy machine gun.

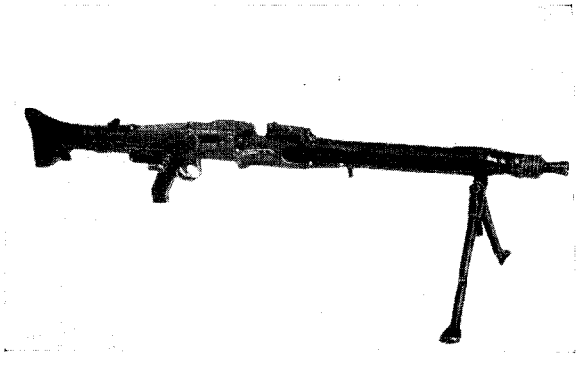


Figure 14.—M.G. 42, caliber 7.92 mm, on bipod mount.

b. MODEL 42 MACHINE GUN (*M.G. 42*). (1) *General description.* This is the latest type of German machine gun known and in most cases has replaced the *M.G. 34* as a standard dual-purpose weapon (*Fig. 14*). Like the *M.G. 34,* it may be used on a fixed bipod, a tripod mount, or an antiaircraft mount. The square barrel casing makes this machine gun unsuitable as a tank weapon. The main features of the weapon are the extensive use of pressings in its construction, a greatly increased rate of fire, and a quick barrel change feature necessitated by the high rate of fire which causes the gun to heat rapidly. The weapon is fundamentally similar to the *M.G. 34* and has the same short recoil action. It has no provision for single-shot fire, however.

(2) *Characteristics.*

Caliber . . . . . 7.92 mm (0.312 inch).
Length, over-all . . . . . 49 inches.
Weight . . . . . 23¾ pounds.
Rate of fire
(cyclic) . . . . . 1,200 to 1,400 rounds per minute.
(practical) . . . . . As LMG 250 rounds per minute.
As Hv MG 500 rounds per minute.
Effective range . . . . . As LMG 600 to 800 yards.
As Hv MG 2,000 to 2,500 yards.

(3) *Ammunition.* This machine gun fires the standard German 7.92-mm rimless ammunition.

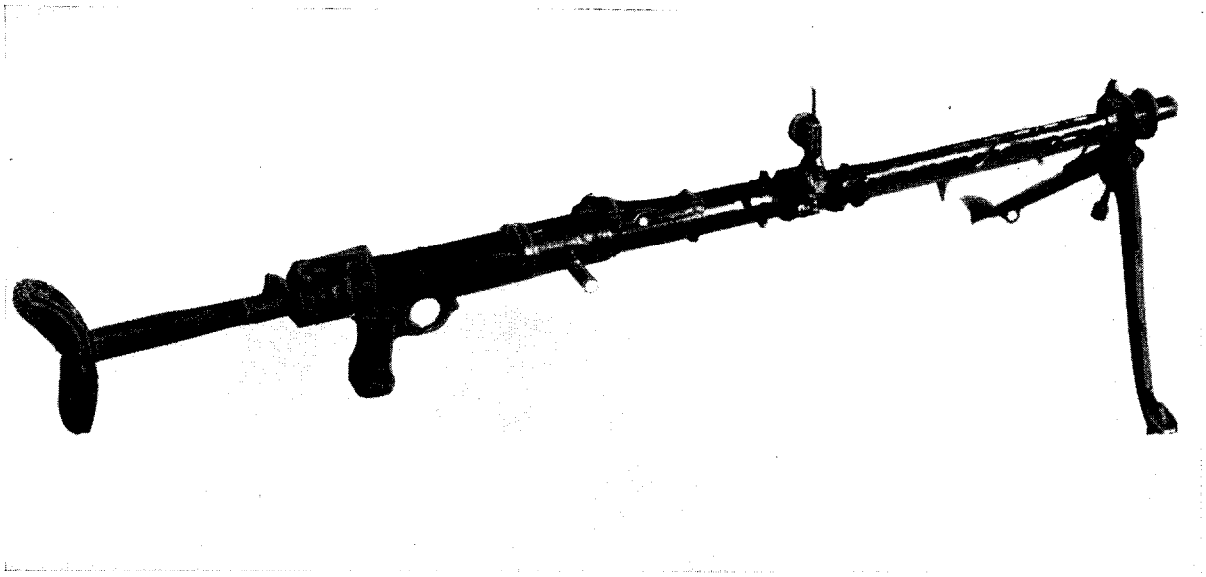


Figure 15.—M.G. 15, caliber 7.92 mm, aircraft machine gun adapted for ground use.

c. MODEL 15 MACHINE GUN (*M.G. 15*). (1) *General description.* Although primarily intended as an aircraft machine gun, the *M.G. 15* has been adopted as a ground weapon (*Fig. 15*), using an adapter, which clips around the barrel for attaching the standard bipod, and a butt extension. It is a light weapon and has short recoil action, firing automatic only.

(2) *Characteristics.*

Caliber .....7.92 mm (0.312 inch).
Length, over-all .....42 inches.
Weight .....15 pounds 12 ounces.
Feed .....75-round saddle magazine.
Rate of fire
(cyclic) .....1,000 rounds per minute.
(practical) .....300 rounds per minute.

(3) *Ammunition.* The standard 7.92-mm rimless ammunition is used in this machine gun.

d. MODEL 151/20 MACHINE GUN (*M.G. 151/20*). (1) *General description.* Although primarily an aircraft machine gun (*Fig. 16*), it also has been found on an improvised ground mount as an antitank weapon and triple-mounted on a half-tracked vehicle. When used on the ground, the gun is hand cocked and mechanically fired, instead of utilizing the electrical cocking and firing mechanism provided for its use in aircraft. The gun is entirely recoil-operated. The 15-mm *M.G. 151* is sometimes used instead of the *M.G. 151/20* on the triple mount. It often is supposed that these two are the same gun fitted with interchangeable barrels; this is not the case, although the guns are very similar in construction.

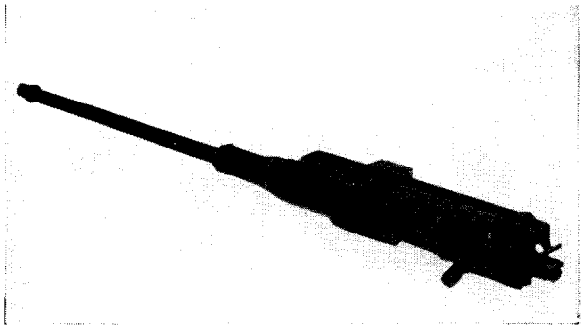


Figure 16.—M.G. 151/20, a 20-mm aircraft machine gun.

(2) *Characteristics.*

Caliber .....20 mm (0.787 inch).
Length, over-all .....69¾ inches.
Weight.....93½ pounds.
Feed .....Disintegrating metallic-link belt.
Rate of fire .....800 rounds per minute.
Muzzle velocity (HE).
2,656 feet per second.

(3) *Ammunition.* This gun fires HE, AP, and APHE ammunition.

7. Antitank Weapons

a. RIFLES. The original German antitank rifles were the 7.92-mm *Panzerbüchse 38,* with automatic extraction mechanism, and the 7.92-mm *Panzerbüchse 39,* operated entirely by hand. These weapons were not very effective and are

now obsolete. Next followed the 20-mm Solothurn, which was issued in two models: one single shot, and the other both single shot and automatic. The tendency during 1944 has been to adopt antitank grenade launchers in preference to rifles, and the only relic of these four models is the *Granatbüchse,* which is a *Panzerbüchse 39* modified to fire rifle grenades from a rifle launcher cup.

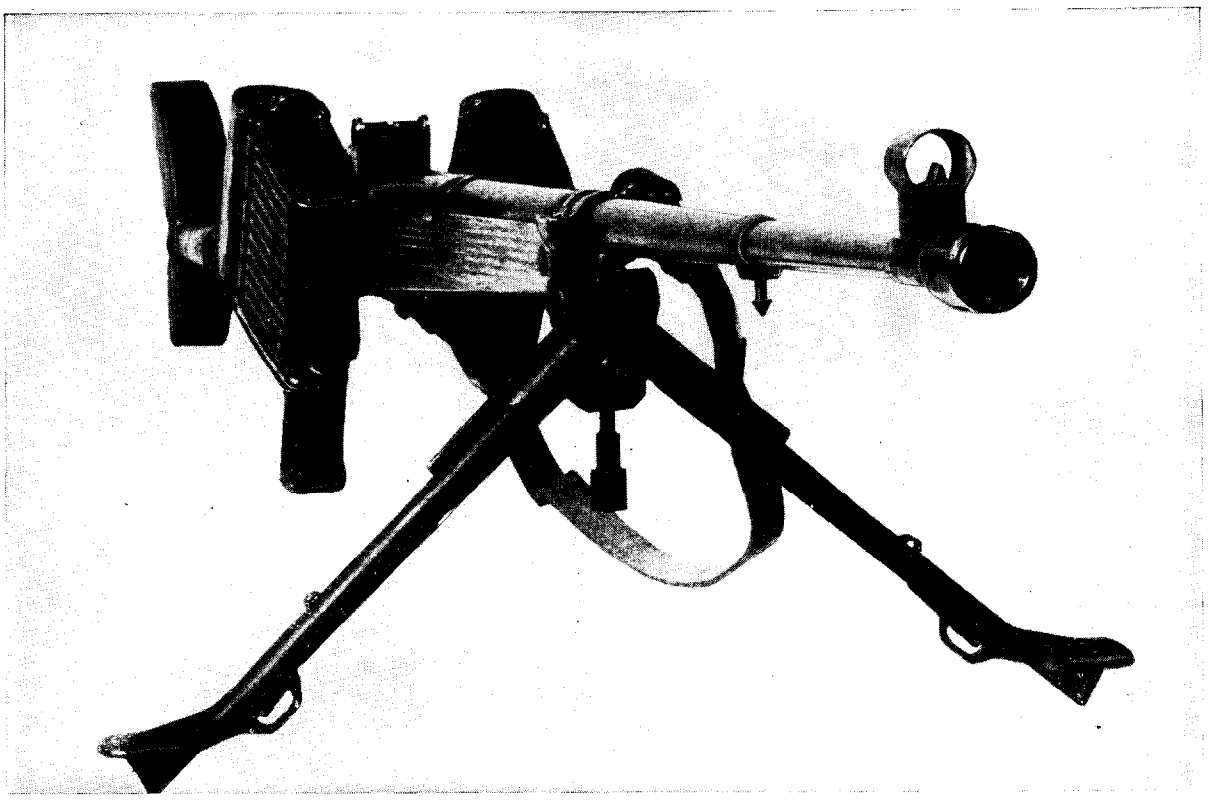


Figure 17.—Panzerbüchse 39, a 7.92-mm antitank rifle.

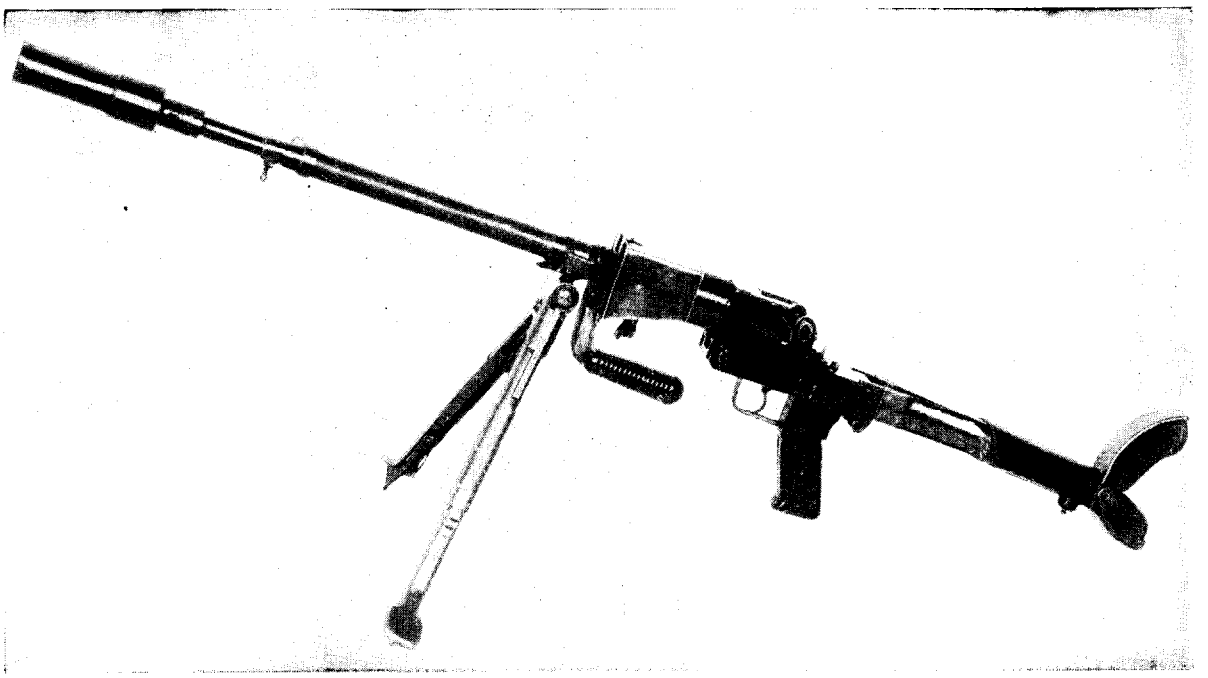


Figure 18.—Granatbüchse 39, a 7.92-mm antitank rifle modified for launching rifle grenades.

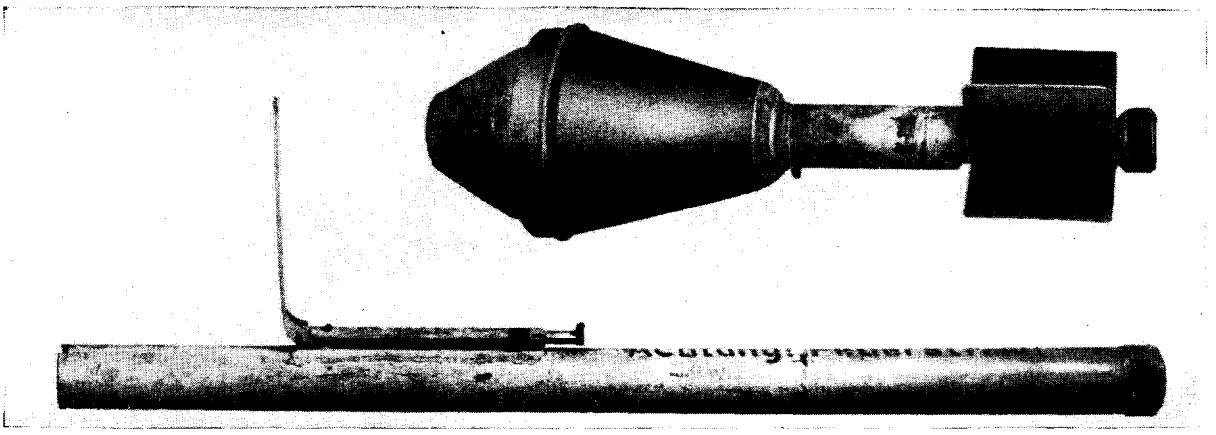


Figure 19.—Faustpatrone 2 (Panzerfaust), 44-mm recoilless antitank grenade launcher, showing launching tube and grenade.

b. Recoilless Antitank Grenade Launchers—*Panzerfaust.* This is a series of antitank grenade launchers each bearing the name *Panzerfaust* but each having a different number after the name.

(1) *Panzerfaust 30*

(a) *General Description.* This weapon, also known as the *Faustpatrone 2,* was the first of the four models of recoilless antitank grenade dischargers to be produced. It is designed for use against armor at ranges of about 30 yards, at which range a penetration of just over 200 mm is obtained.

The weapon consists of a steel launching tube, containing a percussion fired propellent charge. A hollow-charge antitank grenade is fired from the tube.

The weapon is fired from the standing, kneeling or prone positions, aim being taken over the vertical sight and the forward end of the bomb.

(b) *Characteristics.*

Diameter of tube .....1¾ inches.
Over-all length ..... 41 inches.
Weight ..... 11 pounds.

(c) *Ammunition.* The grenade is provided with spring steel fins which are wrapped around the tail for loading and which are released as the projectile leaves the tube and stabilize the bomb during flght.

(2) *Panzerfaust Klein 30*

This weapon, also known as the *Faustpatrone 1* or *Gretchen,* is a smaller version of the *Panzerfaust 30* and has a differently shaped projectile head. The system of operation is the same and the range is again about 30 yards. A penetration of 140 mm is claimed for this projectile.

(3) *Panzerfaust 60*

This launcher is similar in appearance to the *Panzerfaust 30.* A redesigned firing mechanism has been fitted and also a new sight, which has apertures for 30, 60 and 80 meters.

The tube of this weapon is slightly thicker than that of the *Panzerfaust 30* and the weight has been increased to 13½ lbs.

The penetration figure of 200 mm for the *Panzerfaust 30* will apply equally well to this weapon.

(4) *Panzerfaust 100*

This is the latest of the *Panzerfaust* series of antitank launchers to be encountered. In appearance it is similar to the *Panzerfaust 60,* though slightly increased in size and performance. A penetration figure of 200 mm is claimed for this weapon, which is sighted up to 150 meters.

c. Rocket Launcher (*Raketenpanzerbüchse 54*). (1) *General description.* This weapon, which is also known as the *Ofenrohr* (Stovepipe) or *Panzerschreck* (Tank Terror), is similar to the U. S. 2.36-inch rocket launcher (Bazooka) and fires a hollow-charge rocket projectile. The launcher consists of a steel tube provided with fore and back sights and a cocking lever and trigger which operate an electrical firing mechanism. For firing, the rocket is inserted in the rear of the tube, where it is retained in position by a catch and makes a contact with the electrical leads at the rear of the launcher. When the trigger is pressed, a magnetized rod passes through a coil located in a housing underneath the projector. This generates a current which provides the spark necessary to ignite the propellent charge in the tail end of the projectile. Later models of this projector are fitted with steel protective shields clamped around the barrel. In each shield there is an observation window on the left of the firer. These shields eliminate the necessity for the firer to wear protective clothing. The Germans claim

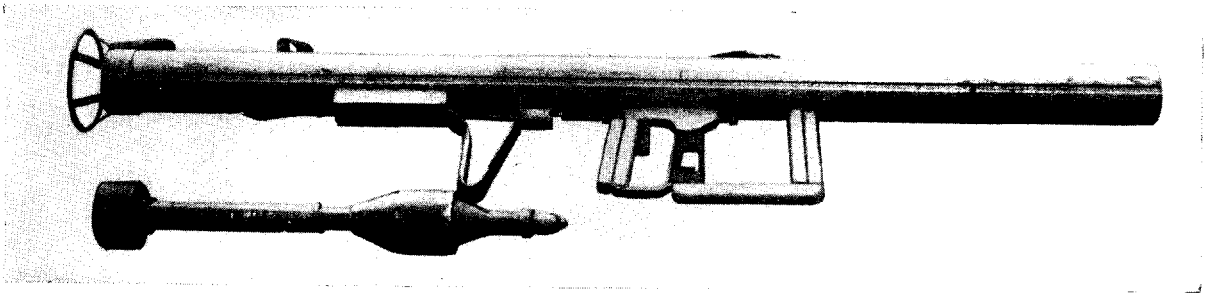


Figure 20.—Raketenpanzerbüchse 54, an 88-mm antitank rocket launcher.

an effective range of 120 meters (130 yards) for this weapon.

(2) *Characteristics.*

Caliber .....88 mm (3.5 inches).
Length, over-all .....5 feet 4½ inches.
External diameter .....3.7 inches.
Weight .....20½ pounds.
Maximum range .....132 yards.

(3) *Ammunition.* The projectile is a 7-pound hollow-charge rocket containing a propellant in the tail tube. The rocket is equipped with a nose fuze and a circular tail fin. It measures 2 feet 1¼ inches in length.

d. Heavy Rocket Launcher (*Raketenwerfer 43* or *Püppchen*). (1) *General description.* A heavier version of the *Raketenpanzerbüchse,* this weapon fires hollow-charge rockets against tanks. The barrel, mounted on a two-wheeled, single-trail carriage with protective shield, has a simple hinged breechblock with striker mechanism. No traversing or elevating wheels are provided on the carriage; the gun must be held at the required elevation by a spade hand grip and manually traversed on a traversing slide. The weapon has a front sight and an adjustable rear sight mounted on the barrel. The rear sight is graduated from 180 to 700 meters (195 to 765 yards). This may mean that the weapon can be used in an antipersonnel role as a mortar at long ranges.

(2) *Characteristics.*

Caliber .....88 mm (3.5 inches).
Length, over-all .....9 feet 2 inches.
Weight.....270 pounds (approximately).
Width of carriage.....3 feet 3½ inches.
Height of barrel .....1 foot 6 inches.
Elevation .....—18° to + 15°.

(3) *Ammunition.* The projectile is an 88-mm hollow-charge rocket similar to that used with the *Raketenpanzerbüchse,* but with a flash cap in the center of a rimmed base fitting over the end of the stabilizing fins. The rimmed base serves as a cartridge case and remains in the breech after the projectile has been fired.

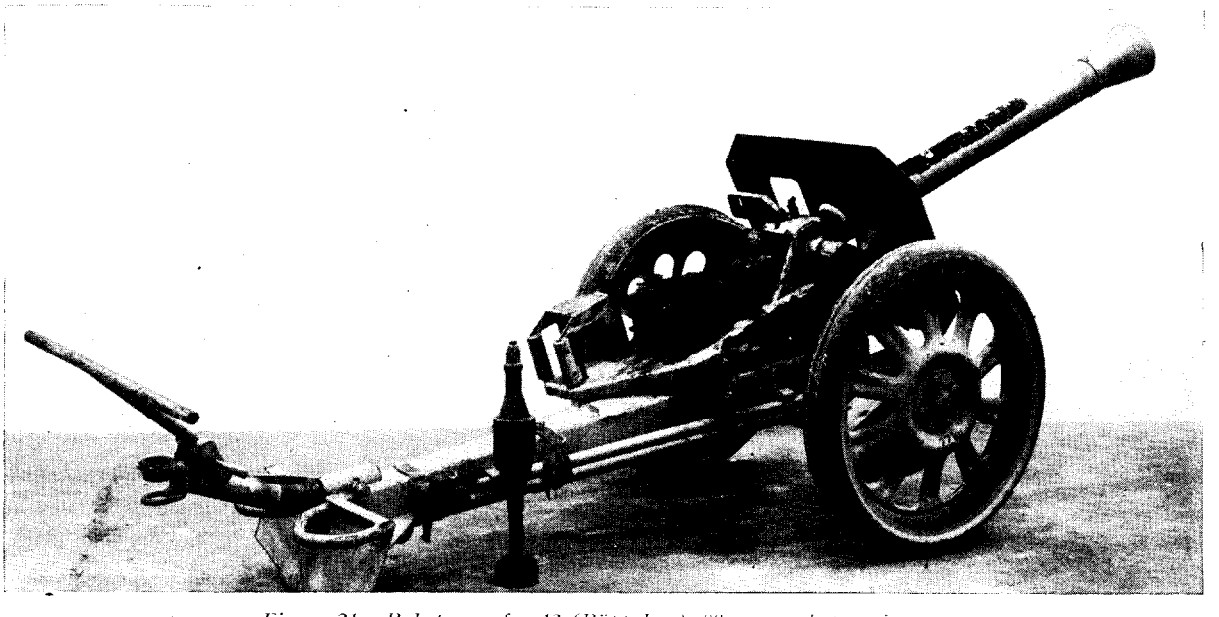


Figure 21.—Raketenwerfer 43 (Püppchen), 88-mm rocket projector.

Section III. MORTARS

1. General

The Germans began the war with two principal mortars: the 50-mm and 81-mm pieces as company and battalion weapons, respectively. They found, however, that these weapons did not match the mortar fire power of their enemies, particularly that of the Russians. Two principal measures were taken in an effort to correct this deficiency. A short 81-mm mortar was developed for use as a light weapon to supplement the 50-mm piece. A copy of the Russian 120-mm mortar, which far surpassed the performance of any German mortar, was adopted.

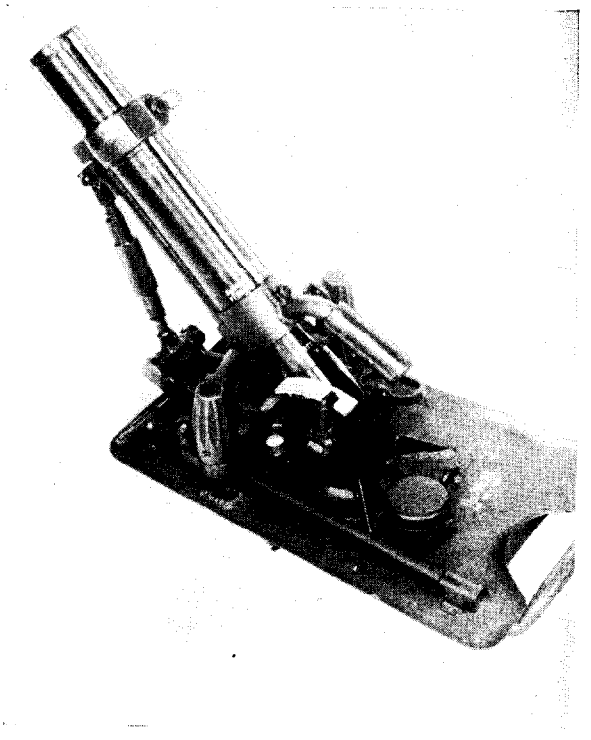


Figure 22.—5 cm leichter Granatenwerfer 36.

2. Light Mortars

a. 50-MM MORTAR (*5 cm Leichter Granatenwerfer 36*). (1) *General description.* This is a muzzle-loaded, trigger-fired weapon used solely for high angle fire. Elevation is adjusted by an elevating arm attached to the baseplate and supporting the tube, with provision for both coarse and fine adjustment. Traverse of about 15 degrees in either direction is controlled by a traversing arc of conventional design. Two cross-leveling handscrews, one on each side of the baseplate, are used for initial laying and to steady the mortar during firing.

(2) *Characteristics.*

Caliber .....50 mm (1.97 inches).
Total weight .....31 pounds.
Maximum traverse .....34°.
Elevation .....43° to 90°.
Maximum range .....570 yards.
Weight of shell.....2.2 pounds.
Rate of fire...12 to 20 rounds per minute.

(3) *Ammunition.* This weapon fires an HE shell weighing 2.2 pounds, including 4.5 ounces of TNT explosive filling.

b. 50-MM AUTOMATIC MORTAR (*5 cm Maschinengranatwerfer*). (1) *General description.* This power-operated automatic mortar is almost twice as long as the standard 50-mm weapon. Six-round clips are manually loaded into a rack on the left side. As each round is fed onto the breech-block, the tube slides down over the shell and locks, releasing the firing pin. The feeding, locking, and firing mechanisms are electrically operated. The mortar has been found only in special concrete turrets in fixed defensive systems. These emplacements, below ground except for the roof of the turret, incorporate ammunition storage, power plant, ammunition hoist, and living quarters for the crew.

(2) *Ammunition.* Standard 50-mm ammunition is fired and a range scale in the turret indicates a maximum range of 820 yards.

3. Medium Mortars

a. 81-MM MORTAR (*8 cm Schwerer Granatenwerfer 34*). (1) *General description.* This weapon is the German equivalent of the U. S. 81-mm mortar M-1. It is a smooth-bore, muzzle-loaded weapon with a fixed firing pin. The elevating, traversing, and cross-leveling mechanisms are of conventional design.

(2) *Characteristics.*

Caliber .....81.4 mm (3.19 inches).
Total weight .....124 pounds.
Maximum traverse .....14°.
Elevation .....40° to 90°.
Maximum ranges firing HE shell
Main propelling charge .....591 yards.
Additional charge 1 .....1,094 yards.
Additional charge 2 .....1,597 yards.
Additional charge 3 .....2,078 yards.
Additional charge 4 .....2,625 yards.
Weight of shell .....7.7 pounds.
Rate of fire...10 to 12 rounds per minute.

Figure 23.—8 cm schwerer Granatenwerfer (81-mm mortar) in action.

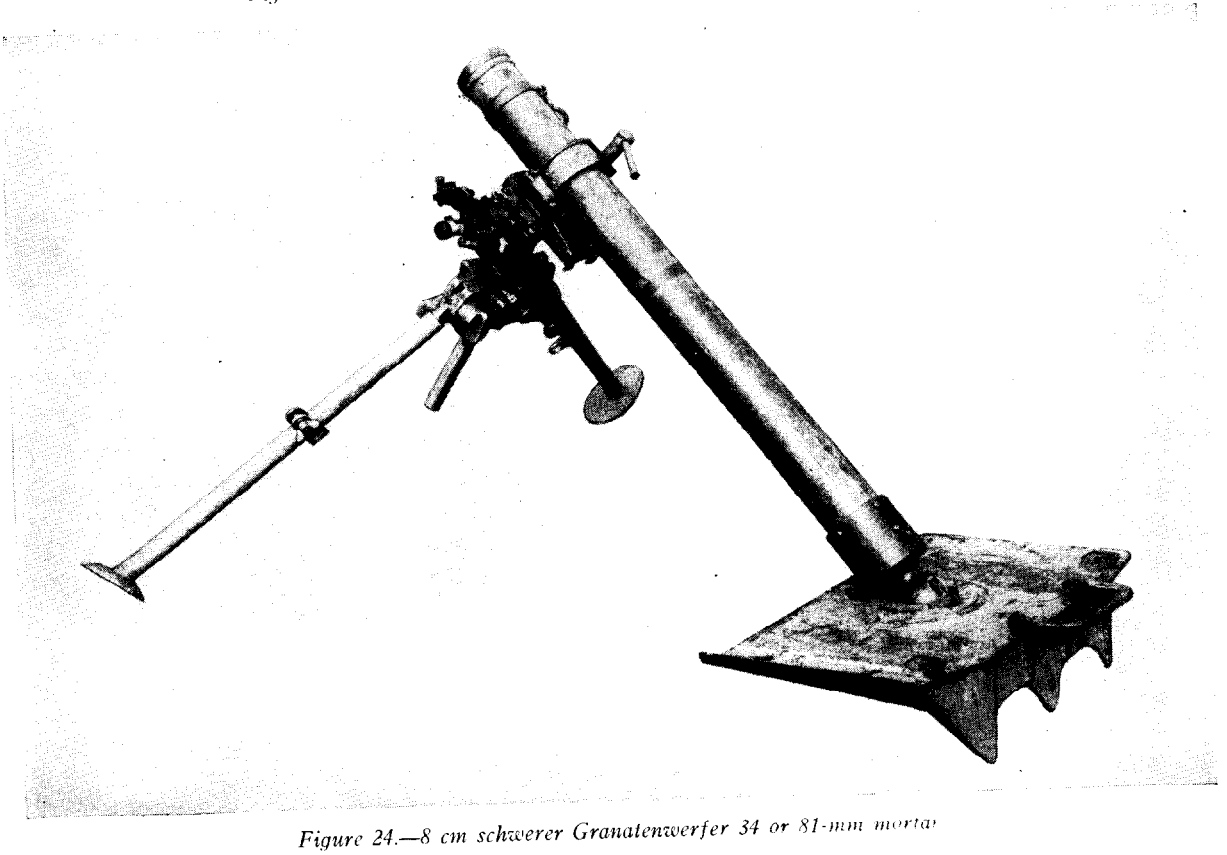


Figure 24.—8 cm schwerer Granatenwerfer 34 or 81-mm mortar

(3) *Ammunition.* The HE shell contains 1.1 pounds of TNT, and the smoke shell contains 1 pound of sulphur trioxide. In addition to the standard smoke and HE ammunition, another shell known as the "bouncing bomb" was used with this mortar to provide air burst, but proved unsuccessful. This projectile weighed the same as the standard HE shell but contained only 0.8 pound of TNT.

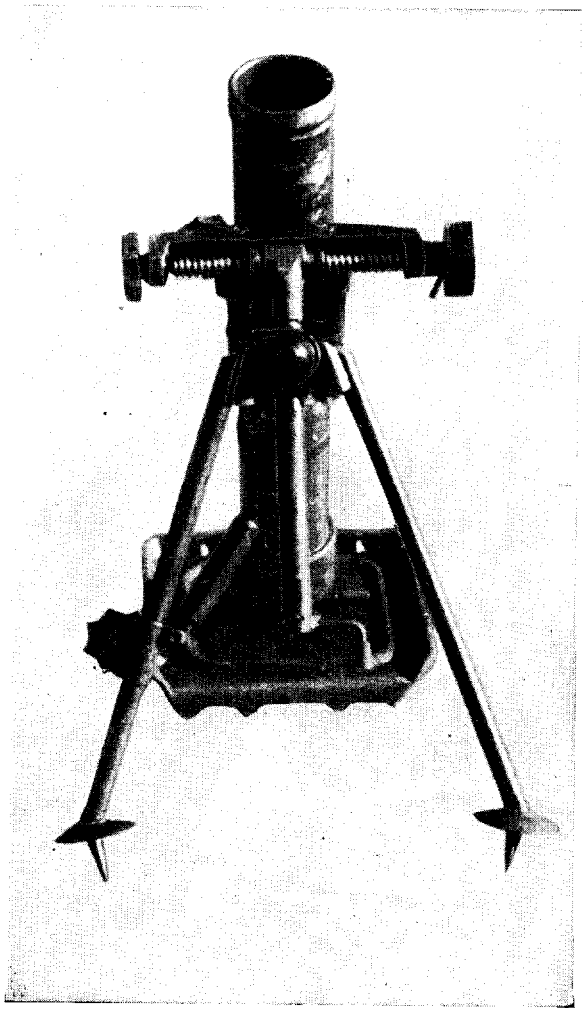


Figure 25.—8 cm Kurzer Granatenwerfer 42 or short 81-mm.

b. SHORT 81-MM MORTAR (*8 cm Kurzer Granatenwerfer 42*). (1) *General description.* This weapon represents an attempt to combine the hitting power of a medium mortar with the mobility and lightness of a smaller weapon, such as the 50-mm mortar. It is a reduced version of the standard 81-mm mortar with modified elevating and traversing gears. The cross-leveling mechanism is similar to that used in the U. S. 81-mm mortar M-1.

(2) *Characteristics.*

Caliber .....81.4 mm (3.19 inches).
Total weight .....62 pounds.
Maximum traverse .....10°.
Elevation .....47° to 88°.
Maximum range .....1,200 yards.

(3) *Ammunition.* This weapon fires the same ammunition as the standard 81-mm mortar, but only three increments may be used, giving a maximum range of 1,200 yards with HE.

4. Heavy Mortars

a. 105-MM SMOKE MORTAR (*10 cm Nebelwerfer 35*). (1) *General description.* This is an enlarged version of the standard 81-mm mortar. Issued originally to chemical warfare troops, it was intended primarily for firing smoke and chemical shells, although HE shells now are issued. In appearance the mortar is almost identical with the 81-mm mortar.

(2) *Characteristics.*

Caliber .....105 mm (4.13 inches).
Total weight .....231 pounds.
Maximum traverse .....13°.
Elevation .....45° to 80°.
Maximum range .....3,300 yards.
(with four increments)
Weight of shell .....16 pounds.

(3) *Ammunition.* Both HE and smoke shells weigh 16 pounds. The HE shell contains 3.75 pounds of TNT.

b. CHEMICAL MORTAR (*10 cm Nebelwerfer 40*). (1) *General description.* This is a smoothbore, breech-loaded weapon transported on a carriage from which it can be fired. The mortar is of monobloc construction. The unusual breech mechanism is so designed that the movement of the operating handle causes the rear of the mortar to ride over the breechblock, which is secured to the frame. A buffer cylinder is located internally on each side of the frame, the buffer pistons being attached to the sides of the breechblock. The carriage is constructed of steel tubing and provided with elevating and traversing gears and a sighting arrangement.

(2) *Characteristics.*

Caliber .....105 mm (4.13 inches).
Total weight .....1,708 pounds.
Maximum traverse .....14°.

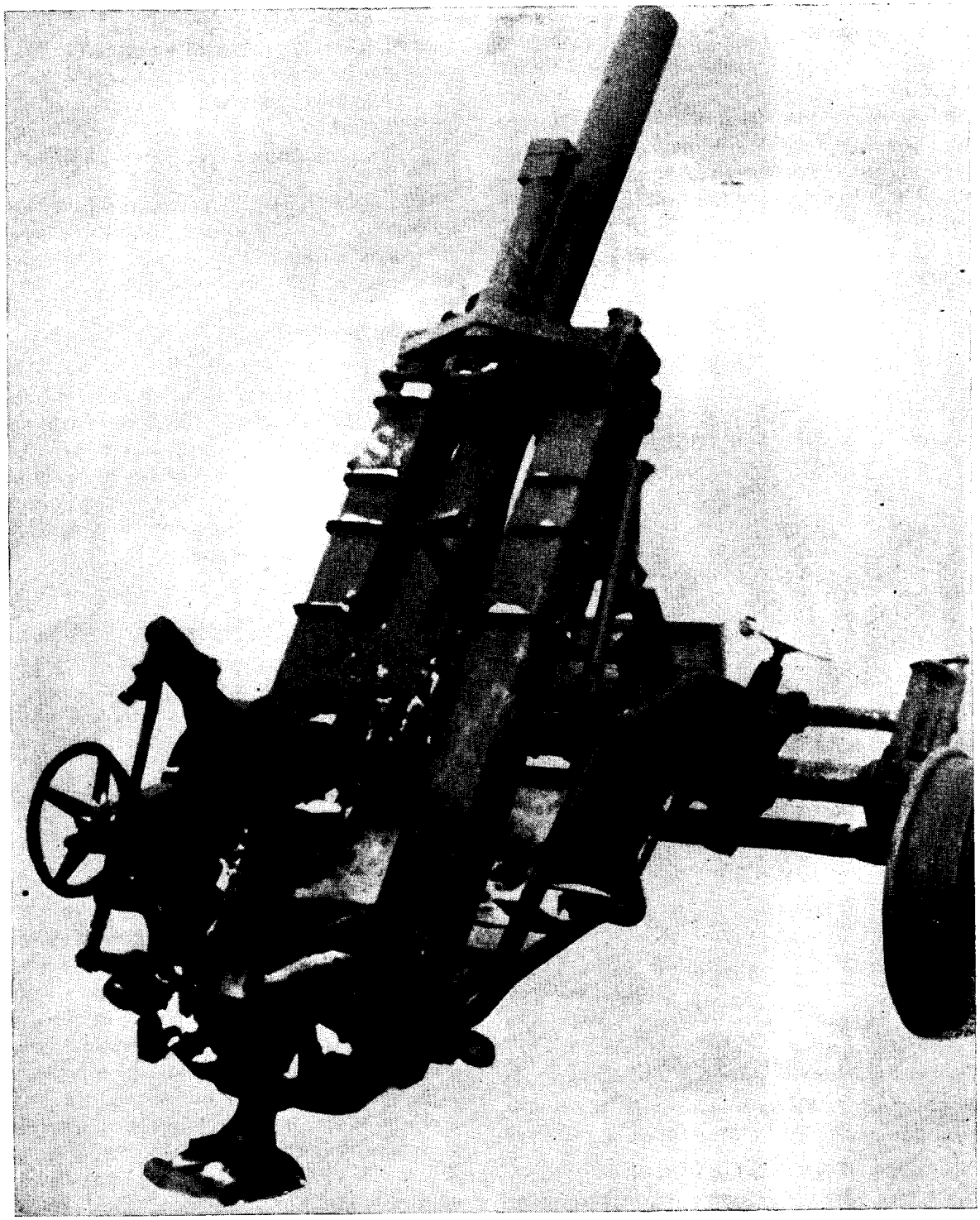


Figure 26.—10 cm Nebelwerfer 40.

Elevation .....45° to 85°.
Maximum range (HE shell)..6,780 yards.
Weight of HE shell.....19.1 pounds.

(3) *Ammunition.* This mortar fires both HE and smoke projectiles. The smoke shell weighs 0.5 pound more than the HE shell.

c. 105-MM FIXED DEFENSE MORTAR *(10 cm Leichte Haubitze Turm).* (1) *General description.* This mortar is incorporated in underground defensive systems. The mortar itself is located in the upper compartment of a large cylindrical emplacement and is completely enclosed except for a

small firing aperture covered by a steel shutter. The lower compartment is used for storing ammunition and housing the crew. Ammunition is carried up to the mortar on a conveyor belt and is manually loaded. The mortar is a smooth-bore, breech-loaded weapon, fitted with a semiautomatic breech mechanism, horizontal sliding breechblock, and hydropneumatic recoil system. The mortar tube is held in a cradle which may be raised and locked into firing position. The traversing mechanism is arranged so that turning the traversing handle rotates the entire fighting compartment. Fire normally is controlled electrically from an observation post, but also can be controlled by means of a periscope in the fighting compartment.

(2) *Characteristics.* Details of the characteristics of this weapon are lacking. Limits of elevation are 45 degrees to 90 degrees.

(3) *Ammunition.* Ammunition fired is the same as that used with the 105-mm smoke mortar (*Nebelwerfer 40*) but with different charge weights.

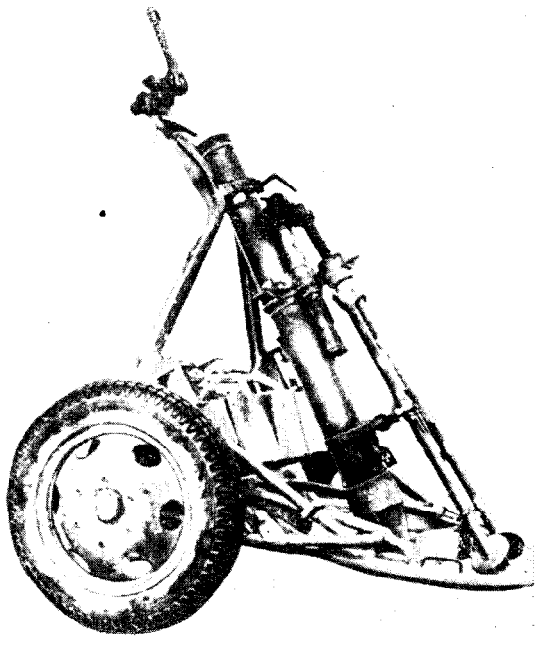


Figure 27.—12 cm Granatenwerfer 42 or 120-mm mortar.

d. 120-MM MORTAR (*12 cm Granatenwerfer 42*). (1) *General description.* This is a virtually exact German copy of a standard Russian weapon. The mortar itself is of conventional construction and consists of a tube, a circular baseplate, and a bipod. It has the advantage of being highly mobile, however, since it is equipped with a two-wheeled, quickly attached axle, and the bipod is carried clamped to the mortar ready for action. The weapon can be quickly towed or manhandled into a new firing position. The heavy shell and long range of this weapon provide a type of fire support comparable with that from the 105-mm field howitzer.

(2) *Characteristics.*

Caliber .....120 mm (4.7 inches).
Total weight .....616 pounds.
Maximum traverse .....16°.
Elevation .....45° to 85°.
Maximum range .....6,600 yards.
Weight of shell .....35 pounds.

(3) *Ammunition.* This mortar fires four types of HE projectiles.

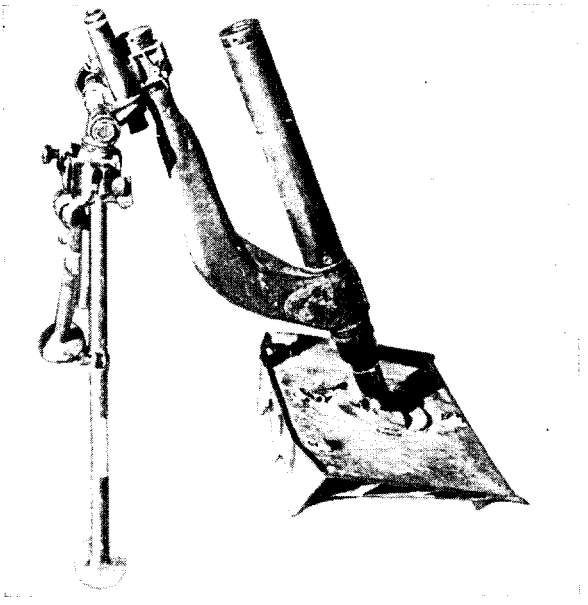


Figure 28.—20 cm leichter Ladungswerfer light spigot mortar.

e. 200-MM LIGHT SPIGOT MORTAR (*20 cm Leichter Ladungswerfer*). (1) *General description.* This weapon consists of a bipod, baseplate, spigot, and spigot arm. The baseplate is of conventional German design and is provided with a socket to receive the base-cap knob at the lower end of the spigot. The bipod is similar to that used with the 81-mm and 105-mm mortars but has more powerful shock absorbers. The spigot is in the form of a drawn steel tube reduced at the lower end where it is threaded to receive the sup-

porting arm. Two insulated electrical contact plates are located above the supporting arm and are connected internally to a contact tube running to the upper end of the spigot to contact the electric primer of the propelling charge.

(2) *Characteristics.*

Diameter of spigot .....3.5 inches.
Total weight .....205 pounds.
Total traverse .....5°.
Elevation .....45° to 80°.
Maximum range .....766 yards.
(three increments)
Weight of shell .....46 pounds.

(3) *Ammunition.* This mortar fires HE or smoke projectiles. The HE shell contains 15 pounds of amatol explosive. Reports indicate ammunition known as the "harpoon projectile" is also used. This shell is said to project a cord and grapnel with which to clear mines or networks of charges.

f. 380-MM HEAVY SPIGOT MORTAR (*38 cm Schwerer Ladungswerfer*). (1) *General description.* No details of this weapon are available, its existence having been established from identification of a 380-mm HE spigot shell. This mortar is probably an enlarged version of the 200-mm weapon.

(2) *Characteristics.*

Diameter of spigot .....6.25 inches.
Weight of shell .....331 pounds.

(3) *Ammunition.* Both HE and smoke ammunition are fired by this mortar. The HE shell bursting charge weighs 110 pounds.

Section IV. ARTILLERY

1. General

a. DEVELOPMENT. The Germans, comparatively speaking, neglected their artillery during the early stages of the war and since have been compelled to give increased thought to it. The German concept of modern war in 1939 was that of the *Blitzkrieg* or "Lightning War", in which armor and the dive bomber jointly were to dominate the battlefield. The enemy was to be softened up by bombing and smashed by the tanks, and artillery scarcely had more than a subsidiary role. The *Blitzkrieg* was successful against inadequately equipped armies, but the gradual recovery of Germany's enemies and the complete bankruptcy of the "Lightning War" theory have compelled the Germans to attempt a refurbishing of their artillery doctrine.

b. DIVISION ARTILLERY. The division artillery weapons with which Germany started the war were all of the "18" class (*10 cm le. F.H. 18, 10 cm K. 18, 15 cm s. F.H. 18*), and all these guns are still standard. Various experimental modifications may be standardized eventually as "42" series, but no fundamental redesign of any of their weapons appears to be contemplated at present.

2. Infantry Guns

a. 75-MM LIGHT INFANTRY GUN *(7.5 cm le. I. G. 18)*. (1) *General description.* The *7.5 cm le. I. G. 18* is an infantry close-support weapon firing in both lower and upper registers. It has a box-type mount on pneumatic-tired disk wheels, and is fitted with a shield. A modification, the *le. Geb. I. G. 18,* has wooden-spoked wheels, a split tubular trail, and no shield; this version has similar performance and is used by airborne troops. Both models have an unusual tube, encased in a slipper block. Operation of the breech mechanism causes the rear of the tube to rise clear of the block for loading.

Figure 29.—7.5 cm le. I.G. 18 (75-mm light infantry gun) in action.

(2) *Characteristics.*

Caliber .....75 mm (2.95 inches).
Length of tube.....34.75 inches.
Weight in action.....880 pounds.
Maximum range.....3,900 yards.
Muzzle velocity.....725 feet per second.
Traverse .....12°.
Elevation .....—10° to + 73°.
Traction .....Motor- or horse-drawn.
Mountain version.....Six pack loads. (heaviest 165 pounds).

(3) *Ammunition.* HE and hollow-charge rounds are fired by this gun. The HE rounds weigh 13.2 and 12.13 pounds.

b. 75-MM INFANTRY GUN (*7.5 cm le. I. G. 37*). (1) *General description.* The *7.5 cm le. I. G. 37,* formerly called *7.5 cm Pak 37,* consists of a 75-mm tube, 21 calibers long, on the *3.7 cm Pak* mount. The gun has a four-baffle muzzle brake which is square in cross section.

(2) *Characteristics.*

Caliber .....75 mm (2.95 inches).
Length of tube.....5 feet 1.95 inches.
Weight in action.....1,124 pounds.
Maximum range (with trails dug in 3 feet to increase elevation)...5,630 yards.
Muzzle velocity.....1,165 feet per second.
Traverse .....Under 60°.
Elevation .....22° 30′.
Traction .....Horse- or motor-drawn.

(3) *Ammunition.* HE and hollow-charge projectiles are fired. They are identical to those used with the *7.5 cm le. I.G. 18.* The hollow-charge projectile will penetrate 75 mm (2.95 inches) at 30 degrees from normal.

c. 150-MM HEAVY INFANTRY GUN (*15 cm s. I. G. 33*). (1) *General description.* The *15 cm s. I. G. 33* is a standard infantry weapon, which can be used for high- or low-angle fire. The tube is monobloc, with a horizontal sliding breechblock and cartridge case obturation. The piece is mounted on a two-wheeled carriage with a box trail. Recently this gun has been issued with a stick bomb used against wire and minefields.

(2) *Characteristics.*

Caliber .....150 mm (5.9 inches).
Length of tube.....5 feet, 4.57 inches.
Weight in action.....3,360 pounds.
Maximum range (HE).5,140 yards.
Muzzle velocity.....787 feet per second.
Traverse .....11° 15′
Elevation .....0 to 73
Traction .....Horse- or motor-drawn.

(3) *Ammunition.* HE and smoke projectiles are fired, in addition to a stick bomb. Projectile weights are: HE, 84 pounds; smoke, 85 pounds; and stick bomb, 197 pounds.

