Forms of camouflage and concealment that have been noted are as follows:

(a) Garnished nets, turf, and seaweed are used to conceal concrete bunkers in northwest France.

(b) Tanks, probably worn out or obsolete, have been buried in the sands of the coastal regions of France and Belgium, the gun turrets painted to blend with the sand. Private houses in the same area have been converted into gun emplacements without altering their external appearances.

(c) Some underground machine-gun nests are concealed by a natural earth covering about 3 feet thick.

(d) Certain large shelters capable of accommodating approximately 500 men each are camouflaged green, gray, and black. (This is a fairly common German camouflage combination.)

(e) Extensive use has been made of nets to camouflage harbor installations.

(f) In northern France props have been used to conceal surface hangars and airfields in order to make them look like a village from the air. On one airfield was installed a light wood framework, painted to look like the side of a farm house. A false top was painted to represent tiles. A number of other false buildings, including a replica of a church, were also installed in the same place.

(g) Numerous camouflaged shelters for individual planes are also reported. In one place they were built among trees at the edge of a wood. The shelters were of wood, with gabled roofs, were covered with netting, and had trees painted on the doors. In other places individual hangars take the form of farm buildings and hollow haystacks. Many shelters have been camouflaged to look like sand dunes or have been buried in dunes in areas with long, sandy stretches.

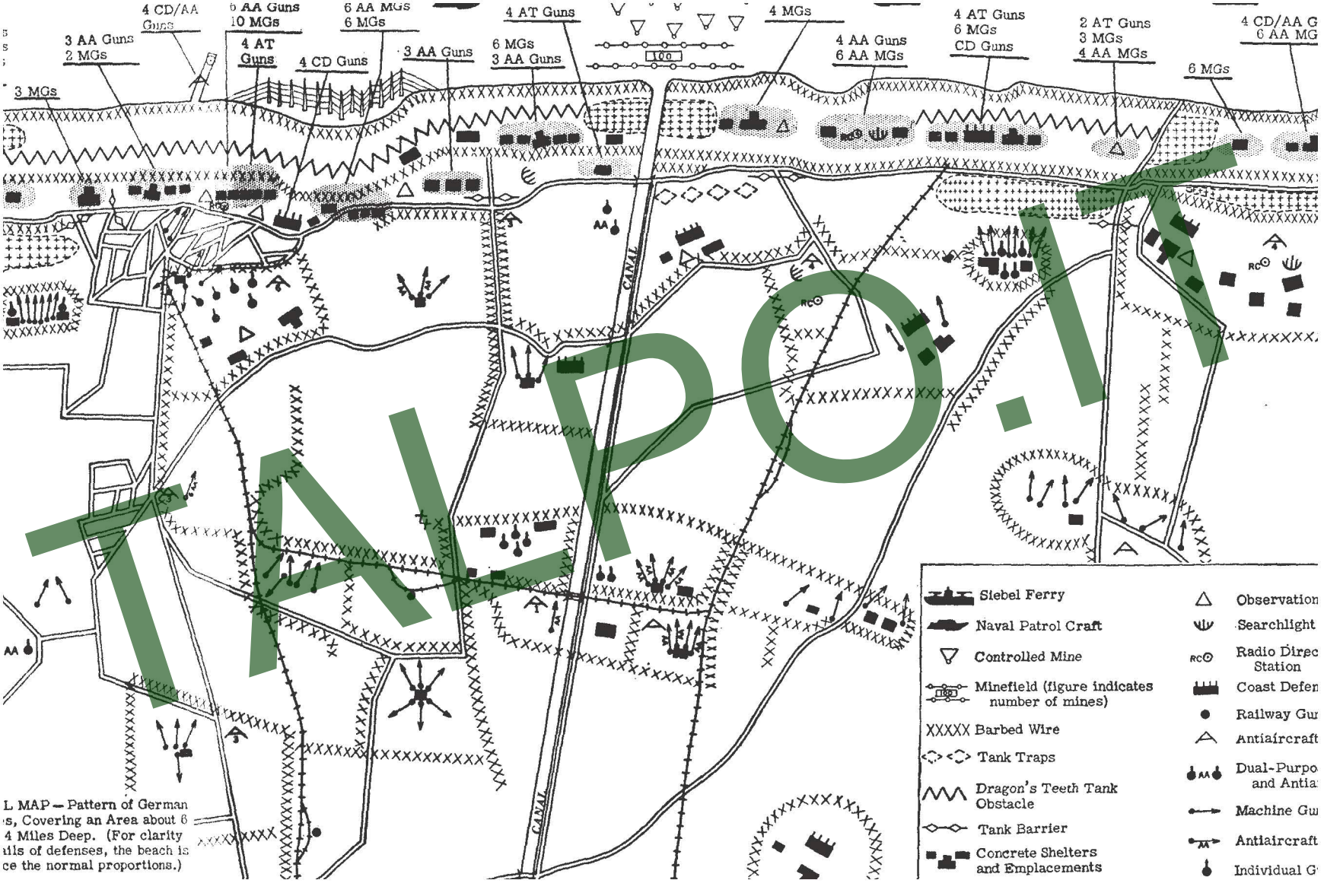
(h) In rocky country, the combination of camouflage around concrete forts is likely to consist of rocks and nets. In one region where the sand has a yellowish tinge, the Germans have camouflaged their installations with yellow patterns, broken by green stripes.

