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SECTION I

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AIR

1. THE ME-323 TRANSPORT

The existence of a new GAF transport, the Me-323, has recently been confirmed. This high-wing monoplane appears to be a development of the "Gigant" glider, originally identified as the "Merseburg." In view of take-off difficulties believed to have been experienced with the latter, it is probable that the powered aircraft will supplant the glider version. The dimensions of the Me-323 tally exactly with those of the "Gigant," so far as known.

The Me-323 is of metal and plywood construction and has a welded-tube fuselage of the "two-deck" type, the upper deck being detachable for the transport of freight. The wing has a span of 178 feet, a length of 88 feet, a root chord of 27 to 28 feet, and a gross area of 3,200 square feet. It has plywood ribs, every other one of which is reinforced by metal profile welded to a single spar. Both fuselage and wing are fabric covered, plywood being used for the leading edge and extending over surfaces about three feet aft. Camber-changing flaps are employed.

The aircraft has a single fin and rudder. The tailplane, which has a span of about 50 feet, is fitted with an adjustable stabilizer. The landing gear is thought to have 10 wheels, 5 in tandem on each side of the forward part of the fuselage.

Six twin-row, radial, air-cooled engines, believed to be Gnome-Rhone 14 M, are estimated to deliver a maximum horsepower of about 4,920, or 820 each, at an altitude of 10,000 feet. The maximum speed of the aircraft is estimated to be about 160 mph at 10,000 feet altitude, and 140 mph at sea level.

The Me-323 has a useful load of from 20,000 to 25,000 pounds. It eventually may be re-engined with a Gnome-Rhone 14 M model capable of developing 1,085 hp at take-off. It is believed that this would permit a further increase in load and make the aircraft capable of independent operation. At the present time, it is thought that some form of assisted take-off, such as a tug, may be employed for a full military load of 22,000 pounds.

The Me-323 can carry 120 fully equipped men, or an alternative load of small tanks or motor vehicles, when the upper deck is detached. Freight is loaded through the double doors that form the curved nose of the airplane; this is accomplished by a jacking system enabling the nose to be lowered to a convenient height.

The aircraft is fitted with six machine guns, which fire through apertures in the sides of the fuselage, a plywood frame being provided for each aperture. Fore and aft armament has not as yet been reported.

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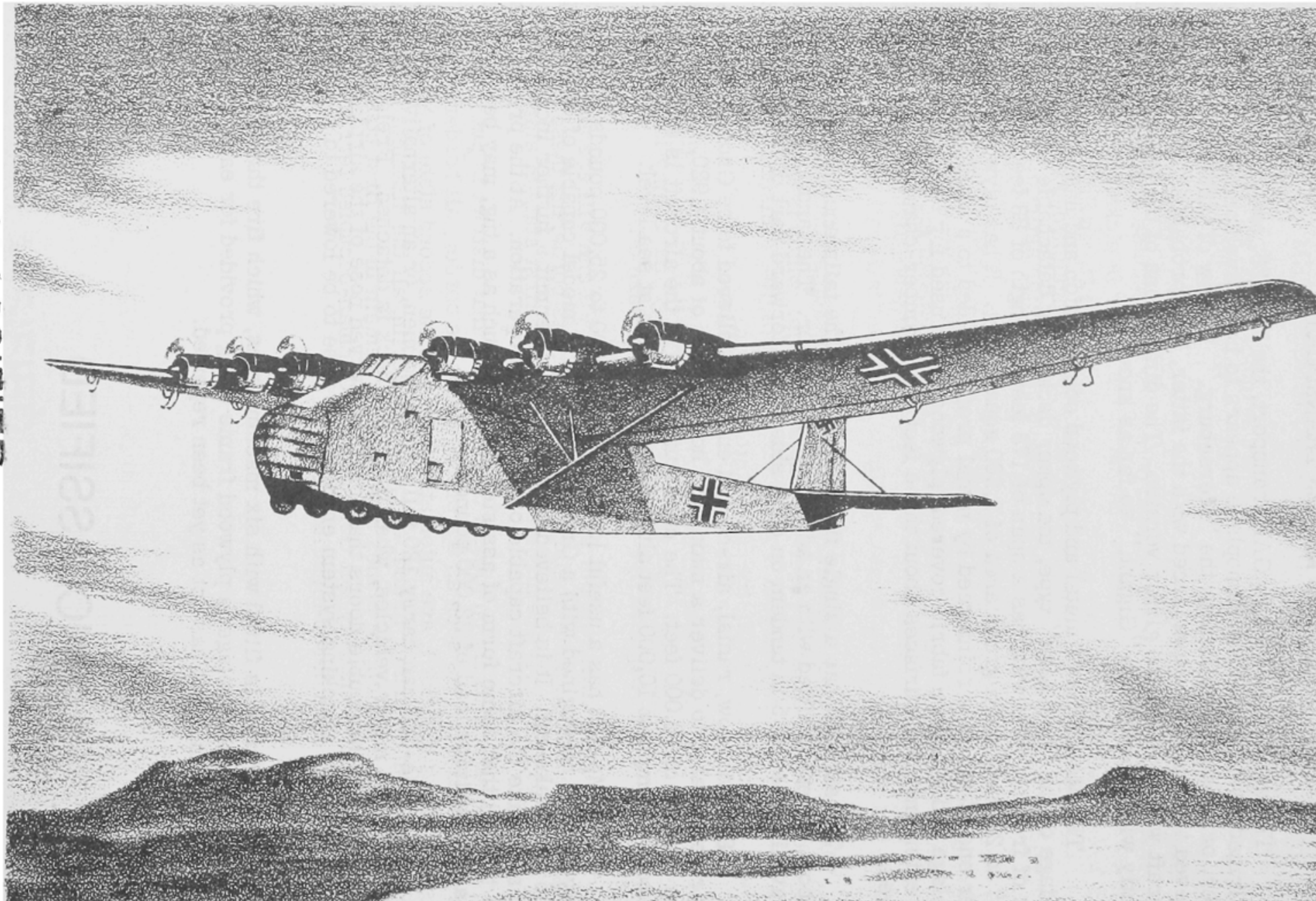

THE ME-323 TRANSPORT

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2. GERMAN AIR-RAID WARNING SYSTEM

Recent reports from German sources indicate that all of Germany and German-occupied countries are divided into air districts numbered I, II, III, etc. Listening devices on the coast or frontier detect the approach of enemy planes while they are still at a considerable distance from any German air district. These listening devices, it is said, can detect the motor noise of an enemy plane as far away as 175 miles. When the sound of the motor is picked up, those districts toward which the planes are flying are alerted first. In this preliminary alarm, all factory lights which are noticeable are extinguished, radio stations go off the air, and the crews of antiaircraft guns prepare for action.

As the planes approach the coast or frontier, it becomes evident toward which district the planes are flying. That district is then put in the second state of alarm, which means that the sirens are sounded and everybody goes to the air-raid shelters. All factory lights - including emergency lights - are extinguished, and everything is put into readiness by the antiaircraft crews.

In the case of a typical example, it may be assumed that hostile planes are approaching air district I (see accompanying map), which is then put in the second state of alarm, while all districts bordering on No. I (districts II, VII, and VIII) are automatically put in the first state of alarm.

As soon as the attacking planes enter district I, it is put in the third state of alarm (Hoechstalarm, or maximum alarm), meaning "the enemy is attacking." The antiaircraft guns begin to fire and pursuit planes take off.

At the same time, the bordering districts II, VII and VIII are automatically put in the second state of alarm, and all districts bordering these (in this case, IX, X, XII, and III) are automatically put in the first state of alarm.

If the attackers fly on toward the district II, that district is put in the third state of alarm. As soon as the planes cross its border, all bordering districts, including district I, are automatically put in the second state of alarm. If the planes continue further inland, e.g., toward Berlin, all the districts in the line of flight, and over which the planes have passed, remain in the first state of alarm until the planes have entirely left Germany and German-occupied ~~territory, and~~ the attack can be considered terminated.

3. GERMAN AA GUNS FOR USE AGAINST MECHANIZED VEHICLES

The Germans have made extensive use of their 20-mm and 88-mm antiaircraft guns for engaging mechanized vehicles. The 37-mm antiaircraft gun, though suitable for a dual-purpose role and provided with armor-piercing ammunition, has been used to a lesser extent. In addition to these three weapons, a German document shows that the use of four other antiaircraft guns against mechanized vehicles is envisaged. These guns are:

a. 40-mm AA/AT Gun (4-cm Flak 28 Bofors)

This Bofors-design gun is generally similar to the U.S. 40-mm Bofors. Some of the particulars of this weapon are reported as follows:

Muzzle velocity	2,950 f/s
Length of bore	60 cals
Max. horizontal range	12,300 yds
Effective ceiling	16,200 ft
Weight of projectile (HE)	2.2 lbs
Rate of fire (practical)	80 rpm
Weight in action	1.9 tons
Weight in traveling position	1.9 tons
Elevation	-5° to $+90^{\circ}$
Traverse	360°

b. 50-mm AA/AT Gun (5-cm Flak 41)

Little is yet known of this weapon, which was introduced in December 1940, except that it fires both HE and AP, is an automatic weapon, and is produced in either mobile or fixed models. The sight fitted is Flakvisier 41, which is operated by one man and is described as a completely automatic clockwork sight.

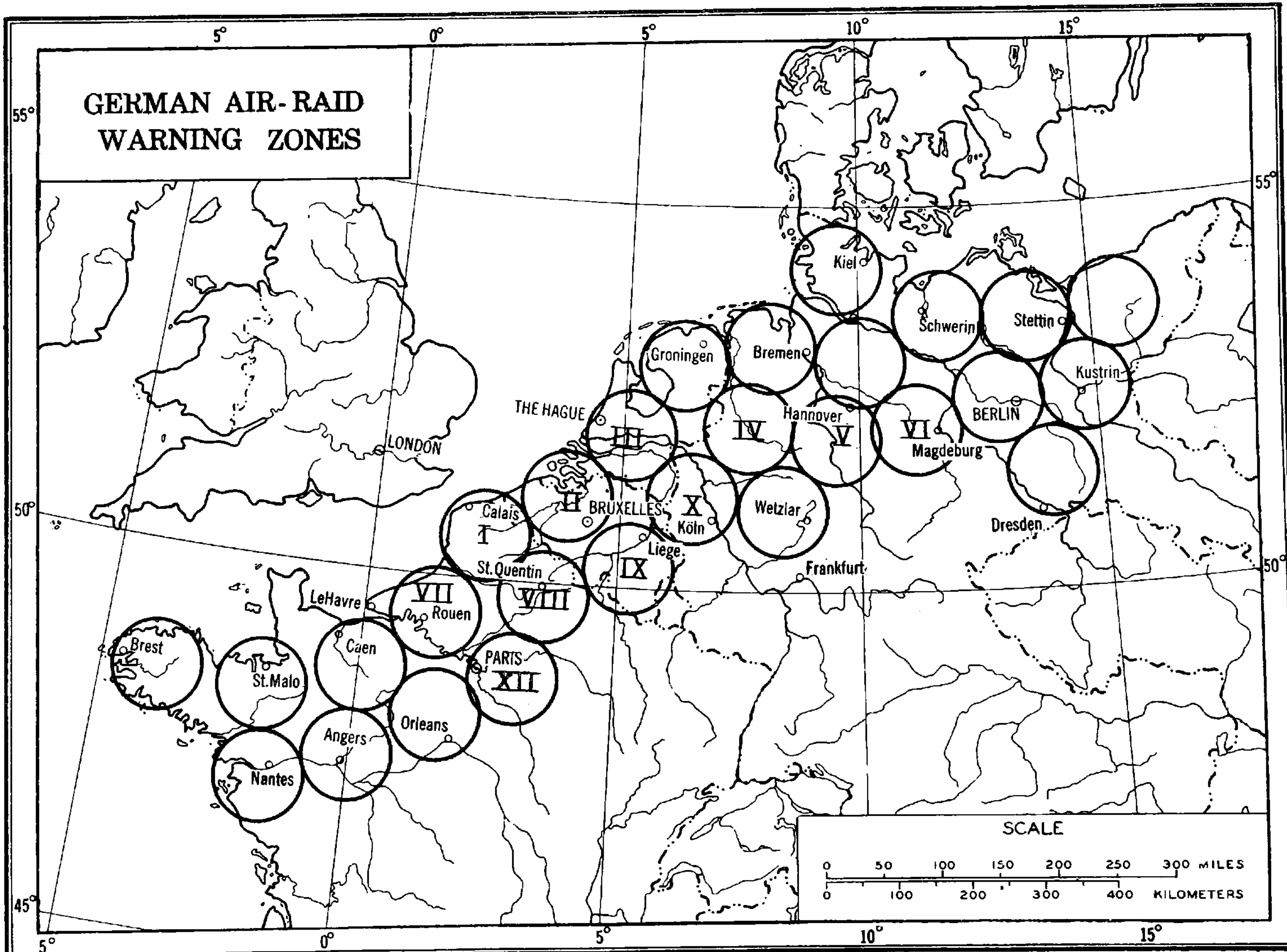
There is a possibility that this may be a tapered-bore gun, as the only two other German guns designated with the number '41' (the 2.8-cm Pak 41 and the 4.2-cm Pak 41) have been of the tapered-bore type.

c. 83.5-mm AA Gun (8.35-cm Flak 22 (t*))

This is a Skoda gun introduced into the Czech Army in 1922 as their standard semimobile heavy AA gun. Particulars are:

Muzzle velocity	2,625 f/s
Length of bore	55 cals
Max. horizontal range	19,650 yds
Max. vertical range	39,250 ft
Weight in traveling position	8.4 tons
Elevation	0° to $+90^{\circ}$

*Abbreviation for "tscheck," meaning Czech.



