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ARMY GROUND AND AIR FORCES AND SERVICES OF SUPPLY

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# SECTION I

## 1. JAPANESE PILOTS

The Japanese Army and Navy have two classifications for their pilots and bombardiers, namely: "Division I" and "Division II". This classification is based on combat experience, initiative, and combat ability.

The pilots and bombardiers of Division I usually have had approximately 4 years combat experience in China. This Division totals about 1,500 pilots, including Army and Navy.

The performance of the personnel of Division II is not comparable with that of Division I, as was demonstrated during the Port Darwin bombardment of March 19 when the pilots and bombardiers of Division I, in one flight of 18 bombers, sank 11 of 17 ships on their first time over, from a height of 24,000 feet. Meanwhile, the personnel of Division II were indiscriminately bombing the airfield and hangars. Recent reports have indicated that the Japanese, in order to conserve their first-line pilot strength, are sending out their less-experienced pilots on routine missions with the leader alone coming from their first-line group.

The first-line Japanese pilot is well trained and resourceful, and handles his plane in a skillful manner; he will initiate attack, is aggressive in combat, and is a fighting airman not to be underestimated. It is also noteworthy that they will change their methods with alacrity whenever they find their aerial operations successfully countered. They are alert, and quick to take advantage of any evident weakness. A disabled plane will receive more fire than other planes in formation. Stragglers are sure to be concentrated on, and a gun not firing is a sure point of attack. Several instances have also been reported where our airmen have been machine-gunned from Japanese planes while parachuting to earth. Our airmen should delay opening the parachute when forced to leave the plane.

While there is little information available concerning the number of pilots being trained in Japan, conservative estimates placed this figure at 360 per month prior to December 7, 1941, and concluded that there were at that time approximately 9,750 trained pilots, many of whom had seen service in China. It is estimated that the Japanese have lost approximately 400 planes per month for the first 5 months of the war. Thus the rates of loss and replacement are approximately the same. The above estimated Japanese losses and production of pilots apply to a period when very little opposition was encountered by the Japanese, and it is safe to assume that when the United Nations undertake a more determined offense, the losses will be at a substantially higher rate. It is reasonable to assume that the Japanese have anticipated this and have increased the production of trained pilot personnel to meet this expected higher monthly loss. Therefore, a fair inference would be that Japan must at the present time be turning out, at the minimum, 600 to 700 new pilots per month in order to take care of losses and provide for expansion of the air forces.

In Japan it has been the tradition that Naval officers are of a higher type than officers of the Army, and it has been observed that in planes of corresponding type, the naval pilot is much harder to combat, and that apparently the

materiel, quality of personnel, and training in the Naval Service are of a higher standard than in the Japanese Army Air Forces. However, morale is undoubtedly high in both services.

## 2. GERMAN AIRDROMES IN WESTERN EUROPE

### a. General

Since German Air Force (GAF) airdromes in the occupied countries of Western Europe have served more generally for offensive activity, they have been developed in some instances to a greater extent than those in the Fatherland. The latter are now being used principally as supply and training bases. During the past 2 years, airdromes in France and the Lowlands have undergone extensive improvements in regard to dispersal arrangements, night-landing systems, the number and length of runways, and the construction of shelters and other facilities.

Occupied France has been the theater of greatest development, with at least 500 bases now available to the GAF. Forty-seven of these are fully equipped bomber airdromes, 28 permanent fighter airdromes, and 9 bomber-reconnaissance bases. There are approximately 23 GAF airdromes and landing fields in Holland; and while Belgium has 34 German landing fields and 32 airdromes, few of these are in operational use at present. Seaplane bases are not included in these estimates.

### b. Shape and Size

GAF airdromes on the Western Front are usually square in shape, and have an area of about 450 acres. Prior to 1941 few airdromes had more than one bomber runway, rarely exceeding 1,400 yards in length. Today, almost all bomber airdromes have three runways from 1,500 to 3,000 yards in length. A single instance of a bomber runway 6,000 yards long has been reported in the Morbihan area (in Brittany). The runways of bomber airdromes are flanked by specially levelled strips, probably prepared with a bituminous dressing, and providing a serviceable surface some 180 to 200 yards wide. Concrete taxi-tracks connect the runways with the dispersal areas; and there are apron assembly areas at the ends of the runways, sufficiently large for about six aircraft to assemble and take off in quick succession. Early runways on bomber airdromes were laid near and parallel to one boundary of the landing area. More recently, they were laid across the countryside, terminating at the edge of the airdrome. It is now the practice to lay additional runways across the countryside and connect them with extended dispersal areas.

Both day and night twin-engine fighters are based at airdromes similar to those used by bombers, although these airdromes are often not quite large enough, or of the proper construction, for heavily laden aircraft. The Me-110's, however, sometimes operate from airdromes which have one or two runways

from 800 to 1,100 yards long. There is a specially constructed twin-engine fighter airdrome at Denain (Northern France) that has two 1,650-yard runways.

In contrast to the square-shaped bomber airdrome, a typical single-engine fighter airdrome is long and narrow, i.e., 1,400 by 700 yards, with shelters around the perimeter and near the landing surface. It has one, or sometimes two, runways averaging 850 yards in length.

Dive-bombers operate from any of the above types of airdromes, but usually from forward landing fields that have received the minimum of preparation. The use of advanced bases enables the Germans to decrease the radius of action of the bomber, thus making it possible for a larger bomb load to be carried. These fields are about 870 to 1,100 yards square. In Holland the distinction between fighter and bomber airdromes is less apparent. Here all-purpose fields, suitable for every type of aircraft, have been developed to a high degree of efficiency.

c. Dispersal of Aircraft

The normal complement of aircraft at a bomber airdrome in the occupied countries is a Gruppe of 30 to 40 planes; however, an additional bomber reconnaissance Staffel of from 9 to 12 aircraft is sometimes found at the bomber base. An airdrome built specially for bomber reconnaissance usually accommodates one or two Staffeln, and serves equally well for a Staffel of twin-engine fighters. The take-off area of such an airdrome is likely to be small and unsuitable for aircraft carrying heavy bomb loads.

The standard of dispersal of aircraft and facilities in GAF airdromes in occupied countries is thought to be superior to that in Germany. Aircraft are dispersed according to type, bomber airdromes having large areas well removed from the field, while fighter airdromes have smaller areas near the perimeter. There is usually one such area for each Staffel of 9 to 12 planes. An airdrome at which a Gruppe is stationed will normally have three to four dispersal areas. Each dispersal area has its own aircraft shelters, repair hangar, and storehouses for bombs, fuel, and ammunition.

Dispersal of aircraft has been known to cover an area of 6 square miles, and plans are said to be under way at several airdromes to accommodate two or even three Gruppen. It is believed that as many as 2,000 fighters could be stationed in the Calais-Boulogne area, distributed among at least 50 or more airdromes, and dispersed in such a way as to be almost invulnerable to attack. The existence of stop-off and alternate escape airdromes together with operational airdromes that remain unoccupied until the day of an offensive are important factors in facilitating dispersal of air units.

Key fighter airdromes are protected by satellite or auxiliary airfields located in the same vicinity, which also function as extended dispersal areas but sometimes serve as decoys. It is believed that most of the permanent GAF fields along the French coast have satellites, over 20,000 acres of land having been

estimated as lost to cultivation because of this program. This is in marked contrast to the policy in Germany of confining shelters within small compact areas to save agricultural acreage.

d. Protection for Aircraft

The system of wide dispersal of aircraft has replaced to a certain extent the use of hangars. Hangars are now employed chiefly as repair shops, the old V-shaped and Z types, and the typical French domed structures being the most common. Medium-sized fields generally have from two to six hangars which average about 180 by 105 feet. Larger fields, like the one at Evre, in Brussels, have 40 hangars, 30 feet high in front and 15 feet high in the rear, with walls about 2 feet thick. Each is large enough to hold a bomber with three fighters under its wings, and is camouflaged as a store, cafe, etc.

Well-dispersed revetments apparently afford the most satisfactory protection for aircraft. They are of a more permanent nature than those built in 1939, which consisted of two parallel sandbag walls and were roofless. The new shelters are built beyond the periphery of the take-off runway, in woods, villages, or on farms, and are usually of U-shaped concrete construction with camouflage-net roofs into which foliage has been woven.

The concrete shelters are often built underground and have electric installations. They slope into the earth on all sides except the south, this side being left vertical since it casts no shadow. When two or more planes are stored in a shelter, they are partitioned off by blast walls erected all the way to the roof. T-shaped tunnels about 9 feet deep, into which planes are placed tail-first, are among the underground shelters, and are particularly in evidence at single-engine fighter fields. Underground and semiunderground shelters are used principally as quarters for personnel, protection for individual aircraft, and supply depots; however, entire underground airdromes are known to exist at vital points, and unconfirmed information indicates that the number of airdromes constructed in this way is rapidly increasing.

In addition to concrete shelters, there are shelters of metal construction. It has been estimated that 25 tons of iron were used in the construction of each of 35 shelters at the Vannes airdrome. There are also the "villa" type shelters with red roofs, dummy chimneys, etc., these often being grouped to give the impression of a village. Some of them,e.g., those at the Deelen airdrome in Holland, are large enough for two bomber or several fighter aircraft. Similar shelters in Belgium are made of stone blocks, with roofs of wire netting thatched with heather; one at Liege has a dummy church spire erected over it.

e. Camouflage and Deception

GAF airdromes are camouflaged by the usual methods, some of which have been already mentioned in connection with shelter and hangar construction. Simulated farms, factories, villages, etc., are common; artificial trees, shrubbery, nets to break shadows, and disruptive painting are among the usual

methods of disguise and concealment. In some cases, actual villages are taken over, their principal buildings being used for air shelters, repair shops, hangars, administrative offices,etc. The framework of these buildings is left intact, i.e., a church may serve as a hangar, or a school as barracks. Camouflage is also effected by building airdromes astride important highways, by diverting or covering streams, and by the frequent use of unmarked landing take-off zones in open country (see Tactical and Technical Trends, No. 7, p. 15).

Dummy and decoy airdromes continue to be employed extensively. A dummy airdrome, usually a replica of a real airdrome in its vicinity, is simply a fraud and is never used for landings, while a decoy airdrome, used solely for the purpose of diverting air attacks from a more important target, has been used in the past and will undoubtedly be used again. It has been reported that complete lighting systems have been set up after the pattern of installation used at a real airdrome. The use of dummy installations on active fields, or near any permanent airdrome buildings, has recently been banned since they invite fire from the enemy. Such installations, when employed, were placed one and one-half or two miles from the real airdromes.

f. Refuelling

The old "ladder" type servicing apron, which is still employed, has been the most general refuelling system until recently. Aircraft serviced by this method stood on the concrete rungs of the ladder while motor transport and bomb trolleys circulated freely on the apron on either side of the rungs. Three rungs were normally served by a fuel line, with refuelling points beside each rung. The present trend is for the aircraft to be refuelled from tanks in dispersal areas. At the Morlaix airdrome in France there is an underground concrete reservoir system for gasoline storage. The reservoirs are close to the perimeter and about 8 feet underground; they measure approximately 1,000 cubic feet and are made of concrete about 3 feet thick. They are connected to each other by central tube, and the complete system is connected to the highway by a hose. Fuel and munitions are also stored in small camouflaged trenches scattered on, or at varying distances from, the periphery.

g. Night Approach Systems

Most GAF bomber and fighter bases are now approached at night by means of the visual Lorenz blind-flying systems. Installations are still in the process of completion, and it is believed that all bases will soon be equipped with this system. Previously, a GAF bomber homing at night would locate its airdrome by means of the direction-finder station. The aircraft would then effect a landing principally by the use of non-visual procedure such as Lorenz, Z.A., etc.

Visual aids at airdromes used for night operations have been developed increasingly during the past 2 years. They include flashing and rotation light beacons, star-shell cannon, searchlights, flare-paths, and obstruction lights. The visual Lorenz is perhaps the most common of a dozen or more lighting

systems; however, a newer method about which little is known is believed to be in effect now.

A Lorenz system consists of a straight line of lights, one and one-half to three miles in length, which aligns the axis of each runway of an airdrome, and is crossed at right angles by short lines of lights 500 to 1,400 yards long. The short lines indicate the exact distance from the airdrome boundary, and the height at which the aircraft should be flying. Several systems of four to six main lines of lights usually approach the airdrome from different directions to line up each runway and to allow for variation in wind direction. Each set of lights is so arranged that it can be switched on independently of the others. Systems have now been completed to provide four to six separate cross lines instead of the two or three formerly used.

In the current visual Lorenz system there is apparently no fixed length for either the main or cross lines of lights. Both the length of the main line, and the distances of the cross lines from the airdrome boundary vary among the several sets of lights at one airdrome; thus pilots must be familiar with each set of lights employed at the airdromes which they use.

h. Protection of Airdromes

All airdromes are well protected with antiaircraft guns. The normal distribution consists of one battery of heavy guns to four or more batteries of light weapons, emplaced from one to several hundred feet from the landing ground, and a varying allotment of small-caliber machine guns, usually 20-mm and 27-mm, emplaced near the immediate approaches of the runways, or even in the midst of the installations. Antiaircraft protection is increased at the more vital bases, especially those equipped with visual Lorenz, to two heavy and eight or nine light batteries.

Heavy 88-mm guns are generally located in a four-pointed star pattern, the gun positions constituting the points, with the predictor unit in the center. Protection of guns and men often appears to be subordinated to better visibility and firing conditions. Wherever obstacles interfere with the field of fire, towers about 30 feet high and 12 feet wide are erected, on which medium and light guns are mounted. Flak towers at Diest-Schaffen in Belgium are 50 feet high, and are mounted with 40-mm guns.

The usual barbed-wire entanglements surround all airdromes; and movable objects such as metal beams are placed on the fields to prevent enemy landings. These obstructions are removed 2 hours before the arrival of friendly aircraft, and are immediately replaced after their departure. Forty cistern trucks were said to have been employed to remove these obstacles from one particular field.

i. Communications

As has been previously reported, GAF airdromes are sited near a main railroad, usually on the outskirts of villages or small towns, or about 3 miles

from cities. There is a notable increase in the number of branch lines being built, and airdromes are frequently encircled by spur tracks with underground discharging points. Motor units are employed for transporting supplies from these points, and from specially built sidings on the fields. Ju-52's continue to be used for air transport throughout the entire GAF.

j. Conclusion

From an analysis of these improvements and changes in GAF policy, we may conclude that the Germans consider the following as the chief elements of airdrome security: means of quick dispersal, adequate antiaircraft defense against low-flying attacks, effective camouflage, and (obviously) the alertness of combat crews. We have only to recall that the typical French airfield in 1940 consisted of about 250 acres and had no special runways and few other facilities, to realize the tremendous undertaking of the Germans. Their achievements represent the solution of serious drainage problems and runway construction difficulties, as well as the immediate replacement of methods, both offensive and defensive, that have proved ineffective. It is needless to say that this program has required a vast airdrome construction and maintenance crew, from one to two thousand civilian and military personnel generally being employed for one airdrome area.