(i) Pillboxes and light-gun emplacements are concealed with heaps of the rubble caused by Allied bombings.

(2) *Dummy installations.*—The use of dummy works and weapons is extensive and serves the double purpose of distracting aerial observation from actual defenses and of inducing the enemy to make wasteful attacks on barren areas while the real defenses remain in operation. A common practice is to install dummy antiaircraft-gun positions and dummy guns, and even to simulate gun flashes in such positions, usually along lines of probable air approach. Sometimes real, mobile guns fire from the dummy positions in an effort to confound aerial reconnaissance. The practice is also extended to other types of artillery. Railway-gun turntables suspected of being faked have been noted in aerial reconnaissance. Dummy observation posts have also been reported. In some places that are heavily mined and wired but do not have a great many weapons, sham turrets and wooden guns are planted in barbed-wire lines.

Many dummy airfields exist along the coast of western Europe. Mock or disused planes and dummy buildings are installed on these fields, and at night they are likely to flash landing lights. From time to time the dummy aircraft are moved around to help fill out the impression of a field in actual operation.

Dummy installations are likely to be deliberately ostentatious or poorly camouflaged, in order to draw fire and distract attention from real and cleverly concealed fortifications.



L MAP — Pattern of German
s, Covering an Area about 6
4 Miles Deep. (For clarity
ills of defenses, the beach is
ce the normal proportions.)

13. HYPOTHETICAL LAYOUT OF BEACH DEFENSES

In order to offer a sample pattern of what the beach defense zone of western Europe is like, a hypothetical map of German beach defenses has been included in this section. The hypothetical map (fig. 23) is composite in style and is based on a study of known positions. It is typical of the defenses of a strategic landing beach with gentle gradient, backed by sand dunes.

Section IV. FORTIFICATIONS

14. GENERAL

The beach obstacles already described are the lesser installations of the elaborate system of coastal fortifications which the Germans have constructed. The backbone of the defenses consists of reinforced concrete works, including units of many different types and sizes. In some places the defenses are rather light—barbed-wire fences, minefields, machine guns, or anti-aircraft guns in small numbers—but in all the strategic areas the Germans have taken advantage of the great deal of time at their disposal to lay out their defenses carefully and in depth, taking the maximum advantage of terrain features.

In some regions the Germans, before planning new defenses or improving old ones, held amphibious maneuvers to discover vulnerable approaches. Then the plans for fortifications were made in the light of lessons learned. They also profited from lessons drawn from actual operations, such as the Dieppe and various commando raids.

The Germans have used reinforced concrete lavishly in constructing forts, underground shelters, pillboxes, dumps, and emplacements for light and heavy weapons and for troops, as well as waterfront shelters for submarines and motor torpedo boats. Maximum use has also been made of existing French, Belgian, and Dutch coastal fortifications, which have been strengthened by

the addition of armor plate, guns, and other matériel from the Maginot Line and other interior fortified positions, by resiting of emplacements, and by additional concrete construction.

The major part of this work has been performed by the *Organisation Todt (O. T.)*, a semimilitary agency that was formed primarily to build Germany's West Wall opposite the Maginot Line before the opening of the war. Organized into labor battalions, this agency employs a large number of locally hired and conscripted workers in carrying out its projects.