GERMAN AIR-RAID WARNING ZONES
LONDON
THE HAGUE
Calais
I
II
BRUXELLES
III
IV
V
VI
VII
VIII
IX
X
XII
St. Quentin
LeHavre
Rouen
Caen
PARIS
Brest
St.Malo
Orleans
Angers
Nantes
Liege
Köln
Groningen
Bremen
Hannover
Wetzlar
Frankfurt
Kiel
Schwerin
Stettin
Kustrin
BERLIN
Magdeburg
Dresden
SCALE
0 50 100 150 200 250 300 MILES
0 100 200 300 400 KILOMETERS

Traverse	360°
Weight of projectile (HE)	22.4 lbs
Tractor drawn.	

d. 105-mm AA Guns (10.5-cm Flak 38 and 39)

This gun is a standard heavy AA gun. It was originally designed as a dual-purpose antiaircraft-coast-defense gun. Experiments were made to produce the gun in a mobile form, and a limited number on mobile mounts appeared at Hitler's birthday parade in 1939. This mount was said to be unsatisfactory, and the gun was used as a fixed model only for a time. Recent reports indicate, however, that a new mobile mount has been provided, and it is reported likely that the Germans intend using the weapon in antitank role as they do the 88-mm gun. Particulars are:

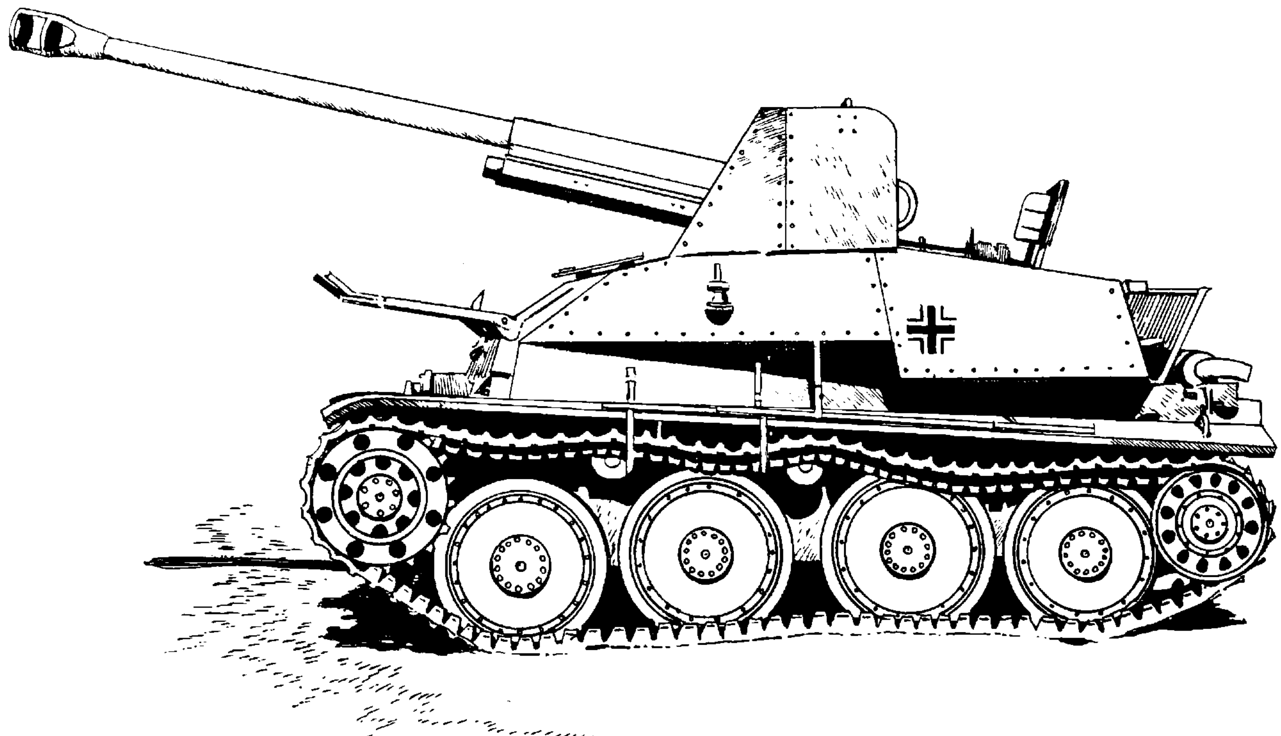
Muzzle velocity	2,890 f/s
Length of bore	60 cals
Max. horizontal range	19,075 yds
Effective ceiling	36,700 ft
Rate of fire (practical)	8 - 10 rpm
Weight in action	11.56 tons
Elevation	-3° to $+85^{\circ}$
Traverse	360°
Weight of projectile (HE)	33.2 lbs
Types of ammunition	HE with time fuze HE with percussion fuze AP shell

Tractor-drawn on a 4-wheeled carriage.

4. GERMAN 76.2-MM SELF-PROPELLED GUN

This weapon is another example of the German tendency to mount a large variety of guns on self-propelled mounts. These weapons have been in action in North Africa. The accompanying sketch is based on photographs of a captured specimen.

The weapon consists of a Russian 76.2-mm gun mounted on the Czech 38 (t) light tank chassis. The gun has a traverse of about 40 degrees, and an elevation of minus 5 degrees to plus 20 degrees. It is an adaptation of the standard Russian light field piece, which is reported to have a maximum range of about 15,000 yards and a muzzle velocity of about 2,300 to 3,400 feet per second; it fires a projectile weighing about 15 pounds.



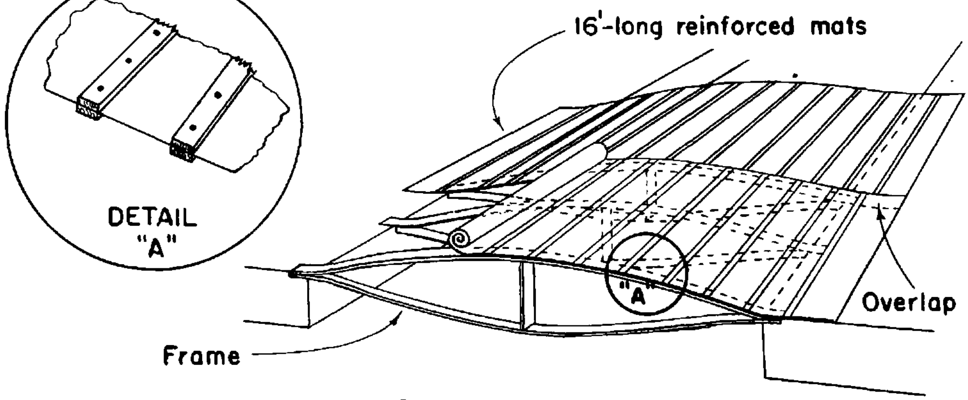
GERMAN 76.2-MM SELF-PROPELLED GUN

5. FINNISH TANK TRAPS OVER FROZEN RIVERS

A recent report on the method used by the Finns to open tank-trap channels in the ice over streams and lakes, and to keep them open and hidden, may be useful for purposes of winter operations. Briefly, the Finns saw out a channel in the ice, roof it over, leaving an air space underneath to prevent re-freezing, and replace the snow over the roof to keep the air space warm and to hide the trap.

The work is not difficult. After the outline of the trap has been traced, the snow over the ice to be cut is scraped back into windrows (as in fig. 1, stage 1). Then, a channel 13 feet wide is sawn out, with the cut on the down-stream side sloping outward and downward from the center, so that the ice cakes can be pushed down into the current and the channel is left clear, (stage 2). Over the cut is then laid a light framework roof with either a curved, or cigar-shaped cross section of the king-post type (stage 3), made of light material. The arch provides the air space over the water. Then the snow is shoveled back (stage 4).

FIG. 3



CONSTRUCTION OF MATS

The best time of year for trap making is early winter, while the ice is still thin, although there must be snow enough for insulation and concealment. Ice less than 8 inches thick will not support a roof. The mats which roof over the cut are made in 15- to 16-foot lengths, 4 to 5 feet wide and rolled for transportation (see fig. 3). They must be supported by frames, of which two types are shown in figure 2. Suitable materials for the mats are roofing felt, shingles, cloth of all sorts, and corrugated paper or stiff paper such as cement sacks. In a pinch, brush will probably do. To place the frames in position, the top of each

FIG. 1

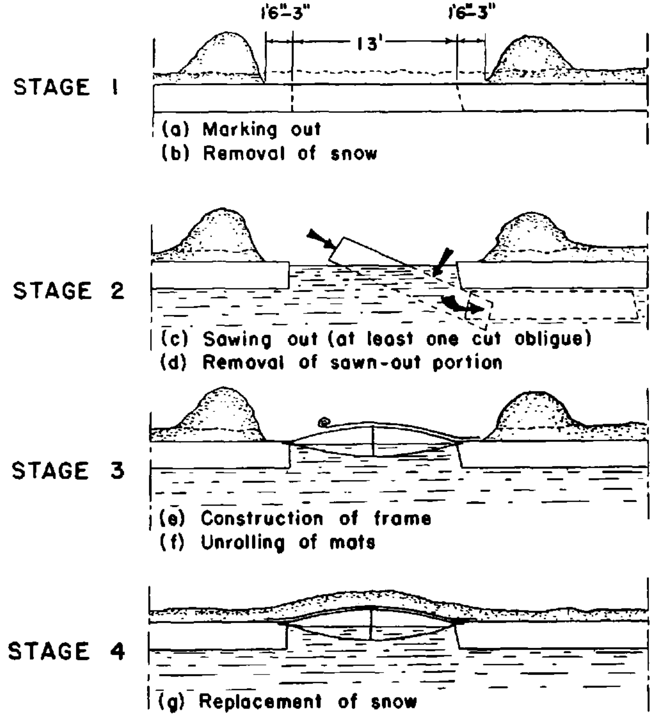
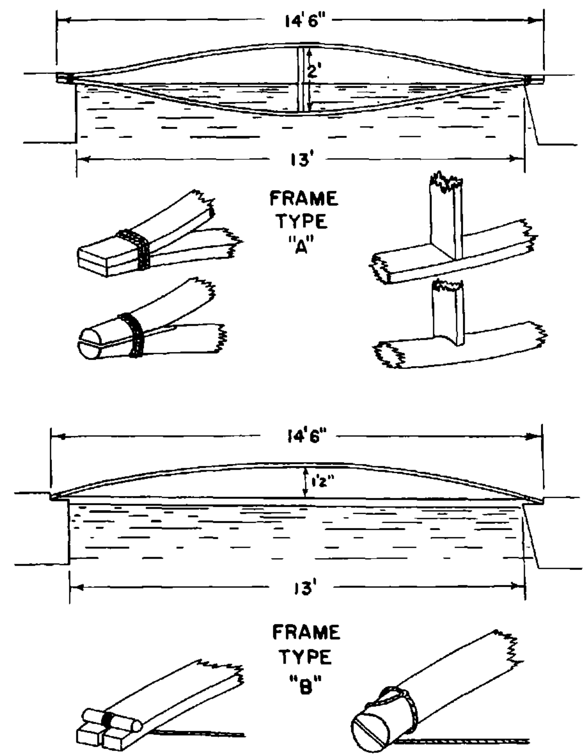


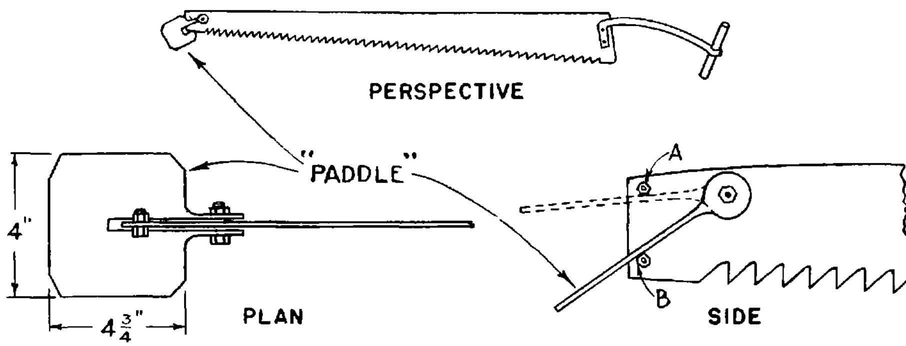
FIG. 2



FINNISH TANK TRAP ON ICE

ice bank is notched back a distance of from 9 inches to 2 feet, and the frames are set in the notches and packed with snow or chunks of ice. Their construction is shown in figure 2. In cold weather they freeze in place in a few minutes. These frames are set at intervals of from 1 foot 6 inches to 2 feet. The snow blanket over the mats should be at least 4 to 6 inches thick, and, if blown away, must immediately be replaced or the channel will quickly freeze.

