PDHonline Course C799 (12 PDH)

The Maginot Line: Triumph of Military Engineering

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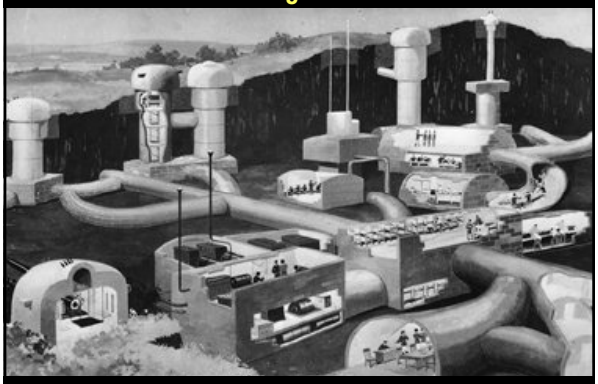
The Maginot Line



Triumph of Military Engineering

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A Monument to Stupidity (?)

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"It has been said critically that there is a tendency in many armies to spend the peace time studying how to fight the last war"

J.L. Schley - Lieutenant Colonel, ***U.S. Army Corps of Engineers***

RE: excerpt from an article he authored entitled: "Some Notes on the World War," which appeared in the January-February 1929 issue of ***The Military Engineer***

5

"There is a partly justified criticism that peacetime generals are always fighting the last war instead of the next one"

Dallas Morning News, November 20th 1937

6

"Fixed fortifications are a monument to the stupidity of man. Anything built by man, can be destroyed by him."
George S. Patton **– General, U.S. Army**

7

"Hit 'em where they ain't"
Douglas MacArthur **– General, U.S. Army**

8

Chain of Forts

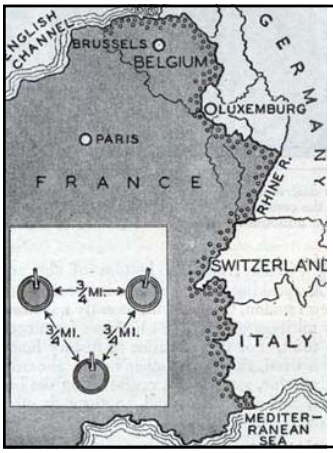
9

"A chain is only as strong as its weakest link"
Ancient Proverb

10

"Not since the ancient Mongols erected the great Chinese wall more than two thousand years ago, has any nation conceived so gigantic a system of defensive fortifications as is now under construction on the eastern frontier of France and Belgium. This system, when completed, will provide a chain of forts stretching from the English Channel to the Mediterranean Sea. Two hundred miles of this chain, reaching from the Mediterranean to Lorraine, are now ready; and that this southern half should be rushed to completion first, shows that the French Republic fears Italy at this time more than disarmed Germany…"
Modern Mechanics and Inventions, **March 1931**

11



Left: caption: "This map shows how the chain of forts will extend from the English Channel to the Mediterranean Sea. The system has been completed from the point where the French border leaves the Rhine southward to the Mediterranean. The Northern half will be completed within two years, and will include Belgium within its shelter, a secret treaty having been signed between the two countries. The inset shows how the fort will be laid out, the one in rear backing up the front line. In wartime the forts will be connected with a system of trenches."

12

"…This defensive chain consists of armored concrete cupolas placed three-quarters of a mile apart, with a secondary chain of similar 'pill-boxes' placed farther to the rear and half way between the first line. Any two of the front line forts, with its corresponding member in the rear, will form a triangle three-quarters of a mile on each side with its base toward the front. In wartime they are to be linked together with a system of trenches and underground passages connecting with each other and with the rear. The entrenched protection line connects to the rear with an underground railway for bringing up munitions and evacuating the wounded…"

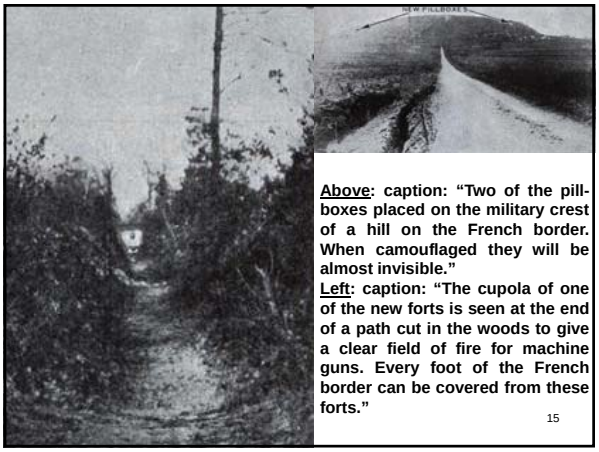
***Modern Mechanics and Inventions,* March 1931**

Above: caption: "Excerpt from a map of the Maginot Line"

13

Above L&R: caption: "Europe's No. 1 fixed frontier, made of steel and concrete, is the French Maginot Line, extending all along France's eastern border. Outside, the fortification looks like a series of pill-boxes, with revolving turrets from which guns are raised or lowered. Barbed wire and rails stuck in the ground are designed to stop German infantry and tanks. Metal ventilators hidden on the hillsides are part of the ventilation system of the interior. Inside there are facilities for garrisoning 300,000 men! Elevators and staircases lead into each 'pill-box' or casemate. At a signal the whole fortification can be put into action in defense of France and it is admitted as a protection to England as well. All the key points are far below the surface, invulnerable to shells and bombs. The Maginot Line looks across the Rhine at the Siegfried Line, Germany's answer to France's late War Minister Andre Maginot, who began the fortification bearing his name."

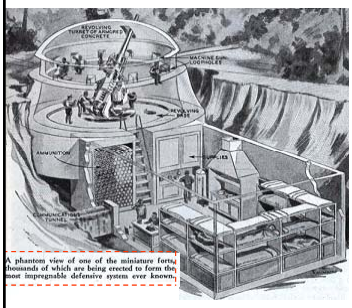
14



Above: caption: "Two of the pill-boxes placed on the military crest of a hill on the French border. When camouflaged they will be almost invisible."

Left: caption: "The cupola of one of the new forts is seen at the end of a path cut in the woods to give a clear field of fire for machine guns. Every foot of the French border can be covered from these forts."

15



A phantom view of one of the miniature forts, thousands of which are being erected to form the most impregnable defensive system ever known.

"…Each of these miniature forts will be equipped with heavy guns for long-distance firing, and will bristle with machine guns for use against attacking infantry. The crew for each casemate numbers thirty men, and comfortable living quarters are provided forty feet underground. Under this forty feet of earth is a ten-foot layer of concrete, while the turrets themselves, which project but slightly above the surface of the ground, will be of heavily armored concrete."

***Modern Mechanics and Inventions,* March 1931**

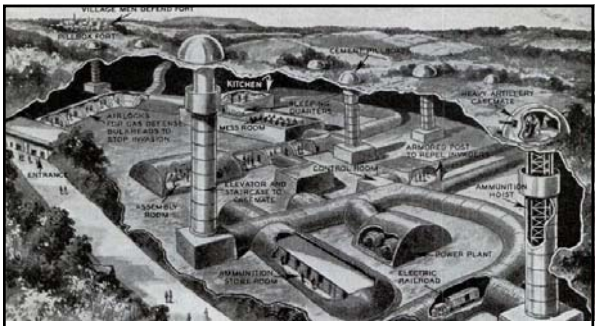
16

"Invisible and sunk beneath the rolling and wooded terrain in Lorraine is a great underground fortification system, 200 miles long, guarding France's vital industrial area. The forts, which cost 150 million dollars, are the greatest in the world and defy attack by gas, infantry, artillery, or air bombs…"

***Mordern Mechanix,* February 1934**

Above: caption: "Solid black line shows location of 200 mile system of French underground forts, opposite disputed Saar basin"

17



"…Living quarters, magazines, power stations, and control stations are out of reach of all means of attack. Bulkheads in the underground passages shut out both gas and invaders and armored posts at various points bring additional protection…"

***Mordern Mechanix,* February 1934**

Above: caption: "Buried deep beneath hills are the impregnable forts shown in the above drawing. Even railways are provided for."

18

Left: caption: "…First Used in the Maginot Line. Hundreds of feet below ground, in the subterranean chambers of the Maginot Line, engineers found what seemed an almost insurmountable problem in water seepage. In some quarters water entered so rapidly that even pumps were useless. Water barriers by the score had been tried and proven ineffective. Baffled in every attempt to find a solution, the government appealed to the waterproofing industry of France to develop a means of controlling the seepage. The answer came in Aquella. Used to treat the line in 1934, it is as effective today as when it was first applied!..." (ad appearing in a 1946 edition of the *Saturday Evening Post*)

19

20

21

22

Dwarfing the Eiffel Tower

23

"To get defense aircraft into action more quickly, architects of Paris have worked out plans for a huge aerodrome tower, more than a mile in height, which will literally hurl planes, into the air at the 5,000-ft. level, ready for combat. High-speed elevators would bring planes from the roof-top-level landing field up to each of the three aerodrome platforms. Swooping downward after leaving the inclined take-off platform, planes would reach flying speed with little loss of altitude."

***Modern Mechanix,* January 1935**

Left: caption: "Towering into skies for more than a mile, proposed Paris aerodome tower would have three decks, with roof-top landing field built around base. Artist's sketch shows how structure, if built on river Siene, would dwarf Eiffel tower. Cutaway sketch shows how Paris defense planes stored in lower aerodrome of tower are taxied down sloping platform, gaining momentum for dive into space from outlet ports. Cross-section of upper third of tower shows elevator leading to top aerodrome."

24

Inspired by Fear

25

"Inspired by the same desperate fear from which sprang that wonder of the ancient world, the Great Wall of China, modern France is rushing to completion the most stupendous work of military engineering of our times…"
***Popular Science,* October 1936**
Above: the meandering *Great Wall of China* is not merely a wall, it is a complete and rigorous defensive work composed of countless passes, watch-towers, garrison towns, beacon towers and blockhouses

26

The Dragon's Back

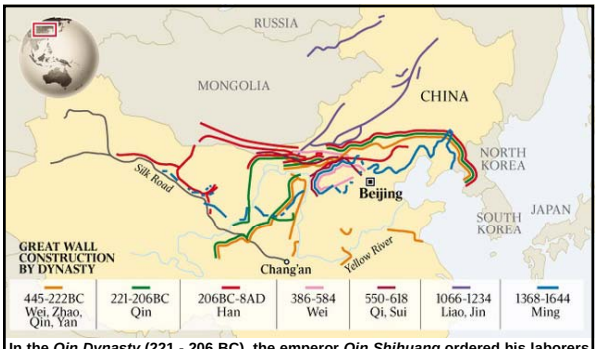
27

"…The great wall was built about 220 B.C. by the first emperor of the Tsin Dynasty as a protection against the roving bands of Tartars, which were then in the habit of descending from the Mongolian plains and making sporadic raids upon the Chinese cities to the south. After 2,150 years the wall is still in remarkable state of preservation considering that only twice, in the fifteenth and again in the sixteenth century, were any extensive repairs made upon the structure…"
***Modern Mechanics and Inventions,* February 1931**

28

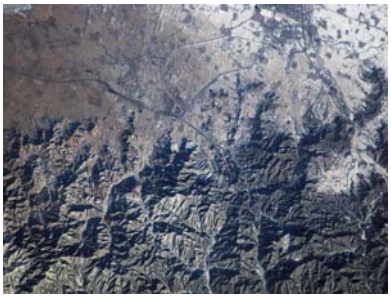
The history of the construction of the *Great Wall of China* dates back to the *Western Zhou Dynasty* (11th Century B.C. - 771 B.C.). However, at that time the wall was only a line of fortresses built to defend against attacks from the *Yanyun* (an ancient nomadic tribe in northern China). The *Period of the Warring States* (476 BC - 221 BC) was an era when the seven states (*Qi, Chu, Yan, Han, Zhao, Wei* and *Qin*) were busy engaging in the construction of the wall for self-defense. Instead of one line, their walls stretched in four directions and varied in length from several hundred miles to one or two-thousand miles.
Left: caption: "Building The Great Wall of China"

29



In the *Qin Dynasty* (221 - 206 BC), the emperor *Qin Shihuang* ordered his laborers to connect these scattered walls and create some new sections, thus forming a "Great Wall" in northern and central China (much as we know it today). The *Ming Dynasty* (1368 – 1644 A.D.) further developed the defensive systems of the wall, allowing it to reach the zenith of its defensive potential. It is one of only a few man-made objects visible from space.

30



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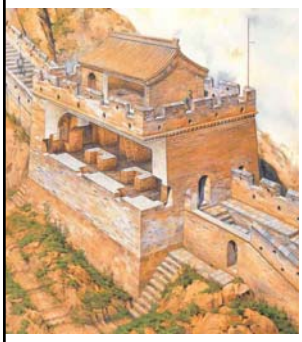
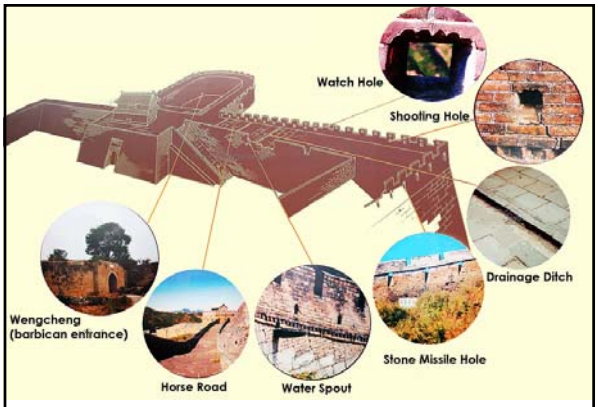


"…The height of the wall ranges from twenty to forty feet, while at intervals of about two hundred yards are towers about 25 feet higher than the wall. The northern parapet of the entire fortification is loop-holed to protect the defenders from the missiles of the enemy, while the towers are surmounted by such a parapet around all four sides. Many of the towers are roofed over, and were no doubt used as barracks by the Chinese soldiers, while sentries were posted at the other towers."
Modern Mechanics and Inventions, **February 1931**

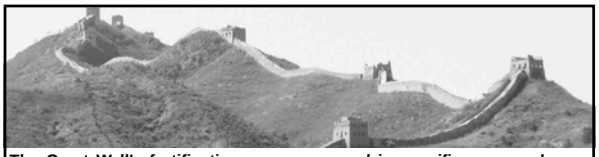
32



Above: caption: "Great Wall Structure Map"

33

34



The Great Wall's fortifications were arranged in specific ways and were under the control of a military command system at all levels. For example, there were about one-million soldiers guarding the Ming Dynasty's Great Wall. The chief military officers were stationed in garrison-towns, while lesser officials and soldiers were stationed in *Guan Cheng* and other smaller fortifications. The eleven garrisons of the Ming's Great Wall were set up along the wall in order to guard the precinct or subsection. The average height of the Ming's wall measures 33-feet and the width about 15-feet. In low, flat areas the wall was built high and more defense lines were added. In the high mountains (above), the wall was lower in order to save lives (it's *a/k/a* as: "The World's Longest Cemetery"), time and cost. Sometimes, even steep cliffs served as natural defensive walls. Today, the *Great Wall of China* no longer serves a military purpose, but as a great work of military engineering, its magnificent beauty and austere structure are still worthy of praise and wonder.

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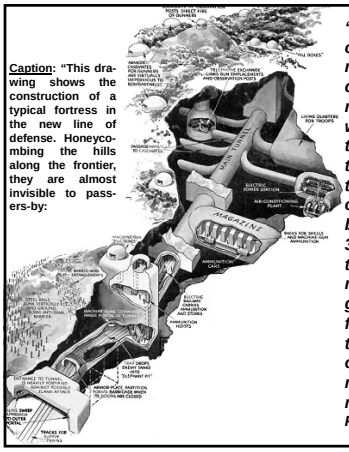
Subterranean Citadels

38



Caption: "This drawing shows the construction of a typical fortress in the new line of defense. Honeycombing the hills along the frontier, they are almost invisible to passers-by:

"…However, beyond the threat of invasion that provides the reason for its existence, the chain of steel-and-concrete fortresses has little in common with the crude barrier of stone that was flung along the northern frontier of China more than 2,000 years ago. Instead of soaring in the air, its towers burrow downward, sometimes 300 feet into the earth. Around the summits of these subterranean citadels grow trees and grass, and peasants feed their flocks. You could walk across the Great Wall of France without knowing it – yet it is the most formidable fortress that man has ever created…"
***Popular Science,* Oct.1936**

39

"…Actually, it is a vast series of underground fastnesses; subterranean tunnels, galleries, and chambers, lighted and heated by electricity; it is air-cooled, gas-proofed, and equipped with every modern device to kill or maim those who attack it, and protect those who defend it. Together with the defenses that Belgium is building along her eastern frontier, this armored belt girds Europe from the Mediterranean to the North Sea. It has cost the thrifty French alone $350,000,000, and they are not through yet…"
***Popular Science,* October 1936**

40

41

"…At all costs, they are determined to prevent another invasion by the route that has been followed by attacking hordes three times within a little over a hundred years. Against that danger, they and the Belgians have called in science and invention to forge for them defensive armor so strong, so modern, that it will either scare-off would-be invaders, or hurl them back…"
***Popular Science,* October 1936**
Above: caption: "The hidden, heavily guarded entrance to one of the forts. Note the railway tracks."

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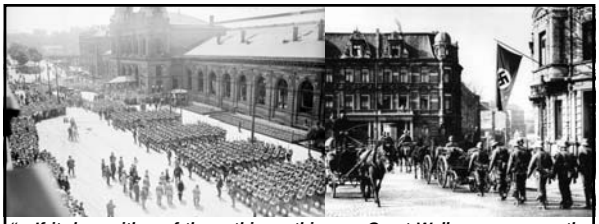
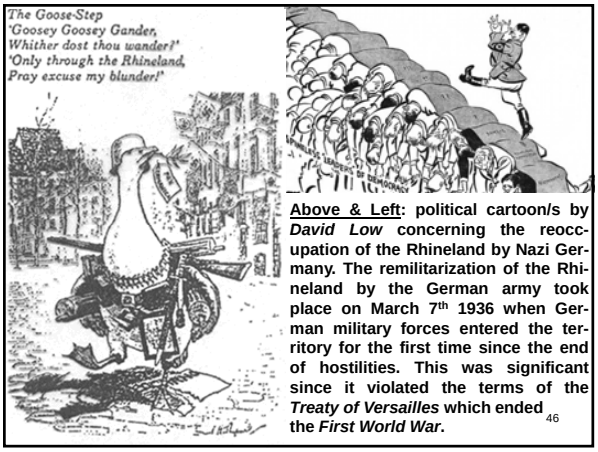
The Peace of Europe

44



"…If it does either of these things, this new Great Wall can preserve the peace of Europe. But will it? Statesmen, soldiers, engineers, millions of anxious men and women, would like to know the answer to that question. A burning question, these days since Hitler tore-up the last shreds of the Treaty of Versailles, and marched his gray-clad battalions across the Rhineland, up to the gun muzzles peering from strange mushroom-shaped casemates that bar France's frontier…"
***Popular Science,* October 1936**
Left: caption: "French Army troops gathering before their departure from Rhineland, occupied Mainz, 1930"
Right: caption: "German forces enter Aachen, on the border with Belgium, following the remilitarization of the Rhineland. March 18, 1936."

45



Above & Left: political cartoon/s by *David Low* concerning the reoccupation of the Rhineland by Nazi Germany. The remilitarization of the Rhineland by the German army took place on March 7th 1936 when German military forces entered the territory for the first time since the end of hostilities. This was significant since it violated the terms of the *Treaty of Versailles* which ended the *First World War*.

46

The *Treaty of Versailles* (signed June 28th 1919, at left) restored the French/German border (established by the 1815 *Treaty of Vienna*) that was lost to Prussia as a result of the *Franco-Prussian War* of 1870-71 (including the lost provinces of Alsace and Lorraine). It was a border completely open to invasion. Thus, it would become the focus of French defensive fortifications.

47

48

"…If we want to become a major player again on the world stage I'm convinced that we have to further increase our industrial output…As next order of business I discussed with my ministers the plan to systematically disassemble the Treaty of Versailles by reinstating a three year draft and reoccupying the Rhineland. At the end of our meeting we had decided that our troops should start marching the very next day, hoping that the British and French will still be busy celebrating the new year…The past few days our troops had been marching through the towns of the Rhineland where they had been greeted by our grateful population. Today they reached their positions at the French border and all we got from Paris and London was a letter or formal protest…Encouraged by this recent success I've decided that the time has come to openly begin the rearmament of Germany…"

***Adolph Hitler,* Chancellor of Germany (Diary entries – January-April 1936)**

49

"Treaties are like roses and young girls – they last while they last"

Charles de Gaulle

50

"…That frontier presents something new in the science of fortifications. It is a practically continuous defense system, as nearly as possible impregnable, extending along the eastern frontiers of France and Belgium. Its right flank is the southern portion facing Italy, Switzerland, and southern Germany. There the great engineer, nature, has provided ready-made defenses in the Alps, Jura, and Vosges mountains, and in the River Rhine. To supplement these, every pass and crossing is guarded by strong concrete forts, sunk in the earth, their apexes barely peeping above the ground. Farther back, upon carefully selected dominating heights, are permanent concrete emplacements for cannon…"

***Popular Science*, October 1936**

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Fools and Sonofabitches

54

"Some goddamn fool once said that flanks have got to be secure. Since then sonofabitches all over the globe have been guarding their flanks. I don't agree with that. My flanks are something for the enemy to worry about, not me. Before he finds out where my flanks are, I'll be cutting the bastard's throat."
George S. Patton **– General, U.S. Army**

55

Part 2

Brialmont's Folly

56

The Battle of Liege

57

Germany, knowing that France would attack from the west and Russia from the east in the event of war, had been planning an invasion through neutral Belgium and into northern France for decades. The Kaiser and his generals had no desire for world conquest (as did Hitler in WWII). Rather, they wanted to take the battle to their adversaries rather than waiting to defend their own borders. By invading France by surprise, Germany would have the upper-hand and could defuse the French threat in time to turn to the east, to fight the Czar's armies. Belgium was not a strategic goal of the Kaiser's armies. Simply put, it was in the way of their advance. In fact, on August 3rd 1914, Germany asked very politely if they could march the German Second Army through Belgium on their way to invade France. The Belgian King declined the invitation. So it was that on August 4th 1914, 320K men led by Field Marshal *Karl von Bulow* invaded Belgium. Not given much thought was the small Belgian town of Liege, at the northern edge of the *Ardennes*. German planners had scheduled two days to march through it as they continued west. There were only 70K Belgian troops stationed there and it had the additional prize of rail lines into northern France. However, after the *Franco-Prussian War*, the Belgians suspected that Germany may someday wish to march through Liege. They built a ring of twelve heavily armed forts on high ground, six on either side of the *Meuse River* (each 3 to 5 km apart and from 6 to 10 km from the city center). The forts contained a total of 400 retractable guns, all pointed toward the German border. These forts helped to offset the relatively small force commanded by Belgian General *Gerard Leman*.

58

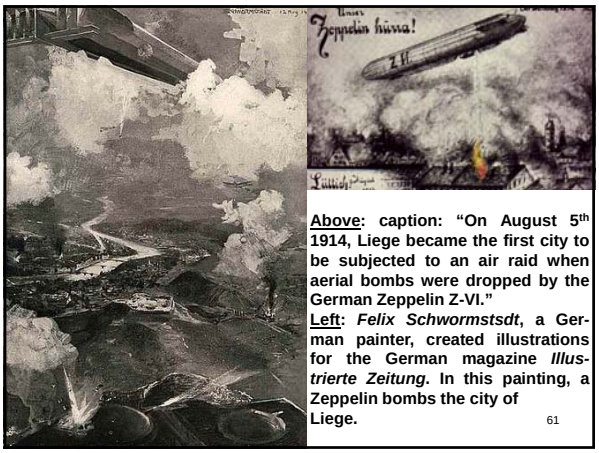
Above: the *Ardennes* is an area of very rough terrain and dense woods located in southern Belgium and northern France. North of the Ardennes, the land begins to flatten and becomes an ideal geographic location for a German army to march on its way to invading France.

59

In the early morning hours of August 5th 1914, with a force of 30K men, the German army attacked Liege. To their great dismay, they sustained heavy losses and made little progress. *Erich Ludendorff* - a German commander, decided not to attack the Belgian forts. Instead, he called in Zeppelins to drop bombs into the city and citadel and personally lead the German 14th Brigade in between the forts (through a gap where the Belgians had intended to build rifle trenches but had not gotten around to doing so). The Belgian garrison in the town surrendered on August 7th, but the ring of forts remained under Belgian control. The delay in taking the forts gave France and Britain time to mobilize their forces and come up with a plan to defend Paris. Because the *Schlieffen Plan* counted on speed, their plan of invasion (and avoiding a two-front war) was now in serious jeopardy. Moreover, the Allies were morally emboldened by the German setback.

60

Above L&R: Belgian (left) and German (right) artist's interpretations of the Liege battles



Above: caption: "On August 5th 1914, Liege became the first city to be subjected to an air raid when aerial bombs were dropped by the German Zeppelin Z-VI."
Left: *Felix Schwormstsdt*, a German painter, created illustrations for the German magazine *Illustrierte Zeitung*. In this painting, a Zeppelin bombs the city of Liege.

61

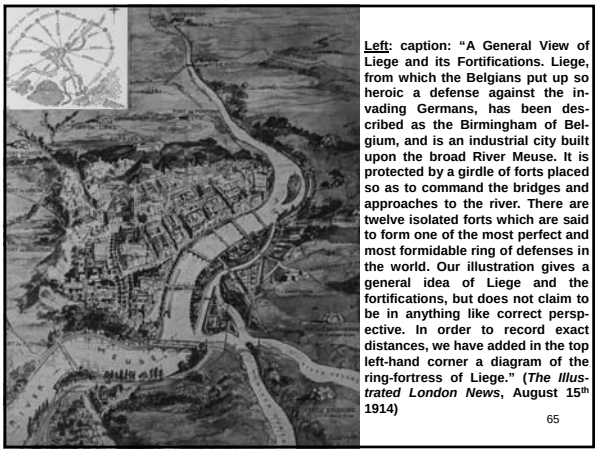
Above: caption: "The Forts of the Fortified Position Liege." The German plan-of-attack, in which the capture of Liege was crucial, envisaged a rapid march through Belgium. After seizing the city, troops would be deployed north of the *Sambre-Meuse Line*, ready for the advance into France. The main defenses in eastern Belgium were the fortified positions of Liege and Namur.

62


The Washington Times
HOME EDITION
Wife of President Is Reported Unchanged
100,000 GERMANS STORMING LIEGE; 11,000 CASUALTIES
GERMAN DIRIGIBLE BLOWN UP BY BELGIANS AND 25 KILLED
CROWN PRINCE HEADS THE INVADING FORCES
2 CRUISERS SUNK IN DUEL OFF THE COAST OF CHINA

63

64

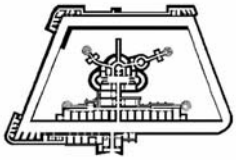


Left: caption: "A General View of Liege and its Fortifications. Liege, from which the Belgians put up so heroic a defense against the invading Germans, has been described as the Birmingham of Belgium, and is an industrial city built upon the broad River Meuse. It is protected by a girdle of forts placed so as to command the bridges and approaches to the river. There are twelve isolated forts which are said to form one of the most perfect and most formidable ring of defenses in the world. Our illustration gives a general idea of Liege and the fortifications, but does not claim to be in anything like correct perspective. In order to record exact distances, we have added in the top left-hand corner a diagram of the ring-fortress of Liege." (*The Illustrated London News*, August 15th 1914)

65

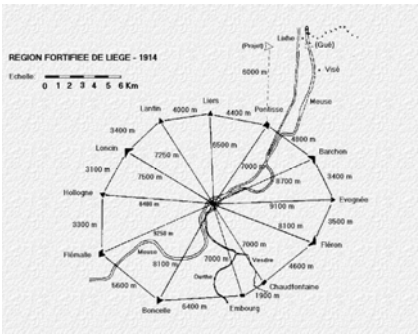
Above: caption: "Ring of Forts defending Liege, 1914." General Leman, in command of 32K troops, was ordered to fiercely defend the Liege fortresses. They were attacked by 60K soldiers of the German Second Army under the direct command of General Von Emmich. The Fortified Position of Liege included six small (*Chaudfontaine, Evegnee, Embourg, Hollogne, Lantin* and *Liers*) and six large (*Barchon, Boncelles, Flemalle, Fleron, Loncin* and *Pontisse*) forts. Outdated forts, like the *Citadel* and *Chartreuse*, were included in the line-of-defense. However, Von Emmich's planned advance was slowed by heroic Belgian resistance which inflicted heavy casualties on the Germans.

66



Above T&B: Fort Embourg
Left: "Fort de Barchon" 67

In the wake of the *Franco-Prussian War* (1870-71), Belgium realized how vulnerable it had become to invasion from either France or Germany. In 1880, *King Leopold II* charged Belgian army engineer; General *Henri Brialmont,* to draw up plans for defense of the country. The result was a plan to build a ring of twelve forts around Liege and another nine around Namur, which lay astride the main invasion route. Additional forts were also planned for Antwerp (to supplement those already built in response to the threat posed by *Napoleon III* in 1859). By 1890, the forts were complete and Belgians felt secure within their three great fortress rings. The forts held impressive armament including 57mm rapid-firing cannons, 150mm cannons and 210mm howitzers. The heavier cannon and howitzers were placed in armored cupolas designed to protect them from high-explosive shells. Each of the larger forts had a garrison of about 500 soldiers. 68



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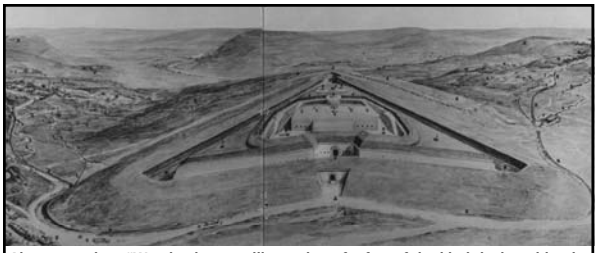
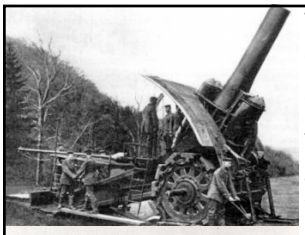


Above: caption: "We give here an illustration of a fort of the kind designed by the famous Belgian military engineer, General Brialmont, and typical of those so bravely defended by the Belgians at Liege against the attacks of the Germans. No man, of course, ever designed an impregnable fort, or ever will. The strength of every such work must depend ultimately on the spirit of its garrison; and Brialmont, like all engineers, drew up his designs on the assumption that the men working the forts would give a good account of themselves. How well this assumption was justified the recent events at Liege simply proved. As shown above, these forts are provided with an elaborate system for repelling attempts to carry the works by assault, and for making a counterattack." 70
(*The Illustrated London News*, August 15th 1914)

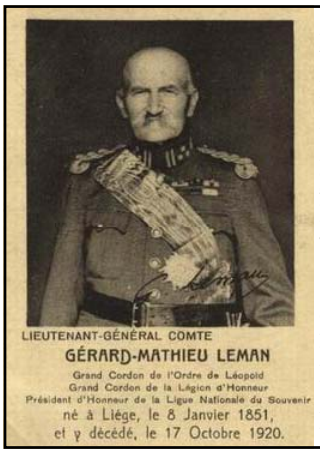
KEY.

A. OUTER GATE WITH DRAWBRIDGE.
B. DITCH COVERED WITH WIRE ENTANGLEMENTS.
C. INNER GATE WITH DRAWBRIDGE.
D. CUPOLAS FOR HOWITZERS.
E. CUPOLAS FOR QUICK-FIRING GUNS.
F. CUPOLA FOR OBSERVATION AND FOR SEARCHLIGHT.
G. COUNTERSCARP GALLERIES WITH MACHINE-GUNS RAKING THE DITCH.
H. GALLERY FROM THE GATE THROUGH THE FORT.
I. VENTILATORS FOR BARRACKS AND MAGAZINES BELOW.
J. INFANTRY POSITIONS ROUND RAMPARTS.
K. MAIN TRENCH WITH RAILWAY.
L. FIRE TRENCHES.
M. INFANTRY POSITIONS (REDOUBTS).
N. FIELD-GUN BATTERY.
O. HOWITZER BATTERY.
P. HEAD OF LIGHT RAILWAY.
Q. DOORS LEADING TO BARRACKS AND MAGAZINE.
R. HEADS OF STAIRCASES TO BARRACKS AND MAGAZINES.
S. WIRE ENTANGLEMENTS.
T. BOMB-PROOF SHELTERS.
U. MOTOR-LORRIES FOR TRANSPORT.
V. SMALL FORT.
X. TWO FORTS, FORMING A GROUP WITH THE CENTRAL FORT.

Above: caption: "Behind wire entanglements come fougasses, or land-mines fired electrically from the forts. When these two obstacles have been nearly reached – covering-fire must cease, because the target will be masked by the advancing infantry. Then the disappearing guns pop-up from the forts; the electric light is turned full upon the enemy, who, blinded by the beam, is prevented from seeing the counter-attacking column, which should be lying in wait for this opportunity amongst the trenches marked *L* and *M* in the diagram. On paper, this counter-attack can never fail. In practice, however, these theoretical arrangements do not always work out."
(*The Illustrated London News*, August 15th 1914) 71



The forts ringing Liege kept harassing the attacking German troops. On August 12th 1914, the Germans placed their heavy 42cm howitzers (top) in position and started to methodically bomb the Belgian fortresses into submission. One day later, on the 13th, *Fort/s Barchon* and *Pontisse* surrendered. Then, on August 15th, at five in the afternoon, a 420mm shell penetrated the ammunition bunker of *Fort Loncin* (bottom). General *Gerard-Mathieu-Leman*, having set-up his headquarters at the fort, was severely injured and taken prisoner by the Germans. The next day, he wrote a letter of apology to the Belgian monarch; *King Albert*, apologizing for having survived the blast. The last of the Liege forts fell on August 16th 1914. 72



"You will learn with grief that the fort was blown up yesterday at 5:20 p.m., the greater part of the garrison being buried under the ruins. That I did not lose my life in that catastrophe is due to the fact that my escort, Commandant Collard, a sub-officer of infantry who unfortunately perished, the gendarme, Thevenim, and my two orderlies, Vanden Bosche and Jos Lecocq, drew me from a position of danger, where I was being asphyxiated by gas from the exploded powder. I was carried into a trench, where a German captain named Guson gave me a drink, after which I was made prisoner and taken to Liege in an ambulance. I am convinced that the honor of our arms has been sustained. I have not surrendered either the fortress or the forts. Deign, Sire, to pardon my defects in this letter. I am physically shattered by the explosion of Loncin. In Germany, whither I am proceeding, my thoughts will be, as they have ever been, of Belgium and the King. I would willingly have given my life the better to serve them, but death was denied me." 73

RE: General Leman's letter to *King Albert*

"Sixty seconds ticked by - the time needed for the shell to traverse its 10,000-meter trajectory - and everyone listened in to the telephone report of our battery commander, who had his observation post 1,500 meters from the bombarded fort and could watch at close range the column of smoke, earth and fire that climbed to the heavens" 74

RE: German heavy artilleryman at Liege

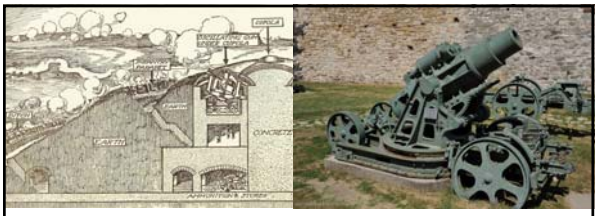
The Liege forts (constructed between 1888 and 1892) were designed to withstand the most powerful projectile of that era which was just 8.4-inches in caliber (as compared to the 16.5-inch, 1,800 lb. shells with a range of nine miles that were directed against forts such as *Loncin*). Exacting German drill allowed a reload time of just five minutes; firing-for-effect took one hour. The heavy guns were fired electrically by a crew lying on the ground three hundred yards away.

Top: caption: "German officers on the ruins of Fort Loncin, destroyed by delayed-fuse shells"

Bottom: caption: "Ruins of Fort Loncin" 75

Above: caption: "The Fiercest of the Assaults on the Defenses of Liege: The Attack on Fort Fleron, as Belgians villagers flee from the invading Germans"
(*The Illustrated London News*, August 15th 1914) 76

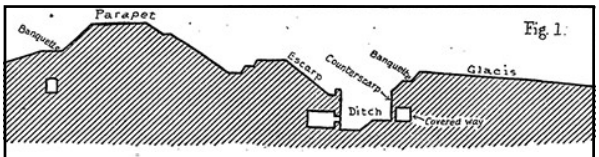
The German attack surprised the Belgians, overrunning the ring of forts at Namur in four days and, passing through gaps between forts, rapidly occupied Liege on the *Meuse River*. When their heavy guns arrived, the Germans reduced the Liege forts one by one using 21cm *Skoda* mortars and, later, 42cm *Krupp* "Big Berthas." *Fort Loncin* was one of the last to fall, being destroyed August 15th when its magazine blew up after being penetrated by a German shell. Over half of the fort's garrison of 550 men were buried beneath the ruins of the fort, which was never rebuilt in the interwar period and remains a memorial to the Belgian soldiers who died there. 77

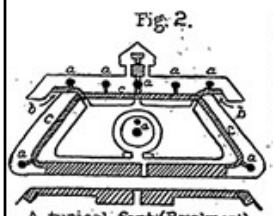


The fortified positions surrounding Liege were built between 1888 and 1892 under Belgian General *Henri Alexis Brialmont*. They were designed to withstand the largest guns of the time; the 210mm. However, by 1914 the German artillery had improved significantly. The Germans used their big siege howitzers; the *Skoda* 305mm and the *Krupp* 420mm, to destroy the forts. The forts could not stand-up to the devastating German bombardment. The Germans attacked on August 6th 1914 and the siege lasted from August 8th to the 16th. The *Battle of Liege* demonstrated that these kinds of forts were vulnerable to heavy artillery fire. The Belgian army fell back to Antwerp, leaving Brussels in the German army's path. The main part of the German army was now free to continue its advance toward the French frontier.

Left: caption: "A section of one of General Brialmont's Cupola defenses" 78

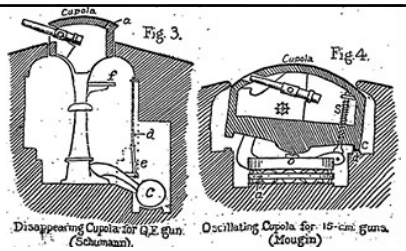
Right: caption: "Skoda 305mm Siege Gun"





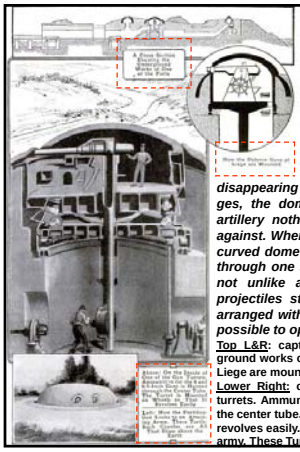
Above: caption: "These diagrams are printed to illustrate the meaning of the terms which appear in telegrams describing the German attacks on the Liege forts.
Figure I shows details of a typical fort designed by Brialmont, who designed the forts of Liege. The name of each part appears on the diagrams.
Figure 2 is of another Brialmont fort and shows the positions of the cupolas for guns…"

79



"…Figure 3 shows the disappearing type of cupola. 'The cupola,' says Clarke on 'Fortifications' (from which these diagrams are reproduced) 'is just overbalanced by the counter-weight (e). By pulling up the bar (d) the structure is made to descend and is held by the catch (c). On freeing the catch, the cupola ascends. The firer sits on a seat (f).'
Figure 4 shows the oscillating type of cupola. 'The cupola is made to oscillate about a horizontal axis (o), the whole weight being transferred from a rounded knife-edge working into an inverted saddle carried upon a turntable (a)…In the firing position, the cupola is titled up till the leg (c) rests upon the rail (d)…The two guns are independently counter-pointed by weights, which allow them to be easily depressed or elevated.'"

80



"Although built approximately 30 years ago, the fortresses surrounding Liege and Namur, which bore the full force of the blows struck by the Germans upon the invasion of Belgian territory, represent some of the most nearly impregnable land fortifications in Europe. The works are entirely subterranean and protected by heavy embankments of concrete and earth. Near the middle of each fort is a polished steel cap, hemispherical in shape, which shields the gun turret. When the heavy disappearing rifles are drawn back after firing their charges, the dome sinks out of sight, leaving the enemy's artillery nothing but a great mound of earth to operate against. When the defense pieces are in action the slightly curved dome rises above the ground, the guns protruding through one side like great eyes. From a distance it looks not unlike a huge turtle's back, which ricochets the projectiles striking it. The observer towers are similarly arranged with protecting domes. The mechanism makes it possible to operate the guns in all directions."

Top L&R: caption/s: (Left): A cross-section showing the underground works of one of the forts. (Right): "How the defense guns at Liege are mounted"
Lower Right: caption: "Above: On the inside of one of the gun turrets. Ammunition for the 6 and 9.7-Inch guns is hoisted through the center tube. The turret is mounted on wheels so that it revolves easily. Left: How the fortification looks to an attacking army. These Turtle-back cupolas are all that show above the earth."

81

82

The design and geographic placement of Brailmont's forts had weaknesses, particularly as the chemical explosive compounds and the metallurgy for shells improved. First, the turrets were vulnerable when in the raised position. Moreover, the triangular and polygonal shape of the forts and their surrounding dry moats served to concentrate the heavy guns in a central citadel position, which increased their vulnerability (the damage done by a single shell at *Fort Loncin* is illustrative). Secondly, the Belgian method of mixing and pouring concrete represented another flaw. The concrete was poured in two layers, which lessened its resistance (the 3-meters of concrete protection called for by the Belgian design proved insufficient). Significantly, unlike the French post-1870 fortifications, the Belgian forts were *not* constructed of reinforced ferroconcrete (and may also have been of inferior quality concrete) and were never modernized to keep up with improvements in artillery, as were the French forts. Tactically, the two fortress rings of Liege and Namur had no way to support each other. There were no permanent interval positions constructed between the forts themselves and the individual forts at Liege and Namur were not sited so as to be mutually supportive.

83

Left: caption: "The destruction of Fort Loncin"

84

The King of Battle

85

The massive German siege guns had arrived on August 10th 1914 and, after two days of preparation, they began to fire on August 12th. The Belgians defenders in the forts suddenly found themselves facing artillery rounds from 305mm *Skoda* siege mortars (borrowed from Austria) as well as the massive 420mm howitzer nicknamed "Big Bertha" (for the wife of *Albert Krupp,* whose armaments factory produced it) which the Germans had secretly developed and produced at the *Krupp* steelworks. The latter was a fearsome weapon-of-war. It weighed about seventy-five tons (it had to be transported by rail in five sections) and set in concrete before being fired. It could fire up to ten 2,200 pound projectiles per hour (with each shell having a hardened lead-tip and a time-delayed fuse for maximum penetration before exploding). It had a range of about nine miles and had such a high trajectory that its shells came down on its targets nearly vertical.

86

Above & Left: caption: "At the Belgian city of Liege, the first two Big Bertha guns (above) went into action. It had taken 200 men 6 hours to assemble each gun and make them ready to fire their 820kg shells (left)"

87

Above: caption: "Big Bertha, 7 August 1914 before shelling Liege." When ready to fire, its crew moved about 300-yards away and covered themselves with protective padding (the gun had to be fired electrically). Though it required much preparation, the results were worth it for the Germans. *Big Bertha* could penetrate even the toughest section of the forts at Liege, breaking apart thick stone fortifications and vaporizing anyone and anything unfortunate enough to be inside.