The following figures, which give average dimensions, are offered as a general guide to the strength of Todt-built concrete works on the coast:

	Observation posts	Personnel shelters	Ammunition magazines
Thickness of walls	3 to 5 feet	2½ to 3 feet	3 feet.
Thickness of roofs	6½ feet	3 to 5 feet	3 feet.
Depth of soil on underground works.	6½ feet	0 to 3 feet	0 to 4 feet.

This section is devoted to descriptions of various unit-types of German field and permanent fortifications which are common on the Atlantic coast. They are discussed individually, and in detail if data is available, for the purpose of showing their characteristics and providing a basis for estimating their structural strength and weaknesses. It must be borne in mind, however, that each unit is only one component of a "hedgehog," or well-calculated system of all-around defense, and that the individual unit con-

tributes its own fire power to, and derives support from, the other elements of the system. (See par. **18**, below.)

15. CONCRETE SHELTERS

a. Rectangular Shelter

A type of concrete shelter found on the Breton Peninsula in the vicinity of Quimper is shown in figure 24. It is 38 feet long and 19 feet wide, by exterior measurement. The interior height is reported to be 7 feet. Its walls are 39 inches thick. The roof is of the same thickness but is reinforced with steel bars, seven-tenths of an inch thick. On one side is an escape ladder, reached from the interior by means of an opening in the roof 27 inches square. This type of fortification is usually made with a loophole (the location of which is unknown), which is closed when not in use with a wooden frame filled with sand.

Each shelter has three or four ventilating chimneys with sandstone flues, and these are built out from the structure proper in order that there will be no weak sections in the walls. This tends to nullify the effect of grenades or other explosive charges that might be dropped into the chimneys, which also have many elbows or bends.

b. Standardized Shelter

A concrete shelter that appears to have been standardized by the Germans and installed along the Channel coast is shown in figure 25. It will be noted that the over-all thickness of the concrete, except for the 12-

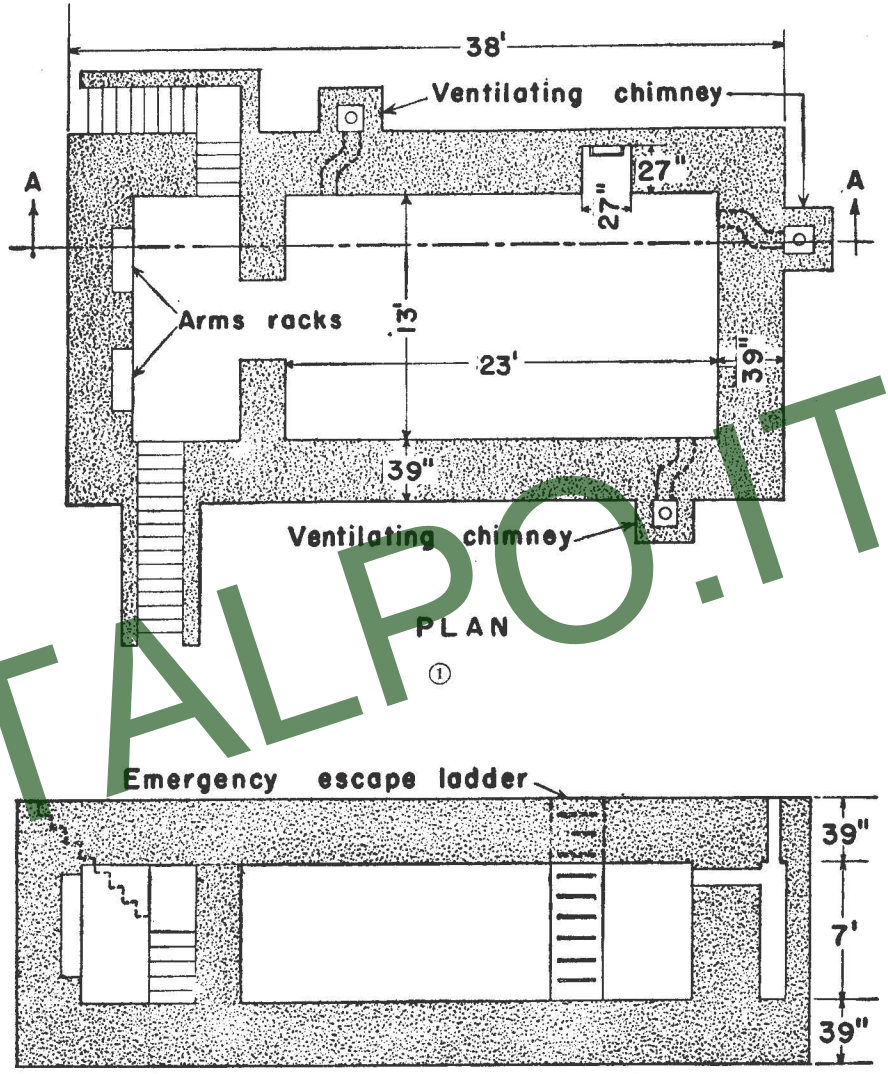


Figure 24.—Rectangular shelter on Breton coast.