FIG. 4



DETAILS OF ICE-SAW

The sawing is done with a saw of the design shown in figure 4. At its tip, the saw carries a hinged, paddle-shaped, steel plate which pivots up and down between stops (a) and (b). On the down-stroke, the paddle is forced down against lower stop (b), which serves to keep the blade firmly pressed against the ice, while on the up-stroke, the plate swings up out of the way against stop (a), in alignment with the motion of the saw, thus permitting easy withdrawal. The fitting of the "paddle" attachment should not be beyond the skill of a good army mechanic. The performance of the saw follows:

Ice Thickness (feet)	Ice Thickness (inches)	Cutting Speed (feet per hour)
1	0	130
1	8	80
2	4	50

The life of a trap depends on the weather and the care which goes into the making of the trap. Naturally, the degree of insulation against the freezing of the water underneath the mat varies with the thickness of the snow cover and with the water level; variations in either may increase or lessen the space. New ice (up to 4 inches) may be taken out with HE. Finnish experience shows that carefully made traps will remain effective against medium tanks for from 6 weeks to 2 months, up to midwinter.

ARMORED FORCE

6. PZ. KW. 3 WITH 75-MM GUN

Among enemy tanks recently examined in the Middle East was a Pz. Kw. 3 mounting a short-barreled 75-mm gun (7.5-cm KwK 38), identical with the short-barreled gun mounted on the Pz. Kw. 4.* The tank had been demolished, but it appeared that the only alteration, apart from the substitution of the 75-mm gun for the normal 50-mm gun, was the fitting of the armored barrel-sleeve into the front plate of the recoil mechanism belonging to the 75-mm. (Compare accompanying sketch with sketch of Pz. Kw. 3 armed with the long-barreled 50-mm gun, appearing in Tactical and Technical Trends, No. 20, p. 11.)

The German nomenclature for this tank is not known, but recently the Germans have referred to an Einheitspanzer. This is said to be a new standard tank combining the best features of both Pz. Kw. 3 and 4, and to consist of a Pz. Kw. 3 chassis with a short-barreled 75-mm gun mounted in the turret. If this is true, the tank examined may be an Einheitspanzer.

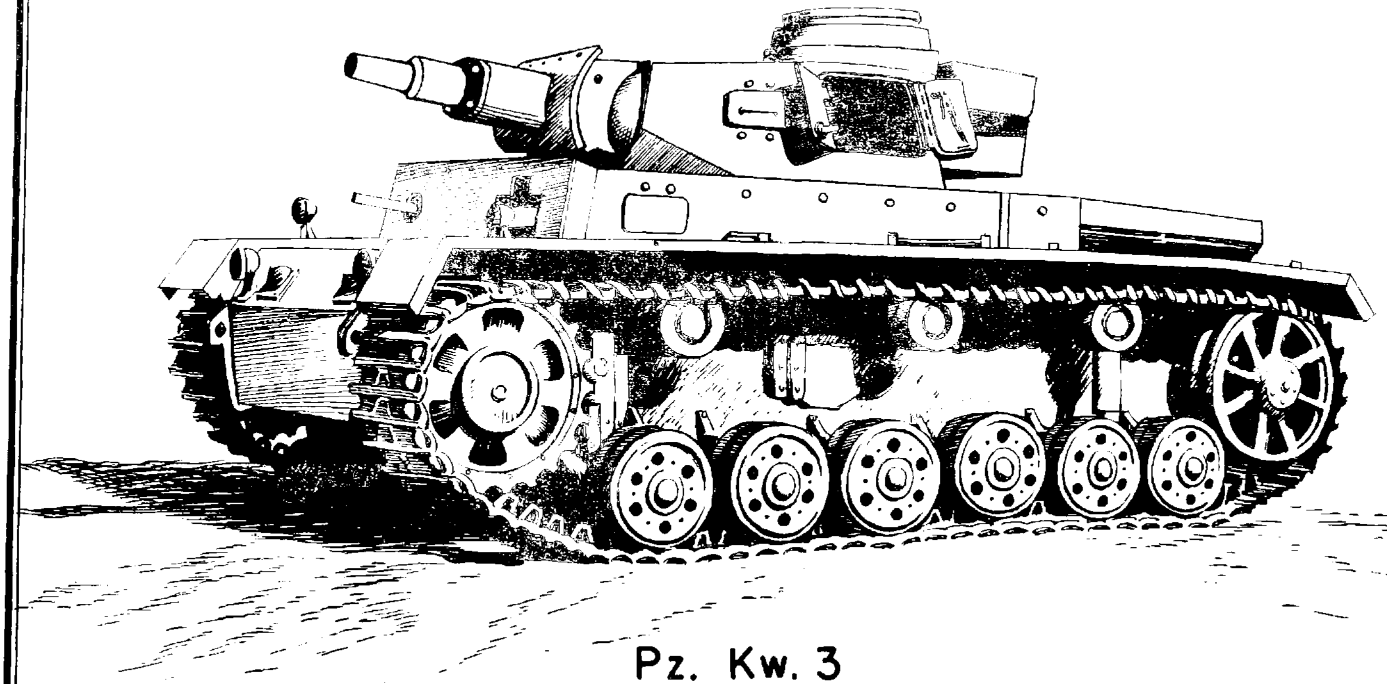
Another Pz. Kw. 3 with the short-barreled 75-mm gun has been captured in Tunisia. Presumably this is the same model tank as that examined in the Middle East.

CHEMICAL WARFARE

7. THREE JAPANESE LACRIMATORY WEAPONS

The Japanese have at least two types of lacrimatory candles, and at least one type of lacrimatory grenade. The agent employed in all three is CN (chloracetophenone), a tear gas.

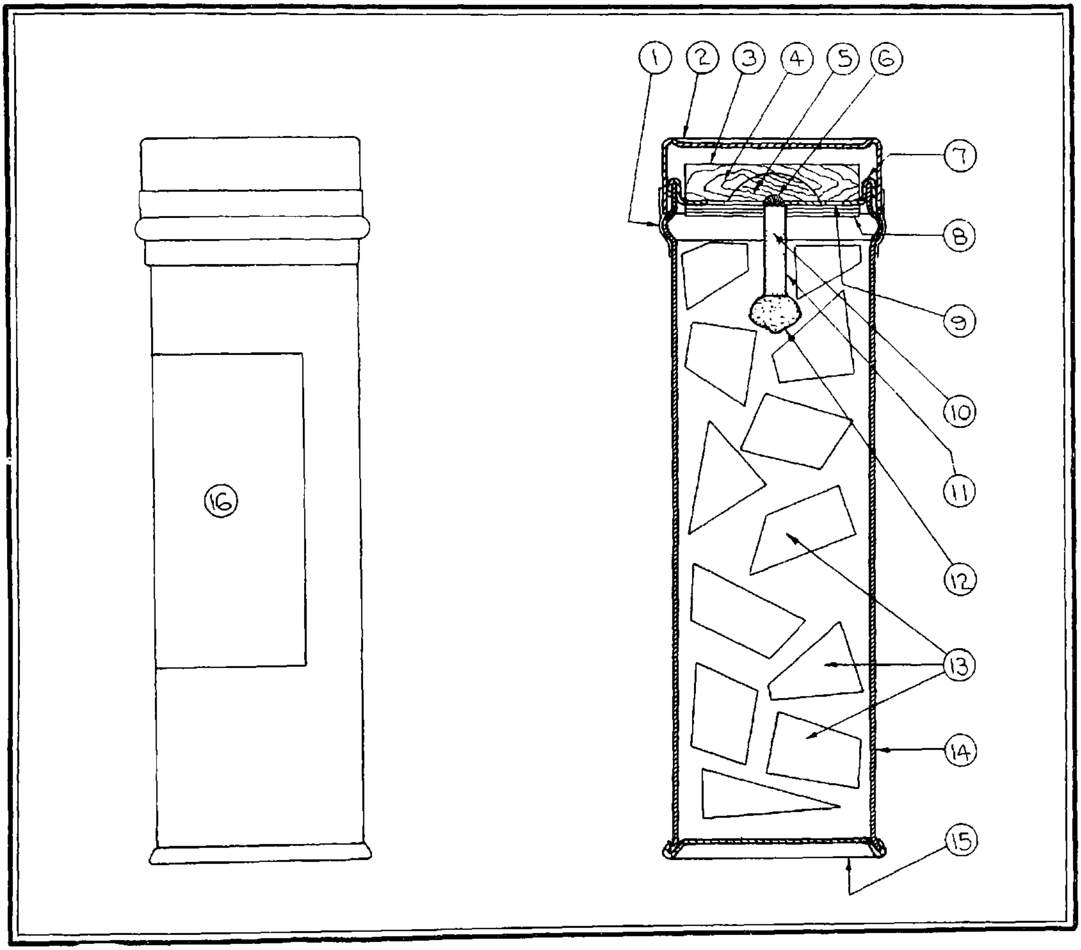
*Recently Pz. Kw. 4's with a long-barreled 75-mm gun have been encountered by Allied forces (see Tactical and Technical Trends, No. 20, p. 10).



Pz. Kw. 3
WITH 75-MM GUN

a. Lacrimatory Candle, Type "89"

This lacrimatory candle, 7 1/16 inches in length, weighs approximately 8.5 ounces, including the chemical filling weighing 4.6 ounces. The lacrimatory filling consists of collodion flakes impregnated with 25 percent CN. The container is painted a greenish-gray color.



Key to Sketch

1. Adhesive tape
2. Lid (metal)
3. Abrasive surface
4. Scratch block (wood)
5. Cotton wad
6. Match head
7. Inner cover
8. Gauze
9. Vents
10. Fuse
11. Fuse tube (copper)
12. Starter mixture
13. Impregnated flakes
14. Container
15. Base
16. Label

The label had the following printed instructions:

(1) Uses

(a) On maneuvers, to represent non-persistent gas;
(b) For dispersing crowds, riots, etc.

(2) Method of Using

(a) Tear off the waterproof adhesive tape (1) and remove the lid (2);
(b) Take out the scratch block (4) and rub it on the top of the match head (6); after ignition, place the candle in position or throw it;
(c) Gas is emitted 4 seconds after ignition.

(3) Special Caution

(a) Before ignition, put on gas mask; the gas vents (9) must face away from the body;
(b) Do not use the candle near inflammable substances;
(c) After all gas has been emitted, do not touch the candle for several minutes, because of the heat generated;
(d) If the chemical comes into contact with the skin, use soap and water (warm water alone will also do) as soon as possible.