## ANTITANK

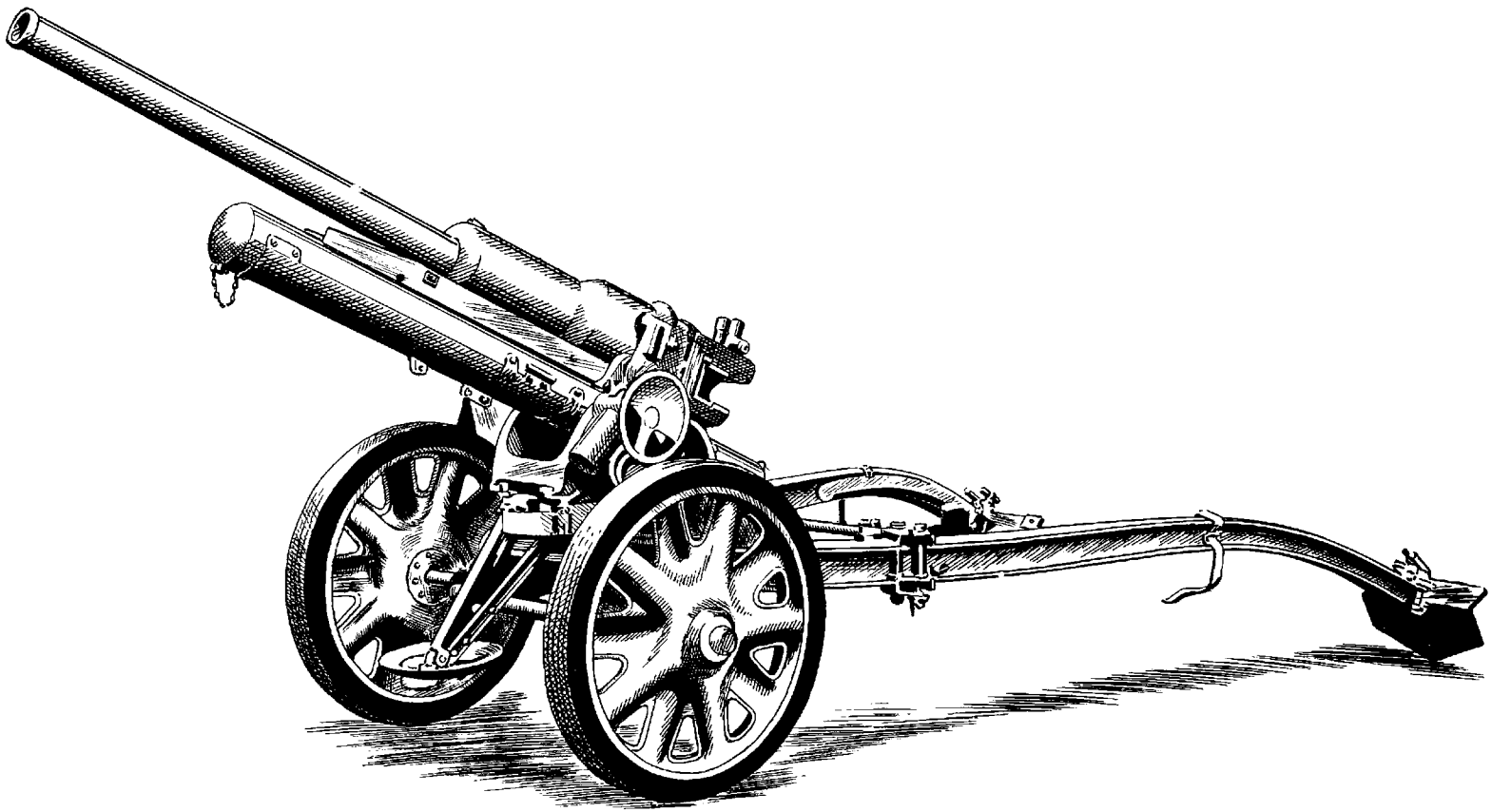
### 3. ITALIAN 1.85-INCH ANTITANK GUN

This weapon (see accompanying sketch) is of Boehler design, and was first introduced in 1935. It has a high rate of fire, and may be fired either on wheels or from its platform. It may be used as an infantry support gun in addition to its antitank role. This gun is a standard Italian antitank weapon.

It fires HE or AP ammunition, although the former is very erratic in performance.

The gun may be transported in any of five ways: by manpower, using special ropes; drawn by one mule; carried on a truck; drawn behind a truck; or divided into five packloads.

The disadvantages of the gun are: no protection is provided for the gun crew; the traverse is limited; and the burst is less effective than that of the British 2-pounder (40-mm).



ITALIAN 1.85-in (47-mm) ANTITANK GUN

Characteristics:

| | |
|---|---|
| Muzzle velocity (AP) | 2,067 f/s |
| Muzzle velocity (HE) | 820 f/s |
| Maximum range (HE) | 3,800 yds |
| Effective range (AP or HE) | 220 - 1,100 yds |
| Rate of fire | |
| theoretical | 20 rpm |
| practical | 7 - 8 rpm |
| Weight of barrel | 172 lbs |
| Weight of gun in draught | 660 lbs |
| Weight of gun in action | 582 lbs |
| Traverse on platform | 70° |
| Traverse on wheels | 40° |
| Maximum elevation | 56° |
| Maximum depression | 15° |

At a range of 100 yards, the AP shell penetrated 55.6 mm of armor plate, while at the greater range of 1,640 yards, the shell pierced 23.9 mm of armor plate.

The minimum gun crew is three men. However, the gun is usually manned by two groups: the firing, and the ammunition.

The firing group consists of six men; gun captain, layer, gunner, loader, ammunition handler, and a supernumerary.

The ammunition group is responsible for getting ammunition to the gun position.

## 4. 50-KILOGRAM PHOSPHORUS INCENDIARY BOMB

Additional details have been received concerning the German 50-kg phosphorus incendiary bomb previously reported in Tactical and Technical Trends, No. 14, p. 13.

### a. Description

The bomb body appears to be a one-piece steel forging and has no weld marks. The suspension eyebolt may be in the side or the nose of the bomb, as in normal 50-kg (110 lbs) HE bombs. The bomb is filled with a very thick, almost black mixture, which is so viscous that there is no sound of movement of liquid when the full bomb-case is shaken. This bomb can be distinguished from the 50-kg HE bomb by the following features:

(1) The rear of the bomb from the shoulder to the filling cap is painted red.

(2) The filling cap is also painted red, and is screwed down on a black rubber washer which is clearly visible.

(3) A sheet metal collar is welded to the case between the filling cap and the shoulder. The collar, which is painted red, is drilled and tapped to take eight screws by which the tail is attached to the bomb.

(4) On one of the bombs seen, a 1-inch red band is painted around the bomb, 1 inch behind the suspension eyebolt. The body of this bomb is painted dark gray-green.

### b. Fuze

The fuze used has been the normal type. No picric pellets have been discovered in the fuze pocket, their place being taken by wooden blocks, shaped like a picric ring, and picric booster pellets.

### c. Functioning

The fuze functions on impact, and the explosion resulting from the detonation of the shell casing splits the bomb-case. The subsequent operation is not known, but it is possible that the flash from the casing detonator ignites the benzene vapor and, provided sufficient oxygen is present, fires the inflammable filling. Because of the sticky consistency of the main filling, the latter does not appear to spread far from the broken pieces of the bomb. Once ignited, the main filling burns briskly, and has been known to burn for as long as 2 hours, giving off sooty black smoke.

### d. Radius of Effect

Reports have been received of detonation occurring below ground level. In such cases a small, shallow crater may be formed. These craters have bee

measured, and may be up to 6 feet in diameter, and up to 18 inches in depth. Pieces of turf and earth have been found scattered up to a radius of 9 feet.

e. Dimensions

| | |
|---|---|
| Length of bomb body | 2 ft 6 in |
| Diameter of bomb body | 8 in |
| Wall thickness | 1/8 in (approx) |
| Nature of filling | Crude benzene, 86%<br>Phosphorous, 4%<br>Rubber (probably pure), 10% |
| Weight of filling | 30 lbs (approx) |
| Total weight | 90 lbs (approx) |

## 5. GERMAN HEAVY ANTIGAS CLOTHING

A sample of German heavy-type antigas clothing has been captured and examined.

The outfit consists of three pieces: jacket with attached hood, trousers, and gloves, each article being simple in design and construction.

a. Jacket

The jacket is seamed, and cut in more or less conventional fashion with single but ample overlap on the chest. It is loose-fitting, but is provided with a substantial rubber belt at the waist, and is worn over the trousers. The hood is also of the usual design, and attached to the jacket at the neck band. It carries two side-flaps which join under the chin. These flaps, used in conjunction with the gas mask, provide an approximately vapor-tight joint. At the wrist, the sleeves are provided with fitting bands consisting of rubber-covered steel wires. These bands fit under the gauntlet of the glove to produce a vapor-tight joint.

b. Trousers

The trousers, which are the overall type, are also seamed and of normal cut. They are of ample proportions and allow bending without much movement of material. Provision is made for drawing them in at the waist. The trouser legs terminate in molded-rubber fitting bands which are of such dimensions as to suggest that they fit over a half-length rubber boot.

c. Material

The material of all the above garments (trousers, jacket, and hood) is of fabric, heavily rubberized on both sides. Their total weight is 7 3/4 pounds. One point worthy of special note is the almost complete absence of metal parts.

d. Gloves

The gloves are of thick gray, molded rubber without fabric reinforcement. They are provided with four fingers and thumb. The weight of each glove is 4.9 ounces.

e. Performance

The resistance of this suit to liquid vesicants is of a high order, being approximately 1 1/2 hours against mustard and considerably longer against lewisite. For the gloves, the figures are about 3 hours against mustard and more than 6 hours against lewisite. Tests on the seams showed that they were as resistant as the rest of the garment, which is in striking contrast to the German light antigas suit.

The aim of the designer appears to have been to obtain a high degree of protection from liquid and vapor for a reasonable length of time, and in this respect he has reportedly been very successful. The suit, however, is completely lacking in ventilation, which tends to restrict the time of wearing in hot climates to extremely short periods.

## 6. GERMAN GAS DEFENSE EQUIPMENT

This report on German gas defense equipment was obtained from an examination of German material captured in North Africa.

a. "Gastilt"

The German gastilt, like the gas mask, is an item of general issue. It is a rubberized sheet and is designed primarily for protection of the person in surprise attacks of liquid vesicants. Four German gastilts, complete with pouches, were found to be of the type described as "rubberized fabric," and consisted of plain rectangular sheets approximately 6 1/2 feet by 4 feet. Three were black; the fourth was khaki in color. The khaki one bore the marking "Tp," a special German marking for supplies intended for use in the tropics.

Three were contained in gray-green or gray canvas pouches; the fourth (not the one marked "Tp"), in a pouch of black American cloth-like material.

Each gastilt has two corners marked with white -- this indicates the corners which are held when the gastilt is opened for use -- which bore the following markings: "bps 1140 -- 80 op-," "evw 12342 40/X, 80 op-," "80 op 4/40/9, b f t," and "b f t, 7-41/6, 80 op (Tp)" respectively.

In every case the bottom corners were marked with a small square of green paint - presumably detector paint.

The weight of the complete outfit (i.e., a single gastilt in pouch) was about 2 pounds.

Regarding the material of which the tilts were made, it seems from the marking "80 op" and "80 op (Tp)," taken in conjunction with the appearance of an item "gasplanen, oppanol" in a captured German ledger of antigas supplies, that these specimens are made of fabric treated with oppanol, a synthetic material consisting mainly or wholly of polymerized isobutylene, which is highly resistant to both mustard gas and lewisite and is made by the I.G. Farben Industrie at Oppau - hence the name "oppanol."

b. German Light Antigas Clothing

The information at present available indicates that this outfit consists of a one-piece suit with short legs and an open back, thigh boots, gloves, and hood.

The material of the suit is described as having an external fabric layer, the inner layer consisting of hardened gelatine. Penetration of vesicants through seams and creases is immediate, but unworn portions resist mustard gas up to 3 hours.

The gloves and hood are described as being made of rubberized fabric. The seams appear to offer little or no resistance to penetration by vesicants. The legs of the boots appear to be of similar material to that of the gloves. This material resists vesicants well, but seams or creases, caused by folding, offer little resistance. The soles of the boots are of thick rubber and give long resistance to penetration by mustard gas (14 hours).

c. German Wax-Paper Gas Capes

This cape of green waxed paper measures about 70 by 46 inches and folds into about 6 by 7 1/2 inches. The paper consists of about 90 to 95 percent Swedish sulphite pulp, the balance of fibers being rag or jute waste. In its waxed state, 31 percent of the paper's total weight consists of white wax and 7 1/2 percent of a water extract which is almost certainly an alginate, and quite possibly sodium alginate. The purpose of the wax is to act as an external waterproofing agent and to counteract the brittle "feel" of the alginate. The alginate is employed as a binder instead of colophony (rosin), and as an inherent waterproofing agent to protect the paper at those points where creasing or cracking has impaired the efficiency of the wax.

The green vegetable dye of a chlorozol type does not react as a gas detector.

It is reported that when subjected to field trials, the paper cape was found to provide a high initial resistance to mustard gas, but resistance was considerably lowered by creasing.

## 7. BRITISH MOBILE SCISSORS-BRIDGE

Over favorable terrain, the tank is the most decisive ground weapon of modern warfare. However, it is particularly sensitive to obstacles. A relatively minor obstacle at a decisive point may so delay attacking tanks as to wholly destroy the success of the attack or result in heavy tank losses. On the other hand, one of the outstanding favorable characteristics of the tank is its battlefield mobility. In order that the tank may take full advantage of this mobility, means for the passage of obstacles which the tank cannot negotiate by itself must be made immediately available. Because of a tank unit's mobility, and the difficulty of coordination and control once the tank attack is launched, this problem of assisting tanks through obstacle areas is extremely difficult, particularly in view of the fact that the task must usually be performed in the face of hostile fire.

One possible answer to this problem has been produced by the British. They have developed and standardized a so-called scissors-bridge, for the purpose of making available to the Royal Armored Corps a tank which is capable of laying a bridge across a tank obstacle up to 30 feet in width. It has been designed so that the bridge can be laid under enemy fire with the tank completely buttoned-up, thus giving the crew a maximum of protection. The bridge has been designed to take a tracked load of 30 tons.

The scissors-bridge equipment has been standardized and adapted to two types of tanks, the Covenanter (cruiser tank Mark V) and the Valentine (infantry tank Mark III), the latter being the newer design and in greater numbers. A second type of tank bridge-layer is being developed from the Churchill (infantry tank Mark IV), which will carry a one-piece 30-foot span capable of carrying a load of about 60 tons.