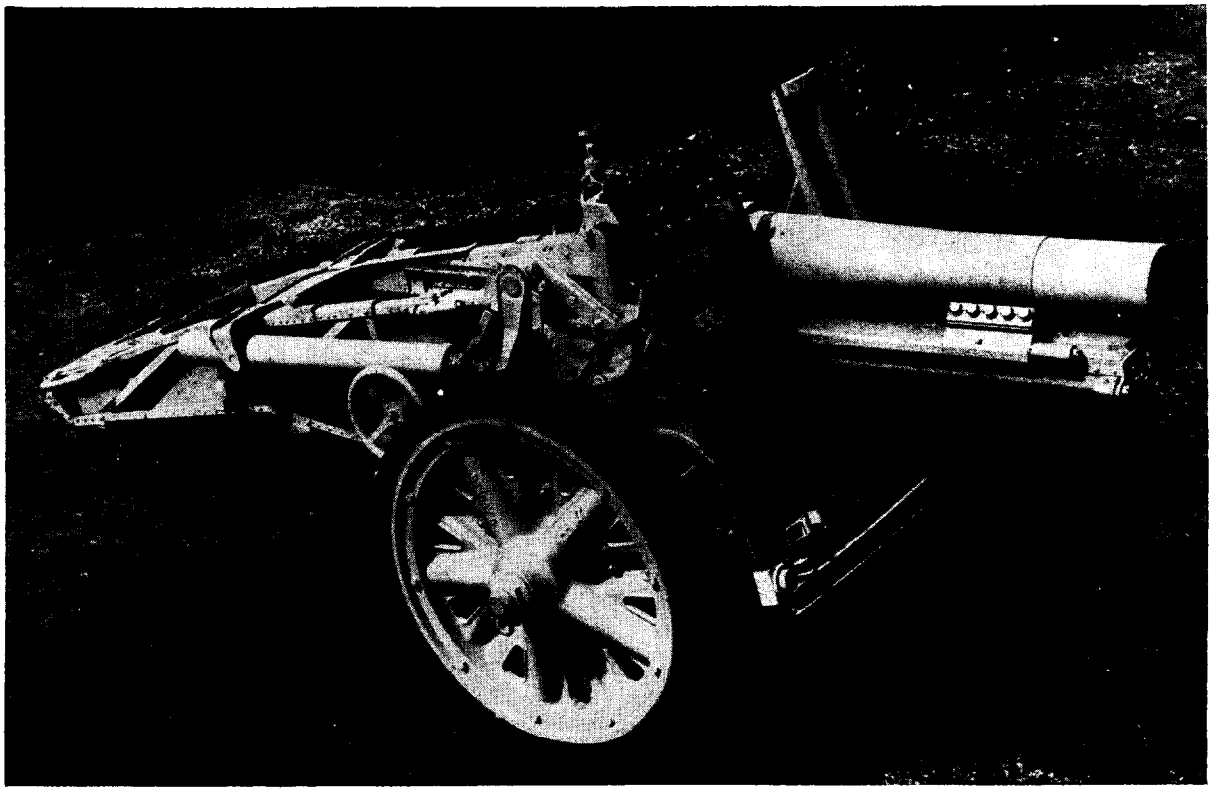


Figure 30.—15 cm s. I.G. 33 (150-mm heavy infantry gun) showing box trail

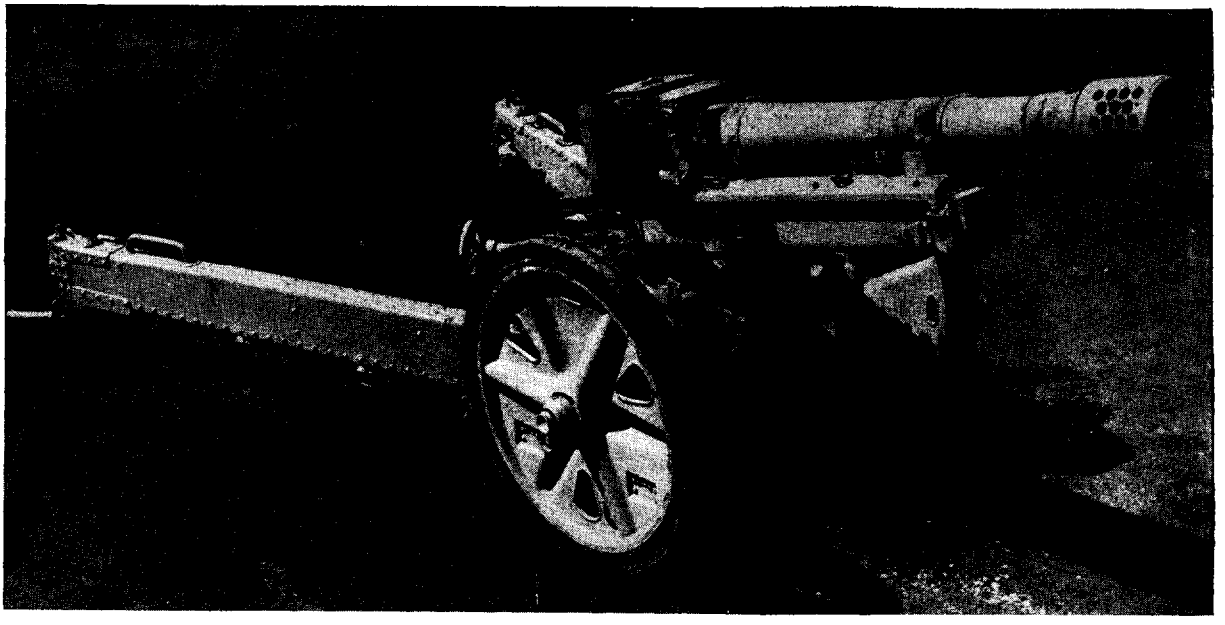


Figure 31.—7.5 cm Geb. G. 36 (75-mm mountain howitzer) with perforated cylindrical muzzle brake.

3. Mountain Guns

a. 75-MM MOUNTAIN HOWITZER (*7.5 cm Geb. G. 36*). (1) *General description.* The *7.5 cm Geb. G. 36* is the standard German light mountain howitzer. The monobloc tube may be fitted with either a baffled or a perforated cylindrical muzzle brake. Both the buffer and recuperator are below the tube. The breachblock is a horizontal sliding type, and the mount has split-box trails, solid rubber tires, but no shield. The howitzer may be quickly broken down into 11 pack loads, the heaviest of which are the tube (249 pounds), and the cradle and recoil system (250 pounds).

(2) *Characteristics.*

Caliber	75 mm (2.95 inches).
Length of tube	57.09 inches.
Weight in action	1,650 pounds.
Maximum range	10,100 yards.
Muzzle velocity	1,558 feet per second.
Traverse	40°.
Elevation	-8° to + 70°.
Traction	Horse-drawn, sledges, or pack.

(3) *Ammunition.* HE and hollow-charge projectiles are fired. The HE projectiles weigh 12.6 pounds, and 12.81 pounds. The hollow-charge projectile weighs 9.75 pounds.

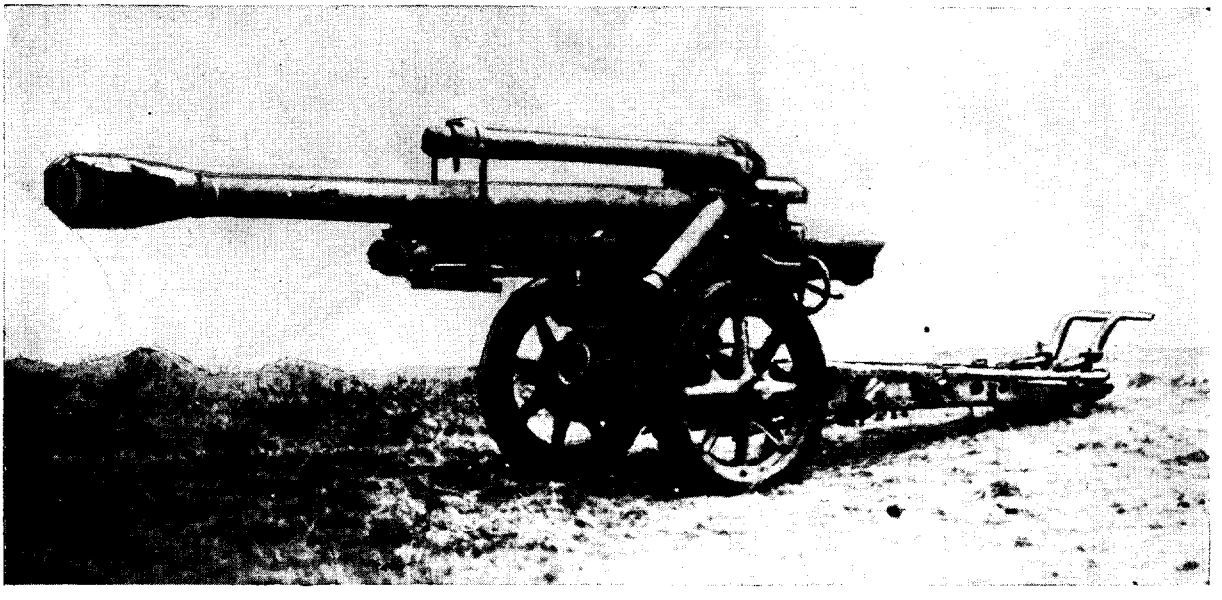


Figure 32.—10.5 cm Geb. H. 40 (105-mm mountain howitzer) with double-baffle muzzle brake.

b. 105-MM MOUNTAIN HOWITZER *(10.5 cm Geb. H. 40)*. (1) *General description.* This weapon is the latest German mountain artillery piece to appear. It is fitted with a double-baffle muzzle brake with wide side flanges, and has a horizontal sliding breechblock and cartridge case obturation. The split-trail carriage is mounted on light alloy wheels. For transport the weapon is disassembled into nine loads, the heaviest of which is the barrel and muzzle brake (551 pounds).

(2) *Characteristics.*

Caliber	105 mm (4.14 inches).
Length of tube	11 feet, 3.4 inches (including breech ring and muzzle brake).
Weight in action	3,660 pounds.
Maximum range	13,810 yards.
Muzzle velocity	1,870 feet per second.
Traverse	50° 40′.
Elevation	− 4° 47′ to + 70°.
Traction	Usually carried by horse-drawn cart.

(3) *Ammunition.* The *10.5 cm Geb. H. 40* fires semi-fixed HE, smoke, star, and hollow-charge ammunition. The HE projectile weighs 32.6 pounds.

4. Airborne Recoilless Guns

a. 75-MM AIRBORNE RECOILLESS GUN *(7.5 cm L. G. 40)*. (1) *General description.* The *7.5 cm L. G. 40,* formerly known as the *7.5 cm L. G. 1 (L) Rh.,* needs no recoil mechanism. The breech is designed to eliminate recoil by emitting part of the propellent gases to the rear. Weight has been reduced considerably by constructing the carriage largely of light alloys, and the gun may be dropped by parachute in two wicker containers. The thin horizontal sliding breechblock is hand-operated. A Venturi tube extends from the rear of the breech which is bored to allow gases to escape. Light metal disk-type wheels are fitted to the mount.

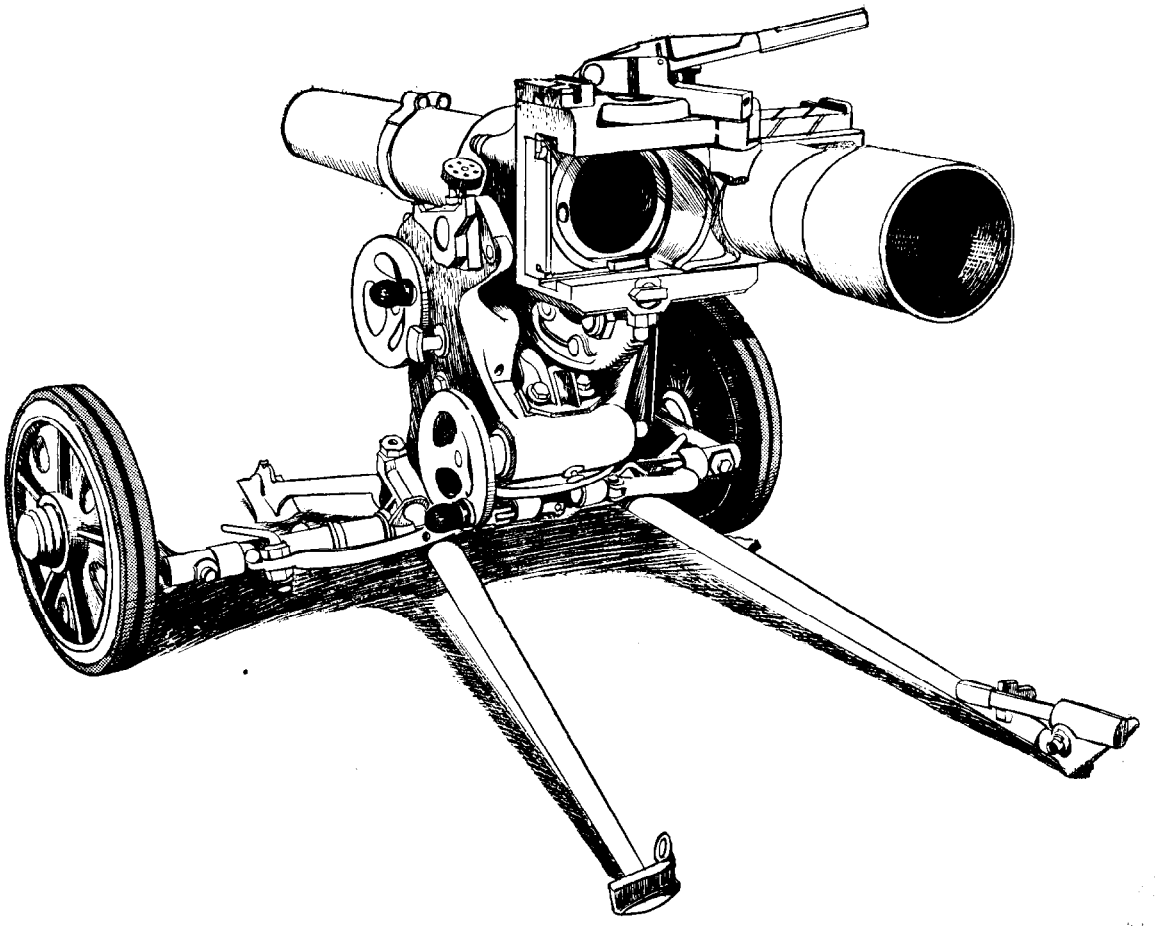


Figure 33.—7.5 cm L.G. 40 (75-mm airborne recoilless gun) showing breech mechanism.

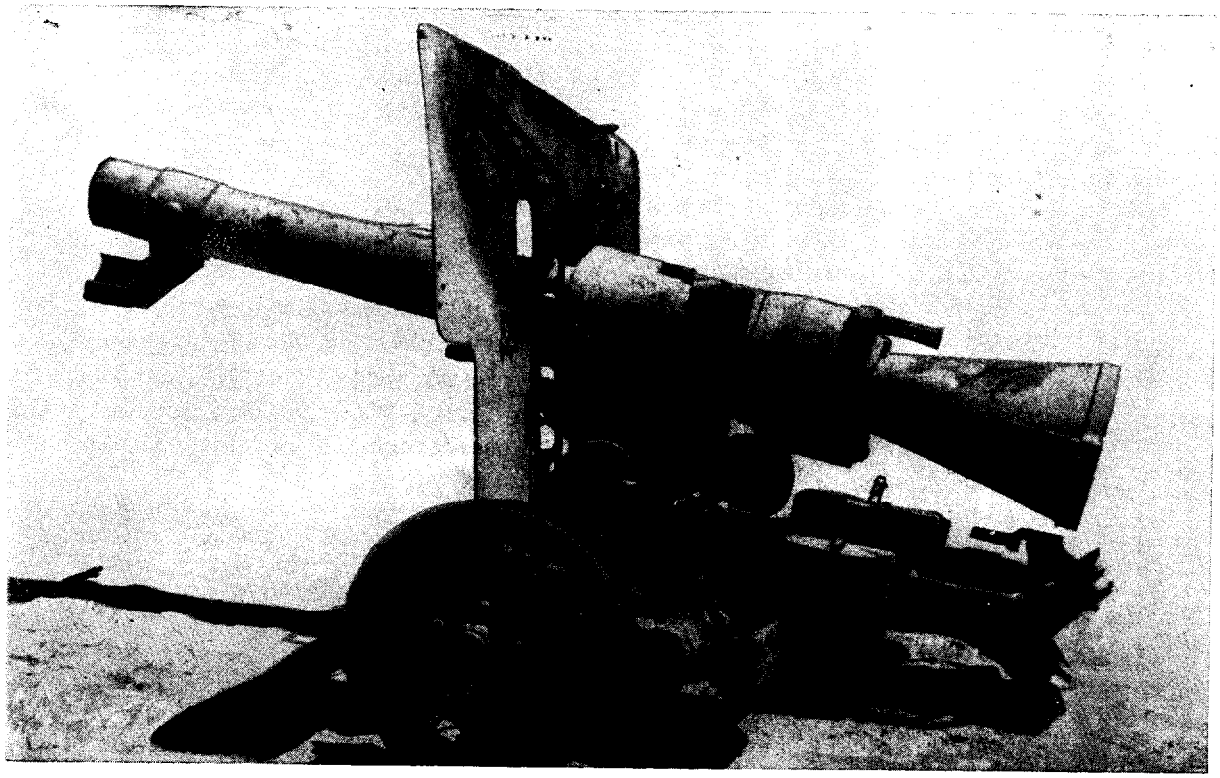


Figure 34.—10.5 cm L.G. 40 (105-mm airborne recoilless gun) in traveling position.

(2) *Characteristics.*

Caliber .....75 mm (2.95 inches).
Length of tube including breech ring and jet .....45.28 inches.
Weight in action.....321 pounds.
Maximum range (HE).8,900 yards (estimated).
Muzzle velocity (HE).1,238 feet per second.
Traverse with elevation —15° to + 42°.....30° right and left.
Traverse with elevation —15° to + 20°.....360° right and left.
Elevation with traverse of 360°.....—15° to + 20°.
Elevation with traverse of 30°, right and left.—15° to + 42°.
Traction .....Airborne.

(3) *Ammunition.* HE, APCBC, and hollow-charge projectiles are fired. Projectile weights are: HE, 12 pounds, APCBC, 15 pounds; hollow charge, 10.13 pounds. The hollow-charge projectile will penetrate 50 mm at 30 degrees from normal.

b. 105-MM AIRBORNE RECOILLESS GUN *(10.5 cm L. G. 40).* (1) *General description.* The *10.5 cm L. G. 40,* formerly known as the *10.5 cm L. G. 2 Kp.,* like the *7.5 cm L. G. 40,* has a jet at the rear for the escape of part of the propellent gases instead of a recoil system. There is no breechblock. The firing mechanism is operated from the top of the breech ring and the striker hits a primer in the side of the cartridge. A modification of this weapon, the *10.5 cm L. G. 40/2,* also exists

(2) *Characteristics.*

Caliber .....105 mm (4.14 inches).
Length of tube, including jet.....6 feet, 3 inches.
Weight in action.....855 pounds.
Maximum range.....8,694 yards.
Muzzle velocity (HE).1,099 feet per second.
Traverse .....80°.
Elevation .....—15° to + 40° 30′.
Traction .....Airborne.

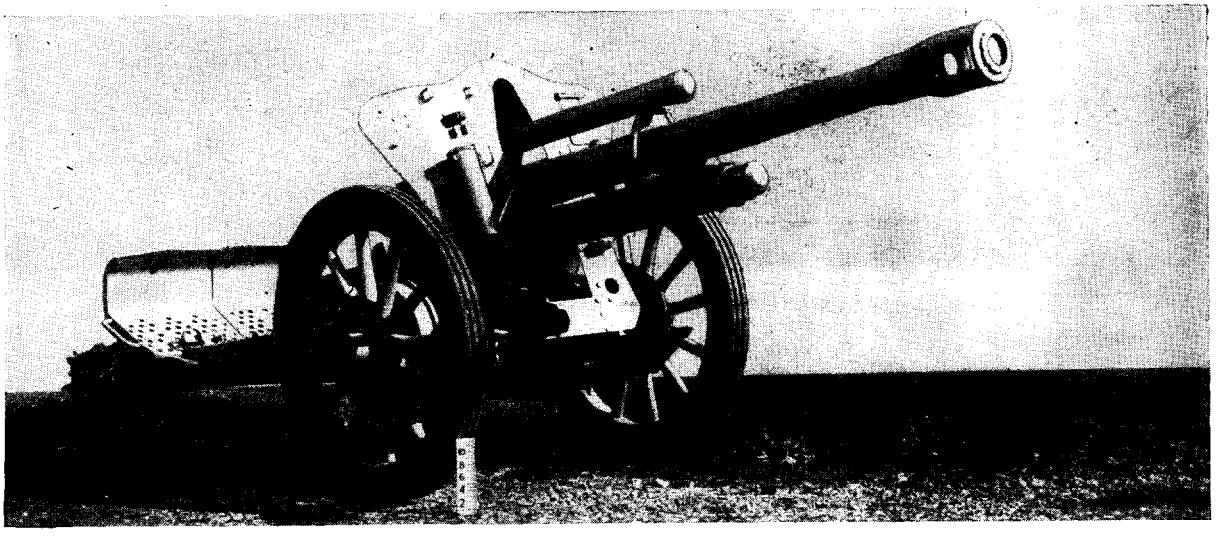
(3) *Ammunition.* HE and hollow-charge projectiles are fired. The base of the cartridge case has a circular bakelite disk which is destroyed when the gun fires. Projectile weights are: HE, 32.63 pounds; hollow charge, 25.88 pounds.

c. 105-MM AIRBORNE RECOILLESS GUN *(10.5 cm L. G. 42).* (1) *General description.* The *10.5 cm L. G. 42,* formerly known as the *L. G. 2 Rh,* differs from the *10.5 cm L. G. 40* in that it has a horizontal sliding breechblock bored for the passage of gases to the rear. The mount is made of fairly heavy tubing, and is designed for rapid dismantling and reassembly. Both air and pack transport are possible. A variation, known as *10.5 cm L. G. 42/1,* differs in weight (1,191 pounds). It uses the same range tables.

(2) *Characteristics.*

Caliber .....105 mm (4.14 inches).
Length of tube.....6 feet, 0.28 inch (including jet).
Weight in action.....1,217 pounds.
Maximum range (HE).8,695 yards.
Muzzle velocity.....1,099 feet per second.
Traverse .....360° at elevations up to 12°; 71° 15′ at elevations over 12°.
Elevation .....15° to 42° 35′.
Traction .....Airborne or pack.

(3) *Ammunition.* This weapon fires HE, hollow-charge, smoke, and HE incendiary projectiles. The projectile weights are: HE, 32.58 pounds; hollow charge, 26.62 and 27.17 pounds; smoke, 32.36 pounds, and HE incendiary, 33.52 pounds.



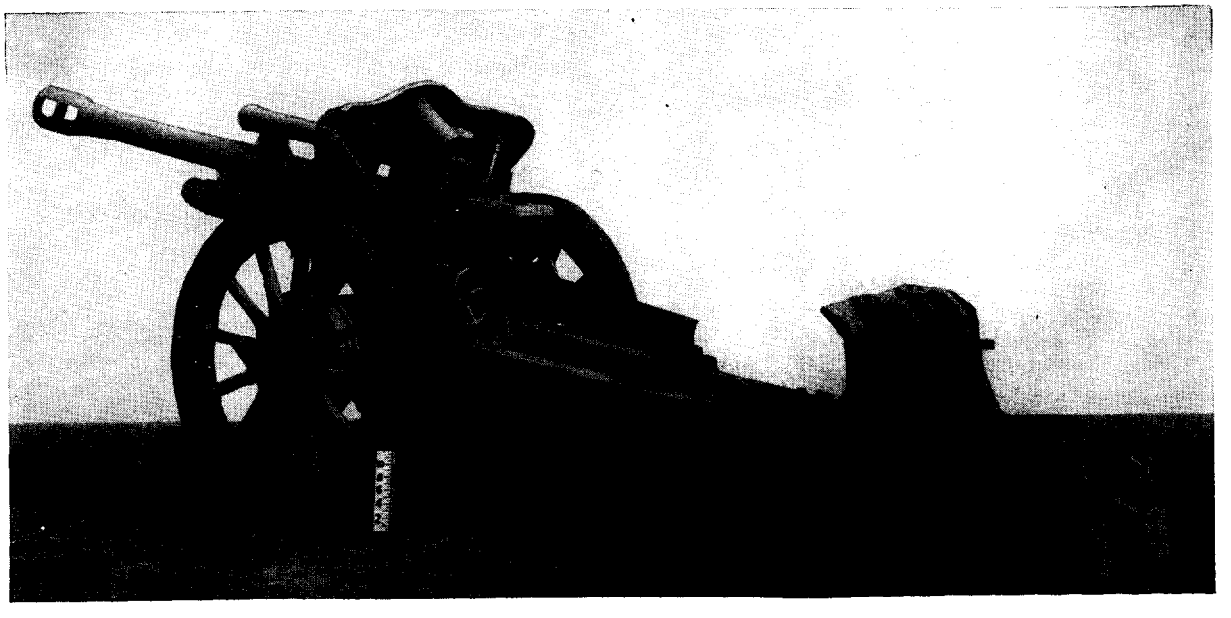


Figure 35.—Right front view (top) 10.5 cm le. F.H. 18 (M), the standard divisional field artillery howitzer with muzzle brake; left rear view (bottom).

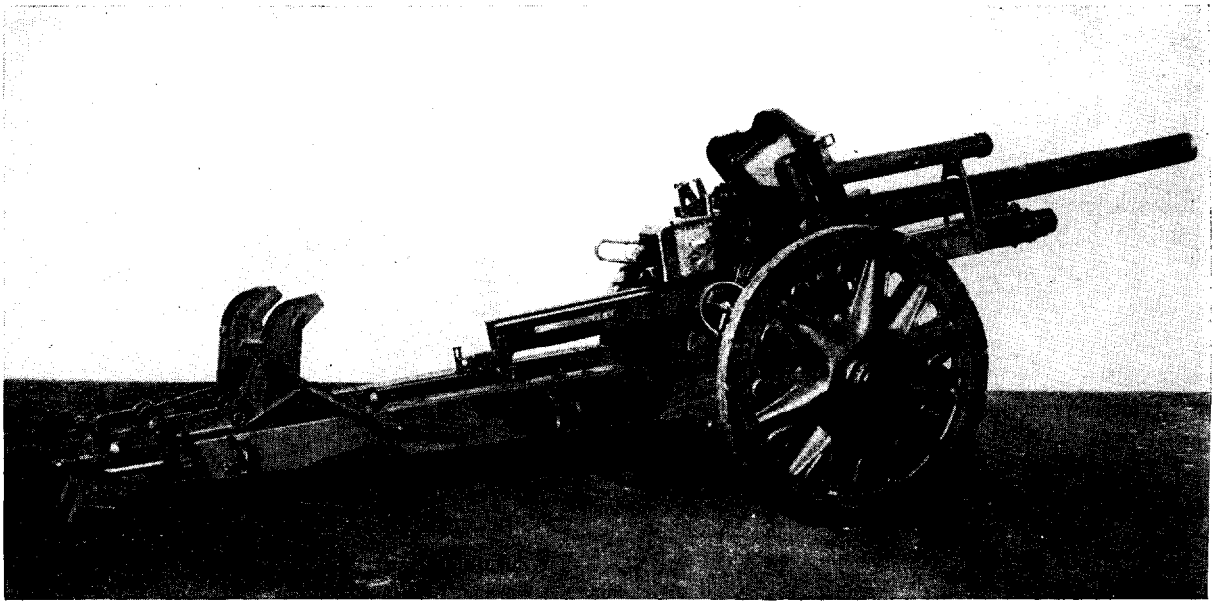


Figure 36.—10.5 cm le. F.H. 18 (105-mm field howitzer), the standard divisional field artillery howitzer.

5. Field and Medium Artillery

a. 75-MM FIELD GUN 38 *(7.5 cm Feld Kanone 38).* (1) *General description.* This gun is of conventional design, with a semiautomatic horizontal sliding breechblock. A slotted cylindrical muzzle brake is fitted to the monobloc tube. The hydropneumatic recuperator is above the tube, and the hydraulic buffer below. Equilibrators are spring type. The carriage has split trails of riveted box construction and artillery wheels.

(2) *Characteristics.*

Caliber .....75 mm (2.95 inches).
Length of tube.....9 feet, 3½ inches.
Weight in action.....3,136 pounds.
Maximum range.....12,570 yards.
Muzzle velocity.....1,985 feet per second.
Traverse .....50°.
Elevation .....—5° to +45°.
Traction .....Tractor.

(3) *Ammunition.* Two types of HE shell and one hollow-charge shell are fired. The HE shells weigh 12.85 pounds and 13.88 pounds, and the hollow-charge, 10.07 pounds.

b. 105-MM FIELD HOWITZER *(10.5 cm Leichte Feld Haubitze 18).* (1) *General description.* This is the standard divisional field artillery howitzer developed during the last war. It has a hydropneumatic recoil system and a heavy, simply designed breech mechanism with a horizontal sliding block and cartridge case obturation. The first modification of the original model appeared in 1941 when a muzzle brake of conventional design was fitted to permit a new long-range charge to be fired, increasing the range by 1,800 yards. This version is known as the *le. F. H. 18 (M).* By 1944 a second modification had appeared, the *le. F. H. 18/40.* The tube of the *le. F. H. 18 (M)* was mounted on the carriage already in large scale production for the *7.5 Pak 40* (75-mm AT gun). By modifying the elevating and firing mechanisms, the rate of fire was increased, and a more efficient muzzle brake decreased the recoil load. The *10.5 cm le. F. H. 18 (M)* and the *le. F. H. 18/40* are ballistically identical and have the same firing tables.

(2) *Characteristics (of 10.5 cm le F. H. 18/40).*

Caliber .....105 mm (4.14 inches).
Length of tube.....10 feet, 8.252 inches.
(including breech ring and muzzle brake)
Weight in action.....4,320 pounds.
Maximum range.....13,480 yards.
Muzzle velocity.....1,772 feet per second.
Traverse .....56°.
Elevation .....6° to +40°.
Traction .....Tractor.

(3) *Ammunition.* HE, smoke, incendiary, illuminating, propaganda, hollow-charge, HE sabot, and AP sabot shells are fired. (Sabot shells may not be fired from guns equipped with existing muzzle brakes, however.) The weight of HE projectiles is 32 pounds, 11 ounces.

c. 150-MM MEDIUM HOWITZER *(15 cm s. F. H. 18).* (1) *General description.* The *15 cm s. F. H. 18* is the standard divisional artillery medium howitzer, with the same mount as the *10 cm*

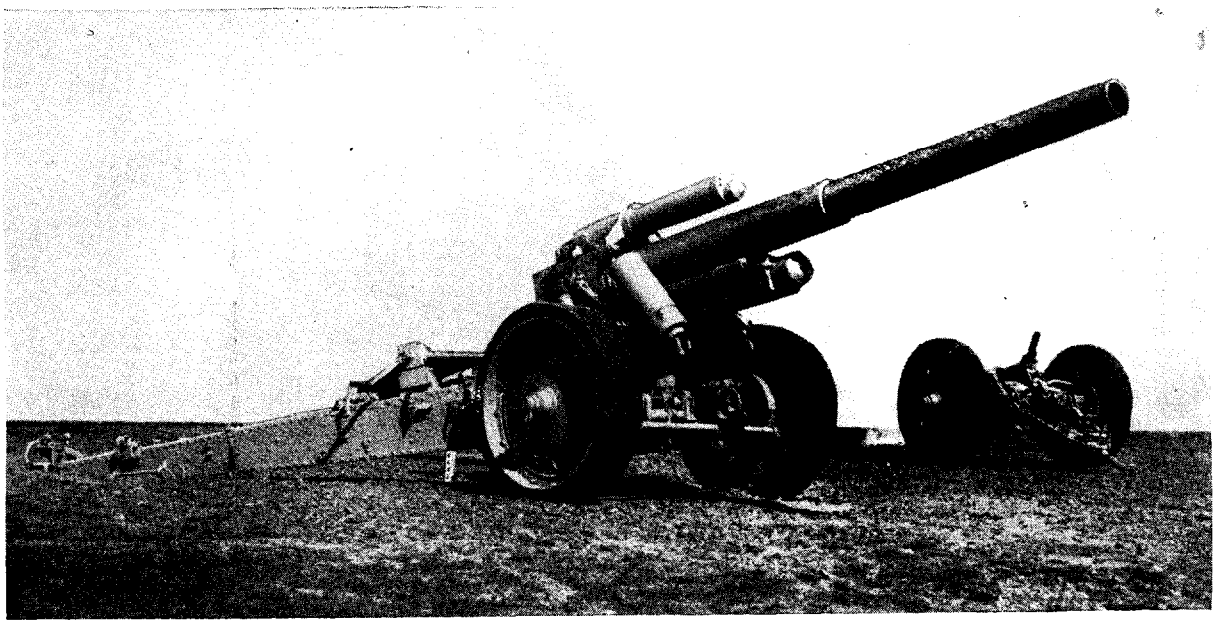


Figure 37.—15 cm s. F.H. 18 (150-mm medium howitzer) in firing position.

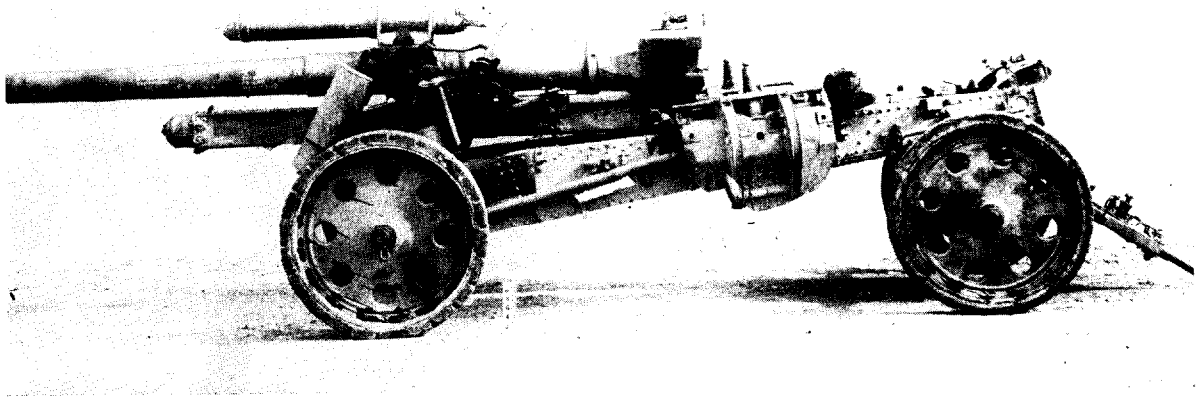


Figure 38.—15 cm s. F.H. 18 (150-mm medium howitzer) in traveling position.

K. 18, the standard medium gun. The tube is solid, and loose in its jacket. The manually operated breech, with horizontal sliding block, has continuous-pull firing mechanism and cartridge case obturation. Spring equilibrators are fitted. The carriage has split-box trails, and double-disk, solid rubber-tired wheels. A new model of this weapon, called the *15 cm s. F. H. 18/40,* is fitted with a muzzle brake. The same ammunition is fired at higher muzzle velocity, 1,952 feet per second, increasing maximum range to 16,514 yards. An *s. F. H. 42,* a further modification, has also been reported.

(2) *Characteristics.*

Caliber .....150 mm (5.866 inches).
Length of tube.....14 feet, 5.46 inches.
Weight in action.....12,096 pounds.
Maximum range.....14,630 yards.
Muzzle velocity.....1,705 feet per second. (with charge 8)
Traverse .....60°.
Elevation ..... 1° 30′ to + 45°.
Traction .....Horse- or tractor-drawn.

(3) *Ammunition.* HE, anti-concrete, AP, and smoke projectiles are fired. Projectiles weigh 95.7 pounds. The propellent charge consists of eight increments.

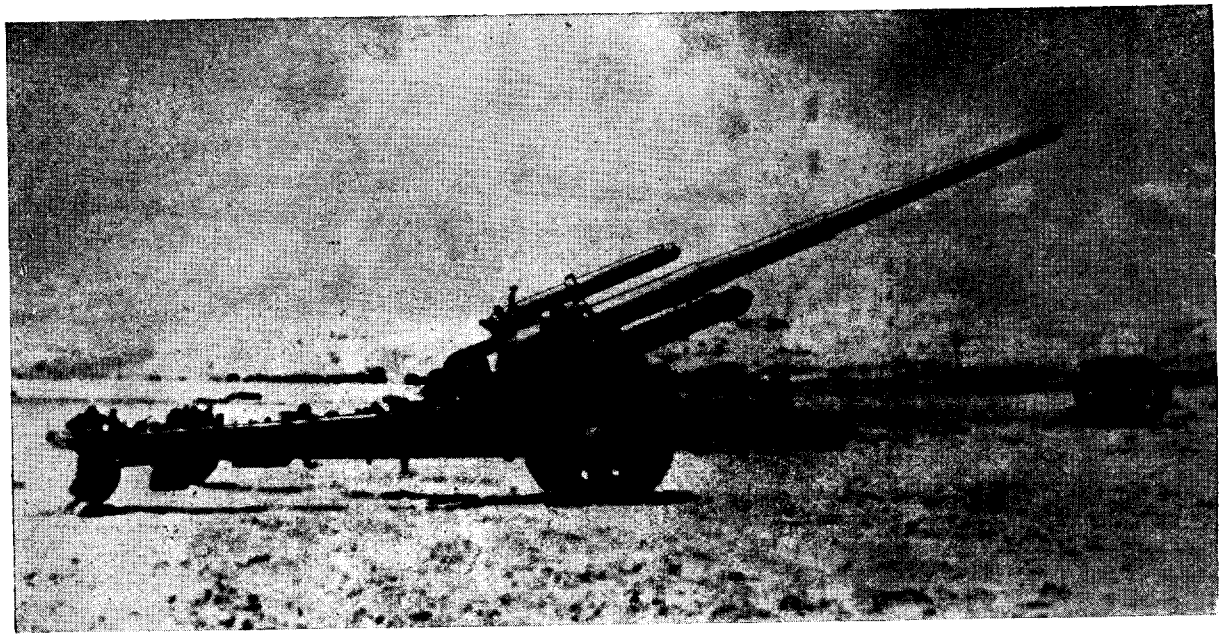


Figure 39.—s. 10 cm K. 18 (105-mm medium gun) in firing position.

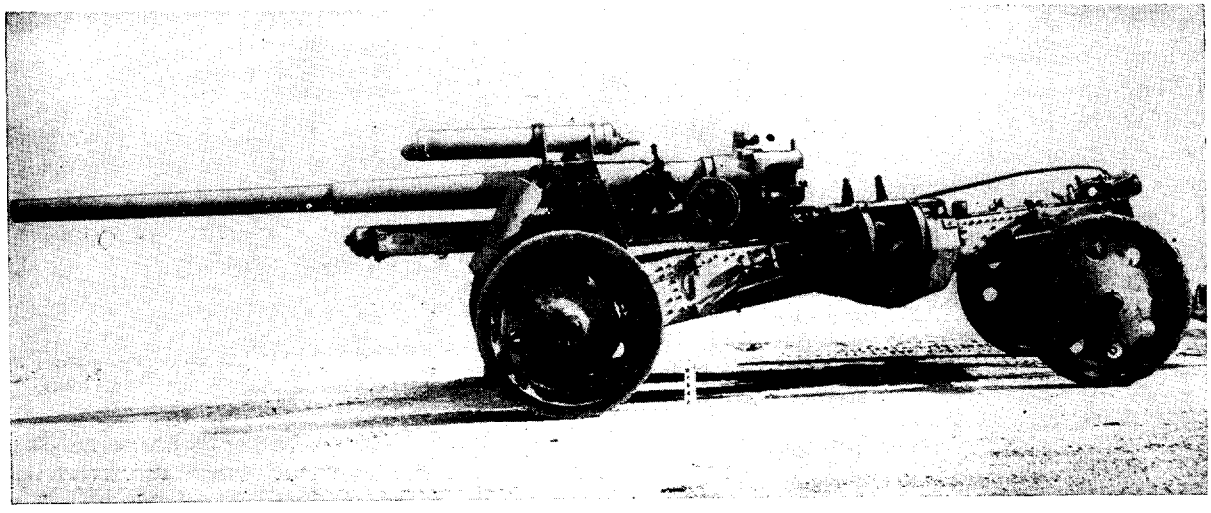


Figure 40.—s. 10 cm K. 18 (105-mm medium gun) with tube in traveling position.

d. 105-MM MEDIUM GUN (*s. 10 cm K. 18*).

(1) *General description.* The *10 cm K. 18* is the standard medium gun. It has a mount interchangeable with that of the *15 cm s. F. H. 18.* The breech is hand-operated, with horizontal sliding block and cartridge case obturation.

(2) *Characteristics.*

Caliber .....105 mm (4.14 inches).
Length of tube.....17 feet 11.28 inches.
Weight in action.....11,424 pounds.
Maximum range.....20,850 yards.
Muzzle velocity.....2,740 feet per second.
Traverse .....60°.
Elevation .....—1° 30′ to + 45°.
Traction .....Horse- or motor-drawn.

(3) *Ammunition.* HE, AP, and APCBC projectiles are fired. Projectile weights are: HE, 33.5 pounds, AP, 31.25 pounds; APCBC, 34.63 pounds. Three charges, small, medium, and large, are used.

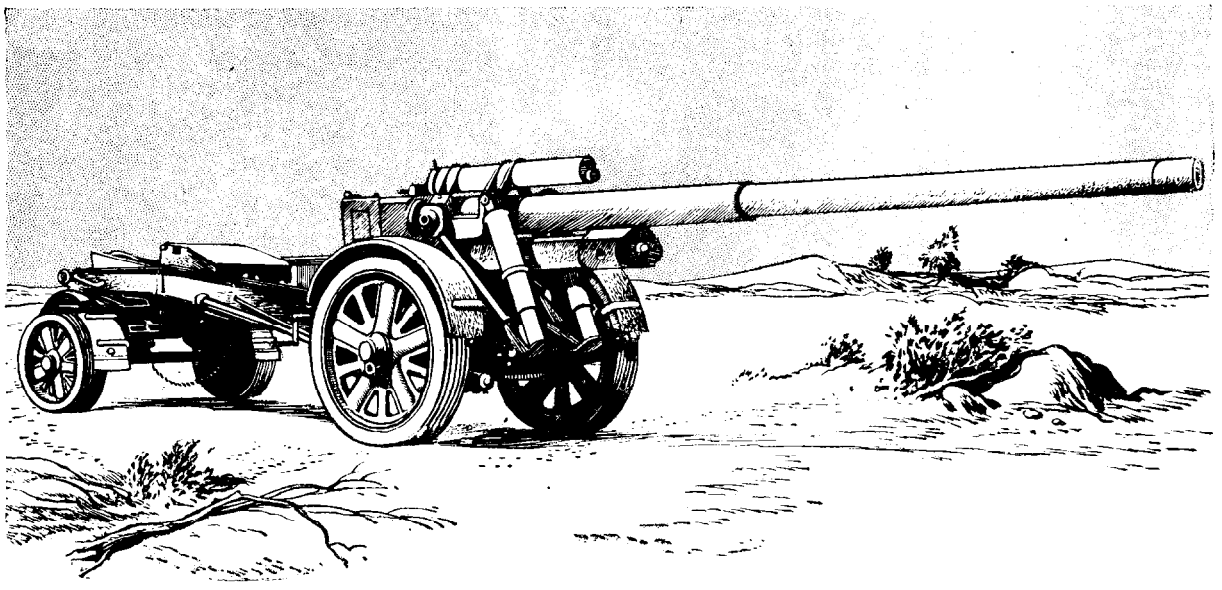


Figure 41.—15 cm K. 18 (150-mm heavy gun) in traveling position.

e. 150-MM GUN (*15 cm K. 18*). (1) *General description.* The *15 cm K. 18* has the characteristic features of German "18" class field artillery design, including the recuperator above and the buffer below the tube. A cartridge case accomplishes obturation, and the usual horizontal sliding breechblock is manually operated. Two hydropneumatic equilibrators are bolted to the tube jacket. The mount is sprung on two wheels, and has a box trail.

(2) *Characteristics.*

Caliber .....150 mm (5.9 inches).
Length of tube.....27 feet, 0.5 inch.
Weight in action.....14.22 tons.
Maximum range.....27,040 yards.
Muzzle velocity.....2,838 feet per second.
Traverse .....12°.
Elevation .....—40° to + 45°.
Traction .....Motor-drawn.

(3) *Ammunition.* HE streamline, AP, and anti-concrete projectiles are fired. Projectile weights are: HE, 94.6 pounds and anti-concrete, 95.7 pounds.

f. 150-MM GUN (*15 cm K. 39*). (1) *General description.* The *15 cm K. 39,* a later version of the *15 cm K. 18,* is used either as a field gun on its split-trail, rubber-tired carriage, or as a coast defense gun, with its field carriage mounted on the turntable of an emplaced platform.

(2) *Characteristics.*

Caliber .....150 mm (5.9 inches).
Length of tube.....27 feet 0.84 inch.
Weight in action.....13.44 tons.
(without platform)
Maximum range.....27,040 yards.
Muzzle velocity.....2,838 feet per second.
Traverse on wheels....60°.
Traverse on platform..360°.
Elevation .....— 4° to + 45°.
Traction .....Motor-drawn.

(3) *Ammunition.* The gun fires HE streamline, anti-concrete, semi-AP, and AP projectiles. Projectile weights are: HE 94.6 and 99.25 pounds; anti-concrete, 95.7 pounds; semi-AP 99.25 pounds; AP, 99.25 pounds.

g. 170-MM GUN (*17 cm K. in Mörser Lafette*). (1) *General description.* The *17 cm K. in Mrs. Laf.* is a long-range, mobile gun mounted on the *21 cm Mörser 18* (210-mm howitzer) carriage. It has a built-up tube, and a separate recoil mechanism for the upper carriage, which also moves in recoil. The breech mechanism is operated manually. The gun has a horizontal sliding block and cartridge case obturation. In spite of its weight, the gun can be put into and taken out of action very rapidly. A firing platform is lowered by jacks, and the wheels are raised for firing. One man, with a trail spike, can traverse the gun 360 degrees around this platform.

(2) *Characteristics.*

Caliber .....170 mm (6.79 inches).
Length of tube.....28 feet 3.6 inches.
Weight in action.....19.04 tons.
Maximum range.....32,370 yards.
(HE streamline)
Muzzle velocity.....3,035 feet per second.
(HE streamline)

Figure 42.—17 cm K. in Mrs. Laf. (170-mm gun mounted on 210-mm howitzer carriage).

Traverse (on traversing arc) .....16°.
Elevation .....70° (Actually limited to 50° by a stop).

(3) *Ammunition.* HE streamline, HEBC streamline, and AP projectiles are fired. The HE projectile weighs 138 pounds, and the HEBC, 148 pounds.

h. 210-MM HOWITZER (*21 cm Mörser 18*). (1) *General description.* The *21 cm Mörser 18* is the standard heavy howitzer. The piece recoils in a cradle trunnioned to an upper carriage. This upper carriage also moves in recoil along a lower carriage. The breech mechanism is operated manually, and has a horizontal sliding block with cartridge case obturation. In action, a firing platform is lowered on jacks and the wheels are raised; the rear of the trail is supported by a traversing path. When traveling, a two-wheeled trailer is attached to and supports the trail, while a separate traveling carriage supports the tube.

(2) *Characteristics.*

Caliber .....210 mm (8.27 inches).
Length of tube.....21 feet 4.37 inches.
Weight in action.....36,740 pounds.
Maximum range.....18,300 yards.
Muzzle velocity.....1,854 feet per second.

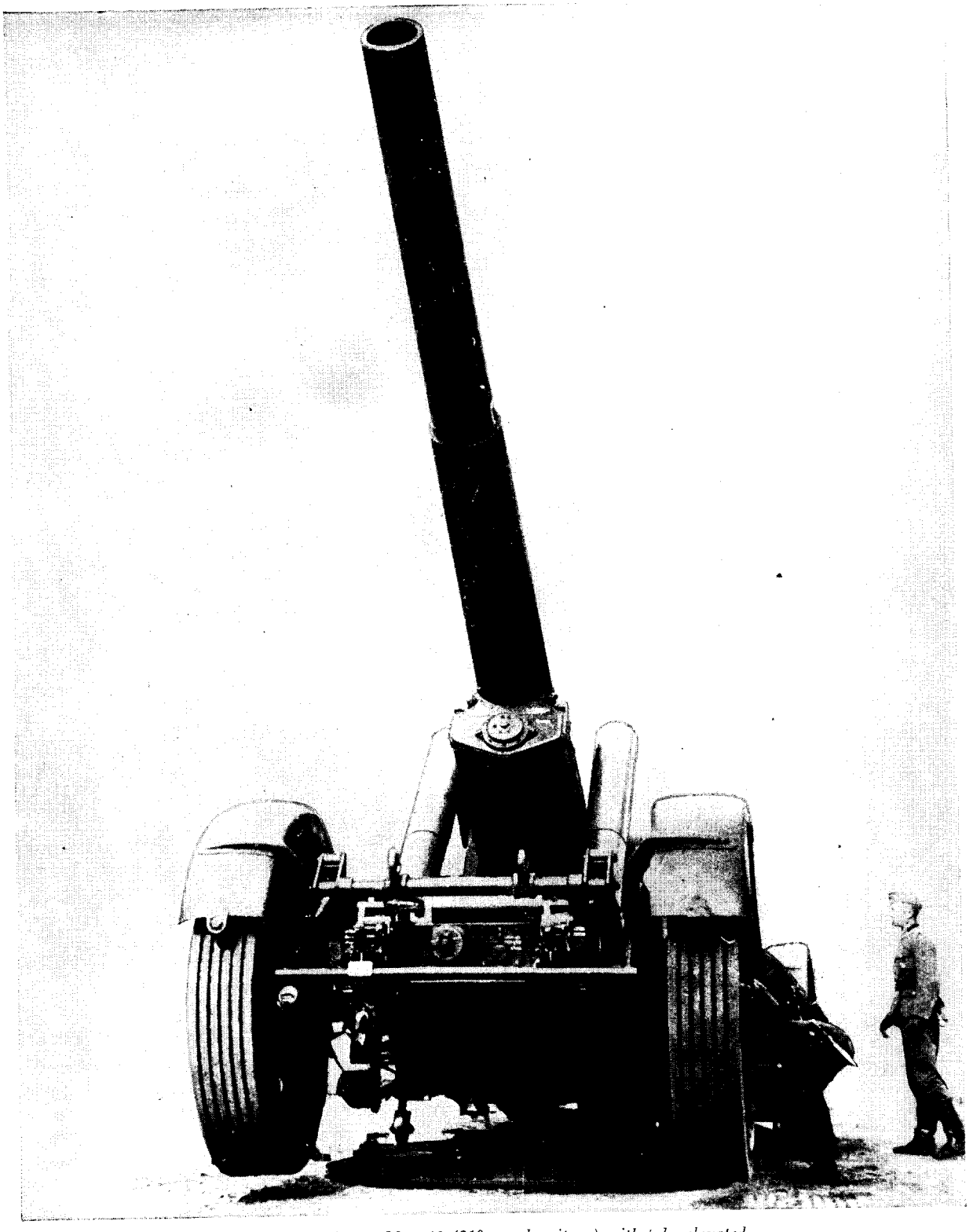


Figure 43.—21 cm Mrs. 18 (210-mm howitzer) with tube elevated.

Traverse .....16°.
Elevation .....70°.
Traction .....Motor-drawn.

(3) *Ammunition.* HE streamline and anti-concrete projectiles are fired, as well as a fin-stabilized, anti-concrete stick bomb. The HE projectile weighs 249 pounds, and the anti-concrete projectile 268 pounds.

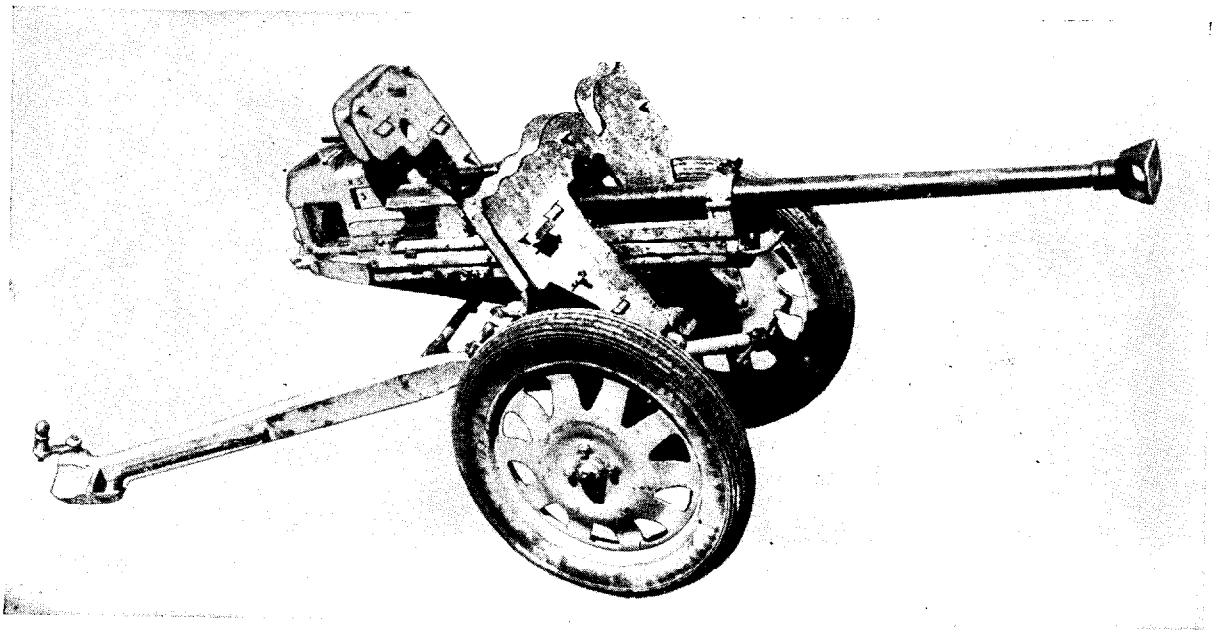


Figure 44.—2.8 cm s. Pz. B 41 (28/20-mm tapered-bore antitank gun).

6. Antitank Artillery

a. 28/20-MM ANTITANK GUN (*2.8 cm s. Pz. B 41*). (1) *General description.* This first Gerlich high velocity tapered-bore antitank gun appeared in 1941. The monobloc tube has a semi-

Figure 45.—Airborne version of 2.8 cm s. Pz. B. 41 (28/20-mm tapered-bore antitank gun).

automatic breech with horizontal sliding-wedge block, and is fitted with a muzzle brake. An airborne version exists which consists of an identical tube on a light alloy cradle and two-wheeled tubular mount. This version weighs 260 pounds.

(2) *Characteristics.*

Caliber (initial).....28 mm (1.1 inches).
(emergent)....20 mm (0.78 inch).
Length of tube.....5 feet 7.62 inches.
Weight in action.....501 pounds.
Muzzle velocity.....4,600 feet per second.
Traverse .....90°.
Elevation .....−5° to + 45°.