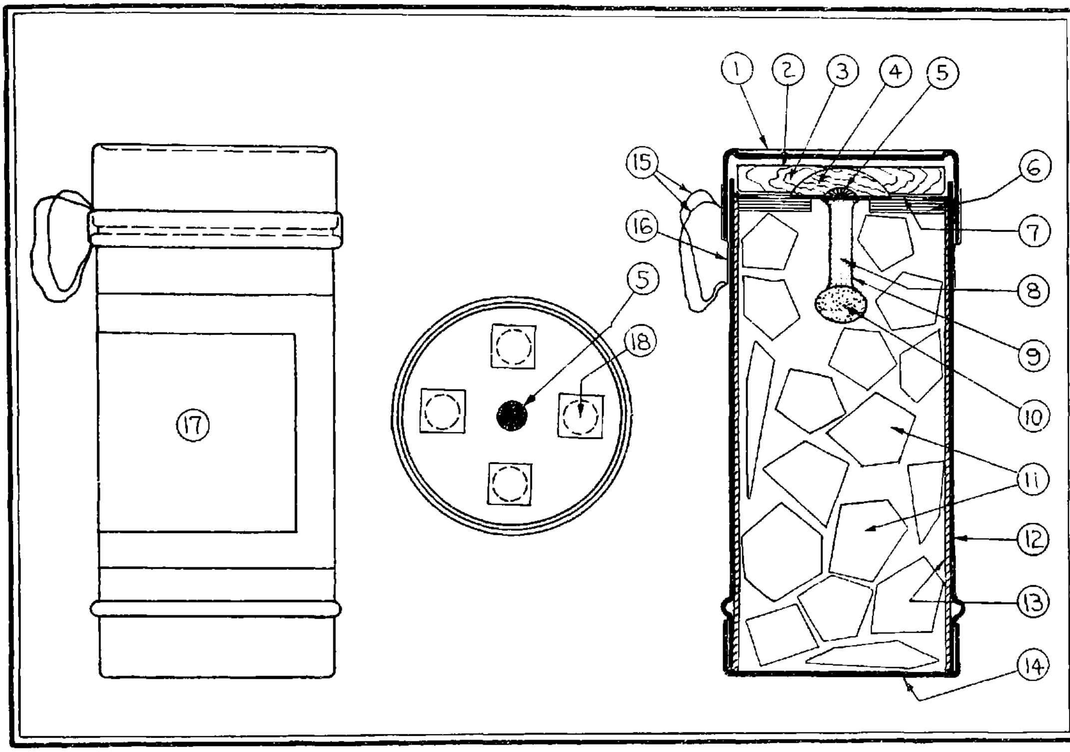
(4) Effective Life

One year after manufacture; thereafter, to be examined for effectiveness every 6 months.

b. Green Lacrimatory Candle, Type "A"

The total weight of this candle is 5.9 ounces, including the chemical filling which weighs 1.9 ounces. It is 2.3 inches in diameter and 5.2 inches in length. The lacrimatory filling consists of collodion flakes impregnated with CN.

The label on this candle is essentially the same as the one under paragraph a. above, except that the period of effective life is six months after the date of manufacture.



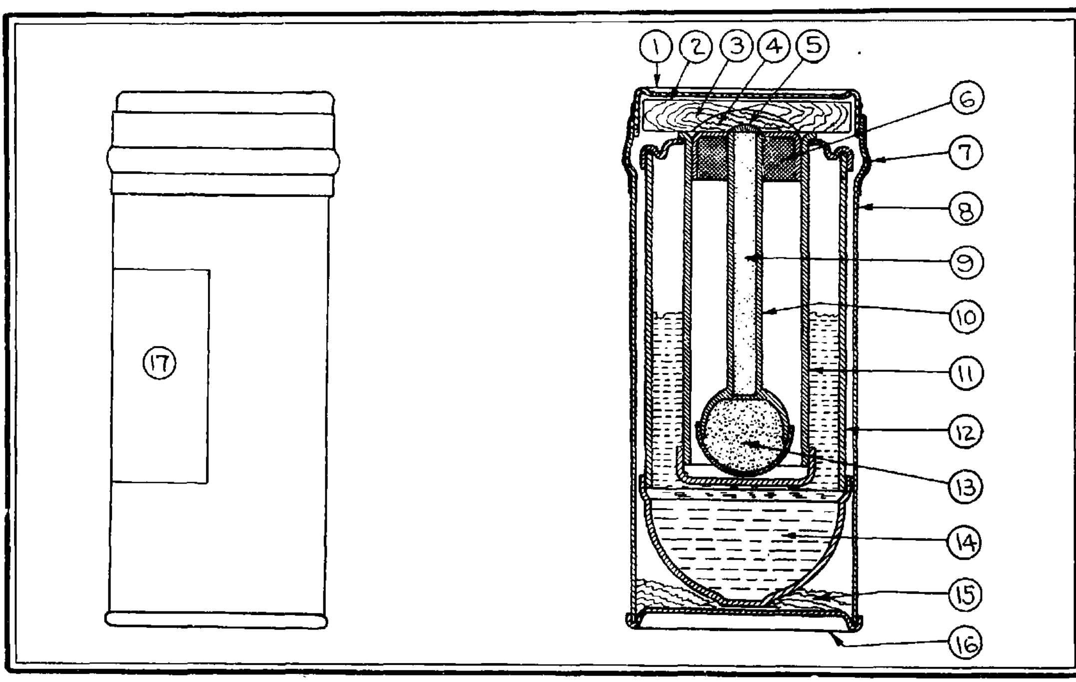
Key to Sketch

1. Lid (metal)
2. Abrasive surface
3. Scratch block (wood)
4. Cotton wad
5. Match head
6. Three layers of gauze
7. Vents
8. Fuse
9. Fuse tube (brass)
10. Starter mixture
11. Impregnated flakes
12. Outer container
13. Inner container (cardboard)
14. Base
15. Cord for removing tape
16. Adhesive tape
17. Label
18. Vents (sealed with oil paper or tinfoil)

c. Lacrimatory Grenade, Type "89," Type "C"

The total weight of this grenade is approximately 11 ounces, including the lacrimatory filling which weighs 4.84 ounces. It is 2.1 inches in diameter and 5.1 inches long. The label (17) on the body gives the details of its use and method of operation. It is painted a silver-gray color.

When the grenade is removed from the outer container (8), a match head (5) forming the top of the fuse (9) is exposed. This is ignited with the abrasive surface (2) of the scratch block (3) and after a delay of 4 to 5 seconds the burster charge (13) becomes ignited. On exploding, the grenade is shattered and the lacrimatory filling (14) scattered. The lacrimatory filling is CN dissolved in carbon tetrachloride. The container for the fuse (10), the insulating tube (11), and the container for the lacrimatory (12) may be vulcanite, celluloid, or some plastic material which would not be corroded by the liquid filling.



Key to Sketch

1. Lid (metal)
2. Abrasive surface
3. Scratch block (wood)
4. Cotton wad
5. Match head
6. Cement stopper
7. Adhesive tape
8. Outer container (metal)
9. Fuse
10. Container for fuse
11. Insulating tube
12. Container for lacrimatory
13. Burster (gun powder)
14. Liquid lacrimator
15. Cotton packing
16. Base
17. Label

ENGINEERS

8. JAPANESE FIELD WORKS AT BUNA

The taking of the Japanese positions in the Buna area (southeastern New Guinea) was a relatively lengthy process. Much of the difficulty was occasioned by the strong field works constructed by the enemy, and by the tenacity with which these works were held. Of interest, therefore, is the following extract from a report made by a U.S. Army engineer.

* * *

The enemy bunkers and dugouts in the Buna area were constructed of cocoanut-palm logs, dirt, sand, and sand bags, covered with natural camouflage. In some instances, pieces of armor plate were set up. No concrete positions were found. The log-and-dirt bunker construction was done carefully and strongly. The corner posts were firmly embedded in the ground, and the horizontal logs neatly and strongly attached and interwoven. Several alternating layers of logs and earth were generally used to give full protection against mortars and light artillery. Roofs were thick and were also made of alternating layers, giving excellent protection. Bunkers were connected to systems of radiating fire and communication trenches on both sides. In some instances, underground trenches were used, and the enemy used these to place snipers in our midst even after they had long been driven from the general area. Leaves and grass were well used to camouflage all bunkers; in addition, the bunkers had been planned and built for just this purpose long before the campaign actually started, and the quick jungle growth, sprouting up over the earthworks, gave first-class natural camouflage.

The enemy work was generally neat and strong. One position in Buna Mission, consisting of kitchens, latrines, dugouts, and trenches, was, in consideration of the locale and the terrific bombardment that it had endured, a model of neatness and efficiency.

The enemy dugout positions were well sited and mutally supporting. It was extremely difficult, if not impossible, to bypass any of the positions, each of which had to be reduced in turn.

It would be impossible to overstress the tenacity with which the Japs clung to their prepared positions. Grenades, and ordinary gun and mortar fire were completely ineffective. There were many instances (not isolated ones) where dugouts were grenaded <u>inside</u>, covered with gasoline and burned, and then sealed with dirt and sand,--only to yield, 2 or 3 days later, Japs who came out fighting. One souvenir hunter, entering, 4 days after the battle, a dugout that had been sealed, was chased out by a Japanese officer wielding a sword. Some of the instances in which Japs lived on in these positions, through the burning and the detonation, in the filth and gore, when sorely wounded themselves, are almost incredible.

INFANTRY

9. JAPANESE RUSES--BUNA AREA

The extensive use of deception and ruses by the Japanese is well known. Below are described two which were used in the Buna area (Southeastern New Guinea).

a. "Dummy" Snipers

An American patrol advancing up the coast was fired on by a sniper in a tree. They halted, located him, and apparently shot him down. They then advanced and were fired on again. This happened several times. Thorough investigation revealed that one sniper had been holding up the patrol, and dummies had been placed in other trees. After the Americans had fired sufficient shots, these dummies were dropped by a pulley arrangement. This caused the Americans to suppose that they had cleared the opposition.

In another case, the sniper's dummy was rigged so that it could be pulled back up into place; the sniper made the mistake of pulling it back up too soon, giving away his ruse.

b. "Short" Rounds

The morale and spirit of an Allied unit advancing under covering fire of friendly artillery was seriously affected by this ruse. Every time our guns opened up to provide covering fire for an advance, or fired on any target, the one known Jap 70-mm gun in the Government Gardens area also opened up and placed its rounds among our forward elements. The Japanese timed the activity of their own gun to coincide exactly with that of our supporting artillery. This made the troops imagine that they were being fired on by their own guns.

10. JAPANESE TACTICS ON GUADALCANAL

The following miscellaneous observations on Japanese tactics on Guadalcanal were made by a U.S. Marine colonel, commander of one of the Marine regiments.

* * *

The Jap has been taught that he is invincible. He is accustomed to having the enemy run when Japanese elements get around their enemy's flanks and rear. He is also accustomed to the enemy running when he charges with the bayonet. In his night attacks, he expects the enemy to be caught in front of or on the tactical objective (always an identifiable terrain or other feature) and to be defeated; thus, the mission of his night operations is accomplished.

Consequently he has been upset, confused, and defeated by American troops who do not run, who themselves charge with the bayonet, and who are not where they are expected to be in night attacks--instead, they counterattack when the Japanese are confused and in process of reorganizing after having reached their night-attack objective.

In night attacks the Japanese would send advance parties by the valleys through the denser cover, reserving the more open terrain of the higher ground for the main body and main effort. They would have the main body make considerable noise in order to drown out any noise the advance parties might make. The Jap has had the advance parties clear away jungle growth along avenues of subsequent approach for larger units, and has "blazed" the trails thus cleared with luminous paint. The Jap moves his main forces up in closed-up columns--partly for reasons of command control.

For purposes of control and orientation, Japanese night attacks followed clearly defined terrain features, e.g., a crest ridge-line or a stream. The Japanese selected night-attack objectives from observation of our dispositions at sunset. If he later fails to find these dispositions where he expects them, he becomes confused in the dark and does not know where to look for us. It would take him an hour or two to get reorganized, and that was the time to counterattack him. Heavy casualties were inflicted on him then.

On Tulagi, the Jap took up his positions on the reverse slopes. This gave him better visibility up against the crests and sky, and permitted intense surprise fire of devastating effect at short ranges. However, when he counterattacked at night out of these positions, he suffered so many casualties that he did not have men enough to hold his reverse-slope positions the next day.