88

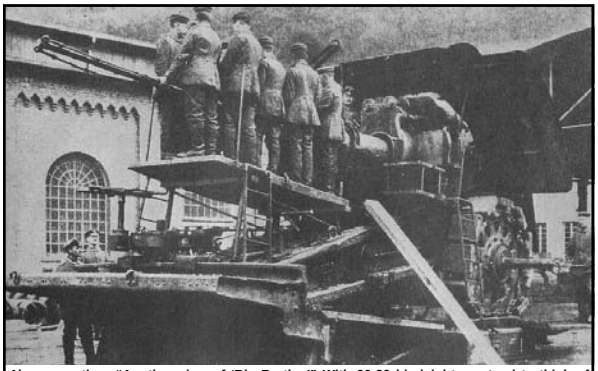
Above: caption: "Effect of Firing on Cupolas. Top dotted line shows the line of flight of siege howitzer shell, finally bursting on top of cupola, the range having been ascertained by the Germans long before war was declared. The bottom dotted line represents field-gun fire and shows shell glancing off cupola."

89

The *Battle of Liege* appeared to be a victory of high explosives over fortification and a demonstration of how little the human spirit mattered in battle anymore. "Brave Little Belgium" (as the British press dubbed the defense of Belgium) displayed much courage and fortitude, but sheer weight of mass and the pure physics of explosive force proved more powerful than human willpower. Ironically, the large caliber German gun's last hurrah took place at Verdun in 1916. Slow to move, the gun was vulnerable to counter-battery fire and the barrels wore-out quickly. However, by the time they were retired, *Krupp* had designed and produced even bigger and better guns.

90

91



Above: caption: "Another view of 'Big Bertha.'" With 20-20 hindsight, we tend to think of poison gas and machine-guns as the great killers of WWI and they were, in fact, responsible for tremendous carnage, but nothing killed quite as efficiently as artillery. Once a branch of military science relegated to lower classes, artillery ended the war universally acknowledged as: "The King of Battle." 92

The new prominence of artillery affected the status of another, newer branch of the combatant nation's militaries: Aviation. Because unarmed surveillance planes were used to correct artillery fire in 1914, the combatants began a new war of attrition for control of the skies. Even before the introduction of wireless, aerial spotting vastly improved the targeting process for long-range artillery. The first method used to calculate the range of a target via aircraft was simple trigonometry. A reconnaissance aircraft would fly over enemy positions at a predetermined altitude and drop a signal flare or smoke bomb when directly over the target. Grounds spotters (who used binoculars to keep watch on the aircraft) would calculate range to the target using the known altitude of the aircraft and it's angle above the horizon. The method was equally effective at night when flight crews used colored lights to signal ground spotters. Although the triangulation method improved general ranging of artillery, there were a number of factors that limited its accuracy. However, two-man reconnaissance aircraft were no match for lightweight and heavily armed scouts specifically designed for aerial combat.
Left: caption: "British Airco DH-1 was no match for single seat scouts" 93
Right: caption: "Germany's Eindekker E-1 ruled the sky in early 1915"

The Battle of the Frontiers

94

On August 7th 1914, a series of battles began that came to be known as: "The Battle of the Frontiers." Germany had a plan to march through Belgium and then, in a big wheel formation, down through France; capturing Paris and surrounding the French Army from behind. They began their march on August 3rd 1914 and by August 5th were hung up unexpectedly in Belgium, at the *Battle of Liege*. While history tends to remember the Germans as "invaders," the fact remains that the French also qualify under the term. France had a plan to attack Germany directly and take back the territories of Alsace and Lorraine, which they had bitterly lost forty years earlier in the *Franco-Prussian War*. In fact, France's entire battle plan consisted of invading Germany. Nevertheless, they reserved one army (the Fifth, under *Charles Lanzerac*) to march north, just in case the Germans were marching in a big wheel formation down through France. Ultimately, the *Battle of the Frontiers* cost 450K lives and both French armies that invaded Alsace and Lorraine were pushed back into France, to a point not much farther from where they had started weeks earlier.

95


Late Reports Indicate That Liege Forts Are Still in Possession of Belgians
HARRISBURG TELEGRAPH
BIG BATTLE BETWEEN FRENCH AND GERMANS SEEMS IMMINENT IN ALSACE
GERMANS OCCUPYING LIEGE BUT BELGIANS STILL HOLD FORTS

(August 10th 1914) 96

While the result of the German invasion of Belgium resulted in the *Battle of Liege*, the result of the French invasion of Germany was referred to as the *Battle of the Frontiers*. It was a combination of several battles along the French-German border:

- Mulhouse (Alsace): August 7-10, 1914
- Lorraine: August 14-25, 1914
- The Ardennes: August 21–23, 1914
- Charleroi: August 21st 1914
- Mons: August 23rd 1914

Left: caption: "The Battles of Mulhouse (blue) and Lorraine (green)

97

As the *Battle of Lorraine* was being fought along France's eastern border, something started to feel wrong to the commanders of the French Army. *French Plan XVII* (in which France was to attack Germany at the onset of war) was to have been met with light German resistance. After all, Germany had to deal with Russia in the east in addition to France in the west. However, it was becoming apparent that a massive German troop buildup was occurring at the French border in the north. In fact, Germany was sending the vast majority of their army west to invade France following the *Schlieffen Plan*. The German Fourth and Fifth Armies (in the center of the big wheel that was to roll through France) were on the march through the *Ardennes*. On August 20th 1914, the French Third and Fourth Armies were sent to meet them in the woods, still not appreciating just how large these German forces really were. On August 21st, in extremely dense fog, the two armies stumbled into one another and skirmishes began. The French were certain that they had encountered a German surveying force sent in advance of the main body of the German Army. In reality, they were heavily outnumbered. This became painfully clear to the French commanders the next day as German machine guns tore through advancing French troops who continued to wear bright red pants that exposed them to the withering German machine-gun and rifle fire. During the *Battle of the Ardennes* there were a series of advances and retreats for the French, who ended up with net ground lost as the Germans continued into France. In the end, 60K French soldiers were dead and/or wounded as a result of battle on open ground.

98

Left: caption: "The German Schlieffen Plan (Red) & French Plan XVII (Blue). The German armies are numbered North-to-South (Kluck's First Army being the Northernmost), while the French armies are numbered South-to-North (Lenrezac's Fifth Army is the northernmost)"

99

Above: caption: "The Fighting in Belgium" (*The Globe*, August 25th 1914)

100

As the French Third and Fourth Armies marched into the woods on August 20th 1914, *Charles Lanrezac* (left), commanding the French Fifth Army, had an insight that the Germans might invade from the north. However, *Joseph Joffre* - the French Commander-in-Chief, would not even consider the possibility. Despite this, by August 20th Joffre gave Lanrezac the OK to move north toward Belgium, though with a smaller force. Little did Lan-rezac know that his army was on a direct course to meet von Bulow's Second German Army, which had just marched past Liege, through Belgium. Joffre est-imated that there would be eighteen German divisions to meet Lanrezac's fifteen. The *British Expeditionary Force* (BEF) had arrived in France and would add three more divisions on the French left flank. Lanrezac estimated that there were far more than eighteen German divisions at the border. To his great misfortune, he was correct.

101

The Germans attacked in force, resulting in the *Battle of Charleroi*. During the battle, communications between the allies broke down. There was a disorganized retreat (amid some otherwise effective counterattacking) as civilians fled in all directions. Finally, Lanrezac ordered a general retreat which saved the French army from total annihilation and, ultimately, saved France from defeat. As a reward for his actions, Lanrezac was fired by Joffre for "not being aggressive enough" and lacking an "offensive spirit." In all, 41K French and BEF soldiers died in the Battle of Charleroi.

Above: caption: "A horse drawn cart to remove French war dead following the Battle of Charleroi"

102

The ***Battle of Mulhouse*** **(a/k/a *Battle of Alsace*) began on August 7th 1914 at 5:00 A.M., when General *Luis Bonneau* of the First French Army crossed the *Vosges Mountains*, on the frontier between France and Alsace. With great cheer and bayonets drawn, Bonneau captured the German town of Altkirch in just six hours, suffering one-hundred casualties. By August 8th, Bonneau had captured the town of Mulhouse, which had been abandoned by the German army. The French media was jubilant and France celebrated the victory over Germany. This battle is noteworthy not only as a military victory because it conformed to the French idea of *elan*, by which battles would be won through fighting spirit and enthusiasm with soldiers charging in red pants and swords sparkling in the sun. The *Franco-Prussian War of 1870-71* was fought by the French primarily as a defensive war, resulting in defeat. This time around, things would be different. France's best defense would be an offense. By the end of August 1914, over 300K French soldiers were dead, victims of a 19th Century mentality that held no merit in an age of high-explosives and rapid fire weaponry.**

103

104

Left: in *En guerre! (At war!)*, the first of two children's books on the war written and illustrated by *Charlotte Schaller* and published during the conflict, Boby, his two sisters, and the neighborhood children act out the first months of the hostilities. Our hero, astride his rocking horse, immediately mobilizes all his toy soldiers. Boby admires the bravery and heroism of the Belgians. One illustration enacts the *Battle of Liege*. The Belgian army, tiny black figures less than one inch high, wages a futile assault on a pair of Prussian boots that dominate the entire landscape and sky.
Right: Andre Helle's wooden toys of 1911 and his book illustrations, which they populated, certainly inspired children's books on the war in which toys participated in the conflict. Helle's alphabet took the conflict out of the playroom. The sequence begins with A – Alsace - and ends with Z, for Zouave, who, he assures his young readers, fights with great bravery, and does not exist simply to be the final letter in an alphabet book. In between, such pairings as "Batterie" and "Charge" made the war vivid and, critics asserted, appealing to children.

105

106

Unfortunately for France, the French army's victory on German soil would be fleeting; Mulhouse would soon be lost. On August 9th 1914, Germany (which had been waiting patiently for reinforcements) counterattacked. General Bonneau's First Army began a slow withdrawal to avoid encirclement. By the time French reinforcements arrived, the French lost Mulhouse and Bonneau had lost his command for "not being aggressive enough" and for lacking an "offensive spirit" (just like *Charles Lanrezac*). By August 10th, over 7K French soldiers were dead.
Top: caption: "French troops in 1914 in their original red trousers – a symbol of French elan"
Bottom: caption: "Captured French soldiers await transport"

107

French Win With Heavy Loss.

A battle began Saturday evening on the ridges of the Vosges mountains. Aeroplanes took part. The French troops, after a desperate encounter, obtained possession of the mountain passes of Bonhomme and Sainte Marie. Then, on Sunday morning, when the fighting was resumed, they took a position dominating Sainte Marie-Aux-Mines.

The French losses in the taking of Sainte Marie are not specifically given in the official report, which confines itself to declaring they were serious.

The wounded French and German soldiers were taken to the French fortress of Epinal for treatment.

Aeroplane Takes Part.

A French aeroplane, which ascended during the engagement, was repeatedly fired at, the officer who was acting as observer of the German movements received a bullet in the hip. The pilot of the machine, however, brought him safely to the ground, and he was able to return to Belfort, whither the aeroplane also was sent for repairs.

The German troops inundated the valley of the Seille, hoping by this means to stop the advance of the French, but the quantity of the water was not sufficient, and the French troops were able to continue their march.

The French today were in force on the outskirts of the forest of Hardt, in front of Neu Beelsach, which appears to be occupied in force.

SOME OF THE AEROPLANES IN TO-DAY'S AERIAL CONTEST.

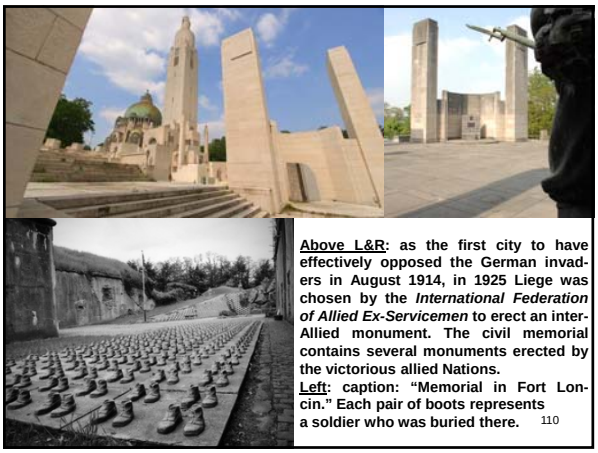
Left: excerpt from the *Evening Times-Republican*, Marshalltown, Iowa. Early reports of French victory at the *Battle of Mulhouse* would prove to be short-lived. Also, something new for war – the aeroplane, which was used for reconnaissance of the German army. In the early days of the war, the airplane (1914 types, above) was not used for battle, and the pilots of opposing forces would often wave to one another in what would be known as the "friendly wave" period.

108

The Impact of the precipitous fall of the Liege and Namur fort/s was both immediate and long-term. The immediate effect was to free up the supply lines from Germany to support the massive wheeling movement of German armies into France under the *Schlieffen Plan.* More importantly, the failure of the Belgian forts to stop the Germans convinced the French to abandon plans to use their own fortress system, which led to near disastrous results at Verdun in 1916 as these forts were stripped of their heavy guns and their garrisons redeployed.

Left: caption (postcard translation): "VERDUN – Monument to the Defense of Verdun in 1870"

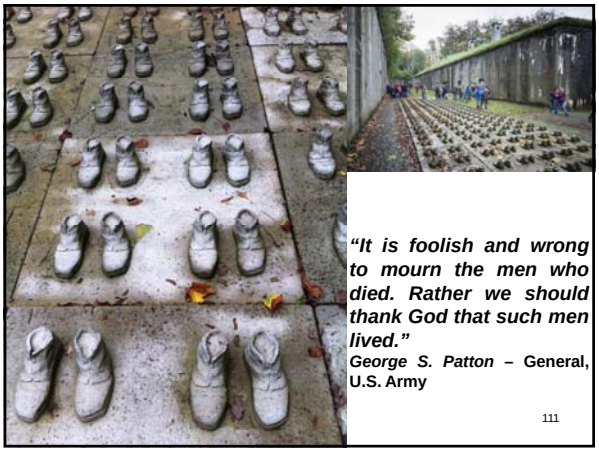
109



Above L&R: as the first city to have effectively opposed the German invaders in August 1914, in 1925 Liege was chosen by the *International Federation of Allied Ex-Servicemen* to erect an inter-Allied monument. The civil memorial contains several monuments erected by the victorious allied Nations.

Left: caption: "Memorial in Fort Loncin." Each pair of boots represents a soldier who was buried there.

110



"It is foolish and wrong to mourn the men who died. Rather we should thank God that such men lived."

***George S. Patton* – General, U.S. Army**

111

112

Above L&R: caption: "Belgian Liege Medal 1914"

113

Achilles Heel

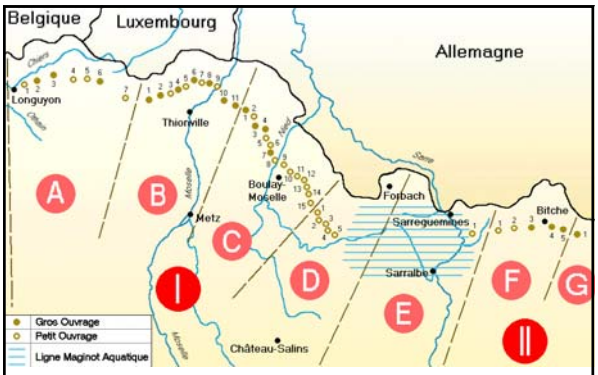
114

"…Today, Belgium is strengthening these defenses, but counts on French troops to aid her, if Germany attacks. For if that attack overran Belgium, as in 1914, it might fold up and crush France's part of the front at its vital, vulnerable center. This critical sector begins where the French frontier leaves the southeast corner of Belgium, to run eastward, opposite Luxembourg and the German Saar, to the Vosges and the Rhine. These 125 miles are the Achilles' heel of France, where nature passed the buck. So, after each invasion, the French have built more forts. This time they have created the Great Wall of France…"

Popular Science, October 1936

Left: caption: "France's vulnerable eastern frontier, and the chain of defenses she is building to protect it"

115



IA - Fortified Sector of Crusne
IB - Fortified Sector of Thionville
IC - Fortified Sector of Boulay
ID - Fortified Sector of Faulquemont
IE - Fortified Sector of Faulquemont
IIF - Fortified Sector of Rohrbach
IIG - Fortified Sector of the Vosges

116

117

118

"…By similar means, part of the left flank in Belgium can be defended. Mines are ready to explode and block the few roads of the wooded Ardennes mountains; sluices to release rivers like the Scheldt to overflow lowlands. But there are gaps. In one, is the city of Liege. In 1914, the Germans amazed the world by quickly seizing its forts, with the bridges and tunnels at the Meuse. Now, bridges and tunnels are mined, there are more and better forts, and the new Meuse-Antwerp canal is a protecting moat, in turn protected by concrete forts…"

Popular Science, October 1936

Above: caption: "Fort Loncin, near Liege, destroyed by German artillery during the advance through Belgium in 1914"

119

Part 3

Paths of Glory

120

Lesson Learned

121

The idea for the *Maginot Line* (named after French Minister of Defense *Andre Maginot*) was a line of concrete fortifications, tank obstacles, artillery casemates, machine-gun posts and other defenses which France constructed along its borders with Germany and Italy based on their experiences in WWI and in the run-up to WWII. In general, the term describes either the entire system or only the defenses facing Germany while the "Alpine Line" refers to the Franco-Italian defenses. It was born from one of the bloodiest and most futile battles of WWI: the *Battle of Verdun*. Unlikely as it may seem, this battle contributed to a renaissance of fortifications in France. The fortress ring of Verdun represented the culmination of the building of fortress rings in France after its defeat in the *Franco-Prussian War.*

122

Verdun consisted of two rings of forts; the outer ring comprising the newest and most modern fortifications (including the pride of the French army; *Fort Douaumont*). The French had stripped their forts of most of their armament when they saw the vulnerability of Belgium's fortifications to German heavy artillery. Thus, when the Germans launched their offensive at Verdun, a partially garrisoned Fort Douaumont, stripped of many of its weapons for close defense, fell to a handful of men who moved across the unguarded obstacles protecting the fort. Other French forts fared better, but it took many months to recapture Fort Douamount which withstood virtually all the artillery the French could throw against it.

Right: caption: "The largest fort in the French defensive system, this fort (virtually ungarrisoned) was captured by the Germans 25 February 1916. Over 120K shells fell upon it before its recapture by the French on 24 October 1916."

123

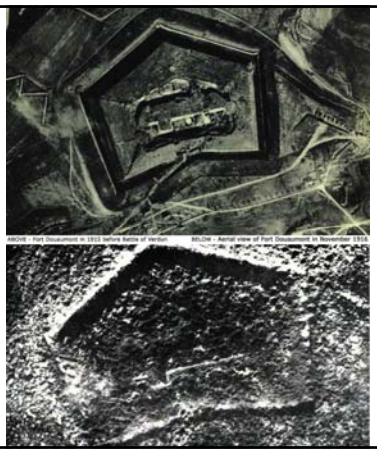
124

125

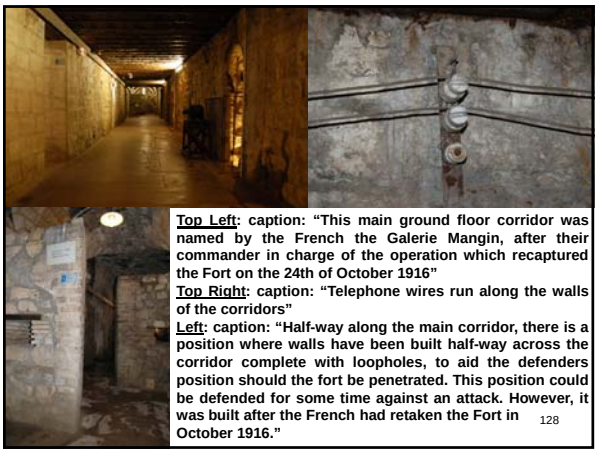
***Fort Douaumont* was one of a series of forts near Verdun, constructed after the *Franco-Prussian War* in order to ensure the area could be defended against any future attack. It was constructed mainly between 1885 and 1891, with the concreting taking place in 1888. However, work did not finish until 1913. The fort stands on a site over 1,200-feet high and has commanding views over its surroundings. The barracks were built to accommodate a garrison of 635 soldiers. In 1914, the garrison was smaller in size than the maximum capacity (only a single infantry com-pany plus artillery and engineers; just under 500 men total). However, after similar Belgian forts failed to hold up the German advance into Belgium, views on the usefulness of such forts changed and the garrison was much reduced. When the German offensive near Verdun began in early 1916, the fort had been disarmed of nearly all its large guns and only a small garrison of fifty-seven French soldiers was present. The ceiling of the fort was six meters thick. It's estimated that in 1916, the fort was struck by between 800 and 1,400 German shells each day. On February 25th 1916, the Germans captured Fort Douaumont with relative ease.**

126

Above: caption: "155mm turret position as seen on the top of Fort Douaumont"

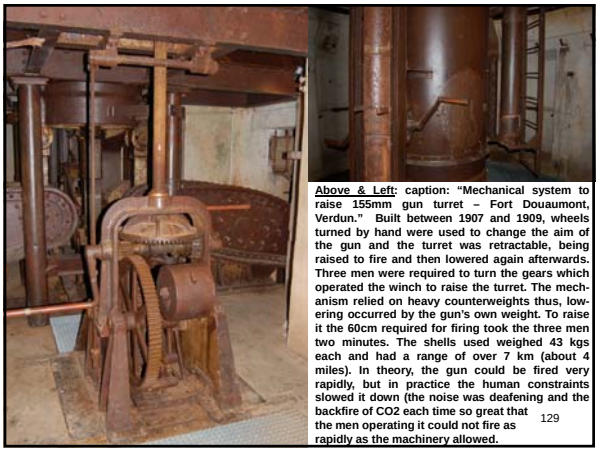


127



Top Left: caption: "This main ground floor corridor was named by the French the Galerie Mangin, after their commander in charge of the operation which recaptured the Fort on the 24th of October 1916"
Top Right: caption: "Telephone wires run along the walls of the corridors"
Left: caption: "Half-way along the main corridor, there is a position where walls have been built half-way across the corridor complete with loopholes, to aid the defenders position should the fort be penetrated. This position could be defended for some time against an attack. However, it was built after the French had retaken the Fort in October 1916."

128



Above & Left: caption: "Mechanical system to raise 155mm gun turret – Fort Douaumont, Verdun." Built between 1907 and 1909, wheels turned by hand were used to change the aim of the gun and the turret was retractable, being raised to fire and then lowered again afterwards. Three men were required to turn the gears which operated the winch to raise the turret. The mechanism relied on heavy counterweights thus, lowering occurred by the gun's own weight. To raise it the 60cm required for firing took the three men two minutes. The shells used weighed 43 kgs each and had a range of over 7 km (about 4 miles). In theory, the gun could be fired very rapidly, but in practice the human constraints slowed it down (the noise was deafening and the backfire of CO2 each time so great that the men operating it could not fire as rapidly as the machinery allowed.

129

The Dead Comrades

130

Using the captured fort as an ammunition depot would prove catastrophic for the victors. Somewhere between 800 and 900 Germans were killed in the explosion which occurred at 6:00 A.M. on May 8th 1916. It happened when a store of grenades exploded and nearby flamethrowers ignited. The scenes of death were horrific. Some of those who died were buried outside the fort, but there were so many bodies that many were walled up in two casemates in the fort itself. Six hundred and seventy nine lie behind the wall here marked with a cross remembering "The Dead Comrades." There is also a metal plaque on the wall to the left commemorating those who died.
Left: caption: "A cobbled section of the corridor leads to the German Cemetery"
Right: caption: "A cross on the wall behind which are the remains of 679 German soldiers"

131

New and Improved

132

After WWI, the French military studied carefully the events of the *Battle of Verdun* and concluded that the day of the fort had not passed (based on their own experience trying to recapture *Fort Douaumont*). In the early 1920s, after much study and debate, they opted to create a line of fortifications to protect France and the territories of Alsace and Lorraine (returned to France by the *Treaty of Versailles*) from a resurgent Germany. The French wanted to establish the fortifications to provide time for their army to mobilize in the event of attack and/or to entice Germany to attack neutral Belgium (to avoid a direct assault on the line). Experience in static, defensive combat during WWI was a key influence on French thinking during the interwar years. Initially the commission assigned to study and recommend the best type of defensive system to employ found itself divided between the ideas of Marshal *Henri Petain* and those of Marshal *Joseph Joffre*. Petain insisted upon a continuous front consisting of the type of defenses reminiscent of the trench warfare of WWI. However, Joffre advocated a system of strongly fortified regions (not greatly different from those built after the *Franco-Prussian War* by General *Raymond Sere de Rivieres*). Ultimatley, they agreed on Joffre's strategic plan, with heavy fortifications linked by a line of continuous defenses (although they did not cover all the territory between the Swiss border and the *North Sea*).

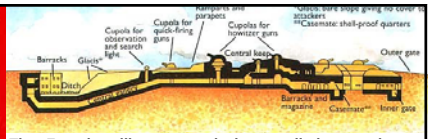
133

"…Those vulnerable 125 miles they honeycombed like a giant rabbit warren. The most expert French engineers went over it, foot by foot, and made the most of whatever assistance nature offered. They adapted their 'wall' to the slightest ups and downs of terrain, seeking covered, higher ground, before which spread slopes offering a good field of fire against attacking troops. That fire will not blaze from the surface of the ground but from beneath it. It will come from new cannon, firing new shells faster and farther than any World War guns…"
***Popular Science,* October 1936**
Left: caption: "The interior of a heavy gun casemate on the Maginot Line"

134

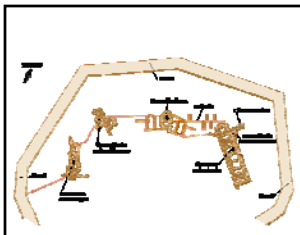
"…The moment they cross the frontier, invaders will find themselves already in the toils of those formidable new defenses, of which the outermost, sensitive tentacles are earthworks of the familiar type, backed by trenches of concrete, and small, turret-shaped machine-gun pill boxes. Held by infantry and screened by a curtain of artillery fire, these may resist attack by enemy infantry. But then, amid clouds of smoke and dust, up come roaring new-type tanks – fast, nimble, and crushing. In their tracks, the attacking infantry follows triumphantly…"
***Popular Science,* October 1936**

135



The French military commission studied several proposals for a new type of subterranean fort. The designs were heavily based on those of the battle-tested works at Verdun, especially *Fort Douaumont,* which impressed the designers of the *Maginot Line* with its resilience. However, when actual construction began, the French military engineers (under the direction of General *Marie Eugene Debeney*, Chief of the Army Staff) decided to save on construction costs by eliminating the surrounding ditch (a/k/a "fosse"). General/s *Maxime Weygand* and *Maurice Gamelin* (who both later commanded the armies occupying the Maginot Line) played an important role in the development of the new fortifications.
Above: caption: "Fort Douaumont cross-section"
Top Left: caption: "General Maxime Weygand on Time magazine cover in 1933"
Top Right: caption: "TIME Magazine Cover: General Maurice Gamelin - Aug. 14, 1939"

136



In addition to *Fort Douaumont*, *Fort Moulanville* and other French forts of that era, a smaller fortification at Verdun known as the *Ouvrage of Froideterre* (left) had an important influence on the layout of the new forts. Furthermore, certain features of the German defenses of the fortress rings of Metz (right) and Thionville, in Lorraine (10 km behind the border) also appear in the *Maginot Line* forts. Thus, the design features of the new French forts were rooted not only in French forts like Douaumont and Moulanville and minor fortifications like Froideterre, but also in the new German forts in Lorraine.

137

Left: caption: "Half buried in the ground at the end of a village street, this stout blockhouse connects with an underground fastness"
Right: caption: "French soldiers on guard in one of the concrete machine-gun emplacements that form the outer fringe of the great Maginot Line"

138

Death Trap

139

"…Thousands of cannon, of every caliber from seventy-five to 400 millimeters, are flaming from the parapets of the Great Wall of France, yet the invaders can see none of them. They can barely see their winking flashes, stabbing from amid trees or behind knolls. The long slope is dotted with figures in gray; many lie motionless; others limp painfully rearward, but some still crawl bravely toward the higher ground. Now they see that every knoll, every smallest rise, must conceal cannon that rain shells – both high-explosive and gas – upon them. And the fore of these cannon, too, forms a pattern, into whose entangling meshes the attackers thrust their heads…"
***Popular Science,* October 1936**

140

"…Suddenly, shouts of dismay arise. One tank after another comes to a stop, blocked by rows of steel rails set firmly in the ground with their sharpened ends protruding. Rushing on, the infantry must enter a deeper inferno. They must ascend a steep, bare slope, swept by machine guns firing from a checkerboard pattern woven in years of expert study, so that the gun protects its neighbors. This death trap is set with belts of barbed wire at intervals permitting a diabolical series of artillery barrages, falling with clockwork precision upon the infantry trying to break through them. The farther the struggling, gasping attack progresses, the more intense becomes this barrage, while, simultaneously, the areas in the rear of the shock troops are blasted by heavier shells fired at longer ranges…"
***Popular Science,* October 1936**
Left T&B: caption: "Maginot Line fortifications"

141

"…Shells from the invaders' artillery burst near the flashing guns, but apparently with little effect. Yet, with splendid, disciplined persistence, some attacking groups reach the last barbed wire. Amid its clutching, tearing coils they struggle. They seem about to win through the last open stretch before the guns. Then, suddenly, an army has sprung from the ground across their path! The slope, bare a moment before, now swarms with blue-clad soldiers. With rehearsed precision, they hurl themselves upon the trapped men in gray. Grenades crash, rifles crack, bayonets flash in fierce struggle. Back and forth the conflict sways, but always more men in blue appear, as from the earth, at unexpected places. Down to earth are beaten the men in gray; the attack is repulsed…"
***Popular Science,* October 1936**

142

"Few men are killed by bayonets, but many are scared by them. Having the bayonet fixed makes our men want to close. Only the threat to close will defeat a determined enemy."
***George S. Patton* – General, U.S. Army**

143

"…An imaginative picture, of course, but based upon known facts, and the belief of those who know the technical perfection of this 'Maginot Line,' named for a French minister of war, now dead. The ambition of his life was to build a line of defense secure against every device of attacking artillery, infantry, tanks, and aviation. Not even bombs from the sky, the French claim, can silence its guns – and bombs would be few, since hostile airplanes would have to pass through the tightest anti-aircraft defense ever devised, using remarkable new quick-firing guns whose sensitive-fused shells are directed by automatic eyes and ears…"
***Popular Science,* October 1936**

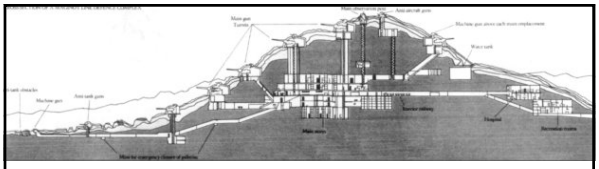
144

Gas!

145

"…Into it leap the surviving attackers. Thrusting into the lower chamber, they see a gruesome sight. About the shattered gun are contorted blue figures, and another crouches against the farther wall. One hand holds an automatic; the other reaches for an electric switch. Pistols crash. His body sags, but not before his hand has found the switch. A heavy steel trapdoor in the floor clangs shut; a gong rings; the air is filled with a sweetish odor. Gas!..."
***Popular Science,* October 1936**

146



"…Only two of the attackers survive, and the gas mask of one is bullet-pierced, useless. He sinks to the floor. The second affixes another bomb to the trapdoor. It takes several minutes, but at last, the cover grates move slowly back. A circular staircase, leading downward into invisibility; the dull twinkle of elevator cables and shafts; then pitch darkness. As his eyes become accustomed to the blackness, the invader sees steel shields, and black muzzles pushing through them. He starts to withdraw his head, but he is too late. From below, a brilliant searchlight sears his eyes. Then comes the ripping crash of a big, 0.50 caliber machine gun, and slowly the trapdoor clangs shut. The underground Great Wall has proven too high for the assault from the sky…"
***Popular Science,* October 1936**
Above: caption: "Section through a Maginot Line Fort." The *Maginot Line* was based on the "Impregnable Fortress" doctrine.

147

"…That desperate, gallant stroke could hardly have won, even had more attackers penetrated the gun platform, and got through the trapdoor into the shaft leading down hundreds of feet into the earth. For the invader, that shaft is a descent to hell; its dark spiral staircase and elevator shaft, built primarily to rush ammunition up to the cannon, are lined with steel shields for machine guns. And, if attackers should run that gauntlet, deep down they would strike another obstacle more solid and formidable. The base of the casemate is a solid blockhouse of steel and concrete protected not only by a machine guns but by light cannon, from attack not only from the shaft above, but from the main gallery and lower levels of the labyrinth…"
***Popular Science,* October 1936**

148

"…Suppose that even one invader, somehow, got through that? He would stand on the concrete floor of the main gallery, miles long, whose high roof and sturdy walls are of stone. He would see, at his feet, railroad tracks, running down this main gallery, branching off here and there. If disguised in French uniform, he ventured further, he would come upon great chambers, dormitories, kitchens, hospitals, for the thousands of blue-clad men he would see everywhere.…"
***Popular Science,* October 1936**
Left: Operating Room

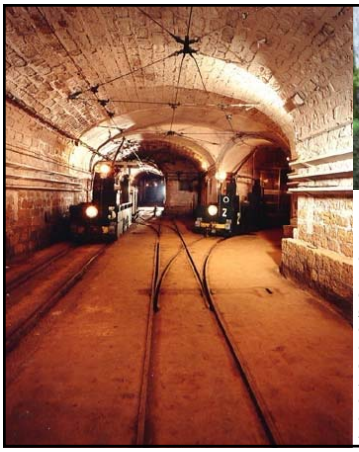
149

150

151

152

153



"…Their clattering hobnails would be the only sound in those quiet depths, save for carloads of shells rattling along the tracks, through thick steel doors guarded by machine guns, into blockhouses like the one through which he just came. And through those steel doors, the sighting of elevators, bearing shells upward to the cannon thudding dully in the casemates high above…"[154]
***Popular Science*, October 1936**

155

Subterranean Sentinels

156

"…These shafts are the towers of France's Great Wall. They stand with feet anchored deep in earth by the concrete blockhouses, their heads barely peeping into open air. From the casemates peer the muzzles of cannons of various calibers, on special mounts…"
***Popular Science*, October 1936**
Above & Left: caption: "Turret shaft and mechanism

157

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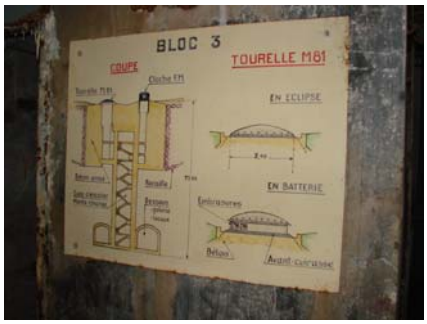
160



161

162

"…Their eyes are special observation posts on the most commanding ground outside, hidden perhaps in a special casement, a 'peasant's hut' of concrete, or a 'tree' of steel, where crouch blue-clad men, reporting everything they see, by subterranean telephone cables, to headquarters…"
***Popular Science,* October 1936**
Left T&B: caption: "Observation Cupolas"

163

164

"…This is the innermost fastness of the whole labyrinth. Here, before a map of the whole system, sit the commanding officer and his staff. To them, by telephone, radio, and buzzer signal, come reports from all parts of their fortress, and from all the other fortresses that, linked together, make the Great Wall of France…"
***Popular Science,* October 1936**
Above & Left: caption: "Command Room"

165

166

"…From here got the orders for counterattacks that send troops to the surface to push back attacking bodies that get too close. These may go by tunnels to sally ports hidden in ravines, woods, or villages, at spots tactically important, or they may issue from the main portal of the fort…"
***Popular Science,* October 1936**
Above: caption: "Telephine cubicles"
Left: caption: "Communications room in Maginot Line fort"

167

168

"…This portal connects with a great rearward network of railroads and highways that insure quick movement of reinforcements and supplies up to the Great Wall. The approach to it is a road sunk in the ground. The entrance itself is low, and is guarded on either side by steel-and-concrete turrets, mounting guns. Between them is a great steel door, with an air lock, that connects with a powerful system of ventilators and electric fans. When it is locked, these raise the air pressure within so much above that outside, that it blows out incoming gas. There are also stores of oxygen and gas masks…"
***Popular Science,* October 1936**

169

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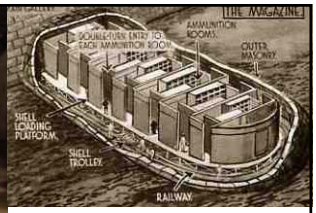
171



"…The biggest of the subterranean chambers is the munitions magazine, It is semi-circular, with a narrow-gauge railway running around the great racks on which are piled shells in thousands, high-explosive and gas, grenades, bombs, small-arms ammunition, flares, and barbed wire for entanglements, to be strung at a moment's warning over the peaceful fields above…"
***Popular Science,* Oct. 1936**

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173

174

175

176

177

160K Picked Men

178

"…The defenders of the Great Wall are 160,000 picked men of the finest French regiments. They believe in their Great Wall. Daily they rehearse its defense, knowing that in an emergency their numbers would be doubled immediately by eager reserves…"
***Popular Science,* October 1936**
Left T&B: caption: "French troops inside and outside a Maginot Line fort"

179

180

181

The Art of War

182

In 1937, the first *Maginot Line* facilities were being put into operation. Life in the underground forts was cold, damp, dark and lonely for most of the soldiers. Some of the men were artists in soldiers uniform thus when the opportunity presented itself to make the bare, windowless concrete walls of their bunkers more aesthetically appealing, they took it. Typically, these took the form of "Fresco" paintings which, of course, take time and patience - something the soldiers stationed in the fortifications had an abundance of.

183

184

185

186

187

188

After the *Fall of France* in June 1940, the *Maginot Line* was taken over by the conquering Germans. After the war, the facilities were once again used by the French military up until the mid-1960s, when they were abandoned and left to decay. Some parts were auctioned-off to the public and have been turned into wine cellars, a mushroom farm and even a discoteque. As well, a few of the bunkers have been turned into museums, which host visitors in the summer months. Only one fortification remains in active service, the *Ouvrage Hochwald*. The two *Mickey Mouse* paintings and the fresco depicting soldiers bursting into the underground bunkers of the Maginot Line are part of the converted museum: *Bois de Bousse* (a/k/a "Fort aux Fresques"). Though most frescoes have survived, many are in a state of decay.

189

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191

192

193

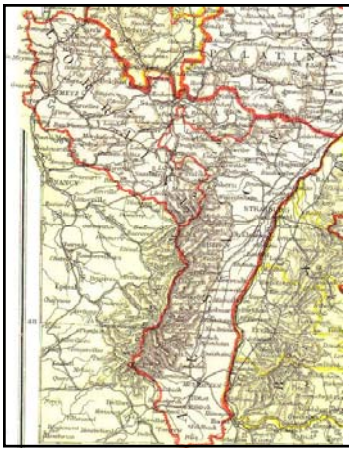
Part 4

Islands in an Enemy Sea

194

Savior of France

195



After Prussia annexed Alsace and Lorraine in 1871 (at the conclusion of the *Franco-Prussian War*) the natural boundary of the *Rhine River* (which had been the long-established border between France and Germany) no longer existed. A 250 km gap (between Belfort and Longwy) was left without any defensive break that would protect France from a Prussian invasion. To slow down an attack (in order to facilitate mobilization of the French army), General *Raymond Sere de Rivieres* – Director of Engineering Works for the French army, would build a series of formidable fortifications in consideration of "the replenishment of the border in the East." In essence, it would form an obstacle to any future German invasion plans.

Left: caption: "Map of Alsace-Lorraine, 1871"

196

Above: caption: "The Siege of Paris 1870 by Meissonier"

197

Metz, principal military base in France during the 19th Century, received a ring of detached forts on the eve of the *Franco-Prussian War* of 1870-71 (a war which established Prussia's military supremacy and united a divided Germany). As a result of the *Treaty of Frankfurt* (1871), two formidable fortification systems emerged:

• In France, the Sere de Rivieres system including the cities of Verdun, Toul and Epinal;

• In German-held Lorraine, the "Moselstellung" (Moselle position) - a system built around Metz and Thionville by the Germans which made Metz (above) the strongest fortress in Europe on the eve of the First World War

198

The *Franco-Prussian War* left France with an open breach in its defensive system. On July 28th 1872, a Fortifications Committee – consisting of nine members (with Seres de Rivieres as Secretary) was established by presidential decree. On February 1st 1874, General Seres de Rivieres was appointed Head of the Engineering Department in the Ministry of War and assigned the task of building a line of fortifications to defend France; from Dunkirk - on the *North Sea*, to Nice - on the *Mediterranean Sea*. Three main groups of fortifications were called for. Sere de Rivieres was replaced in 1880 by General Cossseron de Villenoisy who continued the fortification work which, by then, was in an advanced state. For a total cost of 450 million francs (for construction) and 229 million francs (for armaments), a belt of 196 large forts, 58 small forts and 178 artillery batteries were established from north to south along France's eastern frontier. These fortifications would play a key role in 1914.

Left: caption: "General Raymond Seres de Rivieres (1815-1885)"

199

Seres de Rivieres fortifications were of three basic types:

1) Arresting Forts: these were isolated structures designed to cut lines of communication in order to delay the enemy advance in order to allow time for the main army to mobilize;

2) Curtain Forts: a fort alignment which allowed for mutual support in order to form a defensive curtain, and;

3) Strongholds: surrounded by a ring of forts (i.e. Verdun)

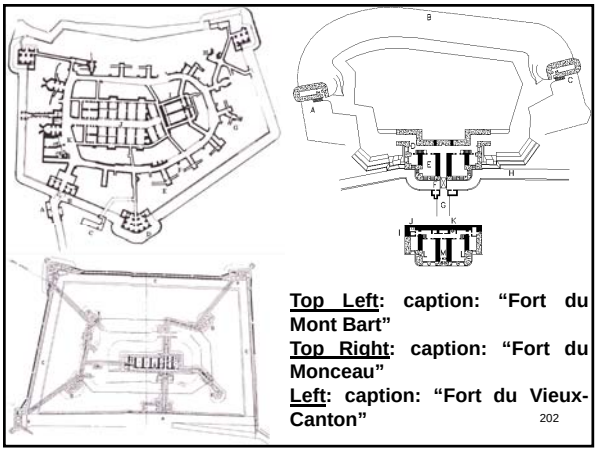
Left: caption: "Border Defense Plan"

200

Seres de Rivieres built upon the ideas of the *Marquis de Montalembert* (1714-1800), which provided French fortifications with perpendicular lines providing interlocking fields-of-fire. The fortifications created by Seres de Rivieres included a surrounding waterless moat (in French: "fosse") with steep walls on both faces. The fortifications were covered with a thick layer of earth to protect against fire from enemy artillery. The fortifications were organized around a buried barracks (which housed the garrison) with a large inner courtyard. Infantry troops would guard the fort's access points and defend against attack from protected positions. Each fort maintained a three-month supply of food.

201

Above: caption: "Fort Conde – a Seres de Rivieres-type fortification"

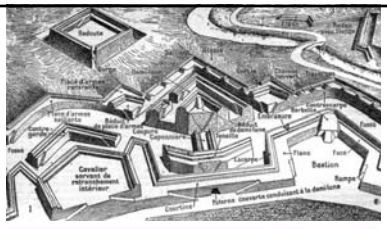


Top Left: caption: "Fort du Mont Bart"

Top Right: caption: "Fort du Monceau"

Left: caption: "Fort du Vieux-Canton"

202



203

204

CORF

205

A decree in September 1927 created CORF: ***C**ommission for the **O**rganization of **F**ortified **R**egions.* This commission was the most important organization concerning the development of the *Maginot Line.* However, the funds necessary to put its plans into operation were not available until late 1929. The planners initially selected three fortified regions (RF) in northeastern France to protect the frontier with Germany. However, only two of these were developed as fortified regions:

- RF de la Lauter
- RF de Metz

Later on, these two RFs (plus the gap between them in the Sarr and the Rhine defenses) became collectively known as "The Maginot Line." The line was built in a number of phases commencing in 1930 by the STG (***S**ervice **T**echnique du **G**enie*) and overseen by CORF. The line stretched from Switzerland to Luxembourg, although a much lighter extension was extended to the channel sea (after 1934). However, the construction did not cover the area of the Belgian *Ardennes* forest (a/k/a "Sector 4"). The main construction was largely completed by 1939, at a cost of about three-billion French francs.