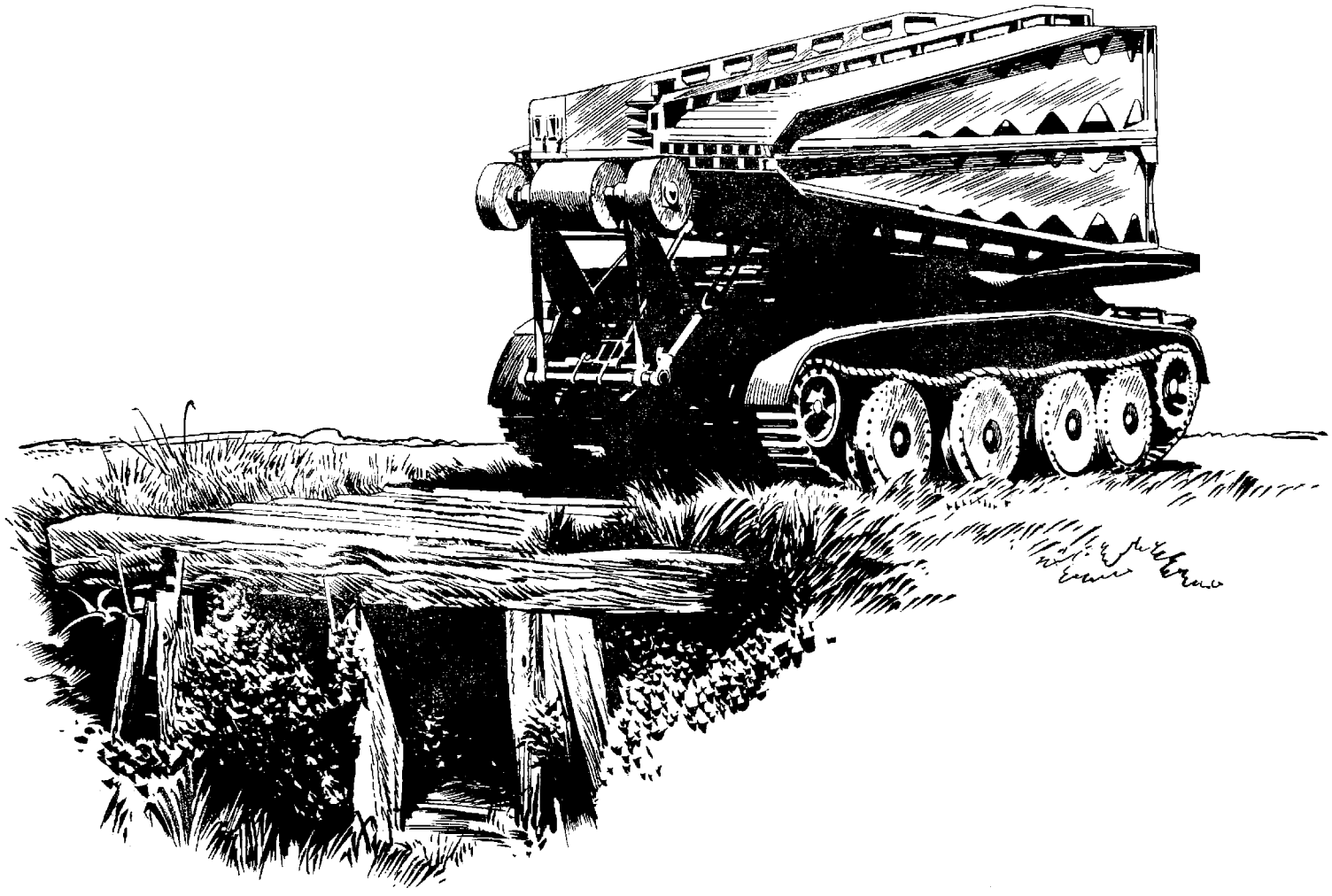
The construction of the scissors-bridge is shown in the accompanying sketches. Sketch 1 shows the bridge in traveling position; sketch 2, in a half-opened position.

General data on the scissors-bridge are as follows:

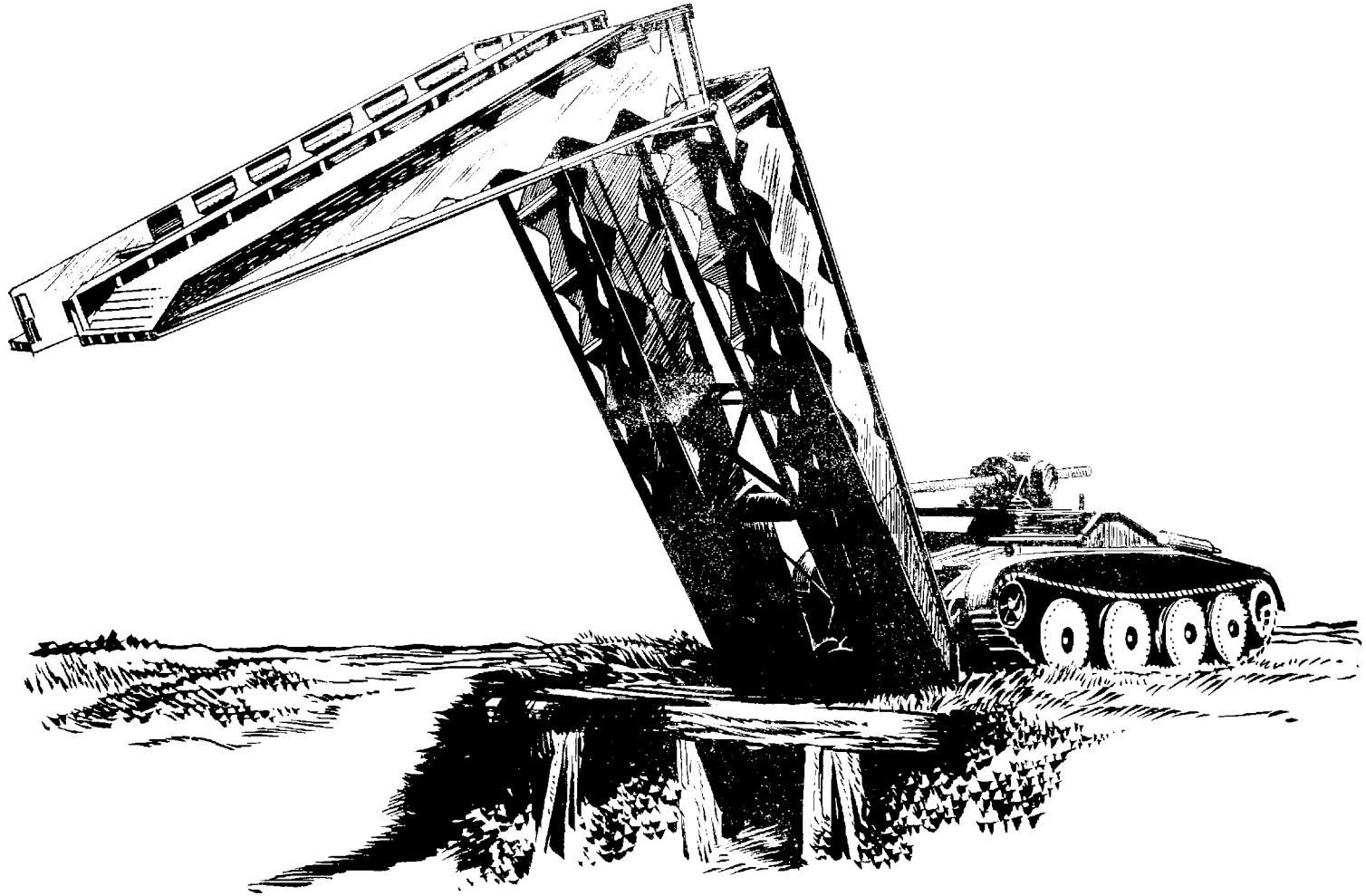
| | |
|---|---|
| Length of bridge | 34 ft |
| Overall width of bridge | 9 ft 6 in |
| Maximum tracked load carried | 30 tons |
| Power required to operate bridge | 30 hp (maximum) |
| Time required for launching | 2.5 min |
| Gear reduction from engine | 19 to 1 |
| Weight of launching equipment and bridge | 3.5 tons |
| Maximum tension load on screw | 30 tons |
| Maximum load on each cable | 7 tons |

The launching and recovering mechanism is operated by power taken from the fan drive of the tank engine, through a small oil-bath clutch and a 2-to-1 reduction gear, to a reversing gearbox directly beneath the screw feed gearbox.

The opening of the bridge begins after the launching mechanism has begun to pivot on the rollers of the launching frame. Since the cables are of fixed



SKETCH 1. BRITISH SCISSORS-BRIDGE--TRAVELING POSITION



SKETCH 2. BRITISH SCISSORS-BRIDGE--HALF-OPENED POSITION.

length, they act to open the bridge as it is pivoted about the rollers. Having been laid across the obstacle, the bridge is disengaged from the prime-mover. The bridge is then ready for the passage of other vehicles. To retrieve the bridge, the prime-mover crosses the bridge to the far side of the obstacle, hooks up to the bridge, pulls it back to the traveling position, and is then ready to proceed to the next obstacle. Safety devices have been installed on all the later models of this equipment, and are so arranged that the power is cut off automatically from the operating screw should the operator fail to disengage the clutch when the bridge is fully launched or recovered.

This equipment has given good service when operated by trained personnel. In one case 1,200 successful launchings and recoveries were made by one vehicle without undue maintenance.

The reporting officer submits the following conclusions:

This equipment is sturdy and compact, and apparently requires very little maintenance.

If enough of these vehicles could be supplied to armored units, they would afford a ready means of crossing tank barriers quickly with a maximum of protection for those laying the bridge.

Since the bridge is recovered after the crossing has been completed, a minimum of such bridging equipment can be carried within each division.

A decided disadvantage of equipment of this type is that it is a single-purpose vehicle, and unless a sufficient number are provided, they will not be available where and when needed.

When used as an organic vehicle of armored units, it should provide a flexibility of operations that would not be possible otherwise.

## 8. ENGINEER SUPPORT OF TANKS

Experience in Russia and Africa has indicated that tanks cannot operate successfully without the support of other arms. Since tanks have probably been more extensively used on the Russian front than anywhere else, of interest is the following summary of an article from the Russian newspaper Red Star of June 7, 1942, written by a Russian lieutenant, on engineer support of tank attacks on organized defenses.

During the attack, each tank should carry at least 2 engineers. The principal function of these engineers is the location and neutralization of mines. For purposes of coordination, a complete set of visual signals between the engineers (when dismounted) and the tanks must be arranged.

Comment: These engineers apparently ride outside the tank behind the turret. In this connection it should be noted that the turrets of Russian tanks are usually set well forward, thereby leaving a relatively large platform-like area between the turret and the rear of the tank. Some protection can therefore be afforded to men riding behind the turret. The Russians also use infantry mounted on tanks (Desyanti) (see Tactical and Technical Trends, No. 3, p. 44).

## 9. ANOTHER GERMAN BOOBY TRAP

A new version of the booby trap is reported to have been used by the Germans in Libya last spring. Trip-wires are strung to give the appearance of a minefield, and the usual gaps are left in the wire. In actual fact, the only mined areas are the gaps themselves. Care must therefore be taken before attempting to go through a gap where no traffic appears to have passed.

## 10. SOME BASIC GERMAN TACTICS

The following are summaries of certain phases of basic German tactics.

### a. The Meeting Engagement

(1) A meeting engagement means that a commander dispenses with preliminary preparations, and deploys straight into battle. Careful coordination and a determination to succeed on the part of all concerned will compensate for the absence of preliminary preparations.

(2) A commander will not commit himself to a meeting engagement unless either:

(a) he feels that his troops and leadership are superior to that of the enemy (this does not necessarily mean a numerical superiority) or;

(b) he would, by waiting to launch a deliberate attack, sacrifice ground which he cannot afford to lose.

(3) Sound tactical decisions in the initial stages are essential. Mistakes cannot afterwards be rectified. The worst mistake of all is hesitation.

(4) The advance guard will delay the enemy and seize important positions, e.g., for artillery OPs. It may therefore:

(a) attack with a limited objective;

(b) defend its existing positions;

(c) withdraw to more favorable positions. (Withdrawal is likely to hinder the deployment of the main body.)

(5) The main body will deploy immediately. To wait for further information in the hope of clarifying the situation is wrong. Time will be lost and lost time can never be regained. The time available determines whether the commander should concentrate his troops before launching them to the attack, or launch them on their tasks as they become available.

(6) The meeting engagement will normally take the form of a frontal attack by the advance guard, combined with one or more enveloping attacks by the main body.

### b. The Deliberate Attack

(1) The object of the attack is to surround and destroy the enemy.

(2) A strong, rapid, enveloping attack can be decisive, provided that it really gets to grips with the enemy, and that the enemy is pinned down by frontal pressure which will be exercised mainly by fire.

(3) Enveloping forces must move in depth if they are not to be themselves outflanked. All enveloping attacks ultimately become frontal.

(4) In all attacks, the commander will select a "Schwerpunkt" or point of main effort, where the bulk of his forces will be employed. ("A commander without a Schwerpunkt is like a man without character.") The considerations when choosing this point are:

(a) Weaknesses in the enemy defense;

(b) Suitability of the ground for cooperation of all arms, but especially for tanks;

(c) Avenues of approach;

(d) Possibilities of supporting fire, especially by artillery.

(5) Boundaries and objectives are allotted to attacking units. This does not mean, however, that a unit must cover the whole ground within its boundaries with troops. It will choose within its boundaries the best line, or lines of advance, and dispose its troops accordingly. A Schwerpunkt battalion can be allotted about 450 yards of front, while a battalion which is attacking in the non-Schwerpunkt area may be given 1,000 yards or more.

(6) An attack on a narrow front must have sufficient forces at its disposal to widen the breach, maintain its impetus, and protect the flanks of the penetration. Once an attack has been launched, it must drive straight on, regardless of opposition, to its objective. It is wrong for the leading attacking troops to turn aside to deal with threats to their flanks. This is the task of the troops which are following them.

(7) A breakthrough must be in sufficient depth to prevent the enemy from establishing new positions in rear. The breakthrough cannot be successful until the enemy artillery positions are captured. This is the special task of the tanks.

(8) As soon as enemy resistance weakens at any point, all available fire and forces must be concentrated to insure the success of the breakthrough.

(9) Continuous artillery support is essential. Therefore artillery must be kept well forward.

c. The Pursuit

(1) If the enemy is able to withdraw under cover of a rearguard, the attack has failed. He must then be pursued.

(2) The object of the pursuing forces will be to encircle and destroy the enemy. Infantry and artillery alone are not sufficient for this.

(3) Aircraft will attack defiles on his line of retreat, and motorized elements will endeavor to pierce his front and envelop his flanks. A Schwerpunkt and clear orders are just as necessary in this operation as in any other.

(4) The task of the pursuing forces is to interfere with, and if possible stop, the enemy's withdrawal, so that he can be dealt with by the slower-moving infantry and artillery which will be following up.

(5) Troops pursuing the enemy may find themselves in great difficulties owing to the speed with which they move and the exposed positions in which they may find themselves. They must be prepared for this, and must rely on aircraft and the slower-moving infantry and artillery to get them out of their difficulties in due course.

d. Defense

(1) A Schwerpunkt is as necessary in the defense as it is in the attack.

(2) A defensive position is only of value if the enemy must attack, or if it is so strong that the enemy is afraid to attack it. If the enemy can avoid a defensive position by passing round its flanks, it has no value.

(3) Defensive positions will be held to the last man.

(4) Essentials of a defensive position are:

(a) A good field of fire for all arms, but especially the artillery;

(b) Good observation;

(c) Concealment;

(d) Natural protection against tanks;

(e) The ability to concentrate the fire of all weapons in front of the main line of resistance.

(5) The defensive position is divided into covering force, outposts, and a main position. The forward edge of the latter is known as the main line of resistance.

(6) The task of the covering force is to deny good observation points to the enemy and to hinder his advance. They will be approximately 6,000 to 8,000 yards in front of the main position. Mines and obstacles will be used to strengthen the position of the covering force. The covering force must not expose themselves to the danger of being overwhelmed. They will be withdrawn at a definite time. They will normally consist of small mobile forces. Their principal task is to force the enemy to deploy.

(7) The outposts are responsible for the immediate protection of the main position. Their tasks are:

(a) To prevent the enemy from surprising the forces holding the main position;

(b) To mislead the enemy as long as possible as to the dispositions and situation of the main position;

(c) To protect advanced OP's.

They will be withdrawn when the situation makes it necessary. They are normally 2,000 to 3,000 yards in front of the main position.

(8) The main position must be defended in depth. This consideration is paramount. Areas and not lines will be defended. If the enemy should succeed in penetrating a position, he must be faced by a series of defended areas, mutually supporting one another by fire, so that in the end he collapses under the concentrated fire directed at him. A battalion will defend from 800 to 2,000 yards.