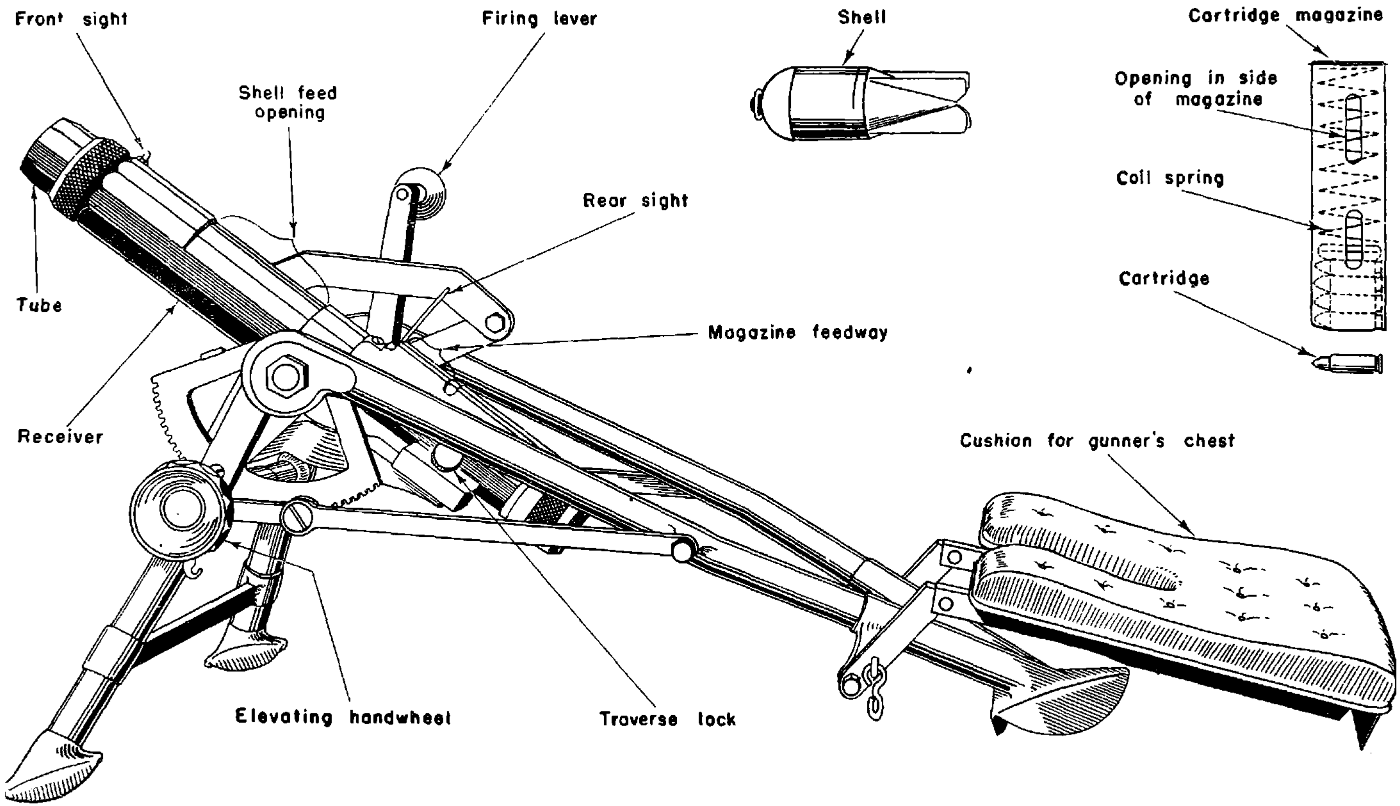
The Japanese machine-gun dugouts were held in strengths of 10 to 12 men. When one man was killed, another stepped up and manned the gun. This required every man to be killed, and so the positions held out for hours. Immediately the Jap discovers a machine gun, he will send over mortar bombs, usually within 10 minutes. The Jap digs in wherever he stops. In a few minutes he will have a slit trench, and in 20 minutes a man-deep foxhole.

ORDNANCE

11. ITALIAN 45-MM MORTAR

Examination of this equipment has identified it as the standard Italian 45-mm light mortar, model 35, Brixia.

The mortar is a breech-loaded, trigger-fired weapon. The shell is a short-finned projectile weighing about 1 pound. It is propelled by cartridges fed from a detachable box magazine fitted on top of the receiver. The shells are loaded singly by hand. As will be noted in the accompanying sketch, the mortar is mounted on a folding tripod, with a padded frame hinged to its rear leg. It is known that the weapon has been used in both the African and Russian campaigns.



ITALIAN 45 MM-MORTAR

The weapon is of very elaborate design, and would probably be very costly to manufacture even in mass production. Because of the complicated mechanism of the mortar, it would be subject to malfunctions and improper operation. It is reported as having a high rate of fire, is steady in action, and folds conveniently for carrying. It is understood that the mortar shell has very poor fragmentation.

a. Characteristics

The general characteristics are:

Caliber	45 mm (1.77 in)
Weight (complete with tripod)	35 lbs
Reported range (maximum)	585 yds
Reported range (minimum)	350 yds
Maximum capacity	10 cartridges
Weight of shell	1 lb

b. Description

This mortar is a smooth-bore, breech-loading, trigger-operated weapon and can be fired at elevations below and above 45°. The shell is hand-loaded, and propelled by a cartridge (clip fed) from a chamber located on top of the receiver. Only one charge is used, but the range may be increased or decreased by closing or opening the ports located under the barrel. Elevation must also be taken into consideration.

The mounting is a folding tripod, with a padded seat or frame hinged to its rear leg. When the mortar is in firing position, this padded frame acts as a cushion for the firer's chest, and when folded in transport it eases the load on his back.

c. Ammunition

The HE shell weighs about 1 pound. The body is constructed of a mild steel with an aluminum tail. The tail is painted to indicate the type of shell. Red is the marking for HE shells. It is reported that practice shells are painted yellow, and instructional ones are unpainted.

The shell examined is fitted with a safety cap held in position by a safety strip. This is to provide safety during handling and transport, and must be removed before loading the mortar.

On setback, the setback locking pin drops to the rear, freeing the arming vane. As the shell is propelled through the air, it is armed by the rotation of the arming vane. On impact, the firing pin contacts the primer, which in turn sets off the booster of Petn (penta-crythritol-tetranitrate) and lead styphenate, and finally the bursting charge of TNT. Located inside the body of the shell is a coil of spring steel. This gives added fragmentation to the shell when it is finally detonated.

The propelling cartridge is constructed of brass and has a mouth crimped into a six-point star.

The primer mixture was the corrosive type, containing mercury fulminate, antimony trisulfide, potassium chlorate,and ground glass. The mixture was covered with a thin film of lacquer.

The powder charge was of the double-base type, and was tamped into place with a ball of cotton wadding. Its probable function is to secure the charge during the necking and crimping operations, as well as to provide a more effective seal for the powder than the crimping does.

12. SOME NOTES ON GERMAN WEAPON DEVELOPMENT

a. General

The goal of all modern armies is the maximum production of good and efficient weapons in a minimum variety of types. The advantages of limiting weapon types to the smallest number consistent with effective warmaking have been shown to be numerous. If weapon designs are highly standardized and relatively few in number, equipment can be produced swiftly and abundantly by mass-production methods. Further, the training of troops is simplified and facilitated, and if the weapons themselves can be used in interchangeable roles (the dual-purpose AA/AT guns are a familiar example), battle efficiency is greatly increased.

Nazi Germany has been most consistently and successfully devoted to the principle of limiting the variety of weapons to the smallest number which will give the required combat strength and effectiveness.

Since the original basic designs upon which the equipment of the present German army was produced, there has been no pause in the intensity of development which followed. As the German army gained experience, newer and more efficient designs of equipment were produced, and existing types were modified as circumstances required. German designers learned their lessons rapidly, and the result is that even standardization carried on to an extreme, as it undoubtedly is in German equipment, has little or no effect upon the development of better and more efficient weapons. Italy has tried hard to conform with the rapidly changing requirements which the present war has brought about, but, hampered by a chronic lack of adequate designers, adequate raw materials, and adequate facilities, she is always just one step - and sometimes just one hundred steps - behind. There has been much for Italy to learn since Italy felt the full weight of modern armaments, and, with an increasing German influence in control, the Italian armament industry is at least making an effort not to be left too far behind. Evidence from many sources, obtained during or immediately prior to present operations, makes it possible to collate what is known about certain new equipment, and makes it possible to draw some conclusions. The following is a partial list of certain enemy equipment identified in the course of recent operations.

b. German Kampfpistole

The Kampfpistole itself is the normal, light-metal signal pistol, slightly bored out and rifled, and has a caliber of 27 mm. The only projectile so far identified is an HE grenade with a direct-action fuze operating on impact. The accurate range is very short, and the maximum range is not more than about 100 to 150 yards. There is little effective fragmentation, and the effect is only to project an "offensive"-type grenade a little further than it could be thrown by hand.

c. Rifle Grenades

(1) Grenade Launcher (Schiessbecher)

This is a heavy-metal grenade launcher in two parts, having a caliber of 30 mm. The main body can be clamped to the muzzle of any rifle model 98 (except Models 98a and 98/40) and carbine model 98K. The clamp itself fits just behind the front sight. Into this component is screwed a cylinder forming the rifled bore of the cup. The rifled cylinder is the male portion and has a very rapid right-hand thread. A special tool is supplied with each cup for assembling.

(2) Grenade Launcher Sight (Granatvisier)

The sight is a simple attachment clamped to the left-hand side of the rifle just to the rear of the rear sight and comprising a "U" notch rear sight and blade front sight, on a base revolving about an axis and aligned by a small spirit level. There are two range scales, reading respectively from 0 to 250 meters for low-angle fire, and 250 to 50 meters for high-angle fire. The graduations apply to the HE round only; when firing the AP round, 75 meters on the low-angle scale correspond to a range of 100 meters, and 50 to a range of 65 meters.

(3) HE Grenade (Gewehr Sprenggranate, or G.Sprgr.)

The projectile consists of a blackened steel body with an aluminum nose fuze and a grooved collar fitting into the rifling of the grenade launcher cup. The fuze operates on impact, but the shock of discharge also initiates a delay system in the base which, in the event of the nose fuze failing to function, detonates the explosive filling after a delay of 5 seconds. The collar carrying the rifling may be unscrewed from the body and the igniter string pulled, in which case the projectile can then be thrown as a hand grenade, operating after 4 1/2 seconds. The effect is equivalent to that of a "defensive" type of grenade, the radius of fragmentation being given as about 30 yards.

(4) AP Grenade (Gewehr Panzergranate, or G.Pzgr.)

This is a form of armor-piercing rifle grenade. It incorporates the hollow-charge principle. In appearance the grenade is a long cylinder, partly steel and partly aluminum, with a black, rounded-metal nose cap and a base plate slotted to facilitate removal. The forward half of the cylinder is constructed of steel and contains the bursting charge, a light metal diaphragm shaping the hollow charge. The rear aluminum half of the cylinder, which carries an interrupted collar with 8 right-hand grooves to fit the rifling of the launcher cup, contains a fuze and explosive train. The weight of the bursting charge is exceedingly small compared with the total weight of the grenade, and the general design is unnecessarily complicated, with considerable waste of efficiency. There is no provision for use as a hand grenade.

(5) Practice Grenade (Gewehr Sprenggranate Ub.)

This round is fitted with a smoke generator, 6 holes for smoke emission being drilled in the side of the body.

(6) Cartridge and Packing

Each grenade is packed with a bulletless, blank rifle cartridge in a cardboard container, which may be marked with the German nomenclature. The cartridges are not interchangeable between rounds of different types. The containers are black with a white spot on the end for AP rounds, and gray for HE rounds.

(7) Range

HE - Maximum range 250 yards (approx).

AP - Moving targets are to be engaged at ranges of less than 100 yards, the vulnerable parts of tanks being penetrated, according to an enthusiastic but probably over-confident handbook, at ranges of under 50 yards. The latter range probably represents the degree of accuracy of aim, since the actual effect is not dependent upon range.

d. 200-mm Spigot Mortar

An effective introduction is the 200-mm spigot mortar (see Tactical and Technical Trends, No. 16, p. 32). Although intended for the destruction of obstacles, minefields, and gun emplacements, it is not considered that the effect would be sufficiently great to mark an advance in minefield clearance methods. The probable appearance of the projectile is an egg-shaped body containing the bursting charge, with a long tubular tail having fins at the base. The tail probably breaks off in one piece on detonation of the round, and there will be considerable blast effect with comparatively little fragmentation. It is possible that incendiary, smoke, and other chemical agents may be used.

e. Small Arms

(1) Pistol P.38

Although not a very new design, this pistol, which incorporates good design points of many previous types of pistol, is gradually replacing existing models.

(2) Machine Guns

A new model, the MG 41, is reported to exist. A still newer model, MG 42, exists and is more satisfactory than the MG 41 (see Tactical and Technical Trends, No. 20, p. 28).

The newer types differ from the MG 34 in having an increased rate of fire, and being lighter in weight. An increase in the rate of fire of ground MGs over the MG 34 (cyclic rate 900 rpm) is likely to prove of doubtful value, since the increased expenditure of ammunition will present difficulties without obtaining any real advantage.