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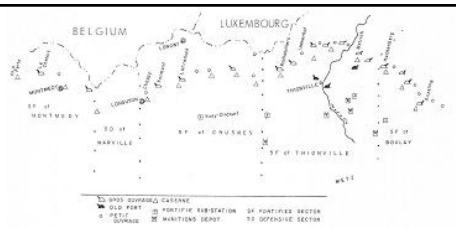

A few years after the construction began in these areas and as it neared completion, the French government authorized new works on what were referred to as the "New Fronts." These included some expansion of the heavy fortifications into the edges of the sector between the two RFs (the *Sarr Gap* and from the vicinity of Longuyon towards Sedan). These works beyond Longuyon have been commonly referred to as "The Maginot Extension" in the post-WWII years. Major fortifications of the *New Fronts* consisted of several ouvrages with more up-to-date designs which saved significantly on construction cost/s.

Above: caption: "Maginot Line in the Fortified Region of Metz and Maginot Extension"

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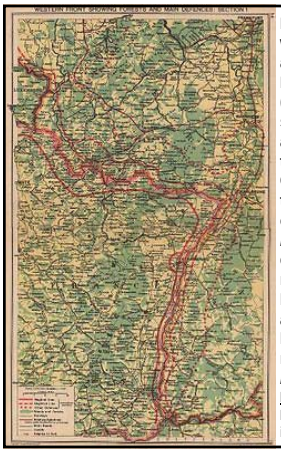
"…The flat countryside lay spread out around us under the cold light of the moon. We were through the Maginot Line! It was hardly conceivable. Twenty-two years before we had stood for four and a half long years before this self-same enemy and had won victory after victory and yet finally lost the war. And now we had broken through the renowned Maginot Line and were driving deep into enemy territory. It was not just a beautiful dream. It was reality."

Erwin Rommel – Panzer Division Commander, May 1940

209



In addition to the major fortifications, work was done on CORF-type fortifications in the vicinity of Maubeuge. None of these included any large forts (in French: "gros ouvrage"), only a few smaller forts ("petit ouvrage") built atop older forts. The construction of these lesser works might have misled German intelligence since the maps they issued indicated the fortifications of the *Maginot Line* running from the *North Sea* to the *Rhine River*. This may explain why Panzer Division Commander *Erwin Rommel* believed that he had passed through Maginot fortifications when he readily rolled over a line of bunkers near the French frontier north of Sedan, well beyond the *Maginot Extension*.

Left: caption: "Western Front Showing Forests and Main Defences: Section I"

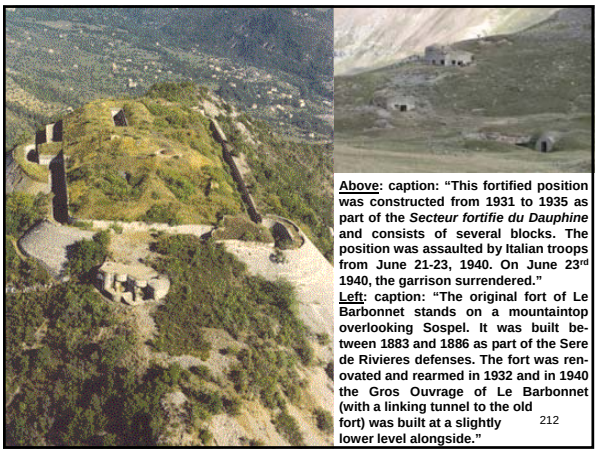
210

Some of the most impressive works of the CORF were not located on the northeastern front but, rather, on the southeastern front facing Fascist Italy. These fortifications extended from the Mediterranean to the Swiss border with the heaviest fortified regions located in the ***Maritime Alps*** (in the vicinity of Briançon and Modane). While not as well known as the ***Maginot Line*** in Alsace-Lorraine, the Maginot Line in the Alps, in reality, covered as much territory as the main Maginot Line and comprised almost the same number of forts. The French also constructed some of the smaller CORF-type fortifications in the form of casemates on the island of Corsica. They also used similar works to create the ***Mareth Line*** in Tunisia (facing Italian-controlled Libya).

Left: caption: "Situated throughout the Alpes-Maritimes were several large forts (gros ouvrages) and smaller satellite forts (petit ouvrages). They formed the Maginot Line's Alpine extension; the Alpine Line (a/k/a: 'The Little Maginot Line')."

Right: caption: "This tank barrier on the Col du Petit-Saint-Bernard was part of the Alpine Line, a part of the Maginot-Line to protect the southeastern regions of France"

211



Above: caption: "This fortified position was constructed from 1931 to 1935 as part of the *Secteur fortifie du Dauphine* and consists of several blocks. The position was assaulted by Italian troops from June 21-23, 1940. On June 23rd 1940, the garrison surrendered."

Left: caption: "The original fort of Le Barbonnet stands on a mountaintop overlooking Sospel. It was built between 1883 and 1886 as part of the Sere de Rivieres defenses. The fort was renovated and rearmed in 1932 and in 1940 the Gros Ouvrage of Le Barbonnet (with a linking tunnel to the old fort) was built at a slightly lower level alongside."

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Ligne Maginot du Desert

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The ***Mareth Line*** was a system of fortifications built by France in southern Tunisia prior to WWII. Its purpose was to defend Tunisia against attacks from Libya, then a colony of Fascist Italy. French plans for defending Tunisia assumed that Italy would launch an overwhelming assault that France could not easily oppose. It was expected that Italy would launch attacks on both Egypt and Tunisia as soon as war was declared, with the Italian navy securing supply lines and interdicting any substantial Anglo-French relief. With a limited force of 6 to 9 divisions to defend all of French North Africa, the French army settled on the idea of a ***Ligne Maginot du desert*** (Maginot Line of the Desert). Construction began in 1936, with the Mareth Line laid out in a similar manner to the ***Maginot Line***. The fortifications stretched for twenty-eight miles of fixed defenses, trenches and cleared firing blinds. Infantry were to be housed in trenches and forty concrete casements as well as fifteen fortified command posts and twenty-eight support posts. The ground was not suitable for underground artillery however, eight large artillery positions were constructed, each capable of accommodating a battery of artillery. The Mareth Line incorporated French experience in trench warfare and infantry-artillery tactics. The line would preserve French manpower and provide a force multiplier to offset numerical inferiority. When WWII began in September 1939, Italy remained neutral until a few days before the French-German Armistice signed on June 22nd 1940, after which the line was demilitarized by an Italian-German commission.

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On March 19th 1943, the British Eighth Army frontally assaulted the Axis-occupied ***Mareth Line*** in ***Operation Pugilist***. The line was penetrated near Zarat, but was driven back by the 15th Panzer Division on March 22nd. Earlier reconnaissance by the ***Long Range Desert Group*** had shown that the line could be outflanked. A force could pass through the southern Matmata Hills, reach the Tebaga Gap from the west and pass on to the coastal plain behind the Mareth Line, which became known as the "left hook." At the same time as Pugilist, General ***Bernard Montgomery*** sent the New Zealand Corps around the Matmata Hills. The attack was held up by Axis units at the ***Tebaga Gap*** from March 21-24. The British attacked again in ***Operation Supercharge II*** on March 26th and broke through the Tebaga Gap on March 27th. This success, combined with a fresh frontal assault, made the Mareth Line untenable.

Left: caption: "The Mareth Line and Operations in 1943"

Right: caption: "Infantry bunker of the Mareth Line"

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At All Costs

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CORF had intended to build a line of fortifications whose primary purpose was to avert the effects of a German surprise attack and to delay an advance into Alsace and Lorraine as the French army mobilized (akin to Seres de Rivieres "Arresting Forts"). The original concept was to create a covering line that could be sacrificed in the initial phases of war. Later, as construction progressed through the 1930s, the French military's policy had already moved towards holding the *Maginot Line* at all costs and preventing any enemy penetrations (no French government could otherwise justify politically the massive expense of such a project, especially during a world-wide depression).

218

When the French government decided to create defenses on the German frontier to protect the vulnerable resources of Lorraine in the early 1920s, two prominent military figures; Joffre and Petain, argued over what defensive design should be employed. Joffre, emphasizing the success of the Verdun fortifications, insisted upon fortified zones similar to the old fortress rings (a/k/a "Strongholds"). Petain (a/k/a "The Hero of Verdun") insisted on a continuous linear defense without forts. The commission rejected Petain's scheme of defense, but he finally came around to accepting the use of heavy fortifications with some modifications. The commission finally ruled out the idea of any defense-in-depth because of the immense expense involved.

Left: caption: "General Henri-Philippe Petain (left) shaking the hand of Marshall Joseph Joffre (right). Verdun, 1916."

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Petain, visualized a continuous line with enough depth to delay the enemy to constitute a "covering line." His idea was to hold the enemy and allow for the completion of mobilization. On the other hand, Joffre believed that strongly fortified zones (like Verdun) could "stand like islands in an enemy sea," and provide bases for striking at the enemy's flanks. In reality, Joffre positions were to be much stronger than that of a covering line, requiring a strong defensive commitment. The *Maginot Line* was not to be a solid, continuous line of defenses but, rather, several RFs separated by defensive sectors. The result was not the uniform defensive line that Petain had envisioned. Instead, it comprised of large, strong fortified zones separated by lighter defenses. The depth that Petain desired was missing. Ultimately, what emerged was a compromise between the ideas of the two great men of France.

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Left: caption: "French Fortification Belts"

By the time war broke out in 1939, the French contemplated using the strongly fortified regions of the *Maginot Line* the way Joffre had intended. In fact, they planned to use defensive sectors to permit the Germans a line-of-advance which would expose their flanks. The RFs would also be used as assembly areas from which the French could strike at Germany while securing their own flanks. Once CORF decided upon the type of fortifications, it gave priority to building the heaviest fortifications in areas most suitable (both militarily and economically) for the construction of large underground works. It relegated the areas that presented the most difficulty for the construction of such fortifications to defensive sectors with lighter works. However, just as work began, the worldwide *Great Depression* imposed financial restrictions and further reduced the scale of construction, leaving the defensive sectors even more lightly defended.

221

Sector of Vulnerability

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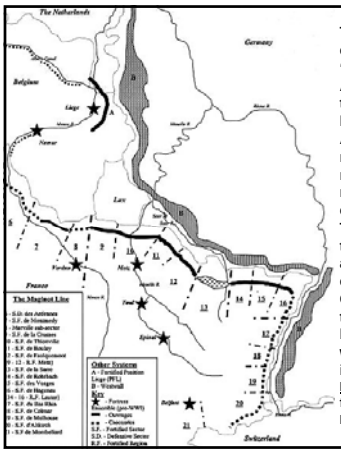

The French High Command weakened the system by allowing a "Sector of Vulnerability" along the Ardennes frontier. Petain was partially to blame for this decision for he concluded in the 1930s that the Ardennes were a major obstacle to modern mechanized warfare and need not be protected. The French military did have a defense plan to cover the Ardennes in time of war. Thus, they did not totally ignore the potential threat of an enemy advancing through it. The French expected that in a future war, the Germans would again advance through Belgium (although they believed that the major effort would be along the more traditional route through Liege).

Left: caption: "Map of the principal fortified section of the Maginot Line"

223

As a result of this mindset, the Metz RF was assigned the mission of covering Belgium's southern border believing that French forces could extend their position towards Arlon and form a southern bastion in Belgium to restrict enemy movements south of the Belgian fortress zone of Liege. Later, they added the *Maginot Line Extension* (as part of the *New Fronts*) further lengthening the actual French defenses along the Belgian frontier towards Sedan. However, the French military and government did not opt for a continuous line along the entire Belgian border. At first, the French were afraid of isolating Belgium and losing her as an ally. By 1936, after Belgium declared neutrality under its new King, French military planners believed that the old, revitalized forts as well as the new fortifications of northern Belgium (i.e. *Eben-Emael*) would still be able to impede any German advance until the French army could intervene. However, the French military continued to neglect southern Belgium's Ardennes, believing a major offensive in this sector highly unlikely.

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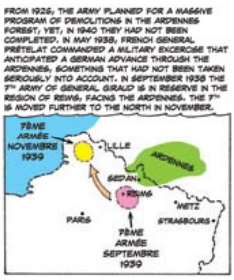

225

Part 5

Ouvrage

226

Deja Vu All Over Again

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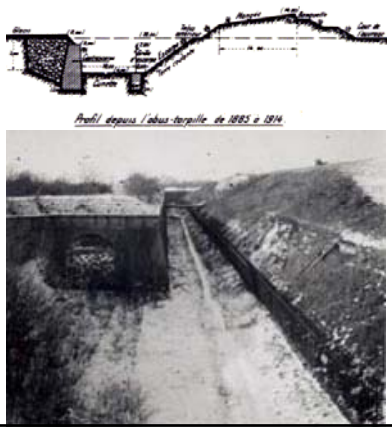
The *Maginot Line* is most remembered for the massive forts that constituted its core in its most vital sectors. These great forts are often depicted as artillery support positions, with large caliber guns. However, this is a misconception not only concerning the forts' armament, but also their functionality. In fact, CORF planners designed the ouvrages to stand in the main-line and meet a direct enemy assault - like the one that had taken place against the Verdun forts in 1916. As was typical for a front line position, the artillery emplacements were of light caliber. The design of these forts was an adaptation of the salient features of the French forts at Verdun and the German forts of Metz and Thionville (although the French engineers would be hard pressed admit to the latter). One characteristic feature of all these Maginot predecessors was a surroun-ding dry ditch (fosse). With the exception of two of the largest forts, no Maginot fort had a fosse even though the original plans called for it. Furthermore, the existing fosses did not completely encircle the forts because the expense was too great. Ultimately, the idea of fosses was dropped entirely to cut costs.

228



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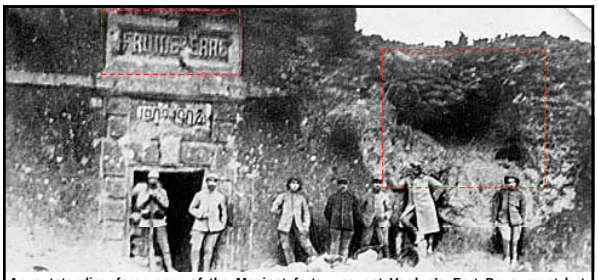
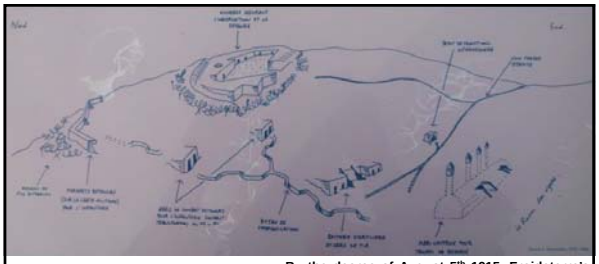


An outstanding forerunner of the Maginot forts was not Verdun's *Fort Douaumont* but, rather, the *Ouvrage of Froideterre* (above). It had individual block positions linked by underground galleries to each other. One of these positions was an artillery casemate which gave flanking fire. Another block contained a turret of twin 75mm guns while another housed a machine-gun turret. These blocks were not positioned on a central area above the fort. Instead, they were dispersed. The overall shape of the fort was irregular and only defined by its perimeter obstacles. The garrison area (in French: "caserne") was separate from the other blocks. Essentially, these would become the basic elements of the large (gros) ouvrages of the *Maginot Line*.

Above: caption: "The center main entrance to the Ouvrage de Froideterre, showing an enormous impact crater at the side of the entrance which killed 5 men"

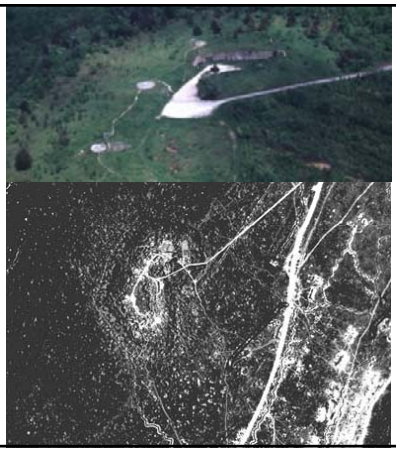
230



By the decree of August 5th 1915, Froideterre's armaments were removed. This decree called for the disarmament of all fixed fortifications of the fortified belt of Verdun. At the time, the French supreme command considered the armaments more useful elsewhere on the *Western Front* (Verdun was a quite sector of the front). However, the twin 75mm short, rotary turret guns were left in place due to difficulties in dismounting them.

Above & Left: map (top) and plan (left) of the *Ouvrage de Froideterre*

231



232

The *Ouvrage de Froideterre* was built between 1887-1888. Although initially it was to be an infantry defensive position, it was completely modified from 1902-1904. New shelters and barracks for 142 men were built. Two armored observation posts and a pillbox (*Casemate de Bourges*) were added. A rotary 75mm turret with two short barrels and two turrets with two machine-guns were added to the fort's armament as well. A fosse (10-meters wide by 5-meters deep) was dug around the fort as well. The fort was quite unusual in shape; divided into four parts separated from each other. The main fire station was located diagonally and forms the eastern part. In the center are three main rooms. The main barracks had no defense other than small gun portals. To the left of the main barracks (the fort's center) the dual, rotating short 75mm turret was positioned. To the left of the twin guns, a second bunker held the second turret containing machine-guns. Both were fairly small structures. Further west, a bunker (equipped with a 75mm gun) was located. Normally, the structure could accommodate 140 men. However, during the *Battle of Verdun*, up to 200 soldiers manned the fort.

Above: caption: "Ovrage de Froideterre – Main Bartracks"

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Top Left: main barracks
Top Right: 75mm rotary gun turret
Left: Casemate de Bourges

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From the beginning of the German offensive on February 21st 1916, the fort was bombarded daily. On March 14th 1916, General Petain ordered the rapid rearmament of the fort. *Casemate de Bourges* was equipped with two 75mm guns. It soon became clear that the weakness of the fort was the lack of connection between each part. Men were obliged to leave the protection of the fort and go outside to move from one part to another. In April 1916, construction began on a tunnel connecting the main barracks with the 75mm twin turret. However, this effort was not successful. In a month of shelling, communication links were destroyed and the ground was covered with huge craters. The growing overpopulation resulted in health/hygiene problems and food and water were lacking as well. On May 10th 1916, a strict order was given to limit access and regulate the number of men occupying the fort. Despite the problems, the fort withstood all German assaults during the *Battle of Verdun*. 235

Above L&R: main barracks (left) and Casemate de Bourges (right) in 1916

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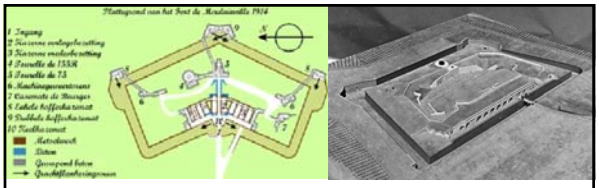
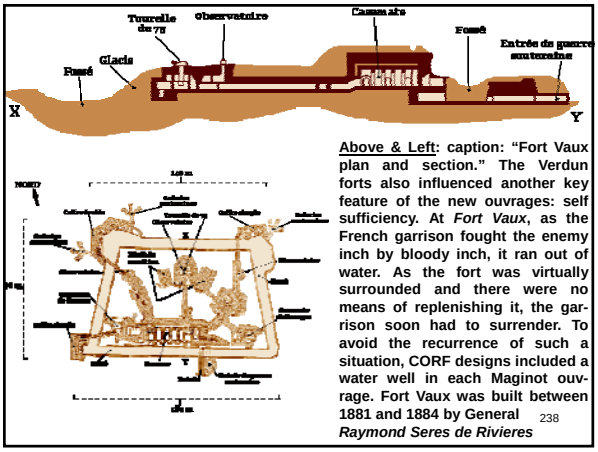


Aside from *Ouvrage de Froideterre* there were three other forts that foreshadowed the Maginot Line's design:
- Fort de Douaumont
- Fort de Moulainville (plan, at left)
- Fort Vaux (model, at right)

These forts were larger and very different from Froideterre. Each of their casernes occupied a large section of the rear areas (a/k/a "gorge") of the fort. The individual positions (similar to those of Froideterre) were in relatively close proximity, clustered within the fort's central area. The French chose not to duplicate this feature in the Maginot forts where they emphasized dispersion. However, CORF designers were quite impressed by the overhead protection of these forts which allowed them to take terrible punishment. 237



Above & Left: caption: "Fort Vaux plan and section." The Verdun forts also influenced another key feature of the new ouvrages: self sufficiency. At *Fort Vaux*, as the French garrison fought the enemy inch by bloody inch, it ran out of water. As the fort was virtually surrounded and there were no means of replenishing it, the garrison soon had to surrender. To avoid the recurrence of such a situation, CORF designs included a water well in each Maginot ouvrage. Fort Vaux was built between 1881 and 1884 by General *Raymond Seres de Rivieres* 238

Fort Vaux (located in Vaux-Devant-Damloup, Meuse, France) became the second Fort to fall in the *Battle of Verdun*. What was left of the French garrison finally gave up after it had completely run out of drinkable water, ammunition, medical supplies and food. Major *Sylvain-Eugene Raynal* sent several messages to his commanding officers via homing pigeons, requesting relief for his soldiers. During his last communication, Major Raynal penned the phrase: "This is my last pigeon." The fort was recaptured by French infantry on November 2nd 1916.

Above L&R: caption: "Scenes from inside Fort de Vaux, Verdun, after it was retaken from the Germans" (from *L'Illustration*, published 1916) 239

"…Everywhere the French and German corpses, a scene I turned away from one to pass another; there was not a hole that did not contain several dead or dying; it was terrible…Vaux was such a massacre" 240

Jacques Ferrandon, Poilu – June 1916

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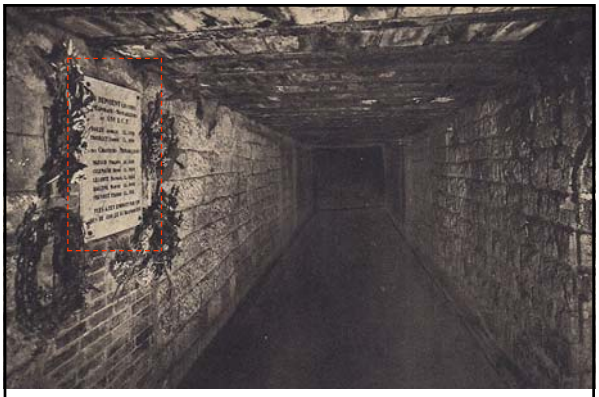
Another hard-learned lesson from the ***Battle of Verdun*** that influenced the Maginot fort designers was the hand-to-hand combat that took place in the galleries of the Verdun forts. In order to secure their positions inside the forts, in 1916 the warring factions had erected a set of temporary "chicanes" (staggered obstacles preventing a direct approach or view by creating one or more turns from which they could repel the enemy). In the Maginot ouvrages, internal gallery defenses became a standard feature and were to ensure further the fort's security.

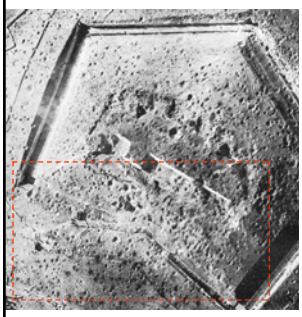
Left: caption: "Defensive embrasure within the tunnels"

242



Above: caption: "Memorial plaque in an interior gallery of Fort Vaux, the scene of heavy fighting in 1916"

243



Fort Douaumont withstood its heaviest bombardment from the rear (highlighted at left) as the French spent months attempting to recapture it. Although overhead protection was included, ironically, the ***Maginot Line*** fort designers did not make the rearward face of any fort so formidable as to make it impossible to recapture (based on the Verdun experience).

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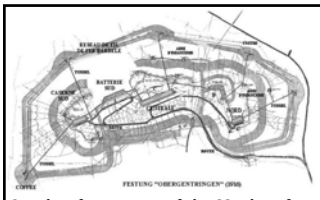

Another forerunner of the Maginot forts was *Fort Guentrange* - one of the most modern of the German forts at Thionville. This fort (like Froideterre) had many features in common with the Maginot ouvrages (it also consisted of dispersed blocks which were larger than those of Froideterre). Those blocks mounting artillery had multiple turrets with heavier guns than the French and underground galleries linked the well dispersed positions. Both internal and external defensive features of this fort can be found in the design of the Maginot ouvrages. However, the French decided to leave out the huge blocks with multiple turrets in order to disperse positions and present smaller individual targets.

Left: caption: "Plan of Fort de Guentrange. Built 1899-1905 north of Thionville in Lorraine, to protect the conquered territory."

248

Right: caption: "Gun turrets – Fort de Guentrange"

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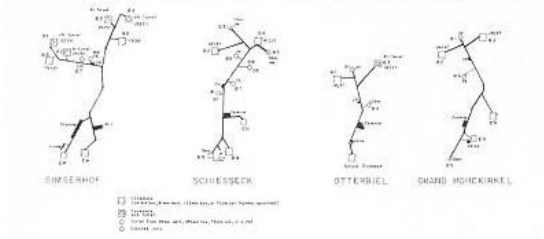
Gros and Petit

250



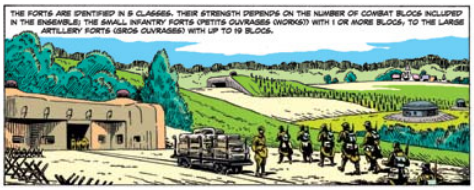
There were basically two types of *Maginot Line* ouvrages:

- Large (Gros)
- Small (Petit)

Actually, CORF engineers' system of classification included five categories (based on size and function) but overall, gros and petit suffices to understand the basic concepts. Whether large or small, the ouvrages were designed to be in the thick of the action while heavy artillery positions behind the Maginot Line (but not part of it) were to lend them support. No two ouvrages were identical and although such positions as combat blocks were built to a standard design, few of them were exactly identical.

251

Above: captions: 'The Ouvrages of the Bitche ensemble"



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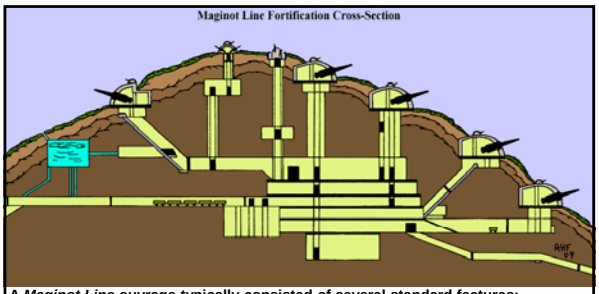

A *Maginot Line* ouvrage typically consisted of several standard features:
- An entrance block;
- Combat blocks;
- An underground caserne (with its own internal power supply (in French: "usine");
- Underground galleries;
- An underground telephone link;
- External power source (with some exceptions);
- Radio communications

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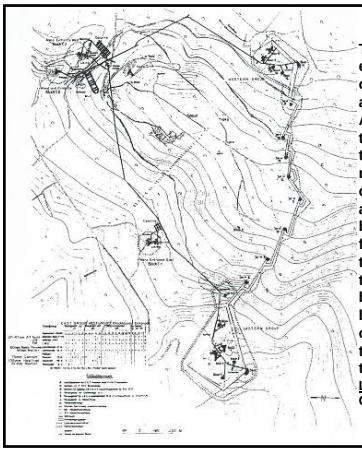
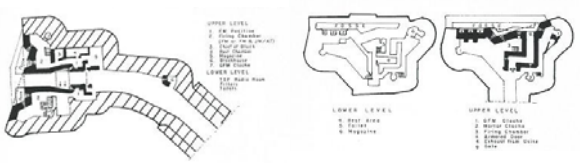


The *Maginot Line* in north-eastern France consisted of over twenty gros ouvrages and about thirty-five petit ouvrages. Along the Franco-Italian border the fortifications included about the same number of gros ouvrages and over twenty-five petit ouvrages. Gros ouvrages usually had two entrance blocks, but there were exceptions. One fort, Hochwald, actually had three entrances (a fourth was in the planning stage when war broke out). Because of the number of blocks and the expanse it occupied, the Germans identified Hochwald as two distinctly different forts.

Left: caption: "German plan of the Gros Ouvrage of Hochwald"

254



In most forts, the two types of entrances were known as the "Munitions Entrance" (in French: "Entree des Munitions" or EM) and the "Men's Entrance" (in French: "Entree des Hommes" or EH). When a single entrance was present it was known as a "Mixed Entrance" (in French: "Entree Mixte"). Ouvrages of the *New Fronts* used a Mixed Entrance with an armored door that dropped down over the entranceway (instead of the rolling gate, as in the older ouvrages).

Left: caption: "Hackenberg – the Munitions Entrance"

Right: caption: "Hackenberg – The Men's Entrance"

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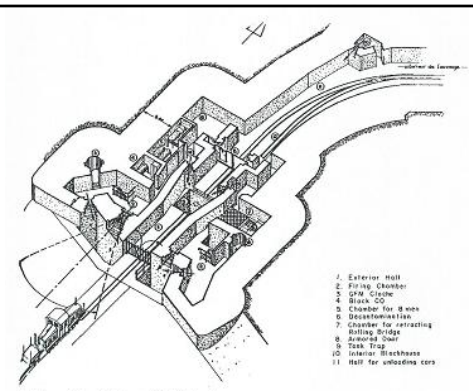

Above: caption: "Hackenberg – EM Type 'A' Entrance"

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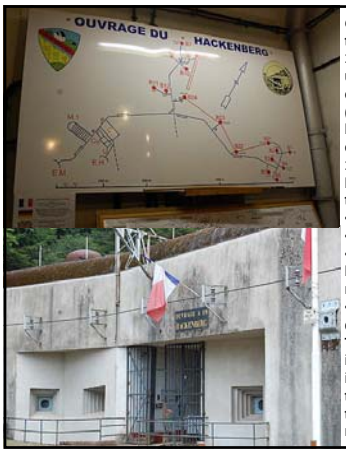

Gros ouvrage de Hackenberg extended for ten kilometers under 1.6 million square meters of scrubby woods, had two entrances/exits and 17 battle blocks (top). It was the Maginot Line's biggest fort, generating enough electric power to run a town of 10K. Linked by a large ditch, the battle blocks were organized in two distinct groups:

- Blocks 1 to 6 (eastern group);
- Blocks 7 to 10 (western group);
- Block 11 and 12 (observation blocks, at an altitude of 343 meters);
- Blocks 21 to 25 (covered the ditch with their fields of fire)

The entrance blocks led directly into the fortress: one for munitions (bottom) and supplies and the other one for personnel. Forty-two officers and 1,040 men manned the fortress.

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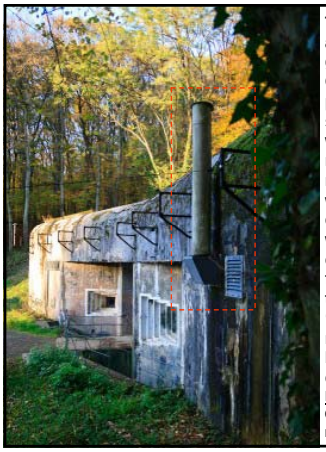

The EM usually allowed direct access to the main underground gallery and the main magazine. On the other hand, the EH usually provided direct access to the caserne. The location of the usine was not related to either entrance, however, in many ouvrages it was situated near the EH where its exhaust fumes were expelled. A number of usines were closer to the EM (in which case the exhaust opened over its fosse). The CORF engineers had to build a special exhaust (a/k/a "chimney block") for those ouvrages where the usine could not be placed close enough to the entrance or combat blocks.

Left: caption: "Entry of the Gros Ouvrage du Michelsberg near Dalstein, Lorraine"

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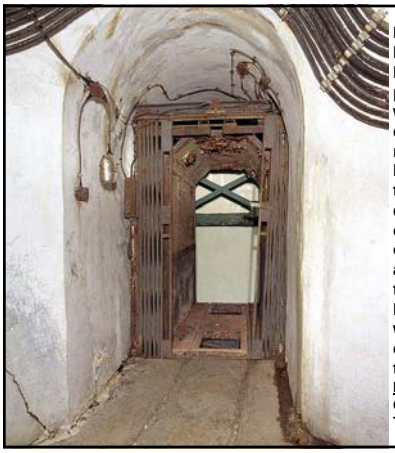
Each entrance block presented one of three basic types of access to the fort's underground complex. The most efficient plan for an EM was a direct level access. On the other hand, for the EH the most favored type was a shaft (left) leading down to the galleries below. The direct level access made the movement of supplies more efficient while the shaft had defensive advantage.

263



In some cases, the galleries had to be so far below ground level for proper protection that it was impossible to access the galleries directly. To solve the problem, two other basic types of approach were devised. One was by use of a lift shaft. Although it offered many defensive advantages, it slowed the re-supply process because each munitions wagon had to be lowered individually down to the main gallery level.

Left: caption: "Gordolon Gros Ouvrage – The Lift"

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The other method was an inclined approach where the difference between the level of the EM and the underground facilities was not too great (i.e. Ouvrage Four-a-Chaux") For this type of approach, CORF planners had to design special vehicles and wagons that could be moved on the incline (this type of access was faster than the shaft method). The inclined approach was not used in EH's since those entrances were designed only for the movement of troops and hand-carried supplies.

Left: caption: "Inclined elevator in an artillery ammunition entrance station. Used to carry the ammunition and material to the upper gallery. This is an exception of the Maginot Line, as usually classical elevators were used."

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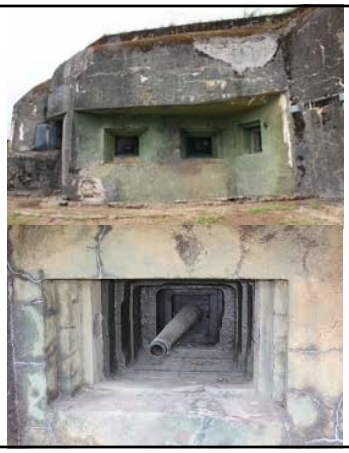
CORF designed the entrance blocks so as to expose a minimum amount of their surface (most of the structure was covered by earth). The exposed face of each of these blocks included defensive positions. For exterior defense there were sometimes one or two firing chambers equipped with machine-guns and, where necessary, anti-tank guns. The smallest embrasure mounted an automatic rifle (in French: "Fusil Mitrailleur" or FM) and the larger ones, a twin machine-gun (in French: "Jumelage de Mitrailleuses" or JM, which was a modification of the FM). An anti-tank gun was mounted in the same embrasure as the JM. The JM had its own special armored crenel cover which fitted right into the embrasure. The JM swung out of the embrasure and was replaced by the anti-tank gun (also mounted with its own special armored crenel) which was attached to an overhead rail and pulled into position. The anti-tank guns were either 37mm or 47mm. The latter was a newer and more effective weapon but it could not be used in the blocks already constructed for the smaller weapon because the embrasures were too small. Whenever possible, the designers placed the weapon positions so that they created interlocking fields-of-fire (a/k/a "cross-fire").

Above: caption: "Fort A5 Bois du Four"

269



270

Entrances also had other, more passive defensive features. On the EM, a concrete bridge crossed the fosse and connected with the face of the block where a heavy iron grating gate was situated. Behind it was a small recess or tunnel leading to a heavy armored door that barred entrance to the block. Normally, the architects placed a firing position for a FM on one side of the armored door. In the tunnel leading to the armored door, a metal bridge (a/k/a "rolling bridge") slid into a compartment situated on the side wall exposing a tank trap. This was usually found on a Munitions Entrance for rail cars.

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In one type of entrance exclusively for trucks, this tank trap was not used (this device was installed in most forts with the exception of those in the Alps). There, a metal drawbridge spanned the fosse which replaced the tank trap in the tunnel. The entrance block also featured an armored door giving access to the main gallery and bunker positions.
Above: caption; "Gros Ouvrage Simserhof's munitions entrance, showing the 60cm rail line"
Left: armored steel door at entrance to underground galleries - Hackenburg"

272

The EH, which was less complicated, generally had fewer weapons and its entrance was much smaller. Its fosse was spanned not by a permanent bridge, but by a small and easily withdrawn metal footbridge. Across the fosse, the entrance gallery made a sharp right or left turn past the gate (grating) into a corridor defended by a FM embrasure. This firing position covered the interior armored door situated out of the enemy's direct line of fire. The EH was also much smaller than the EM because its functions were much more limited.
Above: caption: "Troops of 51st Highland Division march over a drawbridge into Fort de Sainghain on the Maginot Line, 3 November 1939"

273

CORF engineers placed the entrance blocks at a good distance behind the combat blocks (ranging from a quarter to a half mile or more). In exceptional cases, this distance could be shorter. Normally, the caserne, usine and main magazine were located near the entrance block to ensure their safety and their continued operation in case of bombardment of combat positions. Their actual position was undetectable (unless one knew their precise location relative to the rear-facing entrance block which was invisible from the front). However, the exterior wire and anti-tank obstacles spoiled the effect since they actually gave away the shape and perimeter of the forts. The French took great pains to camouflage the blocks, rendering the forts nearly invisible to observers on the ground.
Above: caption: "Anti-tank obstacles connected interval casemates and ouvrages for miles through the landscape. They were supplemented by low barbed-wire obstacles. This is Block 6 of GO Schoenenbourg."

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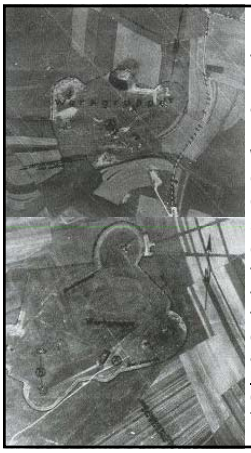

However, CORF engineers failed to take into account advances in aerial photography. As a result, German aerial photographs of the pre-war period show a number of ouvrages whose uncultivated surface stands out clearly against a background of cultivated fields. The photos also show cleared fields of fire and obstacles which outline portions of the fort and even highlight some of the camouflaged blocks.
Top: caption: "German aerial photograph of Fermant, showing the line of obstacles and, highlighted, a false cloche"
Bottom: caption: "German aerial photograph of Rochonvillers. The 75mm gun turrets are labeled 'B'."

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All the underground features of an ouvrage were at the same gallery level. There were no multiple levels of galleries (except in some of the Alpine positions). The caserne could accommodate about one-third of the garrison and included all the basic necessities. The kitchen had ample space for sufficient stocks of food and wine. The water well was usually nearby. There was a small recreation area. More importantly, each ouvrage had its own medical facilities consisting of a small hospital complete with operating room (the larger forts also had a dental office). To cover all contingencies, the CORF planners included a small detention area consisting of a few cells (left). Despite their considerable attention to detail (i.e. gas decontamination chambers), CORF designers overlooked one small, but important detail in the caserne: the safe disposal of refuse. The garbage accumulated by the large garrison had to be taken out at regular intervals. As a result, in at least one of the forts the soldiers had to take out the garbage while under siege.

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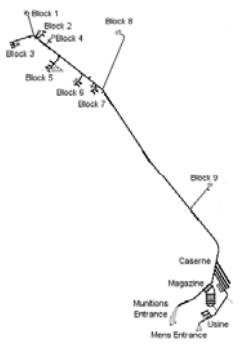
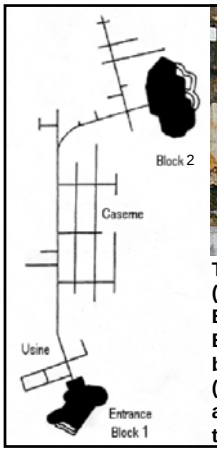


Left: the *Gros Ouvrage of Rochonvillers* is the most northerly fort in the "Thionville Fortified Sector" (located 10 km northwest of Thionville on military land close to Angevillers). When fully manned, the fort had a compliment of 782 troops. It boasted the largest block on the *Maginot Line* - Block 5 (which took 6K cubic-meters of concrete to build). It was armed with three 75mm guns and one 135mm heavy mortar. This was an unusually large fort with five artillery and three infantry blocks and tunnels stretching 2,500 meters from the munitions entrance.

281

Top Left: caption: "The munitions entrance"
Top Right: caption: "The men's entrance"
Left: caption: "Block 5 - the largest block on the Maginot Line"

282



The *Gros Ouvrage de Le Barbonnet* (plan, at left) consists of two blocks, Block 1 (B1) - the entrance (above) and Block 2 (B2) - the fighting block, just below the ramparts of the original (1886) Seres de Rivieres fort. This alpine ouvrage housed 304 troops.

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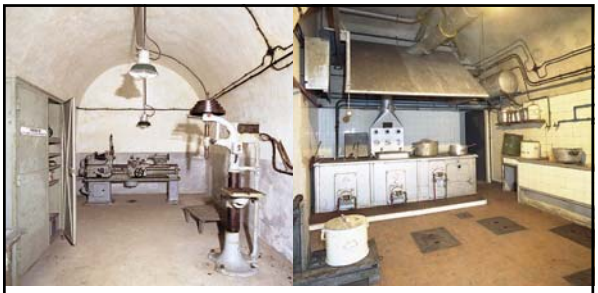

Left: caption: "A Workshop"
Right: caption: "The Kitchen"

284

Left: caption: "Urinals in the caserne"
Right: caption: "Infirmary in the caserne"

285

Left: caption: "Main filters near the entrance"
Right: caption: "Water tank and gauges"

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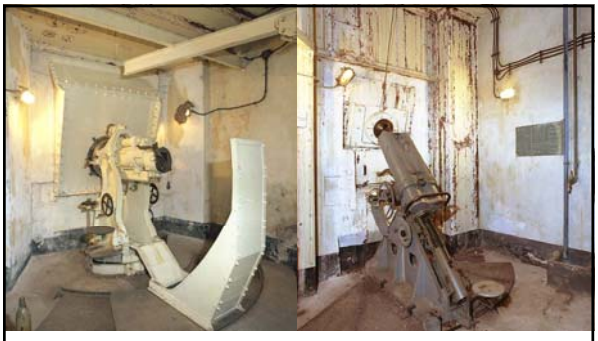
Left: caption: "Telephone booths in the artillery commanders post for communicating with the blocks"
Right: caption: "Switchboard in the artillery commanders post"

287



Left: caption: "75mm cannon"
Right: caption: "81 mm mortar in Block 2"

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The usine (power plant) was usually located near the caserne. It contained generators, transformers and a fuel storage area for its power-producing engines. A combination of underground and aerial cables (usually going underground near the ouvrage) linked the ouvrage to the national electric grid after passing through a fortified sub-station (allowing the fort to conserve its fuel reserves if an enemy threatened to cut-off external power sources). In the Alpine fortifications, some positions had to rely exclusively on internal power because of their remote location.
Left: caption: "The generators (usine)"

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Left: caption: "Not only have the French equipped their famous Maginot Line of fortifications with ample electrical generating facilities – but they also have a large number of American made gasoline or kerosene lanterns for use in case of electrical breakdown. The lantern selected for this important post is the same one you may have used on a fishing trip. Its counterpart is in everyday use on a million American farms. For it gives a strong white light…The clear glass globe for this modern lantern was manufactured by Corning of a special heat-resistant glass after other material had proved unsatisfactory. Similar circumstances have attended the birth of many another product of Corning research…"

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The usine transmitted power to the forward combat positions. This created a need for a sub-station at the other end of a fort for the efficient transmission and redistribution of power. Under normal conditions, an ouvrage could operate on its own power for extended periods. Some ouvrages were linked to neighboring ouvrages so that they could support each others' electrical needs in case of emergency.

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The last major underground position located in the service area was the main magazine or M-1. Some forts did not have an M-1 and used smaller magazines. CORF planners located the M-1 adjacent to the main gallery and designed it so that, in the event of an accidental explosion, the curved walls of the galleries would divert the force of the blast away from the caserne. Each M-1 consisted of a number of cells which housed various types of ammunition. The architects included nearby annexes for the storage of sensitive items (i.e. detonators). A heat-sensitive sprinkler system ran through the M-1 and a special armored door (designed to slam shut once triggered by a sentry in the event of an explosion) also protected the main gallery.