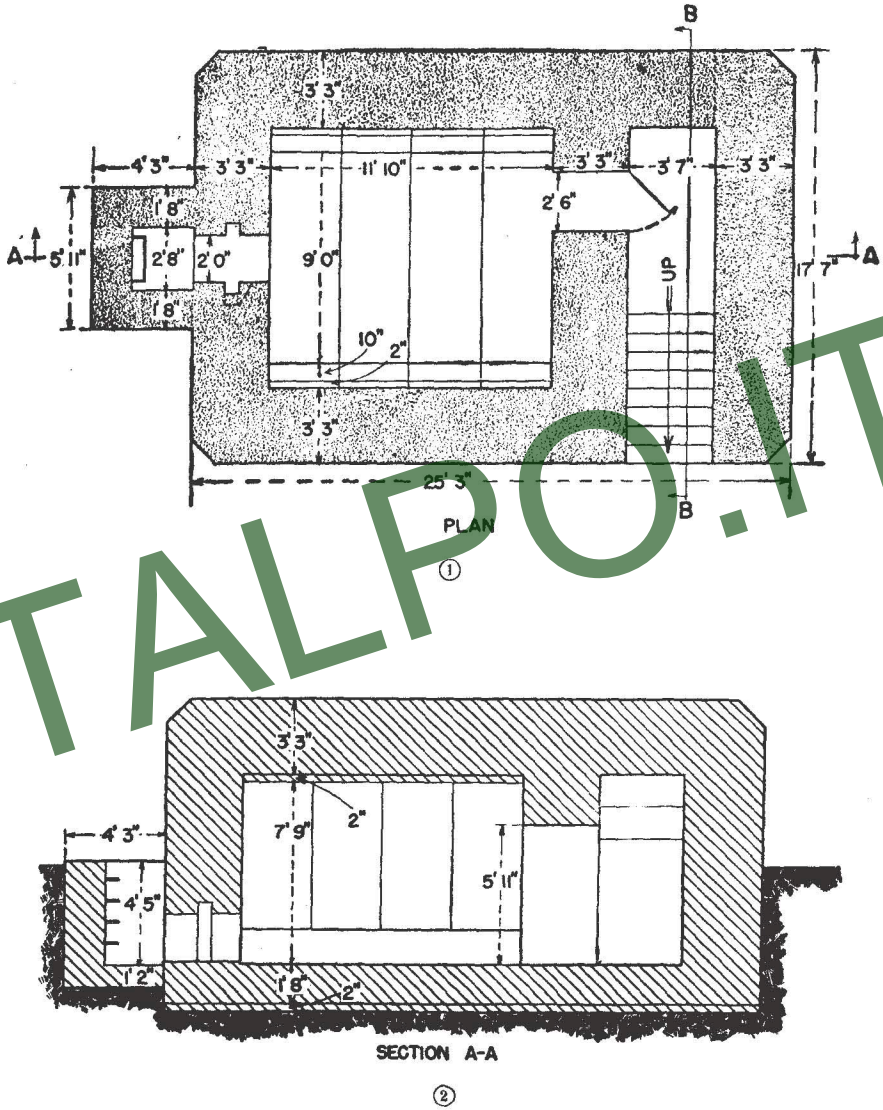


Figure 25.—Standardized shelter on English Channel coast.

inch retaining wall at the emergency exit, is 3 feet 3 inches.