(3) 20-mm Flak 38

This weapon is a development from, and an improvement upon, the 20-mm Flak 30 which has proved quite successful. It does not represent any radical change in design, but is simpler, more accurate in operation, and incorporates many minor improvements.

(4) 20-mm Flakvierling

This equipment consists of four 20-mm Flak 38s on a single, highly mobile carriage. Although probably intended for AA use, it can be used against ground targets and is a very useful marine equipment.

f. Hollow-Charge Ammunition

For reference to the use of German hollow-charge ammunition, see Tactical and Technical Trends, No. 19, p. 27.

g. Rocket Weapons

See Tactical and Technical Trends, No. 18, p. 26.

13. AXIS USE OF DIESEL OIL FOR ANTI-FREEZE

At temperatures running to 30 degrees below zero F. and lower, glycerine-water and glycol-water mixtures are useless as anti-freeze agents. Although two other agents, methanol and ethanol, have too low a boiling point and evaporate quickly, Axis forces reportedly used ethanol-water mixtures on the eastern front last winter.

It has been reported that the German Army, as a result of satisfactory experiments, used diesel oil as a coolant last winter. Since this oil has a lower coefficient of heat conductivity than water, the operating temperature of the engine will be raised--an advantage in extreme cold weather. While the oil is destructive to natural rubber joints, synthetic rubber is immune. Troubles may arise from corrosion, particularly in the radiator, because of a growth of acidity in the oil. At first the oil may be commercially pure, but the addition of moisture and dirt, together with the churning of the water pump, may crack the oil until acids accumulate to a harmful extent. Rust from the cylinder jacket may be present and, together with the emulsified oil, cause trouble. Such acids may attack copper and aluminum. The rising viscosity of the oil may cause mechanical troubles such as pump-shaft shearing or vane breaking.

14. GAS AND OIL IN GERMAN MECHANIZED VEHICLES

Certain data about the German use of fuel and lubricants for their mechanized equipment are reported as a result of the examination of specimens.

a. Gasoline

Analysis of German yellow gasoline shows that this normally has an octane number of 74 (similar to our "regular" as sold in American service stations) or better. The chemical composition of German gasoline varies considerably. It frequently contains a rather high proportion of benzol or of alcohol, and this should result in a slightly higher consumption per mile than with our regular 72 to 75 octane gasoline.

Specimens have shown cases which might cause difficulties in starting in cold weather, owing to lack of front-end volatility (low boiling-point fractions), but, in general, this yellow gasoline should be usable in all automotive equipment which has an octane requirement of 75 or less.

Gasoline containing alcohol is deleteriously affected by even small quantities of water mixed with it.

b. Lubricating Oils from a German Pz Kw 3

(1) Engine Oil

This has a high viscosity-index (95) and a low pour-point (below 0° F). It is intermediate between SAE 30 and SAE 40 in viscosity grade, but rather nearer to the latter.

(2) Gear Box Oil

This is probably a straight mineral-oil product with an original viscosity approximating that of an SAE 140 gear lubricant.

c. Final Drive Oil

This is probably a compounded lubricant, of viscosity grade similar to Hypoid 90 with a pour-point below 0° F.

d. Shock-Absorber Fluid

This is a straight mineral-oil product of rather lower quality than normal light, non-freezing, mineral oil of low viscosity, but within the limits of the specification of this oil as regards specific gravity and viscosity index.

GENERAL

15. FOOD AVAILABLE IN THE JUNGLE

In Tactical and Technical Trends, No. 19, p. 49 some of the "dangers" of the Tropics were pointed up to show that, to a large extent, they were over-emphasized, or their true significance distorted.

The following report of an American Army officer is intended to show the possibilities of "living off the land" in the jungle and to describe the customs of the natives in preparing meals made up of the various types of food locally available. The experiences recounted are the result of a 4-day experimental reconnaissance.

* * *

Eight noncommissioned officers of the 1st Battalion and myself accompanied two French officers and two platoons of the New Hebrides Defense Forces (native troops), on a 4-day reconnaissance trip up the Teouma River. The primary purpose of the trip was to see if it were possible for 75 to 100 men to live off the land indefinitely in the jungles of this island.

Although 3 days' rations were carried by each man, very little was touched except tea and biscuits. It was conclusively proved to my satisfaction that men who are resourceful and who will take the time to learn a little jungle lore can easily live and thrive healthfully in these jungles all about us.

a. Types of Food

To list by group all the various foods we found in the jungle:

Meats

Wild chicken
Wild duck
Wild pigeon
Wild cattle
Wild pig
Flying fox
Fish (mullet)
Eel
Fresh water crawfish (prawn)

Vegetables (all year round)

Taro
Yam
Manioc
Hearts of palm trees
Hearts of pandamus

Fruits

Bananas (all year round)
Oranges (May, June, July)
Tangerines (May, June, July)
Lemons (May, June, July)
Bread fruit (February, March)
Wild raspberries (September, October)
Nakarika (October, November)
Papaya (all year round)
Mangoes (October, February)

Nuts

Coconut (all year round)
Navele (September, October)

Water vine

b. Poisonous Vegetation

We learned that there were seven varieties of nangalat, a poisonous leaf that upon contact with human flesh produces an instantaneous burning sensation and itching that lasts usually about 1 week. The native remedy is to rub immediately the juice from the stem of the poisonous nangalat (the same one that touched you) on the affected part. The worst variety of nangalat can be recognized by the red veins running all through the leaves and by the escalloped edges of the leaves. There is also a poison tree called the "goudron," which is easily distinguished by its coal black sap which invariably runs profusely down some part of the trunk. If you sleep under this tree, you will be taken sick and suffer with a severe headache lasting a long time. If you cut into the tree or in any way contact the "black blood" (as the natives call it), you may get a severe poisoning which puffs up the skin of the face and hands with a very dangerous and painful rash. Once subjected to this poisoning, one need only approach within 50 feet of a "goudron" tree to get the same poisoning all over again. Some people have been known to have been so severely poisoned that they never were completely well again.

c. Lumber Products

We learned that the bark of the rotin (rattan) tree (the wood that all the fences around us are made of) makes a rope of any desired size. It is practically impossible to break even a fine thread of it. The bourrée tree is also excellent for this purpose.

We learned to recognize several very hard woods that are excellent for building anything you wish to last for a long time.

There is a very common bush all about us from which is extracted ricin oil; it is used to produce a high-grade aviation oil.

d. Methods of Cooking

An interesting thing was to see how the native troops cooked the fish, prawn (crawfish), and meat that we ate. There were two methods used in cooking the fish. The first method was to clean and scale the fish and then wrap them up in wild banana leaves. The bundle was then tied securely with rotin-bark twine, placed on a hastily constructed wood griddle, and roasted thoroughly until done. The second method was to wrap up the fish in the same manner, and then place the bundle well down inside and underneath a pile of stones which had been heated in advance until they were red hot.

The crawfish were dumped alive into a hollow section of bamboo about 2 feet long and thus roasted over the open fire. The bamboo chars, but does not burn through. They were very delicious. Meat was cut into small chunks and packed down into this same type of bamboo roasting stick. Meat cooked this way would last from 3 to 4 days without spoiling, if left inside the bamboo stick with the ends sealed. The meat for immediate consumption was cut into steaks and roasted on sticks much as we would roast "hot dogs."

Yam, taro, manioc, and wild bananas were cooked in the coals, and tasted not unlike potatoes if you stretched your imagination a little. Hearts of palm made a refreshing salad, and papaya a delicious desert.

All the wild meat was gamey, and generally a little tough. However, it tasted mighty good after a long march.

e. Methods of Fishing

The natives used two methods of fishing. If a large quantity of fish is desired, they seek out a good deep pool where fish are in considerable numbers, and toss in a hand grenade. This usually yields anywhere from 20 to 60 fish. The largest were about 15 inches long. If a few fish were desired, the natives would scrape a little bark from a navele tree, wrap it up in a leaf, and, wading with the leaf in one hand and a machete in another, drop it over a pool of fish or even a single fish. The curious fish would swim up to the leaf, and, when they did, the juice from the bark of the navele tree would knock them "groggy," and they would float up to the surface in a daze, easy prey for a machete.

f. Shelter

The natives would construct a combination bed and shelter against the rain in about 15 minutes. The bed was built about 3 feet above the ground by laying stout but pliable reeds over a framework supported by forked stakes. Several layers of large, fine ferns were then put on, thus forming a very comfortable bed. Another series of longer, forked stakes were placed alongside the short ones to support a roof about 6 feet above the ground. The roof was constructed in the same manner as the bed.

g. Water Rope

The natives showed us what they called a water rope. It is a vine, and when cut each foot yields about a teacup full of water. They would deftly cut off a 2-foot length and, holding it up, let the fresh water run into their mouths.

h. General Description of the Country

The country was very rugged. After the first day we were forced to wade practically all the time, as the river banks were either too rugged and steep to climb readily, or the jungle so thick as to make it practically impossible to continue without first cutting a trail. The river banks were so steep, and the foliage so dense, that observation was very limited during the whole trip. However, an unnamed mountain west of the Teouma River was a prominent landmark and could be seen intermittently. We passed it the last day, going about 2 miles beyond it up the Teouma. The last of our trip, I took a French noncommissioned officer and three natives with me. We disrobed; half swimming and half wading, we went a mile above the last fordable part of the stream. On this venture, in one case we swam between a narrow gorge 10 or 12 feet wide with sheer, black, rocky walls towering 100 feet straight up over our heads. The natives told us that about 8 to 10 miles further upstream we would come upon a 100-foot waterfall, and several small ones, coming down from the summit of Mount McDonald.

In order to get any military information about the topography of the jungle we traversed, it would be necessary to cut a trail up to the ridge leading directly to Mount McDonald, the highest point on the island. The French officers knew the jungle as well as the natives, and they were most helpful and cooperative throughout the entire trip.

The purpose of the trip from the point of view of the native troops was to harden them. We marched in the mornings and hunted, fished, built camp, and made minor reconnaissances in the afternoons. We covered about 8 to 10 miles each morning, carrying about a 40-pound pack, including weight of weapon and ammunition.

16. JAPANESE DATE SYSTEMS

It may be useful to recapitulate the systems now used by the Japanese in writing dates.

a. According to mythology, the Japanese Empire was founded in the year 660 B.C., and it is from this date that Japanese years are calculated in one system of writing dates. For example, our 1940 is the Japanese 2600, and so on. Type numbers for Japanese aircraft and various other military equipment are often derived from this system of dates. The last two digits of the year concerned, until and including 2599 (1939), are used for the type number; from 2600 (1940) onward, the last digit alone is used. Type "97" was adopted in the year 2597 (1937), Type "O" (zero) in 2600 (1940), Type "1" in 2601 (1941), and so on.*

b. In more general usage, however, is the practice (in use since 1868) of numbering years from the start of each Emperor's reign. A name is chosen for each reign, and a given year is referred to by the number of years that have elapsed since the reign started. The name of the reign of the present Emperor, which began in 1926, is Showa (Enlightened Peace); 1943 is thus the 18th year of Showa, or more simply "Showa 18."

c. The Western or Christian calendar is also in common use among the Japanese.

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*For the use of the term "Zero" as applied to aircraft, see "Tactical and Technical Trends," No. 19, p. 1.

GLOSSARY

17. CODE NAMES OF JAPANESE FIGHTER AIRCRAFT

Code names are used by Allied forces to designate Japanese aircraft. In order to make these code names more familiar, there is set forth below a list of the names used to designate some of the Japanese fighters, followed by a brief explanation of their significance.

1. Hap
2. Rufe
3. Zeke
4. Nate
5. Oscar
6. Claude
7. Dick
8. Perry

Hap, Rufe, and Zeke are all Type Zero aircraft. Zeke is designated by the Japanese as the Type Zero, Mark I, Carrier-borne Fighter, Model 2. The designation of Hap is the same, except that Hap is Mark II where Zeke is Mark I. Rufe is a float-plane fighter, and except for the substitution of the float to replace the wheeled landing gear, this aircraft is believed to be practically the same as Zeke structurally.

Nate is Type 97. It has seen service in various areas, but being an older model, its performance is not up to that of the more recent Hap and Zeke.

Oscar is Type 1, and is believed to be a modification of Nate.

Claude, Dick, and Perry have been less frequently encountered than the fighters above mentioned. They are, respectively, Type 96, Type 98, and Type Zero.

It is well to bear in mind that Japanese fighter aircraft appear to be used with minor alterations by both the Army and Navy Air Services. Zeke and Hap, although used prominently by the Navy, have been reported in operation with Army units also. Likewise, Nate and Oscar, which have been reported most frequently in use by the Army, have, upon occasions of emergency, been used by the Naval Air Service.