(9) The withdrawal of both covering forces and outposts must be carefully planned, to avoid masking the fire of the main position.

(10) Penetration must be met by immediate local counterattacks with limited objectives, carried out by small parties of infantry, and if possible against the enemy's flanks. Unless tanks are available, a deliberate counterattack will succeed only if carried out by superior forces and as a surprise against one or both flanks of the enemy penetration. Like any other deliberate attack, it requires preparation.

e. Village Fighting

Troops are too easily attracted to villages. These give some cover from fire, but also draw it, and may become traps.

(1) Attack

(a) In attack, villages should be bypassed if possible. The enemy in the village must, however, be pinned down, chiefly by artillery fire, when this is happening.

(b) If they must be attacked, heavy supporting fire is needed on the nearer edge, especially on isolated buildings and small groups of houses.

(c) Leading troops will avoid the streets, and fight through backyards and gardens to the far end of the village. These troops are difficult to control and support, and must therefore operate in small independent groups. Their tasks must be accurately laid down, and each group must have its own supporting weapons.

(d) Reserves must move close behind these leading groups, as they may easily get into difficulties.

(2) Defense

(a) Well-built villages make good strongpoints.

(b) Their edges are shell traps. The main defended line should therefore be either inside or outside, not on the edges.

(c) If a village is favorably situated, it should be turned into a strongpoint organized in depth. The irregular shape of its approaches should provide ample opportunities for flanking fire.

(d) Villages are especially useful as antitank positions.

(e) Reserves must be held in readiness outside the village to deal with the enemy's probable attempts to bypass it.

## 11. TRAINING OF RUSSIAN AUTOMATIC RIFLEMEN

The following report, a translation of an article by a Colonel in the Russian Army, is believed to give the latest Russian thought on the training of the automatic rifleman. The Russian automatic rifleman here referred to is equipped with a weapon comparable to the Thompson submachine-gun. According to a Russian instructional poster, best results are obtained with this weapon as follows: single shot, up to about 300 yards; short bursts, about 200 yards; long bursts, about 100 yards.

The fundamental assignments of the automatic riflemen are:

(a) To break up, or throw into confusion, enemy battle formations by sudden assault fire, creating the semblance of encirclement where possible;

(b) To filter through the gaps between the enemy units, and cause heavy losses by striking at his flanks and rear;

(c) To disorganize enemy control by sudden assaults on his staffs and command posts;

(d) To capture and hold important strategic points (crossroads, railheads, bridges, etc.).

It may readily be seen that men required for such tasks must be trained primarily as attackers. They must be excellent athletes and bold fighters. Furthermore, they must be capable of self-sacrifice, and have the ability to operate under any weather conditions, in the daytime or at night. It is of prime

importance that they remain cool under any battle conditions. Surprise is always the basis of their action. In many cases it is necessary to creep up to within 150 to 250 yards of the enemy without being detected, and open fire so as to throw the enemy ranks into confusion if not to wipe them out.

It is necessary to select candidates carefully for this specialty in the Red Army. The men must be physically well developed, as well as in perfect health, particularly as regards eyesight and hearing. Their will-power and determination must be of the highest caliber.

The program of training for automatic riflemen is drawn up with special consideration as to their battle functions. The individual training of the automatic riflemen approximates that of the infantry riflemen in the elementary stages. Emphasis is placed on the following:

(a) Thorough familiarity with the automatic rifle, to include reduction of stoppages and care in the field;

(b) Marksmanship, to include firing from all positions at stationary, moving, and surprise targets;

(c) Throwing of grenades and gasoline bottles, especially against tanks, embrasures, and trenches;

(d) Ability to ski;

(e) Self-orientation by azimuth, compass, or map at any time.

In the individual tactical training of automatic riflemen, 8 to 10 hours are devoted to courses in: "The Automatic Rifleman in Offense," "Actions of Automatic Riflemen in Attack and inside the Enemy Defenses" and "The Automatic Rifleman in Defense." Stress is laid upon movement by rushes and crawling noiseless approach to enemy positions, use of camouflage, and utilization of cover. Each trainee must learn the various means of preparing satisfactory fire positions for prone, kneeling, sitting, and standing fox holes. He must also know how to fire from skis and tanks.

The unit tactical training includes courses in: "Action of Automatic Rifle Units in Attack and inside the Enemy Defenses," "Action of Automatic Riflemen Accompanied by Tank Destroyers in Offense," "Night Attacks by Automatic Rifle Units," "Automatic Rifle Units in Defense," "Automatic Rifle Units in Encircling Movements" and "Action of Automatic Rifle Units in Rear of the Enemy."

All studies should be conducted under practical conditions which approximate battle conditions as closely as possible, i.e., in snowfall, fog, poor visibility, etc. These studies should be filled with adverse situations to complicate operations, such as sudden assault from ambush, outflanking, appearance of enemy on the flanks or in rear, and encirclement.

Such practice develops initiative, cunning, "fight," and ability to think calmly under battle conditions. An automatic rifleman must never be allowed to forget that he may have to fight as an individual, separated from his unit, at any time and under any conditions. On the way to and from exercises, such factors as defense against aircraft, antitank defense, defense against motorized units, etc., are introduced and absorbed. Ability to dig in quickly, to pass through barbed-wire entanglements and other obstructions, and to work while wearing the gas mask,is emphasized.

In order to relieve monotony and to keep interest of the trainees alive, it is suggested that the different subjects be taught in varied, short lessons to achieve desired standards. A model daily lesson outlined early in the course consists of: complete assembly and disassembly of the automatic rifle; fire from cover; observation on the battlefield; discovery and choice of targets; study of grenades; and use of hand grenades.

Comment: Although the actual number of automatic rifles in Red Army infantry units is not known, it is believed to be comparatively high. Before the war with Germany,there were at least two per rifle squad, and it is believed the number per large infantry unit has been increased.

The Soviet press has repeatedly emphasized the importantce of automatic rifles. Many photographs taken at the front show whole units of automatic riflemen.. The Red Army "desyanti" troops who ride the tanks are always pictured armed with this weapon. Pictures of junior officers with this weapon have been noted.

As the Red Army teaches "close-in" fighting, using short ranges, it is readily understandable why so much emphasis is placed on this weapon and on the training of men to use it in the proper manner. The above article deals with the ideal training which is striven for but not believed to be achieved. The average automatic rifleman is, of course, more highly trained than an infantry rifleman.

## 12. NOTES ON OPERATIONS IN MALAYA

"One of the reasons for our failure in the Malayan Campaign was that we were mentally and physically surprised by actual conditions of jungle fighting." After arriving at this conclusion, British General Headquarters in India issued a long report containing an analysis of the difficulties faced by the British troops in Malaya, suggestions for overcoming them in future campaigns, and, finally, suggestions for specialized training of troops to fight in the jungle.

In this campaign, as in others, bombs and machine-gun fire from enemy aircraft had an unduly detrimental effect on the morale of the troops unless they were allowed to engage them with small-arms fire. The material effect of such firing is relatively unimportant compared with the morale effect, which is enormous.

The jungle growth in Malaya falls into two categories: primary jungle, which is natural vegetation that has not been touched; and secondary jungle, which consists of terrain cleared of primary jungle but subsequently overgrown by very dense underbrush. In the first type, visibility is usually from 20 to 30 yards, and on the tops of hills the foliage is quite thin. Travel through this type of vegetation is not too difficult and requires only a small amount of cutting. Secondary jungle, on the other hand, requires heavy labor to cut through the ferns and brambles; it is found on the sides of roads and the banks of rivers, often giving the impression that the primary jungle beyond it is also impassable.

In Malaya, as in nearly all jungle country, there are a small number of open areas, in this case, the tin mines. However, little use could be made of the effective fields of fire, since these areas were nearly always outflanked.

The British comments emphasize a striking similarity between jungle warfare and night operations, in that both favor the offensive. The extremely limited visibility, the small fields of fire, and the impossibility of securing effective artillery support all hinder the defenders and favor the attackers.

a. Difficulties of Jungle Warfare

One of the most significant features of jungle fighting was found to be the unusual amount of fatigue which troops felt in this type of warfare. Called upon to march long distances without the aid of their motor transport, often isolated from supplies and support, and subjected to the enervating climate and difficult terrain of the jungle, soldiers were much more susceptible to fatigue than usual.

Morale, too, was affected by conditions not encountered in normal types of warfare. Tactical situations often appeared much worse than they were, since control of subordinate units was frequently lost in the dense jungle where communications presented unusual difficulties. It was found that rumors were even more prevalent than usual among groups of soldiers, and this, also, was at least partially due to difficulties with communications. The British believe that greater efforts must be made to maintain communications, not only for command purposes but also to support morale, by keeping all the small groups informed of the local, and so far as possible, the general situation.

b. Japanese Offensive Tactics

The Japanese invariably advanced on as broad a front as possible, making use of all available communications (roads, railways, rivers, and the sea) as well as sending their infantry through the jungle. In attacking, they would nearly always undertake to contain the forward defenses and then make an envelopment. The British stated that nearly every time that light holding attacks were made against their forward positions, they could be sure of an impending encirclement. It was also noted, however, that when the British flanks were effectively secured, the Japanese did not hesitate to make a frontal attack aimed at infiltration and penetration. Such tactics obviously emphasize the necessity for allotting the minimum number of troops to the strategic defense of vital areas

and retaining the maximum number for counterattack. They also emphasize the vital necessity of maintaining control of these reserves through proper communications.

It is interesting to note that the Japanese ordinarily launch two encircling attacks in depth, the first to a depth of 1,000 yards, and the second to a depth of about 5 miles. These figures apply to a Japanese regiment. Ordinarily, when contact was made at about 0800, the first encircling attack came almost immediately and the second sometime in the early afternoon. The first, shallow attack was not considered dangerous by the British and in some actions the Japanese omitted this preliminary and concentrated on the larger encirclement. During these attacks, the Japanese employed a holding detachment against the British front lines.

c. Artillery

The jungle did much to limit the effectiveness of artillery, but where it could be employed it caused the Japanese a great deal of trouble. Captured reports nearly always referred to British artillery in terms of the greatest respect. The best type of artillery fire was found to be a rolling barrage laid astride a road on a front of 300 to 400 yards.

d. Tanks

Since the few tanks that were used were confined to the roads, the problems of antitank units were greatly reduced. Often as many as 30 to 50 tanks participated in one attack, but they were usually easily ambushed. Although the fronts were not vulnerable to the 2-pounder, they could nearly always be knocked out by a hit on the side or the rear.

e. Communications

Individual runners were the most satisfactory. Visual signal devices were practically useless, and there was seldom time or material to lay wire. Some use was made, however, of civilian communication facilities. When this was done, the exchanges had to be carefully guarded and supervised by military personnel, since the local operators could not be depended upon. In the few cases where wire was laid, it functioned satisfactorily, and was not so vulnerable to enemy bombing and artillery fire as it would have been in more open terrain. The range of radio was greatly reduced by the jungle, and it seldom worked at night. Small "walkie-talkies" were the most valuable form of radio and lent themselves particularly well to the operations of small groups. Code was almost never used below division headquarters, for runners took less time than coding and decoding.

f. Personnel Vehicles

Tracked carriers and armored cars were effectively used where the road net was satisfactory. The carriers, however, in addition to being vulnerable

to armor-piercing ammunition, were also inviting targets for grenades dropped from trees, a favorite Japanese trick. Wire netting over the tops of carriers would have been an effective method of neutralizing this danger. The light machine gun on the carriers had the advantage of height and was almost never removed and used on the ground. The armored car, although even more road-bound than the tracked carrier, had the advantage of operating silently and could, therefore, be used in mobile surprise attacks. It also had heavier and better armor, making it less vulnerable than the carrier. In the withdrawal these armored cars were usually the last to go, for they were particularly suited for ambushing the enemy.

g. British Suggestions for Offensive Tactics

In jungle warfare the advantages accruing to the attackers are so great that the British believe the careful working out of a tactical plan should be subordinated to seizing and maintaining the initiative. This does not mean that thorough grounding in tactics and techniques of small groups, and of the individual soldier should be minimized, but rather that "the essence of the encounter battle (meeting engagement) is that it must be fought automatically by all officers and men according to a battle procedure...constantly practiced and applied to all types of ground."

As a result of these observations this report suggested the following tactics to British troops:

The success of the encircling attack lies in its speed. To attempt this, highly trained jungle troops, capable of quick cross-country movement and well-trained in map reading, are employed to seize a part of the road from the enemy. This initial seizure is simply to establish control before the beginning of the main attack, which will be made against the rear of the enemy defenses. This main attacking force may be divided into 3 detachments: (a) the initial striking force which secures a strip of road (not more than 400 to 600 yards should be necessary for a battalion attack); (b) a second force which attacks the enemy's rear immediately upon seizure of the road; (c) a reserve which may be used either to exploit the action of the second force or to relieve the first if the latter has lost too heavily in its initial encounter.

The success of such an attack is dependent primarily upon supplies and speed, for there can rarely be assistance from supporting arms. Consequently, the point selected for the attack in the enemy's rear should provide good cover for the unsupported infantry.

In the jungle the frontal attack is normally made on a narrow front, astride a road. It is designed to exploit the fact that all control is concentrated along the road, and is executed with a relatively narrow artillery barrage, usually extending about 200 yards on either side of the road. One of its advantages is that it allows for greater use of artillery. The use of tanks will be effective only if the enemy is insufficiently supplied with antitank guns, and if the attacking infantry follows very closely behind the tanks.

To achieve the best results the British believe that this attack should be combined with infiltration on the flanks of the main attack. These infiltrating detachments should be given objectives well to the enemy's rear, such as bridges or ammunition dumps.

h. Defensive Tactics

The defense, as stated, is inevitably hampered in jungle warfare. In the face of greatly superior enemy forces, when it is not possible to seize the initiative at once, the object must be a system of defense which will kill the maximum number of the enemy, but above all which will maintain the defending forces as a unit. Only by maintaining control is there any hope of reducing the enemy's numbers to the point where a counterattack can be launched. The static defense is as worthless in the jungle as in the desert, and the British now believe, for example, that the only way to hold a position for a prearranged number of days is to meet the enemy sufficiently far forward so that the delaying actions will last for the number of days desired. To apply these tactics requires troops of the highest caliber, for their morale will inevitably suffer in a series of even short withdrawals, and the tendency will be for smaller units to withdraw before they are ordered to do so.

Since control of the roads is the objective of both the forces, defense must take the form of a series of zones of resistance located in depth down the road. In successful defensive action in Malaya, battalion depth was about 2 miles and regimental depth up to 6 miles. Above all, the enemy must not be allowed to get completely in the rear of the defensive positions. Company defense areas are about 300 yards in diameter; and within platoons, squad defense areas should be about 100 yards apart. Squads themselves are usually dispersed in 2 or 3 groups, 30 yards from one another.