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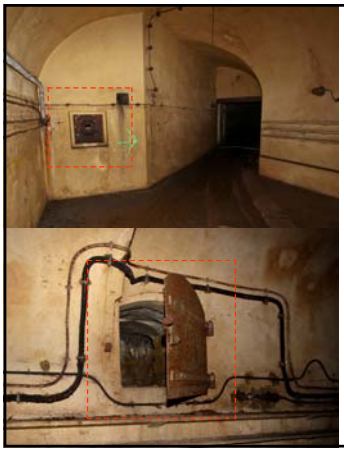
Top: caption: "The tunnel splits left and right at the ammo entrance lift"
Bottom: caption: "An ammo carriage for the 60cm railway"

295

Top Left: caption: "M1 magazine platforms. Ammo goes in one end and goes out at the opposite end where the railway loops round and passes the opposite end of each chamber."
Top Right: caption: "About half way into a magazine chamber (there are several chambers)
Left: caption: "Ammo came off the 60cm railway trucks and onto these overhead monorails"

296



A single gallery connected the service support area to the combat blocks. At key positions, defensive emplacements consisting of armored doors and bunker-like positions further ensured the security of the gallery. Additionally, in the main gallery were strategically located small compartments containing explosives ready to be detonated should the galleries be penetrated by the enemy.
Top: caption: "The entrance to the ammo lift area is protected by a machine-gun crenel"
Bottom: caption: "Access to an explosive charge which was used to collapse the tunnel in the event of penetration by the Enemy"

297

Above: caption: "Rochonvillers Gros Ouvrage - the gate and blast door into the secondary entrance"
Left: caption: "Blast Door, Maginot Line, France"

298

The CORF architects also designed a special small tunnel which would not only serve as a drainage outlet but as an emergency exit as well. A bunker-like position covered the interior of this tunnel in case the enemy should discover it. A secret chimney-type escape exit built into each ouvrage was sealed with sand and earth which had to be cleared before it could be put to use. It was completely covered over on the surface so that it could not be detected when not in use. A few ouvrage plans show tunnels leading to nowhere which were apparently listening posts for the detection of enemy mining and, possibly, might have been used for counter mines.

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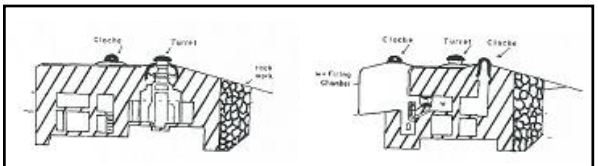

The CORF designers of the *Maginot Line* situated the combat positions of the ouvrages in the forward area as a cluster of blocks (in some of the larger forts there were two of these clusters). The number of combat blocks was variable. Like the entrance blocks, the combat blocks had basic features and came in standard types:
• Observation
• Infantry
• Artillery
(or a combination of these three). Each combat position was either designed as a casemate block, a turret block or a combination of the two. No block ever mounted more than a single turret, but usually included one or more cloches.

300

Above L&R: caption: "Cross-section of turret/casemate block"

Main types of combat blocks in the *Maginot Line Proper* (NE France):

Artillery Blocks:
1. Casemates;
   - 3 x 75-mm guns or
   - 1 x 135-mm Lance Bombe or
   - 2 x 81-mm breech loaded mortars
2. Turrets;
   - 2 x 75-mm guns
   - 2 x 135-mm Lance Bombe
   - 2 x 81-mm breech loaded mortars

Infantry Blocks:
1. Casemates;
   - FM and JM
   - 37-mm or 47-mm anti tank guns where needed
2. Turrets;
   - Machine Gun turrets (designed to mount a 25mm gun later)

Observation Blocks:
1. Observation cloches of GFM type and/or special cloches mounting large periscopes

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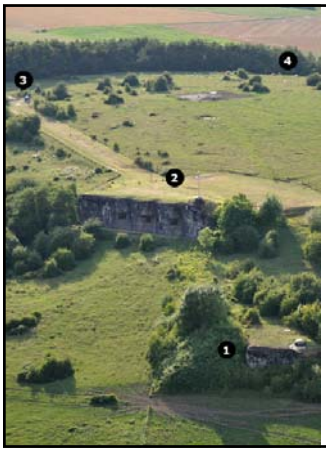


Left: caption: "An aerial view of several combat blocks of ouvrage Fermont:

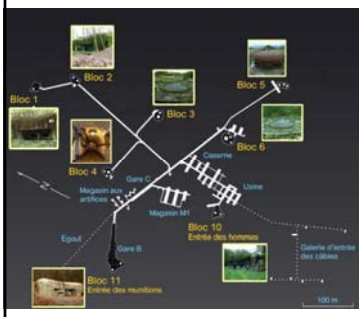
1) Combat Block 7 Armament: 2x JM Reibel, 1x 47mm, 1x GFM cupola, 1x LG cupola

2) Combat Block 4 Armament: 3x 75mm mod32, 1x GFM cupola, 1x MG turret

3) Combat block 1 Armament: 1x 75mm mod33 turret, 1x GFM cupola, 1x LG cupola

4) Combat block 2 Armament: 1x GFM cupola, 1x LG cupola, 1x MG turret"

302



Left: caption: "Map of Galgenberg." This structure (built beginning in 1931) had the role of *verouillage* (an artillery ouvrage with six combat blocks). With its two turrets of artillery and the cover provided by its neighbors, Galgenberg was a formidable obstacle to any potential attacker.

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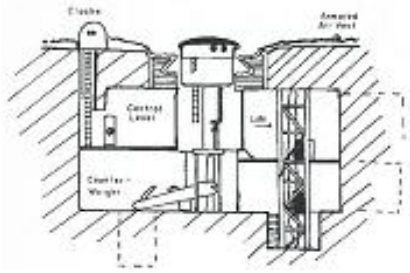

Except in the case of the Alpine positions, the only features of an ouvrage the enemy could observe were its turrets and cloches. The French used short barreled weapons so all the turrets could be retractable and present a smaller profile. The turrets equipped with 135mm and 81mm weapons were situated in a recessed position because of the high angle of fire of their guns. Unlike the 75mm gun turret and machine gun turret, they also lacked direct observation.

305

Above: caption: "135mm howitzer turret"

The average number of artillery weapons and emplacements (estimated) for the ouvrages built on the main-line are as follows:

Weapons:
1. Six pieces of 75-mm or 135-mm artillery as follows:
   - four or five 75-mm guns
   - one or two 135-mm howitzers
2. Two 81-mm mortars

Emplacements:
1. Turrets;
   - one or two 75-mm gun turrets
   - one or two Lance Bombes de 135-mm turret
   - one 81-mm mortar turret
2. Remaining non-turret mounted weapons in casemates

Note: two main-line forts were fitted-out per this description

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Artillery men manned all the artillery weapons while infantrymen garrisoned the other positions in combat blocks. The "Genie" (engineers) also helped keep the fort operational. Each of the combat blocks had two levels with various facilities on each, depending on the type of armament. Artillery blocks normally had a M-3 magazine (the smallest of those used in the forts). Ammunition moved from this magazine into the firing chambers or turret control rooms located in the block below the turret. Each block had filters for protection against poison gas. This filter system was part of a larger system that maintained a high atmospheric press-ure in the ouvrage that prevented the infiltration of gases. The caserne also had a larger battery of these filters.

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The combat blocks were linked to the galleries below by a stairway (left). Those with artillery weapons also had a lift. Artillery blocks had additional facilities (i.e. the M-2 magazine), at the level of the main gallery). The infantry blocks had fewer facilities. The gallery led to the main gallery and normally contained a set of airtight armored doors.

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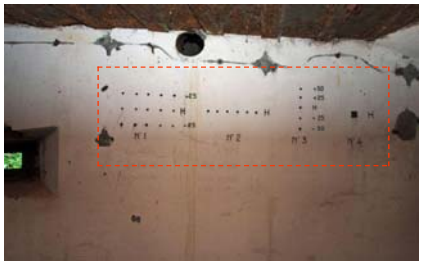
310

Command & Control

311

The command post was usually located in the forward section of the ouvrages, under an observation block. In some cases, as in Hackenberg, where the nature of the terrain required that the observation block be near the rear to ensure adequate observation, the command post was also situated at the rear below the observation block rather than in the forward section. The command post housed telephone exchanges and various offices. It was linked by telephone and order transmitters, like those found on a ship, to each block and to positions outside the ouvrage. There were order transmitters in all the artillery blocks in order to eliminate a possibility of error through verbal command. The artillery men had carefully sited and marked the location of all positions within range of their guns before 1939. However, because the fortifications were in populated areas, the weapons were never test fired.

312



313

In most ouvrages, a small train (a/k/a "metro") served the main gallery and hauled munitions. Ouvrages with entrances and service areas close to the combat blocks lacked a metro. This was mostly the case in the Alpine forts where the support areas were grouped with the combat blocks due to the nature of the terrain. Power cables and communication lines were duplicated and lined both sides of the gallery linking it to the rear areas.
Left: caption: "Station (passing loop) on the intermediate level – GO Gordolon"

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The overhead earthen cover for the galleries and the concrete protection for the blocks were sufficient to resist the heaviest German artillery known in WWI; the 420mm "Big Bertha." Concrete protection was of four strengths. The greatest protection was Number 4 (about 3.5-meters thick) used on the areas most likely to be subjected to direct enemy fire. Most exposed casemate walls were generally given a Number 1 protection (about 1.5-meters thick). Only the gros ouvrages had Number 4 protection while petit ouvrages had no more than Number 3 protection (about 2.75-meters thick) that could resist artillery fire of 300mm caliber.

316

In peacetime, the garrison was stationed at a nearby surface caserne, but when danger was imminent it took up positions within the ouvrage. It operated on a three shift system (similar to that used by the French navy). Their mission was simply to wait until the enemy attacked because the limited range of its weapons reduced its action to observation and harassing fire. However, two gros ouvrages; Hochwald and Schoenebourg, mounted some old 120mm guns in surface positions after WWII broke out in order that its garrison strike back at the Germans. Most of the gros ouvrages had a garrison of five to six-hundred while the largest forts had over a thousand men. The Alpine gros ouvrages commonly had a garrison of four hundred men or less, although they had just as much firepower as the main-line forts. Many of the men assigned to these garrisons were first-line regular troops and their morale was, in general, high.

317

PO

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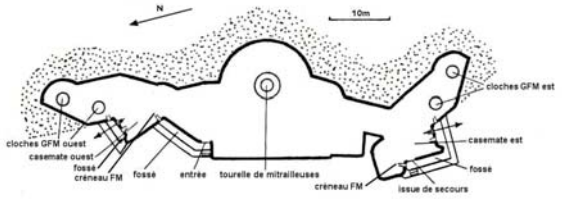

The *Maginot Line* also included *petit ouvrages* (PO) which came in different sizes, some with separate entrance blocks and others with combination combat/entrance blocks. In the 1920s, some of them had been designed to be gros ouvrages but, due to financial limitations, their size had been downgraded. A few of them consisted of a single mono-block. Very few petit ouvrages mounted artillery and those that did contained nothing larger than 81mm mortars. In the Alps, these petit ouvrages were much smaller than those of the northeast and had less defensive strength. In many cases they were little more than defended shelters. As well, the concrete protection of the petit ouvrages was thinner than that of the gros ouvrages. Often, the galleries had less protection from bombardment because they were closer to the surface.

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Above: caption: "Plan - Petit Ouvrage Oberheid"

The petit ouvrages proved to be very vulnerable and several actually succumbed to the Wehrmacht when they placed 88mm guns behind them. The 88mm proved to be the nemesis of the *Maginot Line*. It could wreak havoc against the rear exposed casemates as well as penetrate the protruding cloches of an ouvrage.

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PO Einseling

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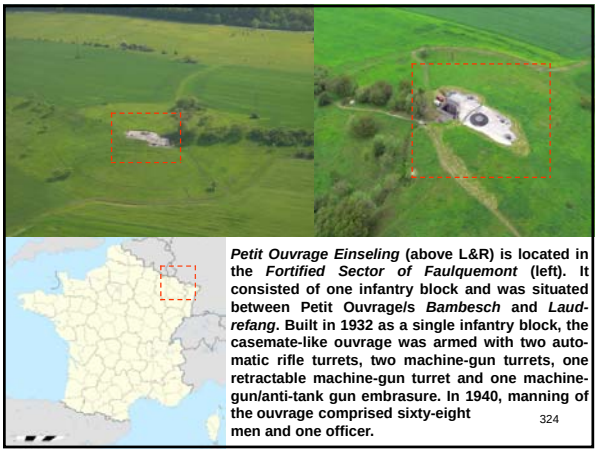
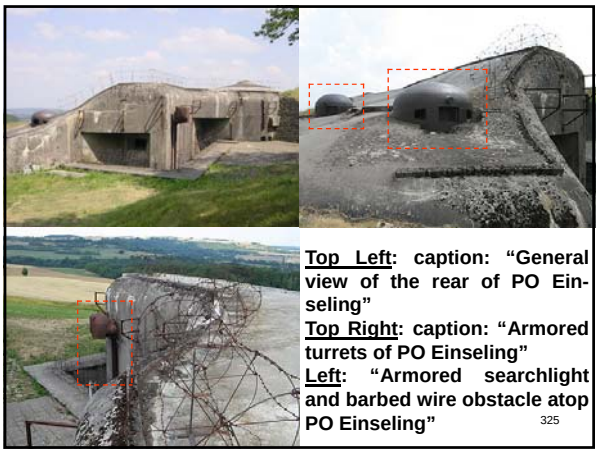
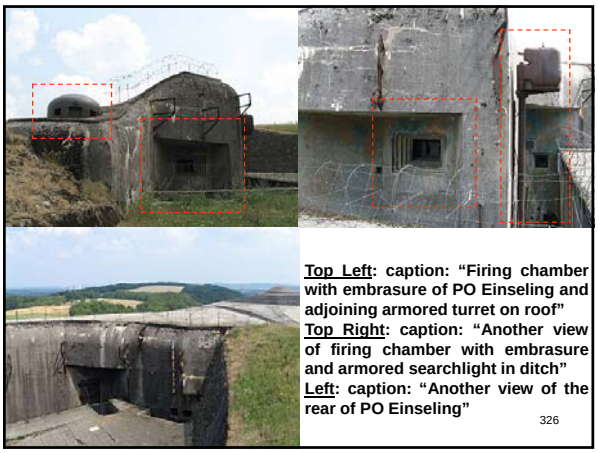


Petit Ouvrage Einseling (above L&R) is located in the *Fortified Sector of Faulquemont* (left). It consisted of one infantry block and was situated between Petit Ouvrage/s *Bambesch* and *Laudrefang*. Built in 1932 as a single infantry block, the casemate-like ouvrage was armed with two automatic rifle turrets, two machine-gun turrets, one retractable machine-gun turret and one machine-gun/anti-tank gun embrasure. In 1940, manning of the ouvrage comprised sixty-eight men and one officer.

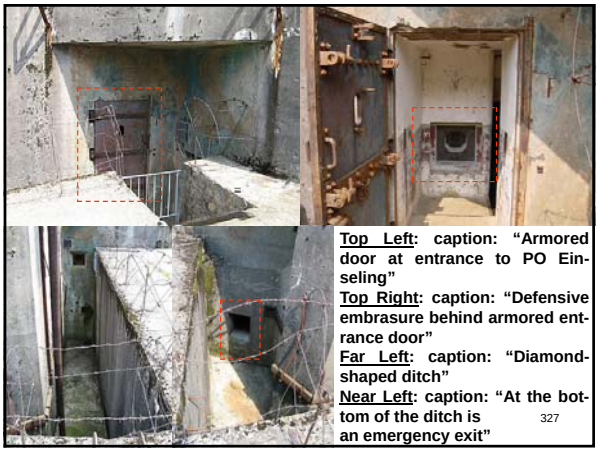
324



Top Left: caption: "General view of the rear of PO Einseling"
Top Right: caption: "Armored turrets of PO Einseling"
Left: "Armored searchlight and barbed wire obstacle atop PO Einseling" 325



Top Left: caption: "Firing chamber with embrasure of PO Einseling and adjoining armored turret on roof"
Top Right: caption: "Another view of firing chamber with embrasure and armored searchlight in ditch"
Left: caption: "Another view of the rear of PO Einseling" 326



Top Left: caption: "Armored door at entrance to PO Einseling"
Top Right: caption: "Defensive embrasure behind armored entrance door"
Far Left: caption: "Diamond-shaped ditch"
Near Left: caption: "At the bottom of the ditch is an emergency exit" 327

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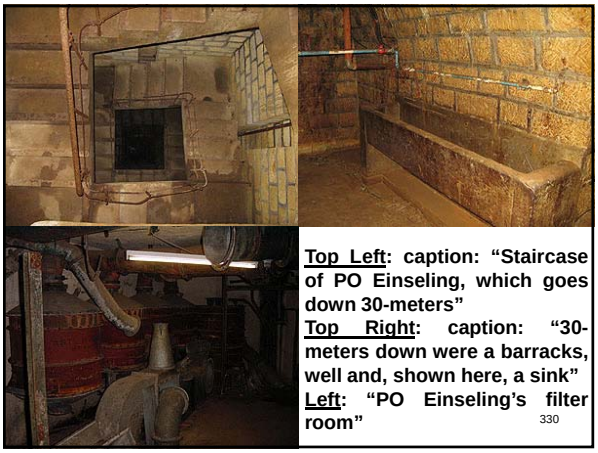
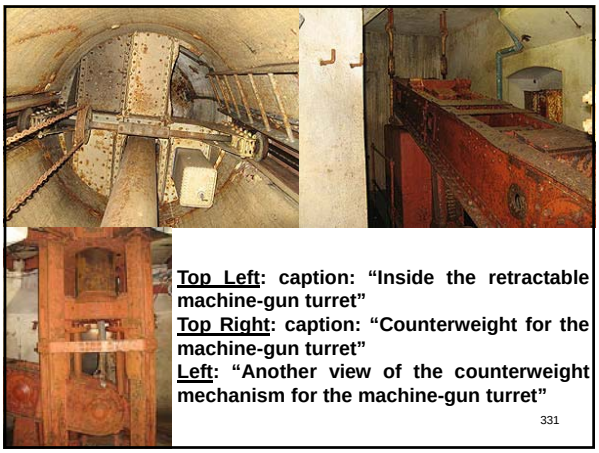
Top Left: caption: "View from above PO Einseling showing armored turrets"
Top Right: caption: "Retractable armored turret in foreground and fixed armored turrets beyond"
Left: caption: "Another view of PO Einseling's armored turrets" 329



Top Left: caption: "Staircase of PO Einseling, which goes down 30-meters"
Top Right: caption: "30-meters down were a barracks, well and, shown here, a sink"
Left: "PO Einseling's filter room" 330



Top Left: caption: "Inside the retractable machine-gun turret"
Top Right: caption: "Counterweight for the machine-gun turret"
Left: "Another view of the counterweight mechanism for the machine-gun turret"

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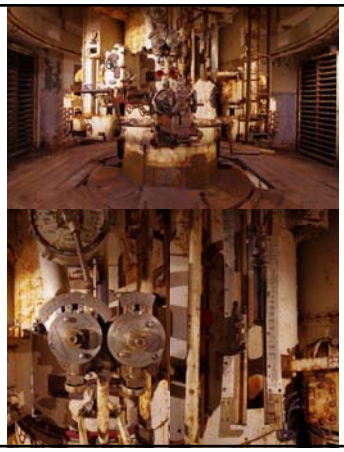

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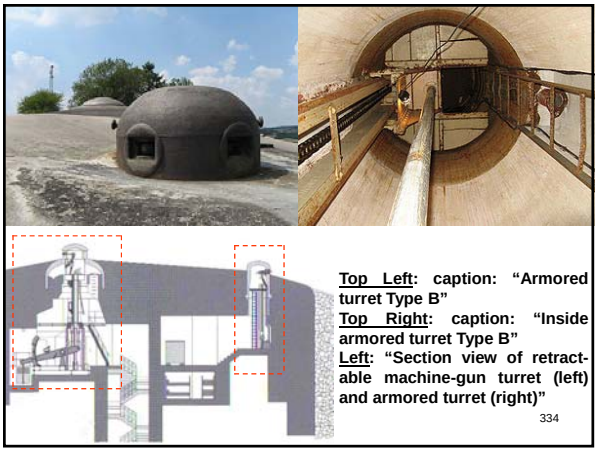

Top Left: caption: "Armored turret Type B"
Top Right: caption: "Inside armored turret Type B"
Left: "Section view of retractable machine-gun turret (left) and armored turret (right)"

334

Top Left: caption: "Water drainage system at PO Einseling. Note the barbed wire obstacle is still dense around the drainage ditch"
Top Right: caption: "Cistern for PO Einseling"
Left: "Small quartering structure at the foot of the hill – about 500-meters from PO Einseling"

335

Following the June 15th 1940 breakthrough by German forces through the *Saar Gap*, the Germans advanced along the rear of the *Maginot Line*. The German 167th Infantry Division approached PO's *Kerfent, Bambesch, Einseling* and *Teting* on June 19th. On the 20th, the Germans successfully assaulted PO Bambesch, which was not within the range of French heavy artillery. On June 21st 1940, PO Einseling faced a determined German attack. Unlike its less fortunate neighbors to the west, Einseling was able to resist the attack with help from *PO Laudrefang*, its neighbor to the east (PO Einseling was within range of Laudrefang's 81mm mortars). Laudrefang's fire, along with accurate fire from Einseling's lighter weapons, broke up a German artillery attack. The petit ouvrage survived until the Second Armistice at Compiegne took effect on June 25th 1940, when it surrendered.

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Above L&R: caption: "PO Einseling firing chamber door closed (left), open (right)"

The ***Maginot Line Extension*** **(part of the *New Fronts*) was begun in the mid-1930s. It included four ouvrages, two of which were large but were further apart than those in the main-line (as a cost-saving measure) thus limiting their ability to support each other. CORF planners did not design these ouvrages as well as those of the main-line, making them much more vulnerable. As a result, in 1940 the Wehrmacht captured the *Petit Ouvrage of La Ferte* (last of the four to be built). High-velocity 88mm anti-aircraft guns penetrated the protruding cloches as a bombardment followed by assault troops put the mixed arms turret out of action. Ironically, the fall of La Ferte led the French army to abandon the other three ouvrages on the Maginot Line Extension without a fight.** 337

Above: caption: "The Villy la Ferte Memorial"

The Gap

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The *Sarr Gap* was a low area where the CORF engineers determined it would be difficult and costly to construct ouvrages. Instead of building forts in the area, they decided to rely heavily on the numerous local reservoirs for flooding the sector. Unfortunately, when the war broke out weather conditions proved unfavorable to the French and this plan did not work. As a result, the Germans were able to penetrate the scattered blockhouses and break through in June 1940 (just as they had in 1870). The Germans assaulted some of the petit ouvrages on either side of the Sarr Gap and their 88mm guns again penetrated the exposed cloches causing more than one of these small, lightly armed forts to fall when attacked from behind. By the time the Germans successfully penetrated this sector and the Rhine defenses after Dunkirk, most of the field troops manning the intervals had been withdrawn. However, German attempts to assault the gros ouvrages failed in all cases. 339

In spite of the best efforts of the French army to keep the fortifications secret, when WWII began the Germans already had several plans for the French ouvrages. How they came by them and what their content was has been the subject of much speculation. Captured German records show that the Germans had known the location of most ouvrages by 1937 and were cognizant of their rudimentary design, features and armament. A plan of the large fort of Simserhof in their possession (left) attests to this fact (its only serious flaw is that it indicates the turrets mounting single guns only). Some plans show positions that were never constructed, but had been planned. With or without errors, there's no doubt that they gave the Germans a good working knowledge of the *Maginot Line*. Paradoxically, the German intelligence services had garnered much of the information from German workers who took part in the construction of the forts.

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When war broke out in 1939, the French rushed their troops to the *Maginot Line*. A large number of field divisions were placed behind the line in the *Sarr Gap* since the French army had never intended the fortifications to stand alone. The field troops were to occupy the intervals and participate in local counterattacks. In addition, some of the old forts (i.e. the German forts in the Thionville area) were revitalized (they had long range 105mm guns in their turrets to provide artillery support). As well, the French moved up heavy caliber rail-mounted guns behind the line (for long range bombardment). The French garrisoned the southeastern defenses with minimal forces. 341

Above: caption: "This French 320mm railway gun uses sliding recoil"

In 1940, the largest and most modern of France's three Army Groups; *Army Group 1*, with most of the mechanized and armored divisions, stood along the Belgian frontier awaiting the German Army to repeat its WWI invasion plan. Many of these divisions would not have been available had there been no *Maginot Line*. Most probably, they would have been more equally distributed (with *Army Group 2*) instead. The French may have manned the frontier defenses with Germany with more troops than necessary, but many more field divisions would have been committed had the Maginot Line not been present (because of the prevailing attitude of the French High Command). In the southeast, the Italian offensive ground to a halt against already depleted French forces (a number of units were rushed north in the aftermath of Dunkirk). The Maginot Line itself was not breached until after Dunkirk (with the withdrawal of all field troops from the interval positions). 342

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In battle, the ouvrages were a formidable force to contend with. The enemy would have to breach the obstacles which surrounded them, their anti-tank rails, their wire obstacles and scattered booby traps and their defensive fire. They would also have to withstand the barrage of fire laid down on top of the fort by neighboring forts. During the 1940 campaign, no gros ouvrage fell to a German assault (although some fell in 1944 when defended by the Germans against advancing American forces). However, the Germans had partially stripped the forts of their weapons and equipment which they had transferred to the *Atlantic Wall*. The few forts that the Germans defended, even under these limitations, still proved extremely difficult to subdue.

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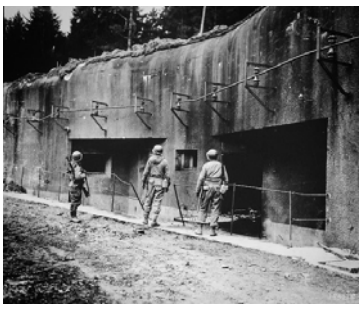

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Part 6

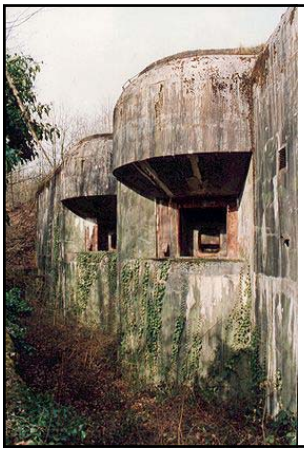
On the Periphery

347

Interval Casemates

348

The ouvrage was the key defensive position in the *Maginot Line*, but it was not the sole defensive feature. Between the ouvrages there were CORF-designed interval casemates similar to the infantry casemates of an ouvrage. Their largest weapon was an anti-tank gun covering their rear or flank. One or more "cloches" (armored cupola) permitted observation and limited fire to the front. These casemates had either one or two firing chambers and were classified accordingly as single or double. Except along the Rhine, these casemates usually had two levels and their own generators to make them self-sufficient. The normal garrison comprised about thirty men and an officer. The Rhine casemates had a single floor and were positioned in one line along the river and another further inland. Those along the river (like other casemates) only fired to the flanks and their river side wall had no embrasures. Some of these CORF casemates came in pairs and had an underground link. Few interval casemates were built in the Alps. 349



CORF engineers (following the pattern used in the Verdun forts), created casemate positions that only faced the flanks of the forts and, in some cases, covered their rearward approaches (only the blocks with turrets and cloches could fire forward, except in the Alps). As a result, the majority of a fort's weapons were only able to fire to the flank/s or rear - not to the front. Although this set-up has been criticized in retrospect, it was actually highly efficient since it only allowed attacks on these non-turreted positions from the flank or rear where it would be difficult for the enemy to position heavy artillery in order to fire at their facades. The exposed casemate walls had a minimum of protection (about 1.5 meters of concrete), just enough to fend-off fire from light and/or medium artillery (weapons of less than 150mm caliber). CORF engineers, remembering the capture of *Fort Douaumont* at Verdun in 1916 (and the subsequent long and bloody battle for its recapture) decided on these relatively thin walls so that the position could not resist heavy artillery fire from the French (rear) side. 350

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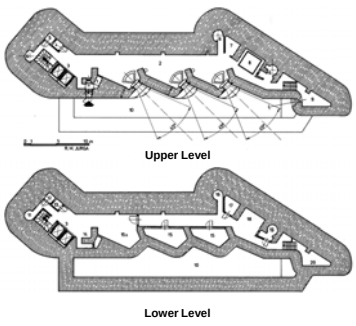

Upper Level

Lower Level

Hackenberg, Block 5 Artillery Casemate for 3x 75mm guns

1. Defended exit with decontamination area
2. Firing chambers for 75-mm guns
3. Munitions elevators
4. Munitions
5. Munitions
6. Cloche (the two on the ends are GFM, the center one is for an automatic mortar that was never perfected)
7. Munitions
8. Water reservoir
9. Flanking coffer for light MG
10. Fosse
11. Storage
12. Magazine
13. Storage
14. WC
15. Rest area
15a. Ventilator and Filters
16. Storage
17. Officers room
18. Rest area
19. Storage
20. T.S.F. (Radio Room) 354

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CORF interval casemates were built during the various building phases of the *Maginot Line*. Introduced by General Belhague in early 1929, their purpose was to defend the areas and obstacles (barbed wire and anti-tank) between the main components of the line (i.e. ouvrages) by means of flanking fire. This concept originated from experience gained during WWI. In most cases, CORF interval casemates defended the obstacles placed in between the gros and/or petit ouvrages with machine-guns, mortars and anti-tank guns. Casemate firing chambers were not positioned towards an attacking enemy but, rather, to the flanks. There were two main reasons for this:

• It minimized the chance of receiving direct frontal fire;

• Should attackers pass the casemates, they would be hit in the flanks where they were most vulnerable

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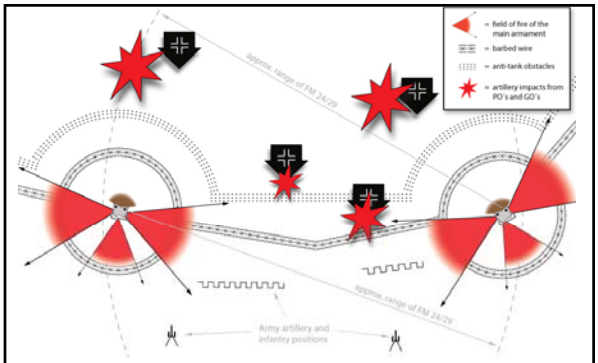

Above: caption: "Interval casemates (first generation, 1929) and their fields-of-fire." This illustration shows a general view of two double interval casemates (spaced about 1,200 meters apart) between two ouvrages (not shown). Often, in front of the casemate, was a mound of earth (indicated in brown) meant to conceal the embrasures and concrete. The artillery of the ouvrage/s and army had to provide fire support when casemates were attacked head-on. Limited frontal fire support was available by the casemates themselves in the form of machine-guns and mortars.

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Frontal fire was possible but limited (especially for the first generation of casemates), but the ability to do so was expanded later by means of specialized cupolas The cupolas were often embedded in concrete to make them less vulnerable to enemy artillery.

Above: caption: "A cupola was sometimes used to replace a flanking embrasure, and to add a forward firing capability"

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Integrated Defense

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It was the task of the neighboring ouvrage/s with their greater firepower to clear the areas in front of or even on top of the interval casemates (the casemates were designed to be strong enough to withstand impacts from neighboring ouvrage artillery fire). As well, the French army's artillery batteries and infantry troops were supposed to play a key role in their defense. After all, the *Maginot Line* was a defensive system in which various elements of the army played a key role. Unfortunately, this multi-faceted defensive system would demonstrate its inherent weaknesses in the spring of 1940.

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In general, a CORF interval casemate had two main armored firing embrasures per firing chamber (and sometimes a third for close-in defense). One for a twin machine-gun and one that could be used for either a second twin machine-gun or for a 37mm or 47mm anti-tank gun.
Above: caption: "1) Close-in defense (7.5mm) 2) Twin machine-gun position 3) Twin machine-gun position + anit-tank gun 4) 50mm mortar 5) Spent cartridge exit tubes"

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1) Grenade launcher (for defense of the ditch)
2) Automatic Rifle
3) Magazine loading device
4) Camemberts (magazines for the twin machine-guns)
5) Magazines for the Automatic Rifle
6) Flexible tube for spent cases
7) Type RB mounting

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In the latter embrasure, the twin machine-guns were mounted on a hinged steel construction that could be swung horizontally out of the way. This system made it possible to make room for an overhead mounted anti-tank gun on a rail. It could be slid forward and locked into position into the embrasure. However, changing a weapon during combat was not without risk. When a machine-gun mount was swung back, a large gap presented itself, albeit temporarily, as a welcome target for the enemy. Sometimes during combat, it was simply not possible to change weapons because of the risk involved. After 1935, a few casemates were equipped with a weapon-system in a cupola that combined a 25mm anti-tank gun and two MAC 31 machine-guns.

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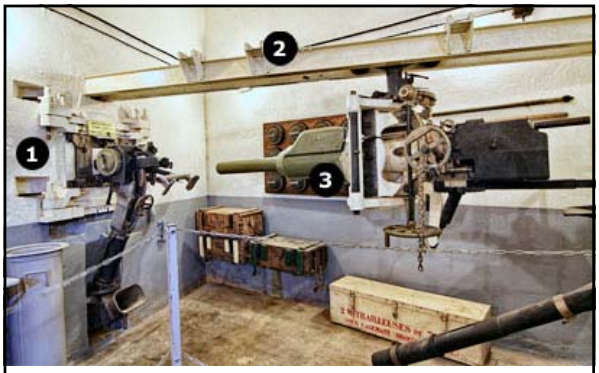

1) Twin machine-guns (in position)
2) Rail
3) 47mm anti-tank gun (on rail)

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Interval casemates were, in reality, small autonomous forts and were provided with everything necessary to make it self-sustaining for a certain period of time. They provided their own electricity by means of a generator, had sleeping quarters for the troops, filter installations, a radio room, water tanks (for consumption and cooling), rations for a considerable period of time, etc. The average garrison consisted of a Lieutenant and up to twenty-nine enlisted men. Commanders were able to communicate with one another by means of telephone lines which were buried deep underground that could not be destroyed by enemy artillery. An armored searchlight mounted on an armored pedestal in the rear of each casemate (operated from the inside) illuminated the area/s in between them. However, using a searchlight was a dangerous undertaking, even if it was armored. Installation of searchlights on many interval casemates had not been completed when war broke out in September 1939. The intended ammunition supply amounted to 600 rounds per anti-tank gun, 40K rounds for each twin machine-gun, 10K rounds for a 7.5mm automatic rifle mounted in a cupola and 1K rounds for close-in defense. Additionally, there were 240 hand grenades available for the defense of the moats and a 1K rounds for the 50mm mortar.

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<u>Top Left</u>: caption: "Crew quarters inside interval casemate Grand Lot"
<u>Top Right</u>: caption: "Communications office in interval casemate Dambach Nord"
<u>Left</u>: caption: "An armored searchlight with an armored door (closed) mounted on a pole on the left as can be seen near the entrance of PO Bois Karre in the Bois de Cattenom"

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Generations

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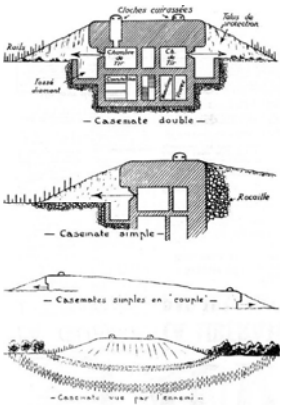

Interval casemates were all based on a series of standard plans. However, these could be modified/altered to meet local situations such as terrain features or the role of the casemate (i.e. observation). In general, they were two-story (ground floor and basement) reinforced concrete structures (about 15 to 20 meters wide). Exceptions can be found along the *Rhine River*, were it was not possible to build a two story casemate so close to the water. Similarly, casemates in heavily forested areas lacked two levels (i.e. in the forest/s of *Mormal* and *Raismes*). The distance between interval casemates was determined to be 1,200 meters. However, when budget cuts were unavoidable, this distance was often stretched to 2K meters or even further distant, thereby endangering the casemates' ability to cover the top of flanking fortifications (because of limitations on maximum range, such as the 7.5mm automatic rifle.

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<u>First Generation</u>:
Either a single casemate that had positions for weapons on one flank (one firing chamber) or a double casemate that had weapons on two flanks (two firing chambers). Sometimes, the terrain situation made it impossible to build a double casemate. In such cases, a pair of "casemates simples" were built, positioned back-to-back so that they fired in opposite directions. Often, a subterranean passage connected them. A "coupole GFM" was located on the rooftop for observation and close-in defense. An excellent example of a first generation CORF casemate structure is *de la Route d 'Outange Est*.

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Second Generation:

These came into being after introduction of the JM cupola (1931). Sometimes, these cupolas replaced a concrete embrasure thus reducing the exposed frontal surface A JM cloche was also a more difficult target to hit and it enabled designers to sometimes reduce the number of emb-rasures and/or increase the ability for frontal fire. Sometimes, all the armament was mounted in cupolas. There were two or three cloches. This specific type had no moat and two entrance doors (an embrasure for an automatic rifle protecting these with flanking fire was optional). They were not numerous. For example, six were built in the Fortified Sector of Crusnes and two in Thionville. A good example of a second generation casemate is casemate *Quatre Vent Nord*.

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Third Generation:

The third generation of CORF interval casemates came into being during the *New Fronts* building phase. These casemates can be recognized by the following characteristics:

• Larger ground plan;
• Rounder shapes;
• Better armament;
• Searchlights embedded in concrete

A fine example of a third generation CORF casemate structure is *Thonne-le-Til*.

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CORF engineers tried to build the casemates into the sides of hills or large mounds of earth in order to conceal the concrete from the enemy (most casemates had a concrete protection level of 2 or 3). The walls which were not shielded by earth were protected by a ditch approximately 2-meters wide by 3-meters deep. These ditches served several purposes:

- Prevented an enemy from attacking embrasures and doors with explosive charges;
- During bombardments, provided space for chunks of concrete to fall into (this way, they did not pile up and block the embrasures);
- Allowed spent cartridges to be ejected into it

The ditches were defended by machine-guns as well as special launchers to allow hand grenades to be dropped directly into the ditch.

Left: caption: "Ditch surrounding Block 2 - Petit Ouvrage La Ferte. Note embrasure above" 380

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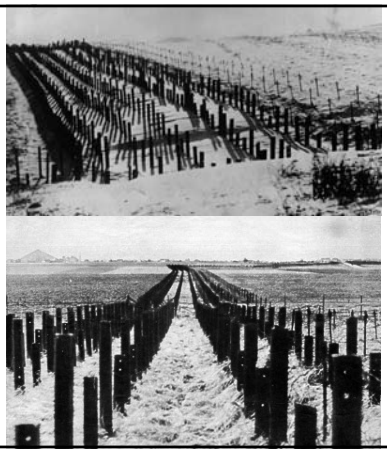
Interval casemates were surrounded by low barb-wired entanglements. Very often the area in front of the fortifications were further protected by anti-tank obstacles. These consisted of six rows of steel rails set vertically in concrete (depth was about 11.25 meters). Especially in the *Old Fronts*, these rows were a few miles long, running through the landscape. German artillery often tried to get rid of these obstacles by means of an artillery-barrage just before an attack.

Above: caption: "Anti-tank obstacles connected interval casemates and ouvrages for miles through the landscape. They were supplemented by low barbed-wire obstacles. This is Block 6 of GO Schoenenbourg." 382



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CORF interval casemates had their main embrasures protected from plunging artillery fire by a roof overhang

Above: caption: "The overhang as can be seen at Block 1 of PO La Ferte. The grey square in the concrete at the left is the armored door of a searchlight. This is a typical construction for casemates/ouvrages built after 1935. Original camouflage paint can be seen around the embrasures."

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An armored door in the rear provided access to the casemate. One could walk through this door via a removable bridge, thus crossing the ditch. It was defended by one or two embrasures for automatic rifles: one flanking the entrance and sometimes a second inside the corridor (positioned to fire through the doorway when the door was open). Blocks containing turrets and cloches rarely had emergency exits if they had no casemate position/s. However, casemate blocks sometimes included emergency exits which either opened from the lower level of the block into the floor of the fosse (where there was a ladder) or from the higher level. In the latter case, the men pushed a small metal bridge out over the fosse. In both cases, an interior crenel and an armored door (not full size) protected the exit.

Left: caption: "This emergency exit leads out into the bottom of the 5-meter-deep moat"

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In the Alps, not all the casemates had weak walls since several artillery casemates actually faced the enemy line of advance. These casemates not only had thicker walls, but also more armor protection. This was done because in many positions the engineers could not justify the emplacement of an expensive artillery turret which would have a limited field-of-fire.

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Abris

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Abris (shelters) for the infantry in the main-line also served as command posts and came in two basic types:
• abri-surface
• abri-caverne
They also had positions for automatic rifles and cuppolas. Both types of abris were equipped with commodities that rendered them virtually self sufficient (kitchen, gas protection, power generators, etc.). The origins of these infantry shelters can be traced back to before and during WWI. Abris were the "homes" for the French troops stationed in the intervals between the gros and petit ouvrages. The *abri-caverne* (underground infantry shelter): could be recognized by two entrance blocks on the surface (approx 60-meters apart), while all the dormitories, kitchen etc. were underground to provide maximum protection. The depth at which these abri-cavernes were built varied. When the ground contained rocks, the depth was 8-meters, while soil containing clay permitted building to a depth of 20-meters. The *abri-surface* (surface infantry shelter) were large, above ground concrete blocks with two entrances. For both types, defense was provided by 7.5mm embrasures and two cupolas on top (in the case of an abri-caverne). However, there were exceptions (i.e. an abri with a twin machine-gun cupola or an anti-tank gun).

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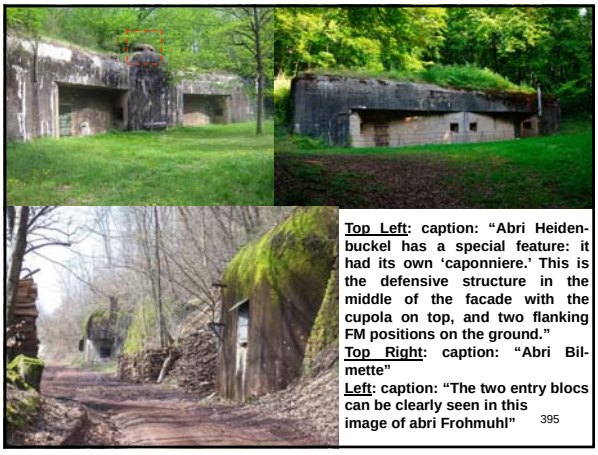
The abris were equipped with a charcoal-burning kitchen and sufficient supplies for four days. As well, there was a storage room containing rations for fifteen days. Heating was provided by a boiler which also provided hot water. The warmth was spread throughout the dormitories and offices by means of the ventilation system. The abris which also served as headquarters had a radio-room and could be easily recognized by the horizontal antenna on the outside. Fifty-eight abris were built on the *Old Fronts* (from Aumetz to the Rhine) while twenty-five abris (of a much simpler type) were built along the Rhine. These infantry shelters had a passive role and were therefore built in areas which would not bear the brunt of an enemy attack. However, there were notable exceptions:
• *Abri-Caverne Petersberg* (had a cupola);
• *Abri-Surface Colming* (had a firing room with a 37mm anti-tank gun and a twin machine-gun);
• *Abri-Surface de Berge du Rhin Leopold* (equipped with a cupola);
• *Abri-Surface de Heidenbuckel* (with a protruding *caponniere* - a case-mate protruding from the facade, providing flanking fire);
• *Abri-Caverne de Petit-Rederching* (had three entrance blocks, instead of two)

394



Top Left: caption: "Abri Heidenbuckel has a special feature: it had its own 'caponniere.' This is the defensive structure in the middle of the facade with the cupola on top, and two flanking FM positions on the ground."
Top Right: caption: "Abri Bilmette"
Left: caption: "The two entry blocs can be clearly seen in this image of abri Frohmuhl"

395

In addition to the abris, there were observatories, numerous blockhouses (constructed by the French army) and obstacles (in the form of wire and anti-tank rails). Also, throughout the main-line and to the rear, there were access compartments to the underground telephone cables where the commander of a local unit could tie into the communications net. The telephone was the main form of communication since the radio antennas strung along the exposed faces of casemates were vulnerable and had a relatively limited range.