For further details on these planes see Tactical and Technical Trends, No. 19, p. 1.

SECTION II

SOME GERMAN VIEWS ON FORTIFICATIONS

A. ELEMENTS OF MODERN FORTIFICATION DESIGN

The German army was noted in the early stages of this war for its offensive operations, but the German High Command has not neglected the art of defensive warfare, in which fortifications may play a major role. The following article, translated from a German military review (1941), presents a summary which is regarded as representing certain aspects of German theory on the design of modern fortifications.

* * *

a. General

Like all the means of waging war, fortifications have been subject to constant change throughout the course of history. New methods of attack give rise to new designs in fortification, and new designs similarly force the development of new means of attack. Every war brings new experiences. Nevertheless, simple basic designs can be recognized, designs that remain uniform at the core. In what follows, these will be discussed especially from the tactical viewpoint, and without consideration of the operational significance of the fortification.

Every fortress is a reinforcement of the terrain, and results from the effort to increase further the superiority of emplaced weapons against a mobile attacker. The defender can choose his position, his "emplacement" in the terrain, and can reinforce and strengthen it according to the time and materials available. On the other hand, the attacker of fortifications is forced to penetrate the defender's position with strong means of assault, or at least so to interdict the defender's action that the attacker can move in close and overcome him in close combat. Even fortifications that lead the attacker to give up the idea of making an attack have fulfilled their purpose.

b. Fundamental Principles

The objective of the defender is to annihilate the attacker by fire. For this purpose, fortifications must withhold their firepower until the moment in which it can be used to decisive effect. Until that time the fortification must provide cover against the effect of the attacker's arms. The attacker's fire effect will be further weakened or dispersed if his observation is made difficult by the concealment of the defensive positions.

Fire effect, cover, and concealment are, therefore, the basic considerations that determine the forms of fortified positions, and which must always be weighed against each other in their development and application.

These factors are mutually related: they complement each other in part, but they also interfere with each other. It is impossible to achieve the ideal of a perfect combination, but a calculated and planned combination must be made. Sometimes the main aim to be attained in the combination of these factors can be determined by tactical considerations; how this aim can be achieved under given circumstances depends on the individual case. Fire effect has priority over cover: concealment increases and provides a substitute for cover up to a certain point; adequate cover reduces the importance of concealment. However, poor concealment facilitates enemy observation and thereby his operations; faulty concealment can thereby nullify the fire effect planned for the decisive moment. In modern fortifications there is no fundamental distinction between permanent fortifications (i.e., those developed with the means available in peacetime) and field fortifications, except that construction of the latter is limited by war conditions with respect to the outlay of time, labor, and materials possible. In the case of permanent fortifications, the basic designs can be developed and perfected to a correspondingly greater extent.

c. The Shelter

The simplest form of fortress is the shelter. It is an example of a form that developed in field fortifications and has found a place in permanent fortifications. In their modern form, small in size and accomodating only one or two squads or gun crews, shelters can be scattered throughout the battle position and can provide possibilities of cover everywhere. Small as targets, they are easy to conceal, and this can be done most completely by sinking them to the level of the ground surface. Technical limitations may be met if the water table is high. In every case the entrance to the shelter must be higher than the water table, even though account must be taken of the increased costs when the construction must be done in ground water, and when water-proofing must be arranged for.

The disposition of shelters on the terrain depends on the fire plan. In addition, to meet unforeseen battle situations, some shelters may be used to contain reserve units.

In modern fortification practice, shelters are made of reinforced concrete. The thicknesses vary according to the mission of the emplacement, and according to the type and penetration power of the arms expected to be used by the attacker. In the case of small and well-concealed shelters, one can take into account the fact that the effectiveness of attacking arms will be relatively limited. With the methods used in permanent fortifications, shelters can easily be fitted out so as to make them livable for long-term occupation. The degree to which shelters are livable has tactical significance, since it helps in determining how long a group can garrison the shelter without relief. The longer this period, the fewer total effectives are needed.

However, shelters are merely cover: fire effect is not possible from them, and the garrison has to leave them for firing assignments and combat. Here arises a serious danger: that in large-scale battle, if the attacker covers the emplacement with heavy fire and smoke, the defenders will not recognize in time the decisive moment when the enemy infantry nears the position. The attack may reach the advanced shelters and put them out of action before the defenders can emerge and organize their defense.

This danger must be met primarily by arrangements for suitable observation. It is difficult, however, to guarantee that the arrangements will function at the critical moment. The solution may be sought by using telescopes which can be sighted in any direction, in armored observation towers, or by using observers in exposed or partially protected positions. The first method has the disadvantage of spoiling the complete concealment which is the major advantage of a shelter, and the second method lessens the protection afforded to personnel.

Even if they have been installed in advance, firing emplacements which are open and have covered approaches or lateral communications can betray the locations of shelters to enemy observation; therefore these open emplacements demand great care in construction.

d. The Loophole Position

Summing up, it may be said that as regards cover and concealment, shelters can be developed almost to ideal perfection--but at the cost of the fire effect. The more attention given to cover and concealment, the less assurance that the planned fire effect can be realized at the decisive moment. These disadvantages of the shelter are reduced if it is made possible to fire from the shelter (or from some special combat space in it), thus combining cover with fire effect. The simplest means for accomplishing this is the loophole, and the result is the loophole position.

(1) The Wall Loophole

The simplest design is the wall loophole. This can be used for observation when firing is not in progress; in the latter case, a second loophole is needed unless the loophole has been widened to permit both observation and fire. The loophole position, however, has a disadvantage: concealment is largely sacrificed in the interest of fire effect. The loopholes must be placed above ground level; often, in fact, rather high above it because of vegetation. Additional space, above the loopholes, is necessary for the movements of the gunners, and the cover must come above this space. All this means a rather high structure. Only in particularly favorable conditions, for example on rising ground, can the structure be adapted to the ground and thereby given suitable concealment.

In addition it is necessary to allow sufficient space for traversing and elevating the gun in order to obtain adequate fire effect. The result of this requirement is loophole "mouths" of greater or lesser size, depending on the wall thickness. These mouths can hardly be camouflaged without diminishing observation and reducing fire effect. Especially in the critical moment when the gun goes into action, these mouths are easily detected and attacked.

The size of the outer openings can be reduced by designing the loopholes in the shape of an ≫≪ ; in this case the guns are emplaced partly in the thickness of the wall, and this arrangement makes it easier for the crew to swing the gun laterally. However, by this arrangement the gun no longer has the protection of the full thickness of the wall. This disadvantage can be reduced, but not eliminated, by armorplating the loophole.

(2) Loophole Armorplate

The logical carrying out of this principle leads to the development of loophole armorplate; with only a fraction of the wall thickness, this armorplate can offer the same resistance as the thick reinforced concrete. The loophole opening can be made correspondingly smaller. Nevertheless, the open loophole is still easy to detect, especially since the armorplate is harder to camouflage than a concrete wall. Nor can this disadvantage be eliminated by special construction of the loophole shutter. The place where a vertical piece of armorplate is joined to the reinforced concrete structure is a weak point, and requires special attention in designing. Furthermore, the elevation of the structure remains unchanged. To reduce the elevation, one possible solution is to use a flat roof of armorplate. Even in this case, a considerable cubic volume is still needed to give room for handling the gun and the crew--aside from the fact that the structural joints become more complicated, and that construction costs are greatly increased by the use of armorplate. These disadvantages are especially notable in the case of frontal loopholes, and so another possible solution is by siting guns for loophole flanking fire only. This solution, however, simply substitutes one problem for another, since frontal fire is absolutely indispensable for repelling attack. Furthermore the terrain often gives the attacker opportunities for flank observation, and positions for combatting these flanking loopholes--or, the attacker may acquire such vantage points in the course of the battle.

(3) The Loophole Position and the Fire Plan

An advantage of the loophole is that, up to a certain point, it permits the preparation of an almost automatic fire-plan. The place of each gun in the fire plan is clearly indicated by the position of its loophole. But here again is a point of weakness: if guns are put out of action, gaps in the fire may develop, especially if the defender is depending on the "automatic" functioning of his fire plan. A fire plan with overlapping fires, arranged in depth, minimizes this weakness but increases the number of installations and weapons employed. Therefore, the exclusive use of loopholes imposes a certain rigidity on the defense, and does not permit the defense to adapt its fire to changing and unforeseen combat situations. Some guns may remain idle because, in their sector, no target is visible to them, while in other places the guns may not be adequate to combat the targets offered. This problem can only be met by a defender who is energetic, and who views the loophole position only as a shelter cover which must be abandoned if necessary in the interest of fire effect.

(4) Large Weapons in Loophole Positions

The difficulties in installing loophole positions increase with the size of the guns. Fire missions will occur in which emplacement behind loopholes seems desirable and suitable not only for machine guns but also for guns of larger caliber, especially antitank guns. These larger guns are the ones which can or should be limited in their field of fire to a specified sector. In the case of cannon, the problem of embrasures is even more difficult, since, apart from the size of the weapon, a greater clearance is needed for aim, especially with regard to elevation. The result is rather complicated and expensive construction.

On the other hand, guns emplaced in cover are thus provided a certain measure of protection and better possibilities for concealment (i.e., in comparison with open works), although these possibilities are limited in the case of aerial attacks. Further improvements may be made by providing bomb-proof quarters, in shelters, for the gun crews and for ammunition, and by arranging routes of withdrawal and alternate positions. A simple problem, and one which can be easily solved, is the installation of high-trajectory weapons under cover from which they are capable of firing. High trajectory fire is especially effective in supplementing and overlapping frontal fire.

e. The Armored Turret

Perhaps the most compact form of combat position is the armored turret, consisting of armorplate with a circular base and a rounded cover. This form affords enemy fire the smallest target and the least favorable surface of impact. Its elevation is kept down to the indispensible minimum needed for the service of the weapon. Also, the solid union of an armored turret with the concrete block offers no great structural difficulties. On the other hand, turrets are very costly. Protection can be obtained in any degree desired by varying the thickness and quality of the material, but the question of cost and the technical problem of transportation weight here approach their maximum limits. Even in the case of turrets, we find the opposing, interacting relationship between the objectives of fire effect and concealment. The latter is very difficult if great fire effect is to be achieved.

Turrets may stand in the open and thus have an all-round field of fire, or they may be built into the terrain and have a field of fire limited to a predetermined sector. A turret with only one loophole affords the smallest possible target and can thus be adapted to almost any terrain. However, a turret loophole gives no more tactical fire effect than any other loophole, and it costs much more. If the number of loopholes is increased to two or three, giving a firing radius of 200 degrees, this immediately complicates the factor of concealment because the semi-circular form of turret necessarily becomes more visible. However, the turret with several loopholes does solve one major problem in the arrangement of the fire plan. Even more important, it permits the same weapons to be used for other missions when they are not serving their principal mission in the fire plan. In this way the rigidity of the prepared fire plan is to a certain degree reduced, and thus a weakness is remedied. Furthermore, several loopholes make it possible, at least in emergencies, to use several guns. The multiple-loophole turret thus gives a much greater fire effect, without additional expense.

The advantages just discussed are gained especially in the case of turrets constructed for all-round fire: either with guns mounted so as to rotate inside the turret, and fire through a number of loopholes, or with the turret itself so constructed as to rotate. The rotating turret is more expensive and demands special provision for the protection and operation of the rotating mechanism. Such turrets realize a maximum fire effect with a minimum use of space, but they can at best be only incompletely concealed.

This disadvantage is eliminated by building disappearing turrets, which are raised out of their cover only for firing, but this naturally involves a further complication and expense. In addition there is the difficulty of observation and the problem of determining the correct moment for raising the turret. At that moment no concealment is possible, although the fire effect may be increased by the element of surprise involved. Even heavy weapons, especially cannon, can be built into turrets. For these weapons, only rotating turrets can be considered; otherwise the dimensions become too great and fire effect is severely limited. The protruding barrel of the gun is its most sensitive part; it can, however, be protected by special casing, or can be so designed as to permit easy replacement. Further effective protection can be achieved by the careful siting of the turret on the terrain, care being taken not to spoil the fire effect.

It is particularly difficult to protect antiaircraft guns, but it is relatively easy to solve the problem of sheltering in turrets the smaller of the high-trajectory weapons. Observation posts can also be set up in turrets.

f. The Combination of Defensive Elements

Shelters, loophole positions, and turrets are the basic units which enter into the design of all modern fortifications. The central problem of all fortification design turns on the construction of the positions from which the fire effect must be achieved, and on their adaptation to the terrain. In the construction and lay-out of all shelters which are designed not for combat but for the convenience and comfort of troops, the purely technical possibilities and the questions of cost are the determining factors.