(3) *Ammunition.* HE and AP (tungsten carbide core) rounds are fired. Projectile weights are: HE, 3.1 ounces; and AP, 4.6 ounces. The AP ammunition will penetrate 53 mm (2.09 inches) at 400 yards, 30 degrees from normal.

b. 37-MM ANTITANK GUN (*3.7 cm Pak*). (1) *General description.* Formerly the main German antitank gun, this weapon is still likely to be met. AP 40 ammunition gives the gun a reasonable penetration performance at ranges up to 400 yards. The breechblock is horizontal sliding type, and the shield is $^{3}/_{16}$-inch armor plate.

(2) *Characteristics.*

Caliber .....37 mm (1.45 inches).
Length of tube.....5 feet 5.52 inches.
Weight in action..... 970 pounds.
Muzzle velocity (AP40) .3,450 feet per second.
Muzzle velocity (AP) . 2,625 feet per second.
Traverse .....60°.
Elevation ..... -8° to + 25°.
Traction .....Motor-drawn; carried in truck; airborne.

(3) *Ammunition.* HE, AP, and AP 40 projectiles are fired, as well as a hollow-charge stick bomb. Projectile weights are: HE, 1.38 pounds; AP, 1.5 pounds; and AP 40, 12.5 ounces. The stick bomb, 6.25 inches in diameter, weighs 18.75 pounds. Penetration of homogeneous armor at 400 yards, 30 degrees from normal, firing AP 40

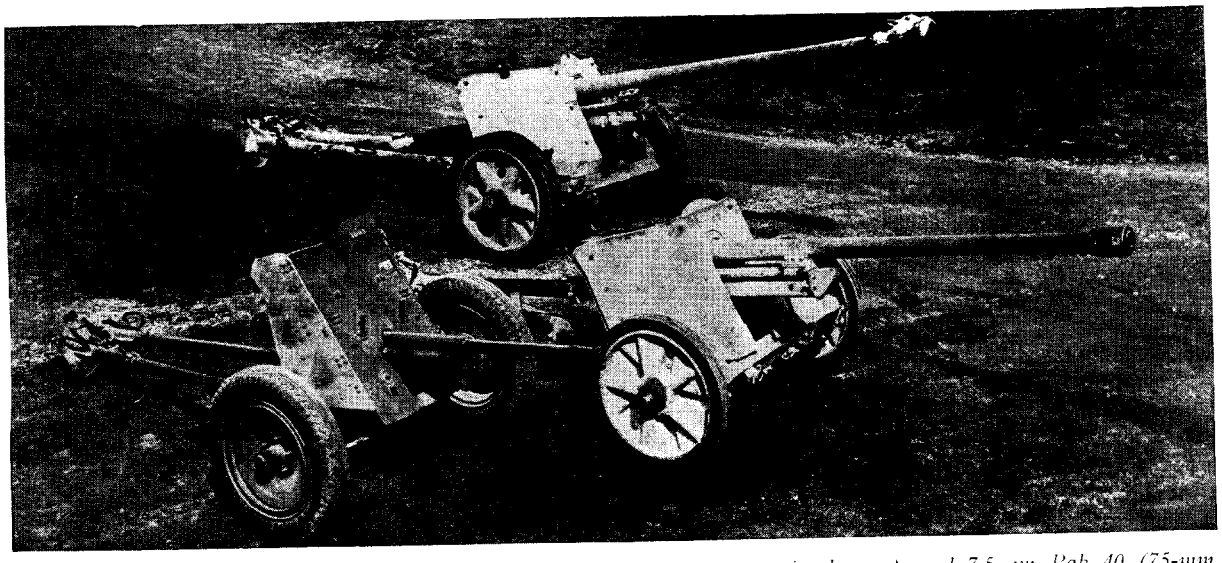


Figure 46.—3.7 cm Pak (37-mm antitank gun), 5 cm Pak 38 (50-mm antitank gun), and 7.5 cm Pak 40 (75-mm antitank gun) (front to rear).

ammunition is 49 mm (1.93 inches). The stick bomb will penetrate about 6 inches of homogeneous plate. The range at which a moving target may be hit does not exceed 150 yards.

c. 42/28-MM ANTITANK GUN (*4.2 cm le. Pak 41*). (1) *General description.* The *4.2 cm le. Pak 41* is the second of the tapered-bore antitank gun series. The monobloc tube is long with obvious external as well as internal taper, and has no muzzle brake. The horizontal sliding breechblock is hand-operated. The mount is identical with that of the *3.7 cm Pak,* but with a double upper shield. A second shield, 3/16-inch thick, is riveted to the standard shield, with an intervening space of approximately 1⅝ inches.

(2) *Characteristics.*

Caliber (initial).....42 mm (1.65 inches).
(emergent)....28 mm (1.1 inches).
Length of tube.....7 feet 4.5 inches.
Weight in action.....990 pounds.
Muzzle velocity.....4,100 feet per second.
Traverse .....44°.
Elevation .....- 8° to + 32°.
Method of traction.....Motor-drawn.

(3) *Ammunition.* HE and AP (Tungsten carbide core) rounds are fired. Projectile weights are: HE, 0.56 pound, and AP, 0.69 pound. At 700 yards this weapon, firing AP ammunition, will penetrate 68 mm (2.88 inches) of armor at 30 degrees from normal.

d. 50-MM ANTITANK GUN (*5 cm Pak 38*). (1) *General description.* This gun, introduced in 1941 to replace the *3.7 cm Pak,* is mounted on a split-trail carriage of conventional design. The monobloc tube is fitted with a muzzle brake, and

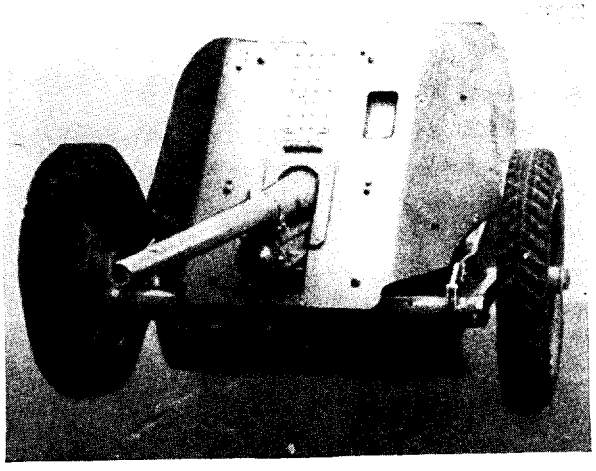


Figure 47.—4.2 cm le. Pak 41 (42/28-mm tapered-bore antitank gun) showing front of double shield.

the breech mechanism is semiautomatic with a horizontal sliding block. Solid rubber tires are fitted, and the shield consists of two 4-mm armor plates about 1 inch apart.

(2) *Characteristics.*

Caliber .....50 mm (1.97 inches).
Length of tube.....10 feet 4.96 inches.
Weight in action.....2,016 pounds.
Muzzle velocity (AP40).3,940 feet per second.
Muzzle velocity (AP)..2,740 feet per second.
Muzzle velocity (HE).1,800 feet per second.
Traverse .....65°.
Elevation .....- 18° to + 27°.
Traction .....Half-tracked tractor.

(3) *Ammunition.* Projectile weights are: AP, 4.56 pounds; AP 40, 2.025 pounds; and HE, 3.94 pounds. Penetration, firing AP ammunition, is 56 mm (2.2 inches) of armor at 1,000 yards at 30 degrees from normal.

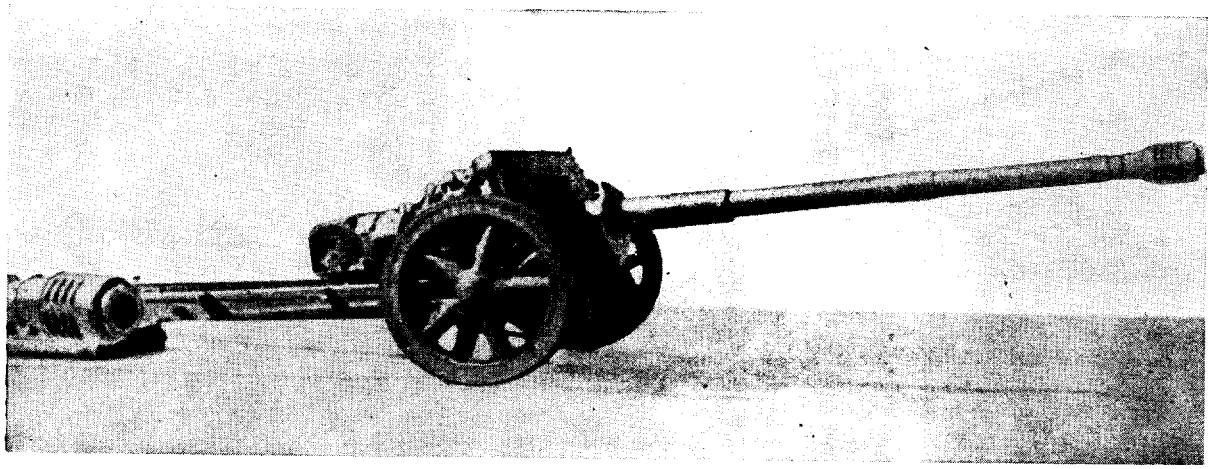


Figure 48.—7.5 cm Pak 41 (75/55-mm tapered-bore antitank gun).

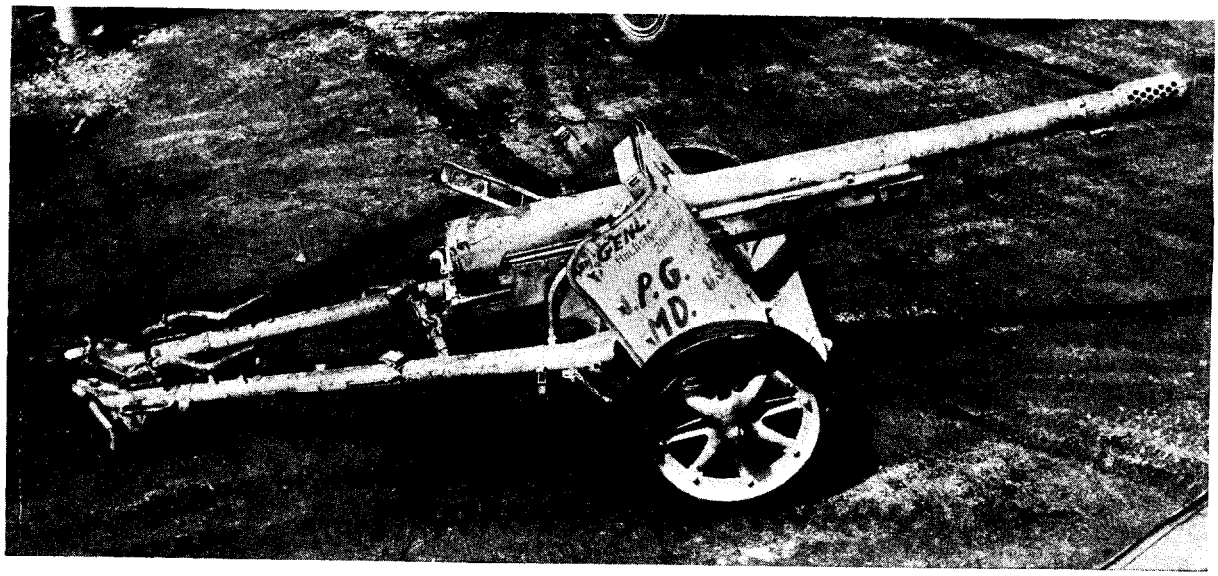


Figure 49. 7.5 cm Pak 97/38 (75-mm antitank gun) with Solothurn muzzle brake.

e. 75-MM ANTITANK GUN (*7.5 cm Pak 40*). (1) *General description.* The *7.5 cm Pak 40* is similar in appearance to the *5 cm Pak 38*. The monobloc tube is fitted with a double-baffle muzzle brake, and the breech mechanism is semiautomatic with a horizontal sliding block. The carriage, with tubular split trail, has solid-rubber-tired wheels and torsion bar suspension and may be towed at about 25 miles an hour. The shield consists of two 4-mm armor plates spaced about 1 inch apart.

(2) *Characteristics.*

Caliber .....75 mm (2.95 inches).
Length of tube.....11 feet 4 inches.
Weight in action.....3,136 pounds.
Muzzle velocity (AP40) .3,250 feet per second.
Muzzle velocity
(APCBC) .....2,530 feet per second.
Muzzle velocity (HE) .1,800 feet per second.
Muzzle velocity (hollow
charge) .....1,476 feet per second.
Traverse .....65°.
Elevation ..... 5° to + 22°.
Traction .....Motor-drawn.

(3) *Ammunition.* Weights of projectiles fired from this gun are: HE, 12.54 pounds; APCBC, 15 pounds; AP shot, 9.125 pounds; hollow charge, 9.97 pounds; and smoke 13.7 pounds. With APCBC ammunition, penetration of homogeneous armor is 102 mm (4.02 inches) at 30 degrees from normal, at 1,000 yards.

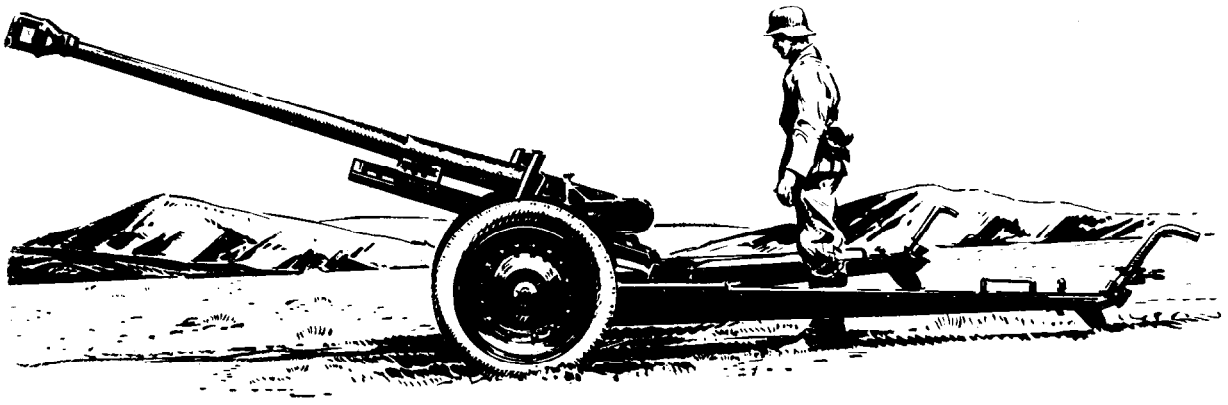


Figure 50.—7.62 cm Pak 36 (r) (3-inch antitank gun).

f. 75/55-MM ANTITANK GUN (*7.5 cm Pak 41*). (1) *General description.* This was the third tapered-bore antitank gun to be introduced. It has a muzzle brake, and a semiautomatic vertical sliding breechblock. A cylindrical cradle, covering the rear half of the tube, is attached to the shield by a spherical universal joint.

(2) *Characteristics.*

Caliber (initial) .....75 mm (2.95 inches).
Caliber (emergent) .....55 mm (2.17 inches).
Length of tube.....13 feet 7.375 inches.
Weight in action.....3,136 pounds.
Muzzle velocity (estimated).....3,936 feet per second.
Traverse .....60°.
Elevation .....—10° to + 18°.
Traction .....Motor-drawn.

(3) *Ammunition.* AP and HE projectiles are fired. The AP projectile weighs 5.68 pounds, of which 2.01 pounds is tungsten carbide core. The AP projectile will penetrate 130 mm (5.12 inches) of homogeneous armor plate at 30 degrees from normal at 1,000 yards.

g. 75-MM ANTITANK GUN (*7.5 cm Pak 97/38*). (1) *General description.* This weapon, originally introduced in 1942, consists of the well known French 75-mm gun, Model 1897, mounted on the *5 cm Pak 38* carriage, and fitted with a long perforated muzzle brake. The breech mechanism is hand-operated with eccentric screw-type block.

(2) *Characteristics.*

Caliber .....75 mm (2.95 inches).
Length of tube.....9 feet 8 inches.
Weight in action.....2,624 pounds.
Muzzle velocity (HE).1,788-1,892 feet per second.
Muzzle velocity (hollow charge) .....1,476 feet per second.
Muzzle velocity (AP)..1,870 feet per second.
Traverse .....60°.
Elevation .....—8° to + 25°.
Traction .....Motor-drawn.

(3) *Ammunition.* AP, HE, and hollow-charge projectiles are fired. AP and HE projectiles weigh 14.8 pounds, and 13.4 pounds respectively.

h. 3-INCH ANTITANK GUN (*7.62 cm Pak 36 (r)*. (1) *General description.* The *76.2 cm Pak 36 (r)* is a German modified antitank version of the 7.62-cm Russian field gun, 296 (r). The built-up tube is rebored to take a longer cartridge case, and a two-baffle muzzle brake is added. The breech mechanism is semiautomatic with a vertical sliding block.

(2) *Characteristics.*

Caliber .....76.2 mm (3 inches).
Length of tube.....12 feet 9.35 inches.
Weight in action (without shield).....3,564 pounds.
Muzzle velocity (APCBC) .....2,430 feet per second.
Muzzle velocity (HE).1,805 feet per second.
Muzzle velocity (AP40).3,520 feet per second.
Traverse .....60°.
Elevation .....5° to + 75°.
Traction .....Motor-drawn.

(3) *Ammunition.* APCBC, AP 40, and HE projectiles are fired. Projectile weights are: APCBC, 16.72 pounds; AP 40, 9.24 pounds; HE, 12.64 pounds. Penetration, firing APCBC projectiles at 1,000 yards at 30 degrees from normal, is 83 mm (3.27 inches) of homogeneous armor plate.

i. 3-INCH ANTITANK GUN (*7.62 cm Pak 39*).

(1) *General description.* This 3-inch antitank gun is a modified version of the Russian field gun *7.62 cm F.K. 297 (r)*. The chamber is bored out, and a *7.62 Pak 36* muzzle brake is fitted. The breech mechanism is semiautomatic with a vertical sliding block. The mount has box-type trails and pneumatic tires.

(2) *Characteristics.*

Caliber .....76.2 mm (3 inches).
Length of tube.....11 feet 5 inches.
Weight in action.....3,360 pounds.
Muzzle velocity.....2,230 feet per second.
Traverse .....57°.
Elevation .....—6° to + 45°.
Traction .....Motor-drawn.

(3) *Ammunition.* This gun fires the same ammunition as the *7.62 cm Pak 36 (r)*, but has somewhat lower performance.

j. 88-MM ANTITANK GUN (*8.8 cm Pak 43*).

(1) *General description.* The *8.8 cm Pak 43* is an electrically fired, semiautomatic gun on a two-bogie cruciform mount. It may be fired from its wheels if the direction of fire is within 30 degrees of the longitudinal girders, but must be fired with its platform on the ground when used in an artillery role. With platform down, the top of the shield is only 5 feet 6⅞ inches high. An automatic firing cut-out restricts elevation when firing over the legs to 12 degrees on early mounts and 16 degrees on later mounts. The *8.8 cm Pak 43* is ballistically identical with the *8.8 cm Pak 43/41*.

(2) *Characteristics.*

Caliber .....88 mm (3.45 inches).
Length of tube.....21 feet 7.25 inches.
Weight in action.....8,000 pounds.
Muzzle velocity (HE) 2,460 feet per second.
Muzzle velocity (APCBC) .....3,280 feet per second.
Muzzle velocity (AP40) .3,705 feet per second.
Traverse .....360°.
Elevation .....8° to + 40°.
Traction .....Tractor.

(3) *Ammunition.* Weight of projectiles fired from this gun are: HE, 20.68 pounds; APCBC, 22 pounds, and 22.36 pounds; AP 40, 16 pounds; Hollow charge, 16.8 pounds. At 1,500 yards, the APCBC and AP 40 projectiles will penetrate approximately 130 mm (5.12 inches) of homogeneous armor plate at 30 degrees from normal.

k. 88-MM ANTITANK GUN (*8.8 cm Pak 43/41*).

(1) *General description.* This 88-mm gun, 71 calibers long, is mounted on an orthodox two-wheeled carriage. The legs of the split trail are hinged to a base which also mounts the upper carriage. The wheels, on stub axles, are sprung independently. The gun has a four-point support when firing. A muzzle brake is fitted, and the breech mechanism is semiautomatic with a horizontal sliding block.

(2) *Characteristics.*

Caliber .....88 mm (3.46 inches).
Length of tube.....21 feet 7.25 inches.
Weight in action.....9,660 pounds.
Muzzle velocity (AP40) .3,705 feet per second.
Muzzle velocity (APCBC) .....3,280 feet per second.
Muzzle velocity (HE) .2,460 feet per second.
Muzzle velocity (hollow charge) .....1,968 feet per second.
Traverse .....50°.
Elevation .....5° to + 38°.
Traction .....Motor-drawn.

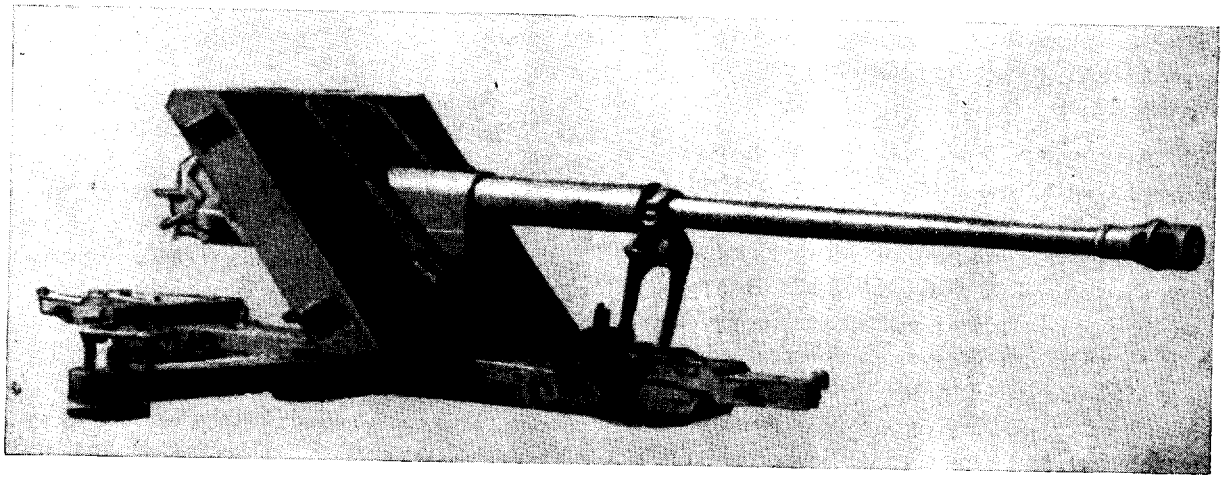


Figure 51.—8.8 cm Pak 43 (88-mm antitank gun) on a cruciform mount.

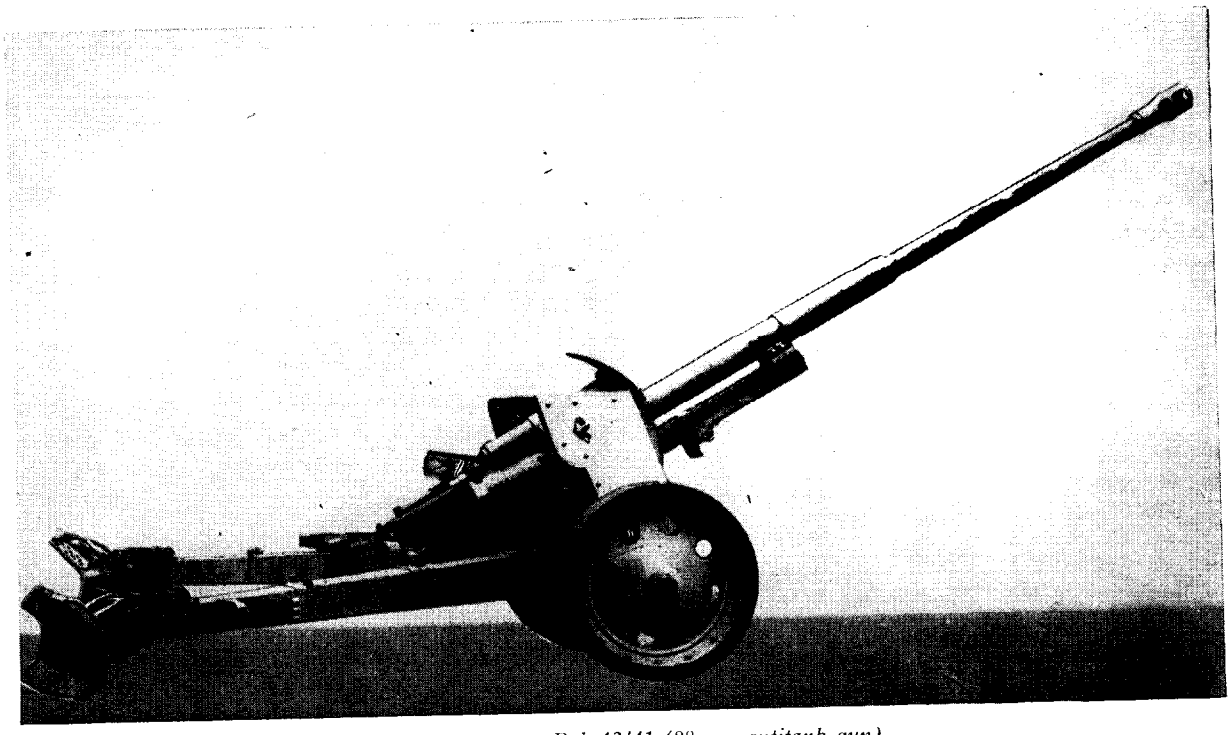


Figure 52.—8.8 cm Pak 43/41 (88-mm antitank gun).

(3) *Ammunition.* Projectile weights are: HE, 20.68 pounds; APCBC, 22.36 pounds, and 22 pounds; AP 40, 16 pounds; hollow charge, 16.8 pounds. At 1,500 yards, the APCBC and AP 40 projectiles will penetrate approximately 130 mm (5.12 inches) of homogeneous armor plate at 30 degrees from normal.

7. Antiaircraft Artillery

a. General. German antiaircraft guns have been increasingly developed as dual-purpose, or as with the 88-mm antiaircraft gun, multipurpose weapons. All standard German antiaircraft guns may be used against ground targets, and armor-piercing ammunition is available in all calibers. (Antiaircraft rocket weapons are described in Section VII.)

b. Automatic Weapons. (1) *20-mm Antiaircraft Gun (2 cm Flak 30).* (a) *General description.* The *2 cm Flak 30* was the standard light antiaircraft gun until the introduction of the *2 cm Flak 38* and the *Flakvierling 38.* It is recoil-operated, fed by a 20-round magazine, and may be fired either full or semiautomatic. A combined flash hider and muzzle brake is used The carriage consists of an undercarriage leveled by three adjustable feet, and a top carriage supported on ball bearings.

(b) *Characteristics.*

Caliber .....20 mm (0.79 inch).
Length of tube.....56.6 inches.
Weight in action.....1,064 pounds.
Effective ceiling.....3,500 feet.
Maximum horizontal range .....5,230 yards.
Rate of fire: practical..120 rounds per minute.
Muzzle velocity (HE).2,950 feet per second.
Muzzle velocity (AP)..2,625 feet per second.
Muzzle velocity (AP40).3,250 feet per second.
Traverse .....360°.
Elevation .....−12 to +90°.
Traction .....Motor-drawn or SP.
Antiaircraft sights: *Flakvisier 35, Lineakvisier 21, Schwebekreisvisier 30/38.*

(c) *Ammunition.* Projectile weights are: HE, 4.2 ounces; AP, 5.2 ounces; and AP 40, 3.6 ounces.

(2) *20-mm Antiaircraft Gun (2 cm Flak 38).* (a) *General description.* The *2 cm Flak 38* was introduced to replace the *2 cm Flak 30.* It is operated by short-barrel recoil, and the residual pressure of gas in the barrel. Except for a higher cyclic rate of fire, it does not differ in performance from the *Flak 30.* This gun also is mounted on a 760-pound carriage, which may be disassembled easily into 27 loads for mountain warfare. The total weight of the gun on this light mount is 1,013 pounds. This combination is designated *2 cm Geb. Flak 38.* (The normal *2 cm Flak 38* gun and mount weigh 1,650 pounds traveling.)

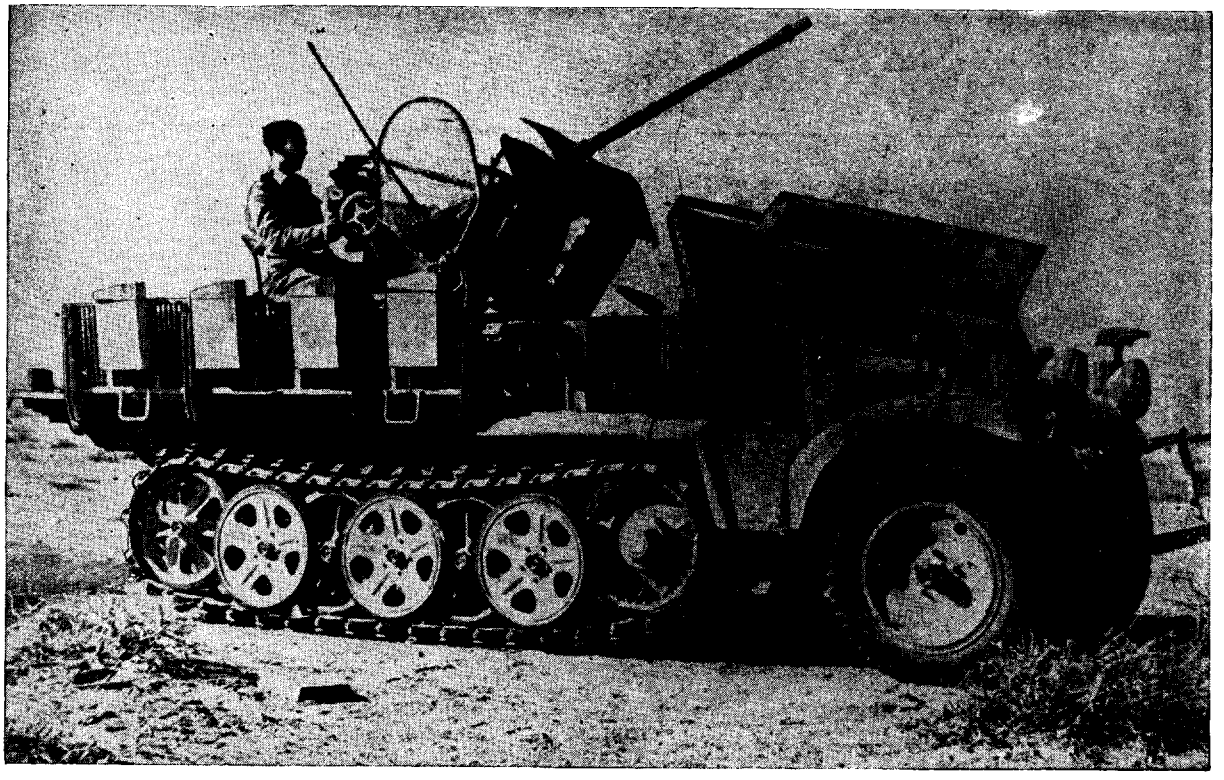


Figure 53.—2 cm Flak 30 (20-mm antiaircraft gun) on half-track.

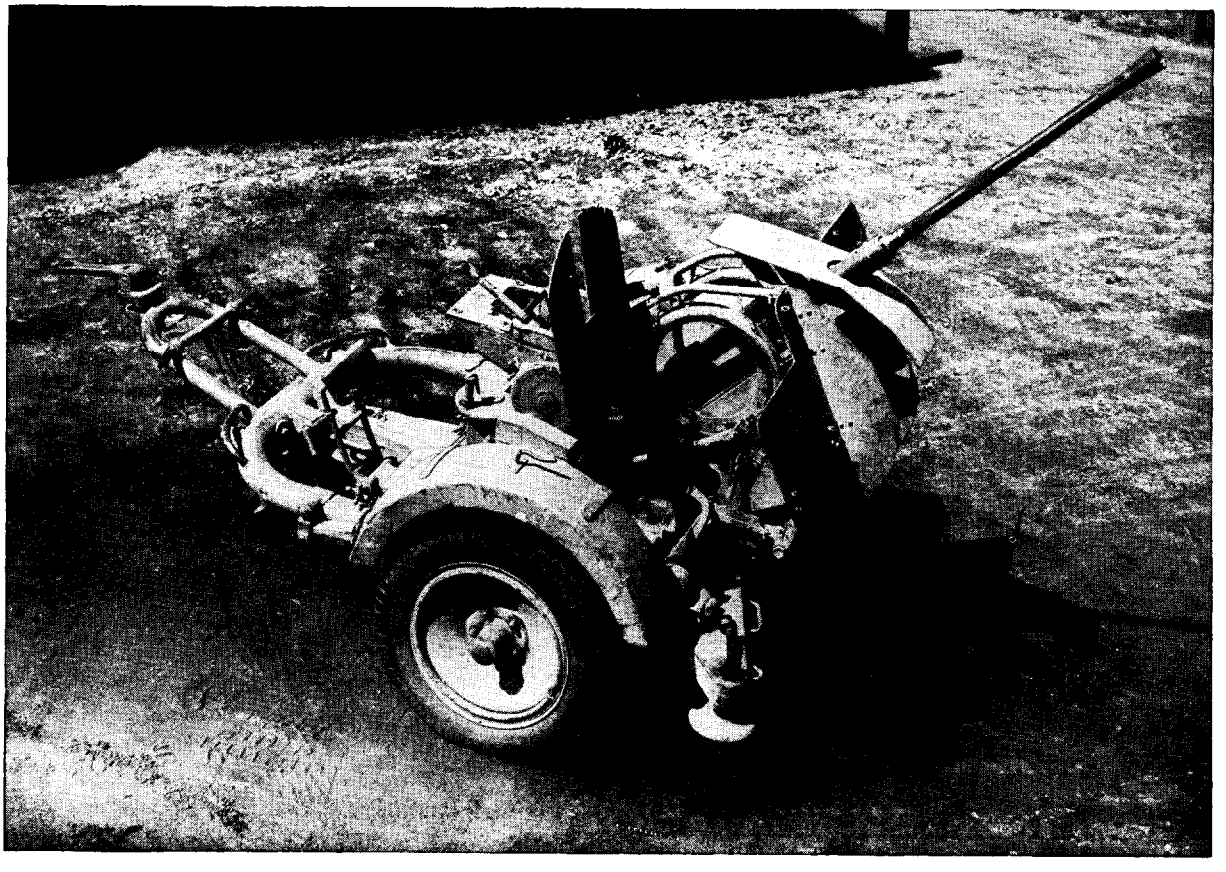


Figure 54.—2 cm Flak 38 (20-mm antiaircraft gun).

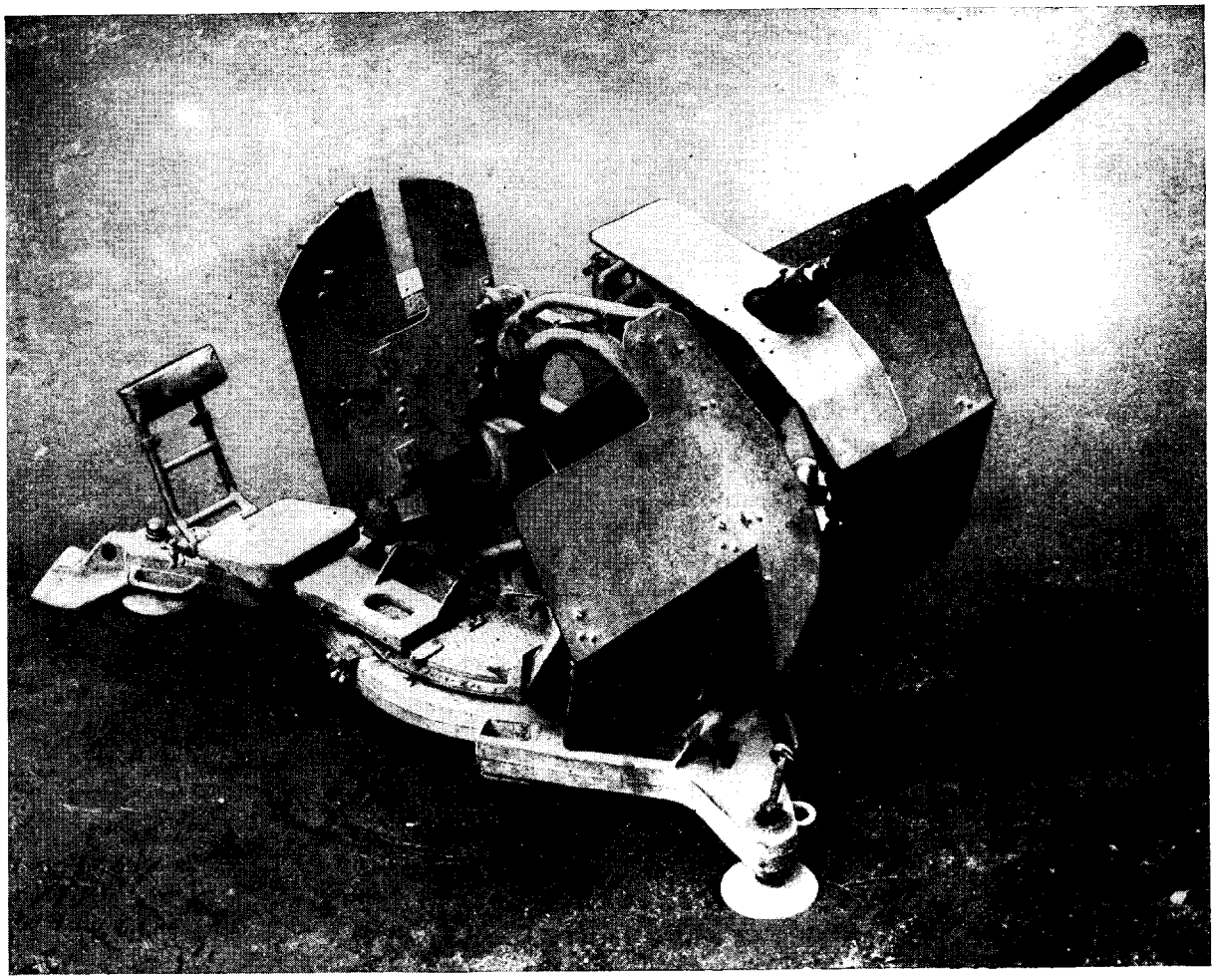


Figure 55.—2 cm Flak 38 in firing position.

Figure 56.—2 cm Geb. Flak 38 (20-mm mountain antiaircraft gun).

(b) *Characteristics.*

Caliber .....20 mm (0.79 inch).
Length of tube.....56.6 inches.
Weight in action.....896 pounds.
Effective ceiling.....3,500 feet.
Maximum horizontal range .....5,230 yards.
Rate of fire: practical..180 to 220 rounds per minute.
Muzzle velocity (HE).2,950 feet per second.
Muzzle velocity (AP)..2,625 feet per second.
Muzzle velocity (AP40).3,250 feet per second.
Traverse .....360°.
Elevation .....—20° to +90°.
Traction .....Motor-drawn, RR, SP.
Antiaircraft sights: *Flakvisier 38, Linealvisier 21, Schwebekreisvisier 30/38.*

(c) *Ammunition.* Weights of projectiles fired by this gun are: HE, 4.2 ounces; AP, 5.2 ounces; and AP 40, 3.6 ounces.

(3) *20-mm Four-Barreled Antiaircraft Gun (2 cm Flakvierling 38).* (a) *General description.* The *2 cm Flakvierling 38* consists of four *2 cm Flak 38's* on a triangular-base mount with three leveling jacks. Muzzle preponderance is counteracted by an equilibrator bolted to the mount.

(b) *Characteristics.*

Caliber .....20 mm (0.79 inch).
Length of tube.....56.6 inches.
Weight in action.....1.68 tons.
Effective ceiling.....3,500 feet.
Maximum horizontal range .....5,230 yards.
Rate of fire: practical..700 to 800 rounds per minute.
Muzzle velocity (HE).2,950 feet per second.
Muzzle velocity (AP)..2,625 feet per second.
Muzzle velocity (AP40).3,250 feet per second.
Traverse .....360°.
Elevation .....—10° to + 100°.
Traction .....Motor-drawn, SP, or static.
Antiaircraft sights: *Flakvisier 40, Linealvisier 21, Schroebekreisvisier 30/38.*

(c) *Ammunition.* Weights of projectiles fired are: HE, 4.2 ounces; AP, 5.2 ounces; AP 40, 3.6 ounces.

(4) *37-mm Antiaircraft Gun (3.7 cm Flak 18, 36, and 37).* (a) *General description.* The *3.7 cm Flak 18* has a monobloc tube, and an automatic action operated by barrel recoil and residual gas pressure. A combination muzzle brake and flash eliminator is fitted. The cruciform mount has two bogies, and screw-type leveling jacks. The *3.7 cm Flak 36* is identical ballistically with the

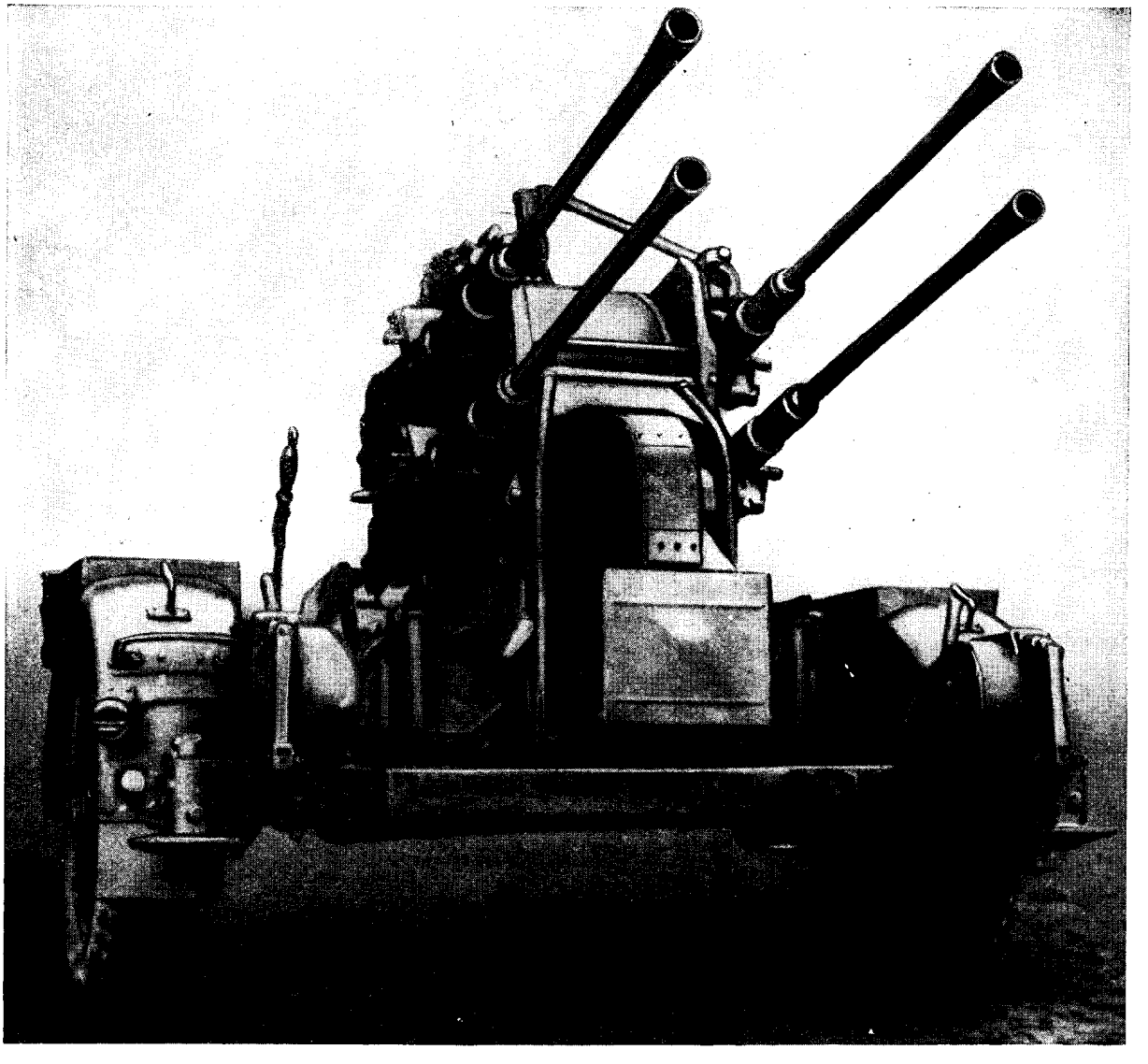


Figure 57.—2 cm Flakvierling 38 (20-mm four-barreled antiaircraft gun).

Figure 58.—3.7 cm Flak 36 (37-mm antiaircraft gun) mounted on half-track.

Flak 18. It is mounted on a triangular platform on three adjustable leveling feet. Piece and mount are carried on a two-wheeled trailer. Weight in action is 1.71 tons. The *3.7 cm Flak 37* consists of a normal *3.7 cm Flak 18* mounted on a modified carriage. Ballistically, it is identical with *3.7 cm Flak 18* and *36*.

(b) *Characteristics.*

Caliber .....37 mm (1.45 inches).
Length of tube.....10 feet 8.75 inches.
Weight in action.....1.93 tons.
Effective ceiling.....5,000 feet.
Maximum horizontal range .....7,200 yards.
Rate of fire: practical..80 rounds per minute.
Muzzle velocity.....2,690 feet per second.
Traverse .....360°.
Elevation .....—5° to + 85°.
Traction .....Motor-drawn.
Antiaircraft sights: *Flakvisier 33, Flakvisier 37 (for Flak 37), Schwebedornvisier.*

(5) *37-mm Antiaircraft Gun (3.7 cm Flak 43)*. (a) *General description.* Although this gun does not differ externally from the *3.7 cm Flak 18, 36,* and *37,* it has a completely different, fully automatic, gas-operated action. The gun is fed by eight-round clips on a fixed loading tray in the left side. Using a fixed firing pin, it fires on the forward movement of the bolt. Of low build, the *3.7 cm Flak 43* has a pedestal mount with a shield. A twin version known as the *Flakzwilling* exists, with one gun mounted above the other. The guns may be fired together or independently. In action the twin version weighs 3.08 tons.

(b) *Characteristics.*

Caliber .....37 mm (1.45 inches).
Length of tube.....9 feet 8.16 inches.
Weight in action.....1.37 tons.
Effective ceiling.....5,000 feet (approximate).
Maximum horizontal range .....7,200 yards (approximate).
Rate of fire: practical...150 rounds per minute.
theoretical.250 rounds per minute.
Muzzle velocity.....2,750 feet per second.
Traverse .....360°.
Elevation .....—6° to + 90°.
Traction .....Static emplacement, mobile mount, or SP.
Antiaircraft sights: *Flakvisier 43, Schwebedornvisier.*

(c) *Ammunition.* HE-tracer, HE-incendiary-tracer, AP-HE, HE-incendiary, and HE projectiles.

(6) *50-mm Antiaircraft Gun (5 cm Flak 41)*. (a) *General description.* The *5 cm Flak 41* is similar to the *3.7 cm Flak 36*. It is gas-operated, and is fired by the forward movement of the breech mechanism. Clips of five rounds are fed from the left. The mount is a triangular platform with two short outriggers forward.

(b) *Characteristics.*

Caliber .....50 mm (1.97 inches).
Weight in action.....3.42 tons.
Effective ceiling.....10,000 feet.
Maximum horizontal range .....14,760 yards.
Rate of fire: practical..130 rounds per minute.
Muzzle velocity.....2,755 feet per second.
Traverse .....360°.
Elevation .....—10° to + 90°.
Traction .....4-wheel trailer, motor-drawn.
Antiaircraft sight: *Flakvisier 41.*

(c) *Ammunition.* Projectile weights are: HE, 4.8 pounds; HE-incendiary-tracer, 4.8 pounds; AP, 4.87 pounds.

(7) *Miscellaneous.* The following antiaircraft automatic weapons possessed by the Germans in limited numbers may be encountered occasionally:

2 cm Flak 28 .....Oerlikon type.
4 cm Flak 28 .....Bofors type.
4.7 cm Flak .....Manufactured for the Czechslovakian Army by the Skoda works.

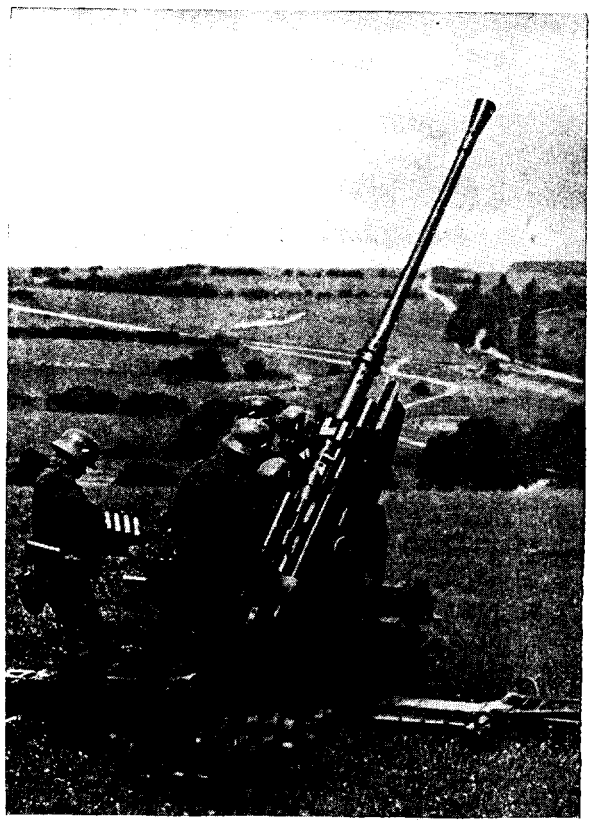


Figure 59.—3.7 cm Flak 18 (37-mm antiaircraft gun) being prepared for firing.

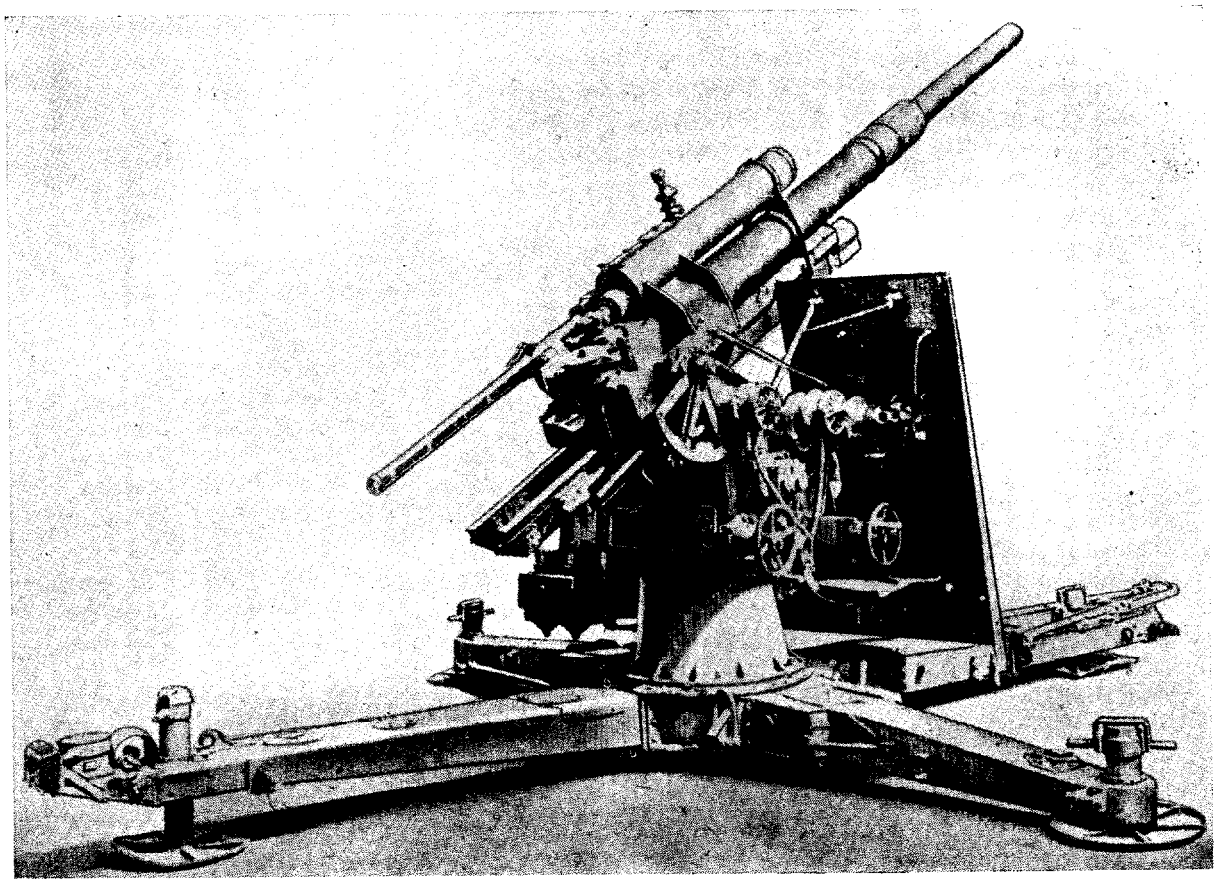


Figure 60.—8.8 cm Flak 36 (88-mm antiaircraft gun) in firing position.