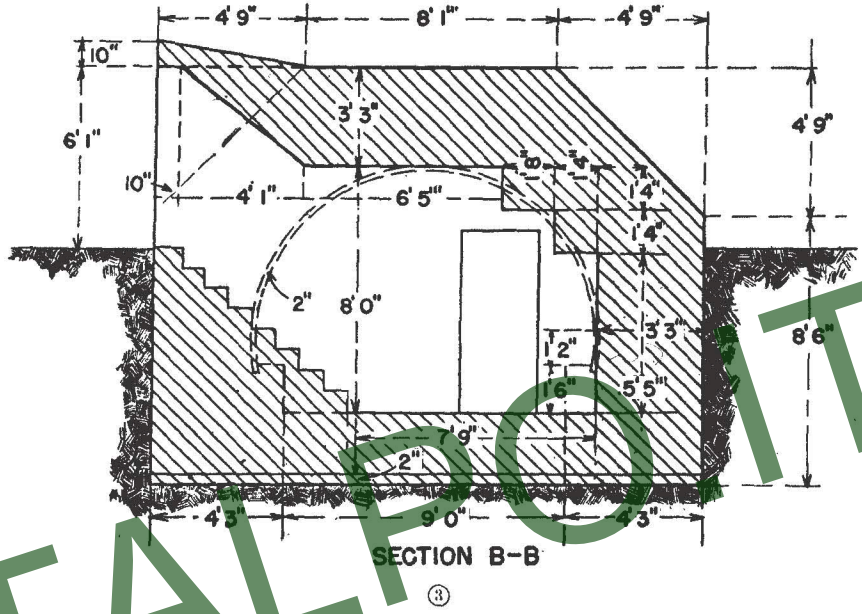


Figure 25 (*continued*).—Standardized shelter on English Channel coast.

c. Dune Shelter

Another type of reinforced concrete shelter, reported to be common in the "golden sand" dunes in the vicinity of Erquy, on the north central coast of the Breton Peninsula, is shown in figure 26. Shelters of this kind are buried in the dunes and camouflaged with turf. They are about 14 feet 8 inches square, with walls 2 feet 6 inches thick. The interior is divided by a concrete wall into two bays, each 4 feet 3 inches wide.

Figure 27 shows a photograph of a shelter that may be a variation of the type described above. It was con-

structed at Nieuport, on the Belgian coast. The photograph shows it before it was covered with earth.

It is reported that the dunes between Mariakerke and Middlekerke in Belgium have been hollowed also,

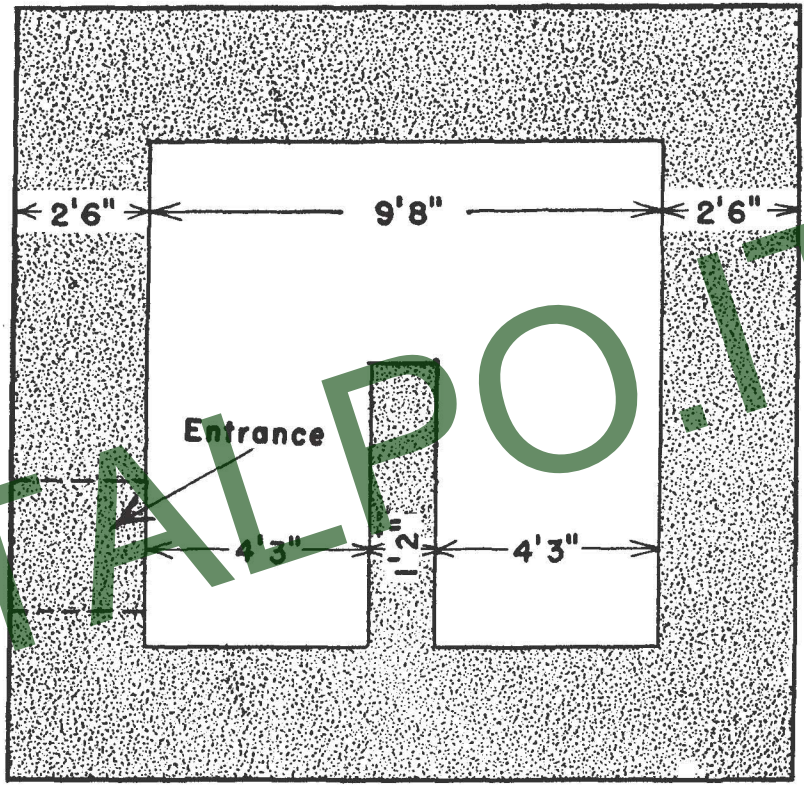


Figure 26.—Sketch of dune shelter.

and that concrete shelters, probably of this type, have been built into them. Reports indicate that the Germans have installed batteries of guns up to calibers of 210 mm behind these dunes. Antiaircraft guns and antiaircraft machine guns are included in the battery positions. In some dune areas, the Germans have

Figure 27.—Photograph of shelter built in dunes.