In order to conduct a defense successfully, normal Japanese tactics must be studied. The Japanese usually make initial contact on a road, with the objective of finding and containing the front line troops, as a preliminary to encirclement. Since this initial contact is made with considerable speed and at the expense of ordinary security measures, their leading formations are particularly vulnerable to ambush. A normal Japanese leading detachment would consist principally of a group of 4 or 5 bicyclists, followed at several hundred yards by another group of 60 or more bicyclists. After the forward group is allowed to pass, a successfully camouflaged ambush should be able to wipe out the large group following. Another type of ambush for these forward Japanese troops might consist of placing fairly strong, well-camouflaged forces on the flanks of a road, some distance in front of the other friendly positions. The Japanese are allowed to make contact, and to bring up their troops for the holding attack and subsequent encirclement; they may then be struck from the rear by the forward troops on the flank.

i. Counterattacks

The Malaya fighting indicated that in the jungle immediate rather than

deliberate counterattacks were required. Counterattacks were invariably unsuccessful when ordered by higher command since the situation had nearly always changed, usually for the worse, by the time the attack was launched. On the other hand, immediate counterattacks by reserves of forward units were nearly always successful. One general type of counterattack proposed for the future is as follows:

When the enemy makes contact, the leading defending battalion immediately withdraws. The enemy is then allowed to push forward to a bridge, village, or other vital feature. At this point a surprise frontal attack is made. This method has the advantage of not breaking up the main body to place counterattacking units on a flank.

j. Patrols

The British believe that in the jungle, fighting patrols, rather than mere observation patrols are always desirable. Patrols should aim to kill as many of the enemy as possible, giving information to their commander by "reporting by fire." This is based on the belief that events move so quickly in the jungle that a patrol which waits to report enemy movements on its return will invariably be giving stale and incorrect information. Patrols should also be considered as one of the best means of locating and disorganizing enemy encirclements during the approach march. Finally, the British believed that only small patrols can achieve the requisite mobility, and they recommend a patrol of one leader and two others.

## 13. TANKS IN NIGHT ACTION

The following report is from an article by two Russian officers in Red Star, an official Russian newspaper. It describes how a German regiment was dislodged from a strong position during night fighting.

* * *

Until very recently the extent of night tank action on the front has been limited to night marches, negotiation of water obstacles, and movement to jump-off positions for attack. On the field of battle, the tanks participated only from dawn to dusk. The opinion prevailed that at night the tanks were blind and would therefore lose direction, bog down in natural and artificial tank obstacles, and would not be able to conduct aimed fire. However, recent battles on one sector have shown that the effectiveness of night tank action is well worth the difficult preparations involved. The following is a report on one night action.

An enemy regiment had defended two important hills for some time. From these hills, he had good observation of our positions, which were on the far side of a river. Our positions were continually kept under effective fire. The attempts of the Soviet infantry to capture the hills were in vain.

The commander decided to attack at night. Under cover of darkness, a tank unit was ferried across the river, and concealed in a grove. The following day was spent in reconnaissance, and coordination and establishment of communications. The commander decided to send the tanks on a flanking movement from the south and the southwest, in order that the impression would be created in the enemy that they were surrounded by a large force.

The tanks were echeloned in depth. The heavy tanks were in the first echelon, the light tanks with "desyanti" (infantry mounted on tanks -- see this publication, No. 3, p. 44) were in the second echelon, and in the third echelon were tanks hauling guns. The shells for the gun were carried on the tanks.

Three minutes before the attack, the artillery fired an intensive preparation on the front lines of the enemy, and then shifted to the rear, concentrating on the possible avenues of retreat. Zero hour was 30 minutes before dark. In these 30 minutes the tanks moved from the jump-off positions, reached the Soviet infantry positions, and moved out.

A full moon aided observation. After crossing the line of their own infantry, our tanks opened fire. The flashes of the enemy guns, and flares discharged by Soviet infantry aided fire direction.

The enemy artillery conducted unaimed, disorderly fire, and often shelled their own infantry. Pressed from both the flanks and the front, the enemy started a disorderly retreat. In 4 hours of battle, our tanks and infantry took full possession of the enemy strongpoint. After that the tanks maneuvered along the south and southwestern slopes of the hills, enabling our infantry to consolidate their positions. When it became evident that the hills were securely occupied by

our infantry, the tanks returned to a grove to refuel, take on more ammunition, and be inspected.

The German dead, the equipment left on the field of battle, and the prisoners captured that night gave proof that the night attack was a complete surprise to the Germans. The impression of complete encirclement was created, and enemy officers and men scattered in all directions. The enemy attempted a few counterattacks, but they were all beaten back.

In the following days, a few more night attacks were made on this and other sectors of the front. They were all successful and resulted in very few losses in Soviet tanks.

From the experience of these battles, the following conclusions can be drawn.

(a) The attacks must be made on moonlit nights, when the infantry can orient itself and give the tanks the signals necessary for them to maintain direction.

(b) The tanks must be used in echelons. This allows movement on a comparatively narrow front, and creates an exaggerated idea as to the number of tanks in battle.

(c) Having occupied a certain line, the tanks must continue their maneuver so as to enable the infantry to consolidate its positions.

(d) During the attack, the tanks must under no circumstances be separated from the infantry. The tanks need the help of the infantry at night more than in the daytime.

## 14. LESSONS FOR ARMORED UNITS

The following report is from an account of the operations by a British armored brigade group in the western desert during August-September, 1942. The lessons emphasized below are believed to be some of the essentials for successful desert operations.

The antitank regiment of the group was found invaluable in holding battle positions. The brigade commander was responsible for the siting of antitank guns in the brigade area, and for coordinating the antitank defense with units on either flank. He was also responsible for the inclusion of antiaircraft guns of the brigade in the antitank defense plan. The antitank regiment was invaluable when used as a screen to cover the movement of the armored vehicles.

A semicircular screen of mines, some 300 or 400 yards in front of the bivouac area, gave great confidence in the ability to hold off any surprise night attack by enemy armored vehicles. The minefield was not marked or dug in, and was removed by engineers just before daylight. It is not known what number of antitank mines were used in the semicircular minefield, but when a complete circle of mines is required, some 3,000 to 4,000 mines will be necessary.

During daylight, given a good field of fire, small-arms fire from tanks can protect antitank guns from enemy infantry. At night, however, this cannot be done, since the tank is very vulnerable, and must be withdrawn out of range of enemy patrols. It is the infantry therefore that must provide the necessary protection at night for both tanks and antitank guns.

## MEDICAL

### 15. TREATMENT OF WAR WOUNDS IN THE MIDDLE EAST

In the course of the six campaigns which have been fought over the Western Desert since September, 1940, British medical officers have had a great deal of practical experience with the treatment of war wounds. The following summary of the surgical conference held recently by the Director of Medical Service, Middle East Forces, and attended by a majority of the experienced surgeons in the Middle East is believed to represent the general trend of surgical thinking in this area on this important subject.

#### a. Surgery in the Forward Areas

This question brought up several interesting problems. Generally speaking, it is much better to operate where a patient can be retained for a suitable, if brief, post-operative period rather than make him travel within a few hours of the operation. On the other hand, in active desert warfare (and the experiences related were mainly in connection with the second Cyrenaican campaign), the time lag between infliction of the wound and arrival at a forward surgical unit is commonly more than twenty-four hours. Most cases are therefore best passed to the rear early without interference, and the work of the advanced mobile surgical teams becomes mainly that of "life or limb surgery." Into this category fall severe hemorrhage, penetrating abdominal wounds, sucking chest wounds, and devitalized limbs. Primary suture of wounds came in for universal condemnation. The still somewhat prevalent practice of tight plugging of wounds with gauze and an over-liberal dose of vaseline was also deplored. The rest of this discussion was concerned chiefly with the organization and equipment of mobile teams.

b. Penetrating Wounds of Chest

A trend from the more radical procedures of the last war to a more conservative attitude was the most striking feature of the discussion. In hemothorax, although the ideal treatment is early aspiration with air replacement, the best procedure in forward areas under prevailing conditions is simple wound toilet only and evacuation, provided the base hospital is likely to be reached within a week. The great majority of patients with hemothorax do not exhibit dyspnoea at rest and travel well. In a minority, early aspiration is required. The risk of infection is greatly lessened by the oral administration of sulfa drugs along the line of evacuation, and by delaying aspiration until it can be done under optimum conditions at the base. Removal of intra-thoracic foreign bodies is rarely necessary in forward surgery; even for later removal the indications are probably few.

c. Early Treatment of Burns

There was much adverse criticism of tanning procedures in forward areas, since sepsis, often severe, is an almost invariable sequel. Other local applications advocated were sterile vaselined lint strips (with or without dusting of the area with sulfanilamide or sulfathiazole), picric acid, saline compresses, and cod liver oil. Even the value of tanning in base areas was doubted by some. It seems there is little to choose between the various methods of local treatment of first and second degree burns so long as a high standard of cleanliness can be maintained.

d. Open Fractures of the Femur

Not only in this discussion, but in several others there was both great commendation of the value of the Thomas splint and criticism of its not infrequent faulty use and application. The standard Thomas splint technique described in the Royal Army Medical Corps training manual covers all the points raised, but re-emphasis is needed on one or two points. In first aid and during evacuation, only enough extension should be applied to assist immobilization. It is the comfort of the patient, not the reduction of his fracture, that is all-important until he reaches the base. Skin extension strapping should take the place of first aid clove hitches, halters, skewers, and foot clamps, and the sooner the better. A common fault in applying the splint has been looseness and faulty padding of the upper ring. The leather ring should not have superadded padding, and stability must be maintained by a long immovable pad between the outer part of the ring and the thigh. Too often this pad does not retain its position during transport. A long pad of firmly bandaged wool is advised for this. Adequate fixation of splint to stretcher is also highly necessary for proper immobilization. Fixation of limb to splint by encircling plaster of paris bandages is helpful, but sores or worse are apt to develop if the limb is insufficiently padded. Splitting the plaster when set is the safest course. The plaster of paris hip spica was mostly condemned as an immobilizing agent in evacuation.

To return to the compound fractured femur, it still remains one of the greatest problems of war surgery. Treatment of initial shock, provision of ample dependent drainage at the initial operation because of the depth of the lesion, and comfort during evacuation are life-saving measures which far outweigh in importance the position of the bone fragments.

e. Penetrating Wounds of the Knee Joint

Some guiding principles were laid down. In the past, through-and-through gunshot wounds with small entrance and exit apertures were not excised at all; it is impossible to be thorough with the whole tract. More extensive wounds frequently reach the surgeon after a delay which precludes proper debridement. Then the only necessity is to ensure adequate drainage. The surgeon at the base is often confronted with the problem as to whether a joint is or is not infected on the arrival of the patient a week or two after infliction of the wound. Thorough immobilization and expectant treatment for a few days is probably the best course at this juncture. All are agreed on the necessity for extensive incisions once the joint has to be opened. To prevent gravitational spread of pus into the thigh, it is wise to lower the limb till the heel is just off the bed.

f. Emergency Amputations

The indications for primary amputation (i.e., on or about the first day) are quite straightforward and generally agreed upon. But they are not so easy at a later date. Amputation for infection is a most difficult decision. Greater risks can be taken in upper limb cases, firstly, because the upper limb is so much the more precious, and secondly, because septic absorption is so much less marked than in the lower. There was some little disagreement in the discussion as to whether secondary hemorrhage should be such a relatively frequent indication for secondary amputation. There are infrequent cases of secondary hemorrhage unassociated with bone damage and with but slight sepsis. For these, local ligature at the most is sufficient. In the more common form, associated with gross bone or joint sepsis, one point of view was that amputation is too quickly resorted to, the other was that lives are lost by undue delay. A general working rule adopted by most was as follows: expectant treatment, with minor local measures, for any initial small hemorrhage; local, or if impossible, proximal, ligature for the first large hemorrhage; and amputation for a second large hemorrhage. Stressed and restressed by speakers was the necessity for saving every possible inch of limb on amputation. There is no telling how much the inevitable sepsis in war conditions will eventually further shorten the limb. Sites of election do not exist in war surgery. To anticipate the sepsis, most prefer not to perform the guillotine operation, but to cut flaps and either sew these back temporarily or insert stitches which may be tied after a few days. Early skin traction is useful. When decisions have to be taken regarding the upper limb it is well to remember that a few stumps of thumbs and fingers are better than the best prosthesis.

g. Wounds of the Upper Face

The audience at this meeting was reminded that the skin of the face is too precious ever to be excised in wound treatment and that because of this, and to avoid possible later powder and tattoo marks, such wounds must have a more thorough cleansing than others. Any piece of bone with soft tissue still attached must be retained, firstly because its recovery is probable, and secondly because its removal causes deformity. Suturing of facial wounds is indicated only where the wound is recent, where there is no loss of time, and where fine needles and sutures are available. Otherwise it is best simply to apply a sulfanilamide, tulle gras, and saline dressing, and to transfer the patient to a plastic surgery center. In plastic surgery, any attempts to close a gap where there is loss of tissue must be resisted. Big stitches under tension lead to serious sepsis and irreparable scars.

Protection of the cornea is the principle underlying treatment of wounds of the eyelids. A sulfanilamide dusting, tulle gras and saline dressing is advised and twice daily the eye is irrigated with normal saline and liquid paraffin drops instilled. Vitreous loss is the greatest danger to the future integrity of the eye after penetrating wounds. Such patients should be kept lying and not treated as walking wounded. The risk of sympathetic ophthalmitis in eye wounds is almost negligible up to nine days, and patients therefore should be sent back to have major operations in the best possible surroundings..

h. Wounds of the Head

When head wounds are seen early (up to about thirty-six hours after receipt), closure is advised after cleansing with a stab drain down to the bone only. In heavily infected cases, seen several days later, gentle cleansing should be done; the removal of any superficial pieces of bone then will also help remove highly infective material such as hair and dirt, which also prevent drainage. Although more a matter of argument, there is a good case for the closing of these late wounds also; since protection of the brain is so important. The large potential space for effusions between scalp and bone is a great safety factor, and the scalp has tremendous powers of healing. Routine lumbar puncture on the second or third day not only relieves pressure but gives a good idea of what is happening within the skull. Only a minority of indriven fragments and metal causes abscesses; interference with these should therefore be limited.

i. Treatment of Infected Wounds

Great tribute was paid to the value of blood transfusion for patients with severely infected wounds, especially in the chronic suppurative stage, and also even earlier. Such transfusions must be large, even massive, in amount. Most agree that one large transfusion is better than repeated small ones. The loss of plasma proteins in copious discharges raises the question of making good its loss, and this was described as best accomplished by a T.B. diet with fresh fruit and plenty of fluids.

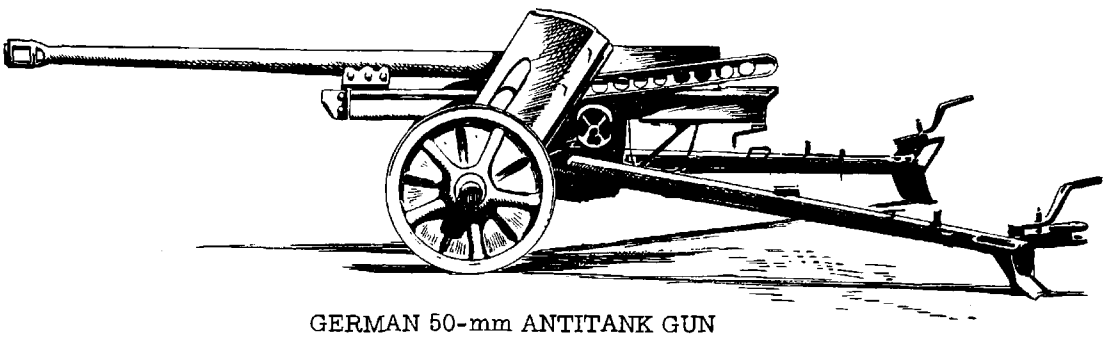
A case was presented for less conservation in dealing with these infected wounds and for a return to irrigation procedures. The solution advocated is 0.25 percent electrolytic sodium hypochlorate. This is diluted ten times for continuous irrigation, only twice for intermittent lavage. Many of those present seemed content with dressings consisting usually of a powdering of sulfanilamide, a layer of tulle gras, and a covering of saline gauze.