Figure 61.—8.8 cm Flak 36 (88-mm antiaircraft gun) in traveling position.

c. HEAVY ANTIAIRCRAFT GUNS. (1) *88-mm Antiaircraft Gun (8.8 cm Flak 18, 36, and 37).* (a) *General description.* The 88-mm gun was produced first in 1934 as the standard mobile antiaircraft gun. The tube consists of either an outer tube with an inner locking tube and a loose three-section liner, or of a loose barrel fitting into a jacket. A semiautomatic, horizontal sliding-wedge breechblock is used. The mount has two outriggers to steady the gun for firing other than directly front or rear. The *8.8 cm Flak 36* differs from the *Flak 18* only in having a slightly different

mount, while the *8.8 cm Flak 37* is identical with the *Flak 36* except for a slightly different data transmission system.

(b) *Characteristics.*

Caliber .....88 mm (3.46 inches).
Length of tube.....15 feet 5 inches.
Weight in action.....5.49 tons.
Maximum ceiling.....32,500 feet.
Maximum horizontal range .....16,200 yards.
Rate of fire: practical..15 to 20 rounds per minute.
Muzzle velocity (HE).2,690 feet per second.
Muzzle velocity (AP)..2,600 feet per second.
Traverse .....360°.
Elevation .....—3° to + 85°.
Traction .....Motor-drawn.

(c) *Ammunition.* Projectile weights are: HE, 20 pounds; AP, 21 pounds.

(2) *88-mm Antiaircraft Gun (8.8 cm Flak 41).* (a) *General description.* The *8.8 cm Flak 41* is designed for use against air, ground, and sea targets. Although usually fired from the platform, it may be fired from its wheels, with the side members of the platform extended. The breech has a horizontal sliding-wedge block, and the gun has an automatic rammer. An electric firing mechanism is employed.

(b) *Characteristics.*

Caliber .....88 mm (3.46 inches).
Length of tube.....21 feet 5.75 inches.
Weight in action.....8.85 tons.
Maximum ceiling.....49,200 feet
Maximum horizontal range .....21,580 yards.
Rate of fire: practical..20 rounds per minute.
Muzzle velocity (HE).3,280 feet per second.
Traverse .....360°.
Elevation .....—3° to + 90°.
Traction .....Motor-drawn (12-ton half-track, *Sd. Kfz. 8*), or static.

(c) *Ammunition.* Projectile weights are: HE, 20.68 pounds; APCBC, 22.45 pounds.

(3) *105-mm Antiaircraft Gun (10.5 cm Flak 38 and 39).* (a) *General description.* The 105-mm antiaircraft gun appears in two models. It is produced in static and mobile versions, and also is mounted on railway cars. The breech has a horizontal sliding block, which may be operated manually or automatically, and an electric firing mechanism. The buffer is hydraulic, the recuperator hydropneumatic, and the equilibrator of the spring type. Traverse and elevation may be accomplished either manually or by power. A remote control, power-operated fuze setter and a power rammer are part of the complete unit.

(b) *Characteristics.*

Caliber .....105 mm (4.13 inches).
Length of tube.....21 feet 9.6 inches.
Weight in action.....11.03 tons.
Maximum ceiling.....36,750 feet.
Effective ceiling.....31,000 feet (approximately).
Maximum horizontal range .....19,100 yards.

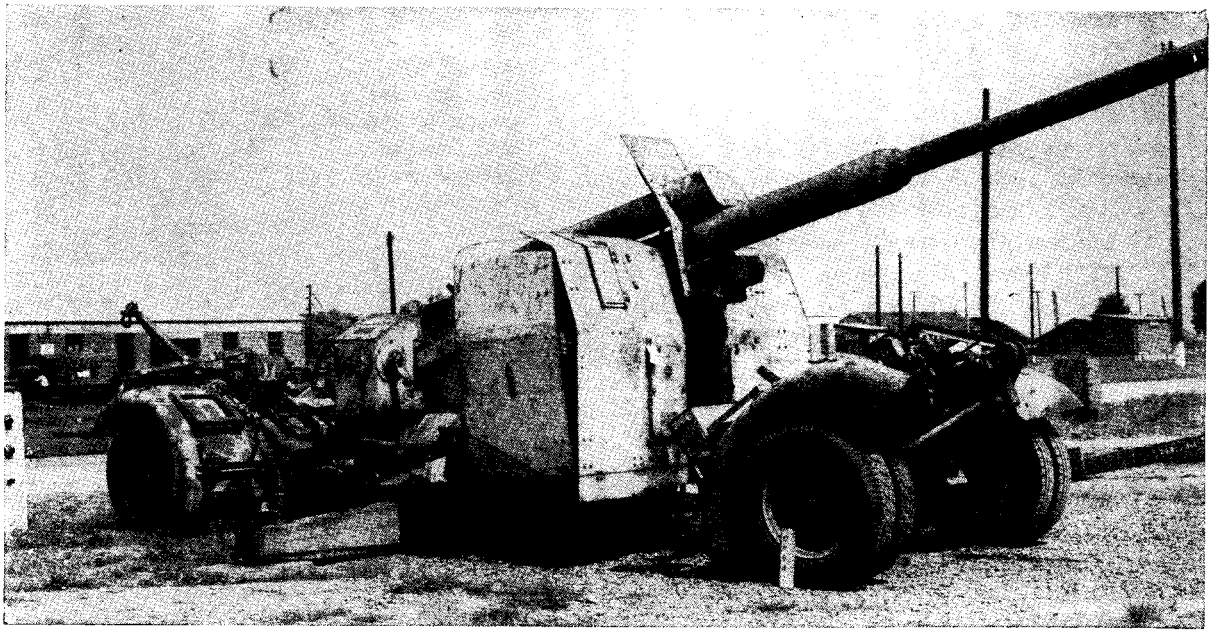


Figure 62.—8.8 cm Flak 41 (88-mm multipurpose gun) showing carriage lowered.

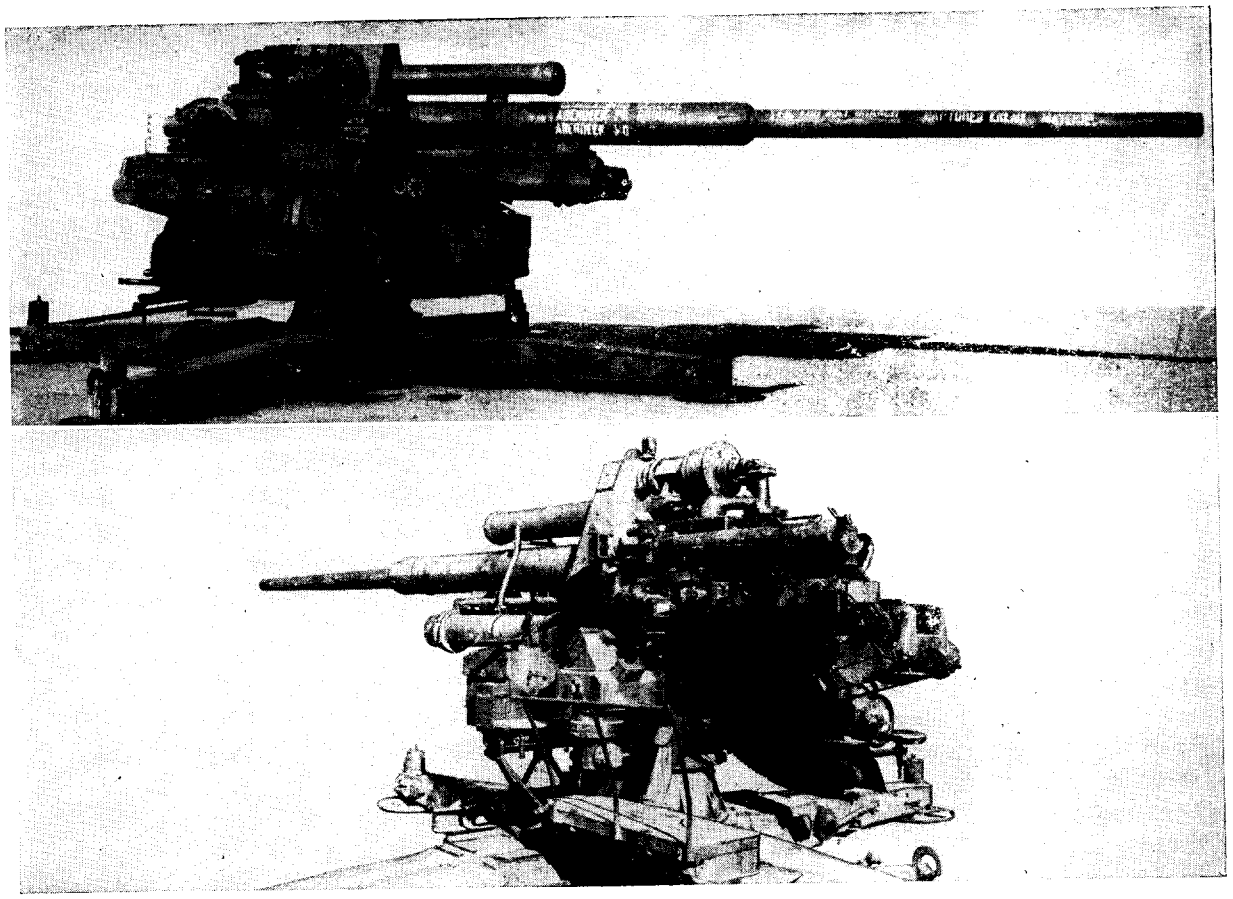


Figure 63.—105-mm Flak 38 (105-mm antiaircraft gun), top view showing elevating and traversing mechanism on right side of gun; bottom view showing left side with drill round in fuze setter tray.

Rate of fire: practical..10 to 15 rounds per minute.
Muzzle velocity.....2,890 feet per second.
Traverse .....360°.
Elevation .....—3° to + 85°.
Traction .....Motor-drawn, static, or RR.

(c) *Ammunition.* HE (time fuze), HE (percussion fuze), and APCBC projectiles are fired. The HE time fuzed projectile weighs 33.2 pounds.

(4) *128-mm Antiaircraft Gun (12.8 cm Flak 40).* (a) *General description.* The *12.8 cm Flak* looks like the *10.5 cm Flak.* The breechblock slides horizontally to the right, and incorporates an electric firing mechanism. The recoil system is conventional, with hydropneumatic recuperator above the tube, and buffer below. Hydropneumatic equilibrators are used. Elevation and traverse are either manual or powered. Fuse setting is by director control, and loading is facilitated by a power rammer incorporating two horizontal rubber rollers at the entrance to the bore. The gun may be statically emplaced, transported on a mobile mount, or mounted on a railway car. A twin-barreled version of this gun also exists, but it is produced only for a static role.

(b) *Characteristics.*

Caliber .....128 mm (5.04 inches).
Length of tube..... ...25 feet 8.5 inches.
Weight in action:
mobile version.....18.75 tons.
static version.....14.34 tons.
Maximum ceiling.....48,555 feet.
Maximum horizontal range .....22,910 yards.
Rate of fire: practical..12 rounds per minute.
Muzzle velocity (HE).2,886 feet per second.
Traverse .....360°.
Elevation .....—3° to + 88°.
Traction .....RR, motor-drawn, or static.

(c) *Ammunition.* Projectile weights are: HE, 57 pounds; and APC, 58.13 pounds.

(5) *150-mm Antiaircraft Gun (15 cm Flak).* This large caliber gun exists in limited quantities, and apparently is manned by navy personnel. Its use is confined to Germany proper in a static role.

d. AA FIRE CONTROL. (1) *Automatic weap-*

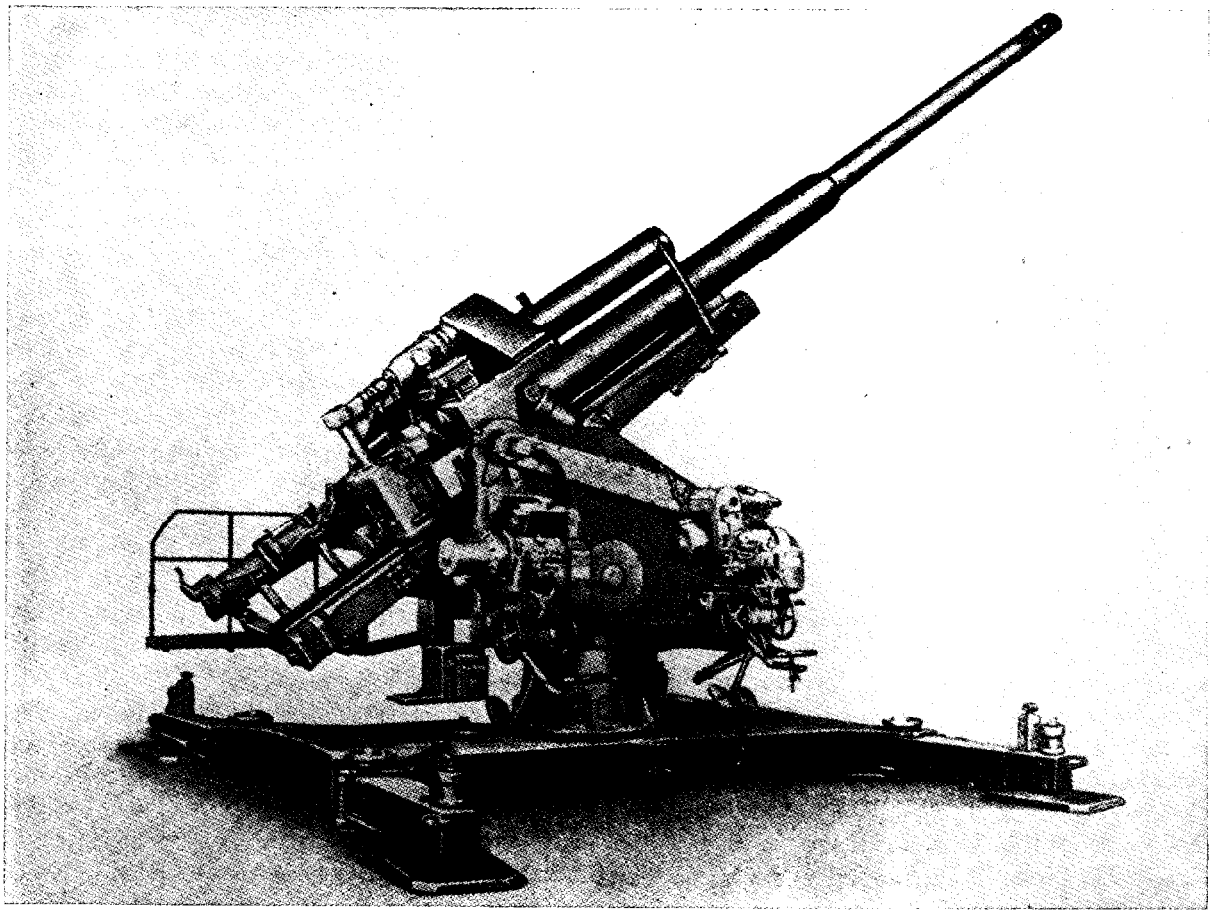


Figure 64.—12.8 cm Flak 40 (128-mm antiaircraft gun) on static mount.

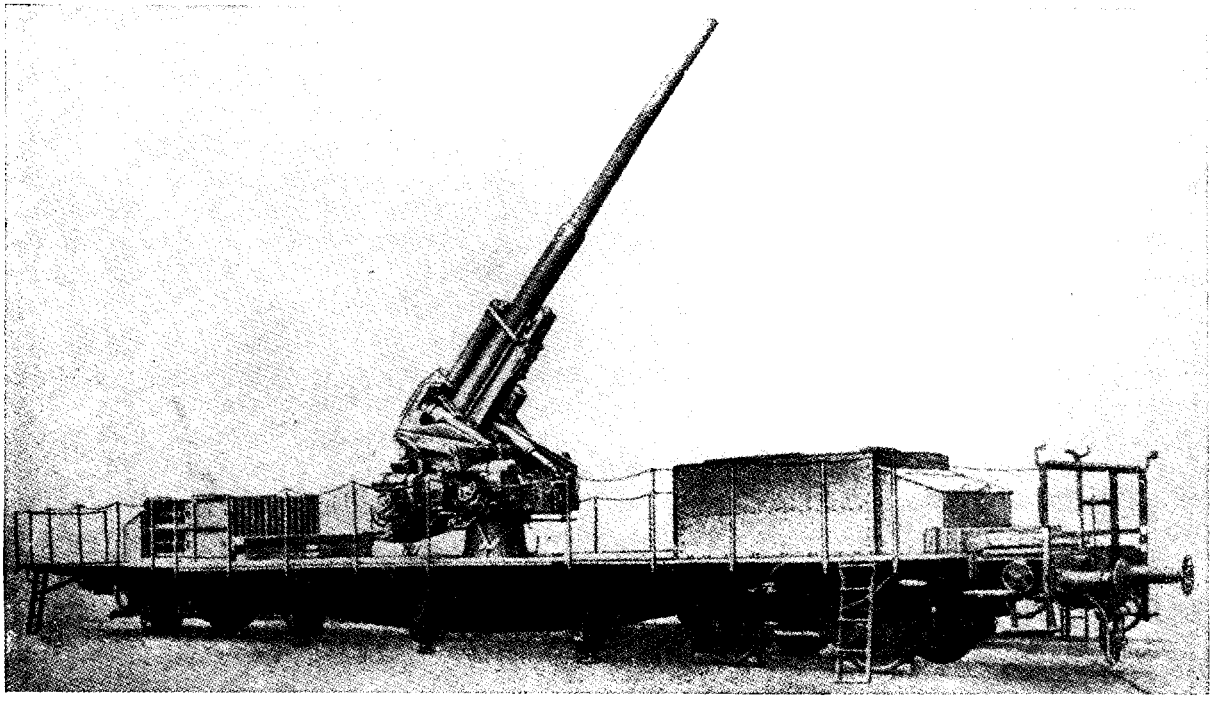


Figure 65.—12.8 cm Flak 40 (128-mm antiaircraft gun) on railway mount.

ons. (a) *General.* Antiaircraft fire control for automatic weapons is accomplished through the use of various types of on-carriage sights, ranging from the simple manually operated *Lincalvisier* (linear sight) through various mechanical types and the complicated, electrical *Flakvisier.* Range must be set into some of the simpler sights, and this is obtained either through estimation or through the use of a one-meter base range finder. Tracer observation also is used for fire control.

(b) *Lincalvisier (Linear sight) 21.* This is a simple, adjustable type of speed ring sight, used as an alternate for the more complicated sights designed for use on the 20-mm antiaircraft guns. Range, course, and speed of target, angle of dive or climb, and superelevation are set in through manual manipulation of the sight.

(c) *Flakvisier (Antiaircraft sight) 35.* This is a mirror sight with a computor mechanism operating on the course and speed, slant-plane-linkage principle. It depends on accurate setting of target range, course, and speed. It can engage level-flying, climbing, or diving targets. It normally is used on the *2 cm Flak 30,* but also may be found on the *2 cm Flak 38* and *2 cm Flakvierling* in place of the electrical *Flakvisier 38 and 40.*

(d) *Flakvisier 38 and 40.* The *Flakvisier 38* is an electrically operated, range-rate sight which computes lateral and vertical leads plus superelevation. The azimuth rate and elevation rate are measured through tachometer generators coupled to the gun's traversing and elevating gears. Slant range is introduced as a battery voltage, modified by a rheostat, calibrated in hundreds of meters. In tracking, the reticles of the sight head are displaced by the battery voltage and tachometer generator voltage in such a manner that the gun is trained automatically on the future position. The use of electric current eliminates mechanical time lag. This sight is used normally with the *2 cm Flak 38.* The *Flakvisier 40,* which is used with the *2 cm Flakvierling,* differs from the *Flakvisier 38* only in minor details of construction. The principle of operation is the same.

(e) *Flakvisier 33.* Used with the *3.7 cm Flak 18* and *36,* this sight is similar in operating principles to the *Flakvisier 35.*

(f) *Flakvisier 37 (43).* This *Flakvisier* is a mechanical computing sight used with the *3.7 cm Flak 37.* When used with the *3.7 cm Flak 43,* it is known as *Flakvisier 43.* Computation for deflections is based upon the angular rates of quadrant elevation and azimuth. Ranges are estimated or obtained from a separate source, and are set into the sight by hand. A clock-work motor drives three disc and wheel mechanisms which perform the multiplications necessary in the computation of deflections. Uni-directional drives from the elevating and traversing mechanisms rewind the clock motor. In operation, the necessary deflection is obtained by mechanically offsetting the cross hairs of the reticle of a one-power telescope. Provision is incorporated for corrections for superelevation and temperature changes. The sight is of compact box-shaped construction, approximately 10 inches by 9 inches by 4½ inches in size and 23 pounds in weight. It is fitted to the sight bar of the gun by a suspension bracket and lug.

(g) *Schwebedornvisier.* This is a relatively simple antiaircraft sight recently developed for alternate use on the *3.7 cm Flak 37* and *43.* The sight works on the linear principle. Target speed, direction, and angle of climb or dive are set into the sight manually.

(h) *Schwebekreisvisier 30/38.* This is a recent type of relatively simple, pivoted ring sight designed for use with the *2 cm Flak* weapons. Its use is becoming more and more frequent on the later models of *2 cm Flak* in lieu of the more complicated electrical *Flakvisier 38* and *40.*

(i) *Flakvisier 41.* This is a completely automatic, tachometric clock-work, range-rate sight employed with the *5 cm Flak 41.* Operated by one man, range is introduced and angular velocities are calculated in such manner that superelevation and vertical and lateral deflections are applied automatically. The principle of operation is the same as that of the *Flakvisier 38* and *40.*

(2) *Heavy antiaircraft guns.* (a) *Kommandogerät 36.* (1) This instrument is the earliest standard German linear speed antiaircraft director, providing continuous data for the engagement of aerial targets by heavy antiaircraft guns. It employs a mechanical solution of the antiaircraft problem, and has facilities for making necessary ballistic corrections to gun data. The instrument is mounted on a four-wheel trailer for transport.

(2) The director has a main pedestal with three leveling feet and two suspension arms by which it is raised and secured to front and rear bogies for transport. The main pedestal supports a casting carrying the director mechanisms and supporting brackets on which a stereoscopic, four-meter range finder rests when the director is emplaced for action.

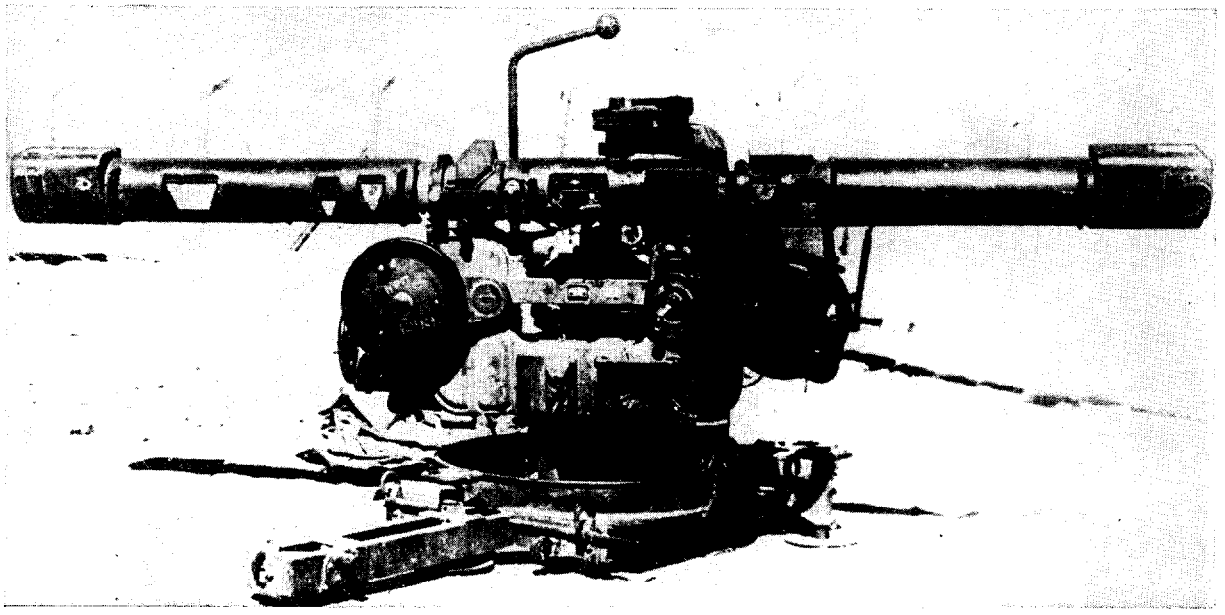


Figure 66.—Kommandogerät 36 (antiaircraft gun director) in operating position.

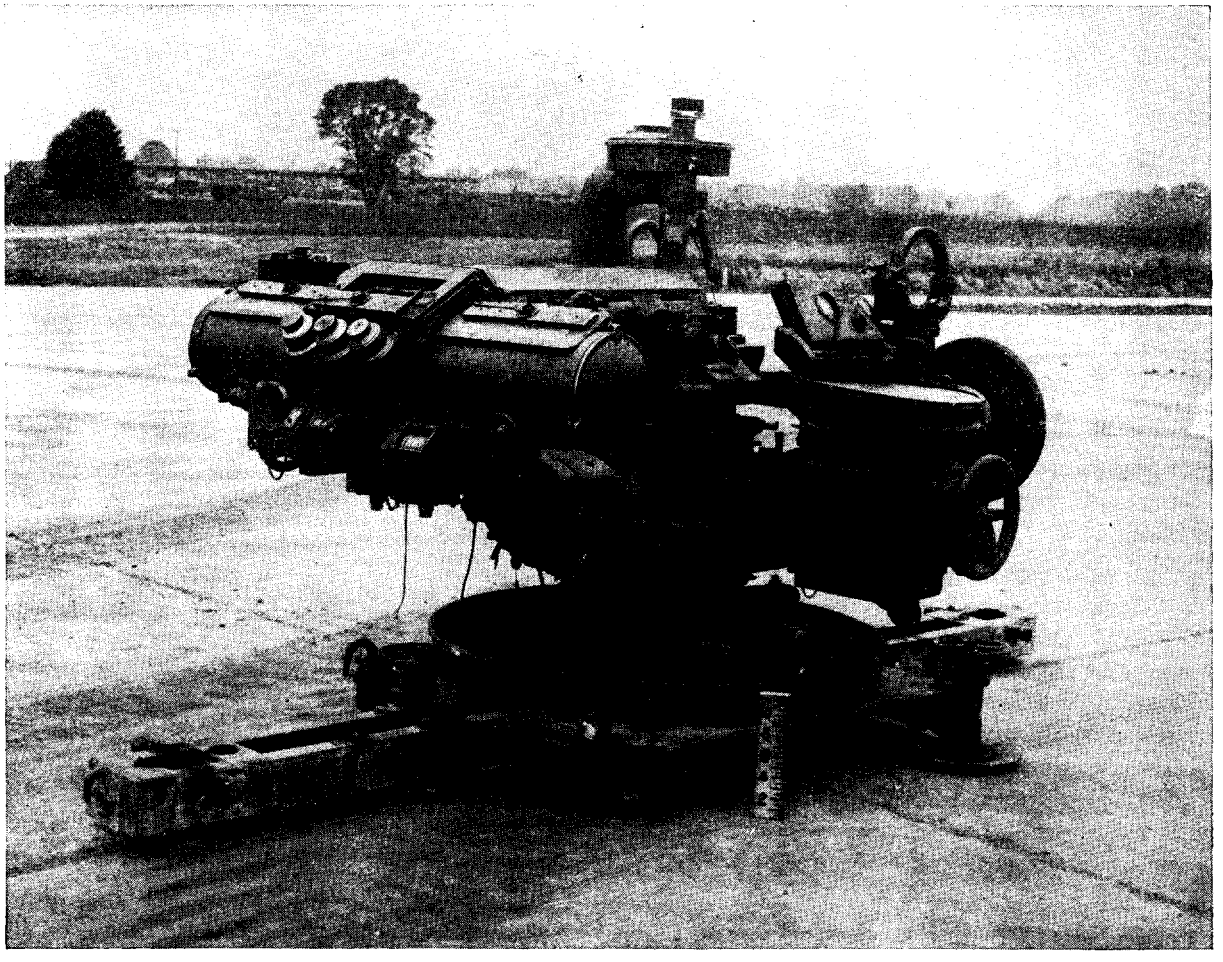


Figure 67.—Kommandogerät 36 (antiaircraft gun director) without range finder.

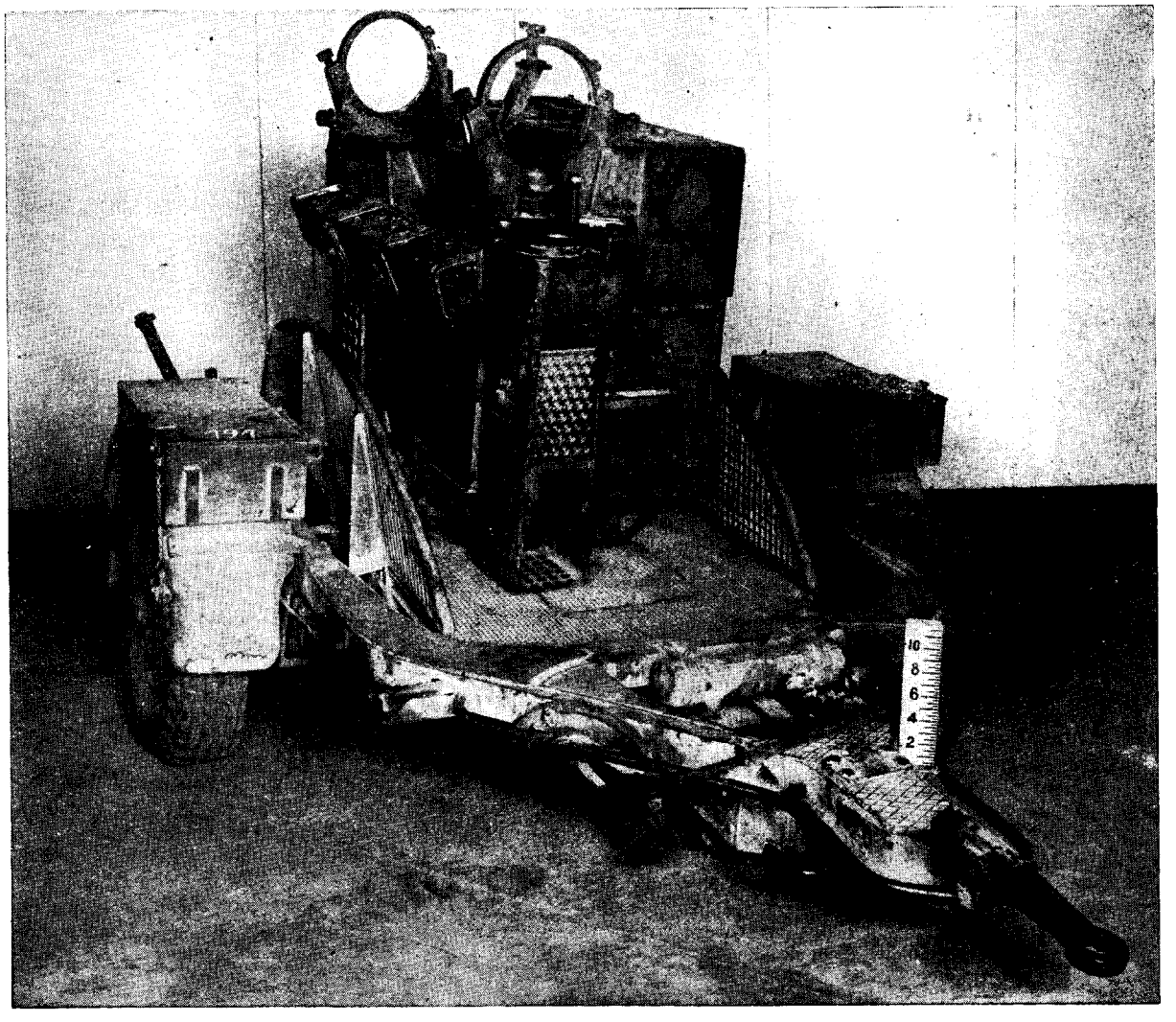


Figure 68.—Kommandogerät 40 (antiaircraft gun director) in trailer for traveling, without range finder.

(3) Firing data determined by the director (firing azimuth, quadrant elevation, and fuze) are transmitted electrically to appropriate dials on the guns.

(b) *Kommandogerät 40.* (1) This is a later and improved version of the *Kommandogerät 36,* which it has superseded to a very large extent for use with all heavy antiaircraft guns. The four-meter, stereoscopic range finder used with the "40" model is mounted on the director, and gun data is transmitted electrically to the guns. It also uses the linear speed method of data computation. However, the "40" model can be operated by five men, whereas 11 men are required to operate the "36".

(2) The "40" director incorporates a mechanism which copes with changes in target altitude and target course (curvilinear flight).

(3) This director can be used with the different types of heavy antiaircraft weapons by changing the ballistic cams. The *Kommandogerät 41* is a *Kommandogerät 40* fitted with cams for the *8.8 cm Flak 41,* the nomenclature apparently being a convenient way of distinguishing its use for this purpose.

(c) *Kommandohilfsgerät 35.* This is an older type of antiaircraft director used only for auxiliary purposes. It operates on the angular-rate method of data computation. The four-meter base range finder used with this instrument is mounted separately, and gun data provided by the director normally are transmitted to the guns by telephone.

(d) *Range finders.* Four-meter base stereoscopic range finders furnish slant range for the antiaircraft directors. Range Finder 34 is used with the *Kommandogerät 35* and is separately

Figure 69.—Kommandohilfegerät 35 (antiaircraft gun director) used as an auxiliary.

emplaced. Range Finders 36 and 40 are used with *Kommandogerät 36* and *Kommandogerät 40,* respectively. Range Finders 36 and 40 are mounted in brackets on the directors.

(e) *Fire control radar.* Several types of radar, known as *Flakmessgerät,* are used by German antiaircraft artillery to furnish basic antiaircraft gun data to the directors. As radar is a fairly recent development, the directors have been modified to receive this basic data.

(f) *Flakumwertegerät Malsi 41, 42, and 43 (Flak Converter Malsi).* This is a plotting instrument used to convert antiaircraft fire control data received from a distant source into basic data suitable for use by individual batteries. It is reported that the latest type can deal with displacements up to 5 miles, and is more accurate than the two earlier models.

e. SEARCHLIGHTS. (1) *150-cm (60 inches) Searchlight 34 and 37.* (a) The standard antiaircraft searchlight is 150 cm (60 inches) in diameter, and is equipped with azimuth and elevation receiver dials for receiving initial locator data. Normally hand-controlled, later versions of the 150-cm searchlight also are equipped with remote control gear.

(b) The high-current-density arc lamp is self-regulating and is fitted in an inverted position. The light is 990 million candle power and has a range, in favorable weather, of 8,800 yards at a height of 13,000 to 16,500 feet. The searchlight can be moved in azimuth through 360 degrees, and in elevation from —12 degrees through the vertical to —12 degrees on the other side. Current is supplied by a separate 24-kilowatt generator driven by an eight-cylinder internal combustion engine.

(c) For visual searching, a "dark search equipment" (*Dunkelsuchgerät 41*) is used. This consists of a pair of binoculars (having a few degrees of lateral and vertical movement) mounted on the searchlight. In operation, the searchlight and optical equipment are laid initially by location data furnished from a separate source.

(d) Sound locators are of the ring-trumpet type which work on the binaural principle, with provision for calculation of and correction for "sound lag". They also are equipped with electrical data transmitters for passing azimuth and elevation data to the receivers on the searchlight.

(e) Antiaircraft fire-control radar equipment is also used to furnish data for searchlights. *Flak* converter equipment known as *Flakumwertegerät* is used as an aid to the radar equipment and permits three searchlights at a distance from the radar to be supplied simultaneously with corrected azimuth and elevation.

(2) *200-cm (80 inches) Searchlight 40.* Many of the searchlight units are equipped at least partially with these larger searchlights. Although methods of location of initial data are similar in principle to those employed for the 150-cm searchlights, these larger 200-cm searchlights usually are equipped with necessary apparatus for remote control. For visual searching, a "*Flak* laying equipment" (*Flakrichtegerät*) is used, consisting of a pair of binoculars mounted on a control pillar. This light is reported to be 2,430 million candle power with a range effectiveness 60 per cent over that of the standard 150-cm searchlight.

(3) *60-cm (24 inches) Searchlight.* (a) The equipment consists of a 60-cm searchlight and an

8-kilowatt generator, and was designed for use without a sound locator against low-flying aerial targets. The searchlight is controlled manually in azimuth and elevation by a layer seated on the equipment. No separate location equipment is used. The beam can be exposed and covered by a shutter of venetian-blind type. This searchlight usually will be found in the vicinity of automatic weapons.

(b) The high-current-density arc lamp is self-regulating and is fitted in an inverted position. The light is 135 million candlepower and has a range under favorable weather conditions of 5,700 yards at a height of 5,000 feet. With beam dispersed the range is 3,500 yards.

(4) *Miscellaneous.* (a) In addition to the above, there are a few 150-cm searchlights employed on a special quadruple mount. These mounts, carrying four searchlights, are equipped with remote control gear.

(b) A few obsolete 110-cm (43 inches) searchlights, and a few French 200-cm and 240-cm (90 inches) searchlights, also may be found still in active use.

f. Barrage Balloons. Two main types of barrage balloons are employed by the Germans for added protection of vital installations against low-flying aircraft. The standard barrage balloon, which is reported to have a hydrogen gas capacity of 200 cubic meters (7,062 cubic feet), usually is flown at an altitude of 6,000 or 8,000 feet. A smaller barrage balloon, reported to have a gas capacity of 77 cubic meters (2,718 cubic feet), is capable of use at altitudes under 2,900 feet. A large type of German barrage balloon capable of being flown at altitudes of 18,000 to 20,000 feet has been reported, but this balloon has not been used extensively.

8. Heavy and Railway Artillery

Details available on German heavy and railway artillery are given in Figures 40 and 41.

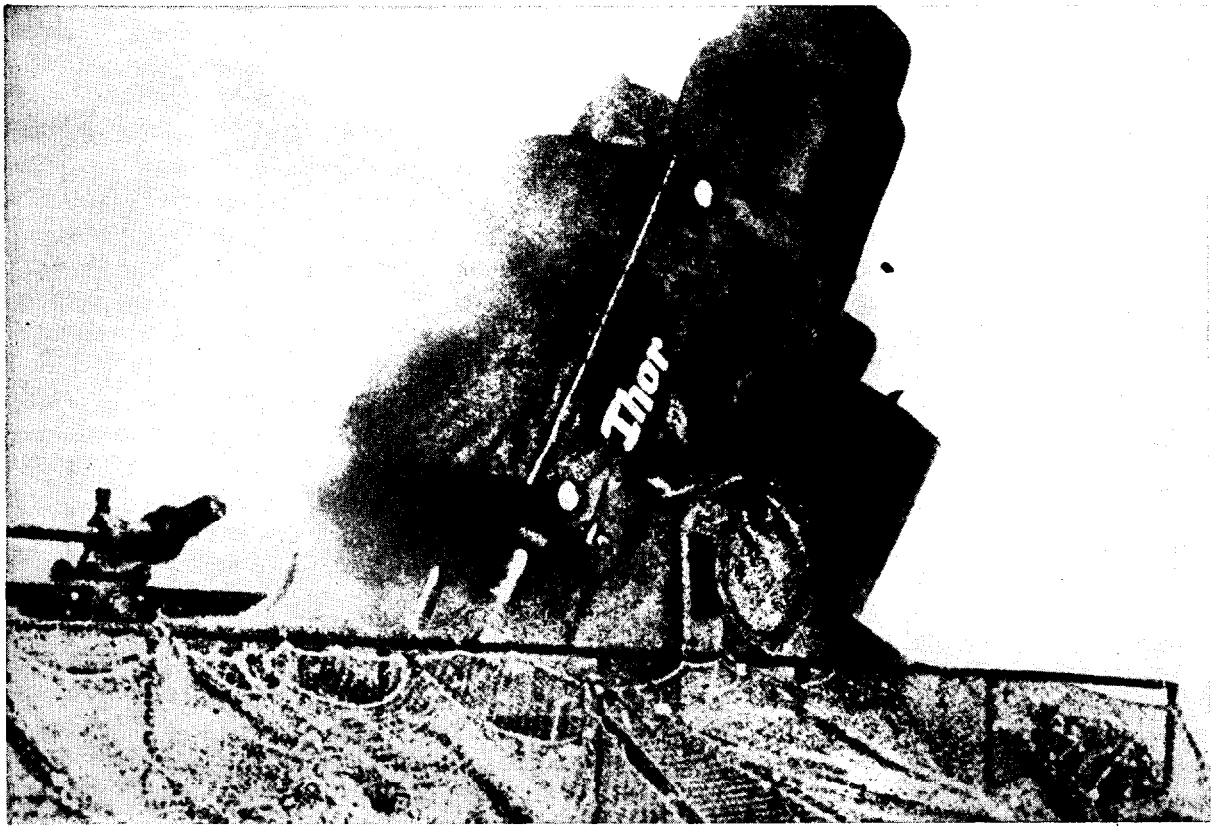


Figure 70.—61.5 cm Karl Mrs. (24-inch gun), also known as "Thor".

Figure 71.—42 cm Gamma Mrs. (16.5-inch gun) being tested.

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	Caliber	Length of Tube	Weight in action (tons)	Maximum Range (yards)	MV (f/s)	Traverse	Elevation	Shell		Remarks
								Type	Weight (lbs.)	
21 cm K. 38	8.3″	38′ (55 cals)	28	36,000	2,970	16°	50°	HE	265	Box trail; mounted on platform containing recoil system. Transported in two loads.
21 cm K. 39	8.3″	31′ 3.6″ (45 cals)	37.24	32,800	2,625	360°	45°	HE SAP AP AC	278	Platform mounted. Carriage in three parts on four-wheeled limber. Models *K. 39/40* and *K. 39/41* exist; performance and details similar.
24 cm H. 39	9.4″	21′ 11″ (28 cals)	30.24	19,700	1,970	360°	70°	HE SAP	365	Platform mounted. Improved Model *24 cm H. 39/40* with similar performance exists.
24 cm K. 3	9.4″		59.36	41,010	3,248			HE	331	Carriage in five sections.
24 cm K. 18	9.4″	43′ 1″ (55 cals)	59.36	40,460	3,182	6°	56°	HE	334	Carriage in five sections. Box trail plus platform. Fires pre-rifled shell.
28 cm H.L/12	11″	11′ (12 cals)	55.33	11,370	1,148	360°		HE	770	Platform semi-static. Obsolete.
28 cm Kst. H.	11″		40.88	12,470	1,243	360°		HE	770	Platform static. Obsolete.
35.5 cm M1	14″		82.65	21,870	1,870			HE AC	827	Carriage in seven sections. Also fires AC fin stabilized stick bomb.
42 cm Gamma Mrs.	16.5″	22′ (16 cals)	15.43	15,530	1,483	45°	66°	AC	2,249	Semi-static platform. Obsolete.
54 cm Karl Mrs.	21.25″	17′ 8.5″ (10 cals)	132	13,000? HE			70°(?)	AP AF[1] HE	3,310	S. P. tracked carriage. Known as "Thor".
61.5 cm Karl Mrs.	24.21″	16′ 2″ (8 cals)	132	6,200? HE			70°(?)	AP HE	4,400	Carriage as for *54 cm Karl Mrs.* Known as "Thor".

? Unconfirmed.

[1] Anti-fortification.

Figure 72.—German heavy guns.

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UNCLASSIFIED

	Caliber	Length of Tube	Weight in action (tons)	Range (yards)		MV (f/s)	Traverse	Elevation	Ammunition		Remarks
				Max.	Min.				Type	Weight (lbs.)	
15 cm K. (E)	5.9″	19′ 8″ (40 cals)	84	25,000?	12,360	2,800	360°?		HE AC	95	Top carriage traversing railway mount with outrigger.
17 cm K. (E)	6.7″	22′ 4″ (40 cals)	88.48	29,200?	14,770	2,870	360°?		HEBC	138	Same as above.
20.3 cm K. (E)	8″	39′ 4″ (59 cals)	95.2	40,000?		3,040?		45°?	HE,AP Star	247 (AP)	Car traverse. Usually fired from turntable. Carriage does not recoil.
21 cm K. 12 (E)	8.3″	135′ 7″? (196 cals)	373?	126,800?	49,230	5,330?			HEBC	236	Fires pre-rifled shell.
24 cm Th. Br. K. (E)	9.4″	27′ 5″ (35 cals)	104.16	22,200?	10,940	2,210?	1°	25°	HEBC	328	Railway mount, car traverse.
24 cm Th. K. (E)	9.4″	31′ 4″ (40 cals)	105.28	29,000?	14,990	2,670?	1° 360°[1]	25°?	HEBC	328	Railway mount, car traverse. Carriage does not recoil. Usually fired from turntable.
28 cm Kz. Br. K. (E)	11″	36′ 8″ (40 cals)	130	32,300?	15,645	2,690?			HEBC AP	529	Same as above.
28 cm Lg. Br. K. (E)	11″	41′ 3″ (45 cals)	135.5	40,500?	18,380	2,820?			HEBC	626	Same as above. A 50 calibers long version, *28 cm s Br. K. (E)*, has estimated range of 40,500 (?) yds., a min. range of 18,380 yds. A *28 cm Bruno NK. (E)* also exists.
28 cm K.5 (E)	11″	69′ 8″ (76 cals)	241	67,900	27,350	3,950?	1° 360°[1]	50°	HEBC	551	Shell splined instead of having driving bands. Double recoil system, turntable. Fires rocket assisted shell.
40.6 cm K. (E) Adolf	16″			49,200		2,657 3,445				2,271 1,323	
38 cm K. (E) Siegfried	15″	64′ .5″ (52 cals)	316?	60,900		2,690 3,445	360°[1]		HE	1,764 1,091	Projectile fitted with three driving bands. Double recoil system, turntable.
80 cm Gustav Geschütz	31.5″	94′ 9″ (36 cals)	1,344	51,400					AC	16,540	Also known as "Dora."

(?) Unconfirmed.

[1] On turntable.

Figure 73.—German railway guns.

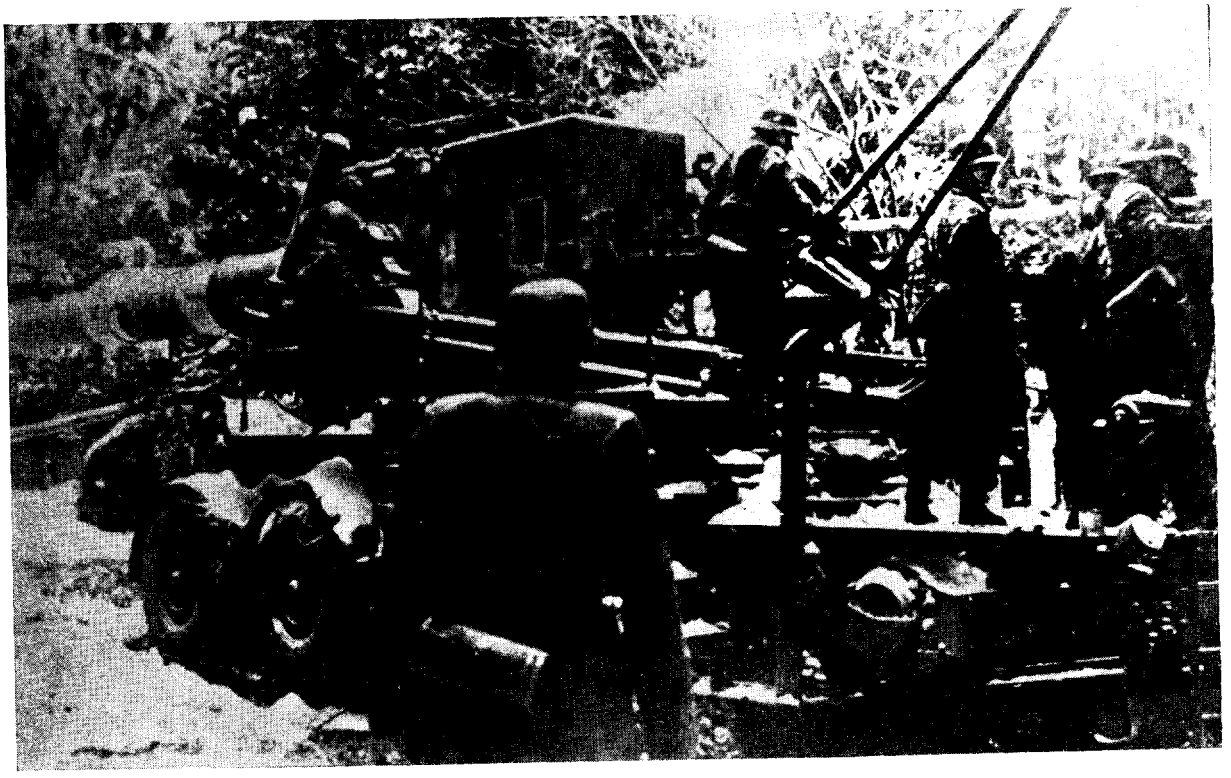

Figure 74.—35.5 cm M.1. (14-inch howitzer) being emplaced.

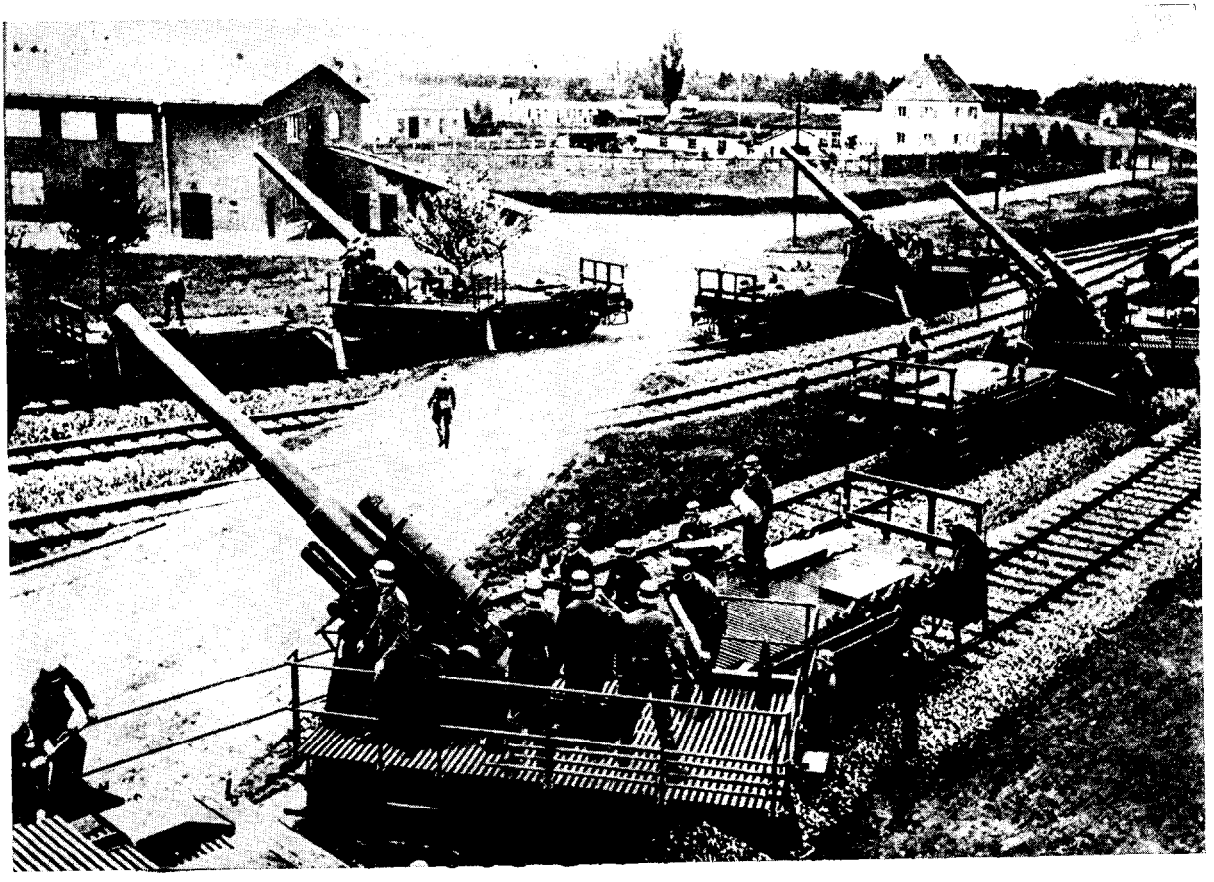

Figure 75.—15 cm K. (E) (150-mm railway guns) in action.