396

397

398

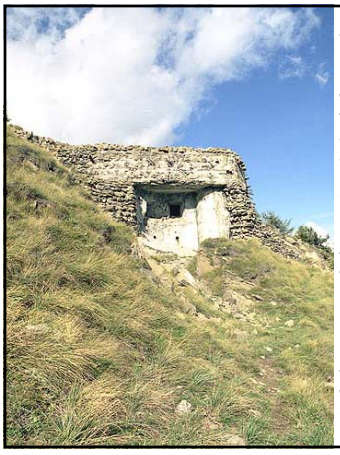
In front of the *Maginot Line* there was a combination of fortified houses and *avant postes* (advanced posts) which were to sound an early alarm. These positions were usually small and only intended to delay an enemy advance. In the 1930s, the French made a belated attempt to build a "stop line" of small blockhouses behind the Maginot Line thus adding some depth to the overall defenses. These positions had been planned for early on and were never intended to create a system of defense-in-depth.

399

The *Maginot Line* defenses lacked only one defensive feature which might have made it even less accessible: land mines. The Germans pioneered the mass use of anti-personnel and anti-tank mines with the construction of the *Siegfried Line*, while the French had not developed land mines sufficiently enough by the outbreak of WWII (other than the limited production of some types for use as booby-traps).

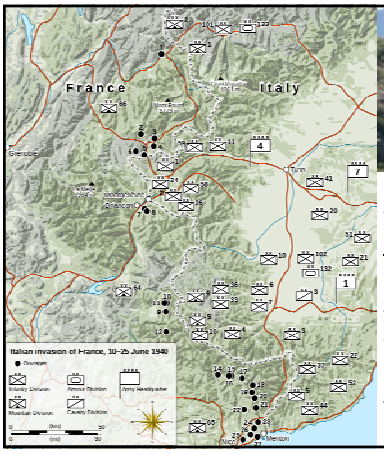
400

Above: caption: "U.S. Army training aid used to help GI's identify German land mines"



In the Alps, the longest line of fortifications was in the *Maritime Alps*. Here too, there was a line of *Avant Postes*, but these were much larger than those of the main line. Although more akin to concrete field fortifications, they sometimes included several bunkers and trenches. There were advanced positions in front of sectors (i.e. Modane and Briançon), but they were also stronger than those of the main-line (the Italians were not even able to breach this line of covering positions). When the Italians bypassed them along the coast, they came to a complete halt when they came across the line of ouvrages around the Menton area.

401



Above: caption: "Block B1 at Rimplas"

Left: caption: "The Alpine Line 1: Fortified Sector of Savoy
2-6: Fortified Sector of Savoy
7-12: Fortified Sector of Dauphine
14-27: Fortified Sector of the Maritime Alps"

402

403

404

Part 7

Fields of Fire

405

Infantry Weapons

406

407

The FM 1924/1929 7.5mm light machine-gun was a popular and reliable weapon used in almost every ouvrage and interval case-mate. It weighed nine kilos and was gas operated/air-cooled. The manu-facturer; MAC (*Manufacture d' Arm-es de Chatellerault*), proposed this light machine gun in 1924. Similar to the *Browning Automatic Rifle* (BAR), it was capable of both semi-automatic and full automatic fire. A two-trigger mechanism provided the modes of fire. Automatic fire could be activated via the rear trigger and semi-automatic fire (single shots) by the front trigger.
Left: caption: "FM 24/29 on a SP mounting in an armored entrance door. Note the double trigger."

408

After the weapon was chosen for use on the *Maginot Line*, it was decided that the spent cases be disposed of via a flexible tube when used in a cupola. When the weapon was mounted in a SP (door) or SB (interior defense) mounting, spent cases were collected in a canvas bag (though some SBs used a tube). The original FM Mle (model) 1924 fired 7.5 x 57mm ammunition introduced that same year. In 1929, the cartridge was shortened because it was too powerful and caused damage to the barrel. The consequence was that all the FMs Mle 1924 had to be modified in order to fire the new cartridges (7.5 x 54mm), hence the designation "FM 24/29." 409

Above: caption: "FM 24/29 mounted in a cloche"

Top Left: caption: "FM 24/29 in an RB mount with a flexible tube for spent cases attached"
Top Right: caption: "FM 24/29 mounted in a cloche Type A. The duralumin block is visible in the embrasure. Visible in the right hand corner is a pair of binoculars for surveillance. Once the machine gun was removed, it could be mounted in it's place."
Left: "FM 24/29 in Block 1 of Petit Ouvrage La Ferte. The embrasure is a Type FMB 40" 410

Some first generation casemates (1930-1931) had FM Mle 1924/1929 gun positions mounted one above the other (left). The machine-gun in the upper mount covered the facade or entrance. The lower mounted machine-gun fired downward in order to defend the ditch. However, in later designs the latter was replaced by a hand grenade discharger. The FM Mle 24/29 used in the *Maginot Line* was not the same as those used in the field army. For the Maginot Line, the barrel of the FM Mle 24/29 was modified to fire the heavier ammunition. What also distinguished these weapons was the absence of a hand guard in front of the triggers and no bipod (this made the Maginot FM Mle 24/29 difficult to use in the field). 411

Above: caption: "A field army FM 24/29. Note the handgrip in front of the trigger which was absent on the Maginot models."
Left: caption: "The FM 24/29 was also used in the field Army as an anti-aircraft weapon" 412

FM 1924/1929 Automatic Rifle:

Magazine capacity	25 rounds
Range	2,000 meters
Rate of fire	200 to 500 rounds per minute (rpm)
Muzzle velocity	820 m/sec

FM 24/29 Ammunition 7.5 x 54mm (also used on the JM Reibel):

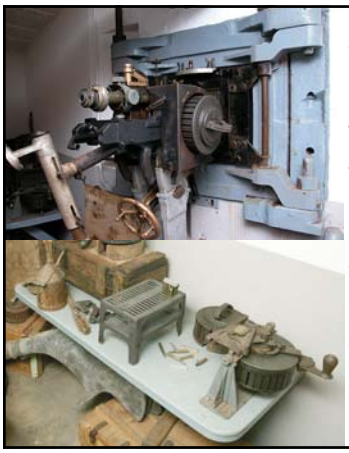
Model	**Type Velocity**
Model 1929 D	heavy ammo 694m/s
Model 1929 C	lightweight ammo 840m/s
Model 1929 T	tracer ammunition
Model 1929 TP	tracer/armor-piercing ammo

413

The twin machine-gun was best known by the name: "JM Reibel" (Reibel was the name of the director of the state owned arms factory (MAC) were it was developed and produced. The basis for this weapon was the single MAC Mle 31, often shortened as "MAC 31." In 1930, the FM 1924/1929 light machine gun was used as a basis for the MAC 1931. The main difference was that the MAC 1931 made use of a drum-fed magazine (150 rounds). This resulted in a higher rate-of-fire. Eventually, it was rejected by the Infantry. However, it was well suited for use in the *Maginot Line* when used on a twin-mount. This configuration made it possible to make use of one weapon, while the other cooled down. If the situation called for it, both guns could be used simultaneously. This machine-gun configuration was used in many cupolas, turrets and concrete/casemate positions. Maximum range was up to 4,900 meters (it was gas operated). Interval casemates were equipped with two JM's.
Above: caption: "In an adapted form (not like the example in the image), the MAC 31 weapon was also used on armored vehicles. The telephone on the table (model 1932) could be plugged into a network in an ouvrage or interval casemate." 414

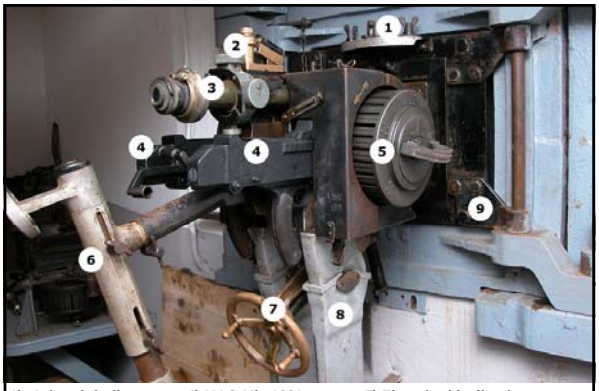
Top: caption: "Soldier demonstrates a Reibel. Elevation and traverse was changed by means of his body. Extendable shoulder stocks (barely visible in the picture) connected to the MG mounting made this possible. Note the spare magazines on the shelf."
Bottom: caption: "Reibel or JM in Gros Ouvrage Schoenenbourg, Block 7. The olive green drum magazines mounted against the MAC 31s were nicknamed 'Camemberts.' The canister in the left-hand corner was normally filled with water and served the purpose of cooling the barrels, once a MAC 31 had been taken out of the JM Reibel mount."

415



Top: caption: "An excellent study of a JM. The diagonal bar/tube at the rear was normally in a horizontal position. The stocks on both ends were placed against the shoulders to facilitate the handling/aiming of the twin mount. Also of interest is the leveling instrument on top of the aiming device. It made firing/aiming with heavier ammunition easier."
Bottom: caption: "The device on the right (bolted onto the table) with the crank was used to re-fill the magazines (nicknamed camemberts) with ammunition"

416



1) Azimuth indicator
2) Level indicator
3) Scope
4) MAC Mle 1931
5) Magazine
6) Shoulder rest
7) Elevation/declination
8) Spent case selector
9) Movable embrasure mtg.

417

In a firing chamber, one of the two JMs had to share an embrasure with an AT (anti-tank) gun. During combat, changing weapons was a hazardous situation (for a short period of time the embrasure would be open). When there were just two JMs in a firing room (no AT gun), eight men operated the weapons (two gunners, two loaders, two assistant loaders, one mechanic and a commander). Normally, one machine-gun per twin-mount was used. When it became overheated, the second machine gun was put into action. The JM Reibel came in two different versions:
• Type T (tourelle = turret)
• Type F (for casemates and cupolas)
The main difference was the way the triggers were operated. The Type T model (for use in retractable turrets) made use of a Bowden cable. The Type F model was directly operated by a soldier and had the typical layout (handgrips and shoulder stocks). The Type F model was used in JM cupolas and casemates. When mounted in a casemate, the JM was connected to a pipe in the wall by an extendable tube to drop the spent cases into the fosse. In a cupola, a flexible tube was used. Each JM Reibel needed around twenty liters of water per day for cooling purposes. Barrels were put in a bucket of water when overheated, or cooled by spraying water on them with a portable water sprayer. On December 24th 1931, firing tests were carried out at the casemate *Bois de Kanfen-Est*. The JM Riebel proved to be an accurate and deadly weapon.

418

Left: caption: "One of the firing rooms of interval casemate Grand Lot. Visible on the left side is one of the embrasures with a JM Reibel. The 47mm AT gun can be seen mounted on the rail on the right."
Right: caption: "Information about firing modes during daytime and night. 'Debit accelere' means rapid fire. '3 Chargeurs' means 3 magazines."

419

JM Reibel Fire Modes:

• **Exceptionally fast for a longer period of time** (half a magazine [75 rounds] per machine-gun). When to counter an assault with the aim to cross the barbed wire obstacles.
• **The accelerated rate of fire** (450 rounds per minute, three full magazines per machine-gun). The machine guns are used one after the other. After 3 magazines have been spent on one machine gun, the second one is used. This way it allows the barrel of the first one to cool down. This rate of fire was used for barrage and destructive fire (for a maximum of 2 minutes).
• **The normal rate of fire** (150 rounds per minute, 1 full magazine per weapon). Firing in bursts for one minute per machine-gun. This rate of fire was used for neutralizing and interdiction fire.
• **Slow rate of fire**. Used for harassing fire.

JM Reibel Ammunition 7.5 x 54mm (also used on the FM 24/29):

Model	Type	Velocity
Model 1929 D	heavy ammo	694m/s
Model 1929 C	lightweight ammo	840m/s
Model 1929 T	tracer ammunition	
Model 1929 TP	tracer/armor-piercing ammo	

420

The Hotchkiss Mle 1930 heavy machine-gun (13.2mm) was an enlarged version of the 8mm Hotchkiss machine-gun Model 1914, which had a very good reputation. The model 1930 was proposed to the army as an infantry weapon, but rejected because of the problems the heavy ammunition would create in regard to re-supply. In the *Maginot Line*, it served as an anti-boat weapon (in many Rhine casemates) and fulfilled an anti-tank (AT) role in the northeastern (Vosges) area. The reason for installing it in these regions was that some casemates had firing chambers which were too small for either a 37mm or a 47mm AT gun. It was not used in ouvrages. It was mounted in an articulated frame or in a way the AT guns were mounted (suspended from a double rail). The weapon was automatic-only (gas operated/air-cooled). The effective range was 800 meters. 421

Above L&R: caption: "The Hotchkiss Mle 1930 in a Rhine casemate"

Hotchkiss Mle 1930 Heavy Machine Gun (13.2mm):

Weight	38 kg (approx.)
Armor penetration	18mm/30° at 500 meters
Rate of fire	450 rpm (practical)
Muzzle velocity	800 m/sec
Magazine capacity	30 rounds
Range	2,500 meters

422

The 37mm anti-tank gun was primarily used in first generation casemates built in 1930-31. The reason for this was that the 47mm gun (Canon AC Mle 1934 47mm) was too big to fit in the casemate firing chambers (which were less than three-meters deep). The 37mm anti-tank gun was suspended on a carriage attached to a rail mounted to the ceiling of firing chambers in casemates or infantry combat blocks of ouvrages. This permitted the crew to slide the gun back and forth in order to swap the anti-tank gun for a JM Reibel. Of several 37mm guns issued to the French Army in the 1930s, the Mle 1934 had the best performance. 423

Above: caption: "Canon AC Mle 1934 37mm photographed at GO Hackenburg"

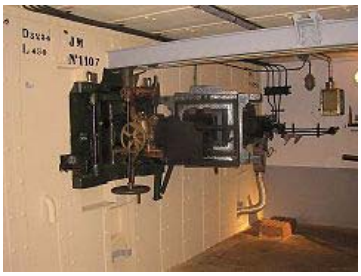
Canon AC Mle 1934 37mm Anti-Tank Gun:

Total weight	142 kg
Armor penetration	60mm/30° at 400 meters
Rate of fire	25 rpm
Muzzle velocity	880 m/sec

424

The Canon AC Mle 1934 47mm anti-tank gun was used in large numbers (339) in casemates and infantry blocks of ouvrages. The gun was suspended on a carriage attached to a rail mounted to the ceiling of the firing chamber which allowed the crew to slide the gun back and forth in order to swap the AT gun for a JM Reibel (moving the gun into its embrasure had to be done carefully). 425

Above L&R: caption: "Canon AC Mle 1934 47mm in PO La Ferte"
Left: caption: "Canon AC Mle 1934 47mm being pushed into the embrasure" 426



427

<u>The Canon AC Mle 1934 47mm Anti-Tank Gun</u>:

Total weight	330 kg
Armor penetration	80/30° at 400 meters
Rate of fire	25 rpm
Muzzle velocity	880 m/sec

428

The exposed face of each entrance had its own small fosse (to prevent fragments of shattered concrete from blocking the entrance and firing embrasures). The fosse was also meant to be an obstacle for potential attackers and an outlet for spent casings from the firing chambers. Special tubes were built into the casemate walls to allow the spent casings to slide out. In the firing chambers, there were special grenade launchers which consisted of a tube-like apparatus leading into the fosse (designed to drop grenades into the fosse).

429

The Mortier Mle 1935 50mm mortar was a breech loaded, smoothbore barrel infantry weapon originally designed to defend dry moats/ditches and dead ground. Standard weapons (which fire grenades/bullets in a more or less straight trajectory) could not reach these spots. Therefore, a curvilinear trajectory was needed. The need for such a weapon was identified as early as 1931, but it was not until 1935 that MAC came up with a prototype of a curved trajectory weapon. Typical for this weapon (in contrast with its Army counterparts) was the fixed elevation: 45-degrees in casemates and 20-degrees in a GFM cloche Type A. Range could be altered via a valve on top. Excess propellant gasses escaped though a pipe mounted on top of the barrel.
<u>Top</u>: caption: "This mortar is on display at ouvrage Hackenberg"
<u>Bottom</u>: caption: "A cloche GFM Type A at interval casemate Marckolsheim-Sud. The smaller, shorter tube on top of the barrel was the exhaust for excess propellant gasses."

430

At some ouvrages with AT moats the model 1935 mortars were installed in combat blocks, most of the time on the lower level of a block, shielded by the *contrescarp* (steep outer slope) of the moat.
<u>Above</u>: caption: "The embrasure of a basement firing chamber is hidden from view by building it into a dry moat. This way, enemy fire couldn't hit it."
<u>Left</u>: caption: "The inside of the 50mm firing chamber. Some instructions can be seen on the wall underneath the lamp."

431

A disadvantage of the weapon was that when mounted in a cupola, the barrel was vulnerable since it stuck out somewhat. Approximately 1,600 mortars were delivered in 1940, but not all of them were installed (only about 1,009 were installed in GFM cloches). Those that were installed, fulfilled an important role of clearing the craters around fortifications, created by German artillery, which were used by attacking soldiers for cover.
<u>Above</u>: caption: "An illustration of the mortar, as can be found on the site of the GO Schoenenbourg"

432

The Mortier Mle 1935 50mm mortar was removed in large numbers from *Maginot Line* fortifications, and reused in the *Siegfried Line*, were they were fitted on German designed mountings.

Left: caption: "After the campaign in France, German troops removed a lot of mortars from casemates and ouvrages for use in the Westwall. This is a 5cm Festungsgranatwerfer (Gerat 950 S6)."

433

Mortier Mle 1935 50mm Mortar:

Magazine capacity	150 rounds
Range	Min. 65m (at 45°) Max. 1,400m (at 45°) Max. 700m (at 20°)
Rate of fire	10-15 rpm (1 person) 25-30 rpm (2 people)
Total weight	11 kg
Weight of grenade	950g (of which 95kg were explosives)

434

All cloches and casemate embrasures had crenel covers and special crenel mounts for their weapons. They were not intended to be uncovered during combat despite some photos showing German assault troops throwing grenades through them (apparently, the scenes in these photographs were staged for the benefit of the press).

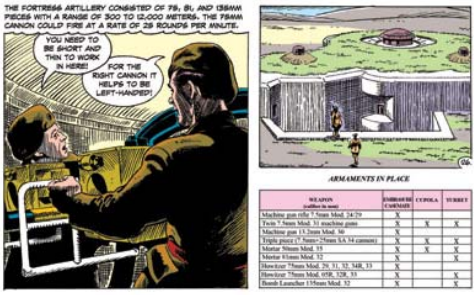
Above: caption: "Artist's depiction of an assault on the Maginot Line, distributed across Germany on leaflets to boost morale and show the strength of German forces"

435

436

Casemate Mounted Artillery

437



438

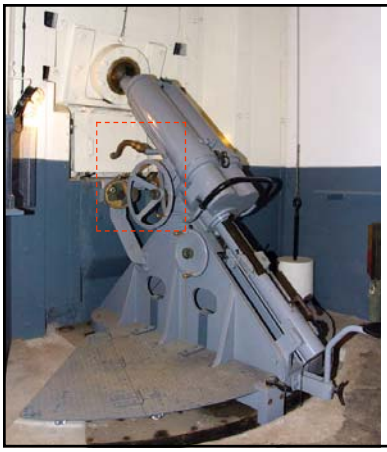
The casemate mounted 81mm model 1932 mortar was specifically designed (although derived from an existing mortar) for the *Maginot Line.* This mortar was installed in both turrets and casemates at a fixed angle of 45-degrees. The 81mm mortar's task was to shell enemy forces by indirect fire in hilly terrain or, in general, defiladed positions near and/or in front of ouvrages and/or casemates. The 81mm mortar was well suited for this task, since the shells had a parabolic trajectory. The mortar was derived from the infantry mortar model 1927/31 of the same caliber made by the ***Stokes-Brandt Company***. It was a standard-setting design that was widely copied and/or licensed for manufacture world-wide. It had a smooth-bore, breech loading barrel.

439

When installed in a casemate (left), the 81mm mortar was usually located in a firing chamber below ground on the bottom level of the casemate. To load the mortar, a shell was placed on the loading tray extending down from the mortar breech. The breech block was then manually slid upwards and rotated to the right using a handle. This action moved the fin-stabilized, spinning projectile into the tube and sealed the breech.

440

441



Range was controlled by first adjusting the number of propellant charges which could be attached to the fins of the round. The two large cylinders above the mortar tube accumulated gas vented from the breech during firing. This gas was then released to the exterior of the block through a flexible tube that was connected to a fitting on a short pipe extending out from below the mortar tube. The top hand wheel controlled how much gas was vented from the breach.

Left: caption: "81m mortar at Ouvrage Bois-du-Four. Note the flexible tube is in place, just above the largest hand wheel, through which gas was released to the exterior of the block."

442

The shells fired by the 81mm mortar were the FA 81mm model 1932. It weighed 3.3 kg and carried an explosive load of 350 to 400 grams. The maximum range was 2,400 meters. It was fin-stabilized (six blades). The shell had a deadly blast radius of approximately 10-meters.

Above: caption: "The mortar rounds were fin stabilized. Note the black holes between the fins. These were exits for propellant gasses which caused the grenades to spin, aiding the accuracy."

Left: caption: "This device was used to attach the empennage to the shell"

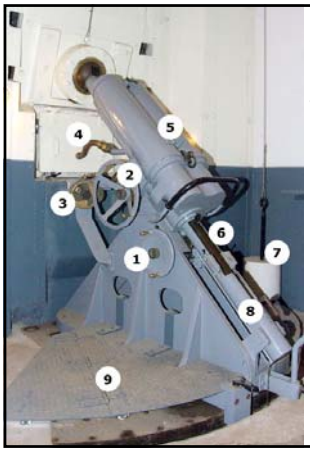
443

In March 1936, trials were carried out with new tail design (in order to increase the range). This shell was the 81 FA model RF 1936, with a maximum range of 3,600 meters. There were three types of ordnance:

- Smoke
- HE (High Explosive)
- AP (Anti-Personel).

The lower hand wheel controlled horizontal traverse of the entire mounting, thus controlling the direction of fire (the total traverse possible was 45-degrees). A total of forty-two 81mm mortars were eventually installed (in twenty-one turrets) and eighty-six were mounted in casemates (for flanking and/or frontal fire). During 1939-1940, a large number of accidents occurred in turret-mounted 81mm mortars. The problem usually was a burst barrel pipe and early firings due to overheating of the cylinder head caused by too high a rate of fire.

444



81mm Mortar Model 1932:

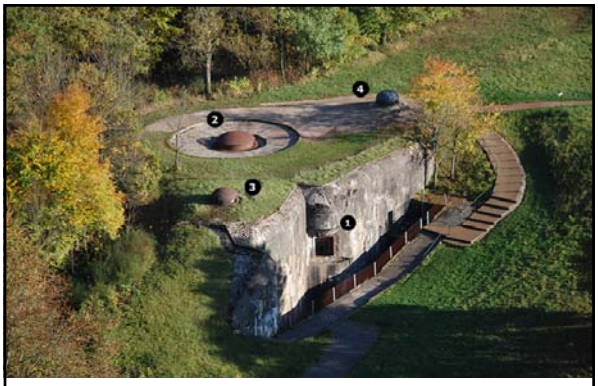
Weight	Approx. 2,000 kg
Max. range	3,600 m (w/FA model RF 1936)
Rate of fire	13 rpm

1) Azimuth control wheel
2) Gas release wheel
3) Scope
4) Gas release pipe
5) Cylinders
6) Load tray
7) Counterweight for shutter
8) Breech block
9) Personnel platform

445

The casemate mounted Lance-bombe 135mm model 1932 howitzer, though modest in size, fired the heaviest shells of all the artillery pieces designed for the *Maginot Line*. This weapon was not derived from an existing gun as was the 81mm mortar. Rather, it was born out of the desire of CORF for a weapon that could be mounted inside casemates and turrets. The shells it fired were particularly suited for this task, containing 4.57kg and/or 5.49kg of explosives (depending on shell type). By comparison, a 75mm shell contained 0.7kg of high explosives. Despite the long range of the weapon, CORF planned to replace them with a 105mm or 155mm variant because of problems with the original barrels (i.e. unreliable ballistic characteristics, returning muzzle flames and/or barrel warp on the turret mounted guns). Most of the 135mm howitzers produced were mounted inside turrets (34 of the 43). Whenever a howitzer was placed in a combat block (either in a turret or on a casemate mounting) it shared that block with another weapon.

446

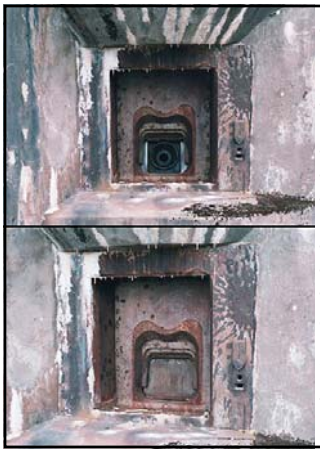


Above: caption: "A picturesque view of Artillery Block 9 of GO Hackenberg. 1) embrasure for one 135mm model 1932 howitzer 2) 135mm gun turret 3 & 4) GFM cupolas

447

Left: caption: "Underneath the lamp, mounted against the wall, is a device which could 'merge' the shell and the cartridge case. In the bottom right corner hangs a weight, attached to a steel wire, to close the armored slide on the outside. In the top right corner a silhouette of a remote fire-directing device, while a grenade-launcher is visible on the left, just above the voluminous spent case bin."
Right: caption: "A detail of the rear of the gun"

448



The embrasures of the nine casemate mounted howitzers can be recognized from the outside by vertical sliding armor plate. Apart from that, the embrasures look the same as those used for the 75mm model 1929 gun. However, in order to reduce the size of the embrasure, the maximum elevation of the howitzer was limited to 40-degrees.
Left: caption: "The vertical sliding armored shutter of the embrasure. Note the shell splash just above the optics opening on the embrasure."

449

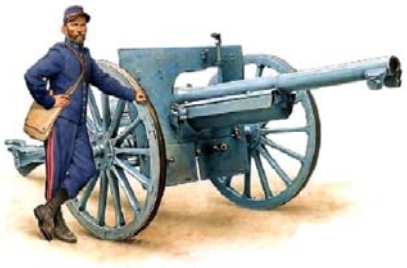
135mm Howitzer Model 1932:

Barrel length	1.14m
Traverse	45° (casemate)
Elevation	0 to +40°30
Rate of fire	6 rpm
Max. range	5.6km

450

The casemate mounted Canon-Obusier 75mm Model 1932 was the main weapon of the *Maginot Line* ouvrages. This rapid firing, short recoil artillery piece was a descendant of the famous "soixante-quinze" (75mm model 1897). It had a range of about 12 km and could fire from 12 to 30 rpm. By comparison, the Lance bombe de 135-mm had a range of 5.5 km and a rate of fire of 8 rpm. Together with the 135mm weapon, it gave the ouvrage and its neighboring positions close supporting fire which could lay down an effective barrage against attacking forces. Some Alpine ouvrages had a 75mm breech loaded mortar whose trajectory and limited range (6 km) were actually advantageous in the mountainous terrain. Most of these weapons were specially designed for the fortifications. They also included the FM and JM (the former was the same type used in tanks and with infantry) as well as the 50mm breech-loaded mortar.

451



452

The model 1932 was an improvement over the model 1929, which had the disadvantage of its long tube (1.50m), which made a massive overhang above the embrasure necessary (in order to protect the barrel from artillery grenades). The model 1932 had a tube that was 30cm shorter than that of the model 1929 and it protruded only 45cm from its embrasure. This had the advantage that, to further protect the barrel from enemy fire, two armored shutters (controlled from the inside by counter-weights) could be installed to hide them from sight while closed. The gun-howitzer was initially equipped with a "Nordenfeld-Type" breech but later, it was replaced by a semi-automatic breech (model SA 1933). The advantage of the latter was that it completed a number of actions automatically: the breech block closed after the shell had been loaded, opened once the shell had been fired and ejected the empty shell case (the *Nordenfeld* automated only one action: ejecting the empty cartridge case).

453

Above: caption: "Embrasure with armored shutters – GO Fermont, Block 4"

Despite the advantage of having a shorter barrel, there were some complications. In order to allow recoil at maximum elevation, the mounting was of a complex nature. The complexity lay in the fact that the pivot had to be raised 65cm, which made it next to impossible for the gun-crew to load the gun at small angels of elevation. To facilitate loading, a platform was built that was balanced by two counter-weights. The height of the platform was now relative (in a practical way) to the breach of the gun, no matter what the elevation was. Now, the gunners had easy access to the breach at any moment.

454

Above: caption: "An example of the 75mm gun-howitzer at GO Schoenenbourg. There is no physical pivot for the gun, hence the French term: "pivot fictif."
Left: caption: "A detail of the rear of the gun"

455

The large construction of the gun-mount necessitated a new casemate design. The facade was made narrower by placing the elevators and the shaft to the rear. Seven of these artillery casemates were built (equipped with three guns each). The model 1932 gun was not only used at the "Ancient Fronts" (main-line fortifications), but also at the Alpine fortifications. *Ouvrage de Restefond* had two of these guns, placed in a casemate, for frontal fire. The 75mm guns Model 1932 proved their worth during the German attacks on the *Maginot Line*. As an example, reports indicate that the six guns of *Ouvrage du Latiremont* fired a total of 14,452 rounds.

456

Left: caption: "Notch for 7.5cm Cannon"
Right: caption: "2x 7.5cm Cannon (Model 1932)

75mm Gun-Howitzer Model 1932:

Barrel length	242 cm
Traverse	450-degrees
Elevation	-9 to +40'30'
Max. Range	11.90 km
Rate of fire (normal)	13 rpm
Rate of fire (max.)	25-30 rpm

457

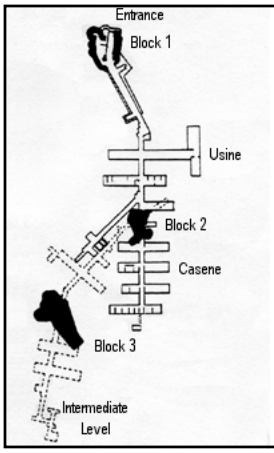
The casemate mounted Canon-Obusier 75mm Model 1933 was designed to arm the huge 75mm model 1933 gun turrets. This gun-howitzer made use of the same barrel as the model 1932. However, the mount of this gun differed from the model 1932 in several ways. First, the large platform of the model 1932 was replaced by two smaller ones (given the limited amount of space inside a turret). Since the muzzle could not protrude from the very small embrasures, the decision was taken to move the floating pivot all the way to the muzzle of the barrel. The mount of the 75mm model 1932 was large. The construction that was used for the model 1933 for placement in casemates for the Alpine fortifications was even larger (it measured 2.5-meters in height and almost 3-meters in length). Casemates instead of turrets were chosen for some of the Alpine ouvrages since it was economically and technically unfeasible to install them. Eventually, eight were placed. After the fall of France in June 1940, the Italians removed all the guns from the casemates. None survived the war (all were destroyed by allied bombing at their storage location in Italy).

458

459

In the Alpine fortifications, the combinations of arms were more numerous and could include two or even all three types of artillery weapons (most of the Alpine blocks were less standardized than the main-line forts). The combat blocks had various types and sizes of cloches which not only included the GFM, but also the JM and AM cloches. The GFM cloches had three to five embrasures. The JM cloche had a 45-degree field-of-fire restricted to a single crenel for its twin machine-guns which were meant to protect the top of the ouvrage. The AM cloche mounted a twin machine-gun with a 25mm gun and had a field of fire limited by two crenels, each giving a 45 degree field of fire and spaced closely together. Some of the ouvrages of the *New Fronts* mounted turrets with 25mm guns. There were two types of turret for this AM assortment:
• A position for two sets of 25mm guns each with a JM
• A position for one 25mm gun, two machine-guns firing through the crenels and a 50mm mortar firing through the roof.
In the Alps, one fort even had a casemate that mounted four old 95-mm naval guns

460



The *Gros Ouvrage de Gordolon* (plan, at left) is located close to the western bank of the *Vesubie River*. Gordolon is on two levels, with the entrance block, usine and caserne at road level (a stairway leads up to an intermediate level corridor 60-feet above). At each end of this corridor, stairs lead to the two fighting blocks. The layout was similar to other forts in the *Alpes Maritimes Sector*. Just inside the entrance, there is a defended dog-leg and beyond that an air-lock into the main lower corridor. The fort was manned by 246 men.

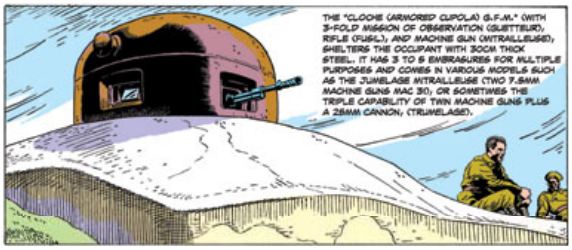
461

Block 3 had two 81mm mortars and Block 2 had two 81mm mortars on the lower level and two 75mm canons on the upper level. Alongside the mortars in both blocks were two ammunition lifts from the floor below.
Above L&R: caption: "Block 3 - 81mm mortar with ammunition lift alongside"

462

Turrets (Fixed)

463



Above the entrance there were normally one or two non-movable armored steel turrets referred to as "cloches." They came in several sizes and types, but those on the entrances were usually of the observation and machine-gun type known as the GFM (*Guet Fusil Mitrailleur*). The GFM cloche, in addition to permitting direct observation from its firing crenels, sometimes mounted a small periscope in its roof. It also could mount a scope in its crenel. The weapons used in these cloches were a FM and a small breech loaded 50mm mortar.

464

The Cupola GFM Model 1929 Type A observation/machine-gun cupola was the first produced model of this cupola and was also the most numerous one. In the context of the *Maginot Line*, The main visual characteristic of the cupola is the rectangular embrasures (3 to 5 total). Made of cast armored steel, the cupola (just like the B model) was used for observation and close-in defense. For this purpose, it was armed with an FM Mle 24/29 or a 50mm mortar Mle 1935. A characteristic feature of all GFM Type A cupolas are the ear-like lifting points on each side. These were used to move/lift the cupolas into place during installation.

Left: caption: "This is a GFM Model 1929 Type A of Block 8 at GO Molvange. Note the hole on top for a periscope."

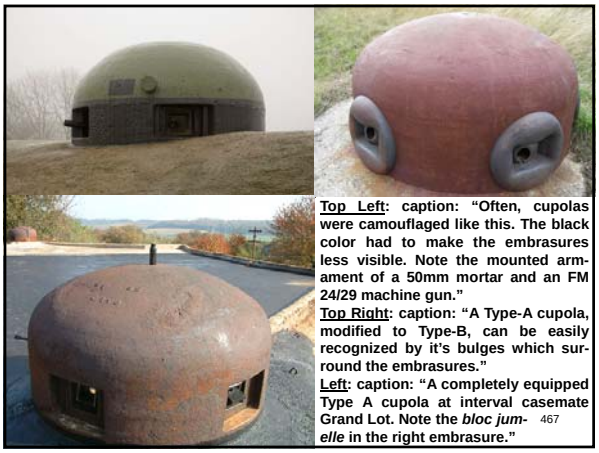
Right: caption: "This is a armored cupola Type A at casemate Du haut de l' Anguille"

465

Cupola GFM Model 1929 Type A Models:

- **PM** (*Petit Modele* = small model) - On casemates with protection levels 1 or 2
- **PMA** (*Petit Modele Allonge* = small lengthened model) - On casemates with protection levels 1 or 2. This armored cupola sometimes replaced the PM when more declination of the armament inside was required due to its position relative to the casemate.
- **GM** (*Grand Modele* = large model) - On combat blocks with protection levels 3 or 4.
- **GM Two-Piece** - Exclusively used in mountainous areas on combat blocks with a protection levels 3 and 4

466



Top Left: caption: "Often, cupolas were camouflaged like this. The black color had to make the embrasures less visible. Note the mounted armament of a 50mm mortar and an FM 24/29 machine gun."

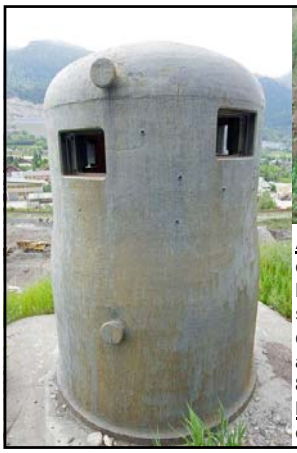
Top Right: caption: "A Type-A cupola, modified to Type-B, can be easily recognized by it's bulges which surround the embrasures."

Left: caption: "A completely equipped Type A cupola at interval casemate Grand Lot. Note the *bloc jumelle* in the right embrasure."

467

During combat, the *Duralumin* mounts of the Type A models proved to be the weakest point. Designers were aware of this, and introduced the Type B cupola in 1934. The plan was to modify all existing cupolas by means of field modifications. However, this was a costly process and the work of upgrading was still in progress when the German invasion began in May 1940. These modified/upgraded cupolas are easily identifiable by the large bulges around the embrasures.

468




Above: caption: "This Type A cupola, modified to Type B can be found on case-mate Einseling Nord in the SF Faulquemont area. The large scars are probably the result of 88mm shells."
Left: caption: "Type A cupola"

469


In 1934, a new type of cupola was adopted. Just like the Type A, it had 3 to 5 embrasures. It had slightly thicker armor and, most importantly, much better protected mounts. These ball mounts were integrated into the embrasures and were capable of resisting a 25mm hit when in use and could withstand a 47mm hit when closed (with its opening turned away). The embrasures had a conical shape able to withstand heavier impacts (in stark contrast with the Type A). The installed equipment was limited to a FM 24/29 or a diascope. Two models were produced; the PM and GM model/s. The PM was meant to be used on fortifications with concrete protection level/s 1 and 2 and the GM on protection level/s 3 or 4 fortifications.
Left: caption: "A cupola Type B"
Right: caption: "This cupola was a Type A, but only got partially converted to a Type B"

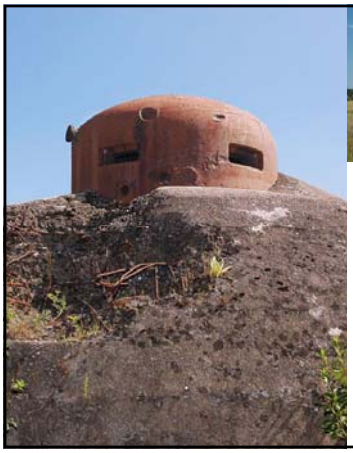
470

The Type C cupola was installed in blockhouses (hardened field fortifications) of the *CEZF Line*, with protection level 2. The CEZF Line was a second line of defense behind the northern part of the *Maginot Line* (the fortifications of the CEZF line were still incomplete by the time WWII began). The absence of a ball mount meant that no observation devices (which were available for the cupola Type A) could be used. The observer had to rely on the naked eye or a pair of binoculars. However, an opening was made in the top of the cupola for a Type F1 periscope. The advantage of this cupola was its simplicity that allowed quick manufacture.

471

Above: caption: "The cupola Type C was made from the same steel and mold as the type B cupola, but was simpler. It did not have a movable floor, inner lining or a ball mount. It had three simple narrow slits, measuring 84mm in height and 210 mm in width."

472




Above: caption: "A cupola type C on STG case-mate C18 at Audviller"
Left: caption: "One of the few Type C cupolas which were actually placed, on top of a CEZF fortification."

473

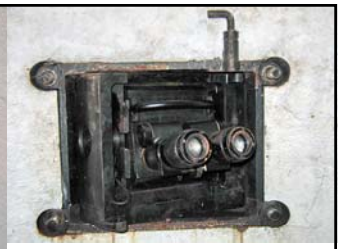
For observation, an *episcope* (a miniature periscope), a periscope (there were several types available) or a *bloc jumelle* were used. Most GFM cupolas possessed a fitting in the top through which the periscope could be raised. In some cases (i.e. when a GFM cupola was used as an auxiliary observation cupola for artillery), an observer could scan the surroundings with a periscope Type J2 (7x enlargement). In other cases, a Type F1 or F2 were used (for less precise, general observation).

474

475

Above: caption: "A Type F1 periscope mounted on top of a cupola"
Left: caption: "A soldier from the Cameron Highlanders looks through a periscope in the Fort de Sainghain on the Maginot Line, 3 November 1939"

476



Above: caption: "A *bloc jumelle* was in fact a miniature periscope and a pair of binoculars combined into one"
Left: caption: "A type F1 periscope seen from the inside of a cloche"

477

The JM Model 1930 Machine-gun Cupola, with one embrasure, could provide either frontal or flanking fire. It was equipped with the same 7.5mm machine guns (JM Reibel) as those mounted in the casemates and ouvrages. This design changed the appearance of the casemates after 1930 and increased their field-of-fire. A small number of JM cupolas were modified in the field to house an AM armament (it was a labor intensive and technically difficult undertaking). It was deemed necessary because of the fact that some casemates did not have anti-tank weapons. Work commenced in March 1940.
Left: caption: "The business end of the armament inside a modified JM cupola. It housed a 25mm AT gun and two 7.5mm machine-guns. Note the trapezoid shape of the embrasure."
Right: caption: "One of the very few JM cupolas which were modified to house an AM. This one can be found at PO l' Einseling."

478

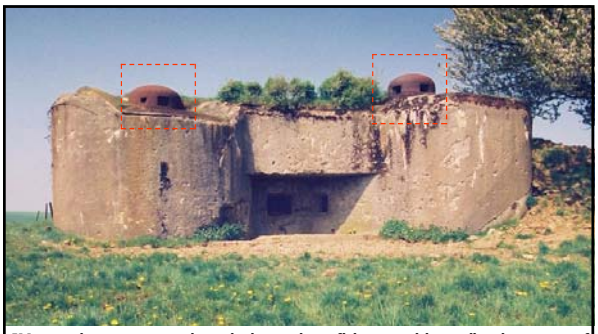
479

JM cupolas had a single firing port, which were flanked on either side by trapezoidal observation ports. The cupola had a mobile platform and a lift to facilitate the transportation of magazines to the loader. The rear was often encased in a concrete embankment, which provided additional cover and reduced the silhouette of the cloche. This in stark contrast to the GFM cupolas of Type A and B, which could often be seen from a considerable distance.
Left: caption: "A cupola JM well protected by concrete"

480

The AM Model 1934 machine-gun/anti-tank gun cupola had an oval-like shape due to the fact that both of the firing embrasures were placed at a 45-degree angle from each other (the AM weapon required space so it could pivot easily from one embrasure to the other). An armored plug was put into an embrasure that was not used. Fortifications built with protection level 1 and 2 had the model PM (***Petit Modele***) cupola. Casemates or combat blocks with protection levels 3 and 4 were equipped with a model GM (***Grand Modele***) cupola. There were 72 of these oval-shaped cupolas installed on the ***Maginot Line***, all on fortifications of the ***New Fronts***.

Above: caption: "This cupola AM at Po Rohrbach clearly shows the plug which was used to close the embrasure that was not in use" 481



JM cupolas were used as independent firing positions (in the case of "casemates cuirassees") or could be integrated with other weapon positions to create a broader field-of-fire. Sometimes, they even replaced a weapon in a firing chamber, thus reducing the two main concrete embrasures to one instead of two. 482

Above: caption: "Casemate Cheniere-Est"

Known as the LG Model 1934 Mortar cupola, it never received the armament it was designed for. The original plan was to install a Brandt 60mm mortar (model 1931). However, because of development problems, it was never produced. The intention was to replace it with the 50mm mortar model 1935, which was already in service, but this weapon was never delivered for the purpose of equipping the LG cupolas. This proved to be a major disadvantage in some cases during the fighting in May/June 1940.