There is some evidence to suggest that improved drainage plus Proflavine (powder) has been instrumental in clearing up resistant infection (usually staphlococci) in late stages.

## 16. GERMAN 50-MM ANTITANK GUN 38

### a. General

This weapon was introduced in 1941 to replace the 37-mm antitank gun. It is one of the most effective German antitank guns at present in service. The following sketch illustrates this gun.



GERMAN 50-mm ANTITANK GUN

The barrel is of monobloc, loose-barrel construction, and is fitted with a muzzle brake.

The carriage is of the split-trail type, and is carried on solid rubber tires 31 1/2 inches in diameter. There is a third detachable wheel to increase the speed of bringing the gun into action.

The shield consists of two 4-mm sheets of armor plate spaced about 1 inch apart. The left side of the shield has a sighting port.

The gun is normally towed by a half-track. There is also a self-propelled type. Recently, the gun, without a muzzle brake and electrically fired instead of by percussion, has been mounted in the latest type of Mark III tank.

The gun fires AP shell, and AP 40 shot. The latter is a light shot with a ballistic cap and a tungsten carbide core, which has a good armor-piercing performance at ranges under 500 yards. The following table gives the complete data on the three types of ammunition.

| Type | Weight of complete round | Length of complete round | Weight of projectile | Fuze | Identification |
|---|---|---|---|---|---|
| AP tracer shell | 9 lbs 3 oz | 21.4 in | 4 lbs 9 oz | Base | Projectile black |
| HE shell | 7 lbs 3 oz | 23.7 in | 3 lbs 15 oz | Nose | Projectile dark green |
| AP 40 shot | ----- | ----- | 2.025 lbs | ----- | Projectile black |

The following figures show the penetration of the two different types of armor-piercing shells.

(a) AP shell:

60-mm (2.36-in) homogeneous plate at 250 yards at 20°;
60-mm (2.36-in) homogeneous plate at 1,300 yards at normal.

The above figures are probably conservative, and were deduced from trials with a limited supply of ammunition.

(b) AP 40 shot:

90-mm (3.54-in) homogeneous plate at 330 yards at 20°.
64-mm (2.54-in) homogeneous plate at 440 yards at 20°.

The above figures are unconfirmed.

b. Particulars

| | |
|---|---|
| Muzzle velocity (AP) | 2,740 f/s |
| Muzzle velocity (AP 40) | 3,940 f/s |
| Muzzle velocity (HE) | 1,800 f/s |
| Maximum range (HE) | 2,640 yds |
| Maximum range (AP) | 1,540 yds |
| Maximum range (AP 40) | 770 yds |
| Effective range (AP) | 1,000 yds |
| Effective range (AP 40) | 500 yds |
| Effective range (HE) | 2,000 yds |
| Rifling | 21 grooves, twist 1 turn in 32 cals |
| Depression | -18° |
| Elevation | +27° |
| Traverse | 65° |
| Weight of complete equipment | 2,016 lbs |

## 17. GERMAN MOBILE TRUCK MAINTENANCE COMPANY

According to a prisoner of war, the Germans have employed in North Africa a special mobile maintenance company, used solely for the repair of trucks. The company has a strength of about 100 officers and men. It is fully motorized, being equipped with 15 vehicles; two of these vehicles are machine-shop trucks which are equipped with lathes, drilling machines, and welding equipment. The unit, while equipped with trucks fitted with cranes, very seldom performs recovery functions. Repairs are carried out in a large tent in which there is sufficient room for the company's 20 machinists to work at once.

## 18. U.S. RATIONS AND KITCHEN EQUIPMENT UNDER DESERT CONDITIONS

Recently, the British forces operating in the Middle East theater, were given the following American rations and equipment for testing: 24 "K" rations, 6 packages of "M" rations, one 2-piece enameled cooking-utensil, and one portable pressure stove. The results of the field tests under desert conditions are noted below.

The "K" ration was well received. Several features responsible for this satisfaction were: its excellent waterproof packing, high food value, variety, absence of waste connected with its use, and the attractive way in which prepared. The only serious questions raised concerning its fitness for use in the Middle East were its availability and the date of the canned foods.

Specifically, the report of a tank crew that used the ration was that it satisfied all hunger and energy needs, was appetizing, nothing was wasted, no ill effects were noted, the packing protected the contents from sand and oil, and the weight and size of the ration was less than the one customarily used. The only unfavorable reaction was the increased thirst resulting from eating the biscuits and graham crackers. In view of the fact that these crews were on one-half gallon a day water rations for drinking and washing, this is a serious complaint

The comments concerning the "M" ration in general are that the packing is excellent, stands up well in transport, and under usual conditions its contents are adequately protected. The lemonade powder had attracted moisture and became hard and difficult to use. All other ingredients were in good condition for use. The amount of water required, and the time required to cook a meal, detract considerably from its value as a ration in this particular theater.

The cooking utensils proved to be an excellent set of compactly packed and easily cleaned utensils.

The portable pressure-stove was a failure. The chief defects observed were the absence of a wind screen, and the small size of the pressure chamber. In the desert, a stove must have a wind screen of some sort to prevent the flame from being blown out. Pressure could not be maintained for more than 30 seconds, and this required the attention of one man for continual pumping. The fuel used was unleaded, 70 to 80 octane gasoline. The fuel jets were frequently clogged from sand and oil.

## 19. REPORTS FROM THE FIELD ON PERFORMANCE OF EQUIPMENT

No piece of equipment can be said to be satisfactory until it has successfully met the test of combat conditions. Also, relatively minor modifications of equipment may greatly improve its performance. The man actually using the equipment is one of the best sources for determining its quality and ways in which it can be improved. In order to tap this source, the German High Command on April 17, 1942 issued the document set forth below. It will be noted that soldiers

who think they have useful suggestions to make are to communicate them directly, and not through the usual channels.

* * *

To Army Groups, Armies, Corps,and Divisions for Distribution down to Battalions.

War demands continual improvements in weapons and equipment. New ultra-modern weapons are now being produced. These will show the world our superiority to the enemy in armament also.

To hold this advantage, and if possible even to increase it, is an important condition for final victory.

The basis for the creation of new weapons and for every improvement in existing equipment must be the practical experience of the front-line soldier. He actually realizes the advantages and disadvantages of his weapons and equipment, and knows best the requirements of battle. The quickest possible interpretation of this front-line experience and its immediate utilization in armaments production must be ensured. The Minister for Armaments and Munitions has set up a special board to test immediately all practical suggestions and proposals from the front for the improvement of our weapons and the invention of new ones, and to pass them on to the actual manufacturers.

Any soldier who thinks that he can make any useful suggestions or proposals in regard to weapons and equipment on the strength of his experiences in battle is authorized and ordered to communicate them direct, and not through the usual channels, to the

Headquarters of the Armed Forces
Army Branch.

This order is to be repeated to all front-line troops.

Signed: Adolf Hitler.

## 20. GERMAN WIRE COMMUNICATION IN NORTH AFRICA

The following report was made after observation and inspection of the system of wire nets used by the Germans in North Africa.

### a. General

The German use of wire communication is very flexible, and the extent of use varies according to the time available, conditions, and the tactical situation.

At periods when the troops are not engaged in active operations, a complete wire net is laid, and radio is used only by forward patrols and as an emergency means in case of interruptions and excess traffic over the wires.

Wire is not used as a means of communication during periods of inactive operations when mounted messengers are available. In forward areas, the Germans take every precaution against interruption of messages sent over the wire nets.

It is definitely known that in at least one German battalion, the orders issued to it specified that operational traffic was to be sent by telephone or telegraph until the latest possible moment: i.e., until the lines were cut by enemy action, and only then was radio to be used.

The following notes concern the wire network of the German Afrika Korps from June to October 1941. During this period there were no important operations; hence, what follows probably shows the fullest extent to which wire has been used in Africa by the Germans.

### b. Wire Nets

The wire nets for a large unit like the Afrika Korps may be divided into four classes.

(1) Local lines to the individual staff officers, corps headquarters, and communications personnel.

(2) Lines direct to lower units, corps troops, corps artillery, etc., which are controlled directly by corps headquarters.

(3) Lines to the main units (divisions) under the command of the corps headquarters. These units themselves had large switchboards, through which corps headquarters could communicate directly with the regiments and battalions of the particular division.

(4) Lines to large centrals at fixed geographical points, such as Capuzzo, Gambut, and Gazala. These centrals were not in any unit headquarters, but provided a medium whereby corps headquarters could contact organizations not directly connected with it.

It must be noted, however, that there is no very clear distinction between (3) and (4) above. There are frequent instances of division switchboards acting as intermediaries between corps headquarters and non-corps divisions, or even of fixed centrals doing this, in addition to their normal function as the central exchange for their own regiments. Thus, in July and early August, the Trento Division switchboard carried the Afrika Korps communications to the Afrika Korps headquarters' switchboard at Gambut and Acroma, and to other Italian divisions such as the Brescia and Pavia (none of the Italian divisions belonged to the Afrika Korps.) In June, the Afrika Korps actually had no direct wire to the German divisions under its command. These were contacted through the Trento switchboard. Similarly, in September, the Bologna Division had nearly all the German heavy artillery units as subscribers, while at the same time the Afrika Korps headquarters' switchboard provided wire to the XXI Italian Army Corps, the Brescia and Littorio Divisions, and fixed centrals at Acroma and Gazala.

Furthermore, no distinction is made in the circuit diagrams between unit switchboards and fixed centrals.

Another interesting fact about the function of unit switchboards is that comparatively minor units frequently had more important units as subscribers. In August, for example, in the 15th Armored Divisions's wire net, the 1st Battalion, 33d Flak Regiment was the central for both the 15th Motorcycle Battalion and the 104th Motorized Infantry Regiment.

c. Extent of Afrika Korps Wire Communications

The comprehensive wire net developed after a period of static warfare can be shown by taking each of the four categories separately.

(1) Local Switchboard

In July there were some 21 lines from the Afrika Korps staff switchboard. The subscribers were either individual staff officers, or the officers of the various sections of the staff. Five or six additional lines were used for communications personnel (wire maintenance sections, etc.).

(2) Lines Direct to Corps Switchboards

The number of these lines varied according to circumstances. At one period in December, the Afrika Korps seems to have been acting as a fixed exchange for the Italian division at Bardia, and this involved a number of extra lines to installations and detachments. Normally, however, there were about six of these lines, and the units served were AA batteries protecting the headquarters, corps signal battalion, the intercept company, the air cooperation headquarters, and at some periods a reconnaissance unit and an airfield.

(3) Lines to Unit Switchboards

These lines again varied considerably. In June, 1941 the Afrika Korps had no direct lines to its own divisions. Instead, these were contacted through the Italian Trento Division. In October, there were direct lines to switchboards of all three German divisions, and the corps headquarters, while all Italians units were contacted through fixed centrals.

(4) Lines to Fixed Centrals

Early in the period the Trento Division acted as the most important fixed central in the network, and the corps had direct lines also to central exchanges at Gazala and Acroma. During July and early August, the Trento Division and Capuzzo were the only centrals (apart from those of the German divisions) to which the Afrika Korps was directly linked. In mid-August the Bologna Division took over the complete role of the Trento Division. But in September and October, Afrika Korps had direct lines to two fixed centrals, Gambut and Capuzzo, which acted as intermediaries to all units not on the German division exchanges. These centrals correspond with the "North" and "South" sectors into which the Germans divided their main defensive area.

In the final stage of development of this network, after 3 months of position warfare, Afrika Korps had local lines for its various staff sections and staff officers, direct lines to six or seven corps troops units, lines to the switchboard of the corps headquarters, and of all three German divisions, whence lower echelons and units could be called, and finally lines to two large fixed centrals at Gambut and Capuzzo through which they could contact the main Italian units, smaller fixed exchanges, and other German units not covered by the corps wire net.

d. Divisional Wire System

A similar development is shown by the circuit diagram of the 15th Armored Division for the same period. There was a staff switchboard with up to 20 lines: direct lines to small units (AA, communication, medical companies, etc.); lines to main units, whence smaller organic units could be contacted; and lines to main exchanges like the Afrika Korps, or to Gambut for rear and lateral communications.

e. Subsequent Examples

Another circuit diagram showing the communications of the 155th Light Infantry Regiment from April 20, 1942 is interesting as an example of the German wire system.

The Afrika Korps had moved shortly before the date mentioned above, and from the new position had communications only with the 15th Armored Division, 109th Motorized Infantry Regiment, and an Italian division. The old switchboard had not been moved, and was connected to the new one through a fixed central.

This central and the old corps switchboard together provided the new installation with a means of communicating to the 21st Armored Division and other units.

The 90th Light Division, the unit to which the 155th Light Infantry Regiment was attached, had communication to the rear only to the XXI Italian Army Corps, to which command it was at this time attached. No lines to the front were shown from the 90th Division, and a radio net including the 155th Light Infantry Regiment is shown on this circuit diagram.

The 155th Light Infantry Regiment was amply supplied with forward wire lines, but had none to the rear except indirectly via a battery of the 611th Antiaircraft Battalion to the 104th Motorized Infantry Regiment, and thence to the Afrika Korps. The 155th Light Infantry Regiment had the following wire circuits:

(1) A staff switchboard with lines for the regimental commander, adjutant, signal detachment, observation post, etc;

(2) Lines from the switchboard terminating at telephones to the supporting artillery troops and antitank units;

(3) Lines to switchboards running to the two battalions of the regiment simplexed for telegraph.

The battalions had their own local staff lines and lines direct to company headquarters.

f. Forward Wire Communications - Infantry Battalion

Two circuit diagrams of the 1st Battalion, 115th Motorized Infantry Regiment, dated May 27 and June 16, 1941, respectively, show the wire net of an infantry battalion in the front line in Libya.

The earlier diagram shows rear and lateral lines from battalion headquarters to regimental headquarters, a neighboring battalion, and an artillery battery. On the later diagram there is an additional line to the 2d Battalion, 115th Motorized Infantry Regiment. On both dates, the line to regimental headquarters was simplexed for telegraph.

Communications within the battalion were, at the earlier date, as follows: lines from battalion headquarters to 1 and 3 Companies, and radio communication to 2 Company. Both 1 and 3 Companies had lines to 2 Company, and each company had a line to an attached mortar or machine-gun section. In addition, battalion headquarters had lines to two observation posts manned by elements of the heavy weapons company, and from one of these,there was a line to a platoon of the cannon company.

By June 16, the three companies had been compressed to two, a "Left" Company and a "Right" Company, each with one platoon in front. Lines to platoons and sections of the heavy weapons company no longer went back from

company headquarters, but forward from rear observation posts, and an additional line was provided from battalion headquarters to an engineer platoon. The radio net from battalion headquarters to 2 Company was no longer shown.

The 33d Artillery Regiment's wire communications were shown in a circuit diagram to be as follows:

(1) A switchboard with a line back to division headquarters, and local lines to the staff officers;

(2) A second switchboard with lines to each of the three battalions and to the observation posts.

Radio was used for communication between command vehicles of the regiment, and the battalion commanders and observation officers in tank-supporting artillery units; wire cannot be used for these purposes.

## GENERAL

### 21. SUMMARY AND EVALUATION OF OPERATIONS IN EGYPT

October 23 to November 7, 1942.

a. Summary of Operations

On October 23, Axis armored divisions were disposed in two groups as follows: the 21st Panzer and the Italian Ariete in rear of the south end of the line; the 15th Panzer, the Italian Littorio, and the German 90th Light (less certain reconnaissance elements), in rear of the north end of the line.

Beginning October 27, the Axis armored forces which had been concentrated in the north counterattacked vigorously, particularly against the north end of the British line. This was unsuccessful due to prior Axis losses and stiff British resistance.