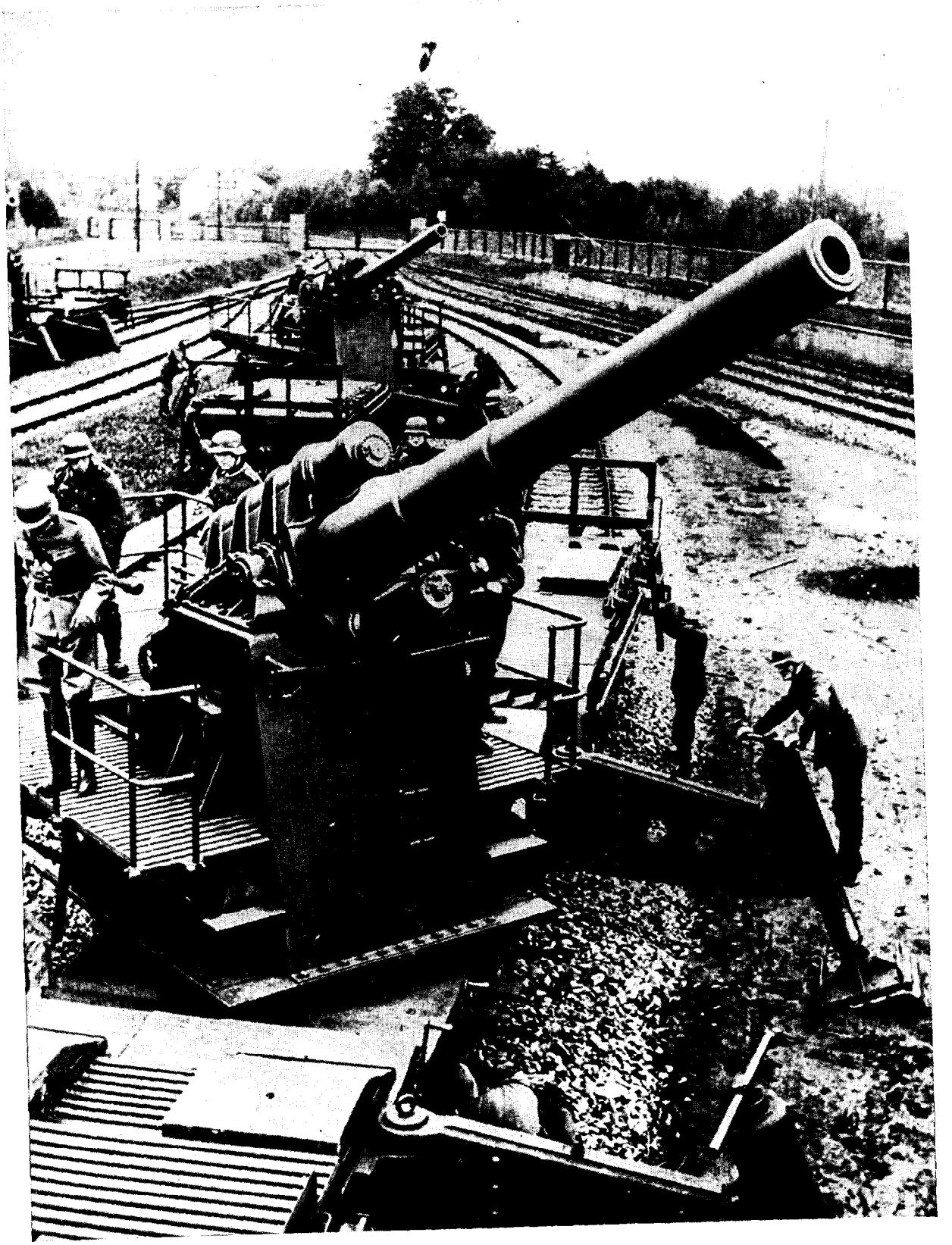

Figure 76.—150-mm railway guns being emplaced.

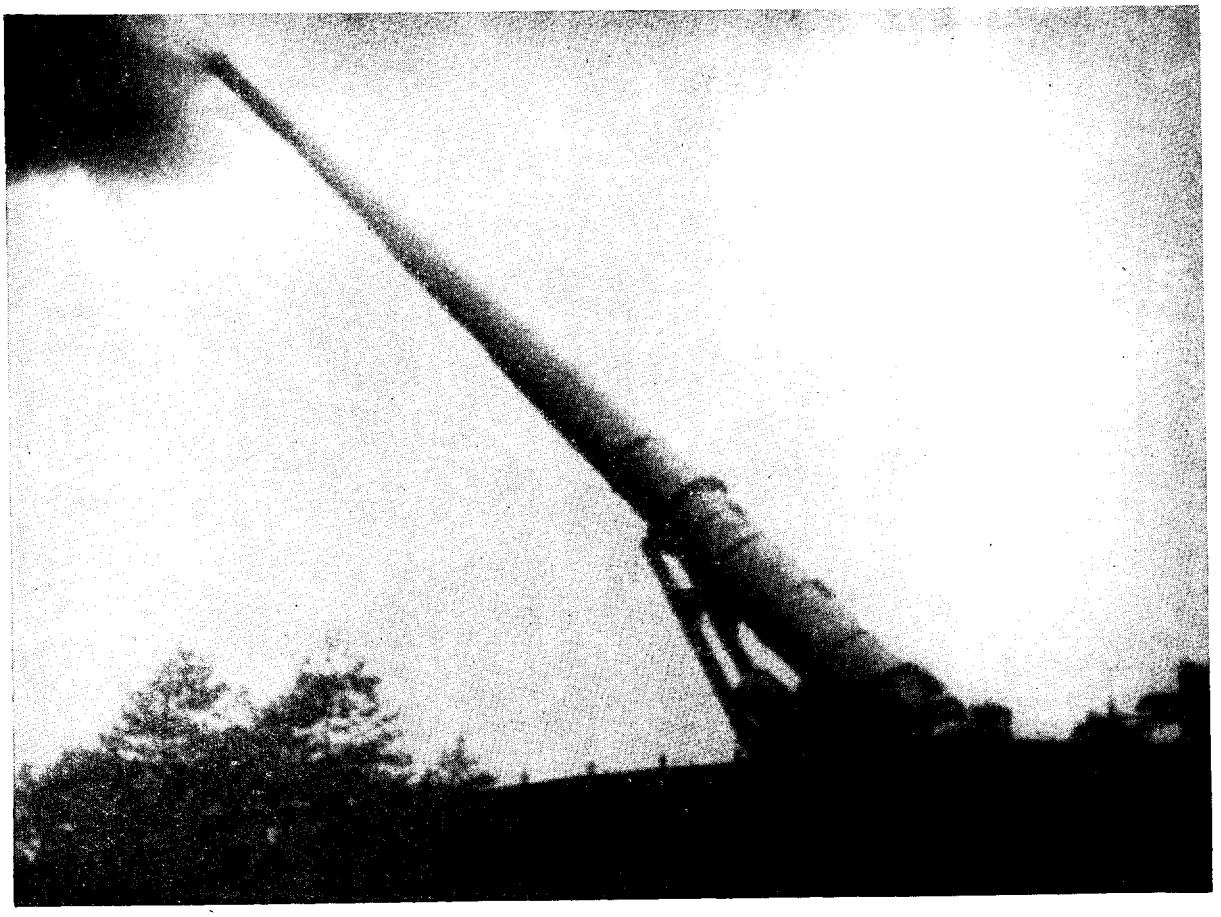

Figure 77.—A large railway gun firing.

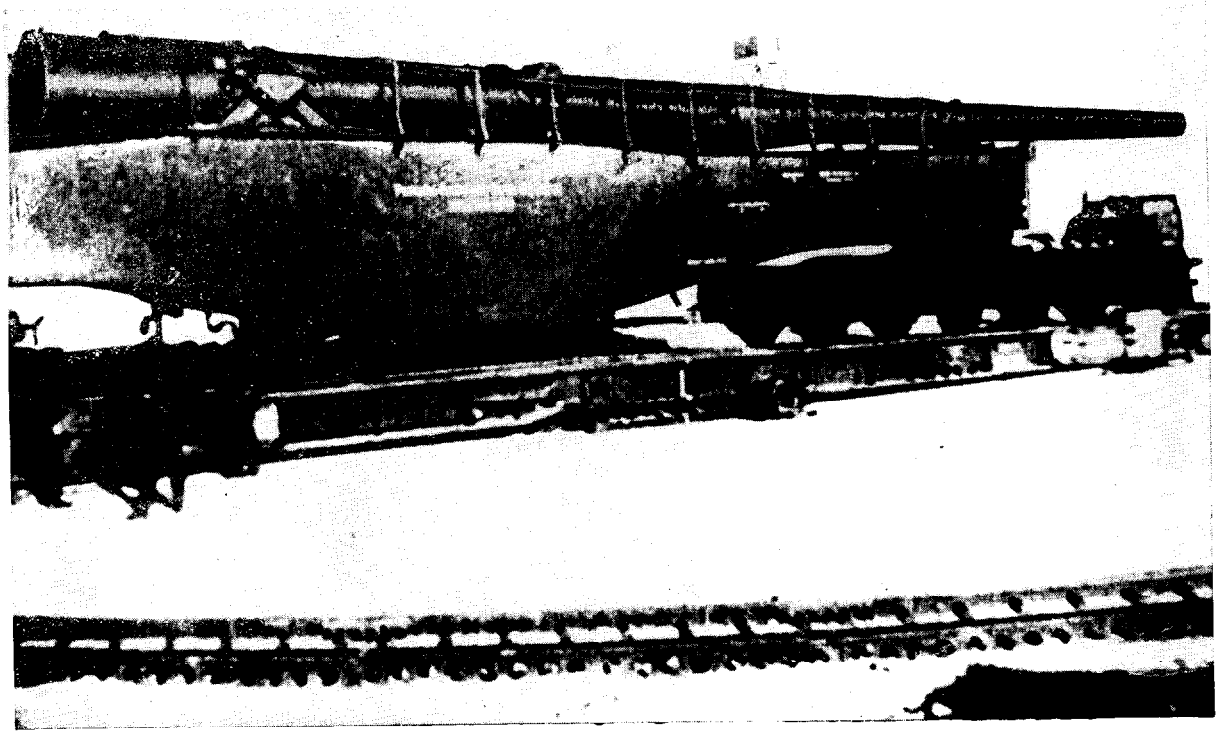

Figure 78.—A large railway gun.

Section V. SELF-PROPELLED ARTILLERY

1. General

a. DEVELOPMENT. German self-propelled artillery has now developed to a point where there is scarcely any artillery piece up to and including 150-mm caliber which has not appeared on at least one self-propelled chassis. Some of these have been experimental, but others have been standardized and have appeared in large numbers.

b. PRODUCTION METHODS. Self-propelled artillery has been produced in three different ways. First, there are the gun-chassis combinations which have been designed and engineered carefully to fill a particular role. These were produced in quantity by major armament factories in Germany and exist in large numbers. The 75-mm and 105-mm assault guns are examples of this type. Second, there are the standard guns fitted on standard tank chassis. Conversion has been carried out in accordance with well-engineered designs at considerable expense of time and skill. Among these are the *10.5 cm le. F. H. 18/2* on the *Gw. II (Wespe)* and the *15 cm s. F. H. 18/1* on the *Gw. III/IV (Hummel)*. Third, there is a large class of self-propelled guns produced by field conversion, carried out in unit or base workshops, and requiring little skill, time, or material. An example of this is the *15 cm s. I. G. 33* mounted on the chassis of the *Pz. Kpfw. I*.

c. TACTICAL USES. German self-propelled artillery may be divided into four types from a tactical point of view, but the line of demarcation often is not clear, as many self-propelled artillery pieces have dual missions. These types are: close-support artillery, including assault guns; field and medium artillery; tank destroyers; and antiaircraft artillery.

(1) *Close-support and assault guns.* The development of close-support and assault guns was begun about 1940. Assault guns are designed for the close support of infantry, and normally consist of a gun of limited traverse on an armored self-propelled chassis carrying heavy frontal armor. They are inclined to be slower and less maneuverable than tanks but are suited particularly well for attacks on enemy infantry heavy weapons and main points of resistance.

(2) *Field and medium self-propelled artillery.* Field and medium self-propelled artillery was introduced first about the middle of 1942. Both types of howitzers (*10.5 cm. le F. H. 18* and *15 cm s. F. H. 18*) in the division artillery now may be found on self-propelled chassis.

(3) *Self-propelled antitank guns.* The first self-propelled antitank gun was the *4.7 cm Pak. (t)* mounted on the then (1941) obsolescent chassis of the *Pz. Kpfw. I b*. Antitank guns now form the numerically largest class of self-propelled artillery weapons.

(4) *Self-propelled antiaircraft artillery.* Self-propelled antiaircraft artillery actually was developed before any attempt was made to apply this principle to other types of weapons, but so far no serious effort has been made to mount anti-

Figure 79.—7.5 cm Stu. K.40.

aircraft guns larger than 37-mm on motor-driven carriages.

d. GUN AND CHASSIS MODIFICATIONS. Guns with the exception of assault guns, are mounted normally on their self-propelled carriages without any major alteration. Assault guns usually are fitted with electric firing devices and modified recoil systems. The chassis, however, particularly in cases where they are those of existing tanks, have undergone considerable modification. Not only have the superstructures been altered, but in some cases the engine has been moved from the rear to a central position to enable the gun crew to stand on the floor of the hull to serve the gun.

2. Close Support and Assault Guns

a. 75-MM ASSAULT GUN ON *Pz. Kpfw. III* CHASSIS (*Stu. G. III für 7.5 cm Stu. K. 40 (L/48)*). (1) *General.* The *7.5 cm Stu. K. 40 (L/48)* is the latest assault gun to be mounted on the chassis of the *Pz. Kpfw. III*. The *7.5 cm Kw. K. (L/24)* and the *7.5 cm Stu. K. 40 (L/43)*, which previously were mounted on this chassis, now have been superseded and are tending to go out of service. The *7.5 cm Kw.K. (L/24)* also has been mounted on an armored half-tracked vehicle and on the modified eight-wheeled armored car. The *7.5 cm Stu. K. 40 (L/48)* has an antitank role, as well as its antipersonnel role as a close-support weapon. It fires both high explosive and armor-piercing ammunition.

(2) *Specifications.*

General

Nomenclature .....*Stu. G. III für 7.5 cm Stu. K. 40 (L/48).*
Type of carriage.....*Stu. G. III, Sd. Kfz. 142/1.*
Length over-all,
Including gun.....22 feet 5½ inches.
Excluding gun .....17 feet 9½ inches.
Width over-all .....9 feet 8 inches.
Height over-all .....7 feet.
Weight .....26.35 short tons.
Crew .....4 men.

Gun

Type .....*7.5 cm Stu. K. 40 (L/48).*
Muzzle velocity .....APCBC 2,300 feet per second.
Elevation .....—6° to + 17°.
Traverse .....10° each way.
Muzzle brake .....Yes.
Buffer .....Hydraulic.
Recuperator .....Hydropneumatic.

Ammunition:

Types fired.....	APCBC	HE	HC	AP 40	Smoke
Rounds carried...	22	27			5
Muzzle velocity... (feet per second)	2,300	1,800	1,475	3,248	1,771
Projectile weight. (pounds)	15	12.7	11	9	13.7

Carriage

Suspension:
Number of bogies....6.
Type of bogies.....Small rubber tired.
Number of return rollers .....3.
Track, length .....9 feet 2½ inches.
Track, width .....8 feet 2½ inches.
Width of link.....1 foot 3¾ inches.

Hull armor:
Front .....81 mm at 52°.
Sides .....31 mm vertical.
Rear .....51 mm at 23°.
Belly .....20 mm.

Fighting compartment armor:
Front .....53 to 71 mm at 15°.
Sides .....30 mm vertical.

Power

Engine:
Type .....Maybach HL 120 TRM.
Cylinders .....V-12 at 60°.
Fuel .....Gasoline.
Location .....Rear.
Horsepower .....295 at 3,000 rpm.
Transmission .....Synchromesh, 6 forward, 1 reverse.
Drive .....Front sprocket.

Performance

Trench crossing .....8 feet 6 inches.
Fording .....2 feet 9 inches.
Step .....2 feet.
Gradient .....30°.
Maximum speed .....20 miles per hour.

Armament

Type .....One *M.G. 34.*
Location .....Carried.

Remarks

Penetration of homogeneous armor at 30°, APCBC projectile:
500 yards .....84 mm.
1,000 yards .....72 mm.

b. 75-MM ASSAULT-ANTITANK GUN ON *Czech 38 (t)* TANK CHASSIS *7.5 cm le. Stu. G. 38 (t)*. (1) *General.* The gun mounted on this carriage, the *7.5 cm Pak 39 (L/48)*, has the same ballistic characteristics and is very similar to the *7.5 cm Stu. K. 40 (L/48)*. Despite the difference in nomenclature the guns are employed in exactly the

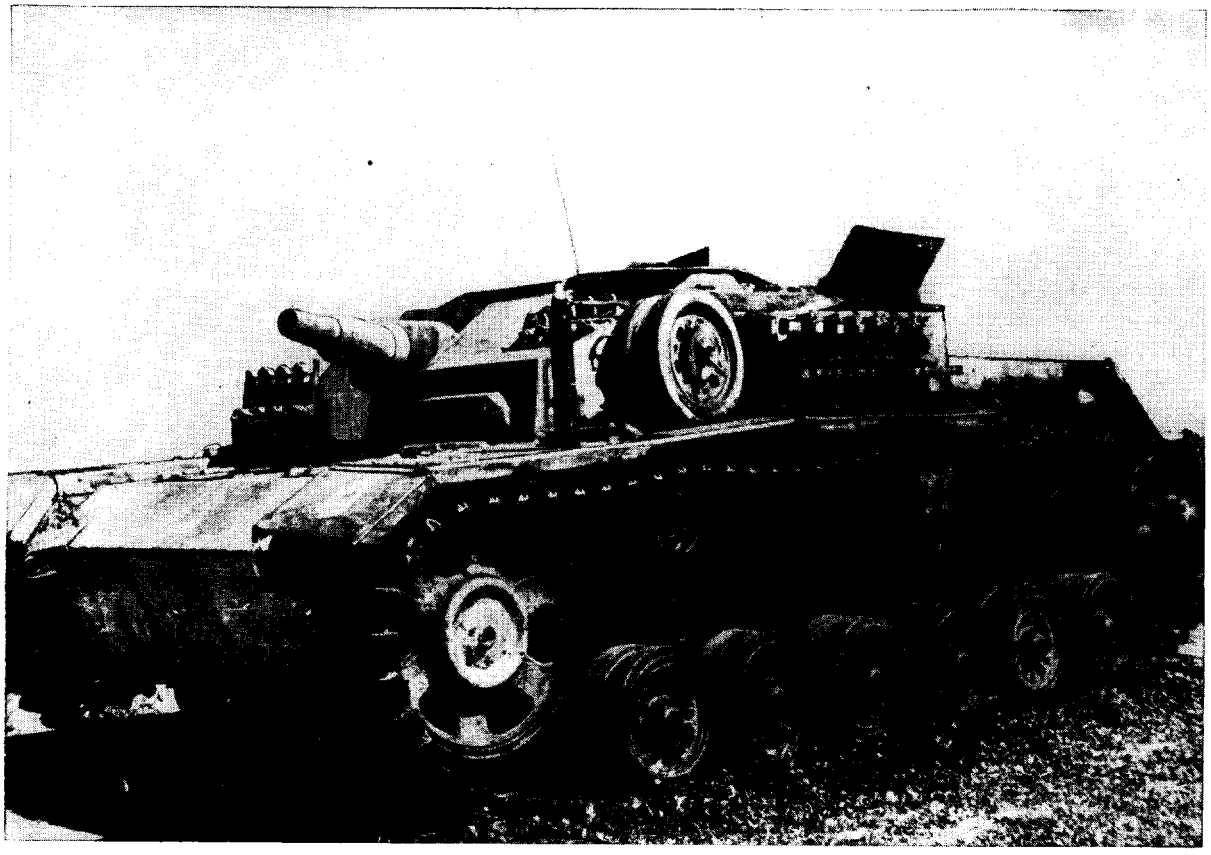

Figure 80.—7.5 cm Assault Gun (Stu. G. 7.5 cm K.).

Figure 81.—7.5 cm Pak 39 (L/48) on Pz. Jäg 38.

same way in both antitank and assault roles. The *7.5 cm Pak 39 (L/48)* is mounted low in a thick, sloping front plate. Previous guns mounted on this chassis, the *7.5 cm Pak 40* and the *7.62 cm Pak 36 (r)*, were fitted in a high superstructure which gave poor protection to the crew. In this case, however, the armor layout has been completely redesigned, and the vehicle has taken on the aspect of an assault gun. (See Paragraph 6 of this section for other vehicles on which the *7.5 cm Pak 40* and *7.62 cm Pak 36 (r)* have been mounted.)

(2) *Specifications.*

General

Nomenclature .....*7.5 cm le. Stu. G. 38 (t).*
Type of carriage.....*Pz. Jag. 38 (t).*
Length over-all:
Including gun .....20 feet 7 inches.
Excluding gun.....15 feet 11 inches.
Width over-all.....8 feet 7½ inches.
Height .....6 feet 10½ inches.
Weight .....17.65 tons.
Crew .....4 men.

Gun

Type .....*7.5 cm Pak 39 (L/48).*
Muzzle velocity.....APCBC 2,300 feet per second.
Elevation .....—8° to + 20°.
Traverse .....10° each way.
Muzzle brake.....No.
Buffer .....Hydraulic.
Recuperator .....Hydropneumatic.

Ammunition:

Types fired.....	APCBC	HE	HC	AP 40	Smoke
Rounds carried...	41				
Muzzle velocity (feet per second)	2,300	1,800	1,475	3,248	1,771
Projectile weight. (pounds)	15	12.7	11	9	13.7

Carriage

Suspension:
Number of bogies....4.
Type of bogies.....Christie.
Number of return rollers .....1.
Track, length.....12 feet 10¾ inches.
Track, width.....6 feet 10½ inches.
Width of link.....1 foot 1¾ inches.

Hull armor:
Front .....60 mm at 60°.
Sides .....20 mm at 15°.
Rear .....20 mm at 15°.
Belly .....10 mm horizontal.

Fighting compartment armor:
Front .....60 mm at 60°.
Sides .....20 mm at 40°.

Power

Engine:
Type .....Czech EP4.
Cylinders .....Six, in-line.
Fuel .....Gasoline.
Location .....Rear.
Horsepower .....150.
Transmission .....Preselective 5 forward, 1 reverse.
Drive .....Front sprocket.

Performance

Fording .....2 feet 11½ inches.
Radius of action.....124 miles.
Maximum speed.....23 miles per hour.

Armament

Type .....One *M.G. 34.*
Location .....Superstructure roof.
Ammunition carried....600 rounds.

Remarks

Penetration of homogeneous armor at 30°, APCBC projectile:
500 yards.....84 mm.
1,000 yards.....72 mm.

c. 75-MM ASSAULT-ANTITANK GUN ON *Pz. Kpfw. IV* CHASSIS (*Pz. Jäg. IV für 7.5 cm Pak 39 (L/48)*). (1) *General.* In this case the *7.5 cm Pak 39 (L/48)*, has been mounted on a modified *Pz. Kpfw. IV* chassis. It again is an assault gun in form, with a dual mission: antitank and anti-personnel.

(2) *Specifications.*

General

Nomenclature .....*Panzer Jäger IV für 7.5 cm Pak 39 (L/48).*
Type of carriage.....*Panzer Jäger IV.*
Length over-all:
Excluding gun.....18 feet 2 inches.
Width over-all.....10 feet 4 inches.
Height over-all.....6 feet 5 inches.
Weight .....27 short tons.
Crew .....4 men.

Gun

Type .....*7.5 cm Pak 39 (L/48).*
Muzzle velocity.....APCBC 2,300 feet per second.
Elevation .....—8° to + 22°.
Traverse .....12° left, 10° right.
Muzzle brake.....No.
Buffer .....Hydraulic.
Recuperator .....Hydropneumatic.

Ammunition:

Types fired.....	APCBC	HE	HC	AP 40	Smoke
Rounds carried...	79				
Muzzle velocity (feet per second)	2,300	1,800	1,475	3,248	1,771
Projectile weight. (pounds)	15	12.7	11	9	13.7

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Figure 82.—7.5 cm Pak 40 on Pz. Kpfw. 38 (t) Chassis.

Figure 83.—7.5 cm Pak 40 on Pz. Kpfw. II Chassis.

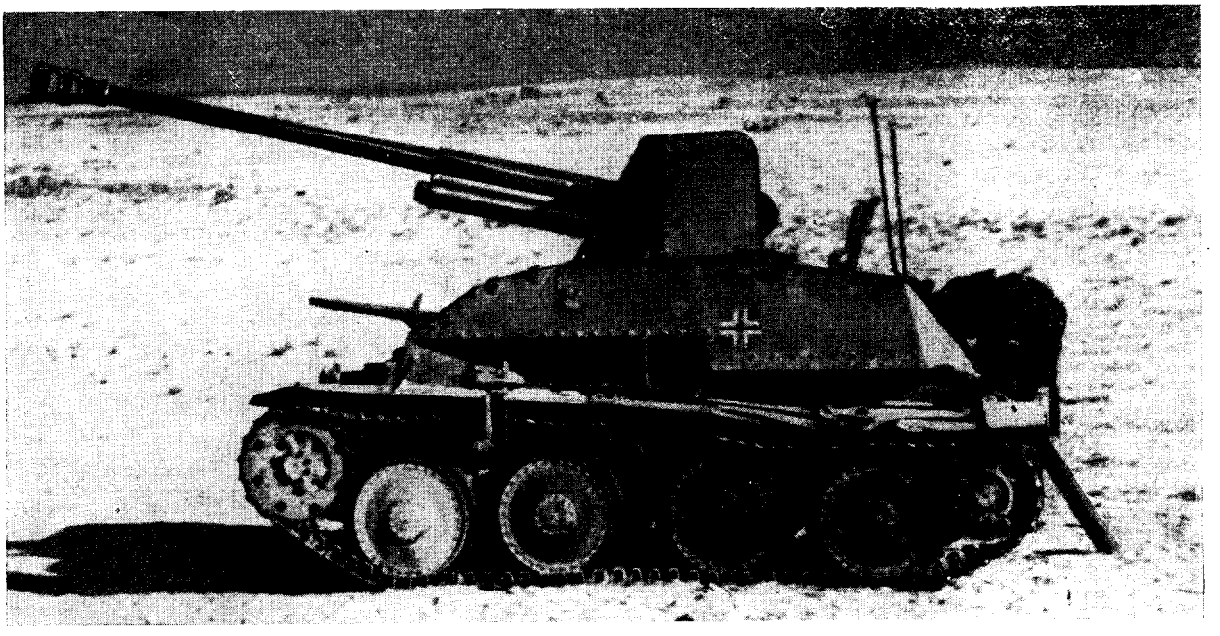

Figure 84.—7.62 cm Pak 36(r) on 38(t) Chassis.

Carriage

Suspension:
- Number of bogies....8.
- Type of bogies.....Small rubber tired.
- Number of return rollers .....4.
- Track, length.....11 feet 6 inches.
- Track, width.....7 feet 11 inches.
- Width of link.....1 foot 3 inches.

Hull armor:
- Front .....60 mm at 45°.
- Sides .....30 mm vertical.
- Rear .....22 mm at 12°.
- Top .....20 mm.
- Belly .....12 mm.

Fighting compartment armor:
- Front .....60 mm at 50°.
- Sides .....30 mm at 30°.

Power

Engine:
- Type .....Maybach HL 120 TRM.
- Cylinders .....V-12 at 60°.
- Fuel .....Gasoline.
- Location .....Rear.
- Horsepower .....295 at 3,000 rpm.

Transmission .....Manual synchromesh, sliding dog type, 6 forward, 1 reverse.

Drive .....Front sprocket.

Performance

Trench crossing.....9 feet.
Fording .....3 feet.
Radius of action.....160 miles.
Step .....2 feet 6 inches.
Gradient .....30°.
Maximum speed.....24 miles per hour.

Armament

Type .....Two *M.G. 42* with mounts.
Location .....Front superstructure.

Remarks

Penetration of homogeneous armor at 30°, APCBC projectile:
- 500 yards.....84 mm.
- 1,000 yards.....72 mm.

d. 75-MM ASSAULT GUN ON *Pz. Kpfw. IV* CHASSIS (*Pz. Jäg. IV für 7.5 cm Stu. K. 42 (L/70)*). (1) *General.* This extremely long-barreled gun, in an assault gun mounting on the chassis of the *Pz. Kpfw. IV*, is a development from the *7.5 cm Stu. K. 40 (L/48)*, which has been mounted on the same chassis but is only 48 calibers long instead of 70. The long-barreled gun has the dual role of antitank and assault gun.

(2) *Specifications.*

General

Nomenclature .....*Panzer Jäger IV für 7.5 cm Stu. K. 42 (L/70).*
Type of carriage.....*Panzer Jäger IV, Sd. Kfz. 162.*

Length over-all:
- Including gun.....28 feet 2½ inches.
- Excluding gun.....19 feet 9½ inches.

Width over-all.....10 feet 4½ inches.
Height over-all.....6 feet 5 inches.
Weight .....27 short tons (approximately).
Crew .....5 men.

Gun

Type .....*7.5 cm Stu. K. 42 (L/70).*
Muzzle velocity.....APCBC 3,068 feet per second

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Elevation .....—5° to + 15°.
Traverse .....10° each way.
Muzzle brake.....Not encountered.
Buffer .....Hydraulic.
Recuperator .....Hydropneumatic.

Ammunition:

Types fired.....	APCBC	HE	AP 40
Muzzle velocity..... (feet per second)	3,068	2,300	3,674
Projectile weight..... (pounds)	15	12.7	10.7

Rounds carried.....Total of 55 rounds.

Carriage

Suspension:
Number of bogies....8.
Type of bogies.....Small rubber tired.
Number of return rollers .....4.
Track, length.....11 feet 6 inches.
Track, width.....7 feet 11 inches.
Width of link.....1 foot 3 inches.

Hull armor:
Front .....80 mm at 45°.
Sides .....30 mm vertical.
Rear .....20 mm, 10° undercut.
Belly .....10 to 20 mm.

Fighting compartment armor:
Front .....80 mm at 50°.
Sides .....40 mm at 30°.
Top .....20 mm.

Power

Engine:
Type .....Maybach HL 120 TRM.
Cylinders .....V-12 at 60°.
Fuel .....Gasoline.
Location .....Rear.
Horsepower .....295 at 3,000 rpm.
Transmission .....Manual, synchromesh, sliding dog type; 6 forward, 1 reverse.
Drive .....Front sprocket.

Performance

Trench crossing.....9 feet.
Fording .....3 feet.
Radius of action.....160 miles (estimated).
Step .....2 feet 6 inches.
Gradient .....30°.
Maximum speed.....20 miles per hour.

Armament

Type .....Machine gun on ball mounting.
Location .....Superstructure front.

Remarks

Penetration of homogeneous armor at 30°.
APCBC projectile:
500 yards.....141 mm.
1,000 yards.....121 mm.

Figure 85.—7.5 cm Stu. K.40 (L/48) on Pz. Jäg. IV.

Figure 86.—10.5 cm Stu. H. 42.

e. 105-MM ASSAULT HOWITZER ON *Pz. Kpfw. III* CHASSIS (*Stu. G. III für 10.5 cm Stu. H. 42*). (1) *General.* This close-support weapon has the usual characteristics of the assault guns mentioned in previous paragraphs, but is confined to a purely antipersonnel role and does not fire armor-piercing ammunition. Like most German howitzers, however, it is supplied with hollow-charge ammunition to give it some anti-armor performance.

(2) *Specifications.*

General

Nomenclature .....*Stu. G. III für 10.5 cm Stu. H. 42.*
Type of carriage.....*Stu. G. III, Sd. Kfz. 142/2.*
Length over-all:
Including gun.....20 feet 2 inches.
Excluding gun.....17 feet 9 inches.
Width over-all.....9 feet 8 inches.
Height over-all.....6 feet 5 inches.
Weight .....25.8 short tons.
Crew .....4 men.

Gun

Type .....*10.5 cm Stu. H. 42.*
Muzzle velocity.....HE 1,540 feet per second.
Maximum range.....8,530 yards.
Elevation .....—6° to 20°.
Traverse .....10° each way.
Muzzle brake.....Yes.
Buffer .....Hydraulic.
Recuperator .....Hydropneumatic.

Ammunition:

Types fired.....	HE	HC	Smoke
Muzzle velocity..... (feet per second)	1,540		
Projectile weight..... (pounds)	32.6	25.9	32.4

Rounds carried.....Total of 36 rounds.

Carriage

Torsion Bar Suspension:
Number of bogie wheels .....6.
Type of bogie wheels.Small rubber tired.
Number of return rollers .....3.
Track, length .....9 feet 2½ inches.

Track, width .....8 feet 2½ inches.
Width of link .....1 foot 3¾ inches.
Hull armor:
Front .....50 mm at 52°.
Sides .....30 mm vertical.
Rear .....50 mm.
Belly .....30 mm.
Fighting compartment armor:
Front .....80 mm at 10°.
Sides .....30 mm vertical.

Power

Engine:
Type .....Maybach HL 120.
Cylinders .....V-12.
Fuel .....Gasoline.
Location .....Rear.
Horsepower .....295 at 3,000 rpm.
Transmission .....Synchromesh; 6 forward, 1 reverse.
Drive .....Front sprocket.

Performance

Trench crossing.....8 feet 6 inches.
Fording .....2 feet 9 inches.
Radius of action.....105 miles.
Step .....2 feet.
Gradient .....27°.
Maximum speed.....25 miles per hour.

3. Field and Medium Self-Propelled Artillery

a. WASP (*Wespe*), *10.5 cm le. F. H. (18/2)* ON THE MODIFIED *Pz. Kpfw. II* CHASSIS. (1) *General.* The Wasp is the most common self-propelled version of the standard German light field howitzer, *10.5 cm le. F. H. 18.* With a maximum elevation of 42 degrees, it has only slightly less maximum range than the field-mounted version. Other modified versions of the *10.5 cm le. F. H. 18* may be found mounted on the French "Lorraine" chassis, the Hotchkiss 39 tank chassis, and the *Pz. Kpfw. IV B* chassis.

(2) *Specifications.*

General

Nomenclature .....*Wespe.*
Type of carriage.....*Gw. II (Wespe), Sd. Kfz. 124.*
Length over-all:
Excluding gun.....15 feet 9 inches.
Width over-all.....7 feet 3½ inches.
Height over-all.....7 feet 10½ inches.
Weight .....12.33 tons.
Crew .....5 men.

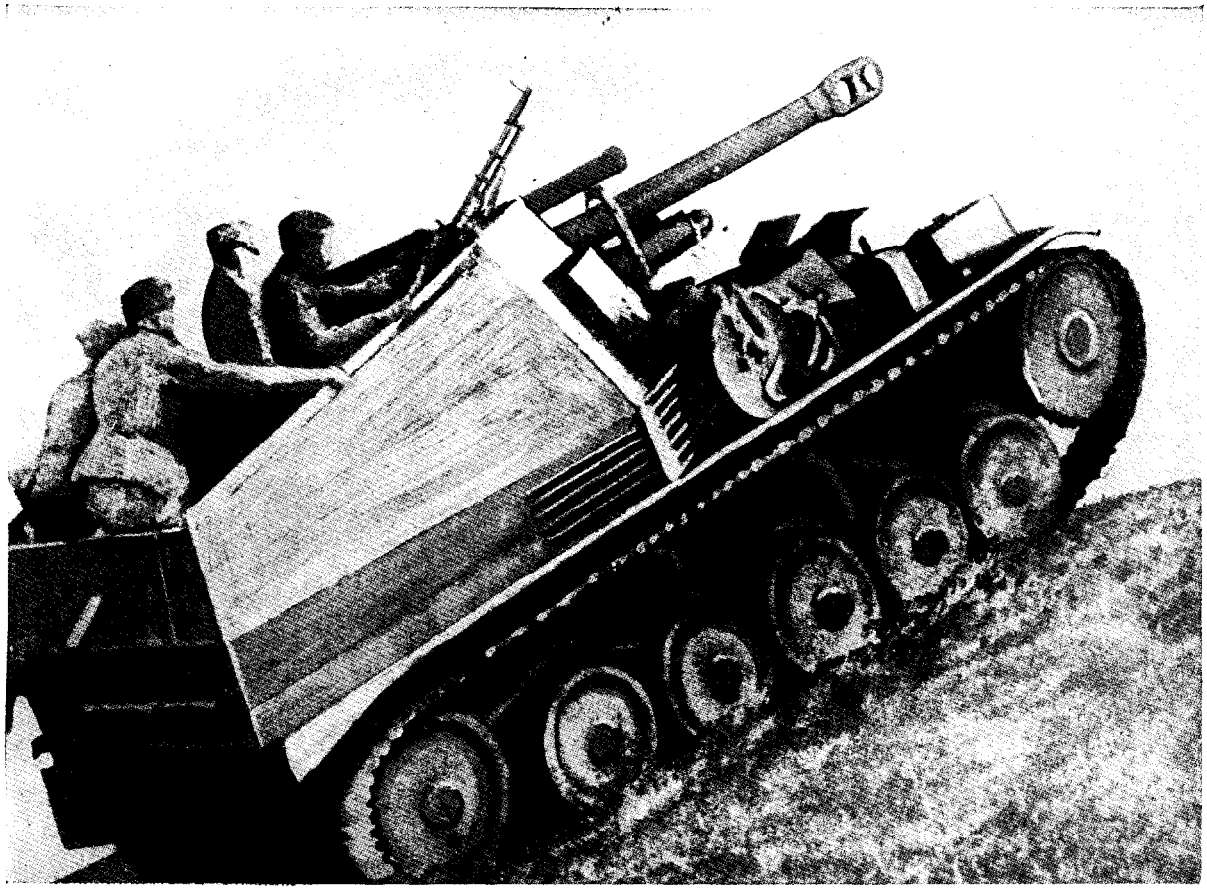

Figure 87.—Wasp (10.5 cm le. F.H. 18/2 on Pz. Kpfw. II).

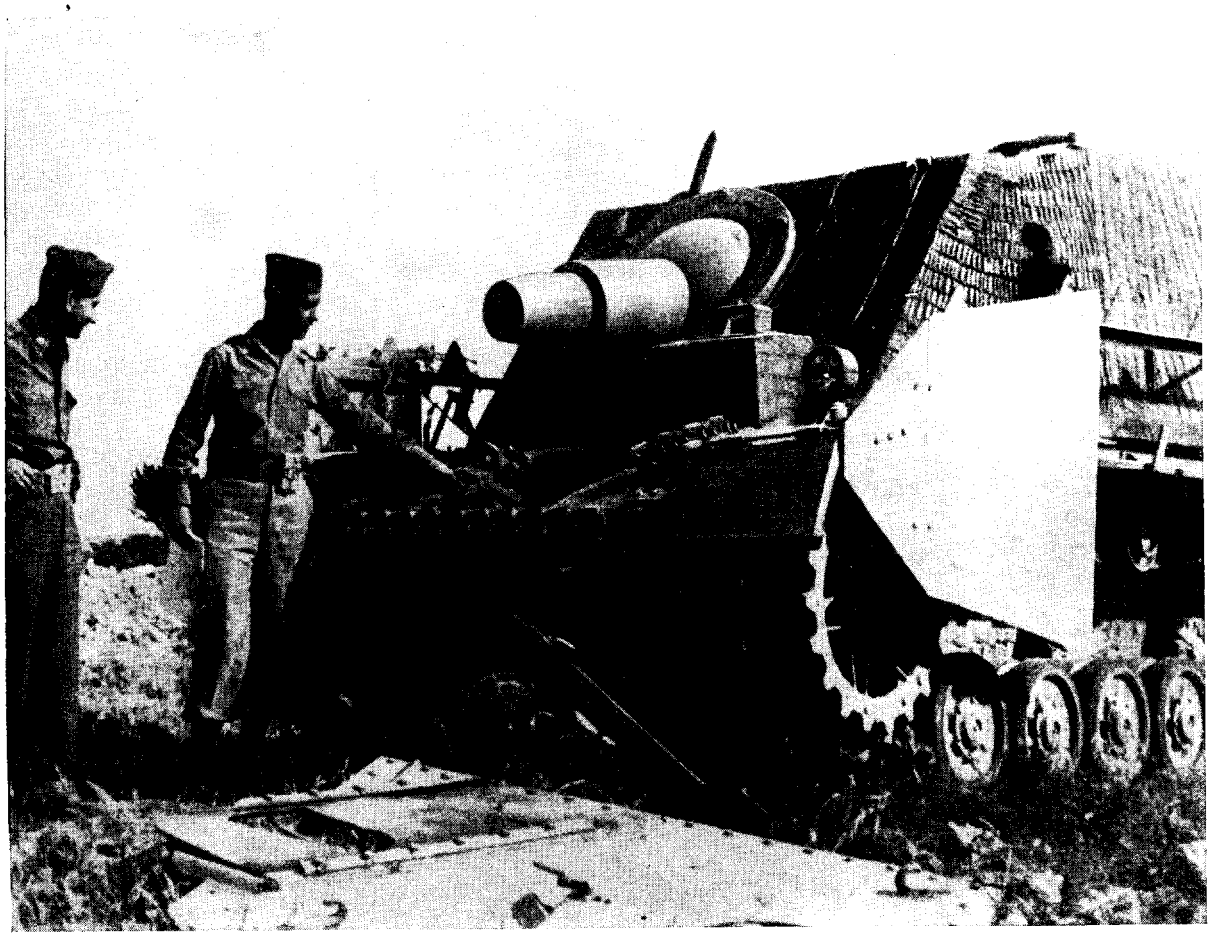

Figure 89.—15 cm Stu. H. 43 on Pz. Kpfw. IV Chassis (Brummbär).

Figure 90.—15 cm Heavy Infantry Howitzer (s.I.G. 33) on Pz. Kpfw. II Chassis

Gun

Type .....*10.5 cm le. F. H. 18/2.*
Muzzle velocity.....HE 1,772 feet per second.
Maximum range.....13,500 yards.
Elevation .....—5° to + 42°.
Traverse .....10° each way.
Muzzle brake.....Yes.
Buffer .....Hydraulic.
Recuperator .....Hydropneumatic.

Ammunition:

Types fired.....	HE	HC	Smoke
Rounds carried.....	22	8	
Muzzle velocity..... (feet per second)	1,772 (supercharge)		
Projectile weight..... (pounds)	32.6	25.9	32.4

Carriage

Suspension:
Number of bogie wheels .....5.
Type of bogie wheels.large.
Number of return rollers .....3.
Track, length.....7 feet 10½ inches.
Track, width.....6 feet 2 inches.
Width of link.....11¾ inches.

Hull armor:
Front .....30 mm.
Sides .....20 mm.

Fighting compartment armor:
Front .....10 mm.
Sides .....10 mm.

Power

Engine:
Type .....Maybach HL 62 TR.
Cylinders .....6.
Fuel .....Gasoline.
Horsepower .....140.
Transmission .....Synchromesh; 6 forward, one reverse.
Drive .....Front sprocket.

Performance

Trench crossing.....6 feet.
Fording .....3 feet.
Radius of action.....127 miles.
Step .....1 foot.
Gradient .....30°.
Maximum speed.....25 miles per hour.

b. GRIZZLY BEAR (*Brummbär*) or *Stu. Pz. 43 (15 cm Stu. H. 43 (L/12) on Pz. Kpfw. IV* CHASSIS). (1) *General.* This is essentially a close-support weapon and mounts a very short-barreled howitzer in a high, armored superstructure. The 150-mm infantry gun (*s. I. G. 33*) performs a similar role on its various self-propelled mountings: the chassis of *Pz. Kpfw. IB, Pz. Kpfw. II,* and the Czech *38 (t)*. The Grizzly Bear gives much better protection to the crew than any of these.

(2) *Specifications.*

General

Nomenclature .....*Brummbär* or *Stu. Pz. 43.*
Type of carriage.....*Stu. G. IV, Sd. Kfz. 166.*

Length over-all:
Including gun.....19 feet 4 inches.
Excluding gun.....19 feet 4 inches.
Width over-all.....9 feet 8 inches.
Height over-all.....8 feet 2 inches.
Weight .....30.4 tons.
Crew .....5 men.

Gun

Type .....*15 cm Stu. H. 43 (L/12).*
Muzzle velocity.....HE 790 feet per second.
Maximum range.....HE 5,000 yards (approximately).
Elevation .....—8.5° to + 30°.
Traverse .....8° each way.
Muzzle brake.....No.

Ammunition:

Types fired.....	HE	HC	Smoke
Muzzle velocity..... (feet per second)	790	902	780
Projectile weight..... (pounds)	83.6	55	85.7

Rounds carried.....Total of 38 rounds.

Carriage

Suspension:
Number of bogie wheels .....8.
Type of bogie wheels.Small rubber tired.
Number of return rollers .....4.
Track, length.....11 feet 6 inches.
Track, width.....8 feet 1 inch.

Hull armor:
Front .....45 plus 50 mm armor at 15°.
Sides .....30 mm vertical.
Rear .....20 mm.

Fighting compartment armor:
Front .....101 mm at 38°.
Sides ..... 50 mm at 18°.
Roof ..... 22 mm at 82°.

Power

Engine:
Type .....Maybach HL 120 TRM.
Cylinders .....V-12.
Fuel .....Gasoline.
Horsepower .....295 at 3,000 rpm.
Transmission .....Synchromesh; 6 forward, 1 reverse.
Drive .....Front sprocket.

Figure 91.—15 cm. s.F.H. 18 on hybrid Pz. Kpfw. III/IV Chassis (Hummel).

Performance

Trench crossing.....9 feet.
Fording .....3 feet.
Radius of action.....130 miles.
Step .....2 feet 6 inches.
Gradient .....30°.
Maximum speed.....25 miles per hour.

Armament

Type .....One *M.G. 34,* ball mount.
Location .....Left of main armament.

c. BUMBLE BEE (*Hummel*) *15 cm s. F.H. 18/1* ON *Gw. III/IV.* (1) *General.* This self-propelled medium howitzer employs a hybrid chassis made up of the suspension of the *Pz. Kpfw. IV* and various components of *Pz. Kpfw. III.* This gun has the same mission in its self-propelled version as in its field version. The *15 cm S. F. H. 13,* an older medium howitzer (obsolete on its field mount), may be found in the same role, mounted on the French "Lorraine" chassis.

(2) *Specifications.*

General

Nomenclature .....*Hummel.*
Type of carriage.....*Gw. III/IV, Sd. Kfz. 165.*

Length over-all:

Including gun.....21 feet 3⅞ inches.
Excluding gun.....20 feet 4⅛ inches.
Width over-all.....9 feet 8⅛ inches.
Height over-all.....9 feet 7¾ inches.

Weight .....25.2 tons.
Crew .....6 men.

Gun

Type .....*15 cm s.F.H.18/1.*
Weight .....2.07 tons (barrel and breech).
Muzzle velocity.....HE 1,705 feet per second.
Maximum range.....HE charge eight 14,570 yards.
Elevation .....0° to 39°.
Traverse .....16° each way.
Muzzle brake.....No.
Buffer .....Hydraulic (under tube).
Recuperator .....Hydropneumatic (over tube).

Ammunition:

Types fired.....	HE	HC	Smoke
Rounds carried.....	12	6	
Muzzle velocity.....	1,705		
Projectile weight....	95.9		86

Carriage

Suspension:

Number of bogie wheels .....8.
Type of bogie wheels.Small rubber tired.
Number of return rollers .....4.
Track, length.....11 feet 6 inches.
Track, width.....7 feet 10⅞ inches.
Width of link.....1 foot 3 inches.

Hull armor:

Front .....30 mm at 22°.
Sides .....20 mm vertical.
Rear .....20 mm at 9°.

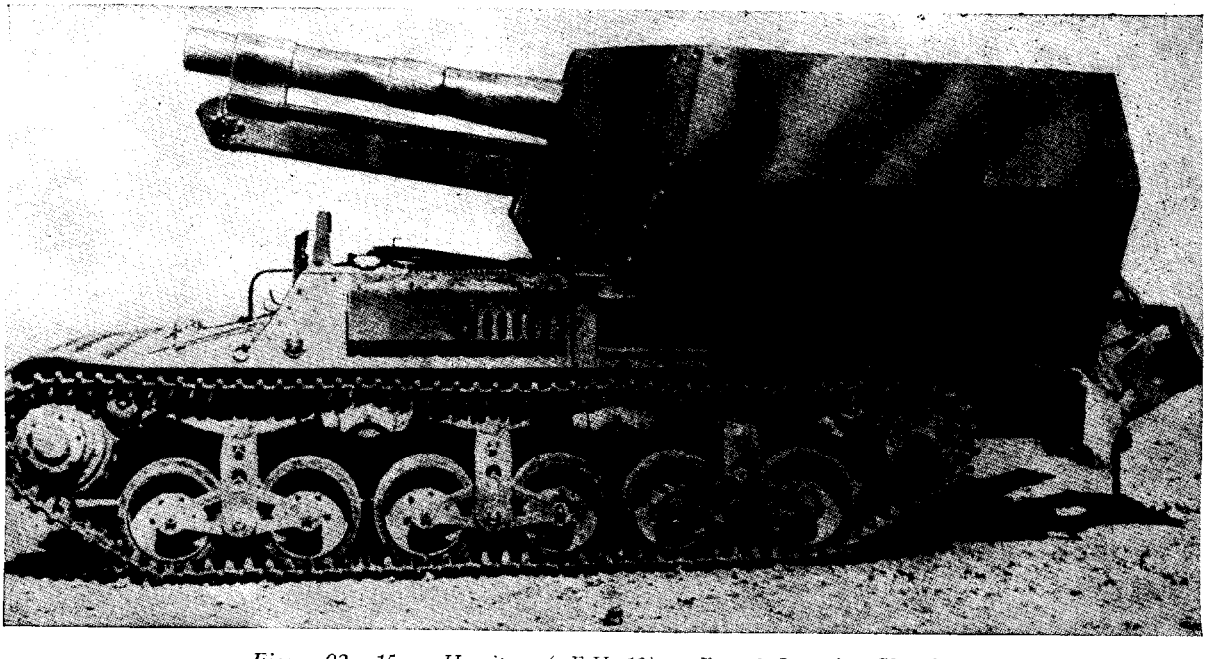

Figure 92.—15 cm Howitzer (s.F.H. 13) on French Lorraine Chassis.

Top .....17 mm horizontal.
Belly .....17 mm horizontal.
Fighting compartment armor:
Front .....10 mm at 37°.
Sides .....10 mm at 16°.
Top .....10 mm at 12°.

Power

Engine:
Type .....Maybach HL 120 TRM.
Cylinders .....V-12.
Fuel .....Gasoline.
Location .....Center.
Horsepower .....295 at 3,000 rpm.
Transmission .....Synchromesh; 6 forward, 1 reverse.
Drive .....Front sprocket.

Performance

Trench crossing .....9 feet.
Fording .....2 feet 7½ inches.
Radius of action .....160 miles.
Step .....2 feet 6 inches.
Gradient .....30°.
Maximum speeed .....25 miles per hour.

4. Tank Destroyers

a. RHINOCEROS (*Nashorn*), FORMERLY HORNET (*Hornisse*), *8.8 cm Pak 43/1* ON THE *Gw. III/IV*. (1) *General.* This is one of the versions of the *8.8 cm Pak 43,* the latest 88-mm antitank gun, mounted on the hybrid chassis of the *Pz. Kpfw. III* and *IV*. The vehicle's silhouette is very high and the armor protection given to the crew by the thin-skinned superstructure is very poor. The gun, however, is able to engage tanks at very long ranges.

(2) *Specifications.*

General

Nomenclature .....*Nashorn.*
Type of carriage .....*Gw. III/IV, Sd. Kfz. 164.*
Length over-all:
Including gun .....27 feet 8¼ inches.
Excluding gun .....20 feet 4⅛ inches.
Width over-all .....9 feet 8⅛ inches.
Height over-all .....9 feet 7¾ inches.
Weight .....27 tons.
Crew .....5 men.

Gun

Type .....*8.8 cm Pak 43/1 (L/71).*
Muzzle velocity .....APCBC 3,280 feet per second.
Elevation .....—5° to + 20°.
Traverse .....15° each way.
Muzzle brake .....Yes.
Buffer .....Hydraulic.
Recuperator .....Hydropneumatic.