483

The LG cupola was specifically designed to cover dead ground in the immediate vicinity of its position. This could be the block it was build into, or surrounding fighting positions. The LG cupola was very hard to spot from a distance and virtually invulnerable to gunfire (because of the fact that it was almost completely embedded in concrete). A very small part of this cloche was exposed to the naked eye, and allowed a mortar crew to fire their weapon (under an angle of 55 to 90-degrees) through a hole in the top (but made them vulnerable to air bursts). The mortar crew would be supplied by grenades via a chain lift which was capable of transporting 25 grenades per minute.

Left: caption: "An example of an LG cupola at GO Latiremont"

Right: caption: "An example of an LG cupola at GO Schoenenbourg. The embrasure is covered with an armor plate." 484

Inside, all the cupolas had a metal and wooden platform that could be raised or lowered to adjust for the height of the soldier occupying the cupola. In case of injured people, it could be lowered all the way down to the base of the cupola (Type C cupolas did not have this platform). In the center of the cupola was a pipe which extended through the platform to the base of the cupola. Spent shell cases fell down the tube into a ventilated bin located at the bottom of the cupola. When manned by the crew (either one or two soldiers depending on the model of the cupola), the cupolas were equipped with observation equipment, weaponry and magazines for the weapons. The horizontal field of view/fire through the embrasures was 72-degrees. There were six different gun mounts, depending on the role and placement of the cupola.

485

Above: caption: "A view at a platform from underneath. On the right (in between the metal beams) is a large chain to move the platform. The spent cartridge pipe is visible in the center. The tube against the ladder is a voice tube."

Left: caption: "A view at the cartridge collection box beneath a platform. Note that the hand-operated ventilation device is no longer present. It was connected via a tube through the circular opening at the top of the box." 486

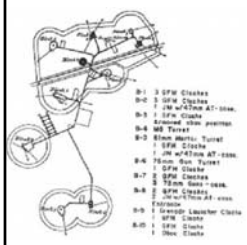

During combat in May/June 1940, the greatest nemesis of these armored cupolas were not the German indirect-fire artillery pieces, but the accurate anti-tank guns with their high-velocity, armor piercing projectiles. There were many combat reports of AT gun crews firing as close as one kilometer or less and penetrating the cupolas with ease. Especially the German 88mm gun proved to be a cupola and concrete "slayer." At greater ranges (+2 km), accuracy and penetration power were less of a threat to the cupola and its occupants.

Left: caption: "An 8.8cm Flak 18 fires at the Maginot Line"
Right : caption: "Ilustration of an 88mm gun on its trailer. The white stripes on the barrel indicate the number of 'kills.'"

487

Left: caption: "Casemate Bassin de l'Industrie, Strasbourg." During the crossing of the *Rhine River* by the Wehrmacht (on May 10th 1940), many Rhine casemates were badly mauled by 88mm flak guns. These had been secretly positioned at close range under the cover of darkness and opened a devastating barrage at the break of dawn. Most of the casemates did not stand a chance and were penetrated well within a minute.

488



Another type of external defensive position (sometimes found on entrance blocks and even combat blocks) was the *cloche de lance* grenade or mortar position. Although the French called it a cloche, it was almost flush with the surface and contained a single weapon below. This weapon was a 60mm mortar which was not perfected by the time the *Battle of France* began in May 1940.

Left: caption: "A 1937 German plan of Mottenberg (plan never used)"

489

Turrets (Retractable)

490

The economic crisis of the early 1930s hit France hard. In order to save money, some ouvrages of the *Nouveaux Fronts* (*New Fronts*) built from 1934 forward (on the left flanks of the de Lauter and Metz Fortified Sector/s) were equipped with turrets which were originally destined for forts built prior to 1914. However, due to the outbreak of war in August 1914, sixteen 75mm Model 1905 (short barreled gun) turrets were placed in storage. The plan was to equip twelve of these turrets with two Model 1934 25mm AC (anti-tank) cannon/s combined with two MAC Model 1931 machine-gun/s. However, extensive modifications had to be carried out before they were installed. For example:

• A periscopic sight had to be installed so that the crew on the intermediate level could observe the surroundings;
• The ammunition hoists for the 75mm shells had to be replaced with new hoists for the "camemberts" and the anti-tank shells

The upper level (a/k/a "firing room") of this manually operated turret (spacious compared to others) housed two AM weapons, which were operated by six men: two gunners (seated below the guns) and two loaders per gun. Both guns could slightly traverse in relation to the turret (a unique feature).

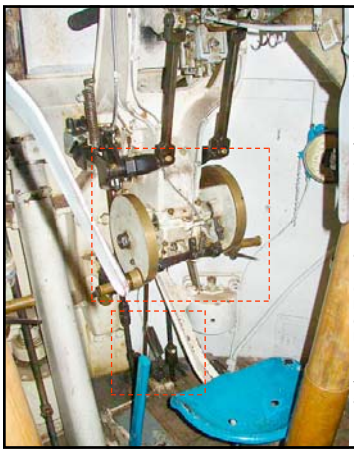
491

The commanding officer of the turret was positioned on the intermediate level and aimed the turret by means of a periscope or coordinates. However, both gunners in the firing room fired at targets independently from one another (they also had periscopic aiming devices at there disposal). The officer communicated with the men in the firing room by means of acoustic tubes or with a "Teleflex" (a device used in the navy which was, basically, a mechanical telegraph).

Left: caption: "Photograph of a restored turret at PO Rohrbach. In view are the lower and intermediate level/s"

492

The operating console at the intermediate level.
1) Voice tubes for communication with the firing chamber 2) Ammunition lift to firing chamber 3) Periscope 4) Teleflexes (mechanical telegraphs) 493



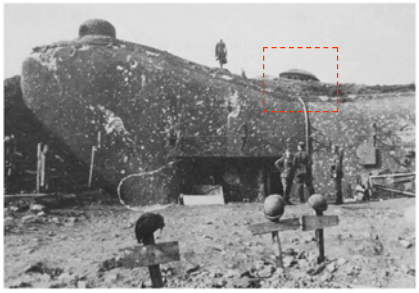
Apart from the commanding officer, there were six more men responsible for operating the machinery:
• Two men to operate and load the ammo hoist;
• Two men responsible for making the turret turn (traverse);
• Two men in reserve
Eight men were at work on the lower level, their task/s being ammunition logistics and moving the turret move up and/or down.
Left: caption: "Gunner's console underneath one of the AM positions at Block 1 of PO Rohrbach. The wheels right in front of the gunner also had handlebars with bicycle brake-like triggers. Barely visible on the floor are the foot peddles."
494

Unfortunately, the pair of 25mm cannon could not replace the artillery protection the *New Fronts* ouvrages required. These anti-tank guns simply lacked the necessary firepower and range. This would have dire consequences in 1940 (i.e. *PO La Ferte*). Only one of the original turrets was placed with the original (75mm) canons (at the *Ouvrage Les Chesnois*).
Left: caption: "Detail view from a battle tower 75mm caliber in the Maginot Line"
495

Top: caption: "The business end of one of the AM units. The barrel of the 25mm anti-tank gun can be seen, as well as the two mini-em-brasures for the MAC 31 machine-guns. The hole in the middle is for the optics device of the gunner."
Bottom: caption: "The top end of the ammunition lift with several ammunition devices:
1) Magazine for the MAC31 (nicknamed 'Camembert')
2) Portable bin for 10 25mm shells
3) Ammunition lift shaft
4) 25mm shell storage place" 496

The primary reason the AM (Arme Mixte) was designed was to add an anti-tank capability to *New Fronts* casemates and ouvrages, many of which were only equipped with light-caliber weapons in cupolas. The system was mounted in an AM cupola, some converted 75mm turrets and turrets together with a 50mm mortar. A secondary reason was to counter the problem that existed when a JM Reibel had to be swung out of an embrasure, to make way for a 37mm or 47mm AT gun which was moved into its place in the embrasure. The gaping hole in an embrasure presented a perfect opportunity for an attacker to fire upon the crew inside the casemate as the JM and AT gun were exchanged. Because the weapon was used in several types of configurations (i.e. cupolas or turrets), several versions existed. The main difference was the length of the barrel. The sector/s in which the AM were employed were: Escaut, Maubeuge, Montmedy, La Sarre and Rohrbach. Eleven JM cloches (in sector/s: Escaut, Maubeuge and Faulquemont) underwent a complicated, labor-intensive and costly upgrade to receive this weapon.
Above: caption: "This AM weapon differs from the one build into some MG turrets. In the latter, the MAC 31's were constructed further apart from the anti-tank gun."
497

Left: this 75mm AM turret was equipped with mixed weapons. The preliminary bombardment of *Petit Ouvrage La Ferte* had disabled the turret, sticking it in the up position, making it unable to turn (traverse). A German shaped charge opened a hole in the weapons embrasure (left). The Germans then dropped a charge into the turret itself. The resulting explosion blew the turret into the air, and it dropped down, falling off center.
498



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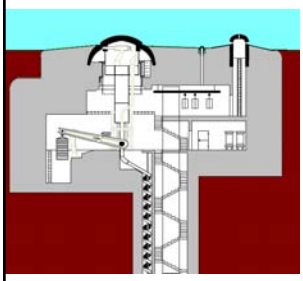
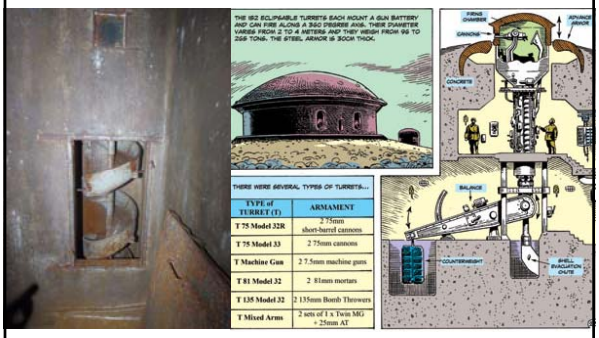


All turrets were powered electrically, but the crews could operate them manually as well if the need arose. Some turrets, depending on the type of their weapon, had *monte charges* (lifts) which carried ammunition from the block up into the firing chamber as well as a set of chutes to carry expended shell casings all the way down to the main gallery level.

Left: caption: "Cross-section of a 75mm combat block showing the operation of the turret"

500



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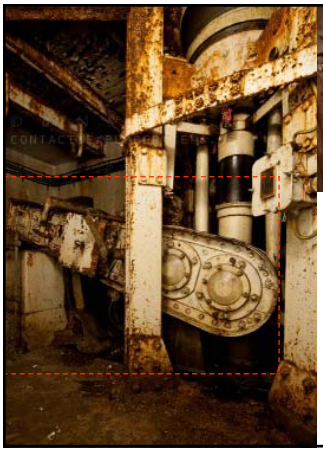


Above: caption: "Almost identical to the earlier Verdun turrets, this is the counterbalance beam to move the heavy armored turret up and down"

Left: caption: "81mm tower in the bunker - Michelberg Block 3"

502

Left: caption: "Access to a fighting block's artillery emplacement."

Above: caption: "Bottom of the turret proper and where the artillerymen accessed the fighting compartment itself."

503

Top Left: caption: "Part of the turret operating mechanism"

Top Right: caption: "Looking up into the turret dome"

Left: caption: "Part of the turret power distribution system"

504

505

The origins of the sixty-one retractable machine-gun (MG) turrets (*Tourelle de Mitrailleuses*) built into the ouvrages of the *Maginot Line* date back as far as 1893 when French army engineers first started work on a turret model. As a result, twenty-nine installations of the the GF4 Model 1899 were made at Verdun fortifications between 1895 and 1914. However, the *Maginot Line* retractable MG turrets were more powerful, technically more refined and had (apart from the concept) few similarities with those of the Verdun ouvrages. On the *Anciens Fronts* (*Old Fronts*), virtually all the large and small ouvrages were equipped with this turret, typically with one to three turrets per ouvrage. It was often flanked by one or two GFM cloches or with casemate mounted (infantry) weapons.

506

The MG turret had three levels, just like all the other retractable turrets used in the ouvrages. The firing chamber was the upper level. A gunner (also turret commander) and a loader were positioned in a very confined space on the upper level which was accessed by a narrow hatch.

Left: caption: "1) Hatch to access the space around the upper level (i.e. to clear debris) 2) Access hatch to the firing room 3) Electric motor for rotation 4) Water reservoir (for cooling the barrels)"

507

The gunner (seated underneath the machine guns) operated the *JM Reibel* by means of his feet and hands. His feet operated two pedals which controlled the rotation (electric-drive) of the turret. Directly in front of him was a wheel by which he could change the elevation of the gun (it also had a trigger for the machine-gun on the left). In case the electricity was cut-off, a second wheel was at his disposal with a handle that also served as a trigger (bowden cable mechanism) for the machine-gun on the right.

Left: caption: "Although this image depicts a mixed weapons unit taken out of a modified 75mm turret, it gives an impression of how the gunner inside a retractable turret was seated. Note the absence of the foot pedals."

508

During a night attack, visibility was close to zero for the gunner in the turret. Therefore, an ingenious solution was made manifest. A device was made that consisted of a graduated arc (with a constantly changing profile) that followed the contours of the surrounding terrain. Because of this arc, when the turret was rotated the elevation of the machine-guns was adjusted, so that barrage fire was laid-down about 20cm above the barbed wire belts at any time during its rotation.

509

A single person on the intermediate level was responsible for the supply of *camemberts* (magazines) to the top of the turret. This task was accomplished by a hoist. Empty magazines were transported back from the firing chamber to the lower level. Here, three soldiers had the task to empty the ventilated box in which the fired cases were collected, reload the empty magazines, and make sure the whole machine operated trouble free.

Left: caption: "The hoist as can be seen inside PO Sentzich. Note the voice tube to the right of the ammo magazine and the beautiful manufacturer's production plate."

510

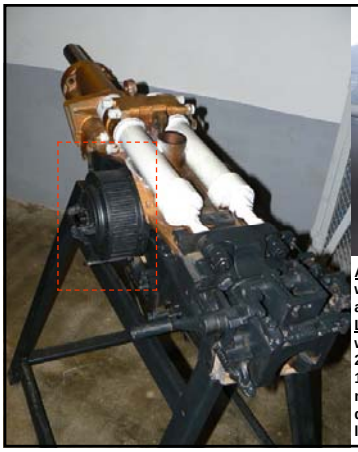
511

In the latter stages of construction of the *Maginot Line*, CORF designers realized that they had underestimated the importance of armored warfare given the inability of the MG turrets to destroy tanks. Thus, a labor-intensive plan was devised to equip them with a 25mm gun that was combined with two MAC 31's (alternative AM combination). The plan was to drill a new embrasure for the right hand machine gun, because its original position was taken up by the anti-tank gun. Fourteen turrets eventually got converted, while others were in the process and/or on the list of being re-equipped. During this process, the turret was non-operational.

Left: caption: "The small openings on the left and right side were for the machine guns, the top one for the aiming device and the second opening from the left was the embrasure for the added 25mm anti-tank gun"

Right: caption: "The steel skirt around the base of the turret (partly sunken in to the ground) had to protect the underlying structures from plunging artillery fire"

512



Above: caption: "This device was used to re-load the magazines"

Left: caption: "Arme mixte. This weapon was a combination of a 25mm AT gun, and 2 MAC Mle 1931 light machine guns, mounted on both sides. Note the drum magazine of the left machine gun."

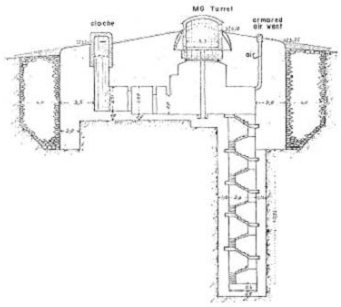
513

This single-piece cast turret (above L&R) housed a Model 1934 25mm anti-tank gun combined with two MAC Mle 1931 machine-guns and one Model 1935 mortar. It was the last turret model designed and was produced in very small numbers (only seven were produced). It combined the best of several features of a number of cupolas. It was capable of direct and indirect fire, observation and could be hidden from enemy guns. Its small size and tough casting made it hard to destroy. Another advantage was that the mechanism to lower and raise the turret needed less space/volume below ground. Instead of a pivot and a counterweight (the usual mechanism for retractable turrets) it had three vertical counterweights attached to chains (set 120-degrees apart, arranged in a triangular configuration).

Left: caption: "The small black hole in the turret roof is the muzzle opening for the 50mm mortar. On the left side of it are four openings: the first one is for the aiming device, the second and fourth for the JM and the third one is for the 25mm AT gun."

Right: caption: "The only remaining example of this turret can be found on top of combat Block 9 of Ouvrage Anzeling. Note the bulbous cap which makes it easy to recognize and the large armored skirt around the turret."

514



Left: caption: "A German plan of 1937 of MG turret block, Block 3, Village de Coume Petit Ouvrage." Note that the diameter of the MG turret indicated (3.3-meters) is more than twice the size than it actually was (the standard size being 1.2-meters).

515

516

Part 8

The Munroe Effect

517

Sky Soldiers

518

"…But suppose that even these were not enough to stop the enemy airmen. Suppose the invaders send a great air squadron. Its loses are terrific, but some get through, bomb and machine-gun the anti-aircraft defenses, and beat-off the French airplanes. Hurriedly they clear a spot above one of the firing French cannon. Into that spot fly a few heavy bombing planes. But these carry no bombs. Down from them float parachutes – a dozen, a score! And dangling from the parachutes are men, the newest type of soldiers…"

***Popular Science,* October 1936**

RE: in 1917, *Winston Churchill* proposed the creation of an airborne force to assault behind the German lines. However, the first modern operation dates to late 1918. Major *Lewis H. Brereton* and his superior Brigadier General *Billy Mitchell* suggested dropping elements of the U.S. First Infantry Division behind German lines near Metz. The operation was planned for February 1919, but the war ended before the plan could be realized. Mitchell conceived that U.S. troops could be rapidly trained to utilize parachutes and drop from converted bombers to land behind Metz, in sync with a planned infantry offensive.

519

"Where is the prince who can afford so to cover his country with troops for its defense, so that ten thousand men descending from the clouds might not, in many places, do an infinite deal of mischief before a force could be brought together to repel them?"

***Benjamin Franklin*, 1784**

RE: with a crude, rudimentary understanding of parachutes, *Benjamin Franklin* was the first person to envision a time when soldiers would drop from the sky. Following WWI, the *U.S. Army Air Service* experimented with the concept of having troops carried on the wings of aircraft pulled off by the opening of their parachutes. The first true paratroop drop was performed by Italy in November 1927. Within a few years, several battalions had been raised and were eventually formed into two distinct divisions. Through the 1930s, other nations including Argentina, Peru, Japan, France and Poland also organized airborne infantry units. France became the first nation to organize women in an airborne unit. Recruiting two-hundred nurses who, during peace time, would parachute into natural disasters. They would also serve as reservists who would be called upon as a medical unit attached to the airborne troops during wartime.

520

"….The first weak spot in parachute troop maneuvers is the fact that airmen are highly vulnerable to enemy fire when coming down the 400 to 500 feet required for a 'chute to open vertically…A second weakness of parachute troops lies in the fact that, under present methods, due to the spaced interval necessary at which the jumpers leave their plane, troops come to earth scattered out all over the terrain. Precious tactical minutes are lost as the troopers assemble on the ground…"

***Mechanix Illustrated,* August 1941**

521

Above: caption: "Soviet Paratroopers deploy from a Tupolev TB-3 in 1930." The Soviet Union was experimenting with the idea of airborne infantry in the late 1920s/early 1930s, planning to drop entire units complete with vehicles and light tanks. To help train enough experienced jumpers, parachute clubs were organized with the aim of transferring into the armed forces, if needed. Planning progressed to the point that corps-size drops were demonstrated to foreign observers. One of the observing parties; Germany, was particularly interested.

522

A Modern Suicide Club

523

"…All are young athletes. They wear an outer costume of leather; underneath, light bullet-proof vests. All have light helmets and gas masks. Some carry machine guns, bombs, and pistols; others, the sections of thirty-seven-millimeter cannon and small armor-piercing shells. Here is the modern Suicide Club – the army that drops from the sky, specially trained to scale the Great Wall…"
***Popular Science,* October 1936**

524

"…They climb it by climbing down into it. Aviators have been rehearsed in dropping men to try to silence one of the flaming cannon, and force entrance to the casemate beneath it. But, as they land, in their ears is the dread sound of machine guns planted all about the gun turret to protect it from just such a threat. The thin ranks of the parachute jumpers become thinner yet, before a devoted, lucky handful manage to crawl like Indians under or around the gun. Wearing rubber gloves. They struggle over electrically charged cables strung to protect it…"
***Popular Science,* October 1936**
Above: caption: "A gun casemate near the entrance to Fort Eben-Emael, Belgium. Captured by German paratroopers in May 1940."

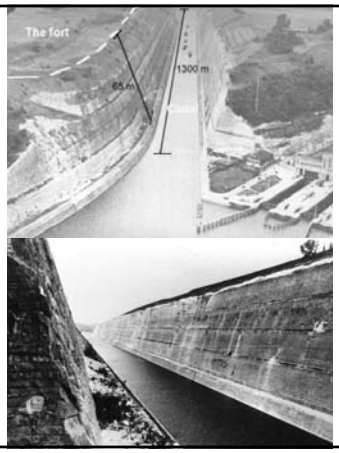
525

Theory vs. Reality

526

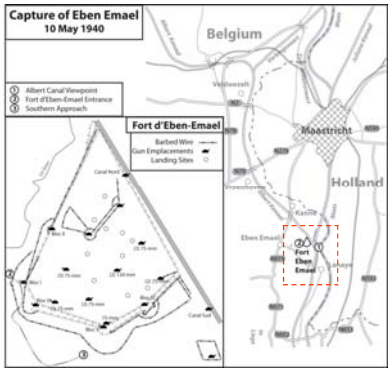
The *Fort of Eben-Emael* (named for a nearby village) was reputed to be the strongest military fortification in the world. On May 10th 1940, the fort was attacked as part of Nazi Germany's planned "Blitzkrieg" (Lightning War) on Western Europe. The fort was north of the large Belgium city of Liege. Built on a natural precipice (above L&R)), it commanded the *Albert Canal* and was seen by the Belgium military as being the principle barrier against a German attack on their eastern border. As well as the Albert Canal, the fort also had a commanding position over the high bridges over the canal. If an enemy captured these bridges, their ability to move military vehicles and troops would have been greatly facilitated. Without control of the these bridges, such movement into Belgium would have been severely restricted and the mobility that Blitzkrieg depended upon for success would have been stymied.

527



528

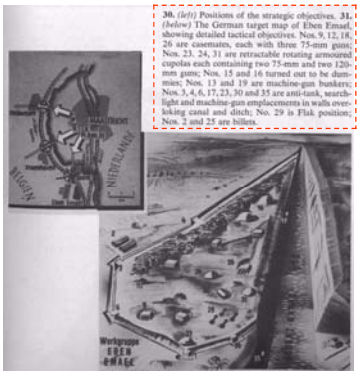
Built between 1932 and 1935, the fort abutted the ***Albert Canal***. Diamond shaped, from north-to-south the fort was 900-meters long and from east-to-west it was 700-meters, overall. The fort was a base for infantry and artillery units and the defenses of the fort were placed so that each provided overlapping fields-of-fire should the fort come under attack. Getting into the fort would have been very difficult. Two of the walls were 40-meters high and nearly vertical thus, attempting to climb them in an assault would have been all but impossible. The other sides of the fort were protected as a result of a man-made ditch (moat) around them, again making any assault very difficult. To further complicate any assault, outer trenches had been built and more walls, the majority of which were 4-meters high. The weaponry within the fort included 7.5cm cannon; 12cm revolving cannon; machine guns; searchlights; anti-tank cannons and anti-aircraft cannon. Dummy weapon emplacements (cupolas) were also placed to fool an attacking enemy. Underground, the fort was connected within by a series of extensive tunnels. There was only one access to these tunnels; at Fort 17 in the southwest corner of the vast complex. The fort was effectively self-sufficient since it contained barracks, sick bays and a communications center. The tunnel complex was built with a ventilation system complete with filters in case of a poison gas attack. 529



530


531

However, Eben-Emael had one major weakness: it was vulnerable to an attack from the air. The German High Command knew that they had to capture the bridges over the ***Albert Canal*** intact if their Blitzkrieg strategy was to work. They also knew that a paratrooper attack – so effective in Holland – would be unlikely to be successful at Eben-Emael (it would give the defenders too much time to react as the paratroopers descended). Hitler's generals were conservative, suggesting a bombardment with heavy guns and then a frontal attack, akin to WWI tactics. Others suggested a siege. Hitler rejected his generals' suggestions and came up with his own plan that would use the element of surprise and a new German secret weapon: the shaped charge, which had to be applied directly to a surface (with a 10-second time delay fuse). This new explosive could punch through the thickest armor, something even the largest artillery shells couldn't accomplish with a direct hit. 532


30. *(left)* Positions of the strategic objectives. 31. *(below)* The German target map of Eben Emael, showing detailed tactical objectives. Nos. 9, 12, 18, 26 are casemates, each with three 75-mm guns; Nos. 23, 24, 31 are retractable rotating armoured cupolas each containing two 75-mm and two 120-mm guns; Nos. 15 and 16 turned out to be dummies; Nos. 13 and 19 are machine-gun bunkers; Nos. 3, 4, 6, 17, 23, 30 and 35 are anti-tank, searchlight and machine-gun emplacements in walls overlooking canal and ditch; No. 29 is Flak position; Nos. 2 and 25 are billets.
533

As American as the Brooklyn Bridge

534

"…the idea originally was as American as Brooklyn Bridge. In fact, it was a New Yorker, Prof. Charles E. Munroe, of Columbian University, who conceived it. He wrote about it in Popular Science Monthly in the year 1900. Eleven years later the Germans tried to tie up the idea with a patent, but somehow failed to do so. As an explosives expert, Professor Munroe discovered that a hollow charge of dynamite was many times more effective than a solid charge of the same weight. He experimented by simply draping a bunch of dynamite sticks around a can with an open end out. Using nine pounds of dynamite, he blew a hole three inches in diameter through the five-inch steel walls of a safe…"

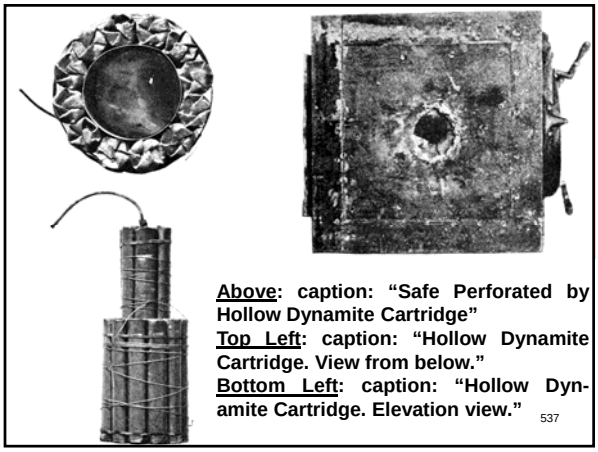
***Popular Science,* September 1943**

Left: caption: "Charles Edward Munroe (1848-1838) in 1919." In 1886, Munroe joined the *Naval Torpedo Station and War College* at Newport, RI, as a chemist. It was there that he discovered "The Munroe Effect" - the basis for explosive shaped charges. He was also the inventor of smokeless gunpowder and wrote over one-hundred books on explosives and chemistry. 535

"…Among experiments made to demonstrate the resistance of structures to attack by a mob was one upon a safe twenty-nine inches cube, with walls four inches and three quarters thick, made up of plates of iron and steel, which were re-enforced on each edge so as to make it highly resisting, yet when a hollow charge of dynamite nine pounds and a half in weight and untamped was detonated on it a hole three inches in diameter was blown clear through the wall, though a solid cartridge of the same weight and of the same material produced no material effect. The hollow cartridge was made by tying the sticks of dynamite around a tin can, the open mouth of the latter being placed downward, and I was led to construct such hollow cartridge for use where a penetrating effect is desired…"

***Popular Science Monthly,* February 1900**

RE: excerpt from an article entitled: "The Application of Explosives – by Charles E. Munroe, Professor of Chemistry, Columbian University" 536



Above: caption: "Safe Perforated by Hollow Dynamite Cartridge"

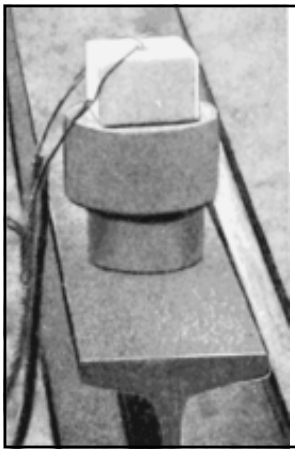
Top Left: caption: "Hollow Dynamite Cartridge. View from below."

Bottom Left: caption: "Hollow Dynamite Cartridge. Elevation view." 537

"…Professor Munroe, in conducting his experiments at the Naval Torpedo Station in 1888, noted that explosive waves tended in certain cases to reinforce each other. His discovery was made quite by accident. Professor Munroe used to mark blocks of guncotton for identification by countersinking letters into the surface of the blocks. When such blocks were laid upon a steel plate and exploded, Dr. Munroe noted that after the guncotton had detonated, the letters were reproduced upon the iron plate. What was most singular was that when the letters on the guncotton were raised above the surface they also came out raised on the iron plate…"

***Popular Science,* May 1944**

538



Above: caption: "Gun cotton disk. With indented inscription, and iron plate upon which the indented inscription has been reproduced."

Left: caption: "Firing on Iron Disk, resting on Lead Disk, in testing the efficiency of Gun Cotton" 539

"…I eventually bored holes of various diameters and depths in guncotton cylinders and in the last instance, I bored a vertical hole completely through the cylinder. These cylinders were each placed on a similar iron plate. When they were successfully fired, it was found that the deeper and wider the hole in the guncotton was, the deeper and wider were the holes in the iron plate. When the completely perforated guncotton cylinder was fired, the iron plate was found to be completely perforated…"

***Popular Science Monthly,* February 1900**

RE: excerpt from an article entitled: "The Application of Explosives – by Charles E. Munroe, Professor of Chemistry, Columbian University." What Munroe had done was to shape an explosive charge in such a way as to cause the detonation waves to reinforce each other. He concentrated much of the explosive force in one direction, parallel to the axis of the cylinder.

540

541

Approaching Perfection

542

"…When the Germans reduced 'impregnable' Eben-Emael in seven hours with a handful of combat engineers and TNT, they set the pattern of destruction that soon may be used against them. For their enemies have improved the method to a point approaching perfection. For instance, one of the most effective weapons of the fort busters is an improved TNT charge. It's encased in steel, the same as the one the Germans began using for the first time in 1940. But secret gadgets have greatly increased its blasting power…The charge the fort busters use weighs 10 pounds and can blow a hole two inches in diameter through 30 inches of steel reinforced concrete. Its exploded by pulling a pin like that used in a hand grenade…"
***Popular Science,* September 1943**

543

The Secret of Secret Weapons

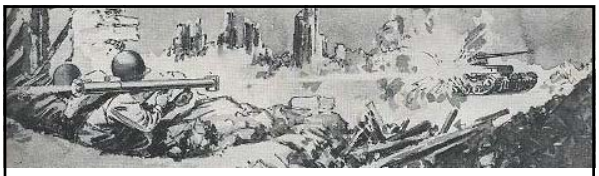
544

"In Popular Science Monthly, 45 years ago this month, Prof. Charles E. Munroe, of Columbian University (now George Washington University), reported his discovery of some 'curious effects produced with explosive substances,' for which he thought useful applications may be found. The most startling of those applications were not discovered until after Dr. Munroe's death in 1938; but they are proving extremely useful now, for they are enabling Army Ordinance to design weapons to punch holes in the thick, reinforced concrete and the heavy armor plate behind which our besieged enemies lurk…"
***Popular Science,* February 1945**

545

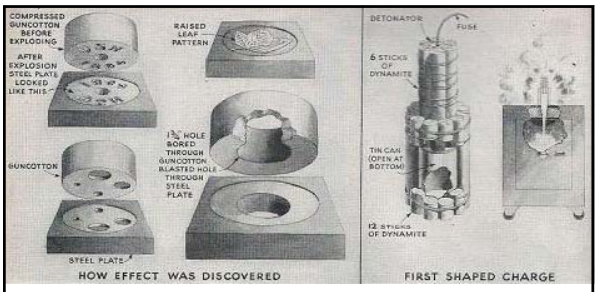
Left: caption: "1900. The first 'Munroe Charge' blew a three-inch hole in the top wall of a heavy steel safe."
Right: caption: "Demolition charges employ the 'Munroe effect' to crack open Axis pillboxes"

546



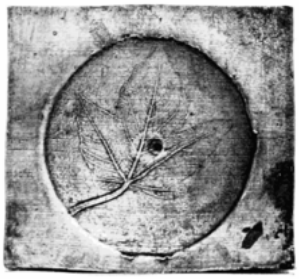
"…The 'Munroe effect' is the secret within many secret weapons, and its utilization is one of the most important scientific developments in the field of explosives during this war. It gave the bazooka its terrific wallop. And it is being used to bore into the very foundations of the fortifications, pillboxes, bridges, and other installations of the Germans and Japanese…"
***Popular Science,* February 1945**

547



Above L&R: caption: "While testing explosives at the Newport, R.I. Naval Torpedo Station, Dr. Munroe noticed that cavities in blocks of guncotton were reproduced on iron plates on which the explosive was test-fired. Leaves placed under the guncotton were reproduced as raised patterns. When this crude hollow charge was exploded on top of a heavy steel safe, it blew a three-inch hole in the 4¾-inch wall. The same amount of dynamite, arranged as a solid charge, had practically no effect on the steel safe wall."

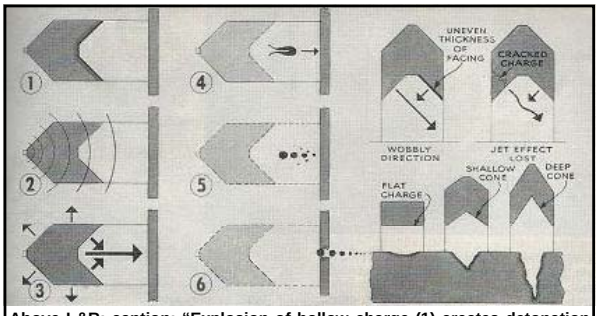
548



549

"…Dr. Munroe, in short, found a way to concentrate a portion of the force of an explosion on a particular spot. And that way, which seemed curious to even him, consists of leaving a cavity in the explosive at the very spot where the maximum force is desired. The British now call the Munroe Effect 'the cavity effect of explosives,' and American experts often describe the blocks of explosives in which this effect is now used as 'hollow' or 'shaped' charges…"
***Popular Science,* February 1945**

550

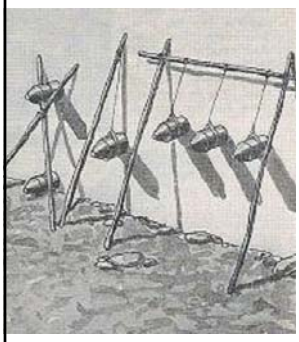


Above L&R: caption: "Explosion of hollow charge (1) creates detonation waves (2). In hollowed-out portion, force is concentrated to form a jet (3). Metal torn-off the cavity lining is turned inside out (4) or form pellets (5) that join the jet to plow through armor (6). Imperfections in the hollow charge may reduce its effectiveness, as seen in the upper drawings. Shape of the charge is varied to suit the target and the kind of effect that it is designed to produce."

551

"…A Norwegian investigator had suggested much earlier that air space might be used to enhance an explosive's effect. The idea was taken to Germany in the 19th century, and applied in the mines of the Saar region, but did not catch on among German military men. A patent on an application of the idea was issued in Germany in 1910, and another patent was issued in Britain in 1911, but no nation did much with the idea during World War I. Interest in Dr. Munroe's principle was revived, however, a few years ago, and his work now has been continued by the Research and Development Service of the U.S. Army Ordnance Department with many remarkable results…"
***Popular Science,* February 1945**

552



"…The Munroe effect may be obtained with any kind of high explosive by cutting a cavity of almost any size or shape in the side of the charge that is placed toward the object to be cut or punctured. Miners have been known to arrange sticks of dynamite in the shape of a tepee to blow a hole in the ground. And demolition engineers sometimes have taken a jackknife and cut a little chunk out of a block of dynamite before placing it against an object to be severed…"
***Popular Science,* February 1945**
Left: caption: "Methods of placing charges against surface to be blasted"

553

Definite Results

554

"…But, to attain the full benefit of the Munroe effect, the cavity must be shaped scientifically, a lining of the correct kind of material must be placed in this cavity, the charge must be held a certain distance from the object against which its force is to be directed, and the detonation of the explosive substance should begin at the rear. No simple rule is known yet by which the effectiveness of certain size or shape of cavity in different weights, shapes, and varieties of explosive charge can be predicted, By dint of much research, however, the Ordnance Department has provided our Army with a wide variety of hollow charges that can be counted on to produce definite results…"
***Popular Science,* February 1945**

555

"…U.S. Army engineers, for example, use demolition charges that look like thick, stubby cones. These are placed in light metal cans, or even more fragile containers, with legs or rims to hold the large end of the cone a suitable distance from the surface to be hit with the maximum explosive force. The charge is then detonated from the opposite, or pointed, end of the cone…"
***Popular Science,* February 1945**

556

"…When it is touched off, a detonation wave races through the explosive substance. This is a chemico-physical wave that progresses from layer to layer of molecules, causing them to vibrate and disintegrate. In TNT, this wave may travel five or six miles a second, and in some other explosive substances it goes even faster. It can jump across short air gaps, yet sometimes can be stopped with surprising ease by interposition of a comparatively thin layer of some sturdy material. The turmoil of the explosive's molecules, as the wave progresses, creates force, which moves outward at right angles to the surfaces of the charge…"
***Popular Science,* February 1945**

557

"…In the hollowed-out portion of a shaped charge, this force coming from the sides of the cavity is concentrated into a jet. This jet has greater energy, pressure, and heat than the force that emerges from the flat, outer sides of the charge. The explosive waves are merged and focused as though they were streams of water, or rays of light, or waves of sound – and their effectiveness is greatly enhanced. By changing the shape of the conical cavity, the width of the jet can be varied. A shallow cone, for example, causes a fairly wide jet and a deep one causes a narrow and more intense jet. Hence, one type of cone is used to punch a wide but shallow hole in an object, and another type to create a deep, tubular hole…"
***Popular Science,* February 1945**

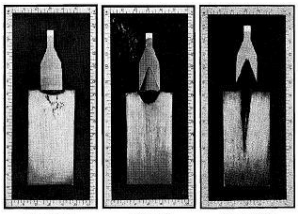
558

Magnified Effect

559

"…Suppose now, that, in addition to the waves of hot gases and explosive force spurting from a charge, pellets or fragments of metal were included in the jet. The destructiveness of the jet would be made even greater. And this is exactly what has been accomplished by placing suitable linings, made of thin metal or some other material, in the conical cavities of shaped charges…"
***Popular Science,* February 1945**

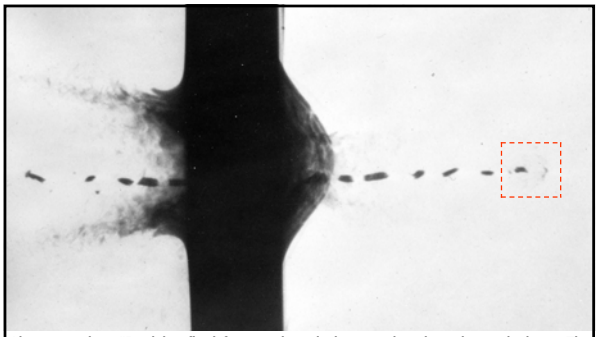
560



561

"…Linings have been developed which are literally turned inside out by the concentrated explosive force. When thus turned about they become teardrop-shaped pellets which are driven into the target. Other linings are torn into tiny fragments quickly by the explosive force and those fragments are hurled at the target. As visualized by ordnance experts, the tiny fragments lead the way, followed by larger ones, and thus a hole is punched in the target that grows wider as the jet continues on its swift, destructive way…"
***Popular Science,* February 1945**

562



Above: caption: "Particles fired from a shaped charge going through metal plates. The photo was taken with a very powerful high speed x-ray camera. The particles are traveling about 24,000 mph – sufficient velocity to escape earth's gravity. The leading particles that created the hole were used up, so those visible beyond the plate simply went through the 'liquified' hole already created by the shock wave of the leading particles, and could punch through more plates. Note the very faint metal vapor shock wave ahead of the first remaining particle."

563

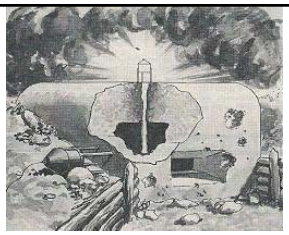
"…With a shaped charge of TNT weighing only 10 pounds, a hole 1¼ inches wide can be blown through eight inches of steel armor plate, or a hole twice that wide can be punched through a 30-inch reinforced-concrete slab. And, by firing a second shaped charge of TNT at the same spot, that hole can be widened and deepened. Such invasions of armor and concrete are possible with the smallest of three standard-shaped charges supplied to the engineers for demolition blasting. By using a slightly bulkier, but no heavier, shaped charge of a new explosive mixture that is more powerful than TNT, the wreckers can blow a wider and deeper hole in either steel or concrete with a single explosion…"
***Popular Science,* February 1945**

564

565

Sufficient Violence

566



"…And for really tough demolition jobs, the engineers use a heavier shaped charge. One blow from this one will punch a hole through five feet of reinforced concrete. If that concrete is part of a pillbox, the interior will be filled with bits of metal, hot gases, torn-off chunks of concrete, and other flying debris that will make life unendurable for the occupants. And if this violence is not sufficient, a long, narrow bangalore torpedo or a flame thrower can be shoved through the hole left by the shaped charge and used to complete the destruction of the occupants of a pillbox…"
***Popular Science,* February 1945**
Above: caption: "Small type on top – large at side – both used according to needs"

567

"…If Japs are hidden beneath log or steel-drum bunkers, one of these big shaped charges can be set on top of their cubby-hole and detonated. The charge will completely penetrate four feet of earth and four layers of 12-inch logs, sending hot metal fragments into the emplacement and filling it for five minutes with highly disagreeable smoke, debris, and dust. If a more massive concrete obstacle must be removed, an engineer can set one of his big shaped charges against it and produce a hole about 60 inches deep, five inches wide at its mouth, and three inches wide at its bottom. A hole that size is plenty big enough for the insertion of more explosives to do whatever additional damage is desired. Yet the shaped charge makes such an opening as readily as you can drive a needle into loose sand…"
***Popular Science,* February 1945**
Left T&B: typical Japanese bunkers

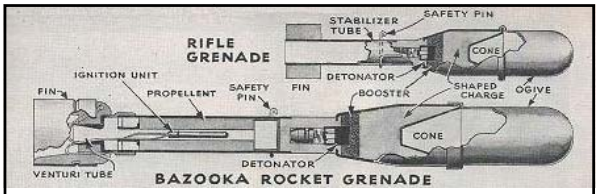
568

Destruction at a Distance

569

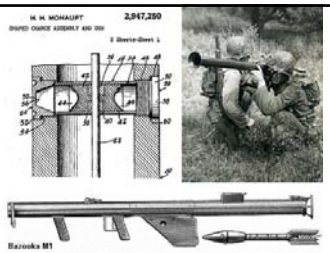
"…But shaped charges need not always carried to their target by hand. They can also be conveyed in rockets. In fact, one of the most important applications of the Munroe effect is in giving relatively slow moving rocket projectiles the penetrating power of high-speed shells…"
***Popular Science,* February 1945**

570



"…The army ordnance bazooka projectile, for example, is a rocket containing a shaped charge. The striking end of the projectile is hollow, and behind this open space is the wide end of a cone. Back of this cone is the explosive. It is detonated by a fuse in the rear, and the explosive force is shot forward after the rocket has hit. This concentration of the force enables a man armed with a bazooka to shoot a hole in the side of a heavy tank. The design of the high-explosive end of big rockets is similar. In a rifle grenade, too, the Munroe principle is applied…"
***Popular Science,* February 1945**

571

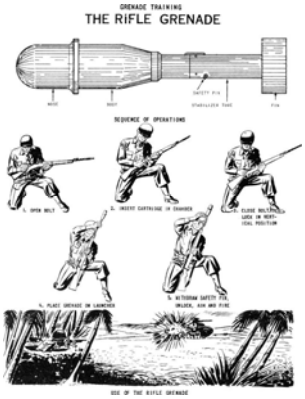


Above: caption: "On September 24, 1951, Henry Mohaupt applies for a U.S. patent for his 'Shaped Charge Assembly and Gun' - bringing to the oil patch his WWII anti-tank 'bazooka' technology patented one decade earlier." Mohaupt had been in charge of a secret U.S. Army program to develop an anti-tank weapon. His idea of using a conically hollowed out explosive charge to direct and focus detonation energy ultimately produced a rocket grenade used in the bazooka. After the war, the potential of downhole rocket grenades to facilitate flow from oil-bearing strata wass recognized by the *Well Explosives Company* of Fort Worth, Texas. The company employed Mohaupt to develop new technologies for safely perforating cement casing and pipe.