On October 30, the 21st Panzer Division moved north and joined the 90th Light Division and the two armored divisions in that area; the Trieste Division (motorized), the only available reserve on the entire front, was committed in the north.

By the morning of November 1, the British completed regrouping the X Armored Corps, and in the evening the Corps attacked due west. The main effort of this attack was directed frontally against the 15th Panzer Division and the Italian Littorio (Armored) Division. Both of these Axis divisions suffered heavy casualties. The British attack penetrated into the Axis rear areas and isolated one regiment of the German 164th Division along the coast. The 21st Panzer Division at this time was also along the coast, west of the 164th Division. The Axis forces counterattacked desperately and lost heavily in tanks and antitank

guns in combat between armored units. Although suffering heavy losses, the 90th Light and the two German Panzer divisions with their depleted forces succeeded in withdrawing to the west.

A large proportion of the Italian forces in the south, lacking transportation, ceased resistance and they, together with miscellaneous German troops, were captured by the British XIII Corps.

b. Change in German Commanders

It is interesting to note that a change in German commanders during this period probably had a marked influence on the Axis conduct of the operation. At the beginning of the period, General Stumme was in command of the Afrika Korps in Marshal Rommel's absence. It was during his command that the Axis armor was split into two groups. On October 26, Stumme was killed in action and General Thoma took command. He initiated the concentration of his armored units for employment as a striking force.

c. Evaluation of Axis Tactics

Concentration of effort has always been a basic German tactical principle. It is almost axiomatic with German commanders to employ their armored units, specifically tanks, in mass to deliver hammer blows.

Hence it is difficult to understand why General Stumme divided his armored force into two parts, one south and the other north, without keeping an armored force in general reserve to deal with a British breakthrough. Perhaps terrain and lack of adequate facilities dictated his choice. Nevertheless, his reported disposition against an alert and well-equipped enemy possessing superior air power invited the Axis defeat that followed.

General Thoma's concentration of his armored forces apparently came too late. The British not only were prepared to take on the Axis counterattacks but they were able to renew the offensive at the proper moment, when the Axis forces were disorganized and expended as a result of these counterattacks.

d. Evaluation of British Tactics

Improvements in British tactics have been noted in the following respects:

(1) Intense and effective use of artillery against tanks and antitank guns.

(2) Judicious use of armored units concentrated for mass employment.

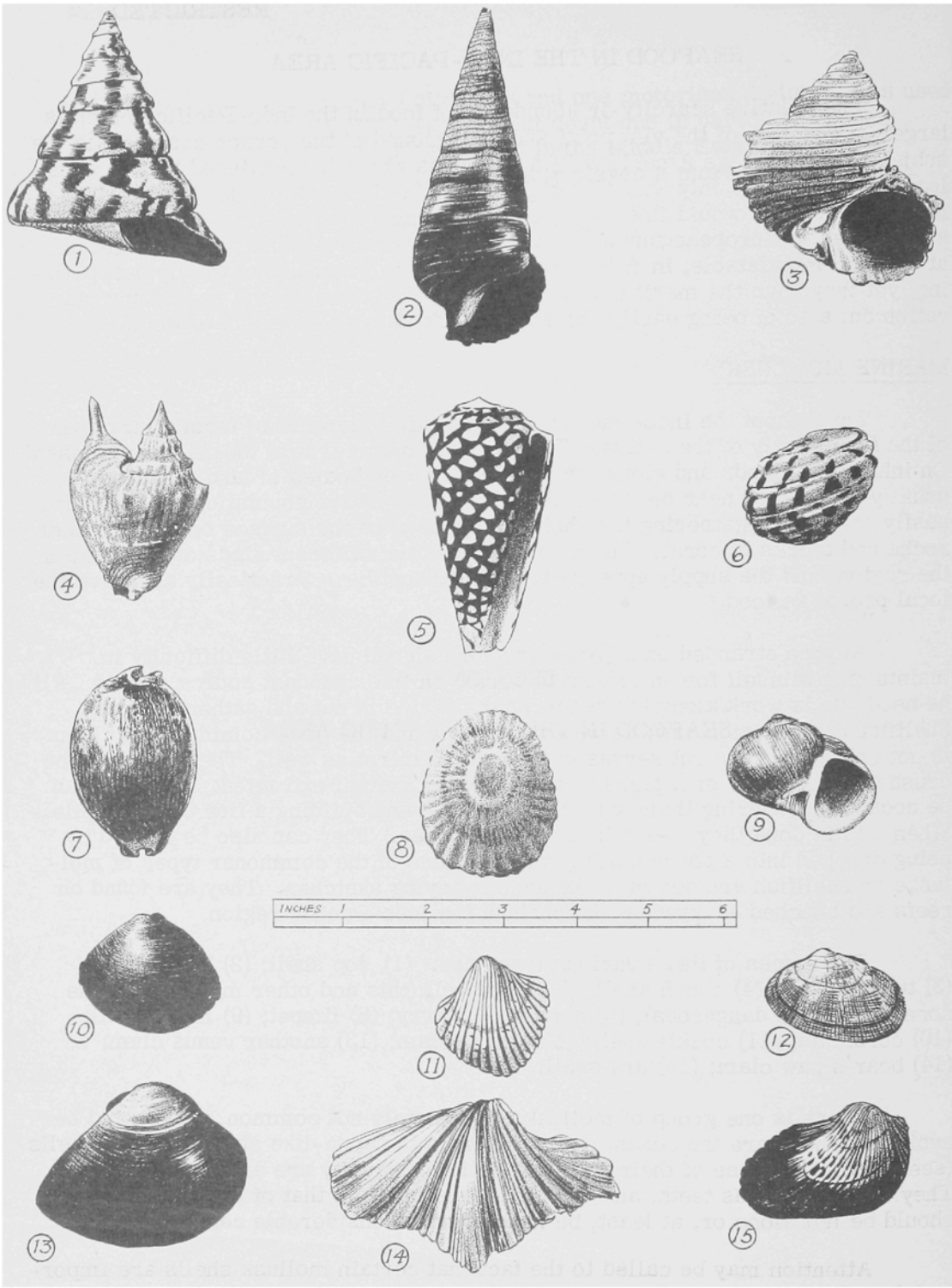
(3) Coordination between tanks and infantry movements.

The conduct of this campaign by the British was at marked variance with that of other desert operations. Previously, armored regiments, reinforced, were used independently as striking forces, but in this action the British X

Corps, composed of two armored divisions and one motorized division, was used as a unit. This change in tactics was without doubt due in part to the recent sweeping changes in British High Command in the Middle East; but lessons learned in previous desert operations probably played a more important part.

# SECTION II

# SEAFOOD IN THE INDO-PACIFIC AREA




SHELLFISH--INDO-PACIFIC AREA

## SEAFOOD IN THE INDO-PACIFIC AREA

The relative scarcity or abundance of food in the Indo-Pacific region is largely a question of the viewpoint and background of the person considering the subject. The average American in most cases would be convinced that in some localities there not only was a scarcity but actually a total lack of food, while a native of the area would find plenty to satisfy his requirements. To the taste accustomed to European forms of food, many items available locally might not at first seem palatable, in fact would probably be regarded as wholly unappetizing; yet they have the merit not only of sustaining strength and preventing starvation but also of being easily obtained. Seafood is an excellent example.

### MARINE MOLLUSKS

Throughout the Indo-Pacific area, shellfish (mollusks) form a large part of the food supply of the natives. This is particularly true of the marine mollusks. On inhabited islands and along the coasts of larger bodies of land, villages usually are placed near beaches. At ebb tide the native population will be found busily engaged in gathering the shellfish exposed on the surface or hidden under rocks and blocks of coral. There are hundreds of different kinds of mollusks in the region, and the supply appears to be inexhaustible. Practically all serve the local people as food.

Anyone stranded on a beach or shore should have little difficulty in maintaining himself for an indefinite period on this abundant source of food. All he need do is work along the beach when the tide is out and gather a supply. Shellfish can be eaten raw, as we eat oysters, and the juice coming from clams is not only nutritious but serves to quench the thirst as well. The shells can be crushed with a rock or a piece of wood and the animal extracted. Shellfish can be cooked by covering them with sand or earth and building a fire over the pile. When this is done they steam in their own juices. They can also be cooked by being dropped into a pot of boiling water. Some of the commoner types of mollusks or shellfish are shown in the accompanying sketches. They are found on reefs and beaches everywhere throughout the Indo-Pacific region.

The names of these various types are: (1) top shell; (2) horn shell; (3) turban shell; (4) conch shell; (5) cone shell (this and other members of the cone family are dangerous); (6) nerite; (7) cowry; (8) limpet; (9) moon shell; (10) corbicula; (11) cockle shell; (12) venus clam; (13) another venus clam; (14) bear's paw clam; (15) ark shell.

There is one group of mollusks, fortunately not common, that should be avoided. These are the cones, so named from the cone-like shape of their shells (see No. 5). Because of their characteristic form, they are easy to recognize. They have poisonous teeth, and their bite is similar to that of snakes. They should be left alone or, at least, be handled with considerable care.

Attention may be called to the fact that certain mollusk shells are important for other purposes. For example, the mountain tribes of the interior of New Guinea, especially in the western half of the island, regard cowry shells (No. 7) as the most valuable medium of exchange. They use the small shells,

those that are about three-quarters of an inch long and look much like a large-sized coffee bean. A man with a pocket full of them could obtain from the pygmy tribes located in that region all the necessities required to satisfy his wants for many months. These people have little regard for any other articles that might be offered for trade purposes. The pygmy-like tribes of the central mountains in the Dutch half of New Guinea are a friendly and helpful people. Even individuals may appear among them in safety. They are industrious agriculturalists, with considerable surpluses of taro, yams, and sugar cane that could be obtained by use of the cowry shells in barter. On the other hand, except for limited areas near the coast, the larger Papuan peoples of the lowlands and the northern mountains are likely to be dangerous to small parties of strangers. The money cowry is a beautiful shell, light-straw color above, and white at the sides and below. Most of the shells used for that purpose come from the Malabar Coast in southwestern India and from the Maldive Islands.

## LAND AND FRESHWATER MOLLUSKS

Land and freshwater mollusks can also be used, but they are rather difficult to obtain. There are a great many forms, including the snails, occurring under different conditions. Some kinds are found only in the hills; others, in the valleys. Some prefer the recesses of the woods, and others the open meadows. Some varieties cluster around limestone rocks; others prefer sandy or clayey districts. Some live only in still or gently flowing waters, while others are never found except where the current is strong and rapid. All of these forms are edible and can be used in the same manner as the marine mollusks. It is safer if the freshwater forms are cooked before eating, as there is some possibility of pollution from the places that they inhabit. As a rule, however, the land and freshwater mollusks are so hard to find that unless a man happened to run across a concentration of them it would be a waste of time to try and locate them, especially since other forms of food are usually to be had.

## CRABS AND LOBSTERS

In addition to the mollusks, crabs and lobsters are to be found in the crevices and among the rocks on reefs and rocky shores. Included among the crabs is a large swimming variety that is related to our Chesapeake Bay blue crab (they turn red on being cooked). This form is distinguished by the paddle-like shape of the last pair of legs. Crabs and lobsters can be caught at night, as that is the time when they generally move about. They may be stunned with a stick or stone, caught in the hands, or trapped. Traps baited with fish or animal flesh are commonly used by commercial crab and lobstermen, but probably would not be practical except in the case of more or less permanently established shore parties. A dip-net, fashioned by making a hoop from a shoot or small branch and interlacing strips of palm leaves or fibers, or a net made from an article of clothing, is most useful in taking these creatures. Spiny lobsters or sea crawfish do not have large pincers on their front legs, but do have "thorns" or spines on their backs. These can produce severe lacerations if seized by the bare hand. Hence the hand should be protected, if possible, by a stout glove or some equivalent. Spiny lobsters may be caught by placing a dip-

net behind them and, with the foot, touching their antenna, the long flexible processes projecting from their heads. This causes the creature to move backward quickly into the net or bag, which must be yanked up immediately. Crabs also occur in freshwater lakes and streams, both in the mountains and on the plains, and frequently travel about on dry land. Some, such as the purse-crab of the East Indies, may be found on the trunks of trees.

As far as is known, all crabs and lobsters, whether marine, freshwater, or the land forms, are fit for human consumption provided they are fresh. Salt-water forms can be eaten raw with little likelihood of bad effects, but all land and freshwater crabs should be thoroughly cooked. The land crabs, particularly in Asia and the closely adjacent islands, are infected with lung parasites that are often fatal to human beings if the crabs are consumed in an uncooked condition. The best way to cook crabs and lobsters is to drop them alive into boiling water. Thus there is no danger of decay before cooking, and they become sterilized at the same time. The shells and pulpy gills are easily removed after cooking. Most people insist that the gills (sometimes called the deadmen's fingers) be removed immediately. Actually they are harmless and will cause no trouble if eaten. They have acquired a bad name because they are about the first spot to spoil, but all danger of this is avoided by immediate cooking and eating.

SHRIMPS

Another source of food is in the freshwater shrimps that abound in all the streams of the Indo-Pacific area. There are two major kinds, the larger forms with an elongated second pair of legs, often called crawfish by those not familiar with the proper technical terminology, and a host of smaller varieties averaging about an inch in length. Commercially, shrimps are taken in various kinds of traps baited with fish and meat scraps. They can be caught in other ways, however, in sufficient quantities to furnish an ample supply. Along larger streams,in the shallow places near the shore where water is nearly stagnant, masses of small shrimps may be found swimming about and be taken with hand nets. Best results are obtained by people working in pairs and standing in the water. One drives the hosts of shrimps towards the other, who dips them out with the net. In some areas the natives will dam a shallow, narrow stream, making a fairly water-tight barrier of branches, sticks, large leaves, mud, and sand. As the section downstream runs dry, the shrimps stranded there or hiding among and beneath rotten pieces of wood, branches, leaves, in the crevices between the rocks, and among roots or other debris, are collected. Fish and crabs are often obtained at the same time. The best yield, however, comes from bailing dry the many pools and puddles still remaining in the bottom of the stream bed. Anything that can be picked up to serve as a scoop is used to dip out the pools, or small dip-nets are made on the spot for that purpose. Where bushes grow along the edge of a stream, and the branches droop down so that some of the twigs and leaves are in the water, large catches are sometimes made by lifting the branches out of the water and catching the shrimps as they drop off the leaves. This produces better results if it is done at night, as the shrimps seemingly leave the bushes during the day.