Ammunition:

Types fired	APCBC	HE	HC	AP 40
Muzzle velocity (feet per second)	3,280	2,400	1,968	3,705
Projectile weight (pounds)	22.4	20.7	16.8	16

Rounds carried .....Total of 48 rounds.

Carriage

Suspension:
Number of bogies....8.
Type of bogies .....Small rubber tired.
Number of return rollers .....4.
Track, length .....11 feet 6 inches.
Track, width .....7 feet 11 inches.
Width of link .....1 foot 3 inches.
Hull armor:
Front .....30 mm at 12°.
Sides .....20 mm vertical.
Rear .....22 mm.
Top .....17 mm.
Belly .....17 mm.
Fighting compartment armor:
Front .....10 mm at 30°.
Sides .....10 mm at 16°.

Power

Engine:
Type .....HL 120 TRM.
Cylinders .....V-12.
Fuel .....Gasoline.
Location .....Center.
Horsepower .....295 at 3,000 rpm.
Transmission .....Maybach synchromesh; 6 forward, 1 reverse.
Drive .....Front sprocket.

Performance

Trench crossing .....9 feet.
Fording .....2 feet 7½ inches.
Radius of action .....160 miles.
Step .....2 feet 6 inches.
Gradient .....30°.
Maximum speed .....25 miles per hour.

Remarks

Penetration of homogeneous armor at 30°, APCBC projectile:
500 yards .....184 mm.
1,000 yards .....169 mm.

b. ELEPHANT (*Elefant*), FORMERLY FERDINAND, *8.8 cm Stu. K. 43* OR *Pak 43/2* ON THE *Panzer Jäger Tiger P.* (1) *General.* This is another version of the latest model, long 88-mm antitank gun. The gun is mounted on the Tiger P chassis, a discarded early version of the Tiger, incorporating twin gasoline generating units with direct electric drive. Although protected by heavy armor, this vehicle has been relatively unsuccess-

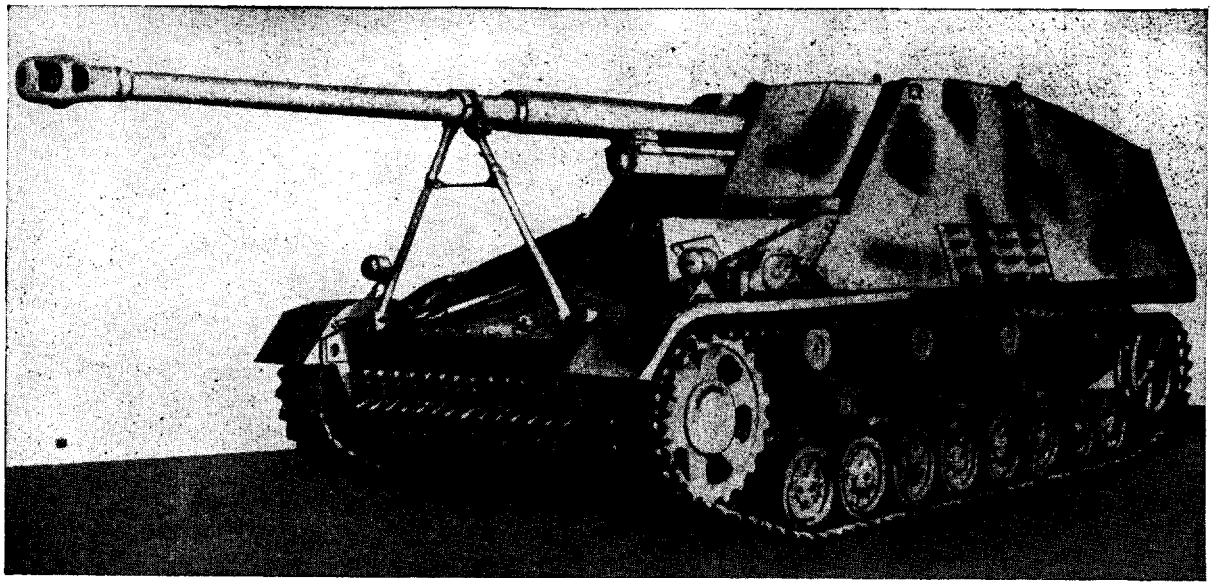

Figure 93.—8.8 cm Pak 43/1 on Pz Jäg. III/IV (Rhinoceros).

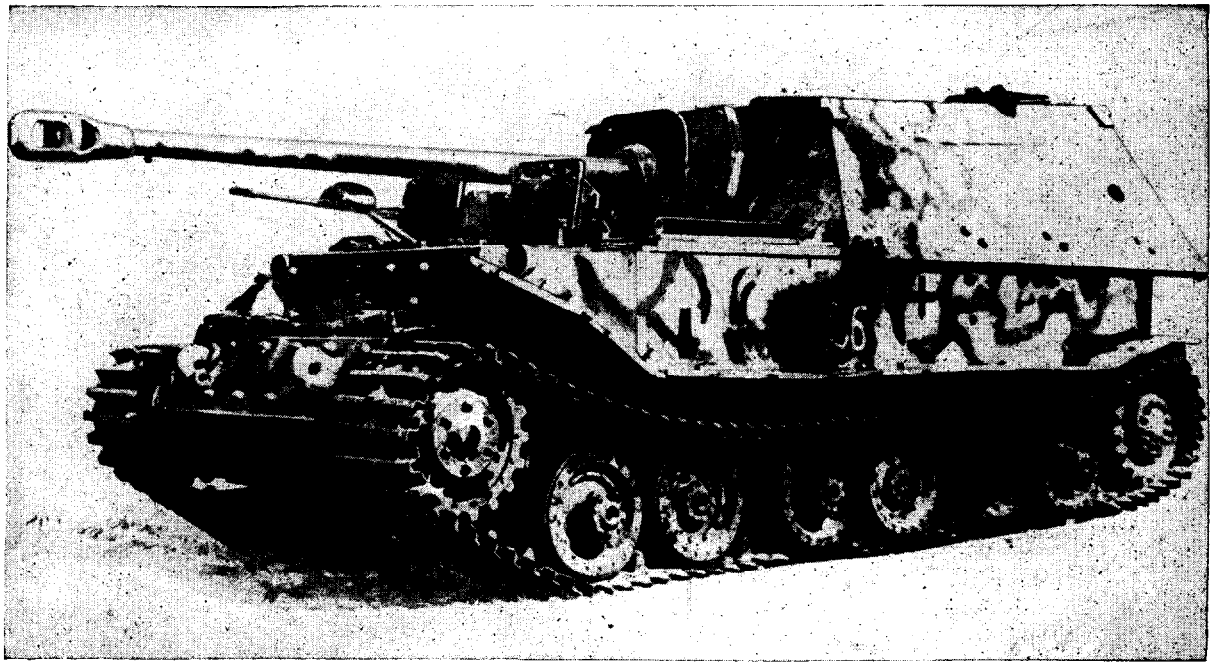

Figure 94.—8.8 cm Stu. K.43/1 on Tiger P Chassis (Elephant).

ful because it is ponderous and difficult to maneuver.

(2) *Specifications.*

General

Nomenclature .....*Elefant.*
Type of carriage .....*Pz. Jäg. Tiger P, Sd. Kfz. 184.*
Length over-all:
Including gun .....26 feet 10 inches.
Excluding gun .....23 feet 4 inches.
Width over-all .....11 feet 3 inches.
Height over-all .....9 feet 10 inches.
Weight .....73 short tons.
Crew .....6 men.

Gun

Type .....*8.8 cm Stu. K. 43 (L/71) or Pak 43/2.*
Muzzle velocity .....APCBC 3,280 feet per second.
Elevation .....—6° to + 25°.
Traverse .....12° each way.
Muzzle brake .....Fitted.

Buffer .....Hydraulic.
Recuperator .....Hydropneumatic.

Ammunition:

Types fired	APCBC	HE	HC	AP 40
Rounds carried	20	70		
Muzzle velocity (feet per second)	3,280	2,460	1,968	3,705
Projectile weight (pounds)	22.4	20.7	16.8	16

Carriage

Suspension:
Number of bogie wheels .....6, in pairs.
Type of bogie wheels. Large.
Number of return rollers .....None.

Hull armor:
Front .....200 mm at 32°.
Sides .....80 mm vertical.
Rear .....80 mm vertical.
Top .....30 mm horizontal.
Belly .....20 mm horizontal.

Fighting compartment armor:
Front .....170 mm at 30°.
Sides .....90 mm at 30°.

Power

Engines:
Type .....Two Maybach HL 120 TRMs.
Location .....Center.
Horsepower .....590.
Transmission .....Electric drive.
Drive .....Rear sprocket.

Performance

Fording .....2 feet 4 inches.
Radius of action .....62 miles.
Gradient .....30°.
Maximum speed .....12.5 miles per hour.

Remarks

Penetration of homogeneous armor at 30°, APCBC projectile:
500 yards .....184 mm.
1,000 yards .....169 mm.

c. *Jagdpanther, 8.8 cm Pak 43/3* OR *43/4 (L/71)* ON THE PANTHER CHASSIS. (1) *General.* This tank destroyer is intended for engaging armored targets at long ranges from stationary positions. A single, heavy, sloping plate protects the front of both hull and superstructure. The gun is mounted centrally in this plate, giving the vehicle the appearance of an assault gun, with the gun rather high.

(2) *Specifications.*

General

Nomenclature .....*Jagdpanther.*
Type of carriage .....*Pz. Jäg. Panther, Sd. Kfz. 173.*

Length over-all:
Including gun .....32 feet 4 inches.
Excluding gun .....22 feet 9 inches.
Width over-all .....10 feet 9 inches.
Height over-all .....8 feet 3 inches.
Weight .....51.25 short tons.
Crew .....5 men.

Gun

Type .....*8.8 cm Pak 43/3* or *43/4 (L/71).*
Muzzle velocity .....APCBC 3,280 feet per second.
Elevation .....—8° to + 14°.
Traverse .....13° each way.
Muzzle brake .....Yes.
Buffer .....Hydraulic.
Recuperator .....Hydropneumatic.

Ammunition:

Types fired	APCBC	HE	HC	AP 40
Rounds carried	28	29		
Muzzle velocity (feet per second)	3,280	2,460	1,968	3,705
Projectile weight (pounds)	22.4	20.7	16.8	16

Carriage

Suspension:
Number of bogies...8.
Type of bogies .....Double.
Number of return rollers .....1.
Track, length .....13 feet 5½ inches.
Track, width .....8 feet 7½ inches.
Width of link .....2 feet 2 inches.

Hull armor:
Front .....80 mm at 55°.
Sides .....30 mm vertical.
Rear .....40 mm at 30°.

Fighting compartment armor:
Front .....80 mm at 55°.
Sides .....45 mm at 30°.

Power

Engine:
Type .....Maybach HL 230 P30.
Cylinders .....V-12.
Fuel .....Gasoline.
Location .....Rear.
Horsepower .....690 at 3,000 rpm.
Transmission .....Synchromesh; 7 forward, 1 reverse.
Drive .....Front sprocket.

Performance

Trench crossing .....8 feet.
Fording .....5 feet 1 inch.
Radius of action .....87 miles.
Step .....3 feet.
Gradient .....30°.

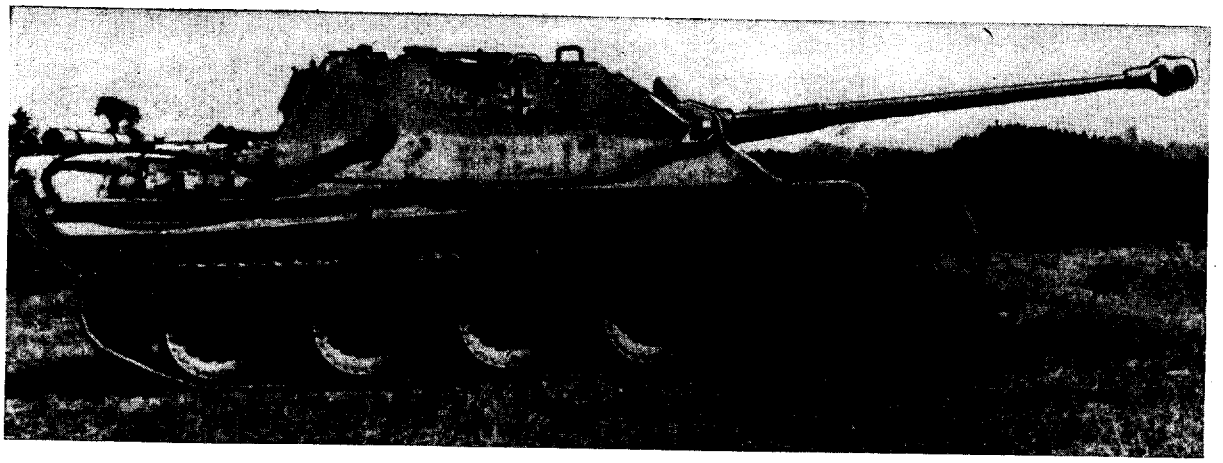

Figure 95.—8.8 cm Pak 43/3 on Panther Chassis (Jagdpanther).

Armament

Type .....One *M.G. 34*, ball mount.
Location .....Glacis plate.

Remarks

Penetration of homogeneous armor at 30°, APCBC projectile:
500 yards .....184 mm.
1,000 yards .....169 mm.

d. *Jagdtiger, 12.8 cm Pak 44 (L/55)* ON THE *Pz. Jäg. Tiger* MODEL B. (1) *General.* The *12.8 cm Pak 44 (L/55)* is the largest caliber antitank gun the Germans have produced so far. It is only found in a self-propelled version, mounted on the *Pz. Jäg Tiger Model B,* which is an adaptation of the King Tiger chassis. The superstructure in which the gun is mounted, is very heavily armored. The *Jagdtiger* supersedes the *12.8 cm K. 40* mounted on a hybrid chassis, which was employed in Russia and will probably not be encountered in the future.

(2) *Specifications.*

General

Nomenclature .....*Jagdtiger.*
Type of carriage .....*Pz. Jäg. Tiger* Model B, *Sd. Kfz. 186.*
Length over-all:
Including gun .....32 feet 2 inches.
Excluding gun .....23 feet 10 inches.
Width over-all .....11 feet 9½ inches.
Height over-all .....9 feet 3 inches.
Weight .....77.2 short tons.
Crew .....6 men.

Gun

Type .....*12.8 cm Pak 44 (L/55).*
Muzzle velocity .....APCBC 3,020 feet per second.
Muzzle brake .....Yes.

Ammunition:

Types fired	APC	APCBC	HE
Muzzle velocity (feet per second)	2,890	3,020	2,886
Projectile weight (pounds)	58.1	62.5	57

Rounds carried .....Total of 40 rounds.

Carriage

Torsion Bar Suspension:
Number of bogie wheels .....9.
Type of bogie wheels. Twin.
Number of return rollers .....None.
Track, length .....13 feet 4 inches.
Track, width .....9 feet, 2 inches.
Width of link .....2 feet 8½ inches.

Hull armor:
Front .....150 mm at 50°.
Sides .....80 mm vertical.
Rear .....80 mm at 30°.

Fighting compartment armor:
Front .....250 mm at 15°.
Sides .....80 mm at 25°.
Rear .....80 mm at 10°.

Power

Engine:
Type .....Maybach HL 230 P30.
Cylinders .....V-12.
Fuel .....Gasoline.
Location .....Rear.
Horsepower .....595 at 2,600 rpm.
Transmission .....Preselector, hydraulic operation; 8 forward, 4 reverse.
Drive .....Front sprocket.

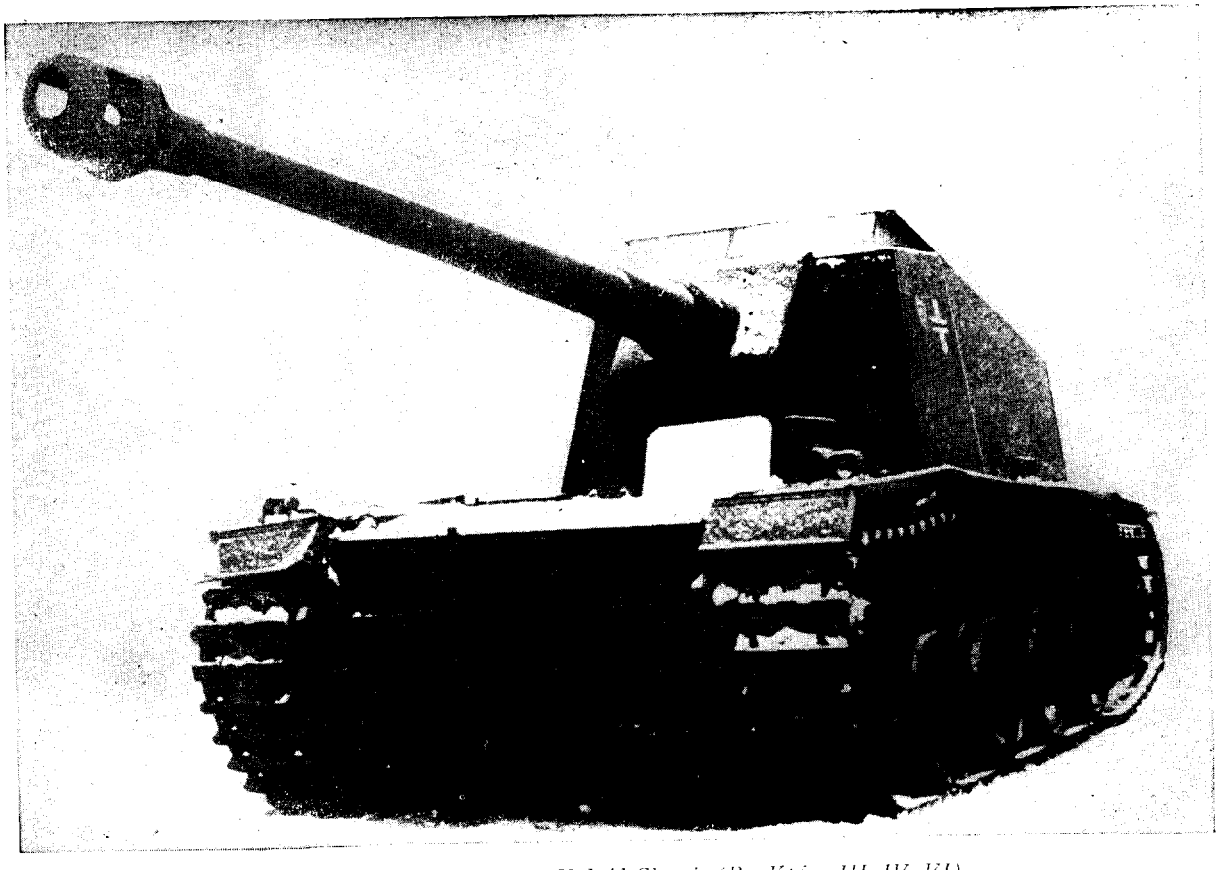

Figure 96.—12.8 cm K.40 on Hybrid Chassis (Pz. Kpfw. III, IV, VI).

Performance

Fording .....5 feet 9 inches.
Radius of action .....106 miles.
Gradient .....35°.
Maximum speed .....26 miles per hour.

Armament

Mounted .....One *M.G.34.*
Carried .....One *M.G.42.*

Remarks

Penetration of homogeneous armor at 30°:

	APC	APCBC
500 yards	172 mm	212 mm.
1,000 yards	148 mm	200 mm.

5. Self-Propelled Antiaircraft Guns

a. General. The growth of Allied air power and the decline of the *Luftwaffe* have forced the Germans to devise self-propelled antiaircraft guns to defend transport columns from low-level air attack.

b. *Flakpanzer.* Light antiaircraft guns of 20-mm or 37-mm caliber mounted on half-tracked vehicles have been in existence for some time, but the appearance of the so-called *Flakpanzer* or antiaircraft tanks is a new development. These consist essentially of a tank with turret removed and replaced by a light antiaircraft gun protected by an armored shield. The following types of *Flakpanzer* have been identified so far:

(1) The *2 cm Flak 38* mounted on the chassis of the Czech *38 (t)* tank.

(2) The *3.7 cm Flak 43* mounted on the *Pz. Kpfw. IV* chassis.

(3) The *2 cm Flakvierling 38* (four-barreled antiaircraft automatic cannon) mounted on the *Pz. Kpfw. IV* chassis with a thin eight-sided shield.

c. Half-Track Carriages. The 15-mm or 20-mm *M. G. 151,* a standard aircraft machine gun, has been recently mounted on the 3-ton, lightly armored, half-tracked vehicle, *Sd. Kfz. 251/21,* in a triple mounting with maximum elevation of 49°. The maximum cyclic rate of fire for the three guns is 2,100 rounds per minute. (Details of antiaircraft weapons are given in Section IV.)

6. List of Self-Propelled Artillery

a. Close Support and Assault Self-Propelled Artillery.

Gun	Carriage
7.5 cm Kw.K. (L/24)	*Pz. Kpfw. III* chassis *(Sd. Kfz. 142)*
7.5 cm Kw.K. (L/24)	Half-track *(Sd. Kfz. 251/90)*
7.5 cm Kw.K. (L/24)	8-wheeled armoured car *(Sd. Kfz. 233)*
7.5 cm Kw.K. (L/24)	Half-track *(Sd. Kfz. 10)*
7.5 cm Stu.K. 40 (L/43)	*Pz. Kpfw. III* chassis *(Sd. Kfz. 142)*
7.5 cm Stu.K. 40 (L/48)	*Pz. Kpfw. III* chassis *(Sd. Kfz. 142)*
7.5 cm Stu.K. 40 (L/48)	*Pz. Kpfw. IV* chassis
7.5 cm Stu.K. 42 (L/70)	*Pz. Kpfw. IV* chassis *(Sd. Kfz. 162)*

b. Field and Medium Self-Propelled Artillery.

10.5 cm Stu.H. 42 (L/28)	*Pz. Kpfw III* chassis *(Sd. Kfz. 142)*
15 cm s.I.G. 33 (L/12)	*Pz. Kpfw. I B* chassis *(Sd. Kfz. 101)*
15 cm s.I.G. 33 (L/12)	*Pz. Kpfw. II* chassis *(Sd. Kfz. 121)*
15 cm s.I.G. 33/1 (L/12)	*Gw. 38 (Sd. Kfz. 138/1)*
15 cm Stu. H. 43 (L/12)	*Pz. Kpfw. IV* chassis *(Sd. Kfz. 166)*
10.5 cm le.F.H. 18/2	*Gw. II (Sd. Kfz. 124)*
10.5 cm le.F.H. 18/4	Lorraine (French) chassis
10.5 cm le.F.H. 18	*Pz. Kpfw. II. 39* chassis
10.5 cm le.F.H. 18/1	*Pz. Kpfw. IV B* chassis
15 cm s.F.H. 13	Lorraine (French) chassis
15 cm s.F.H. 18/1	*Gw. III/IV (Sd. Kfz. 165)*

c. Tank Destroyers.

Gun	Carriage
*2.8 cm Pak 41**	Half-track *(Sd. Kfz. 250)*
*3.7 cm Pak**	Half-track *(Sd. Kfz. 251)*
*3.7 cm Pak**	Renault "Chenillette" (French) armored carrier
*4.7 cm Pak (t)**	*Pz. Kpfw. I* chassis
*4.7 cm Pak (t)**	*Pz. Jäg. I*
*4.7 cm Pak (t)**	Renault R.35 (French) tank chassis
*5 cm Kw.K. 39/1***	8-wheeled armored car *(Sd. Kfz. 234)*
7.5 cm Pak 40	*Pz. Kpfw. 38 (t)* chassis
7.5 cm Pak 40/3	*Pz. Jäg 38 (Sd. Kfz.138)*
7.5 cm Pak 39 L/48	*Pz. Jäg 38 (t)*
7.5 cm Pak 40	*Pz. Kpfw. II* chassis
7.5 cm Pak 40	*Pz. Jäg. II (Sd. Kfz. 131)*
7.5 cm Pak 40	*Pz. Jäg. II (Ausf. D/E) (Sd. Kfz. 132)*
*7.5 cm Kw.K.**	Half-track *(Sd. Kfz. 251/9)*
7.5 cm Pak 40/1	*Pz. Jäg. Lr. S. (Sd. Kfz. 135)*
7.5 cm Pak 40	Truck
7.5 cm Pak 40	Schneider Kegresse Armored Car chassis (modified)
7.5 cm Pak 40	Hotchkiss H. 39 tank chassis
7.5 cm Pak 39 (L/48)	*Panzerjäger IV (Sd. Kfz. 162)*
*7.62 cm Pak 36 (r)**	Half-track *(Sd. Kfz. 6)*
7.62 cm Pak 36 (r)	*Pz. Kpfw. 38 (t)* chassis
7.62 cm Pak 36 (r)	*Pz. Jäg. 38 (Sd. Kfz. 139)*
7.62 cm Pak 36 (r)	*Pz. Kpfw. II* chassis
7.62 cm Pak 36 (r)	*Pz. Jäg. II (Sd. Kfz. 131)*
7.62 cm Pak 36 (r)	*Pz. Jäg. II Ausf. D/E (Sd. Kfz. 132)*
7.62 cm F.K. (r)	*Pz. Jäg. II Ausf. D/E (Sd. Kfz. 132)*
8.8 cm Pak 43/1 (L/71)	*Pz. Jäg. III/IV (Sd. Kfz. 164)*
8.8 cm Pak 43/3 or *Pak 43/4*	*Pz. Kpfw.* Panther chassis *(Sd. Kfz. 173)*
8.8 cm Stu.K. 43/1 (L/71) or *Pak 43/2 (L/71)*	*Tiger (P)* chassis *(Sd. Kfz. 182)*
12.8 cm K.40	Hybrid chassis
12.8 cm Pak 44 (L/55)	*Tiger II* chassis

d. Self-Propelled Antiaircraft Guns.

2 cm Flak 30 or *38**	Half-track *(Sd. Kfz. 10)*
*2 cm Flak 38**	Half-track *(Sd. Kfz. 70)*
*2 cm Flakvierling 38**	Half-track *(Sd. Kfz. 7)*
3.7 cm Flak 18 or *36**	Half-track *(Sd. Kfz. 6)*
*5 cm Flak 41**	
M.G. 151/15 or *M.G. 151/20 Flakdrilling*	Half-track *(Sd. Kfz. 251/21)* (3-ton half-track)
2 cm Flak 38	*Pz. Kpfw. 38 (t)* chassis
3.7 cm Flak 43	*Pz. Kpfw. IV* chassis
2 cm Flakvierling 38	*Pz. Kpfw. IV* chassis

* Obsolete
** See "Armored Cars" for description

Figure 97.—Pz. Kpfw. I, Model A.

(2) *Specifications.*

Specification Number ..... *Sd. Kfz.** 101.
(Commander's Model ..... *Sd. Kfz.* 265.)

	Model			
	A	*B*		*Commander's*
Weight in action (tons)	5.88	6.44	8.96	6.44
Crew	2 men	2 men		3 men
Armor, Hull front	13 mm	13 mm		32 mm
Hull sides	15 mm	15 mm	25 mm	15 mm
Front glacis plate	8 mm	8 mm		20 mm
Superstructure				
Sides	13 mm	13 mm		15 mm
Turret front	15 mm	15 mm	50 mm	
Turret sides	13 mm	13 mm		
Armament	Two *M.G. 13*	Two *M.G. 13*	One 37 mm One *M.G.*	One *M.G. 34*
Dimensions				
Length (feet)	13	14		14
Width (feet)	6.75	6.75		6.75
Height (feet)	5.58	5.73		6.41
Clearance (inches)	9.75	10		10
Road speed (miles per hour)	12	15-16		15-16
Range on roads (miles)	112	87		87

* *Sd. Kfz.* is the German abbreviation for *Sonderkraftfahrzeug*, meaning special motor vehicle.

Section VI. ARMORED VEHICLES

1. General

The story of German armored vehicle development is concerned principally with tanks, which have undergone considerable change since the beginning of the war. German tanks have shown, in the course of 5 years of war, a gradual change from the *Blitzkrieg* concept of battle to greater emphasis on defensive, or at least offensive-defensive, operations for which the latest German tank, the King Tiger, heavily armed and armored but relatively slow and unmaneuverable, is suitable.

German tank development began in 1934, ostensibly at the same time as the rest of the rearmament program, but there is no doubt that considerable thought and experimentation had been devoted to the subject before then. By 1939 the Germans had evolved four types of tanks: the *Pz. Kpfw.*[1] *I, II, III,* and *IV,* with which the *Blitzkrieg* campaigns were conducted. There is evidence that larger tanks were being developed in 1939, and specimens of what are assumed to have been a *Pz. Kpfw. V* and a *Pz. Kpfw. VI* in an experimental stage were employed in the invasion of Norway. These, however, must have proved unsatisfactory, since they were dropped, and the present *Pz. Kpfw. V* (Panther) and *Pz. Kpfw. VI* (Tiger) have no connection with them.

Meanwhile, the *Pz. Kpfw. I* and *II* gradually became obsolescent, first being relegated to reconnaissance roles and then finally disappearing in 1943 from the Table of Equipment of the *Panzer* regiment. The heavier tanks, *Pz. Kpfw. III* and *IV,* which had proven satisfactory under fire, were modified to meet new conditions by thicker armor and more effective guns.

In 1942, the *Pz. Kpfw. VI,* or Tiger, appeared in Russia, and later in Africa. The Tiger was designed in the direct German tradition, and simply was armed more heavily and armored more thickly than its predecessors. It appeared out of its proper order in the line of succession, for the *Pz. Kpfw. V,* or Panther, did not appear until nearly a year later. The Panther was somewhat of a surprise, since it marked a departure from the conventional lines of German design, and in the arrangement of its armor showed strong signs of Russian influence. Its great success in combat undoubtedly gave rise to the decision to redesign the Tiger, which to some extent had fallen short of expectations. The new version is the *Koenigstiger* or King Tiger.

[1] *Pz. Kpfw.* is the German abbreviation for *Panzerkampfwagen,* meaning armored fighting vehicle or tank.

2. Obsolete Tanks

a. General. The *Pz. Kpfw. I, Pz. Kpfw. II,* and *Pz. Kpfw. III,* although obsolete, are discussed here since they still may be met occasionally in the field.

b. Light Tank (*Pz. Kpfw. I*). (1) *General.* This was the first tank to be standardized by the Germans, and the first ones were produced in 1934. Three models (A, B, and C) and a commander's version (based on model B) have been identified, but model C never has been encountered in action. The hull of the *Pz. Kpfw. I* was used as a self-propelled mount for several types of artillery weapons, but it no longer will be met even in this role. [(2) *Specifications* on page 76.]

c. Light Tank (*Pz. Kpfw.* II). (1) *General.* This tank is manned by three men: a commander, who acts as the gunner; a radio operator; and a driver. A large number of models of this tank were produced before it became obsolete. In a very much modified form it has reappeared as the *Luchs* (Lynx) reconnaissance tank in Western Europe. The original experimental models of *Pz. Kpfw. II* were produced between 1934 and 1936; it finally was abandoned as a fighting vehicle in 1943. A flame-throwing version, *Pz. Kpfw. II (F),* also has become obsolete and probably will not be met again. Model F, not the flame-thrower tank, was the latest model encountered. The modified hull of the *Pz. Kpfw. II* is still in use as a self-propelled gun carriage, notably in the case of the *15 cm s. I.G. 33* and the *10 cm le. F.H. 18.*

(2) *Specifications.*

	Model F	*Model L (Lynx)*
Specification number	*Sd. Kfz. 121*	*Sd. Kfz. 123.*
Weight in action (tons)	11.5	13.2
Crew	3 men	3 men
Armor, Hull front	35 mm	30 mm
Hull sides	20 mm	20 mm
Front glacis plate	20 mm	20 mm
Superstructure		
Front	30 mm	30 mm
Sides	20 mm	20 mm
Turret front	35 mm	30 mm
Turret sides	15 mm	20 mm
Armament (coaxially mounted in turret)	One *2 cm Kw.K.30* One *M.G. 34*	One *2 cm Kw.K.18* One *M.G.34*

Figure 98.—Pz. Kpfw. II.

Dimensions, Length (feet)	14.75	14.83
Width (feet)	7.33	8.25
Height (feet)	6.48	6.58
Ground clearance (inches)	13	16 (approximate)
Engine	6-cylinder In-line 133 HP Gasoline	6-cylinder In-line 176 HP Gasoline
Road speed (miles per hour)	15	40
Range on roads (miles)	118	155

Suspension: Model F: 5 bogie wheels each side; quarter-elliptic leaf springing. Front drive sprocket, rear idler.

Model L: 5 axles, torsion bar suspension; interleaved bogie wheels. Front drive sprocket, rear idler.

d. MEDIUM TANK (*Pz. Kpfw. III*). (1) *General.* This tank has appeared in many models but has retained basic characteristics throughout. The latest models to appear are armed with the long-barreled *5 cm Kw.K. 39 (L/60)*, which in 1942 displaced the shorter *5 cm Kw.K. (L/42)*. The original main armament, discarded late in 1940, was a 37-mm gun. The *Pz. Kpfw. III* now is obsolete and rarely encountered. The excellent hull and suspension have been utilized as the carriage for self-propelled guns, and it is in this form that the vehicle remains in production. The *Pz. Kpfw. III* has been encountered armed with the short *7.5 cm Kw.K.* (the original armament of the *Pz. Kpfw. IV*), and also as a commander's vehicle, as a flame-throwing tank, as a wrecker tank, as an armored ammunition carrier, and as an armored observation post.

(2) *Specifications.*

	Models L and M
Specification number	*Sd. Kfz. 141/1.*
Weight in action	24.6 tons (approximately).
Crew	5 men.
Armor, Front nose plate	50 mm.
Glacis plate	25 mm.
Driver's front plate	50 and 20 mm spaced armor.
Hull sides	30 mm.
Rear plates	50 mm.
Turret front	57 mm.
Turret sides	10 mm.
Armament (coaxially mounted in turret)	One *5 cm Kw.K. 39* with one *M.G.34*

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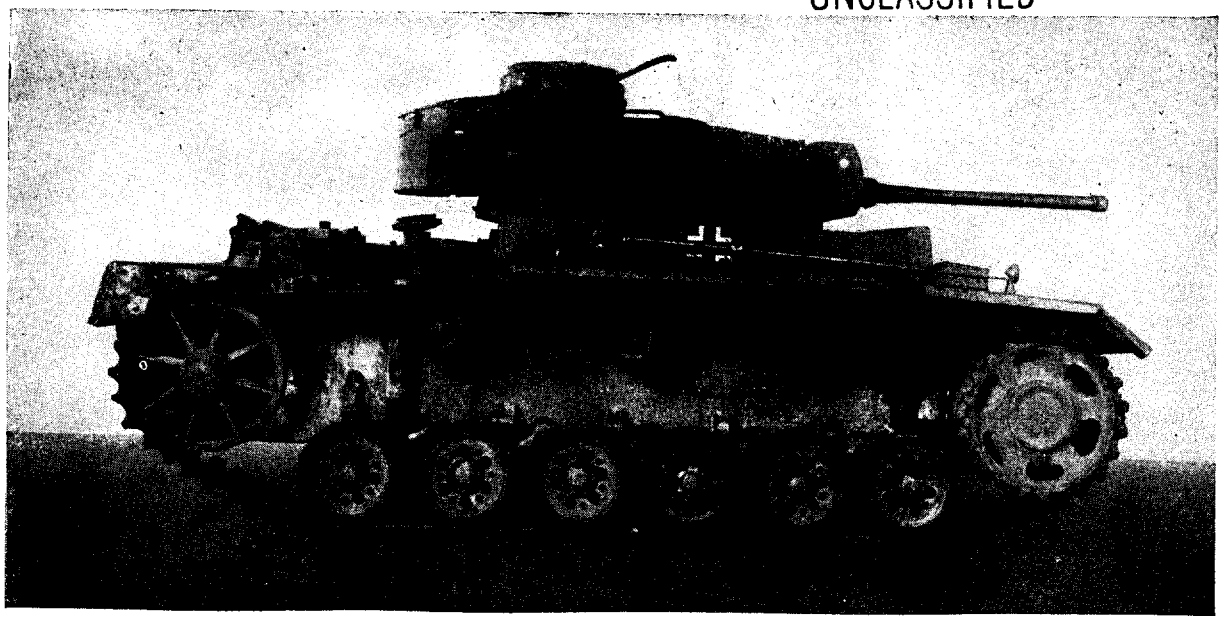

Figure 99.—Pz. Kpfw. III.

In hull .....One *M.G.34.*
Dimensions, Length....17 feet 8 inches.
Width ..... 9 feet 9 inches.
Height ..... 8 feet 3 inches.
Gun overhang..... 1 foot 3 inches. (approximately).
Ground clearance ... 1 foot 2 inches.
Performance, Maximum speed .....35 miles per hour (approximately).
Road speed .....22 miles per hour.
Cross-country speed..10 to 15 miles per hour.
Range on roads .....102 miles.
Range cross-country..59 miles.
Trench crossing .....8 feet 6 inches.
Step .....2 feet.
Gradient .....30°.
Fording .....2 feet 9 inches.
Engine, Type .....Maybach HL 120 TRM.
Fuel .....Gasoline.
BHP .....296 HP at 3,000 rpm.
Transmission: SSG77 Maybach synchromesh gear box, sliding dog type, manual control. Six forward speeds, one reverse.
Suspension: Six small rubber-tired bogie wheels on each side. Torsion-bar suspension.

3. Medium Tanks

a. *Pz. Kpfw. IV.* (1) *General.* Of the four tank types with which the Germans started the war, only the *Pz. Kpfw. IV* survives in service, although its role has been changed and it now carries a main armament which resembles the original gun only in caliber. It was armed originally with a short-barreled 75-mm gun (*7.5 cm Kw.K. (L/24)*) and a machine gun mounted coaxially in the turret. In later models a hull machine gun was added. With this short, low-velocity gun the tank was primarily a close-support weapon. In 1942 it was re-armed with a long-barreled, high-velocity gun, the *7.5 cm Kw.K. 40 (L/43),* and thus changed its role from a close-support vehicle to a fighting tank and displaced the *Pz. Kpfw. III* as the main armament of the *Panzer* regiment. At the present time the *Pz. Kpfw. IV* is only a stop-gap for the Panther. If enough Panther tanks become available, the disappearance of the *Pz. Kpfw. IV* may be expected.

The latest version of this tank to appear is the Model H, which differs from the Model G, of which details are given, only in its 75-mm gun being 48 calibers long instead of 43. There is no change in the ballistic characteristics.

This tank also has appeared in a commander's model, as an observation-post tank, as an ammunition tank, and as an armored antiaircraft vehicle. The hull and suspension also have been employed for self-propelled guns.

(2) *Specifications.*

Model G
Specification number ..*Sd. Kfz. 161/1.* (Model H is *Sd. Kfz. 161/2).*
Weight in action .....26 tons.
Crew ..... 5 men.

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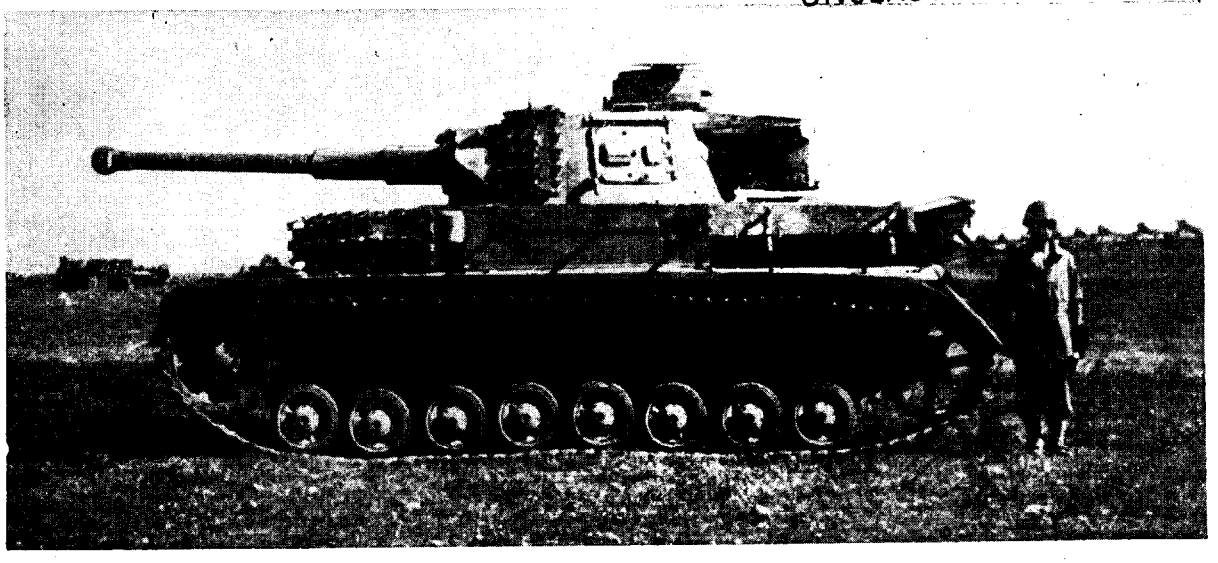


Figure 100.—Pz. Kpfw. IV, Model F2, (Sd. Kfz. 161).

Armor, Front nose plate . 60 mm.
Front glacis plate ... 25 mm.
Driver's front plate . . 60 mm.
Hull sides ..... 30 mm.
Hull rear ..... 20 mm.
Turret front ..... 40 mm.
Turret sides ..... 30 mm.

Armament (coaxially mounted in turret) ... One *7.5 cm Kw.K.40 (L/43)* and one *M.G.34*.
In hull ..... One *M.G.34*.

Dimensions, Length (excluding gun) ... 19 feet 4 inches.
Width ..... 9 feet 7 inches.
Height ..... 8 feet 6 inches.
Gun overhang ..... 1 foot 6 inches. (In model H, 2 feet 9 inches).
Ground clearance ... 1 foot 3 inches.

Performance:
Trench crossing ..... 9 feet.
Step ..... 2 feet 6 inches.
Gradient ..... 30°.
Fording ..... 3 feet.
Road speed ..... 20 miles per hour.
Cross-country speed . . 10 to 15 miles per hour.
Maximum speed ..... 25 miles per hour.
Range on roads ..... 130 miles.
Range cross country . . 80 miles.

Engine, Type ..... Maybach HL 120 TRM.
Cylinders ..... V-12 at 60°.
Fuel ..... Gasoline.
Fuel capacity ..... 126 gallons.
Fuel consumption (per 100 miles)
On roads ..... 93.6 gallons.
Cross-country ..... 153 gallons.
BHP ..... 295 HP at 3,000 rpm.
Capacity ..... 11.9 liters (725.9 cubic inches).

Transmission: Manual synchromesh, sliding-dog type; six forward speeds, one reverse.

Steering: Epicyclic clutch brake mechanism.

Suspension: Four bogie assemblies, each carrying two rubber-tired bogie wheels. Quarter-elliptic springing.

4. Heavy Tanks

a. *Pz. Kpfw.* PANTHER. (1) *General.* In this tank, probably the most successful they have produced, the Germans have departed from their customary lines and sought inspiration in the design of the Russian *T34*. The tank weighs about 50 short tons, and the effectiveness of its armor is enhanced by the fact that most of the plates are sloping. It has powerful armament, and has a high-powered engine which gives it a maximum speed of about 30 miles per hour. Internally the Panther is arranged in the standard German manner, with the driver's compartment in front, the fighting compartment in the center section, and the engine at the rear.

The Panther's design employs the double torsion-bar suspension. There are eight double, interleaved, large Christie-type bogie wheels. Each set of bogie wheels is mounted on a radius arm on the projecting end of a torsion bar which is coupled in series to a second one lying parallel to it. This ingenious device has the effect of doubling the length of the torsion bars.

Figure 101.—Pz. Kpfw. "Panther".

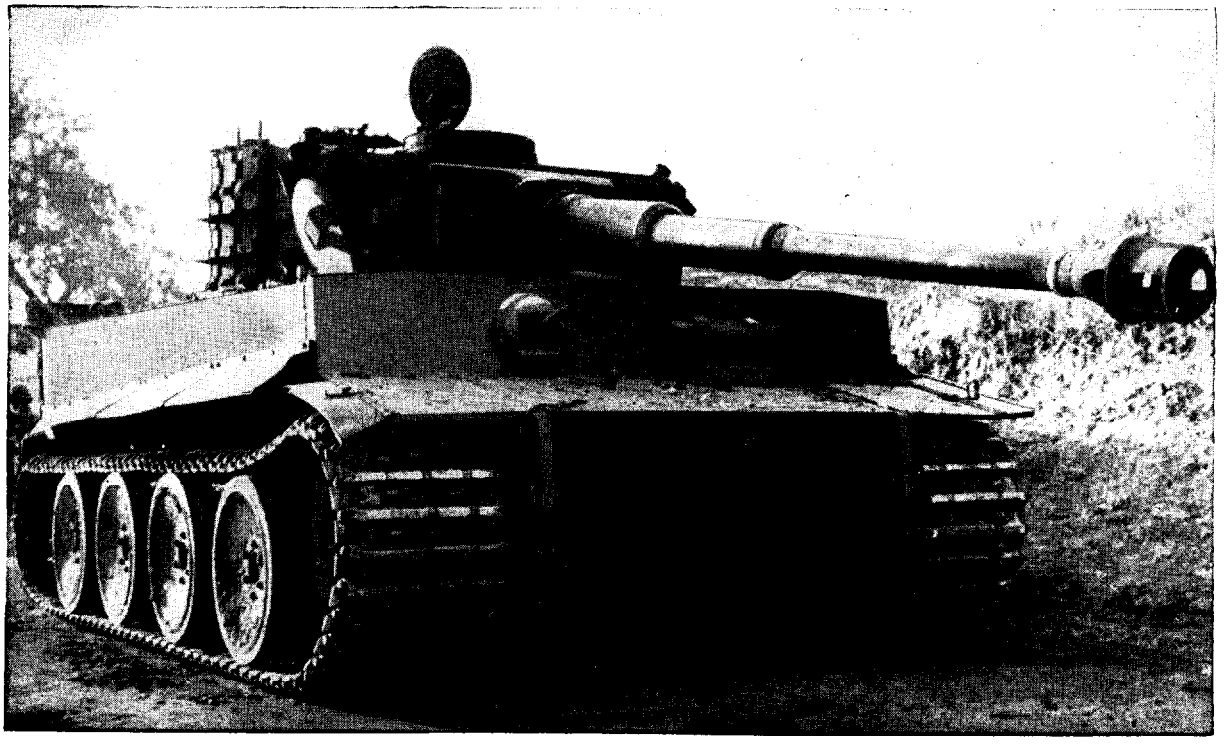


Figure 102.—Pz. Kpfw. "Tiger".

The Panther first was met in action on the Russian front in the summer of 1943. Originally designated *Pz. Kpfw. V,* its nickname, Panther, was adopted as its official nomenclature in February 1944. The latest version to appear is the Model G. The principal reasons for the success of the Panther are its relatively high speed, maneuverability, dangerous armament, and good protection.

Variants of the Panther tank which have been identified are the commander's version, the wrecker tank (*Bergepanther*), and the self-propelled gun *Jagdpanther,* which consists of the *8.8 cm Pak 43/3* or *4* on the Panther chassis.

(2) *Specifications.*

	Model G
Specification number	*Sd. Kfz.171.*
Weight in action	50 short tons (approximately).
Crew	5 men.
Armor,	
Front glacis plate	80 mm at 55°.*
Front nose plate	60 mm at 35°.
Rear plate	40 mm at 30°. (undercut)
Hull sides	40 mm vertical.
Superstructure sides	50 mm at 30°.
Turret front	110 mm at 10°.
Turret sides	45 mm at 25°.
Turret rear	45 mm at 28°.
Armament (coaxially mounted in turret)	One *7.5 cm Kw.K.42 (L/70)* and one *M.G.34.*
In hull	One *M.G. 34.*

* All angle measurements given are from vertical.

Dimensions, Length (excluding gun)	21 feet 11½ inches.
Width	10 feet 9½ inches.
Height	9 feet 4 inches.
Gun overhang	6 feet 5 inches.
Ground clearance	1 foot 7½ inches.
Performance,	
Trench crossing	10 feet.
Step	3 feet.
Gradient	30°.
Fording	6 feet (Some submersible to 13 feet).
Road speed	20 miles per hour.
Cross-country speed	15 miles per hour.
Maximum speed	35 miles per hour.
Range on roads	124 miles.
Range cross-country	62 miles.
Engine, Type	Maybach HL 230 P30.
Cylinders	V-12
Fuel	Gasoline.
Fuel capacity	193 gallons.
Fuel consumption (per 100 miles)	
On roads	149 gallons.
Cross-country	298 gallons.
BHP	690 HP at 3,000 rpm.
Capacity	23 liters (1,403 cubic inches).

Transmission: Maybach synchromesh sliding-dog type; manually operated, giving seven forward speeds, one reverse.

Suspension: Eight load-carrying axles each carrying two large disced rubber-tired bogie wheels, interleaved. Twin torsion-bar suspension.

b. *Pz. Kpfw.* TIGER. (1) *General.* This tank,

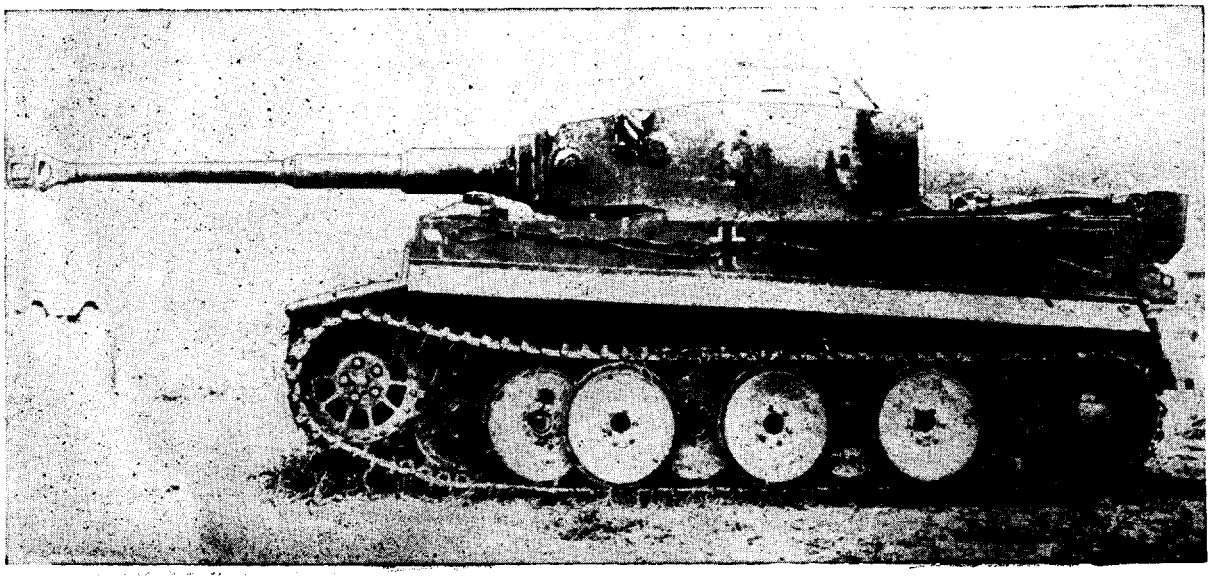


Figure 103.—Pz. Kpfw. "Tiger", Model E (Sd. Kfz. 181).

originally the *Pz. Kpfw. VI,* first was encountered by the Russians in the last half of 1942, and by the Western Allies in Tunisia early in 1943. It's colloquial name, Tiger, was adopted officially in February 1944. The current version is Model E.

Unlike the Panther, the Tiger is designed on familiar German lines, but all the dimensions are increased. The main armament is the *8.8 cm Kw.K. 36,* which is essentially the *8.8 cm Flak 36* adapted for turret mounting. The mounting of such a heavy gun has raised considerable problems of rigidity, and consequently the hull is constructed of large plates entirely welded together. The superstructure is made up in one unit, and welded to the hull. The turrent wall is made from a single large piece of armor, 82 mm thick, bent into a horseshoe shape. Further, all the armor plates are interlocked, in addition to being welded. The armor of the Tiger, at the time of its appearance, was the thickest ever to be fitted on any German tank, the front vertical plate being 102 mm thick and the hull sides 62 mm.

The suspension, which employs interleaved, Christie-type bogie wheels with a very wide track, is reasonably simple and is an effective solution of the suspension problem for such a large and heavy vehicle.

The Tiger engine requires very skilled driving and maintenance to get the best performance, and in the hands of insufficiently trained crews mechanical troubles are apt to appear. This characteristic has been the tank's principal disadvantage.