572

"…The forward end of the grenade is left hollow, and the explosive's force is focused on the target by a cone…"
***Popular Science,* February 1945**
Left: caption: "From the Nazis the Japs copied a rifle grenade (bottom), including the 'Munroe effect' tank-busting hollow charge"

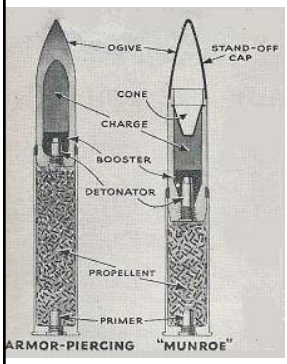
573



574

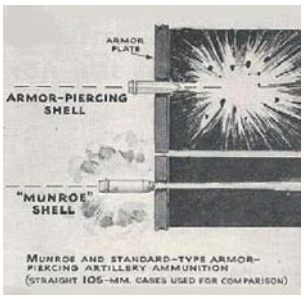
"…The use of this principle in ammunition, however, is not limited to rockets and grenades. It is also used advantageously in artillery ammunition. But this poses a problem that is almost the reverse of that encountered in designing other armor-piercing shells…"
***Popular Science,* February 1945**
Above: caption: "Sectioned high explosive anti-tank round with the inner shaped charge visible"

575



"…A standard type of armor-piercing projectile has a heavy steel nose and is shot from the gun with such tremendous velocity that this nose is driven through the armor before the explosive charge in the base goes off. But ammunition in which the Munroe effect is utilized has a hollow nose, which crumples when it hits the armor. The cone behind the nose then focuses the explosive force against the armor. So, in designing the latter type of shell, the problem is to build a nose that will crumple just the right amount when it hits the armor, rather than one that will go through the armor. Unless the nose crumples exactly the right amount, the hollow charge will be detonated too near or too far from the surface of the armor, and the result may not be satisfactory…"
***Popular Science,* February 1945**

576



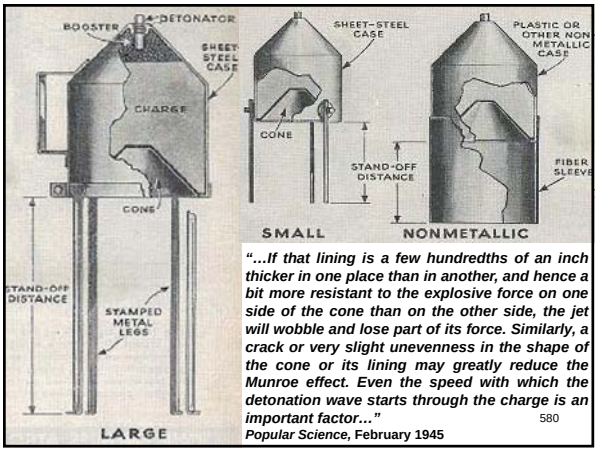
577

Stand-Off Distance

578

"…The distance between a hollow-charge explosive and its target at the time of detonation is known as the stand-off distance. Experience has shown that it is highly important. When this distance is exactly right, the jet from a hollow charge hits with such tremendous force that it actually makes steel flow like thick mud. Much depends, too, on the type and thickness of the cone's lining…"
***Popular Science*, February 1945**
Left: caption: "Pillbox demolition charge"

579

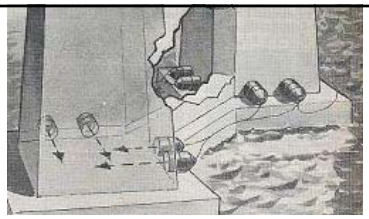


"…If that lining is a few hundredths of an inch thicker in one place than in another, and hence a bit more resistant to the explosive force on one side of the cone than on the other side, the jet will wobble and lose part of its force. Similarly, a crack or very slight unevenness in the shape of the cone or its lining may greatly reduce the Munroe effect. Even the speed with which the detonation wave starts through the charge is an important factor…"
***Popular Science*, February 1945**

580

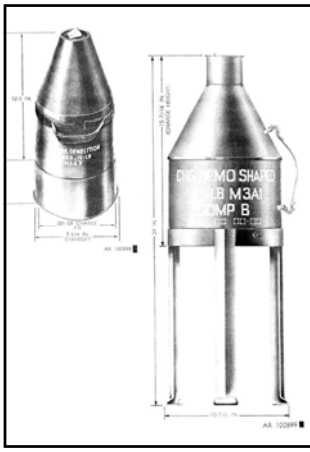
"…You may wonder, when you observe the shape of a hollowed demolition charge placed against a sturdy obstacle, why it does not simply fly off like a rocket when detonated. The experts' answer is that the explosive force is spent too swiftly, and is countered too effectively by the emergence of other force from other sides of the charge. The distance that a demolition engineer must stand back for safety's sake, when detonating his shaped charge, depends partly on the composition of his container – and this is a another matter which has been the subject of research…"
***Popular Science*, February 1945**

581



"…The engineers' uses for shaped charges are manifold. Assume, for a moment, that a bridge must be cut. It can be done either by severing one or more spans or by knocking out supporting pillars. In either case, hollow charges can be helpful. They can be used to weaken a span by punching holes in it. But spans can usually be replaced more quickly than supporting pillars. So the engineers may choose to demolish the pillars. They can do this by punching holes in them with hollow charges, filling these holes with additional explosives, and thus leaving the whole bridge shattered as irreparably as Humpty Dumpty…"
***Popular Science*, February 1945**
Above: caption: "Non-metallic type to form 'blow-holes' for placing demolition charges in bridge piers"

582



"…The extent to which the wild forces of an explosive wave can be focused, however, is truly astounding. If, for instance, a hollow charge with a deep cone such as is used for demolition work is turned toward the sky and shot off at night, the result is a pillar of brilliant, flaming gases, almost as slender as a bolt of lightning, but as straight as the beam from a searchlight…"
***Popular Science,* February 1945**
Left: caption: "Shaped demolition charge M2A3 (left) M3A1 (right)"

583

Quest for Precision

584

"…World War II has been partly a race between United Nations and Axis experts to learn more about the best ways to determine and regulate stand-off distances and to find the most efficient linings for the cavities of hollow charges. It has been a quest for precision. This race has been run by ordnance researchers, however, without benefit of cheers from the public, lest premature revelation of some bits of information help the foe to catch up. Tests that have been made with German and Japanese hollow-charge explosives indicate that the Allied ordnance experts are well ahead of their rivals…"
***Popular Science,* February 1945**

585

586

RECOILLESS ANTITANK GRENADE LAUNCHERS—*Panzerfaust.* This is a series of antitank grenade launchers each bearing the name *Panzerfaust* but each having a different number after the name.

(1) *Panzerfaust 30*

(a) *General Description.* This weapon, also known as the *Faustpatrone 2,* was the first of the four models of recoilless antitank grenade dischargers to be produced. It is designed for use against armor at ranges of about 30 yards, at which range a penetration of just over 200 mm is obtained.

The weapon consists of a steel launching tube, containing a percussion fired propellent charge. A hollow-charge antitank grenade is fired from the tube.

The weapon is fired from the standing, kneeling or prone positions, aim being taken over the vertical sight and the forward end of the bomb.

(b) *Characteristics.*

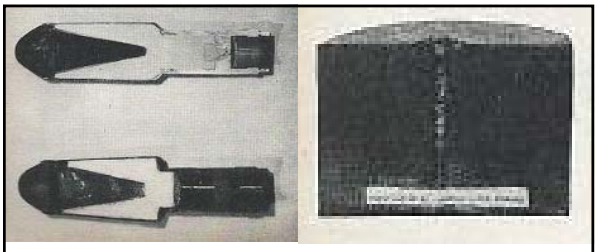
Diameter of tube .....1¾ inches.
Over-all length ..... 41 inches.
Weight ..... 11 pounds.

(c) *Ammunition.* The grenade is provided with spring steel fins which are wrapped around the tail for loading and which are released as the projectile leaves the tube and stabilize the bomb during flight.

Volkischer Beobacher: February, 1945

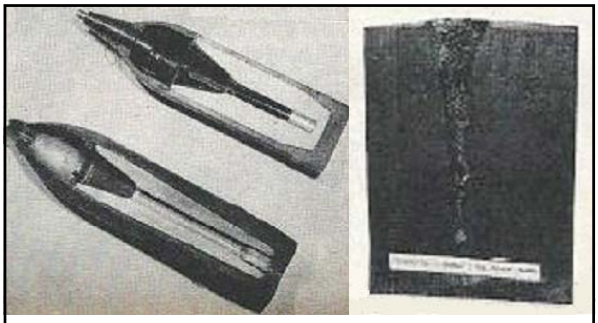
Panzerfaust, 44-mm recoilless antitank grenade launcher, showing launching tube and grenade.

587



Above L&R: caption: "At left, a Jap hollow-charge rifle grenade (top) and German weapon from which it was copied. At right is a block of mild steel (not armor plate), showing a hole 3½-inches deep blown in it by the Jap grenade. Japs put fins on this grenade and drop it in clusters from planes."

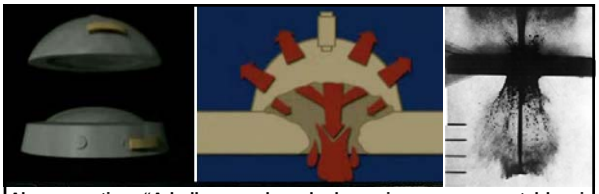
588



Above L&R: caption: "At left, Jap (top) and German 75mm hollow-charge artillery shells. Our ordnance experts say the Jap job is a poor copy. The Nazi shell tore a hole 6¾-inches deep in the billet of mild steel at right, in tests at Aberdeen Proving Ground." 589

Applied Science

590



Above: caption: "A hollow, or shaped, charge is a concave metal hemisphere or cone backed by a high explosive, all in a steel or aluminum casing. When the high explosive is detonated, the metal liner is compressed and squeezed forward, forming a jet whose tip may travel as fast as 10 kilometers per second." In 1885, *Charles Edward Munroe* discovered what came to be known as the "Munroe Effect" (a/k/a "Neumann Effect") in explosives. He noted that a high explosive with a cavity facing a target left an indentation. The Munroe Effect was rediscovered by *Ergon Neumann* in 1911, but no practical applications were developed. Dr. *Franz Rudolf Thomanek* (working with Dr. *Eric Schumann*) developed the hollow charge weapon to take-out fortifications like Eben-Emael, where large cupped explosive charges placed atop armored cupolas would have devastating effect. 591

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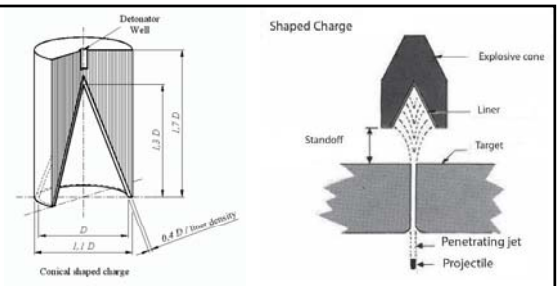
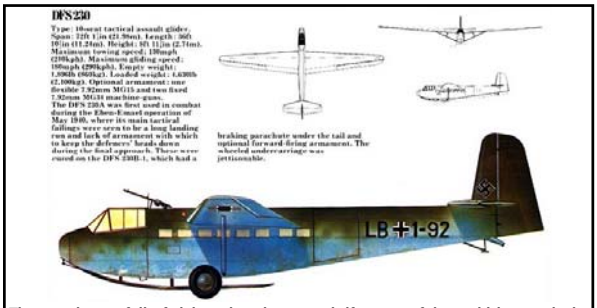


Above L&R: caption: "A thin cone of metal (called a liner) was formed into a cup. The open cupped end would face the target. On the rear side of such a cup explosive was packed (usually contained behind the liner by a cylinder or some other form of container). The explosive would be detonated from above and behind the apex of the cone. The purpose of such a cone would be to focus a molten slug of metal at very high speeds onto the targeted surface. In effect the cone would deform and invert itself forming a superheated molten arrow." 594

Hitler personally determined that the method of attack that would achieve the desired surprise would be glider-borne paratroops. The gliders would land at half-light inside the fort atop its vast, lightly defended earthen roof, thus negating completely its external defenses. The attack had to be carefully coordinated so that it took place in sync with the main Wehrmacht attack across the Belgium border (the gliders would land five minutes prior to the main attack). In this way, the Belgium army would be preoccupied and unable to come to the fort's aid. 595

Above: caption: "DFS 230 Gliders atop Fort Eben-Emael"

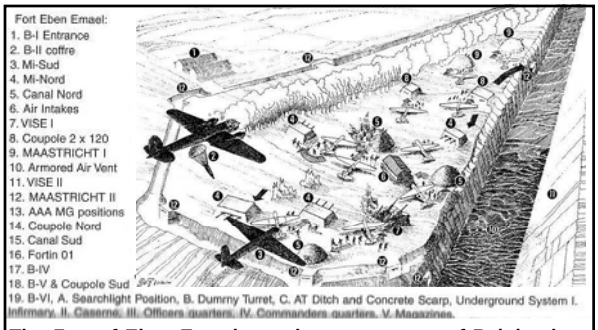


The attack was full of risks – but the reward, if successful, would be worth the risk. Take-off and landings were potential problems. When the gliders came within range of the fort's anti-aircraft guns, they were vulnerable. Therefore, the attack was planned at half-light – making the task of the glider pilots even more difficult since visibility would be limited. The plan was to release the gliders 20 km from the fort at a height of 2K-meters. The pilots selected for the raid were considered to be the best and were given a target of landing their gliders within 20-meters of their target. 596

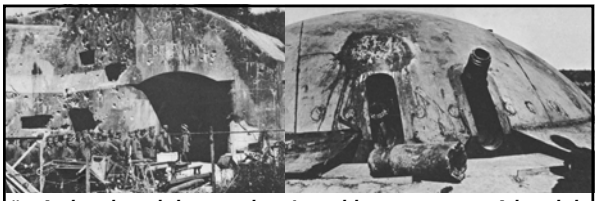
The attack was entrusted to the *Koch Storm Detachment* formed in November 1939. The main section of this unit comprised of paratroopers, including those trained in sapping. The actual attack on the fort itself was carried out by these sappers led by Colonel *Rudolf Witzig*. The unit led by Witzig trained in secret for six months for this specific operation. They were to use eleven gliders and the glider pilots were also expected to participate. Each glider was to fly seven or eight men (excluding the pilot). Each glider unit had two targets to attack. The sappers carried large quantities of explosives and special weapons such as flame-throwers. 597

Above: caption: "German paratroopers alight from a DFS 230 glider during training"

The gliders landed at 05:25 A.M. on May 10th 1940, five minutes before the main Wehrmacht attack across the Belgium border. Nine of the eleven gliders got through to the fort. The *Koch Storm Detachment* had given themselves just sixty-minutes to create a toehold on the fort which they could defend. In this short time, they destroyed many of the gun emplacements. Some of the complex remained in the hands of the Belgium army but by May 11th, the fight was over as the advancing German army arrived in force. Confronted with an enemy literally within and surrounded by a massive army without, the defenders had no real choice but to surrender. There had been many unforeseen circumstances; errors, blunders, oversights, miscommunications etc. on both sides (especially on the Belgian side), but the element of surprise held (for the most part) and the potency of the shaped charges achieved the goal the Fuhrer had set (to the amazement of most of his generals who thought the whole plan farcical). 598



The *Fort of Eben-Emael* was the cornerstone of Belgian border defenses on the eve of WWII. Designed to delay any attack by the German Army long enough for Belgian, British and French forces to organize a more comprehensive defense (just as the Liege forts did in WWI). 599



"…A signal, and the attackers' machine guns stop. A bomb is placed near the projecting muzzle of the cannon. Its rending explosion throws fragments of the gun into the air. A second bomb, and a third, tear cracks in the casemate…"
Popular Science, October 1936

Left: caption: "German soldiers inspect the destroyed concrete fortifications of the Belgian Fort Eben-Emael. District of Liege, Belgium. May 1940." Fort Eben-Emael was taken by a detachment of German paratroopers under the command of Oberleutnant *Rudolf Witzig*. Losses of the German paratroopers were 6 killed and 11 wounded. The Belgian garrison of 1,220 lost 23 killed and 59 wounded. 600

Right: caption: "Blown up artillery turret of the Belgian Fort Eben-Emael"

The attack was a resounding success. The fort was taken out-of-action in keeping with Blitzkrieg doctrine and two of the three bridges over the ***Albert Canal*** were captured intact. The Germans lost only six men killed and fifteen wounded (most of the German casualties occurred on the bridge assault/s). The Belgium defenders lost 23 men killed and 59 wounded (the balance taken prisoner). The attack on the ***Fort of Eben-Emael*** shocked the world for its audacity and skill in execution. For Hitler, it had been a great triumph; tactically, strategically and politically for it was his brainchild – not his generals. For the French, the loss of Eben-Emael did not bode well for their grand hopes of stemming the German tide of invasion with their own version of Eben-Emael (albeit more extensive and complex than a single fort) – the ***Maginot Line***.

601

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604

Making History, Again

605

"…But if, even after such preparation, they should fail, would France be lost? Not yet. Back of the Maginot Line is a succession of cities that are armed camps; Metz, Thionville, Nancy, and Strasbourg; then a second line; Longwy, Verdun, Toul, Epinal, Belfort, and others – all ringed by fortifications that have made history in the past, and may be called upon again to block invasion."
Popular Science, **October 1936**

606

607

Part 9

Opposite Number

608

Can This War Be Won?

609

"What happens when an irresistible force meets an immovable object? This age-old problem in physics, a familiar question to every school boy, seems destined to find an answer in Europe's latest armed conflict. For the present 'war to end wars' is a contest between two of the world's greatest immovable objects. Modern fortifications along the Maginot and Siegfried lines have made France and Germany 'invasion proof.' The result may be a war no nation can win..."
***Mechanix illustrated,* February 1940**

610

Lightning War

611

"…Imagine, if you can, an advancing horde of 2,000,000 men. It is armed to the eyes with high-speed, rapid-firing tanks, motorized cavalry and infantry, mobile artillery and ammunition units, every known type of poison gas, and the most modern and efficient equipment available for pouring forth a ceaseless storm of shot and shell, endless tons of lead, steel and flame. Magnify this glittering array of death on the march five times over - and, against it, the French defenses on the Maginot line still would remain impregnable!..."
***Mechanix illustrated,* February 1940**

612

Blitzkrieg \blits-kreeg\ ***n*** **[German, lit., lightning war, fr. *blitz* lightning + *krieg*war] (1939): war conducted with great speed and force; specif: a violent and concentrated surprise offensive by massed mechanized ground forces and air forces in close cooperation**

RE: dictionary definition. Key elements to the Blitzkrieg's success were shock and surprise, fluidity of the battlefield environment, initiative and flexibility among junior and senior officers on the battlefield, rapid movement into the enemy's rear echelons (especially at night), tactical air superiority and limited self-sufficiency of the mechanized units (i.e. gas enough for 150-200 km of movement, nine days worth of ammunition and provisions etc.). The Blitzkrieg did not depend on superior tanks for victory. In fact in 1940, on average, German tanks were inferior to French tanks and German forces depended heavily on Czech light tanks in the Polish, French, Russian and African campaigns. The Blitzkrieg was a radical, innovative style of warfare that appealed to the unorthodox mind of *Adolf Hitler*, who had seen the failure of static trench warfare firsthand as a young soldier during WWI. It also appealed to German planners for a less well known reason: quick defeat of enemy forces was necessary for an economy that was not yet on a war footing (German war production did not hit its stride until 1942-43). Blitzkrieg solved the problem of the lack of industrial capacity and stocks of materiel necessary to fight a prolonged, two-front war.

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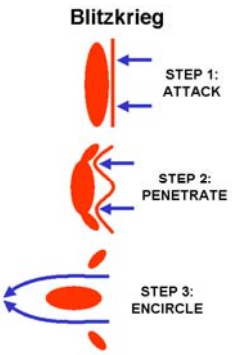

The *Blitzkrieg* was a form of military operation developed by an innovative member of the German military; *Heinz Guderian*, shortly before WWII. It was based on the concept that victory in battle could be achieved with the rapid movement of concentrated mechanized forces supported by close air support as a surrogate for fixed artillery. The Blitzkrieg was based on concepts born (but not exploited) during WWI. This included the tank (panzer), infantry in mechanized troop transports and trucks, mechanized artillery (artillery guns mated with tank chassis) and dive/light bombers for close air support (destruction of front-line enemy troops and vehicles) and interdiction (destruction and disruption of supply lines). Overwhelming mechanized force was concentrated at weak points in the enemy's lines, often with attacking tanks arrayed in a wedge formation. Once through the enemy's main line of resistance (often at multiple points), the mechanized forces then penetrated deep into the enemy's rear, letting speed and confusion in the enemy's ranks take care of exposed flanks and typically enveloping troop concentrations and urban areas in broad pincer movements. Follow-up forces (i.e. non-mechanized infantry) then dealt with reducing the resulting pockets of resistance.

616

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Invasion Proof

619

"…On the other hand, should the Allies abandon such snug security and launch an attack of their own, just as much power and strength and cunning, multiplied many times over, would avail them nothing. The German Siegfried line - not 10 miles away - is just, as redoubtable, just as impossible to penetrate, as the French fortifications. It is Armageddon, giant against giant, with victory in the lap of the gods…"
***Mechanix illustrated,* February 1940**

620

"…German fixed fortifications are known to have as many as nine bunkers connected by bombproof tunnels. Usually each tunnel supports at least two others with its fire, and the steel-and-concrete networks remain a hazard to attacking forces until the last fort is smashed. That's the task of the demolition engineers. They must keep on smacking as long as there's as much as a pillbox in the vicinity…"
***Popular Science,* September 1943**

621

"…The German Siegfried Line is supposed to run from Switzerland to Luxembourg, to be backed up by two other more formidable lines. Its key points are the rebuilt Isten fortress opposite French Mulhouse, the fortifications at Kehl opposite French Strasbourg, the Saar forts and the defenses of Cologne. Foreigners are not permitted in these areas, nor in similar defense areas on the Belgian, Dutch, Danish, Polish, Lithuanian and Czech borders…"
***LIFE* magazine, October 3rd 1938**

622

Above: caption: "Western Front Showing Forests and Main Defences: Section 2"

Left: caption: "Map of the Siegfried line." The original "SiegfriedLine" (in German: *Siegfried-stellung*) was a line of defensive forts and tank defenses built by Germany as a section of the *Hindenburg Line* (1916–1917) in northern France during WWI. In English, "Siegfried Line" more commonly refers to the similar WWII defensive line (built during the 1930s) opposite the French *Maginot Line*, which served a corresponding purpose. The Germans called this defensive works the "Westwall" (the Allies, however, preferred the WWI name). The *Siegfried Line* was a defense system stretching more than 390 miles with more than 18K bunkers, tunnels and tank traps. It went from Kleve (on the border with the Netherlands), along the western border of the old *German Empire* as far as the town of Weil am Rhein (on the border of Switzerland). More with Nazi propaganda in mind than for any real strategic reason, Hitler planned the line in 1936 and had it built between 1938 and 1940.

623

The origin of the name *Westwall* is unknown, but it's likely derived from popular use around the end of 1938. Nazi propaganda didn't initially use the term, but the name was well known from the middle of 1939. On May 20th 1939, Hitler sent an "Order of the Day to the soldiers and the workers at the Westwall." The official name for the line until then had changed several times depending on the phase of construction:
• *Border Watch Program* (1938);
• *Limes Program* (1938);
• *Aachen-Saar Program* (1939);
• *Geldern Emplacement* (1939–1940);
• *Western Air Defense Zone* (1938)
All of these programs were pushed forward with the highest priority, using every material and manpower resource available.

624

Above L&R: caption: "Siegfried Line Bunker with cannon"

"…most of their forts may be evacuated, or may disgorge men and guns for mobile counterattacks. In the event of devastating frontal attack, they can shift reinforcements quickly from forts in the rear or to the side…"
***Popular Science,* September 1943**

625

"…One month ago Hitler came to Kehl to see how far his army engineers had carried these defenses. He was so disappointed that he nearly wept. He roundly insulted the Prussian officers accompanying him. Thereupon he gave the work to Germany's great road builder, Dr. Fritz Todt, and mob-ilized, as he said at Nurnberg, half a million men to speed up the work. By Sept. 15 the Third Reich was sup-posed to be invasion-proof…"
***LIFE* magazine, October 3rd 1938**
RE: the early fortifications were mostly built by private firms, but the private sector was not able to provide the number of workers needed for the program that followed. This gap was filled by the *Todt Organization*. With their help, huge numbers of workers (up to 500K at a time) were put to work on the *Siegfried Line*.
Left: caption: "Fritz Todt - engineer and founder of Organisation Todt"

626

Above: caption: "Todt Organisation Supervisor"
Left: caption: "A German soldier in front of a defensive work at Cap Gris Nez in France. It was built by the Organisation Todt as part of the Atlantic Wall."

627

628

"…There is ample reason to take the claim seriously. Concrete can be poured fast, and the World War proved that concrete can hold out against modern explosives…"
***LIFE* magazine, October 3rd 1938**
RE: at the start of each construction program, basic construction prototypes were laid out on the drawing board and then built, sometimes by the thousands. This standardization of the bunkers (a/k/a "Pillboxes" – left, T&B) and tank traps was necessary because of the scarcity of raw materials, transport and workers.

629

Transport of materials and workers from all across Germany was managed by the *Deutsche Reichsbahn* railway company, which took advantage of the well-developed strategic railway lines built on Germany's western border during WWI. Working conditions were dangerous and often the most primitive means had to be used (i.e. to handle and assemble extremely heavy armor plating weighing up to 60-tons). Life on the building site and after work was monotonous and many people gave up and left. Most workers who stayed received a medal (depicting bunkers) for their service (left).

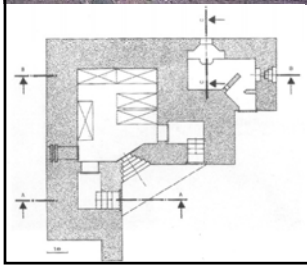
630

The Limes Program

631

The *Limes Program* began as a result of an order by Hitler to strengthen fortifications on the western German border. Bunkers built in this phase (starting in 1938) were more strongly constructed than the earlier border fortifications (the *Border Watch Program* was also instituted in 1938 for the most western positions). The bunkers had a ceiling and walls 4-feet 11-inches thick. A total of 3,471 Type 10 bunkers were built along the entire length of the *Siegfried Line*. The bunkers had a central room (shelter) for 10-12 men with a stepped embrasures facing backwards and a combat section 20-inches higher. This section had embrasures at the front and sides for machine guns. More embrasures were provided for carbines and the entire structure was constructed so as to be safe against poison gas attack. The bunker was heated with a safety oven and the chimney was covered with a thick grating. Every soldier was given a sleeping-place and a stool (the commanding officer had a chair). Each soldier had only about eleven square-feet of space, making the quarters very cramped. Inside the bunkers of this type were signs on the walls including: "Walls Have Ears" and "Lights Out When Embrasures Are Open!"

632



<u>Above & Left</u>: caption: "Type 10 Bunker in the Eifel region is a group shelter with attached combat area. It was built in 1938 and offered accommodation for fifteen crew members. It had two gas locks that lead from the ready room. The fighting compartment included mouth lip portals for MG 34 machine guns and staircase notch for a normal gun."

633

634

635

The German M.G. 34

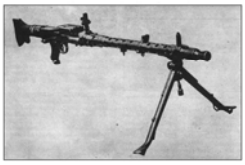
a. Model 34 Machine Gun (*M.G. 34*). (1) *General description.* This weapon (*Figs. 12* and *13*) was the original standard German dual-purpose machine gun and is still used, although it has been replaced largely by the *M.G. 42*. (*M.G.* is the German abbreviation for *Maschinengewehr*, which means "machine gun".) It may be used on a bipod, on single or dual AA mounts, or mounted on a tripod as a heavy machine gun. It still is used as the subsidiary armament of all German tanks. It is operated by short recoil, assisted by muzzle blast, and has a standard Solothurn-type breech mechanism. The gun has a leaf rear sight graduated from 200 to 2,000 meters (219 to 2,190 yards), an AA ring sight, and an optical sight for use with the tripod mount. It is fed either by 50-round metallic-link belts, which may be connected together, or by drums. The [illegible]s air-cooled by a perforated barrel jacket.

(2) *Characteristics.*

Caliber	7.92 mm (0.312 inch).
Length, over-all	48 inches.
Weight with bipod	26½ pounds.
Weight with tripod	42 pounds.
Feed	Belt or drum.
Rate of fire	
(cyclic)	900 rounds per minute.
(practical)	As LMG 100 to 120 rounds per minute.
	As Hv MG 300 rounds per minute.
Effective range	As LMG 600 to 800 yards.
	As Hv MG 2,000 to 2,500 yards.

(3) *Ammunition.* The *M.G. 34* fires 7.92-mm rimless small-arms ammunition.

WAR DEPARTMENT TECHNICAL MANUAL
TM-E 30-451
The German M.G. 34



M.G. 34, caliber 7.92 mm, on bipod mount as light machine gun.

M.G. 34, caliber 7.92 mm, on tripod mount as heavy machine gun.

636

637

Aachen-Saar Program

638

The bunkers built under the ***Aachen-Saar Program*** were similar to those of the ***Limes Program*** (Type 107 double MG casemates with concrete walls up to 11-feet thick). One difference was that there were no embrasures at the front; only at the sides of the bunkers (embrasures were only built at the front in special cases and were then protected with heavy metal doors). The program included the towns of Aachen and Saar-brucken which were initially west of the Limes Program defensive line.

Above: caption: "Battle Bunker Regelbautyp SK / 6 No. 153 at Entenpfuhl in Aachen"

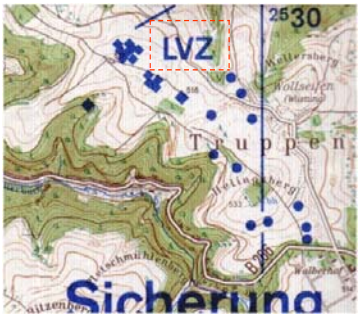
639

The Western Air Defense Zone

640

The ***Western Air Defense Zone*** (***Luftverteidigungszone West*** or ***LVZ West***) continued parallel to the two other lines toward the east and consisted mainly of concrete "Flak" (Anti-Aircraft Artillery – a/k/a "Triple A") foundations. Scattered MG 42s and MG 34s were also placed for additional defense against both air and/or land targets. Flak turrets were designed to force enemy bombers to fly higher thus decreasing the accuracy of their bombing. At close range, these flak-gun emplacements were protected by bunkers from the ***Limes*** and ***Aachen-Saar Program/s.***

641



642

Geldern Emplacement

643

The *Geldern Emplacement* lengthened the *Siegfried Line* northwards as far as Kleve on the *Rhine River* and was built after the start of WWII. The Siegfried Line originally ended in the north near Bruggen (in the *Viersen District*). The primary constructions were unarmed dugouts which were extremely strongly built out of concrete. For camouflage, they were often built near farms.

644

Above: caption: "Geldern Emplacement bunker near Kleve"

Dragon's Teeth

645

Tank traps were also built for miles along the *Siegfried Line* and were known as "Dragon's Teeth" or "Pimples" (in German: *Hocker* = "humps") because of their shape. These blocks of reinforced concrete stand in several rows on a single foundation. There were two typical sorts of barrier; Type 1938 with four teeth (getting higher toward the back) and Type 1939 with five such teeth (left). Many other irregular lines of teeth were also built. Another design of tank obstacle was made by welding together several bars of steel in such a way that any tank rolling over it would be penetrated in its weak bottom armor. If the lay-of-the-land allowed it, water-filled ditches were dug instead of tank traps. An example of this kind of defense are those north of Aachen near Geilenkirchen (right).

646

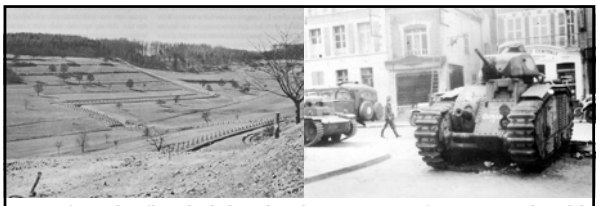
Left: caption: "A front view of the 'Limes' or Siegfried Line of Germany, which has hurriedly been completed during the last year, reveals a formidable barrier of barbed wire. The barbs are said to be scientifically intertwined to give the most trouble to an approaching enemy. Notice, too, the moat, or canal, which extends in front of the fortification to form an added barrier."

647

"…The colossal size of the work before them must be understood by Americans at home as well as by our military leaders abroad. It is best shown by intelligence reports that reveal Germany to have fixed fortifications running to a depth of 50 miles, concentrated into jagged belts each several miles deep. Greatest of all Reich fortifications, the West Wall (Siegfried Line) has three such belts, staggered six to 25 miles apart. In the rear are forts with high-velocity guns usable against aircraft or ground forces…"

***Popular Science,* September 1943**

648

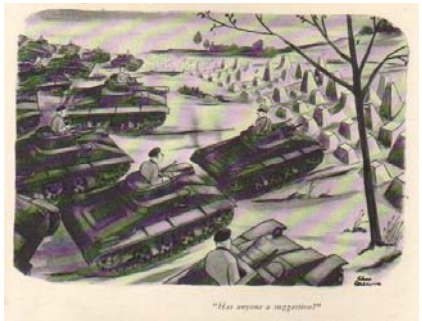


"…Before the first belt is a landscape sown for 300 yards with mines and gouged with moats. Then come what our engineers call 'dragon's teeth,' concrete-and-steel tank obstacles five feet high set in jagged rows two to six deep. The approaches are topped with additional mines beneath a tangled morass of barbed wire. Hitler applied 15,000 mines and 100 tons of wire to each division front of 500 yards…"
***Popular Science,* September 1943**
Left: caption: "Dragon's Teeth of the Siegfried Line run along a hillside, ready to stop French tanks in their tracks"
Right: caption: "A captured French Char B1 tank"
649

650

A prominent feature of the Siegfried Line was the dragon's teeth anti-tank obstacles These were truncated pyramids of reinforced concrete, arranged in irregular rows of four or five. The height of the teeth varied successively from 2.5-feet (in the first row on the enemy side) to 5-feet in the rear row (so that a tank is made to belly on the obstacle). The teeth were cast in a concrete foundation running from front to rear and sometimes also along each row (to prevent the teeth from being toppled over). Dragon's teeth were usually sited in long continuous lines (left T&B), broken only where roads passed through and where the terrain was considered unsuitable for tank activity.
651

652



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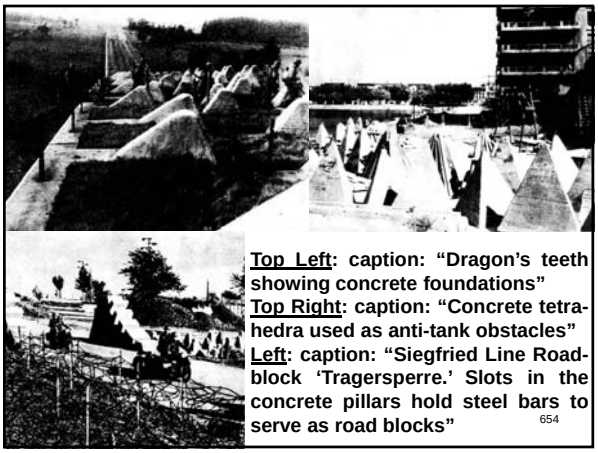
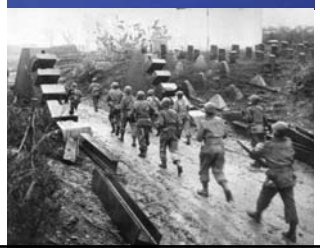


Top Left: caption: "Dragon's teeth showing concrete foundations"
Top Right: caption: "Concrete tetrahedra used as anti-tank obstacles"
Left: caption: "Siegfried Line Roadblock 'Tragersperre.' Slots in the concrete pillars hold steel bars to serve as road blocks"
654



655

Left: the Germans adopted the Belgian "de Cointet" anti-tank obstacle (a/k/a "Element C") Here, a number of units have been fastened together to form a continuous anti-tank wall, but since the units have rollers in the front and rear, the Germans also used them singly as movable blocks.

656

The Germans called their barbed wire road block obstacles "Spanish Riders." They were about 4-feet high and consisted of angle-iron or timber frames. Concertina wire (a/k/a "S-Rolle") was often used by the Germans either in single, double or triple coils. Sometimes it was wired to concrete posts, fixed on top of walls and interwoven with double-apron fences or between concrete dragon's teeth. The Germans also used an obstacle consisting of trip wires (a/k/a "Stolperdraht") arranged about 30-feet in depth. The wire was stretched from 4 to 8-inches above the ground on irregular rows of wooden pickets. The interval between pickets in rows was 10 to 13-feet and between rows 7 to 10-feet.

657

Above: caption: "German double-apron barbed wire"

"…Blasting the Dragon's teeth with TNT is a relatively simple job once the protecting bunkers and blockhouses have been demolished. But while these are hurling shrapnel at the attackers, it's extremely perilous. Some strategists recommend the use of smoke screens to blot the enemy's vision during the assault. Smoke mortars do the trick easily, but the smoke may work to the disadvantage of the attacking force if it becomes necessary to see the objective in order to plaster embrasures with high-velocity shells…"
***Popular Science,* September 1943**

658

Defense-in-Depth

659

"…The 'Siegfried Line,' called by the Germans the 'West Wall,' was a continuous series of pillboxes and emplacements extending along the western boundaries of Germany from Kleve on the Dutch frontier to Lorrach near Basle on the Swiss border. It was constructed in 1939 and 1940 before the development of the German military doctrine of 'strongpoints,' as illustrated by the heavy defenses along the Atlantic and English Channel coasts…the Siegfried Line contained mainly a large number of reinforced concrete pillboxes for machine guns and 37mm AT guns. There was a very limited preparation of open earthworks for heavier artillery, and extensive hasty preparation of field fortifications for infantry…"
Lieutenant Colonel *Thomas L. Crystal Jr.,* Asst. G-2, XIX Corps
RE: after the 1940 victories over France and the low countries, the new "Western" border of Germany became the Channel and Atlantic coast/s. Thus, the *Siegfried Line* became redundant and was stripped of its weaponry, equipment fittings etc. in an effort to reinforce the "Atlantic Wall." It was, quite literally, a shell of its former self. After the successful D-Day landings on June 6th 1944, the Germans rushed to reinforce - as best as they could - the essentially abandoned Siegfried Line.

660

Left: caption: "Germans Prepare for Siegfried Line Stand. The arrows on this map locate the main Allied drives along the Channel coast, and toward Rotterdam, Holland: Aachen and Saarbrucken, Germany, and Strasbourg, France, as the Germans appeared to be massing for a determined stand along the Siegfried Line defenses inside the Reich. Today, the American First Army was on the offensive in the Ardennes Forest area while the U.S. Third Army moved to Metz and Nancy." (September 7th 1944)

661


THE STARS AND STRIPES

Yanks Across Moselle

Point-Plan To Govern Discharges

Firm Grip Taken on East Bank

Nazis in Flight Halt Checking

C-47 Fleet Flies In Gasoline To Bogged-Down 90th Inf.

Report Linkup Near Germany

"…The Siegfried Line was built on the first natural barrier east of the German frontier. Where this natural barrier was weakest the pillbox concentration was strongest. The basic principle behind the placement of pillboxes and AT barriers was simple and logical, namely to increase the defensive potential of the terrain along the German frontier. Where tanks and infantry would have a difficult job in attacking (as across the Rhine River) the defenses were sketchy. Where a natural attack corridor existed (the Belfort Gap, the Moselle River Valley, the Aachen Plain), there the defenses were most dense…"
Lieutenant Colonel *Thomas L. Crystal Jr.,* Asst. G-2, XIX Corps
Left: "Yanks Across Moselle" – headline for Sept. 8th 1944

662

"…Pillboxes occurred wherever the terrain indicated a profitable use of a machine gun or an AT gun. It should be remembered that the basic design of the Siegfried Line called for the employment of mobile field armies operating out of and behind it. The real defense was to be an aggressive counterattacking force basing its offense from the Siegfried Line. The object of the defenses was not to stop the enemy but to slow him up and to tire him in the attack and then hit him with strong counterattacks…"
Lieutenant Colonel *Thomas L. Crystal Jr.,* Asst. G-2, XIX Corps
Left: caption: "The Siegfried Line Campaign: September 11 - December 15, 1944"

663


The New York Times.