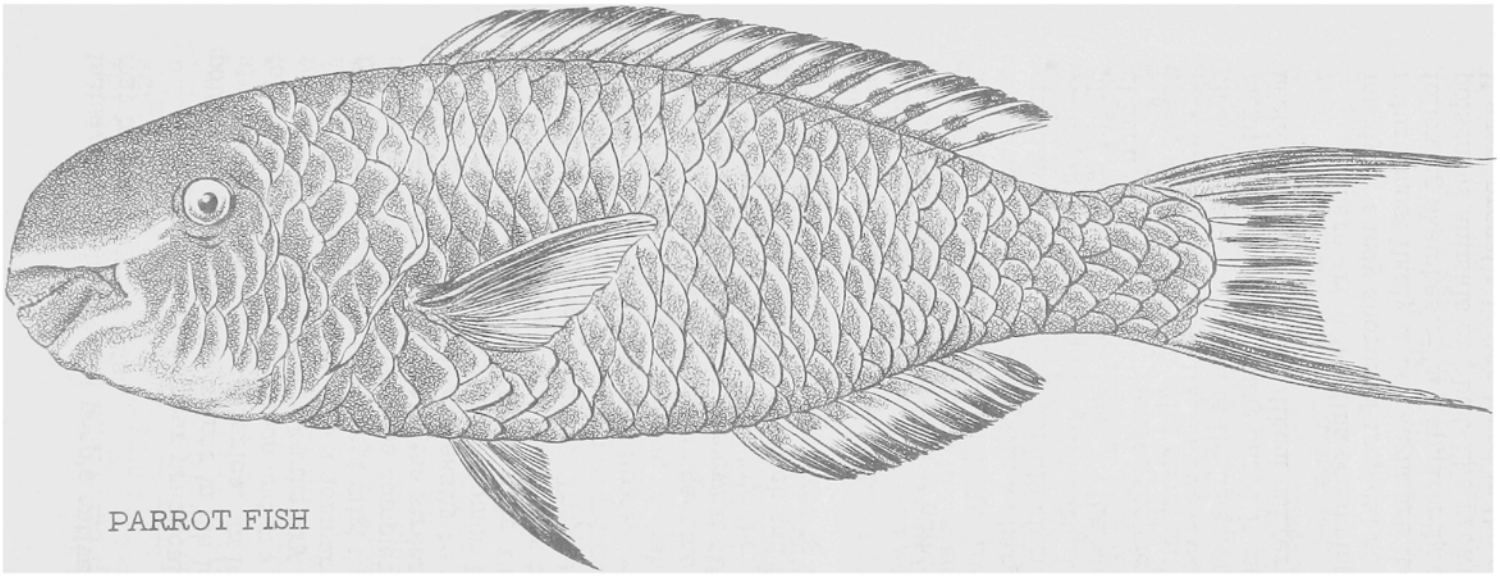
Shrimps usually are cooked by boiling. In the larger forms only the abdomen (the tail end) minus its shell is eaten. The shell is easily removed after cooking. The small forms make good soups or stews when cooked whole, but if they form too great a part of the diet and are eaten continually over a period of time, the shells may produce diarrhea. This can be avoided by straining the soups or stews before using or before adding some other bulky food substance.

Other small shrimp-like animals (the mysids, sometimes called opossum-shrimps) occur on both sides of the Peninsula of India in brackish water, lakes, and estuaries along the coast. They are particularly plentiful in Chilka Lake on the Orissa Coast, the east coast of India. Similar species, though perhaps in not as large numbers, should be found elsewhere in the Indo-Pacific region. The mysids swim in large shoals a short distance below the surface, keeping in the shadows cast by rocks or other objects. Each shoal has its own "beat" to which the majority of the members confine their movements. As a rule, each individual swims the whole length of the "beat" and turns when it comes to the end of it. Occasionally single members will turn at the halfway point, and some will now and then break away and swim out from the sides of the shoal, but they always return after going a short distance. The general tendency of the shoal is to move in an elongated figure eight. The "beat" is never more than one foot wide and may be from 3 to 6 feet long, its limits apparently being determined by the size of the shadows in which the shoal moves. The mysides can be caught by straining the water through a piece of cloth. The natives usually mix them with turmeric, obtained from the tuber or aromatic root of the turmeric plant, boil and dry the mass, and eat it with their rice.

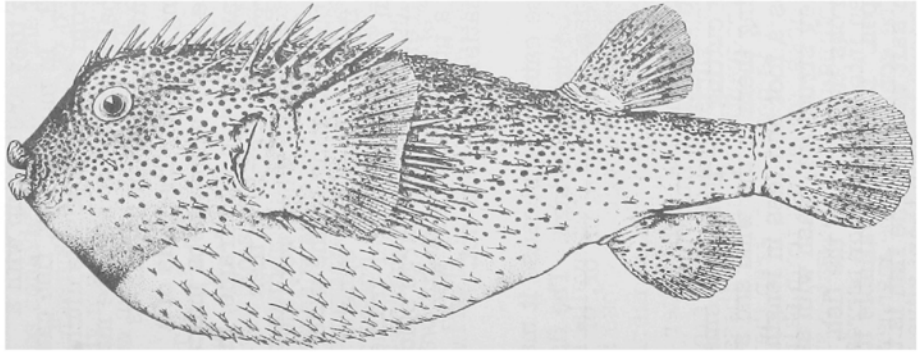
FISHES

Fishes are, of course, one of the most abundant types of food available on the reefs, in the lagoons, and in the sea. At night some species come close inshore and swim along the surface. By remaining still, a person can hit them with sticks or spear them with a sharpened pole as they surface. The outer margins of reefs usually contain channels, and on the surface of the reef are pools among broken rocks and coral blocks. Fish frequently swim into these places at high tide and leave as the water recedes. It is possible to trap them at such times by blocking the opening with rocks, sticks, or leaves from palm trees. Stones also may be built into low walls extending out into the water and forming an angle with the shore. Fish can be driven into this neck or narrow channel, and into a pool at its inner end, and there be confined in the manner mentioned above. In many cases it may be advantageous to keep them alive until needed, a fresh supply without danger of spoilage thus being provided.

There are a few fish occurring along rocky and coral reefs, and along the muddy or sandy shores of tropical seas, that may be poisonous. Those of this nature most likely to be caught are the parrot fish and the puffers, shown in the following sketches. They apparently develop this condition by feeding on small poisonous animals or plant-like growths along the shores. The condition seldom, if ever, prevails in fish found in the open sea. To be on the safe side, the puffers and parrot fish should not be eaten unless it is certain that they are not contam-



PARROT FISH



PUFFER FISH

inated. If it is known that people native to the area are using these fish, they may be regarded as safe.

Freshwater fish occur practically everywhere. Probably none are poisonous except for the spines in the lower front fins of the catfish, which are similar to the catfish in America. In Indo-Chinese countries, air-breathing forms of this fish are common and are found even in the ricefields, in areas where that grain is grown. As the dry season comes on, these fish bury themselves in the mud and go into a dormant state. They can live out of water indefinitely as long as they are kept slightly moist; often they are dug up with a spade from what appears to be completely caked soil. In most areas, fish can be seined not only from most of the streams but also from small, roadside ditches. Simple seins or dip-nets can easily be woven from palm leaves or even be made from a shirt. In some of the Solomon Islands, the natives have an ingenious method of catching fish. They make a hoop by lashing together the ends of a shoot or small branch, and then place the hoop in the forest where webs indicate the presence of large spiders. The spiders then weave a net in this frame, the web being heavy enough to serve the purpose. A large ant or grub is then placed in the frame, and it is floated on the surface of a pool. When wet, the strands of the web do not show. A fish seeing the "bug" floating on the water makes a strike for it, its teeth become entangled in the web, and it is caught. In parts of New Guinea, a somewhat different system is used. A larger frame is made, and the natives then go into the jungle where there are many large spider webs. By passing the frame back and forth through a number of these webs, enough of the strands become fixed to it to make a satisfactory dip-net.

The flesh of any freshwater fish should not be eaten raw because it may contain intestinal parasites that will have ill effects on human beings. The fish can be broiled over open coals if nothing is available to cook them in, or, of course, can be fried or boiled.

When more fish are caught than are required to satisfy immediate needs, it is possible to preserve them for a time by cutting the flesh into small, thin strips, washing them with salt water, and hanging them in the wind and sunshine to dry. Another method, suitable for varieties a foot and less in length, is to slit open the fish, remove the entrails and boney structure, wash with salt water, and cut diagonal slits about an inch apart across the sides of the fish, preferably from the inside where it has been laid open. If salt is available it is rubbed into the cuts, if not they may be washed with salt water. The fish is then hung in the sun or placed on the surface of a rock with the cut portions exposed. If dried on rocks they should be watched and guarded against ants and other vermin. Under ordinary conditions these methods should preserve the catch for several days.

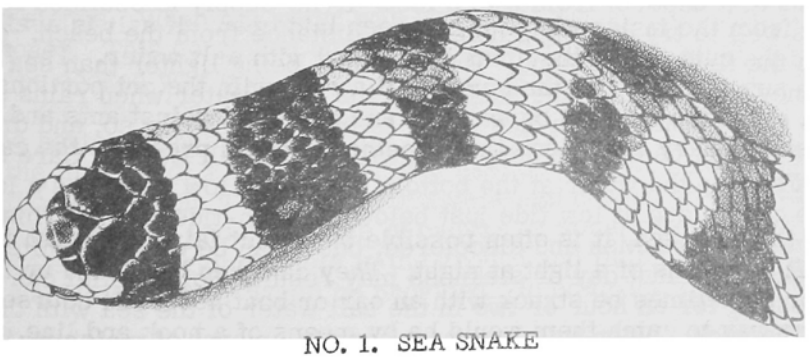
On the open sea, it is often possible to attract fair-sized fish to a small boat or raft by means of a light at night. They can then be picked up in a dip-net, speared, or sometimes be struck with an oar or boat hook. Of course, the most satisfactory way to catch them would be by means of a hook and line, and these items might well be included in the material placed in kit boxes in boats or on

rafts, or a person could make a practice of carrying a short piece of line and a hook in one of his pockets. Frequently a pearl button (or some other kind of light-colored button) placed on the hook is all that is needed in the form of bait. Failure to catch larger fish need not be too discouraging, however, because small edible fishes and crabs can usually be found in masses of floating seaweed. If the seaweed is lifted carefully from the water and shaken over the bottom of the boat or raft, the fish and crabs will fall out. The uncooked flesh of any fish when fresh and caught in the open sea, out of sight of land, is edible. Their blood is drinkable, and the juices in the flesh are much less salty than sea water. This helps considerably when the supply of drinking water is limited or has been used up. Even shark flesh may be eaten. Although they are likely to be somewhat salty and have a tendency to increase thirst, the thick fleshy weeds floating in the open sea can be chewed, furnishing some moisture and nourishment.

## EELS

Eels of various kinds are edible. However, snake eels, moray eels, and some other types resemble sea snakes that are found in certain tropical waters. The sea snakes are very poisonous and should be left alone. They are easily distinguished from eels because they have boney plates (scales) - see accompanying sketch No. 1 - covering their heads and bodies, while the eels (No. 2) do not. This characteristic is shown in the sketches, which compare the two forms. In swimming, the eels glide easily through the water, while the sea snakes tend to wriggle as snakes do when moving on land.

NO. 2. EEL



NO. 1. SEA SNAKE

## TURTLES

Sea turtles breed on sandy shores and little islands. By following the obvious trail that they make across the land, their eggs may be found. They are reputed to be delicious when cooked for half a minute in boiling water. They will not hardboil like fowls' eggs, regardless of how long they are cooked. If it is not possible to boil them, they can be placed in the sun until thoroughly warmed and then be eaten. In eating them, one bites a hole at one end of the "elastic" shell and squeezes the contents into the mouth. The turtles themselves are a source of good food, but some equipment is needed to prepare them. If it is a small specimen, it can be handled by one man. They can be caught with a fish hook or by tossing a noose around the neck. When this has been done, the creature should be held in place by putting a foot on its back; the neck is drawn tight over a piece of wood or a rock and severed with a knife or ax. The head retains life for some time and can still bite viciously after it has been removed, so it should not be handled carelessly. The body is then turned on its back, and the thin shell and heavy skin which connect the bottom and top parts of the shell are cut through. During this operation one must guard against being clawed by the moving feet and legs. Remove the entrails. If it is a female with developing eggs, toss them into the pot. After the viscera have been removed, cut off all of the meat left on the body and legs, or simply remove the legs and toss them into the pot, as cooking will loosen the flesh. Then cut through the unfused portion of the ribs at either side of the center of the upper or back shell (the carapace), remove the central spine, and obtain the good meat concealed behind it. This whole process is greatly simplified if the turtle or tortoise is one of the smaller forms and can be dropped whole into a pot of boiling water. The cleaning and cutting is much easier after cooking. In the case of the large specimens, two or more men would be needed to do the work but the procedure would be the same.

## DRINKING WATER

Drinking water may present as serious a problem as any that may rise when one is separated from the usual source of supplies. Low sand islands in the Pacific area often rise from the beach to an elevation of 35 to 40 feet, and from this high point slope inland toward a central basin which may or may not include a lagoon of salt water. By digging near the foot of the inner slope, water often may be found at a depth of from 3 to 5 feet. If no supply is obtained from such places, it is well to try digging a hole some distance from the beach. Do not go deeper than the first water found. Fresh water, being lighter than sea water, has a tendency to remain on the surface of the salty water when rains soak down through the soil. Thus the surface water is fresh, or nearly so, and drinkable. The well should not be dug too deep or it will strike salt water. Care should be taken not to stir up the water at the bottom of the shallow well. As a last resort, a hole can be dug at low tide just below the high-tide mark. This will yield water that may be brackish and discolored, but it can be used. Limited quantities should be taken the first day or sickness may result. Some relief can be obtained by resting for an hour or two in the salt water of the sea with the body covered to the neck. When this is done a certain amount of moisture is absorbed through the skin.

On islands covered with jungle, there often are many air plants in the trees. The bases of the leaves of these air plants hold water for a long time. It is necessary to strain out bugs, wrigglers, and an occasional frog, but the water is good. Where there are coconut palms, there is always a source of drinking water in the nuts. Green nuts are best but the fluid is good in any of them. Trim off the husk on the free end to a point, chop off the point so as to cut the top of the shell inside, and there is a cup containing coconut water ready to drink. A heavy bush-knife or machete is really essential for this operation. In the last extremity, blood of sea birds will furnish a certain amount of fluid.

The strongly flowing streams and springs of the upper parts of the mountains on the larger islands and portions of the mainland are quite safe to drink unless, of course, a hill village is somewhere upstream in the vicinity. In the lowlands, which may be densely populated, the water in all streams is likely to be polluted. Standing water anywhere is dangerous. Where there are settlements or small villages, one can drink from a well in an emergency. If possible use the water from a well located some distance from the center of the village. The safest procedure, where it is at all practicable, would be to boil the water or to treat it with some of the chemicals provided for that purpose.

## CONTAINERS FOR COOKING FOOD

Mention of the need to cook the shrimps, crabs, and other sea food raises the question of what can be used for a container. Where bamboo is available a section cut from a bamboo stem, the cuts being made below two of the nodes occurring at intervals along the stem so that one end of the section is left closed while the other is open, furnishes a suitable vessel for improvised cooking. The bark or rind on the green bamboo is so durable that water can be heated in it sufficiently for cooking before the fire chars and burns it through.

Stone-boiling, a form of cooking formerly common among the American Indians, might also be used. When this method was employed, hard flat stones, approximately the diameter of an ordinary saucer, or round ones a little larger than a baseball were heated in a fire until very hot and then were dropped into a container holding water. Vessels used for this purpose were water-tight baskets, containers made from bark, and skin bags or pouches. In most cases the system followed was that of partially filling the vessel with water and dropping in a few hot stones. When the water was hot, more was added together with other hot stones. This continued until the desired amount of water was ready. The food to be cooked was then dropped in and other heated rocks were added as needed to keep the "pot" boiling. Sticks or rudely fashioned tongs were used to handle the heated stones. Frequently a small branch, bent in the middle to function in the manner of a nutcracker, was used for the purpose. Whether or not this method of cooking would be applicable would depend on the availability of hard, compact stones and of a piece of canvas or some other fabric that would hold water. By digging a hole in the ground and lining it with some such material, a usable container would be provided. In compact, clayey soils the

earth itself would hold water sufficiently long for such purposes, although anything cooked in it would tend to taste "muddy". In emergencies, however, even that might not be wholly unpalatable.

Note: The foregoing article was prepared at the Smithsonian Institution from memoranda submitted by members of its staff.