(2) *Specifications.*

	Model E
Specification number	*Sd. Kfz. 181*
Weight in action	62.75 short tons.
Crew	5 men.
Armor, Front nose plate	102 mm at 20°.
Front glacis plate	62 mm at 80°.
Lower nose plate	62 mm at 60°.
Driver's front plate	102 mm at 10°.
Hull sides	62 mm vertical.
Superstructure sides	82 mm vertical.
Rear plate	82 mm at 20° (undercut).
Turret front	100 mm at 0° to 11°.
Turret sides and rear	82 mm vertical.
Armament (coaxially mounted in turret)	One *8.8 cm Kw.K.36 (L/56). One M.G.34*
In hull	One *M.G.34.*
Dimensions, Length (excluding gun)	20 feet 8½ inches.
Width with wide combat track	12 feet 3 inches.
Width with narrow transport track	10 feet 4 inches.
Height	9 feet 4¾ inches.
Gun overhang	7 feet ½ inch.
Ground clearance	1 foot 5 inches.
Performance,	
Trench crossing	10 feet.
Step	2 feet 6 inches.
Gradient	30°.
Fording	Submersible to 13 feet.
Road speed	15 miles per hour.
Cross-country speed	5 to 10 miles per hour.
Maximum speed	25 miles per hour.
Range on roads	87 miles.
Range cross-country	53 miles.
Engine, Type	Maybach HL 230 P45.
Cylinders	V-12.
BHP	690 HP at 3,000 rpm.
Fuel	Gasoline.
Fuel capacity	150 gallons (approximately).

Transmission: Maybach-Olvar preselective gearbox, hydraulically operated with eight forward speeds and four reverse.

Suspension: Front driving sprocket and rear idler. Eight load-carrying axles each with three large bogie wheels. Bogie wheels are interleaved. Torsion-bar suspension, one torsion bar per axle.

c. *Pz. Kpfw.* TIGER, MODEL B (KING TIGER). (1) *General.* This tank is a development of the Tiger along the lines of the Panther and with a new main armament, the *8.8 cm Kw.K. 43 (L/71).* The armor is as thick as that of the Tiger—in some parts thicker—and the improved design and the slope given to the majority of the plates (as in the Panther) give the tank vastly improved protection.

The King Tiger is a tank designed essentially for defensive warfare or for breaking through strong lines of defense. It is unsuitable for rapid maneuver and highly mobile warfare because of its great weight and low speed. To accommodate the gun the turret has been made unusually long in proportion to the total length of the tank. When "buttoned up" the tank is extremely blind, and this is one of its weakest points.

Since the King Tiger first appeared in August 1944 in Normandy, modifications have been made in the turret to eliminate the excessive plate-bending involved in the original construction. The King Tiger virtually is invulnerable to frontal attack, but the flanks, which are less well protected, can be penetrated by Allied antitank weapons at most normal combat ranges.

Figure 104.—Pz. Kpfw. "Tiger", Model B.

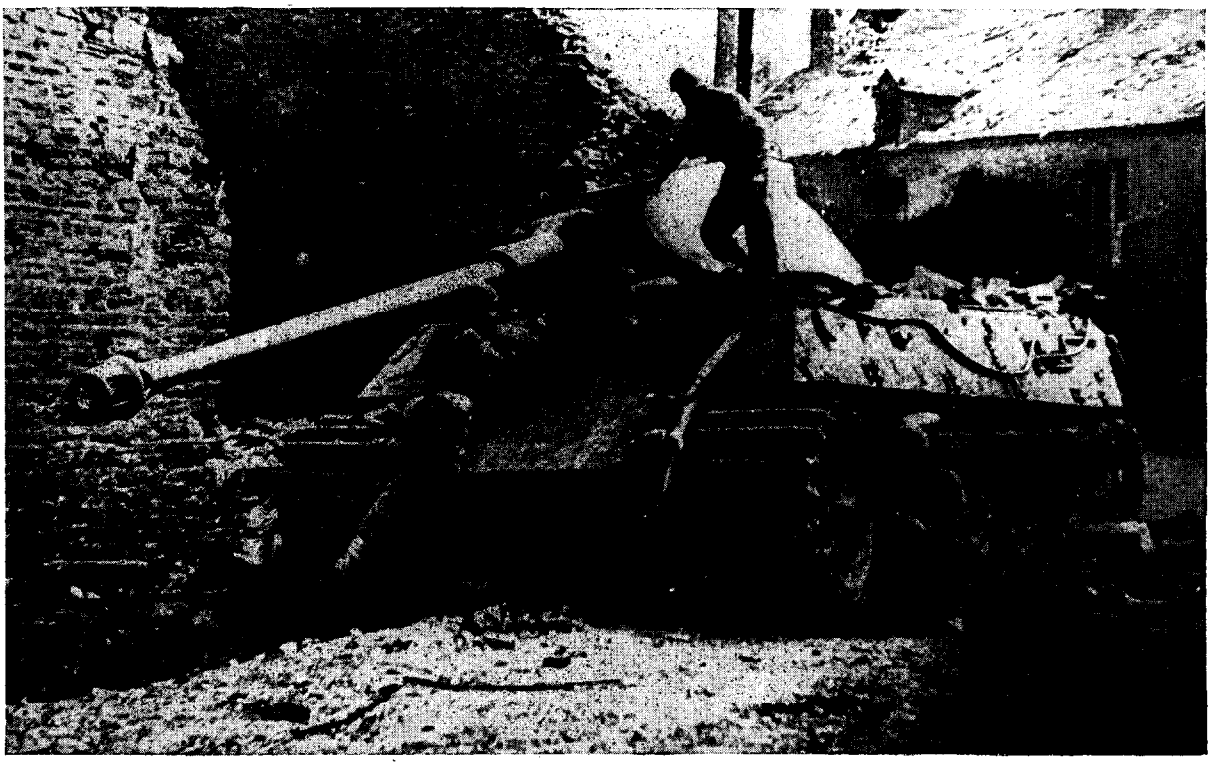


Figure 105.—Pz. Kpfw. "Tiger", Model B (Sd. Kfz. 182)

(2) *Specifications.*

	Model B
Specification number	*Sd. Kfz. 182*
Weight in action	75 tons.
Crew	5 men.
Armor	
Front glacis plate	150 mm at 50°.
Lower nose plate	100 mm at 50°.
Hull sides	80 mm vertical.
Superstructure sides	80 mm at 20°.
Rear plate	80 mm at 25°.
Turret front	180 mm at 10°.
Turret sides and rear	80 mm at 20°.
Armament (coaxially mounted in turret)	One *8.8 cm Kw.K.43 (L/71)* and one *M.G.34.*
In hull	One *M.G.34.*
Dimensions, Length (excluding gun)	23 feet 10 inches.
Width	11 feet 11½ inches.
Height	10 feet 2 inches.
Gun overhang	8 feet 10 inches.
Ground clearance,	
Front	1 foot 7 inches.
Rear	1 foot 8 inches.
Performance,	
Road speed	24 miles per hour.
Cross-country speed	9 to 10 miles per hour.
Maximum speed	26 miles per hour.
Range on roads	106 miles.
Range cross-country	74 miles.
Engine, Type	Maybach HL 230 P30.
Cylinders	V-12.
Fuel	229 gallons.
Fuel consumption (per 100 miles)	
On roads	213 gallons.
Cross-country	300 gallons
BHP	590 HP at 2,600 rpm.

Transmission: Maybach-Olvar preselector type gearbox, hydraulically operated; eight forward speeds, four reverse.

Suspension: Nine load-carrying axles each side, each carrying twin over-lapping bogie wheels. Single torsion-bar suspension. Front driving sprocket rear idler.

5. Armored Cars

a. General. Two main types of armored cars still are in use in the German Army; the light four-wheeled, and heavy eight-wheeled vehicles. These have persisted almost without modification throughout the course of the war, and are vehicles entirely satisfactory in their role. A series of six-wheeled armored cars which existed before the outbreak of war apparently was unsatisfactory or redundant, for this type never has been met in action.

b. Four-Wheeled Armored Car (*Leichter Panzerspähwagen 2 cm*). (1) *General.* In addition to the normal four-wheeled armored car, which is armed with a 20-mm automatic cannon and an *M.G. 34,* there is a model (*Sd. Kfz. 221*) mounting a machine gun only, and a radio vehicle (*Sd. Kfz. 223*), also mounting one machine gun and having a rectangular, overhead, folding, frame aerial.

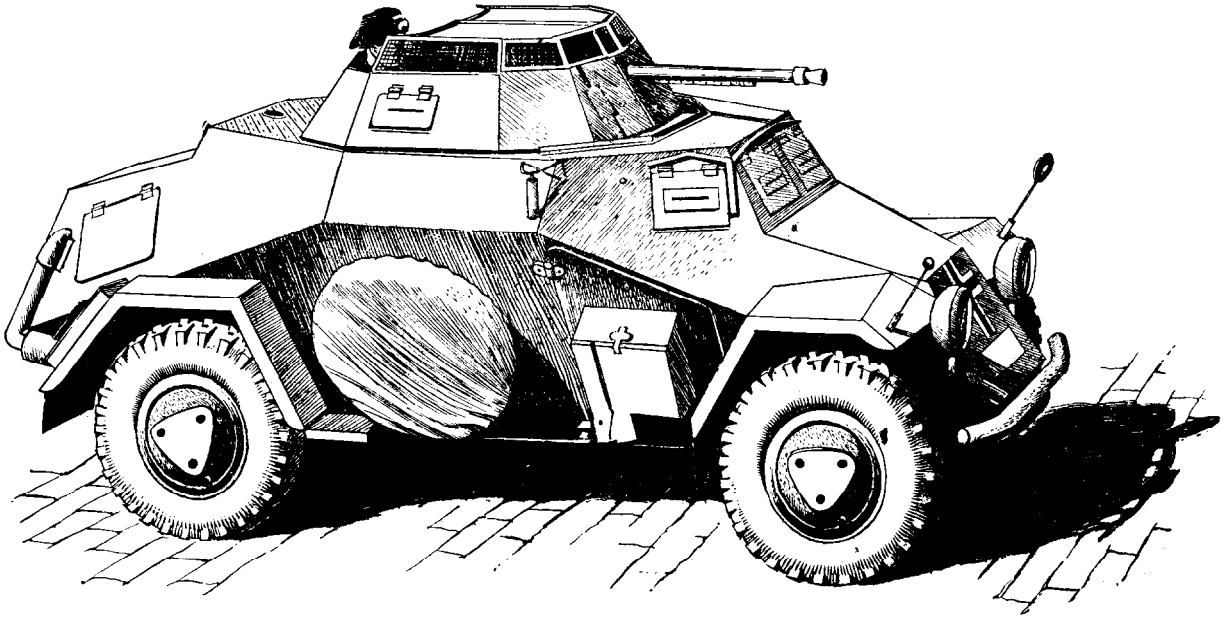


Figure 106.—Four-wheeled armored car (Sd. Kfz. 222).

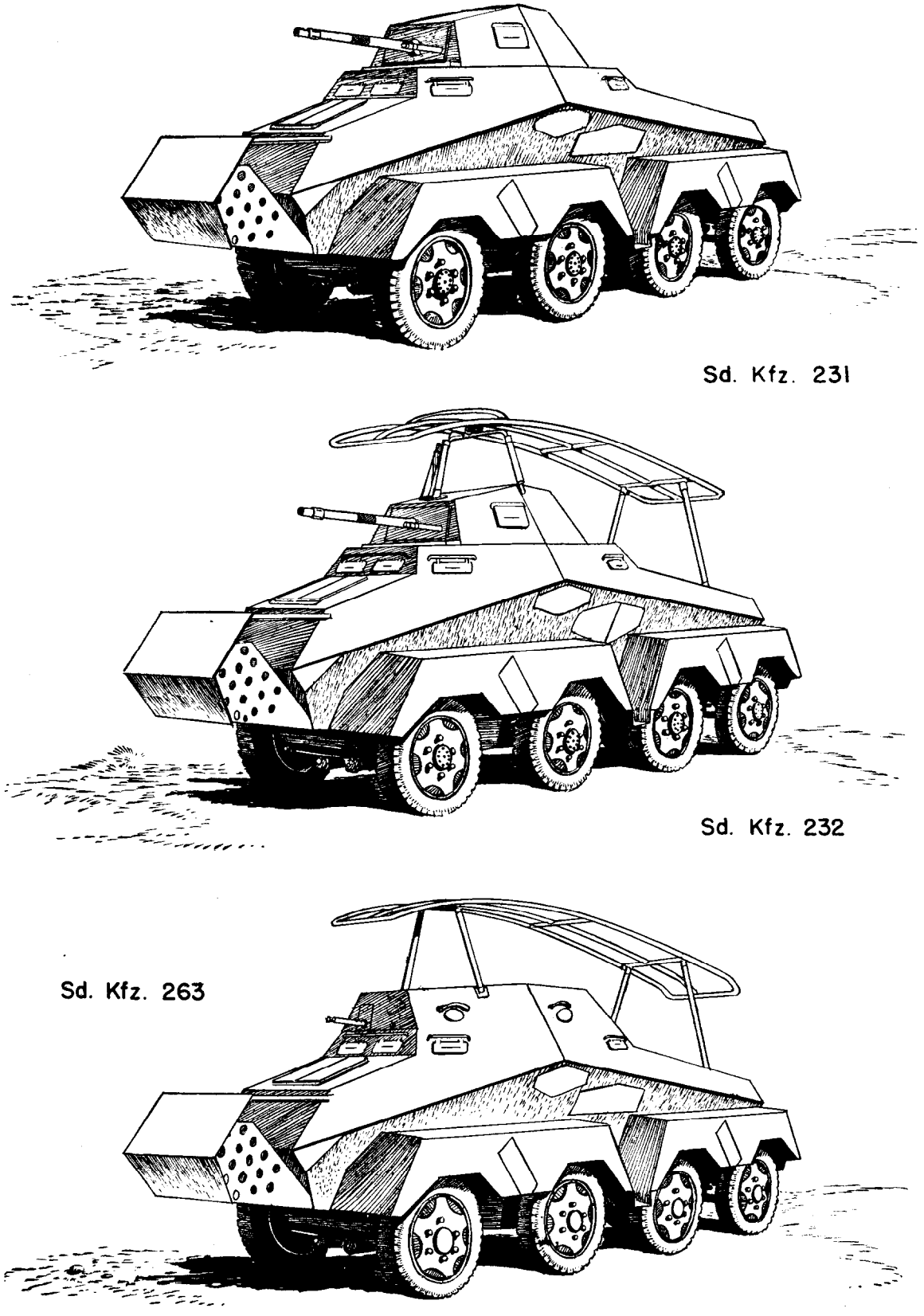


Figure 107.—Eight-wheeled armored vehicles.

(2) *Specifications.*

Specification number...*Sd. Kfz. 222.*
Weight in action.....5.25 tons.
Crew .....3 men.
Dimensions, Length....15 feet 7 inches.
Width .....6 feet 3½ inches.
Height .....5 feet 11½ inches.
Ground clearance ....7¾ inches.
Armor .....8 mm.
Armament .....One *2 cm Kw.K. 30 or 38* and one *7.92 mm M.G.34* coaxially mounted.

c. EIGHT-WHEELED ARMORED CAR (*Schwerer Panzerspähwagen 8 Rad*). (1) *General.* The eight-wheeled armored car has appeared in a variety of subsidiary roles. In addition to the principal version (*Sd. Kfz. 231*), there are two radio vehicles (*Sd. Kfz. 232* and *263*), an armored car mounting the *7.5 cm Kw.K. 38* and having no turret, and the eight-wheeled armored car mounting a *5 cm Kw.K. 39* in a turret (*Sd. Kfz. 234/2*). The radio vehicles have large, rectangular, folding, frame aerials.

(2) *Specifications.*

Specification number...*Sd. Kfz.231.*
Weight in action .....8.35 tons.
Crew .....4 men.
Dimensions, Length....19 feet 1 inch.
Width .....7 feet 3 inches.
Height .....7 feet 10 inches.
Ground clearance ...12 inches.
Armor, Turret front...15 mm.
Turret sides and rear.8 mm.
Superstructure front.18 mm.
Superstructure sides..8 mm.
Hull front nose plate.18 mm.
Hull sides .....8 to 10 mm.
Tail plate .....10 mm.
Armament .....One *2 cm Kw.K.30 or 38* and one *7.92*-mm *M.G.34* coaxially mounted.
Engine .....8 cylinders 155 BHP Gasoline.
Road speed .....51 miles per hour
Cross-country speed ...19 miles per hour.
Range on roads:.....165 to 190 miles.
Range cross-country ..110 miles.
Suspension .....8 single wheels. (8-wheel drive).
Performance,
Trench crossing .....5 feet.
Step .....1 foot 7 inches.
Fording .....2 feet.
Maximum grade ....27°.

d. HALF-TRACKED ARMORED CAR (*Le. Schtz. Pz. Wg. 2 cm*). (1) *General.* This half-tracked armored car is armed with 20-mm automatic cannon and machine gun in a turret.

(2) *Specifications.*

Specification number...*Sd. Kfz. 250/9.*
Weight in action .....6.5 tons.
Crew .....3 men.
Dimensions, Length ... 15 feet
Width .....6 feet 4½ inches.
Speed .....40 miles per hour.

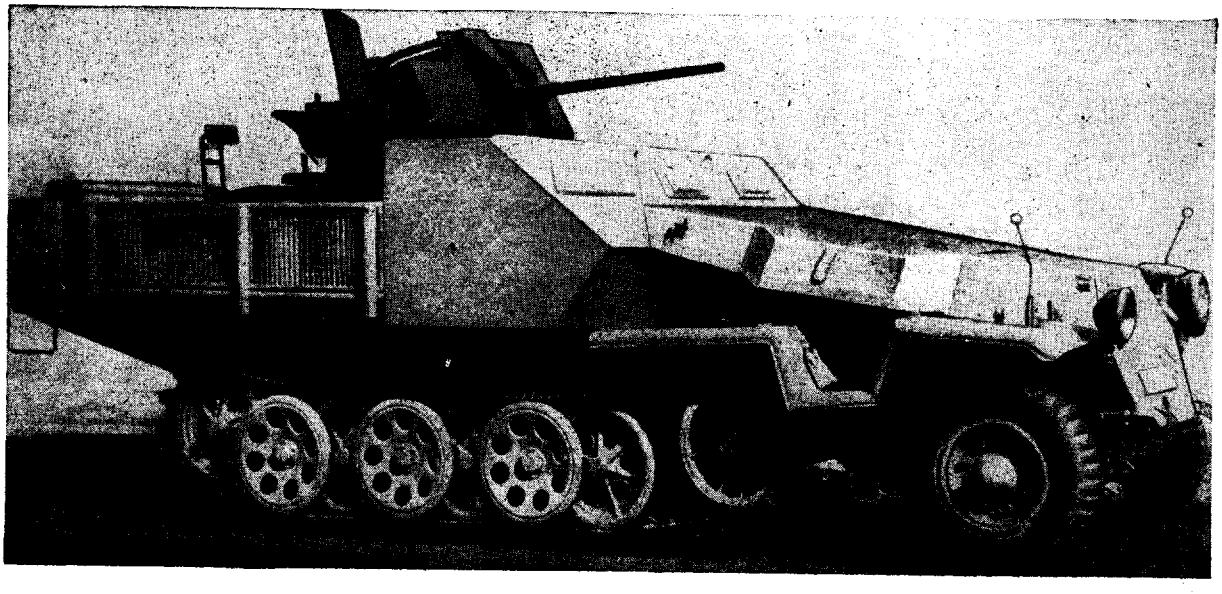


Figure 108.—Armored 3-ton half-tracked vehicle mounting 2 cm Flak 36.

6. Armored Personnel Carriers

A great variety of vehicles of the armored personnel-carrier type are in use in the German Army. Two types of chassis have been used for these: the 1-ton half-tracked prime mover (*Sd. Kfz. 10*) and the 3-ton half-tracked prime mover (*Sd. Kfz. 11*). These vehicles are armored only lightly (5 to 15 mm) and the plates are sloped like those on the armored cars. There has been a recent tendency to mount artillery (antiaircraft or antitank) up to 37-mm caliber in these vehicles. The following are examples of these vehicles:

On the 1-ton half-tracked chassis:
- Light Armored Troop Carrier .....*Sd. Kfz. 250.*
- Light Armored Ammunition Carrier...*Sd. Kfz. 252.*
- Light Armored OP..*Sd. Kfz. 253.*

On the 3-ton half-tracked chassis:
- Medium Armored Troop Carrier .....*Sd. Kfz. 251.*
- Armored Flame-thrower Vehicle ...*Sd. Kfz. 251/16.*
- Self-propelled Anti-tank Gun .....*3.7 cm Pak.*
- Self-propelled Anti-aircraft Gun .....*2 cm Flak 36.*

Section VII. ROCKET WEAPONS

1. General

a. DEVELOPMENT. German rocket weapons have undergone considerable development since their first appearance in combat in 1941, after experiments over a period of several years. There are now about a dozen standard projectors, in addition to a number of non-standard weapons which either are of a specialized design or have not yet reached a stage of development warranting large-scale production. The Germans introduced rocket projectors for laying heavy concentrations of smoke and for massed fire on area targets. Because the projectors are comparatively light, they are far more mobile than field artillery weapons firing projectiles of similar weights. However, the rocket projectors do not have the accuracy of artillery.

b. TYPES OF ROCKET WEAPONS. The more common types of German rocket weapons are the 150-mm six-barreled projector (*15 cm Nebelwerfer 41*), the 210-mm five-barreled projector (*21 cm Nebelwerfer 42*), and the 280-mm and 320-mm projector (*28/32 cm Nebelwerfer 41*), all mounted on two-wheeled tired carriages, and the 150-mm ten-barreled projector (*15 cm Panzerwerfer 42*), mounted on an armored half-track.

2. Field Projectors

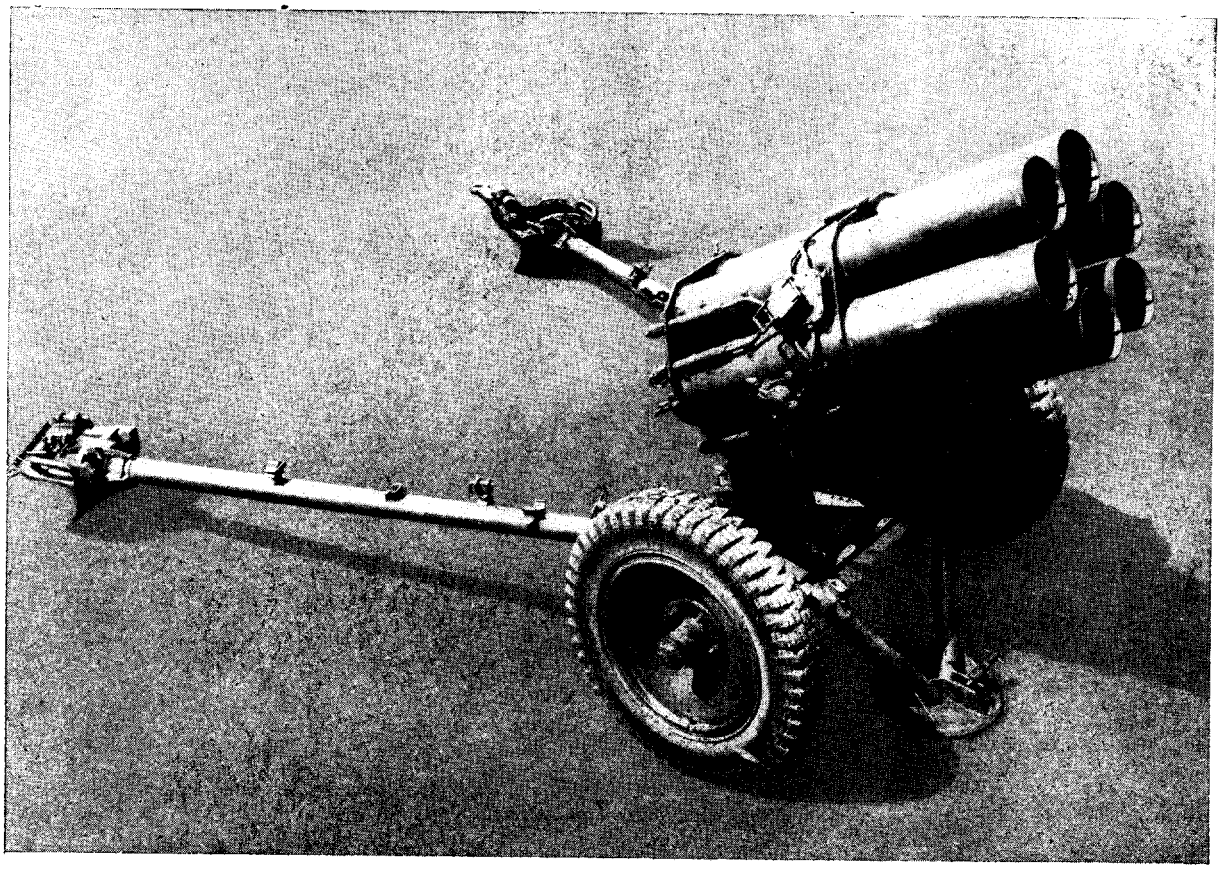
a. 150-MM ROCKET LAUNCHER (*15 cm Nebelwerfer 41*). (1) *General description.* This is the original tube-type equipment and consists of six tubes mounted on a simple two-wheeled carriage with a split trail. It is provided with elevating and traversing gears and has an electrical firing contact at the breech end of each barrel. These contacts lead to a junction box on the upper right-hand side of the barrel assembly. To prevent the weapon from being over-turned by blast, the barrels are fired separately in fixed order (1, 4, 6, 2, 3, 5), all six rounds being discharged in 10 seconds. To escape the blast, the firer lies in a slit trench about 15 yards to the flank and operates the weapon by means of an electrical switch connected to the junction box. Since the crew must seek shelter during firing, it requires about 90 seconds to load and fire a series of six rounds. A single tube projector known as the *Do-Gerät* which fires the same ammunition is used by airborne troops.

(2) *Characteristics.*

Caliber	150 mm (5.9 inches).
Length of barrels	51 inches.
Weight	1,195 pounds.
Traverse	30°.
Elevation	44°.
Maximum Range (HE)	7,330 yards.
Maximum Range (Smoke)	7,550 yards.
Weight of Rocket (HE)	75.3 pounds.
Weight of Rocket (Smoke)	78 pounds.
Velocity	1,120 feet per second.

(3) *Ammunition.* This projector fires HE and smoke projectiles, and there is some evidence that chemical rockets also exist for this weapon.

b. 210-MM ROCKET LAUNCHER (*21 cm Nebelwerfer 42*). (1) *General description.* This is a five-barreled projector on the lines of the *15 cm Nebelwerfer 41,* with similar carriage and electrical firing system. Removable internal rails are now supplied for this weapon to permit firing the 150-mm rockets.



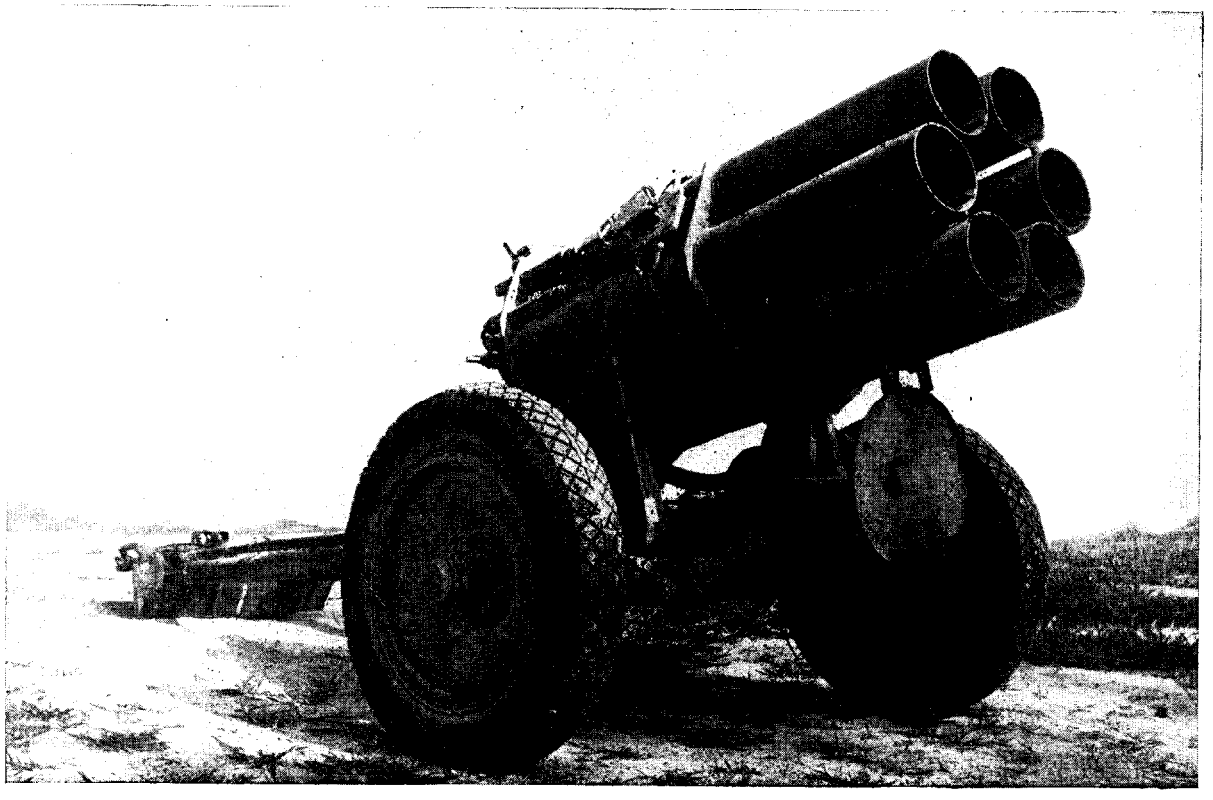


Figure 109.—15 cm Nebelwerfer 41.

Figure 110.—21 cm Nebelwerfer 42.

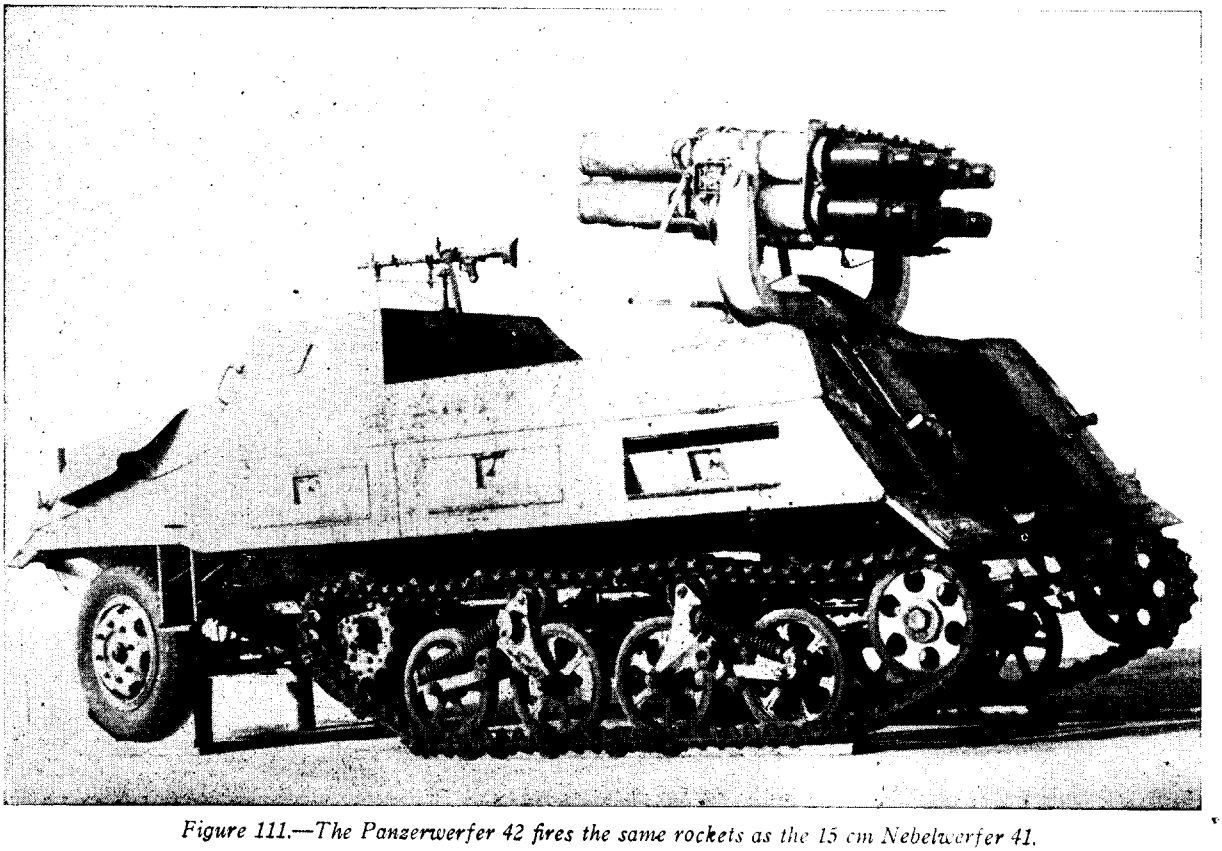


Figure 111.—The Panzerwerfer 42 fires the same rockets as the 15 cm Nebelwerfer 41.

(2) *Characteristics.*

Caliber.....210 mm (8.27 inches).
Length of barrels.....4 feet 3½ inches.
Maximum range .....8,600 yards.
Weight of rocket.....248 pounds.

(3) *Ammunition.* The projector fires an HE projectile with a 28-pound bursting charge.

c. 150-MM SELF-PROPELLED PROJECTOR (*15 cm Panzerwerfer 42*). (1) *General description.* The Germans have mounted this ten-barreled rocket projector on the rear of a lightly armored half-tracked vehicle with a *Maultier* suspension. Two horizontal rows of five barrels are mounted on a turntable with a 360-degree traverse. The weapon is fired electrically by a gunner who sits in the body of the vehicle immediately below the platform, his head protected by a shallow cupola. It is probable that the rate of fire of this weapon is higher than that of the *Nebelwerfer 41,* since the crew remains behind armor near the weapon and can reload in less time.

(2) *Characteristics.*

Caliber.....150 mm (5.9 inches).
Traverse .....360°.
Maximum elevation.....45°.
Maximum range .....7,330 yards.
Vehicle weight.....7.1 tons.
Vehicle road speed.....25 miles per hour.

(3) *Ammunition.* The ammunition is the same as that fired by the *15 cm Nebelwerfer 41.*

d. WOODEN RACK LAUNCHER (*28/32 cm Schweres Wurfgerät 40*). (1) *General description.* This is the original frame-type rocket projector and consists of a simple wooden frame upon which the projectiles are rested to be fired from the crates. The rockets are stabilized in flight by rotation imparted by the 26 jets which are inclined at an angle.

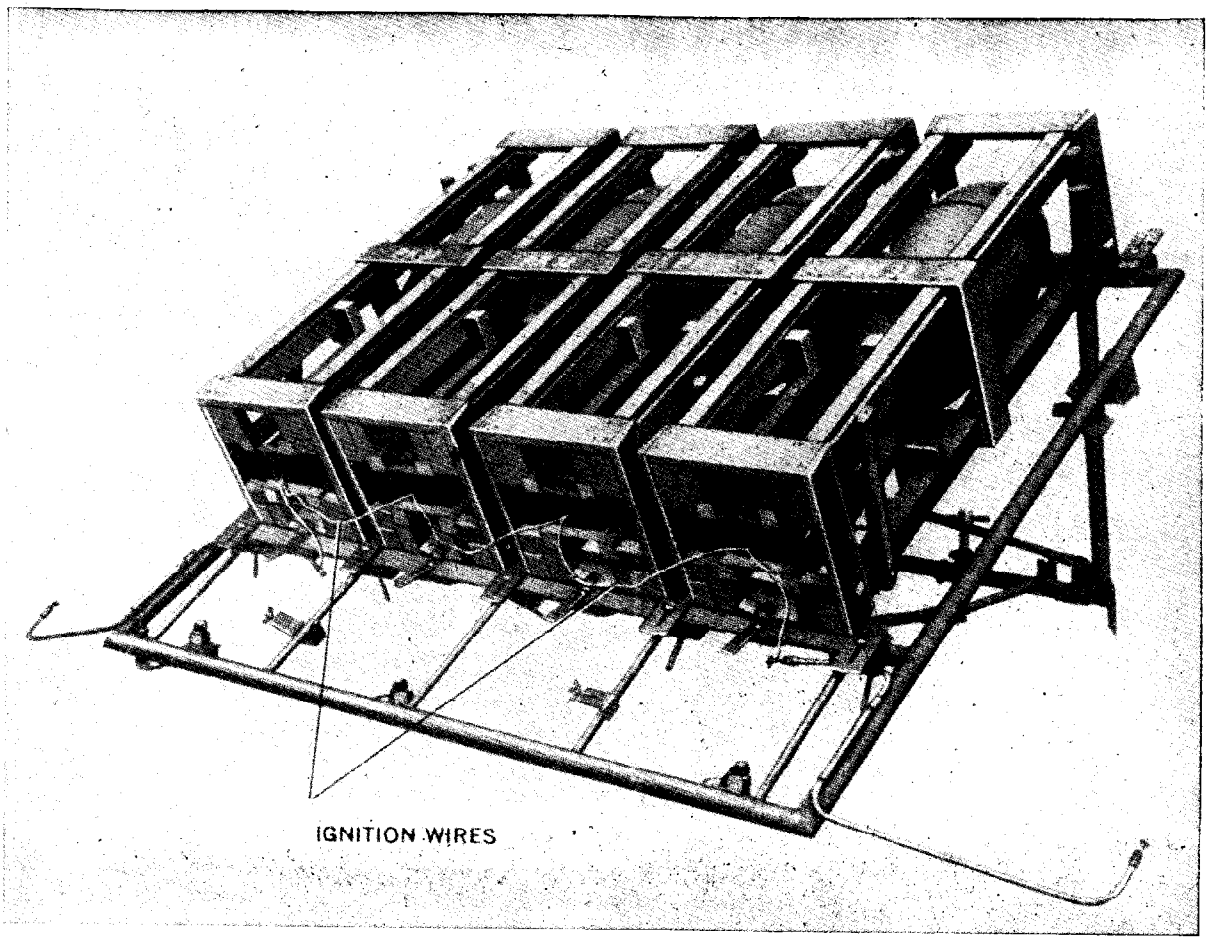


Figure 112.—The Wurfgerät 41 consists of a frame of steel tubing on which may be placed 280- or 320-mm rockets in either wooden or steel crates. (The wooden crates are illustrated above.) The rockets are fired from these crates.

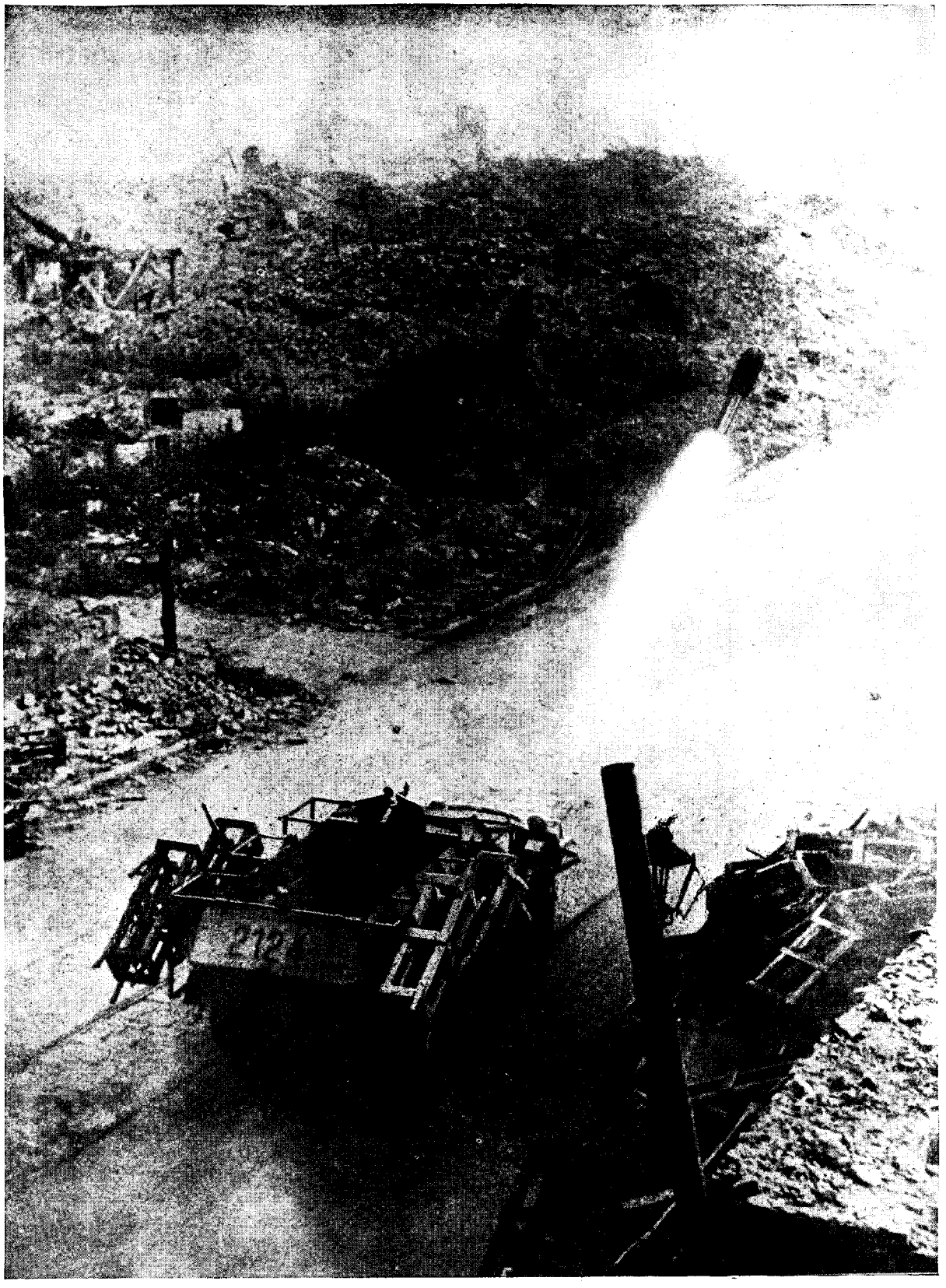


Figure 113.—The Wurfrahmen 40 is here shown in action. Four wooden rocket-carrying crates are in place on the plates on the side of the half-track. The last of the four rockets has just been fired. Empty crates lie at the right.

Figure 114.—U. S. soldiers inspect a captured 28/32 cm Nebelwerfer 41. The weapon is loaded, but electrical leads are not connected to the bases of the rocket motors. Note the box (shown open) which protects the sight.

(2) *Ammunition.* Both high explosive 280-mm and incendiary 320-mm rockets can be fired from this frame.

High explosive 280-mm rocket.

Designation.....*28 cm Wurfkörper Spr.*
Marking .....Pink band.
Weight .....184.5 pounds.
Bursting charge.....110 pounds of TNT.
Maximum range.....2,100 yards.
Length of rocket.....3 feet 11 inches

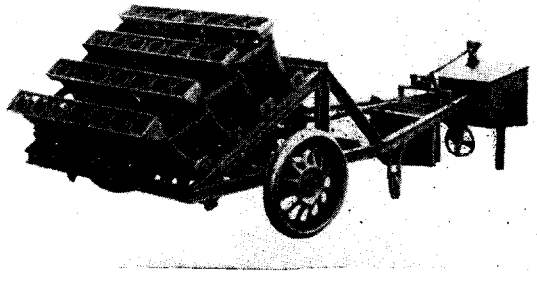


Figure 115.—7.5 cm Multiple Fortress Rocket Projector.

Incendiary 320-mm rocket.

Designation..*32 cm Wurfkörper M. Fl. 50.*
Marking.....Green and yellow band.
Weight .....173 pounds.
Filling.....11 gallons of oil.
Maximum range.....2,400 yards.
Length of rocket.....3 feet 4 inches.

e. STEEL RACK LAUNCHER (*28/32 cm Schweres Wurfgerät 41*). Metal instead of wood construction of the launching frame and crate distinguish this rocket launcher from the *28/32 cm Schweres Wurfgerät 40.* The same HE and incendiary projectiles are fired.

f. MOTORIZED LAUNCHER (*28/32 cm Schwerer Wurfrahmen 40*). (1) *General description.* Modified versions of the *Schweres Wurfgerät* are used on half-tracked armored vehicles. Six projectors are mounted on the vehicle, three on each side. Each projector consists of two parts: a carrier plate bolted on the side of the vehicle and a bracket to hold the crate from which the rocket is fired. This bracket is provided with an elevating scale and clamp.

(2) *Ammunition.* The same projectiles are fired as from the *Schweres Wurfgerät.*

g. MOBILE LAUNCHER (*28/32 cm Nebelwerfer 41*). (1) *General description.* This mobile version of the *Schweres Wurfgerät* consists of a framework designed to hold six projectiles mounted upon a two-wheeled carriage. The trail is detached after the carriage has been towed into position, and the launcher is laid like an artillery piece. The standard electrical firing mechanism is used.

(2) *Ammunition.* The projectiles fired are the standard 280-mm (HE) and 320-mm incendiary rockets.

h. 300-MM MOBILE LAUNCHER (*30 cm Nebelwerfer 42*). (1) *General description.* Similar to the *28/32 cm Nebelwerfer 41,* this six-frame projector launches the largest of the German high-explosive rockets.

(2) *Ammunition.* The 300-mm rocket is better streamlined than the 280-mm or 320-mm projectiles, has a higher ratio of propellent weight to total weight, and as a result has a much longer range.

High explosive 300-mm rocket.

Designation	*30 cm Wk. 42 Spr.*
Weight	277 pounds.
Bursting charge	100 pounds of amatol.
Maximum range	5,000 yards.
Length of rocket	4 feet 7/16 inches.

3. Antiaircraft Rocket Weapons

a. GENERAL. Despite persistent reports of some kind of high-altitude antiaircraft rocket in use by the Germans, only two such projectiles have been identified, and neither has a high vertical range. The two antiaircraft rockets known are the 86-mm free cable and parachute type and 152-mm rocket of similar type but with the cable tied to the ground. The cables emitted by the rockets are designed as a hazard to aircraft.

b. 86-MM ANTIAIRCRAFT PROJECTOR. (1) *General description.* The 86-mm antiaircraft parachute rockets are fired from this single type projector. The frame is enclosed in a square-sectioned sheet metal casing, enlarged at the forward end to form a flash hider. The casing is mounted on a vertical tube provided with elevating and traversing gears. The projector sight is graduated up to 2,625 feet.

(2) *Ammunition.* The rocket, which is percussion fired, weighs 11 pounds and contains 310 feet of thin wire cable with a parachute at one end and a circular counterweight at the other. This parachute is ejected by a small charge actuated by a delay train initiated by the propellant.

c. 152-MM ANTIAIRCRAFT ROCKET. (1) *General description.* The details of the launching device for this rocket are not known. The projectile contains an HE charge in the nose and a parachute and length of cable in the body. When the projectile is discharged it unwinds the cable which is anchored to the ground. The cable is fully unwound at an altitude of about 3,000 feet and pulls out the parachute. The projectile continues its upward flight until destroyed by the nose charge which is fitted with a delay action fuze. The cable, suspended by the parachute, will sink slowly to the ground.

4. Other Rocket Weapons

a. 75-MM MULTIPLE ROCKET PROJECTOR. The latest German frame-type projector consists of 28 frames mounted in four horizontal rows of seven each at the forward end of a long carriage. Each frame is built of a metal hoop and a T-shaped steel guide bar. Each row of frames is a separate assembly and is bolted to the inclined superstructure above the carriage. The four rows are connected by a system of links and are elevated simultaneously from the rear of the carriage, where a shield, 0.4 inch thick, protects the layer. The whole assembly may be traversed either about a forked center pivot or by moving the carriage itself, which is light enough to be manhandled. The limits of elevation are 4 degrees and 55 degrees. The rockets are fired by percussion through a multiple firing pin mechanism at the rear of each row of projectors. Each row is cocked separately, but all strikers are released by one pull on the firing cable. The rocket fired from this launcher has not been identified.

b. 73-MM PROPAGANDA ROCKET LAUNCHER (*7.3 cm Propagandawerfer*). (1) *General description.* This is a very simple launcher consisting of a single cage hinged to a framework base of tubular steel and supported at the front by an adjustable arm. The weapon is intended for close range delivery of paper propaganda.

(2) *Ammunition.* The rocket weighs 7.1 pounds and instead of bursting charge or chemical filling contains 8 ounces of propaganda leaflets.

c. 80-MM ROCKET (*8 cm Raketen Sprenggranate*). This high explosive rocket is provided with studs on the side for projection, which indicate that it possibly is used both as a ground and aircraft rocket. It is unrotated and is stabilized in flight by tail fins. The rocket weighs 15.2 pounds, and the maximum ground range is estimated at 6,300 yards.

d. 240-MM ROCKET PROJECTOR. The existence of this projector has been inferred from the use of a 240-mm rocket bomb. Details are not known.

Section VIII. GRENADES

1. Hand Grenades

a. HIGH EXPLOSIVE STICK GRENADE (*Stielhandgranate 24*). (1) *General description.* This grenade consists of a hollow wooden handle and a thin sheet metal head containing the bursting charge. A double length of cord connects a porcelain bead at the lower end of the handle to a friction igniter and detonator assembly screwed on the head of the grenade. The wooden handle is closed at its lower end by a metal screw cap. A fragmentation sleeve is sometimes used with this grenade to improve the antipersonnel effect. This is a metal collar split longitudinally so it can be clipped around the head of the grenade. The surface of the sleeve may be either smooth or divided by serrations to assist fragmentation.

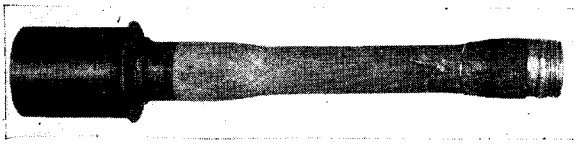


Figure 116.—Stielhandgranate 24, HE Stick Grenade.

(2) *Characteristics.*

Weight of grenade....1.36 pounds.
Weight of bursting charge .....0.365 pound.
Type of bursting charge.TNT.
Length over-all .....14 inches.
Detonator .....Standard German No. 8.
Igniter delay .....4 to 5 seconds.
Igniter *B.Z.24*

(3) *Operation.* To arm the grenade, unscrew the metal cap at the lower end of the handle and pull the porcelain bead. This initiates the friction igniter and the grenade will function at the end of the 4- to 5-second delay.

b. HIGH EXPLOSIVE STICK GRENADE (*Stielhandgranate 43*). (1) *General description.* This is a modified form of the *Stielhandgranate 24.* It has the same thin sheet metal head, but has a solid handle. A blue-capped pull igniter and detonator assembly screw into the top of the grenade head. Like the Model 24, this grenade is used with a smooth or serrated fragmentation sleeve.

(2) *Characteristics.*

Total weight .....1 pound 6 ounces.
Weight of bursting charge .....7 ounces.
Igniter .....*B.Z.f.Eihgr.*
Detonator .....No. 8.
Fuze delay .....4½ seconds.

(3) *Operation.* To arm the grenade unscrew and pull the blue metal cap on the top of the explosive head. This initiates the 4½-second delay.

c. WOODEN IMPROVISED HAND GRENADE (*Behelfshandgranate-Holz*). (1) *General description.* This is an offensive-type grenade constructed entirely of wood. It consists of a cylindrical wooden head screwed on a hollow wooden handle. The head is bored to a depth of 4⅞ inches, and specimens of this grenade have been found to contain half a *Bohrpatrone* (standard 100-gram (3.527 ounces) demolition cartridge). The extra space is filled by a wooden plug. A fuze and detonator assembly is located in the forward end of the handle with the detonator inserted into the center of the *Bohrpatrone.* A pull igniter is attached by cord to a button in the recess under the metal cap at the lower end of the handle. These grenades are packed in wooden boxes holding 14 grenades. They are prepared with charges and delay igniters. The detonators, with a short length of fuze, are carried in a separate container inside the box.

(2) *Characteristics.*

Length over-all..... 15 inches.
Length of head .....5¼ inches.
Diameter of head .....2¼ inches.
Diameter of handle ....1¼ inches.
Total weight .....12 ounces.
Weight of bursting charge .....50 grams (1.763 ounces).
Detonator .....No. 8.

(3) *Operation.* To arm the grenade, unscrew the head and break the paper seal on the *Bohrpatrone.* Screw the detonator and fuze assembly into the igniter and slip the detonator into the head of the *Bohrpatrone.* Replace the head and

the grenade is ready for use. To use the grenade remove the metal cap on the lower end of the handle, pull the button attached to the friction igniter and throw. This grenade is designed to produce blast effect and may be used by troops advancing in the open.

d. CONCRETE IMPROVISED HAND GRENADE (*Behelfshandgranate-Beton*). (1) *General description.* This grenade is an offensive type grenade similar to the wooden improvised hand grenade, except the grenade head is made of concrete instead of wood and a full 100-gram *Bohrpatrone* is used as an explosive charge.