It is a significant fact that a greater number of weapons or living quarters can be more cheaply assembled in one larger structure than in many single units. From the standpoint of tactical considerations, the latter type of lay-out offers the advantage presenting a smaller target, adapting itself better to the terrain, and permitting a more thorough control of an area. In the larger structure, it is possible to achieve the combination of various arms and greater numbers of combat effectives under more closely unified leadership, as a center of resistance.

Thus we have many forms in modern fortifications: so many as to be confusing when all are viewed at once:

(1) Simple (and more complex) shelters for accommodating gun crews, as well as for special purposes such as serving as a command post or providing

storage space for rations, ammunition, and reserves.

(2) Loophole positions (single or multiple loopholes), with or without adjoining shelters.

(3) Combat positions with turrets, to contain various weapons or to be used as observation positions, likewise with the necessary adjoining shelters.

(4) Smaller and larger aggregates (or works-Werke) with various weapons, behind loopholes or in turrets, with adjoining rooms and mechanical installations.

(5) Larger combinations of works and single positions, with gallery connections to separate works and groups of works.

g. Entrances and Communications

A further problem is presented in the matter of entrances. On the number and size of the entrances depends the speed with which the crew can emerge from cover in case of need.

On the other hand, every entrance offers a possibility of attack to the enemy and must therefore be given special protection. High entrances under strong cover have deep recesses, and it is therefore particularly difficult to camouflage them. They complicate, and also impede, exit. Armor-plated entrances reduce this disadvantage, but in their turn increase the cost.

When open communications are used, trampled paths will result in spite of all precautionary measures, and the aerial photograph of these paths betray even installations well camouflaged against surface observation. Open communications, also, are not safe under enemy fire. The difficulties connected with both entrances and communications can be relieved by using gallery communications These permit covered liaison, the supply and transfer of effectives, and simple bombproof routes for telephone lines as well as for supply lines of all sorts. Bombproof resting rooms, command stations, mechanical installations, and depots for rations and munitions and the like, can be connected with these galleries with relatively little additional cost. On the other hand, they require a considerable outlay in construction time and cost, if their bombproof quality is not to be nullified. Favorable earth and ground water conditions are prerequisites for the technical possibility of constructing such works.

h. Obstacles

Finally, obstacles must also be considered among the types of permanent fortifications. Obstacles are erected against infantry and tanks, principally in front of the main line of resistance, but they may also be effective deep within the main battle position. They result in a considerable heightening of the fire effect, because they impede the attacker in his forward movement and thus to a greater degree force his exposure to the effect of the defensive weapons. The obstacles must therefore lie within the effective range of the defensive weapons and must be dominated by their fire. Here, especially advantageous use can be made of flanking and diagonal fire. The obstacles will in general be erected continuously, but gaps may serve to canalize the enemy attack in accordance with the intentions of the defenders. Observation and fire coverage of the obstacles must be maintained also at night and in fog. An important requirement is that the obstacles must not interfere with one's own observation and field of fire, even when allowance can be made for supplementing this fire by high-trajectory weapons. It is very important, in addition, that the lay-out of the obstacles on the terrain does not enable or facilitate recognition of the defense system, especially from the air, thereby exposing the location of otherwise well-concealed structures.

Against infantry, wire obstacles are the common form, and are effective when sufficiently wide or when laid in several bands; but dry and waterfilled trenches, reinforced concrete bump obstacles, post obstacles, rail obstacles, and "hedgehogs" of various kinds, especially steel structures, as well as combinations of these forms, are used against tanks. The danger of interfering with one's own field of fire, and the danger that the obstacles may be used as cover by the attacking infantry areespecially great in the case of antitank obstacles of all kinds. The former danger can be met by reducing the height of the obstacles; the latter by selecting the least massive form possible and by establishing a fire effect which willenfilade the obstacle. These requirements are often difficult to fulfill in practice. All effective antitank obstacles are high in cost. Mines are arranged and concealed more easily and more rapidly, and leave the field of fire open, but they also constitute a risk to one's own mobility in the forward area. A position on terrain which is impassible to tanks should therefore always be sought, and this factor may under certain circumstances decisively influence the choice of the general position.

i. Conclusion

It was not the purpose of the foregoing discussion to indicate the best form of fortification, but simply to report the problems which arise in preparing them. An absolute optimum form does not exist. Fortifications are a combat medium; in combination they must meet operational requirements, and individually they must meet tactical requirements. As in all such matters, advantages and disadvantages have to be weighed against each other in the particular case; this consideration will determine the location of the fortifications on the terrain, and sometimes their form. Important, further, is the recognition of the fact that no one form guarantees success, but only the fighting spirit and morale of the troops placed in them. To achieve and increase this, good weapons are needed, and also suitable fortification designs. Without the will to fight, however, even the best designs are useless, as the fate of the Maginot Line showed.

B. THE FAILURE OF FORTIFICATIONS IN THE 1940 CAMPAIGN

The following article, translated from a German military review (1941), is interesting in its critical analysis of the weaknesses of French, Belgian, and Dutch fortifications against the German attack in 1940. It is also noteworthy that the writer evidently feels it necessary to argue the point that the experiences of that campaign do not prove that fortifications are outmoded.

* * *

a. General

The press is often accustomed to represent the controversy about permanent fortifications in such a light that the reader has to conclude that their value does not bear a reasonable relationship to their cost in time and money.

The mere fact that every one of the fortified positions attacked by German troops fell quickly, does not in itself justify any conclusion as to the value of permanent fortifications. In the war on the Western Front, weaknesses on the opposing side favored our successes.

Without any desire to minimize in the least the unprecedented achievements and offensive power of our troops, the following must still be said:

A permanent fortification that is to be fully equal to its mission must meet the following requirements:

(1) It must block all avenues of attack (even those that seem hardly practicable), leave no gaps suitable for breakthrough, and be uniformly strong everywhere. (It must be understood, of course, that a weaker type of lay-out can be compensated for by favorable terrain.)

(2) In estimating the strength of construction necessary, attention must be paid to the effects of all modern offensive weapons.

(3) The defense of permanent fortifications must be conducted offensively, as any defense should.

b. French Fortifications

The French land fortifications and their defense met these requirements in some places--in fact, along the entire territorial boundary between Switzerland and the Channel coast, they left no gap--but their strength was quite variable. The strongly developed sectors of the Maginot Line proper (except for the support position at Montmedy (Work 505) which could be approached from the flank) were not seriously attacked. Therefore, a conclusive judgment with respect to these sectors can not be given. The German attacks, except for that on Work 505, were directed only against those portions of the position which were more weakly developed. Because of the type of structure (only individual works in a single line) and the limited strength of the construction, and because of an appreciable lack in depth, portions of the French territorial defense possessed no worthwhile fortifications.

The flaws lay, however, not only in fortresses, but also in the spirit of the defense. Not only the inferiority of their air and armored forces, but above all the training and the spirit of the French army weakened the offensive power of the French soldiers and their capacity of resistance. The basic failure, complete concentration on the defensive and a corresponding training program for French soldiers, robbed the fortifications of a large part of their power to repel and to hold. In addition, all of the attacks delivered in June against fortifications were made easier by the fact that artillery and field troops, and even portions of the fortress troops, had been withdrawn from the fortified fronts for the battles in Flanders and for garrisoning the Weygand line.

The French overrated the strength of defensive warfare and at the same time underrated the striking power of the German Wehrmacht, which was combined with special attack tactics for use against permanent fortifications.

A few examples may clarify the points stated:

(1) The first breakthrough at Sedan and to the north struck the junction between the Ninth and the Second Armies (Corap and Huntziger). At this place, where a strategic breakthrough was not expected, the prepared position was not only extremely weak and lacking in depth, but both armies, in spite of repeated requests by their leaders, had been given especially poor consideration as to troop reserves and defensive weapons (for example, antitank and antiaircraft guns).

(2) Work 505 (at the Montmedy bridgehead) courageously resisted for almost 3 days, until the entire garrison was dead.

The troops fighting outside the work did, indeed, stubbornly defend the village of Villy, but the garrison was lacking in sufficient offensive spirit to throw back the Germans who reached the area of the fortification.

(3) The attack on a work heavily damaged by shell fire southeast of Weissenburg was shattered by the stubborn defense; further breakthrough attempts here were abandoned.

(4) The breakthrough west of Lembach in the mountainous, forested terrain of the northern Vosges on June 19 was successful because the French garrison had already been greatly weakened (in artillery and reserves) and permitted the attacker to approach unimpeded to within 100 meters from the fortifications.

(5) The many attacks conducted from the rear against the French border fortifications after the breakthrough and encirclement (for example, Maubeuge and west of Rohrbach) met no active defense whatever. These attacks were made easier by the fact that the rear sides of the fortified installations were weaker, and therefore could not resist even light artillery at short range.

c. Belgian Fortifications

The Belgian fortifications were also founded on obsolete notions. The numerous installations of the border defense position were in part not garrisoned adequately, and in part not at all, so that they could hardly be defended against the lightning assault of the Germans. Not one of the major defense positions could be held until French and British help arrived. In their quick collapse, the decisive factor was the surprisingly swift seizure of Fort Eben-Emael. This could be traced back to the fact that the unprecedented courage of the German parachute troop attack had crippled the fort, which in any event had inadequate fire coverage of the area to be defended. Counterattacks were limited to weak attempts from the fort, from neighboring units, and from the responsible 7th Belgian Division.

With the fall of Eben-Emael and the occupation of undamaged canal bridges both at Vroenhoven and Veldwezelt, the whole major defense position collapsed.

The Dyle position would have been able to hold out longer if it, and its extension along the Meuse from Namur, had been developed as far as France. Even the otherwise useful northern sector of Wavre--Lyon--Lierre lacked the necessary depth.

It was therefore a matter of piecework, and south and north of Namur, as well as at Wavre, easy breakthroughs were made on May 15. The consequence was that even the northern sector had to be evacuated on May 16.

Even the fortress of Antwerp played no part; its northeastern front was broken through on May 17 without offering noteworthy resistance. The evacuation of the Dyle position on May 16 and the occupation of the city of Antwerp on May 18 made the remainder of the Antwerp bridgehead also worthless.

The bridgehead at Ghent, in itself well developed, both to the north (after the fall of Antwerp and the loss of the lower Scheldt) as well as to the south (after the failure of the British) lost its support and had to be evacuated on May 23.

If one wishes to summarize the value of the Belgian fortifications and the reason for their failure, the following will be admitted from what has been said:

(1) The land fortifications of the Belgians were not based on a fundamental, clear plan and, in part for political reasons, were much too extensive for the little country and the weak army.

(2) The help of the French and the British, on which the Belgians had counted in planning the strength of their installations, failed.

(3) The attack power of the German Wehrmacht had been underestimated.

d. Dutch Fortifications

What has been said about the Belgian land fortifications applies to an even greater degree in the case of the Dutch fortified installations.

The Dutch attempts to place fortified positions in the way of the German assault shows a deplorable error in judgment, both of the German power and of their own situation. The Meuse-Ijssel position played no role whatever, any more than did the Peel-Raam position, which was broken through at Mill on May 10-11. The Grebbe line held up the attack at Grebbeberg on May 12 only for a matter of hours. In the new positions there was hardly any possibility of an orderly combat leadership, since at no time did they have communications; every loophole position was on its own. The situation of the fortress of Holland was already critical when the German parachute troops on May 10 took possession of the Moerdijk, Dordrecht, and Rotterdam bridges--undamaged.

Even under the assumption that the fortifications would only have to hold until the arrival of outside aid, about 4 to 5 days, the main defense position was too weak.

e. Conclusion

If there is any inclination to draw from the role which the land fortifications played in the campaigns of 1939 and 1940 the conclusion that their value did not correspond to the costs of installation, the following should be said in summary as an opposing argument:

(1) The German Westwall accomplished its operative mission of giving the command a free hand in the east. Whether it would have also held against a tactical attack was of course not demonstrated, but it may be assumed with certainty that it would have met the test, since on the German side the necessary prerequisites had been met.

(2) The fact that the enemy territorial fortifications did not fulfill their purpose was due to the defensive flaws detailed above, or to the incapability of the commanders to utilize them correctly.

Wherever, in individual cases, the defense of the fortifications was inspired with the proper spirit, the results confirmed the permanently sound principle that fortifications increase the combat power of the army, and that therefore, properly used, they cannot be dispensed with.