(2) *Characteristics.*

Igniter .....*B.Z.4.5Sek.*
Detonator .....No. 8.

Figure 117.—Eihandgranate 39 HE Egg Grenade (left, older; right, later version).

e. HIGH EXPLOSIVE HAND GRENADE (*Eihandgranate 39*). (1) *General description.* This is an egg-shaped hand grenade constructed of thin sheet metal with high explosive bursting charge. This grenade and the *Stielhandgranate 24* are the standard German hand grenades and are used most. The explosive charge is initiated by a detonator and a friction igniter. The wire loop of the friction igniter is connected by a short cord to a blue metal cap screwed on the top of the grenade body. A model of this grenade containing chloracetophenone also exists. It may be recognized by a yellow ring painted around the grenade and four pear-shaped projections on the lower half of the body. It contains a 112-gram (3.95 ounces) TNT bursting charge and a small aluminum capsule containing 5 grams (0.176 ounce) of chloracetophenone.

(2) *Characteristics.*

Weight of grenade....8 ounces.
Weight of bursting charge .....4 ounces.
Detonator .....No. 8.
Igniter .....*B.Z.f.Eihgr.*
Fuze delay .....4 to 5 seconds.

(3) *Operation.* Unscrew the blue metal cap and pull the igniter. The grenade will explode after a delay of 4 to 5 seconds.

f. SMOKE STICK GRENADE (*Nebelhandgranate 39*). (1) *General description.* This grenade can be distinguished from the high explosive stick grenade (*Stielhandgranate*) by three grooves in the handle, which serve as recognition features in the dark, and by a white band painted around the center of the handle and an interrupted white band around the head, with the lettering "*Nb. Hgr. 39*", also in white. The head is made of thin metal and contains a filling of zinc-hexachlorethane. Instead of the detonator used in the high explosive grenade, an ignition tube is used. This is very similar in appearance to the No. 8 detonator, but may be distinguished by the closed end which is painted green. The smoke generated in the head escapes through holes around the handle socket. A pull igniter is located inside the handle.

(2) *Characteristics.*

Igniter .....*B.Z.39.*
Ignition tube .....*N.4.*
Fuze delay .....7 seconds.

g. SMOKE STICK GRENADE (*Nebelhandgranate 39B.*) This grenade is a later model of the *Nebelhandgranate 39* and differs only in the composition of the smoke mixture. In the Model 39B more hexachlorethane and less zinc are used.

h. SMOKE HAND GRENADE (*Nebelhandgranate 41*). (1) *General description.* This grenade has a body which is very similar to that of the *Nebelhandgranate 39* but has, instead of a stick handle, a pull igniter inserted into a plastic adapter in the top of the body. There are only two smoke emission holes. The grenade may be recognized by the letters "*Nb. Hgr. 41*" and a broken line stencilled in white on the body.

(2) *Characteristics.*

Igniter .....*B.Z.39.*
Ignition tube .....*N.4.*
Duration of smoke emission .....100 to 120 seconds.
Filling .....Berger mixture.
Fuze delay .....3 seconds.

(3) *Operation.* The grenade is initiated by unscrewing the igniter cap and pulling the igniter. This initiates the ignition tube and the grenade begins to emit smoke after about 3 seconds.

i. SMOKE EGG GRENADE (*Nebeleihandgranate 42*). (1) *General description.* The elongated egg-shaped body of this grenade is made of thin metal. At the lower extremity a small metal loop is welded or riveted to the body and at the top

there is a threaded socket for the igniter assembly. Three holes allow the smoke to escape. A standard German pull igniter is screwed into the top. The igniter has a brass body and a steel ring attached to the top. The grenade is marked *"Nb. Eihgr. 42"* in white and has three short white bands stencilled around the body. A label near the base warns that the fumes can be dangerous in an enclosed space.

(2) *Characteristics.*

Length over-all .....5.3 inches.
Diameter over-all .....1.96 inches.
Body length.....4.1 inches.
Body diameter .....1.7 inches.
Igniter .....*Zd. Schn. Anz. 29.*

(3) *Operation.* Pull the ring on the igniter before throwing the grenade.

j. GLASS SMOKE GRENADE (*Blendkörper 1H*). (1) *General description.* This grenade consists of a sealed glass bulb in a hexagonal carton of corrugated cardboard. The glass is shaped like a somewhat elongated electric light bulb and is about the same size, but of thicker glass. The bulb contains 260 grams (9.17 ounces) of titanium tetrachloride. This grenade is intended for use against the crews of pillboxes and vehicles.

(2) *Operation.* The grenade is carried in the cardboard container and when required for use it can be withdrawn by a tape attached to the lid of the box; the lid is cemented to the neck of the bulb. Remove the lid and throw the grenade against the target. When the bulb bursts, the mixture will give off a dense smoke.

k. GLASS SMOKE GRENADE (*Blendkörper 2H*). (1) *General description.* The glass bulb of this grenade contains 250 grams (8.8175 ounces) of a yellowish liquid. The bulb is sealed at the neck with a sulphur plug which also holds in position a glass tube, orientated along the axis of the bulb. This tube contains 25 grams (0.882 ounce) of a calcium chloride solution. The smoke liquid consists of titanium tetrachloride with silicon tetrachloride added to lower its freezing point. The calcium chloride is used to lower the freezing point of the water which is included to increase the effectiveness of the smoke under conditions of low humidity.

(2) *Operation.* Throw the grenade at the target in the same way as the Model 1H. A notice on the side of the container, which holds four grenades, states that they are suitable for use at temperatures down to —40° centigrade.

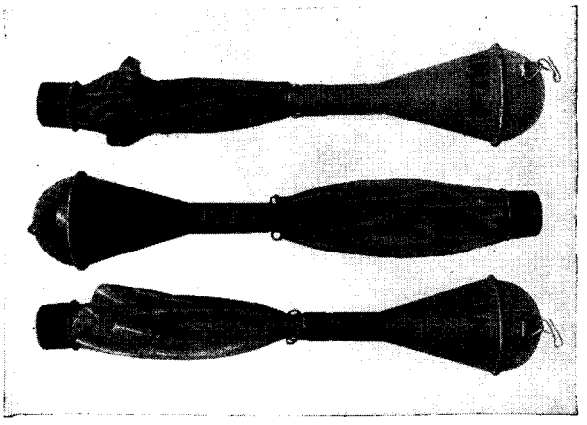


Figure 118.—Panzerwurfmine 1 (L), hollow-charge antitank hand grenade.

l. HOLLOW-CHARGE ANTITANK HAND GRENADE (*Panzerwurfmine 1 (L)*). (1) *General description.* This is a recent type antitank grenade. It is of hollow-charge design and is thrown by hand at tanks from a distance of 20 to 30 yards. The grenade body is in the form of a metal cone with a hemispherical, thin, sheet-metal head. The cone contains an explosive charge, with a concave metal retaining plate at the forward end. An air space is formed between this plate and the sheet metal head of the grenade. The narrow end of the cone is located by setting screws around the circumference of a hollow wooden tailpiece containing picric rings and serving as a throwing handle. Around the outside of the tailpiece are four, cloth, triangular shaped fins. Along the outer end of each fin is a steel spring which retains the fins in the open position when the grenade is thrown. When the grenade is being carried, and up to the moment of throwing, these fins are wrapped around the tailpiece and retained in position by a cap. Located in the tail of the grenade is a striker mechanism fitted with a safety pin which has a cloth tab attached. The safety pin is retained in position by a metal clip attached to one of the fins.

(2) *Operation.* The grenade is held for throwing by the tailpiece, and immediately before throwing the metal cap is removed from the end of the tailpiece. When the grenade is thrown the fins fly outward and the clip attached to one of them comes away from the striker mechanism and releases the safety pin. Upon impact the striker mechanism functions and initiates the bomb.

m. HOLLOW-CHARGE STICKY GRENADE. The tapering steel body of this grenade contains the hollow-charge. A flat sticky pad at the nose is covered by a press-on lid with a small handle. A tapering fuze adapter terminating in a socket, threaded internally to receive an igniter, is attached to the base of the grenade. The igniter socket is closed during transit by a black plastic plug. Specimens of the igniter and detonator have not been received, but it is believed that a No. 8 detonator is used in combination with a standard 4½-second egg grenade igniter. It is not clear whether it is necessary to place the grenade on the tank or whether it may be thrown from short ranges.

2. Rifle Grenades

a. HIGH EXPLOSIVE RIFLE GRENADE (*Gewehr Sprenggranate*). (1) *General description.* This is a high explosive grenade which may be either fired from the standard rifle discharger cup (*Schiessbecher*) or thrown as a hand grenade. The projectile has a steel body containing a bursting charge, a base incorporating a flash pellet and delay train, and a point detonating fuze. The base is rifled to conform with the rifling of the discharger cup and fitted with a screwed-in base plug in which there is a flash hole communicating to a 6½-second delay flash pellet.

(2) *Characteristics.*

Length over-all	5.5 inches.
Diameter	1.17 inches.
Weight of grenade	9 ounces.
Weight of bursting charge	1.1 ounces.
Type of bursting charge	Penthrite-Wax.
Detonator	Similar to No. 8 but slightly larger and perforated.
Maximum range	265 yards.

(3) *Operation.* (a) *As rifle grenade.* When the grenade is fired from the launcher it will be initiated normally by the point detonating fuze, which consists of a striker, primer, and detonator assembly of conventional design. Should the point detonating fuze fail to operate, a flash pellet in the base will ignite a friction composition in the lower end of the projectile body. This will in turn ignite a 4½-second delay pellet which then initiates the detonator in the bursting charge.

(b) *As hand grenade.* A short cord located internally between the top of the base and the lower end of the body connects a friction wire below the 4½-second delay pellet to a washer resting freely in the base. When the grenade is to be thrown by hand, the base is unscrewed and the washer pulled. This operates the friction igniter and sets off the delay train. The grenade is thrown and functions at the end of 4½ seconds.

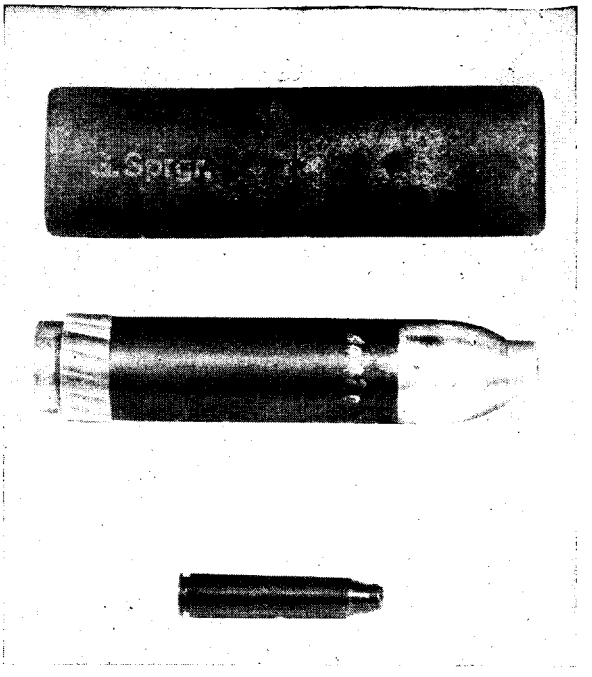


Figure 119.—Gewehr Sprenggranate, HE Rifle Grenade.

(4) *Modifications.* Modifications to this grenade have appeared. The pull igniter is sometimes omitted, permitting the grenade to be fired from the launcher but it cannot be thrown. The self-destroying device is sometimes omitted. An "all-ways" fuze is sometimes fitted instead of the standard point detonating fuze, setting off the charge no matter which way the grenade strikes.

b. HIGH EXPLOSIVE RIFLE GRENADE WITH INCREASED RANGE (*Gewehr Sprenggranate mit Gesteigerter Reichweite*). This is a later model of the standard rifle grenade. The self-destroying device has been eliminated and it is fired by a new propelling cartridge. It is claimed that the maximum range has been increased to 711 yards. The grenades may be identified by the box label (*Gewehr Sprenggranate mit Gesteigerter Reichweite*), by the unperforated base plate and fixed rifle base, or by the propelling cartridge with its bright yellow bullet.

c. ANTITANK RIFLE GRENADE (*Gewehr Panzergranate 30*). (1) *General description.* This

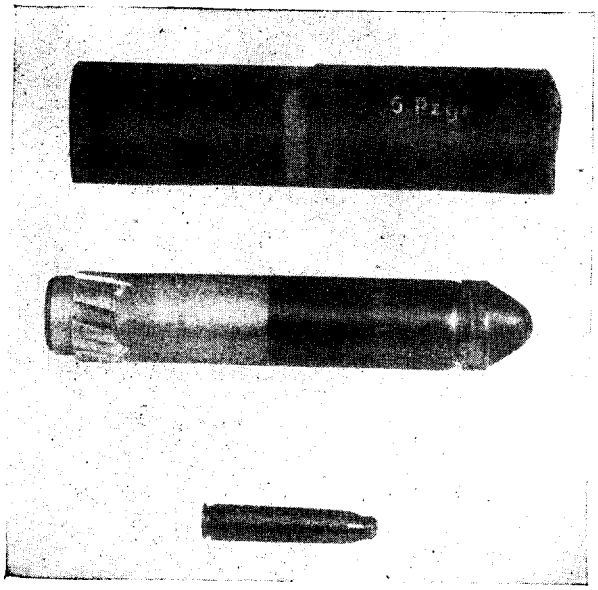


Figure 120.—Gewehr Panzergranate, Antitank Rifle Grenade.

is a rifle grenade incorporating the hollow-charge principle. It is fired from the 30-mm rifled discharger cup (*Schiessbecher*) which can be attached to most types of German rifles. The body of the grenade is in two parts. The forward section is made of steel and contains the bursting charge with the hollow charge cone, closed by a light metal cap. The rear portion is made of light aluminum alloy and contains the fuze and exploder system. A pre-rifled rotating band is located near the base of the grenade. The propellant is contained in a 7.92-mm blank cartridge, crimped at the mouth.

(2) *Characteristics.*

Total weight.....8.8 ounces.
Length over-all.....6.4 inches.
Weight of bursting charge .....1.75 ounces.
Maximum accurate range .....100 yards.

d. LARGE ANTITANK RIFLE GRENADE (*Gross Gewehr Panzergranate 40*). (1) *General description.* This is similar to the *Gewehr Panzergranate 30* except that the front portion is enlarged to accommodate a greater bursting charge. The propellant is contained in a standard 7.92-mm cartridge with a wooden bullet.

(2) *Characteristics.*

Weight .....13½ ounces (approximately).
Length over-all..... 7 inches (approximately).
Weight of bursting charge .....4½ ounces.
Maximum accurate range .....100 yards.

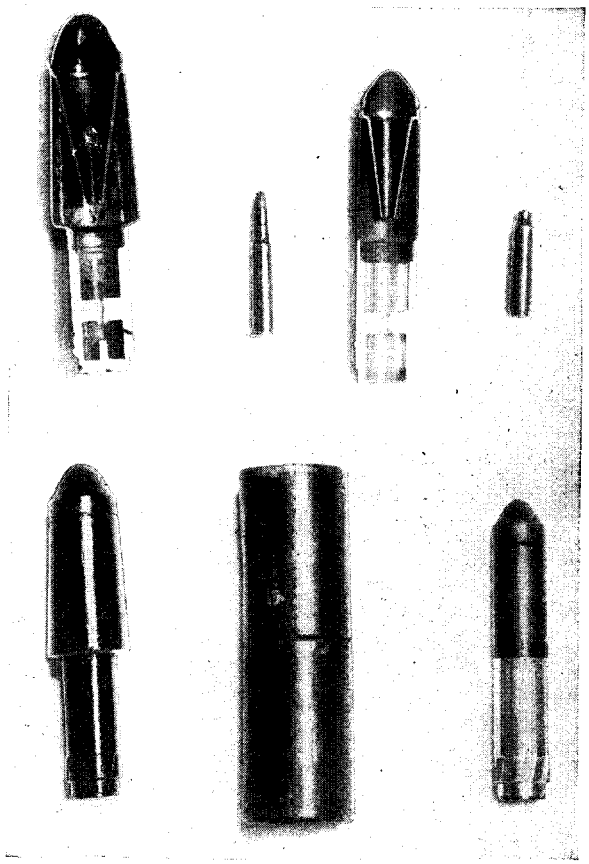


Figure 121.—Gross Gewehr Panzergranate, Large Antitank Rifle Grenade.

e. 46-MM HOLLOW-CHARGE RIFLE GRENADE (*S.S. Gewehr Panzergranate 46*). (1) *General description.* This rifle grenade has a streamlined body with a maximum diameter of 46 mm. The body is treated against corrosion and is closed by a conical unpainted impact cap. The stem is of steel and fits into the standard 30-mm discharger cup. It has a pre-rifled rotating band. The base plug is conical in shape. The propelling cartridge consists of a lacquered steel 7.92-mm cartridge case crimped at the neck and sealed with wax. The cap is yellow.

(2) *Characteristics.*

Weight .....15½ ounces (approximately).
Length over-all.....7.7 inches.
Length of stem.....4 inches.
Maximum diameter of head .....1.8 inches.
Diameter of stem.....1.2 inches.
Type of bursting charge .....RDX-TNT.
Weight of bursting charge .....4.8 ounces.

(3) *Performance.* Static test indicates that the penetration at long ranges is approximately 90 mm of homogeneous armor. At short range (approximately 18 feet) the penetration was 70 mm. A ¼-inch mild steel plate, spaced 11 inches

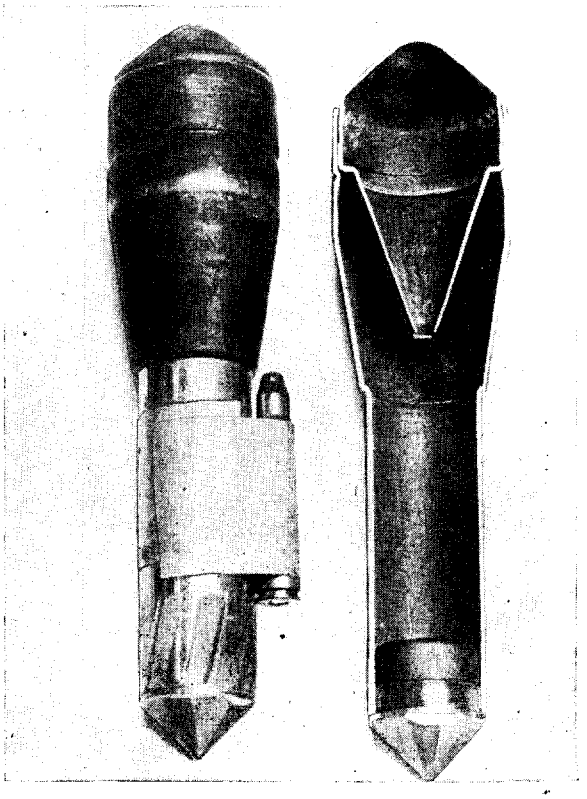


Figure 122.—S.S. Gewehr Panzergranate 46, 46-mm. Hollow-Charge Rifle Grenade.

in front of the armor, completely nullified the effect on the armor.

f. 61-MM HOLLOW-CHARGE RIFLE GRENADE (*S.S. Gewehr Panzergranate 61*). (1) *General description.* This is a hollow-charge rifle grenade similar to the *S.S. Gewehr Panzergranate 46* but having a streamlined body of larger dimensions.

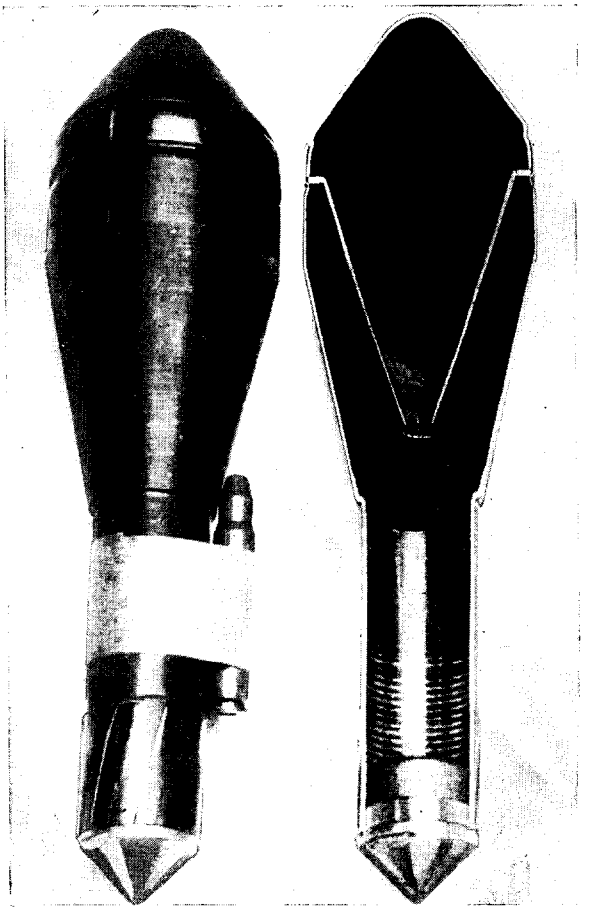


Figure 123.—S.S. Gewehr Panzergranate 61, 61-mm. Hollow-Charge Rifle Grenade.

(2) *Characteristics.*

Weight .....19 ounces (approximately).
Length over-all.....9.4 inches.
Length of stem.....4 inches.
Maximum diameter of head .....2.4 inches.
Diameter of stem.....1.2 inches.
Type of bursting charge .....RDX-TNT.
Weight of bursting charge .....8.5 ounces.

(3) *Performance.* Static tests indicate that the maximum penetration of homogeneous armor at the extreme range of 220 yards will be approximately 126 mm. At a range of approximately 18 feet the penetration falls to 100 mm. A ¼-inch mild steel plate, spaced 11 inches in front of the main armor, completely defeats the grenade.

g. HOLLOW-CHARGE RIFLE GRENADE. This late type hollow-charge rifle grenade is similar in appearance to the *S.S. Gewehr Panzergranate 61*. It differs, however, in having an impact cap that is approximately hemispherical and unpainted. The grenade is 9.61 inches long and its greatest diameter is 2.4 inches. The base is rifled for firing from the standard grenade launcher.

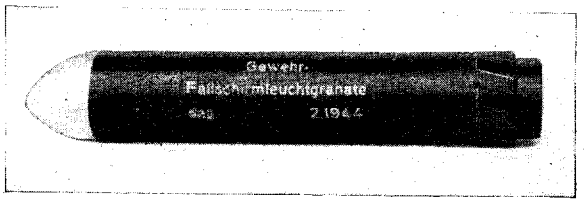


Figure 124.—Gewehr Fellschirmleuchtgranate, Parachute Star Rifle Grenade.

h. ILLUMINATING PARACHUTE RIFLE GRENADE (*Gewehrfallschirmleuchtgranate*). (1) *General description.* This illuminating parachute grenade has a cylindrical steel body. At the front is a conical cap with round tip, and at the rear a base rifled to engage the rifling in the standard grenade launcher. Within the body is a delay pellet, an ejection charge, and a container holding the parachute, rigging, and star flare. This container incorporates a second delay pellet, and a second ejection charge for the parachute and flare. The grenade is fired by a cartridge case containing 1.5 grams (0.05 ounce) of propelling charge. The cartridge is closed by a wooden bullet.

(2) *Characteristics.*

Diameter .....1.18 inches.
Length .....6.88 inches.
Weight .....9.9 ounces.

(3) *Operation.* When the grenade is fired, the flash from the propellent gases ignites the delay pellet in the base of the grenade. After 6½ seconds an ejection charge explodes and ejects the container holding the parachute and star. Simultaneously a second delay pellet in the container is initiated. Two seconds later, the parachute ejection charge is set off and the parachute and star are ejected.

i. PROPAGANDA RIFLE GRENADE (*Gewehr Propagandagranate*). (1) *General description.* This grenade, which weighs 8 ounces when filled, is fired from the standard launcher. The grenade body is a cylindrical steel tube, closed by a loose-fitting ballistic cap. The propaganda leaflets are enclosed in two semi-cylindrical steel covers within the body and rest on a cup-shaped platform. The tail element, with the usual pre-rifled

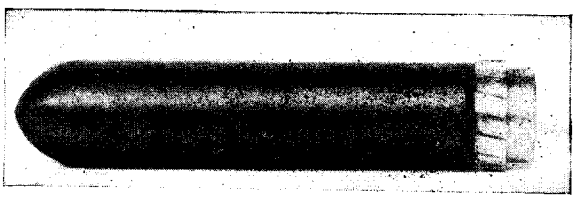


Figure 125.—Gewehr Propagandagranate, Propaganda Rifle Grenade.

base, contains the ejecting charge and a delay train. The propellant is contained in the usual type of blank cartridge, distinguished by a red band.

(2) *Operation.* The delay train is ignited by the flash from the propellant and detonates the ejecting charge. The platform, leaflets, leaflet covers, and ballistic cap are ejected during flight. The maximum range is approximately 500 yards.

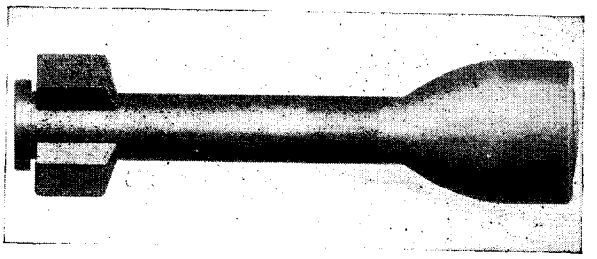


Figure 126.—Gewehr Granatpatrone, Rifle Spigot Grenade.

j. HIGH EXPLOSIVE ANTITANK HOLLOW-CHARGE RIFLE GRENADE (*Gewehr Granatpatrone 30*). (1) *General description.* This grenade consists of a streamlined bell-shaped body, closed in front by a slightly convex closing disc of aluminum, a graze fuze screwed into a projection on the base of the body, and a finned tail unit screwed to the fuze base. It is fired from the standard rifle (*Gewehr 98*) fitted with a spigot type launcher and using blank cartridges with wooden bullets. The bursting charge is cast cyclonite wax with hemispherical cavity in the head. This cavity has an aluminum liner.

(2) *Characteristics.*

Length over-all.....9.3 inches (approximately).
Maximum diameter....2.4 inches.
Length of body.....3.15 inches.

(3) *Operation.* When the grenade is fired, the propellent gases shatter the wooden bullet and shear a safety pin by forcing forward a cutting member. In the armed position, the striker is withheld from the detonator by a creep spring and initiates the grenade when it hits or grazes a target.

3. Grenades for Smooth Bore Signal Pistol *(Leuchtpistole)*

a. HIGH EXPLOSIVE PROJECTILE FOR SIGNAL PISTOL (*Wurfkörper 361, Leuchtpistole*). This projectile consists of the normal egg hand grenade with a stem screwed on in place of the powder train time fuze. The stem contains a powder train fuze (with a delay of approximately 4½ seconds) with a No. 8 detonator at the upper end. In the lower end the projectile carries the cartridge (propellent charge with percussion cap) which expels the grenade and sets off the time fuze. The projectile is secured to the stem by a split pin and ring which must be withdrawn before the projectile is loaded into the signal pistol. The projectile is then armed. A removable liner must be inserted in the tube of the signal pistol before firing this grenade. The liner is inserted from the breech end and held in place by a projecting stud engaging with the upper surface of the breech. (See Section II for a description of signal pistols.)

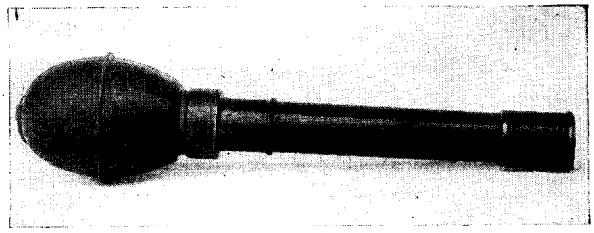


Figure 127.—Wurfkörper 361, Leuchtpistole, modified egg grenade for signal pistol.

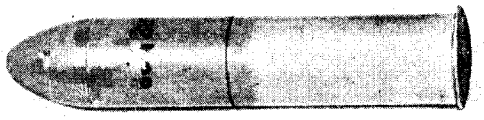


Figure 128.—Wurfgranatpatrone 326, Leuchtpistole, HE projectile for signal pistol.

b. HIGH EXPLOSIVE PROJECTILE FOR SIGNAL PISTOL (*Wurfgranatpatrone 326, Leuchtpistole*). (1) *General description.* This projectile, which is painted yellow, has the appearance of a small mortar shell. It is attached to a signal cartridge case by crimping. The head is hollow and contains a fixed needle which is separated from a pellet containing the detonator assembly and a 7-gram (0.247 ounce) TNT bursting charge by a creep spring.

(2) *Operation.* A pin inserted through the tail of the bomb pushes two metal balls into a groove and thus prevents the pellet from moving forward against the needle. On firing the projectile is automatically armed, since the pin is left behind. On impact the pellet is thrown forward onto the needle.

c. HOLLOW CHARGE GRENADE FOR SIGNAL PISTOL (*Panzerwurfkörper 12, Leuchtpistole*). (1) *General description.* This grenade is fired up to a maximum range of 75 yards from the *Leuchtpistole*, using the reinforcing sleeve, stock, and combined front and rear sight. The grenade has a pear-shaped head containing the hollow charge and is fitted with an impact cap. The grenade tapers to form a tail tube with pre-rifling for screwing into the reinforcing sleeve. A thinner tube, containing the propellant, percussion cap, and a shearing and propelling bolt, is inserted into the end of the tail tube.

(2) *Characteristics.*

Weight of grenade.....1 pound 5 ounces.
Diameter of head.....2.4 inches.
Diameter of tail tube..0.875 inch.
Length of grenade.....8.56 inches.

(3) *Operation.* The complete grenade is loaded into the pistol from the muzzle end. The propellent tube fits freely into the bore until the pre-rifled band meets the muzzle of the reinforcing sleeve, when the grenade must be screwed into the rifling. On firing, the propellent gases drive the propelling and shearing bolt forward. This bolt breaks a shear pin in the front end of the propelling tube and discharges the grenade. The graze fuze in the tail tube is armed by setback as the grenade leaves the pistol.

d. SMOKE EGG GRENADE (*Nebeleihandgranate 42/II*). This grenade reportedly can be fired from the *Leuchtpistole*. No details are available, however. It seems probable that the *Nebeleigranate 42* has been modified for firing from the signal pistol, using the reinforcing sleeve, in the same way as the *Eihandgranate 39* was modified to produce the *Wurfkörper 361 L.P.*

e. TIME FUZED HIGH EXPLOSIVE ROUND FOR SIGNAL PISTOL (*Sprenggranatpatrone, Leuchtpistole Mit Z.Z.*). This is a new type of signal pistol ammunition designed for shooting from tanks or equivalent cover. The round consists of a heavy cased high explosive projectile with a 1-second time fuze in the base and a varnished steel cartridge case. Packing cases for these grenades bear the following inscription: "*Ach-*

tung! nur aus Panzer oder gleichwertiger Decken verfeuern. Brennzeit I Sek." ("Danger! Only to be fired from tanks or equivalent cover. Time of burning 1 second.")

4. Grenades for Modified Rifled Grenade and Signal Pistol

a. HIGH EXPLOSIVE GRENADE (*Sprengpatrone für Kampfpistole*). This round consists of a die-cast aluminum cartridge case into which the projectile is fitted. A percussion cap and propellant are in the base of the cartridge case. Ten holes in a plate above the propellent charge lead the gases to the base of the projectile. The projectile has a rifled aluminum body containing two bursting charges of penthrite wax and a point detonating fuze which is armed as the projectile leaves the muzzle of the pistol. The projectile may be recognized by the letters "*Spr. Z.*" stencilled on the base.

b. SMOKE GRENADE (*Nebelpatrone für Kampfpistole*). (1) *General description.* Externally this projectile is similar to the high explosive projectile. Internally it contains a smoke generator. It is fitted with a point detonating fuze similar to that used in the high explosive projectile, except that there is a charge of gunpowder in place of the detonator below the flash cap.

(2) *Operation.* The projectile functions on impact. The internal charge of gunpowder is ignited by the flash cap and blows off the nose. At the same time the smoke generator is ignited. The smoke generator is projected a considerable distance from the point of impact.

Figure 129.—Sprengpatrone Für Kampfpistole, HE Grenade for Kampfpistole.

c. ORANGE SMOKE GRENADE (*Deutpatrone für Kampfpistole*). (1) *General description.* Externally this projectile is similar to the *Nebelpatrone*, except that it has no nose fuze. The head is parabolic. The grenade is filled with an orange smoke composition. In a central cavity are four strands of quick-match connected to a gunpowder pellet in the center of the projectile base. The smoke jets at the base are covered with a thick pad of compressed paper which is burst by the smoke pressure. "*Deut. Z.*" is stencilled on the base.

(2) *Operation.* When the projectile leaves the cartridge case, the gunpowder pellet is ignited and, after a delay, the quick-match ignites and in turn ignites the smoke mixture.

d. PARACHUTE FLARES (*Fallschirmleuchtpatrone für Kampfpistole*). (1) *General description.* Externally this has the general appearance of the other types. It has a black bakelite head with a white spot in the center. The base of the projectile has a screwed-in plug which is perforated to hold a gunpowder pellet. Above this is a flare with parachute attached. "*F. Leucht. Z.*" is stencilled on the base.

(2) *Operation.* On firing the flash from the propellant ignites the gunpowder pellet which, after a delay, ignites the flare. The bakelite head is blown off and the illuminating type flare ejected.

e. MESSAGE GRENADE (*Nachrichtpatrone für Kampfpistole*). (1) *General description.* This grenade consists of a pre-rifled aluminum body, with a plastic head, and an aluminum cartridge case. The black plastic head, which screws onto the body, contains a message form and pencil. The body contains a smoke generator, a colored silk streamer, and an ejecting charge. The body is closed by a screwed-in base plate with a gunpowder delay pellet. Stencilled on the base are the letters "*Nachr. Z*".

(2) *Operation.* When the projectile is fired, the flash from the propellant ignites the delay in the grenade base plate. This in turn ignites the ejecting charge and expels the message container, smoke generator, and streamer.

Section IX. OTHER WEAPONS

1. Remote Controlled Demolition Vehicles

a. GENERAL. Three main types of remote controlled demolition vehicles in use by the German army have been identified. These are the Goliath which is line controlled, the B-IV controlled by radio, and the *N.S.U.-Springer* which has not been encountered in the field. These vehicles have been unsuccessful in action; they usually have been stopped by small arms fire.

b. GOLIATH. (1) *General description.* This vehicle has been produced in two models; one driven by a gasoline engine; the other by an electric motor. The two models have roughly the same external appearance and resemble miniature versions of the type of tanks used during the war of 1914-1918. The Goliath's hull is divided into three compartments by transverse bulkheads. The explosive charge is carried in the front compartment; the engine (in the gasoline driven version) and control gear are in the center, and the drum carrying the coiled cable is in the rear compartment. In the electrically driven model, a battery and motor are carried in sponsons on both sides. Hinged steel covers give access to the cable compartment and the engine space. The vehicle is driven by front sprockets. There are four bogie wheels, mounted on lever arms with simple coil springing, and a rear idler. A small jockey wheel is mounted between the driving sprocket and the first bogie wheel on each side.

(2) *Specifications.*

Length	5 feet 3 inches.
Height	2 feet.
Width	2 feet 10 inches.
Total weight	800 pounds (approximately).
Weight of explosive charge	200 pounds (approximately).
Speed	5 to 12 miles per hour.
Power plant:	
Gasoline engine Model	2-cylinder, 2-cycle in-line engine with chain drive.
Electric motor Model	Two 12-volt Bosch starter motors geared to driving sprockets.

(3) *Operation.* The Goliath is transported to the front line on a two-wheeled trailer. After it has been unloaded from the trailer and started toward its target it is controlled through the three-core cable, about 2,000 feet long, which unwinds from the rear and is connected to the operator's control panel. In the electrically driven type, this control is direct to the motors which drive each track individually. In the gasoline-driven model, the control operates magnetic clutches which control the tracks. There is no provision for reversing the vehicle. The charge is fired by a dry cell battery in the control unit. Firing is initiated by throwing a switch on the control panel; the firing circuit runs through the two outer wires in the three-core cable. The Goliath is expendable and is destroyed when its demolition charge is set off.

c. B-IV. (1) *General description.* This radio-controlled demolition vehicle, larger than the Goliath, also has been generally unsuccessful. The hull of the B-IV is constructed of poorly welded 8-mm armor plate. It is divided into an engine compartment at the rear, a driver's compartment on the right front, and a radio equipment compartment on the left front. The vehicle is fully tracked, with front driving sprocket, five bogie wheels, and a rear idler on each side. A six-cylinder gasoline engine is fitted in the left-hand side of the engine compartment; two gasoline tanks are on the right, and in the center is the hydraulic mechanism for operating the engine under radio control.

(2) *Specifications.*

Length	12 feet.
Height	4 feet 6 inches.
Width	6 feet.
Total weight	4.5 tons.
Weight of explosive charge	800 pounds.
Armor thickness	8 mm.

(3) *Operation.* The B-IV is driven under its own power to the line of departure near the target, usually an emplacement or pillbox. The control transmitter of the radio equipment, retained by the driver when he dismounts, is used to steer the vehicle to its destination. In contrast to the Goliath the B-IV is not expendable, but deposits its load of explosive at the target and returns. The TNT demolition charge is in a container which rests on the sloping front of the vehicle. The charge is released either directly by radio control, or by a trip mechanism which operates when the vehicle is reversed.

d. *N.S.U.-Springer.* (1) *General description.* This vehicle has not been encountered in action, but it is known to be a remotely controlled demolition vehicle of intermediate size. Lightly armored, it probably is no less vulnerable to attack than the Goliath or B-IV.

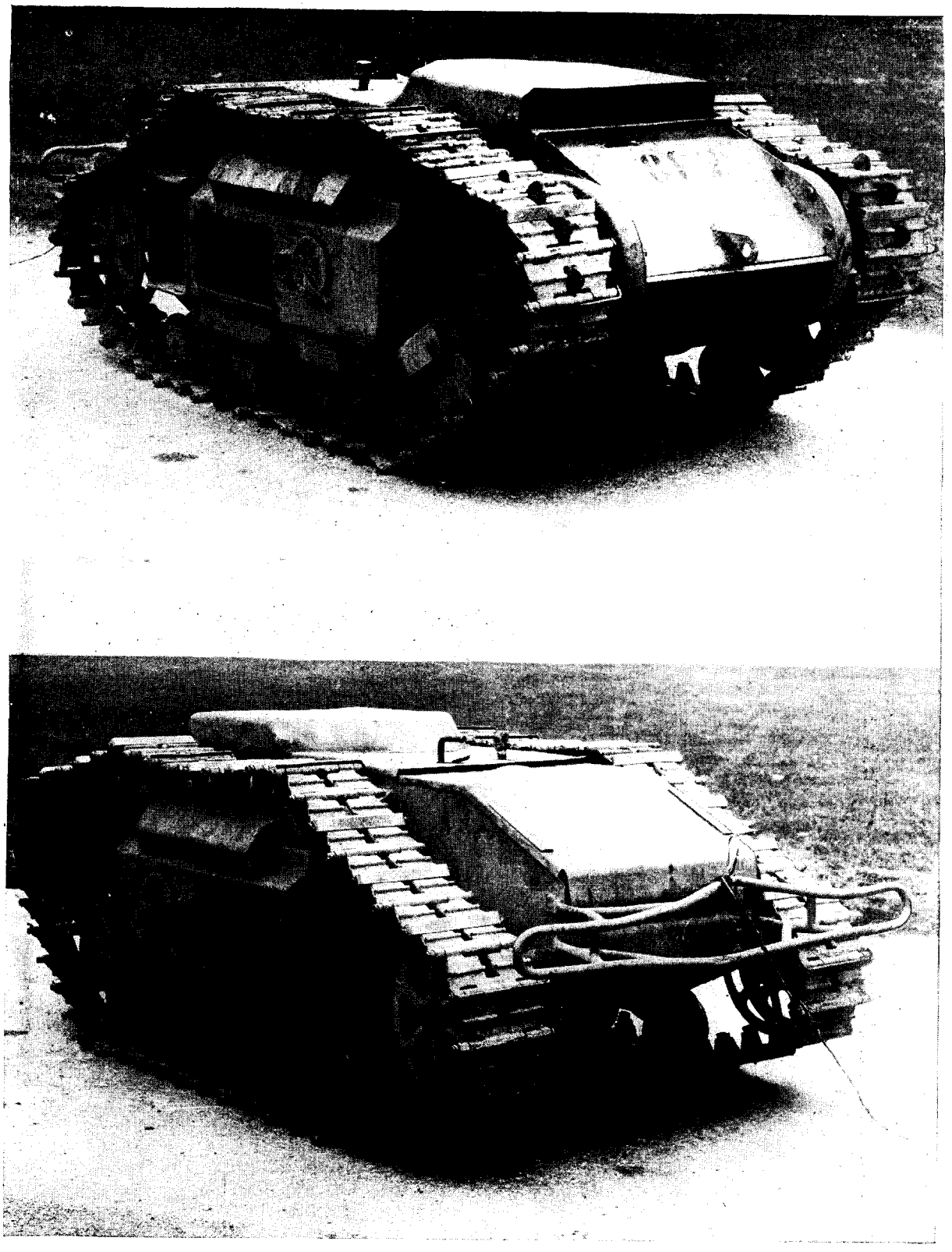


Figure 130.—Demolition Charge (B1 Goliath). Top, front view; below, rear view.

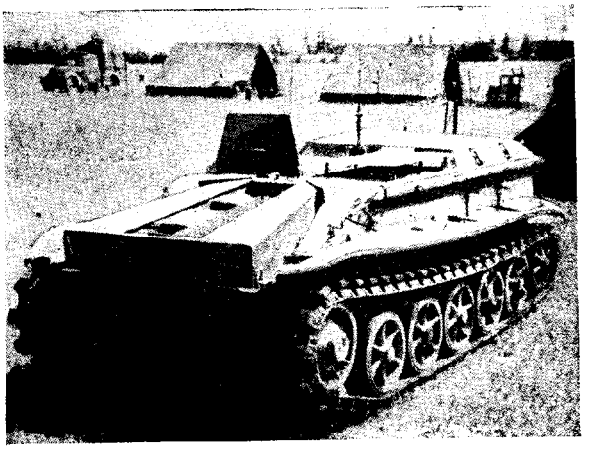


Figure 131.—Radio Controlled Demolition Vehicle (B-IV).

(2) *Specifications.*

Length .....9 feet 3½ inches.
Height .....3 feet 10½ inches.
Width .....3 feet 7 inches.
Total weight .....2.25 tons.
Weight of explosive charge .....661 pounds.
Armor thickness .....5 to 8 mm.
Remote control range ...2,200 yards (Approximately).
Manually controlled range:
On roads .....149 miles.
Cross-country .....87 miles.

2. Armored Trains

a. General. At the outset of the Polish and Dutch campaigns, German armored trains actually preceded the main forces and seized and held key railroad stations or bridges. More recently the Germans made extensive use of armored trains, particularly in Eastern Europe. Their main function has been to patrol and keep open railroads in areas of partisan and guerrilla operations, and their usefulness has been confined largely to operations against enemies who lack heavy weapons. Armored trains are under the direct control of the General Staff and are allotted to army groups. Each train carries a train commandant, who is usually also the infantry commander; an artillery commander; and a technical officer, responsible for the operation of the train itself.

b. Composition. The following details apply to a typical armored train with the nomenclature *Epz.Bp. 42:*

Composition	*Armament*
Two armored gun trucks (37 to 41.5 tons)	Each, one *10 cm le.F.H. 14/19 Pz.*
Two armored antiaircraft gun trucks (37 to 41.5) tons)	Each, one 20-mm quadruple antiaircraft guns and one *7.62 cm F.K. 295/1 Pz.*
Two armored infantry trucks (37 to 41.5) tons)	Each, two 81-mm mortars, one heavy machine gun, 22 light machine guns, and one flame thrower.
One armored steam locomotive (in middle of train)	No armament.

Other details:

Total personnel .....113.
Armor .....15 to 30 mm.
Maximum speed .....35 miles per hour (approximately).
Range .....110 miles.

In addition, composition of the train may include two tank transporter trucks, each carrying a Czech *38 (t)* tank; two light armored Panhard reconnaissance vehicles, capable of traveling either on railroad tracks or across country; and two spare-parts trucks. Various other types of armored trains may be encountered, some incorporating components of an improvised nature, and in these the armor may be anything from boiler plate to railroad ties.

3. Aircraft Armament

a. General. The aircraft armament described in this section is limited to weapons such as machine guns and cannon which form an integral part of aircraft. The numerous types of bombs and mines which are carried in and dropped from aircraft do not form part of the standard attached armament and are not included here. There has been an increasing tendency to use aircraft machine guns on ground mounts, as illustrated by the use of the *M.G.15* as a light machine gun and the *M.G.151/15* and *M.G.151/20* as triple, self-propelled, antiaircraft weapons. (See Section II, Small Arms, for details on use of aircraft machine guns in ground roles.)

b. 7.92-mm Machine Gun *(M.G.15).* (1) *General description.* This was the standard, rifle-caliber, free gun until superseded by the *M.G. 81.* It also is used by the infantry, with bipod and shoulder rest. The design is Solothurn. The gun fires only automatically.

(2) *Characteristics.*

Caliber .....7.92 mm (0.312 inch).
Length over-all .....42 inches.
Weight (without mount) .15.75 pounds.
Operation .....Recoil and residual gas pressure from muzzle blast.
Feed .....75-round saddle magazine.
Cocking .....Manual.
Firing .....Percussion.
Rate of fire .....1,000 rounds per minute.
Muzzle velocity:
AP Incendiary .....3,000 feet per second.

c. 7.92-MM MACHINE GUN *(M.G. 17).* (1) *General description.* This is the fixed gun version of the *M.G.15.* It fires only automatically. Non-disintegrating, sectionally disintegrating, and full-disintegrating ammunition belts are used with the gun.

(2) *Characteristics.*

Caliber .....7.92 mm (0.312 inch).
Length over-all .....47.7 inches.
Weight (with control mechanism) .....27.69 pounds.
Operation .....Recoil and residual gas pressure from muzzle blast.
Feed .....Metal link belt.
Cocking .....Pneumatic, electrical control with mechanical interruption for synchronized firing.
Rate of fire:
Unsynchronized .....1,100 rounds per minute.
Synchronized .....1,000 rounds per minute.
Muzzle velocity:
AP Incendiary .....3,000 feet per second.

d. 7.92-MM MACHINE GUN *(M.G.81).* (1) *General description.* This gun has superseded the *M.G.15* as the standard, rifle caliber, free gun. The high rate of fire of this gun, which is automatic only, precludes its use as a ground weapon.

(2) *Characteristics.*

Caliber .....7.92 mm (0.312 inch).
Length over-all.....35 inches.
Weight .....13.88 pounds.
Operation .....Recoil and residual gas pressure from muzzle blast.
Feed .....Disintegrating metal link belt.
Cocking .....Cable with finger pull at rear.
Firing .....Percussion.
Rate of fire .....1,200 to 1,500 rounds per minute.

e. 13-MM MACHINE GUN *(M.G.131).* (1) *General description.* This gun is compact and very light. Since it is electrically fired, there is no firing pin, and fire interruption or synchronization are facilitated greatly. The gun fires only automatically.

(2) *Characteristics.*

Caliber .....13 mm (0.512 inch.)
Length over-all .....46 inches.
Weight .....40 pounds.
Operation .....Recoil and residual gas pressure from muzzle blast.
Feed .....Disintegrating metal link belt.
Cocking .....Manual.
Firing .....Electric.
Rate of fire .....900 rounds per minute.
Muzzle velocity:
HE Tracer and Incendiary Tracer .....2,370 feet per second.

(3) *Ammunition.* The gun fires tracer, high explosive tracer, high explosive incendiary tracer, and armor-piercing tracer projectiles.

f. 15-MM MACHINE GUN *(M.G.151/15).* (1) *General description.* This Mauser-designed gun is percussion fired by solenoid control and is cocked electrically. It is basically identical in design with the *M.G.151/20.* This gun, which fires only automatically, has been triple mounted on a half-tracked vehicle and employed in a self-propelled antiaircraft role.

(2) *Characteristics.*

Caliber .....15 mm (0.591 inch).
Length over-all .....75.5 inches.
Weight (including electrical control) .....84 pounds.
Operation .....Recoil.
Feed .....Disintegrating metal link belt.
Cocking .....Electrical.
Firing .....Percussion (electrical solenoid, manually operated trigger).
Rate of fire:
With AP .....750 rounds per minute.
With HE .....680 rounds per minute.
Muzzle velocity:
AP Tracer .....2,715 feet per second.

(3) *Ammunition.* This gun fires tracer, armor-piercing tracer, and high explosive incendiary tracer.

g. 20-MM MACHINE GUN *(M.G.151/20).* (1) *General description.* This is the 20-mm version of the Mauser *M.G.151* design. It is only slightly different from the 15-mm gun. Barrels of the 15-mm and 20-mm models are not interchangeable. This gun also is issued in an electrically fired version, with a spring-loaded contact instead of a firing pin. Two types of ground

mounts exist for the *M.G.151/20,* and there is a self-propelled antiaircraft version on a half-track.

(2) *Characteristics.*

Caliber .....20 mm (0.791 inch).
Length over-all .....69.75 inches.
Weight (including electrical control) .....93.5 pounds.
Operation .....Recoil.
Feed .....Disintegrating metal link belt.
Cocking .....Electrical.
Firing .....Percussion (electrical solenoid, manually operated trigger).
Rate of fire:
Unsynchronized .....AP, 800 rounds per minute.
HE, 750 rounds per minute.
Muzzle velocity:
HE Incendiary .....2,650 feet per second.
AP Incendiary and APHE .....2,300 feet per second.

(3) *Ammunition.* Projectiles fired in this gun include high explosive, incendiary tracer, armor-piercing incendiary, armor-piercing high explosive, and high explosive incendiary.

h. 20-MM MACHINE GUN (*Oerlikon F.F. and F.F.M.*). (1) *General description.* This is the German air force version of the standard *Oerlikon* design. It is chambered to fit the short German 20-mm round, and the recoiling parts have been redesigned accordingly. The *M.G.F.F.* is a fixed gun. The *M.G.F.F.M.,* a later version, is mechanically identical, but may have a cooling cowling and hand firing device for use as a free gun. Both models fire only automatically.

(2) *Characteristics.*

Caliber .....20 mm (0.791 inch).
Length over-all .....52.75 inches.
Weight:
Pneumatic cocking ....60 pounds.
Hand cocking .....55.75 pounds.
Operation .....Recoil.
Feed .....60-round drum, 20-round drum, or 15-round clip.
Cocking:
Fixed gun .....Pneumatic, electrical control.
Free gun .....Manual.
Firing .....Percussion.
Rate of fire (operation).400 rounds per minute.
Muzzle velocity .....1,900 feet per second.

(3) *Ammunition.* Ball tracer, high explosive, high explosive tracer, high explosive incendiary tracer, and armor piercing projectiles are fired from this gun.

i. 30-MM MACHINE GUN (*Mk.101*). (1) *General description.* This heavy machine gun is of Rheinmetall Börsig design. It may be fired single shot or automatically. Two heavy coiled springs around the barrel are necessary to check recoil. This 30-mm machine gun is being replaced by the Model 108.

(2) *Characteristics*

Caliber .....30 mm (1.18 inches).
Length over-all .....96 inches.
Weight .....394 pounds.
Operation .....Recoil.
Feed .....10-round box magazine.
Cocking .....Pneumatic.
Firing .....Percussion, electrical solenoid operated.
Rate of fire (estimated)..400 rounds per minute.

j. 30-MM MACHINE GUN (*Mk. 108*). (1) *General description.* The Model 108 is the latest 30-mm machine gun to be employed in aircraft and is replacing the Model 101.

(2) *Characteristics.*

Caliber .....30 mm (1.18 inches).
Length over-all .....3 feet 6 inches.
Weight .....265 pounds.
Operation .....Blowback.
Feed .....60-round disintegrating link belt.
Cocking .....Compressed air.
Firing .....Electrical (sear is actuated by compressed air).
Rate of fire .....500 rounds per minute.
Muzzle velocity .....1,650 feet per second.

(3) *Ammunition.* The high explosive tracer projectile fired from this gun weighs 11.22 ounces. Incendiary tracer projectiles are also fired.

k. 21-CM ROCKET. Single engine German fighters carry two of these rockets, while twin engined fighters carry four. The projectiles, 42.44 inches long and weighing 248 pounds, are projected from open end tubes 50.31 inches long. The rockets are fired by electricity. The launching tubes may be jettisoned by electrical detonator charges.