BATTLES RAGING IN FRONT OF THE SIEGFRIED LINE; RUSSIAN ARMIES RACE ACROSS TRANSYLVANIA; U. S. SHIPS AND PLANES BATTER PALAU ISLANDS

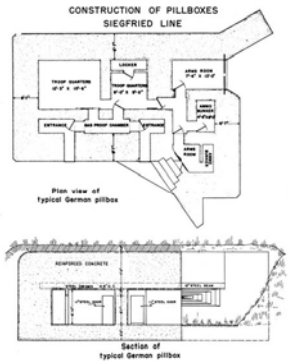
664

Pillbox Warfare

665

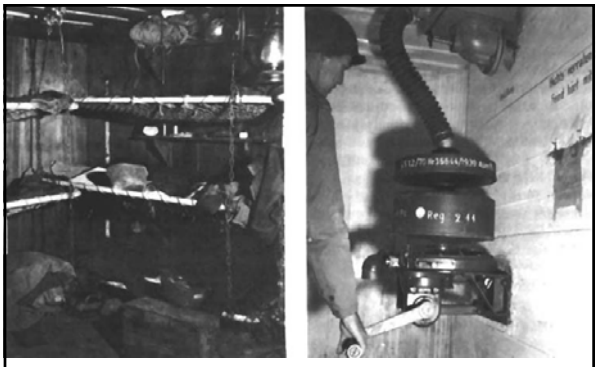
"…Virtually all pillboxes possessed the following general characteristics:
• Limited fields of fire (40 to 50 degrees);
• Incapable of housing any weapon larger than the 37mm AT gun (which was standard for the German army in 1939);
• Four to six feet of concrete overhead and a similar amount underground;
• Walls five to eight feet thick;
• Normal pillbox personnel was generally dependent upon the size and number of openings (roughly a maximum of seven men per firing embrasure);
• Excellent camouflage concealment (materially aided by four years of disuse and natural growth):
• Excellent prepared paths of fire;
• Majority in 'clusters.' The pillboxes in each cluster were linked with each other by communication trenches (none yet found were linked by underground passages). There was a fairly extensive network of buried telephone cables (6-feet deep) between the works, and;
• OP's from underground emplacements with a 7-inch steel cupola occurred roughly one per km. These were usually linked by underground cable to pillboxes, HQ and villages in the vicinity. An OP was usually a CP, with living quarters for 30-40 men and several work rooms in them…"
Lieutenant Colonel *Thomas L. Crystal Jr.,* Asst. G-2, XIX Corps

666



667

Above L&R: caption: "Typical Pillbox. Exterior (left), showing door with firing embrasure. Interior of firing embrasure (right)." 668



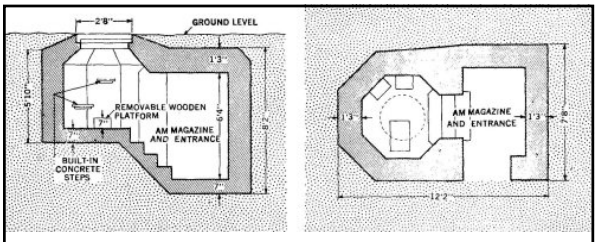
Above L&R: caption: "Typical Pillbox. Bunk area (left) and ventilation device (right)." 669

Open Emplacements

670

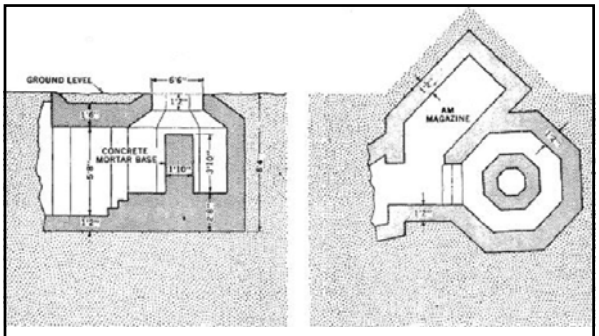
From their experience in the North African campaign, the Wehrmacht derived a type of open, circular pit lined with concrete which they called a "Tobruk." Hitler subsequently ordered them to be used as defense works in the field and instructions for building them were distributed down to the division level. A "Tobruk Pit" (which consisted of a concrete weapon chamber with a neck-like opening at the top) was built entirely underground. The concrete was usually reinforced. Tobruks varied in size (depending on the weapon mounted in them), but the diameter of the neck was kept as small as possible to reduce the risk of direct hits. Instructions to German troops insisted that a Tobruk should not have a concrete roof (since this would reveal the position to the enemy). A board of irregular shape (used as a lid) served to camouflage the circular opening and kept out the rain.

671

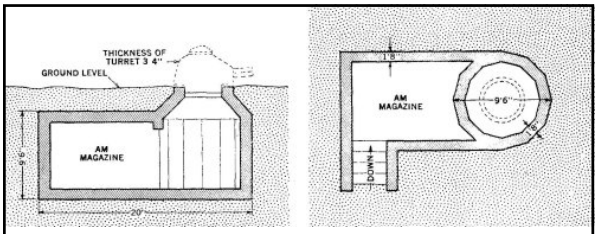


The most common type of Tobruk was designated "58c" by the Germans (above L&R). It was also is called a "Ringstand" (derived from a rail that runs around the inside of the neck). The rail provided a track for rotating a machine-gun mount thus giving the gun a 360-degree traverse. This type of Tobruk had an ammunition chamber which also served as an underground entrance.

672



A Tobruk used as a mortar emplacement (such as "Type 61a" - above L&R) was larger than a Ringstand and had a concrete base in the center of the pit for mounting the mortar. This type also was combined with an ammunition magazine. 673



The Wehrmacht also used a Tobruk as a base for a tank turret (usually taken from a French Renault 35). Such an installation (called a "Panzerstellung" – above L&R) had a turret armed with an antitank gun and a machine gun coaxially mounted. The turret was bolted to a circular metal plate which was rotated by hand on wheels around a track in the top of the pit affording a 360-degree traverse. 674

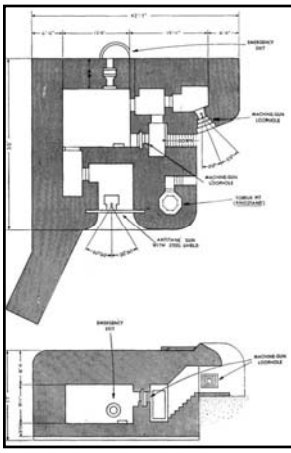
675

Casemates

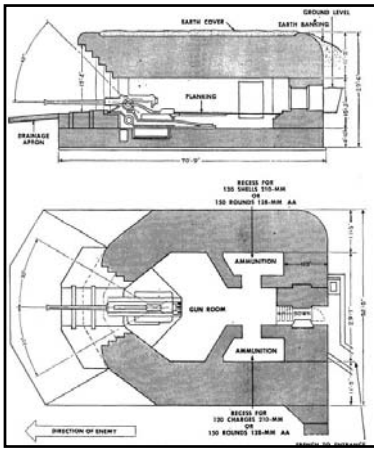
676

Although the Germans had several types of pillboxes and casemates, most infantry and artillery weapons were installed in the open rather than in closed emplacements. In accordance with Wehrmacht doctrine, pillboxes and casemates were to be supported by open field works. Initial ***Siegfried Line*** pillboxes had wall and roof thickness of as little as 2-feet (some of the earliest examples had a thickness of only 1-foot). However, this was increased until all pillboxes had at least the standard thickness of 6-feet 6-inches. Casemates (housing for guns of large caliber) had, at a minimum, the standard thickness. Pillboxes and casemates usually had a stepped embrasure (to prevent bullets from ricocheting into the gun opening). In addition, a steel gun shield closed the opening. Field artillery observation posts line were similar to personnel shelters, with the addition of a steel cupola for the observer.

677

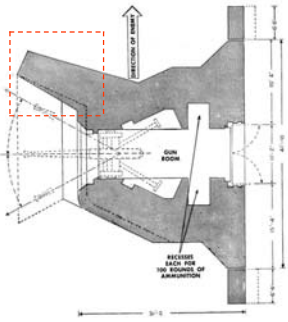


The figure/s at left (T&B) illustrate a type of pillbox designed for a light anti-tank gun, The "Type 630" had 6-feet 6-inches of concrete in the roof, front wall and side walls and 6-feet 4-inches in the rear wall. A machine-gun firing through a loophole in the rear provided close defense and a loophole in the interior wall (at the foot of the stairs) had an opening for a machine gun (to keep attackers from entering the pillbox). A ***Tobruk Pit*** was built into the front wall as an observation and/or machine-gun post. 678



The figure/s at left (T&B) illustrate a typical "Type 685" casemate for a 210 or 128mm anti-aircraft gun. Most casemates were of this simple design, consisting of a gun room (with recesses for ammunition), but some provided quarters for the gun crew. The walls and roof of were 11-feet 5-inches thick. The embrasure permitted a traverse of 60-degrees and an elevation of 45-degrees. A number of similar casemates (Types 683, 684, 686, 688, 689, 690, 692 and 694) had embrasures for a traverse of 90 or 120 degrees. Additional protection and camouflage were provided by banking the sides and by covering the top with a 2-foot 6-inch layer of earth.

679



The Germans often sited a casemate to deliver flanking fire. For this purpose, a wing wall was provided on the side toward the enemy to shield the embrasure from hostile fire, as in the "Type 677" (left) for an 8cm gun (the length of this wing wall depended on local ground conditions). The casemate could be built to fire to the right flank by constructing the wing on the opposite wall.

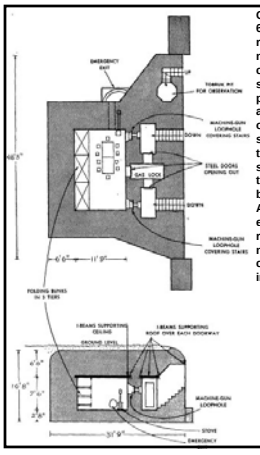
680

Personnel Shelters

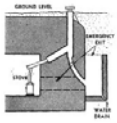
681

Wehrmacht doctrine stressed the desirability of adequate shelter for all troops. As such, personnel shelters were built in the rear of a fortified line to house the reserves and also in individual defense positions for the troops who manned the installation. Some personnel shelters had accommodation for two sections (twenty men), but it was the usual practice to house no more than ten men in one shelter. A personnel shelter could also serve as a headquarters, command post, medical station and/or as a signals center. Types provided for these purposes were similar in design and differed mainly in size and number of interior compartments.

682



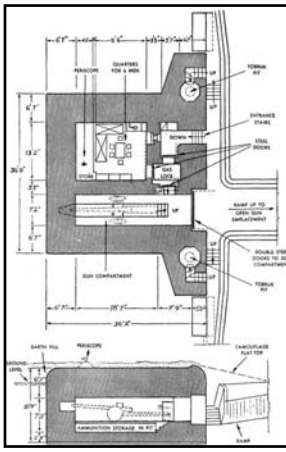
One of the most common personnel shelters was the "Type 621" for one infantry section (left T&B)) It was constructed of reinforced concrete, with the standard wall and roof thickness of 6'-6." It was entirely underground, with an earth covering of 1-foot over the roof. Seventeen steel I-beams supported the ceiling over the interior compartment. Steel plates resting on the bottom flanges of the I-beams provided an all-steel ceiling. Shorter I-beams supported the ceiling over the doors and entrance stairs. A camouflage flattop was stretched over the trench in the rear, which gave access to the entrance stairs (to conceal it from air observation). To secure one side of the flattop, a row of hooks was cast into the roof along the rear side of the shelter. A *Tobruk Pit* was built into one of the wings in the rear for observation. Although the shelter accommodated only ten men, two entrances were provided to enable the section to deploy rapidly when they were required to man their positions nearby or launch a counterattack. Each entrance stair was covered by a machine-gun firing through a loophole in the interior wall (at the foot of the stairs). Both entrances converged into a gas-lock, sealed by three steel doors (each about 1-inch thick). All doors opened out. To make the chimney grenade-proof, the vertical shaft was continued below the stovepipe and curved outward into the space used for the emergency exit. Thus, a grenade dropped into the chimney would not enter the shelter but, rather, fall outside the sidewall and explode harmlessly.



683

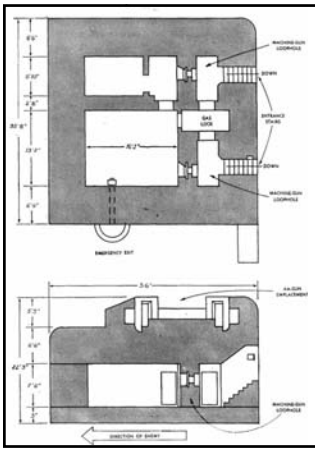
There were four ventilation shafts opening into the rear wall between the entrance stairs. Two of these were dummies to mislead attackers who tried to introduce smoke into the ventilating system to drive out the occupants. The blower was driven by an electric motor, but the Germans usually made provision for manual operation as well (in case of power failure). To communicate with the interior of the shelter, there was a telephone at the head of one of the entrance stairs and both a telephone and a speaking tube. A telephone cable buried deep in the earth lead to neighboring installations. Modifications to the general plans were permitted in order to adapt the shelter to the terrain (i.e. the emergency exit installed in the opposite side wall). Such changes were at the discretion of the local construction authorities. Some types of personnel shelters had a steel turret built into the roof for observation and sometimes a machine-gun was mounted. However, the Wehrmacht insisted that troops not fight from shelters but, rather, use them merely as protection while not engaged in combat. A number of shelters were designed for the storage of supplies, ammunition and drinking water. Such types were typically entirely underground and had a wall/roof thickness less than the standard 6-feet 6-inches. Shelters designed for supply usually had only one entrance and no emergency exit, machine-gun loopholes and/or *Tobruk Pit*.

684



The Wehrmacht provided a special shelter for anti-tank guns and their crews. The figure/s at left (T&B) show a typical anti-tank gun shelter (designated as "Type 629"). Accommodation for the men was similar to that of other personnel shelters, but there was a separate compartment for the gun and ammunition. Double doors in this compartment enabled the gun to be rolled out of the shelter and up a ramp (slope 1:6) to an open emplacement in the rear of the shelter from which it fired over the top of the shelter. The shelter had two Tobruk Pits in which machine-guns were installed to support the anti-tank gun. These Tobruks were connected by telephone and speaking tube to the crew's quarters. The shelter was also equipped with a periscope.

685



The figure/s at left (T&B) show a personnel shelter with an open emplacement on the roof known as "Type L 409" ("L" stands for ***L****uftwaffe*). This type accommodated nine men and its details were similar to those of other personnel shelters. Type L 409 was designed for a light anti-aircraft gun. In others of the L 400 series, the roof emplacement was used to mount a searchlight (L 411) or a radio direction finder (L 405). In some types, the shelter below the gun emplacement was used as a battalion command post (L 434) or an ammunition magazine (L 407).

686

Mobile Steel Pillbox

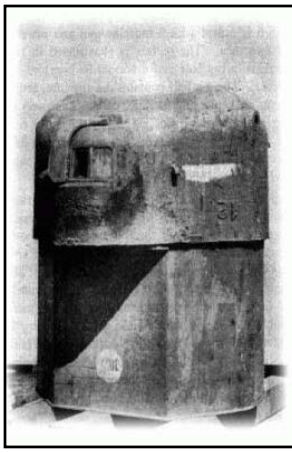
687

"One of the additions to German defensive warfare is the portable pillbox. The Nazis used it in Russia and now the Allies are meeting hundreds in Italy. These pillboxes, made out of cast iron, with a top like an inverted Kettle, are about five feet wide and some six feet high, but only a six inch dome and a machine-gun snout can be seen by a soldier attacking them. Each pillbox is manned by two soldiers. To move the pillboxes the Germans tow them away on a special carriage or load them on a truck. Then they can be dug in and surrounded by rubble or earth so that they can be seen from only a few yards away."

***Yank,* May 19th 1944**

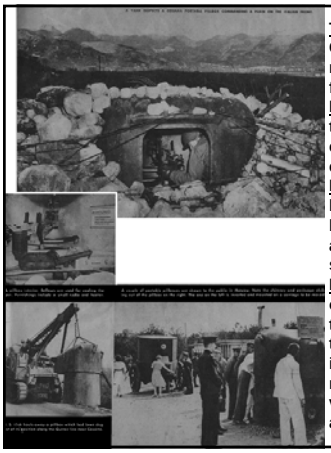
RE: the Wehrmacht also had a mobile steel pillbox which was armed with a machine-gun and manned by two men. The pillbox was constructed in two sections; a top half and a bottom half welded together. The top half contained the aperture, armament, air vents and entrance door. Thickness of the armor varied from 5-inches (at the aperture) to 2-inches (at the sides and top). The bottom half was only ¾-inch thick, but was entirely below ground level when the pillbox was in place. The total weight of the pillbox (without armament or ammunition) was 6,955 pounds.

688



The aperture (left) was divided into two parts: the lower part for the gun barrel; the upper for sighting. The machine gun had an arc of fire of approximately 45-degrees. The aperture cover was operated manually from the interior of the pillbox. Entry was through a small door in the back of the upper half. There were two openings in the top for periscopes (one over each seat). A blower operated by a pedal provided ventilation. The ventilation holes on both sides of the pillbox also enabled an axle to be passed through the pillbox. Wheels were fitted to the ends of this axle and the pillbox could then be towed upside down. When installed, the sides and top were banked to blend with the surroundings.

689



<u>Top</u>: caption: "A Yank inspects a German portable pillbox commanding a plain on the Italian front"

<u>Middle</u>: caption: "A pillbox interior. Bellows are used for cooling the gun. Furnishing include a small radio and heater"

<u>Lower Left</u>: caption: "U.S. tank hauls away a pillbox which had been dug out of its position along the Gustav line near Cassino"

<u>Lower Right</u>: caption: "A couple of portable pillboxes are shown to the public in Moscow. Note the chimney and periscope sticking out of the pillbox on the right. The one on the left is inverted and mounted on a carriage to be moved."

690

Plan of Attack

691

"…When the fort busters begin to move, you can be sure the enemy is in for a bad time. Their 'go' sign is a combined assault in which the region is pummeled by heavy artillery and aerial bombardment. This has a triple purpose: to neutralize enemy fire, to strip the fortifications of camouflage, and to open in the terrain places of concealment for the attackers. Experience has proved that well-built bunkers, pillboxes, and blockhouses can withstand a terrific pounding. So actual damage is likely to be small…"

***Popular Science,* September 1943**

692

Above L&R: camouflaged netting over German bunkers

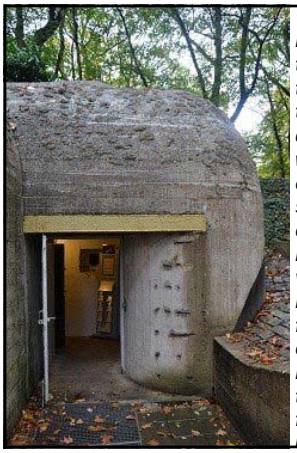
To camouflage pillboxes and casemates, earth was banked over the sides and top, the entrance in the rear was covered by a a camouflage net (left T&B) hung in front of the embrasure while the gun was not in action. In the case of small pillboxes, branches were placed over the embrasure.

693

The Germans also concealed pillboxes and casemates by enclosing them in wooden structures (resembling ordinary houses). The guns were then fired through false doors or windows or a section of the wall over the embrasure was made to drop out of the way. Pillboxes were also built into the cellars of existing buildings. Instructions to troops insisted that no cover or concealment should obstruct the field-of-fire of the gun/s.

Above: caption: "Concrete pillbox camouflaged as a house in Siegfried Line – Kandel, Germany - March 1945"

694



"…Soon this aero-artillery prelude clears the way for use of the direct-fore guns, the 155's, the 105's, the three-inchers, the 75's, and the 37's. As the demolition squad slithers forward, these mobile fieldpieces open up and begin slamming steel and explosives at the embrasures. Bunker crews must close steel doors to prevent serious damage. This reduces enemy machine-gun fore to a minimum, and the engineers increase their pace, now and again leaping up from their belly crawl and running a few yards…"

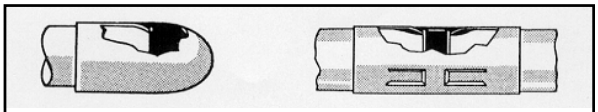
695

***Popular Science,* September 1943**

"…It's a strange task force. Uniforms are nowhere in evidence. Camouflaged overalls speckle the ground. Weapons are chosen for the particular job in hand. On the backs of several men are the big cylindrical tanks of flame throwers. Others carry six-foot sections of pipe loaded with TNT. Used singly or screwed together for a length of as much as 200 feet, these become the famous bangalore torpedoes, so devastating to wire entanglements…"

***Popular Science,* September 1943**

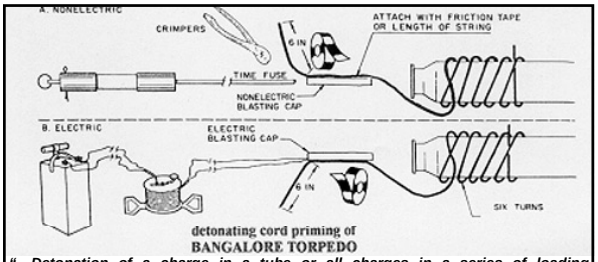
696



"The Bangalore Torpedo is an explosive device consisting of any desired number of slim cylindrical explosive charges in metal containers (i.e. tubes) . Any number of these containers may be attached to each other endwise. The Bangalore Torpedo is generally used against barbed wire entanglements and various other relatively light obstructions, but also against anti-personnel mines and similar small obstacles, and can be turned into boobytraps. When exploding, the Bangalore Torpedo clears a path 10 to 15 feet wide thru barbed wire. In minefield breaching, it will explode all anti-personnel mines and most of the anti-tank mines, but in a narrow footpath only! It is therefore better to use it only in an emergency, as many of the anti-tank mines at the sides of the cleared path may be shocked into a sensitive state, which makes extreme care necessary in any further mine clearing…The weapon consists of a group of 10 loading assemblies, i.e. steel tubes filled with high-explosive which are either used singly, or in series with nose sleeves (forward end) and connecting sleeves (for attachment end-to-end). It will, besides being used for blasting various types of field obstructions, also be used in bundles as substitute explosive charges in Demolition Snakes, M2 and M3 series…"

RE: excerpt from WWII-era U.S. Army training manual (M1A1 Bangalore Torpedo) 697

Above L&R: caption: "Nose sleeve (left) and connecting sleeve (right)"



detonating cord priming of BANGALORE TORPEDO

"…Detonation of a charge in a tube or all charges in a series of loading assemblies may be accomplished by a firing device with blasting cap screwed into the cap well of the tail end of a tube or the tail end of the last tube in a series…Detonation may also be achieved by an electric blasting cap with the leads connected to a source of electric current, or by a non-electric blasting cap attached to a safety fuse or a time blasting fuse and fuse lighter, or by wrapping a minimum of 4 turns of detonating cord around the tube itself in the one-tube assembly, or around any tube in a multiple-tube assembly, and detonating the cord with a delay-detonator or with an appropriately arranged blasting cap primed by a safety fuse and fuse lighter…" 698

RE: excerpt from WWII-era U.S. Army training manual (M1A1 Bangalore Torpedo)

"…The M1A1 Bangalore Torpedo is packed in a single rectangular wooden box, which contains 10 x 5-foot steel loading assemblies or tubes, 10x connecting sleeves, and 1x nose sleeve. The watertight sleeves are 5-feet in length and 2 1/8-inches in diameter, they are grooved and capped at each end. Each end of sleeve loading assembly contains a threaded cap well to accommodate any issue firing device with a blasting cap crimped thereto. The tubes receive an olive drab coating while markings are yellow. Weight of one section is approximately 13 pounds. Four-inches of length at both ends of each sleeve contains TNT booster. The explosive contains approximately 9 lbs. Amatol 80/20 and TNT booster (a later postwar version i.e. Torpedo, Bangalore, M1A2 contains 9 lbs. composition B and composition A-3 booster). The wooden box (final packing) has following dimensions: 64 1/8 x 13 3/8 x 7 1/8-inches, its total weight is 176 lbs…" 699

RE: excerpt from WWII-era U.S. Army training manual (M1A1 Bangalore Torpedo)

"…There is a T38 Demolition Training Kit which has been introduced for training of personnel in the use of Demolition Materials. The kit contains a number of selected inert items for training purposes. Normal colors are however retained in order to simulate the actual colors of the explosives. The inert items used in this Training Kit are to be employed in exactly the same manner and with the same care and precautions as are the explosive items comprising the demolition sets simulated here..."

RE: excerpt from WWII-era U.S. Army training manual (M1A1 Bangalore Torpedo)

Left: caption: Training Demolition Chest – Top Layer (A) 26 x 1-lb TNT Blocks (B) 8 x M-1 Chain Demolition Blocks (C) 16 x M-3 Demolition Blocks (D)12 x ½-lb Demolotion Blocks (EE) Chest" 700

Right: caption: "Training course for Ranger infantry personnel"

Left: caption: "Demonstrating proper use of Bangalore Torpedo." ***Bangalore Torpedoes*** **were used by a variety of troops, both regular Infantry and** ***Corps of Engineers*** **personnel. It was a very useful explosive charge for breaching light enemy obstructions and defenses, therefore very much in use with assault troops such as those having to destroy primary obstacles in order to reach major objectives.**

701

"…A few men carry grappling hooks to explode booby traps and anti-personnel mines by the simple expedient of tossing them ahead and pulling the back to catch trip wires. Of utmost importance are the soldiers with charges of TNT slung around their necks in satchels, carried in steel containers, or on long poles for shoving into bunker portholes. Most of the men lug hand grenades and one or two have smoke grenades. Only a handful carry rifles, but close by, protecting the advance, assault infantry bangs away with Garands…"

Popular Science, **September 1943**

702

"TNT" (*Trinitrotoluene*) was already known as early as 1863, but was in fact only suggested as an explosive around 1890. However, its military importance began in 1904. TNT is the principal constituent of many explosives. It is relatively safe to manufacture and loading, transportation and storage are not considered hazardous due to the fact that it is *not* hygroscopic. TNT usually resembles light brown sugar (when pure, it looks like a crystalline powder of very pale straw color). It dissolves readily in ether, acetone, alcohol and other solvents, but is practically insoluble in water thus, it can be used for underwater charges. TNT is one of the most stable high explosives and may be stored over long periods of time without alteration. It is insensitive to blows or friction but can be detonated by severe impact between metal surfaces. When ignited by flame, it burns rapidly without explosion. However, when exploding in confined spaces, it can produce poisonous fumes. TNT is classified as a quick-acting explosive (it detonates at a rate varying from about 21K feet-per-second (fps) and burns at 266° F.

703

***AMATOL* is a mixture of *Ammonium Nitrate* and Trinitrotoluene (TNT). Due to the shortage of *Toluene* during the early stages of WWI, the British developed this explosive and adopted it as a bursting charge for high-explosive shells (the U.S. introduced it for similar reasons). Consequently, it was still in use at the outbreak of WWII. The ingredients are mixed by weight (i.e. when indicating Amatol 80/20 this is understood as 80% Ammonium Nitrate and 20% TNT). Amatol *is* hygroscopic (though insensitive to friction) and can be detonated by severe impact. It has no tendency to form dangerous compounds with metals other than copper. Amatol 80/20 is a plastic mass resembling wet brown sugar. On detonation, the Ammonium Nitrate oxidizes the excess carbon of the TNT with the result that Amatol 80/20 produces a white smoke upon detonation.**

704

"…In the vanguard at the outset are soldiers with grappling hooks. They clear the way for safe passage across the fields. When the crew reaches the inevitable ring of wire entanglements, the bangalore boys take over and make short work of that obstacle with a deafening blast. The explosion also destroys antitank mines within three feet of either side…"
***Popular Science,* September 1943**

705

"…This the first real breakthrough occurs, and now the attackers are covered even more closely by high-velocity guns, including those mounted on tanks, that roll up to within 1,000 yards of the target. At this juncture, the heavy artillery to the rear raises its lobbing fire to enemy emplacements beyond those under attack…"
***Popular Science,* September 1943**

706

"…Direct fire screams over the heads of the advancing fort busters, who now are approaching their objective. The men with the 70-pound flamethrower tanks on their backs, copper nozzles in hand, edge into the lead. Their movements are agile, despite their load. They know the tricks of their trade. When they run and fall, they land in a rolling movement that eases the tanks to the ground. Otherwise they might break their backs. They roll over to a crouch before rising…"
***Popular Science,* September 1943**
Left: flamethrower operator runs under The flame gun had two pistol grips. The rear grip had a lever that released the fuel from the tanks. The front grip had the trigger that ignited the fuel.

707

First used in WWI at the *Battle of Verdun* by German shock troops, the *U.S. Army Chemical Warfare Service* (USACWS) developed the *M1 flamethrower* in 1940-41. The early models were undependable and cumbersome. Testing continued with the M1 introduced into service in early 1942. The deadly weapon was first used in combat by Marines of the Second Engineer Battalion on Guadalcanal in January 1943. The M1 used gasoline (or a mixture of gasoline and diesel fuel) and hydrogen as its propellant. This caused too-rapid burning of the fuel, which was mostly consumed just beyond the nozzle (requiring the operator had to approach to within 10-15 yards of the target). Another problem was that the flame tended to roll off the target. Testing continued on improved delivery methods for flame weapons. In 1942, the USACWS developed a revolutionary concept; a thickening agent for gasoline. This agent (a/k/a "napalm") improved the range, tightened the flame stream and increased target effect. Consequently, the M1 flamethrower was modified for use with napalm in 1942. The improved model was standardized as the M1-1. This weapon was used in the Pacific campaigns of 1943 and early 1944. Though it was better then its predecessor, the M1-1 was still not a completely satisfactory weapon. In late 1943, the First Marine Division received some M1-1 flamethrowers just prior to the New Britain campaign. In the summer of 1944, the M2-2 flamethrower was introduced into service. This weapon was first used in combat on Guam and was subsequently employed in all Pacific campaigns thereafter. The M2-2 offered improved reliability and a better ignition system than previous models. It still had drawbacks (i.e. it was too heavy and had a high silhouette). This model used nitrogen as its propellant.

708

Above: caption: "Flamethrower operators move back up the line after refilling their tanks with fuel. Iwo Jima, February 1945."
Left: caption: "The Flamethrower, Portable, M2-2. Empty weight: 43 pounds; Filled weight: 68 pounds; Fuel capacity: 4 gallons; Range: 20-40 yards; Fuel type: Gasoline; Propellant: Nitrogen; Burn time: 10-20 seconds."

709

The *U.S. Marine Corps* realized the tactical value of the flamethrower. Each Marine regiment was assigned eighty-one flamethrowers. In combat, assault groups were formed with flamethrowers, demolition and BAR men. They used a technique known as "corkscrew and blowtorch" to destroy Japanese emplacements. Various methods were used in this tactic. BARs would suppress enemy positions with a heavy volume of automatic fire while the flamethrowers approached to within effective range. Then, flame was used to wipe out any pockets of enemy resistance. After the enemy position was neutralized, demolition men would use explosive charges to destroy the emplacement (typically a cave mouth). Since flamethrower operators had to approach very close to enemy positions, effective suppressing fire by BARs and riflemen was critical. Flamethrower operators were extremely vulnerable to enemy fire since, effectively, they had a napalm bomb strapped to their back.

710

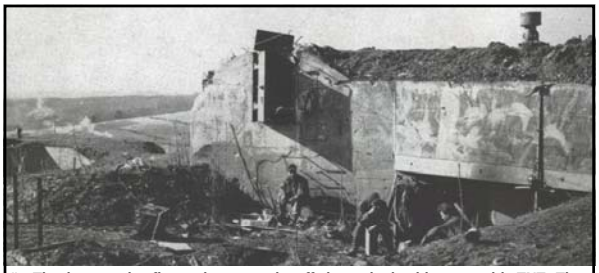
"We kept up a steady fire into the pillbox to keep the Japanese pinned down while the flamethrower came up, carried by Corporal Womack from Mississippi. He was a brave, good-natured guy and popular with the troops. He was big and husky…I was glad we were on the same side. Stooped under the heavy tanks on his back, Womack approached the pillbox with his assistant just out of the line of our fire. When they got about 15 yards from the target, we ceased firing. The assistant reached up and turned a valve on the flamethrower. Womack then aimed the nozzle at the opening made by the 75mm gun. He pressed the trigger. With a whooooooosh the flame leaped at the opening. Some muffled screams, then all was quiet…Amid our shouts of appreciation, Womack and his buddy started back to battalion headquarters to await the summons to break a deadlock somewhere else on the battlefield - or lose their lives trying. The job of flamethrower gunner was probably the least desirable of any open to a Marine infantryman. Carrying tanks with about seventy pounds of flammable jellied gasoline through enemy fire over rugged terrain in hot weather to squirt flames into the mouth of a cave or pillbox was an assignment that few survived but all carried out with magnificent courage."

711

RE: excerpt from: "With the Old Breed at Peleliu and Okinawa" by *E.B. Sledge*

"…In the home stretch, all the men crawl forward till the target looms only a stone's throw ahead. Here the leader (a corporal commands each detachment) lets fly with a signal rocket. There's a final burst of direct fire, in the last salvo of which is a smoke shell, indicating the shift of the bombardment to adjoining bunkers. Now is the time for demolition. Into action go the bazookas, those weird tossers of ultrahigh explosives. Their explosives smash at the embrasures in ear-rending blasts. At 20 yards, the flame throwers begin spouting long, roaring jets of burning oil and gas that blanket the bunker in a mass of fire…"
***Popular Science,* September 1943**
Left: caption: "Practicing flame thrower technique for reducing pillboxes"

712



"…The instant the flame throwers zip off, in rush the blasters with TNT. They explode charges at the bunker doors with a delayed-action fuse that barely gives them time to run back a few paces and throw themselves to the ground. Timing is geared to a split second. No sooner does one charge go off than another is slapped in place. The job is incomplete until the walls (sometimes six feet thick) are opened sufficiently to knock out the bunker crew with hand grenades. That done, the leader motions his men onto the next bunker, leaving the mopping up to assault infantry close behind…"
***Popular Science,* September 1943**
Above: caption: "One of many bunkers in the Siegfried Line that had to be taken"

713

714

Part 10

Object Lesson

715

"The commanders of four U.S. rifle companies which have been in contact with the enemy in the Siegfried Line have furnished valuable information about the resistance offered by German pillboxes, and have submitted comments regarding the vulnerability, as well as the capabilities, of these fortifications. The terrain in which these rifle companies have been fighting contains many steep hills (some as high as 500 feet), woods with thick underbrush, and streams. Consequently, most of it is poor tank country. The pillboxes encountered by rifle companies have been of three types: some have had only one aperture, others have had mounted machine guns and two apertures, while still others have simply been personnel shelters. As to density, there has been approximately one pillbox every 100 yards in width and depth, and the fortifications have been mutually supporting. The Germans have had very good observation and an abundance of artillery and mortar support. None of the company commanders' remarks should be construed as necessarily coinciding with United States Army doctrine…"

***The Intelligence Bulletin,* Vol. III, No. 5: January 1945**

RE: printed by the *Military Intelligence Service* throughout WWII, *The Intelligence Bulletin* was designed to inform officers and enlisted men of the latest enemy tactics and weapons

716

"Some pillboxes of course were tougher than others. But generally they were not as hard to reduce as foreseen. They were in clusters, all inter-supporting and sited to cover each other by fire. But due to the limited traverse of the fields of fire, there seemed to always be one at least in a group, which, if reduced, permitted our men to start a circuit of the remaining pillboxes, using approaches to each succeeding one that could not be covered by fire of the remaining ones. The problem of course, was to discover the key pillbox to each cluster."

Report of G-2, 30th Infantry Division

717

In general, *Siegfried Line* pillbox bunkers were 20 to 30-feet by 40 to 50-feet horizontally and 20 to 25-feet high, of which at least half and sometimes more was underground. The walls and roof were 4 to 8-feet thick and sometimes steel plated. Each pillbox had living quarters for its normal complement of troops. Fields of fire were limited; the path of fire generally did not exceed 50 degrees of an arc. Set in clusters, each pillbox was mutually supporting. French and British intelligence had, to good effect, photographed and plotted the clusters during the construction period/s.

718

Air Strikes in Close Support

719

"…All our previous experience with saturation bombing or medium bomber strikes in close support of ground action has led to the same conclusion this present effort certainly indicates, namely that the present techniques being employed obviously are unable to apply this strategic weapon in a close-in tactical manner. It is believed, nevertheless, that this can be successfully done. To do so, however, in this war would take certain simple, albeit radical, changes in technique. Until those changes have been made however, saturation bombing of close-in areas is not considered practical or possible. On the other hand, the close-in support previously and here given by fighter bombers has been extremely flexible, sensitive to rapidly changing conditions, and outstandingly effective…"

Lieutenant Colonel *Thomas L. Crystal Jr.,* Asst. G-2, XIX Corps

720

721

"…Very little of the saturation bombing landed in the target area. Thus, no pillbox is known to have been affected by the air strike. PW's taken later stated that some of them had been asleep in pillboxes during the air strike and did not know the air strike had taken place. However, fire bomb dropped on pillboxes on the north flank were very effective on personnel dug in supporting the concrete installations…From October 2 to October 24, 41 missions of close support were within 200 yards of front line troops…"

Lieutenant Colonel *Thomas L. Crystal Jr.,* Asst. G-2, XIX Corps

722

Artillery Support

723

"…The effect of direct artillery hits on the pillbox, except the 155mm self-propelled gun and possibly heavier calibers, was not sufficient to destroy the box or prevent its future use. The concussion by a direct hit certainly not too strong-hearted defenders, The 57mm anti-tank gun, 75 mm and 105mm were, except for direct hits in the embrasures itself, ineffective. They could remove the camouflage but little else. The 155mm howitzer required an uneconomical number of rounds to secure direct hits. The 155mm self-propelled guns at ranges between 2,000 and 4,000 yards with a concrete bursting fuse penetrated the 6 feet of reinforced concrete with 3 to 5 hits. The 8-inch howitzer could average a direct hit per 5 rounds, and penetrate after 5 hits. The major contribution of the artillery fire was to drive external defenders inside, and to force defenders inside to come out and surrender after direct hits were secured…"

Lieutenant Colonel *Thomas L. Crystal Jr.,* Asst. G-2, XIX Corps

724

"For nearly a week prior to our unit's crossing we manned static OP's and did considerable firing on pillboxes; the effect was almost negligible. At one time a self-propelled 155mm gun was pulled up at the OP I was on and fired direct at a range of approximately 1,500 yards. In 12 rounds fired he scored 7 hits. The only effect on the pillbox was about 4 feet of concrete removed and some dirt off the top. The enemy inside was probably shaken up by the impact but otherwise unhurt."

Second Lieutenant *E. Robinson,* F.O. - B Company, 117th Infantry Regiment

725

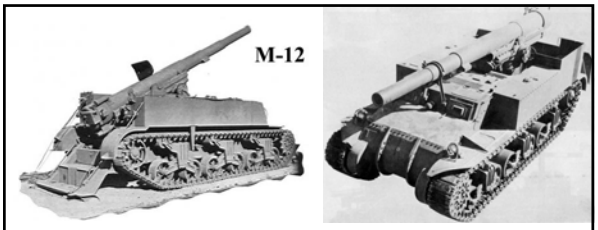
"Our experience in the attack demonstrated that light artillery is almost worthless as far as destroying pillboxes even with concrete piercing fuses; however in most cases it can be effectively used in cooperation with medium or heavy caliber artillery. We fired on suspected locations several times and knocked the camouflage material off exposing the pillbox for adjustment by heavy artillery. Another very effective system we used was to adjust on boxes and stay laid on them while the heavies or mediums fired on them. When the heavier artillery hit a box, the survivors (if any) often ran out of the box in an attempt to get away. We would then fire on them and the effect was usually very gratifying."

Captain *Harley W. Force, Jr.,* 197th Field Artillery Battalion

726

"We have found that Tank Destroyers and 105mm projectiles bounce off the pillboxes. They will rupture or penetrate when they hit in the embrasures…The M1-155 like the 155 howitzer has too much dispersion nor can it be brought sufficiently close up. The 8-inch howitzer is the best weapon we have to bust the pillboxes, when used at about 8,000 yards. Below that range it has too much dispersion. A direct hit will disintegrate a pillbox. It has taken an average of about 5 rounds to obtain a hit. In all cases the dirt has to be knocked off the pillbox before it can be successfully engaged. We use 105 and 155 howitzers with HE delayed fuse for this purpose."
Colonel *Otto Ellis*, Executive Officer, 30th Infantry Division Artillery

727



"As an example of the ineffectiveness of artillery fire on the pillboxes, an M7 was brought up within 1,000 yards of a pillbox and 24 hits were scored, none of which penetrated. Some smoke was seen emanating from the rear of the pillbox after one shot. The M7 then pulled out and an M12 (155mm SP) was brought up and seven hits were scored. One of these seven resulted in smoke coming out of the rear of the pillbox. One and a half hours later, the 197th Field Artillery Battalion was called upon to fire on the same pillbox because ten Germans had come out and were standing in the open."
Lieutenant Colonel *D.V. Bennett*, Battalion Commander, 62nd Armored Field Artillery Battalion

728

"Artillery fire succeeded in the first step of the reduction of the pillbox, namely, to force the personnel from the supporting gun positions in the pillbox. This fire kept the personnel there while the tanks moved up to deliver close range fire, 30 to 50 yards in some cases. This blinded the pillbox so infantry could close in on the blind side."
Second Armored Division

729

"Due to heavy artillery fire, the infantry was unable to move with the tanks. Consequently we had to have a thorough artillery concentration (preparation) both before and during the time that the tanks moved in on the pillboxes. The preparation was on the dug-in positions so as to pin the enemy down, enabling the tanks to move without danger of 'bazooka' fire. We found that time fire was most effective."
Headquarters, 2nd Battalion, 67th Armored Regiment

730

Movement

731

"…Most of the pillboxes seem to have been constructed to permit long-range fire. Once you get fairly close, there are quite a few dead spaces through which troops can filter. We've found it advisable either to view the routes from a good observation post on the previous day or to make a thorough map reconnaissance. One way of avoiding enemy fire has been to move across open ground, from ridge to ridge, during the hour just before daylight. Although one of our rifle companies gained only 100 yards in a whole day of fighting, because of extremely heavy German mortar and machine-gun fire, the same company caught the Germans unaware in the hour before daylight the next morning. It covered 1,000 yards without losing a man, and took six pillboxes without the aid of supporting weapons…"
***The Intelligence Bulletin*, Vol. III, No. 5: January 1945**

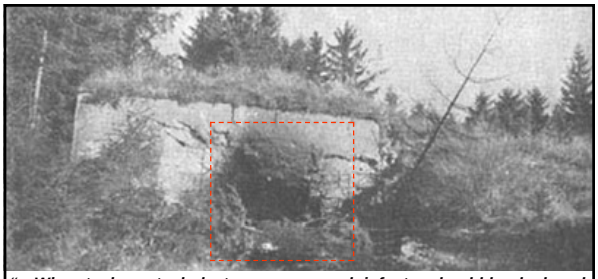
732

"…German instructions for using the pillboxes called for most of the personnel remaining outside in firing positions around the pillboxes. Only 30 or 40 percent of the pillbox compliment would be permitted to remain inside the box; the box normally fired in only one direction and was dependent upon protection by adjacent boxes; neutralizing these adjacent boxes with direct artillery, tank and small arms fire permitted assaulting infantry to work around to the rear, unprotected entrance to the pillbox. If the pillbox personnel did not surrender by this time a bazooka or tank shell through the rear door would normally clinch the argument…"
Lieutenant Colonel *Thomas L. Crystal Jr.,* Asst. G-2, XIX Corps

733

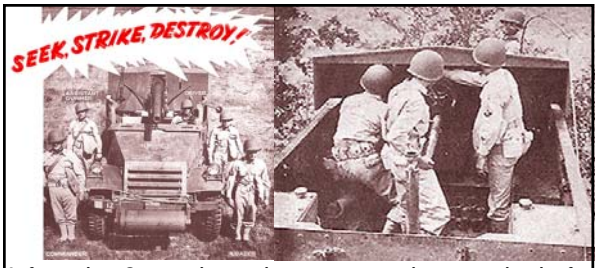
Cooperation with Mechanized Support

734



"…When tanks or tank destroyers are used, infantry should be deployed, ready to rise and advance with the vehicles as the latter pass through the infantry positions. As I see it, infantry should not be allowed to stop because of mortar or artillery fire, for infantrymen who lose close contact with the tanks are more vulnerable, and the demoralizing effect of an infantry-tank assault upon the Germans is lost…"
***The Intelligence Bulletin,* Vol. III, No. 5: January 1945**
Above: caption: "A U.S. tank destroyer has blasted this Siegfried Line pillbox with devastating fire from its 75"

735



Left: caption: Commander – points out targets, gives general order for attacking, orders fire. Gunner – spots moving target, keeps gun aimed. Loader – loads gun, keeps clear of recoil. Assistant gunner – opens, closes breach, fires gun. Driver – observes to front, ready to move vehicle instantly on orders."
Right: caption: "TD is a 75mm mounted on a half-track. Compared to a tank, it can cover territory much faster, is more maneuverable, packs as much of a punch and is easier to build. It capitalizes on the tank's two weaknesses: blind spots and slow speeds. In turn, it lacks armor.

736

"In areas where there is not a concentration of pillboxes we found that you can with reasonable safety, outflank the pillbox. This is the fastest method and we used the following system. One assault platoon concentrates its fire on the pillbox and the other platoon covers them. In the assaulting platoon, one section concentrates heavy fire on the ports and the other section moves around to the rear flanks of the pillbox and lays heavy fire in the back of the pillbox. Generally, this forces a quick surrender."
Headquarters, 2nd Battalion, 67th Armored Regiment

737

"The tanks, firing 76mm ammunition, would engage the pillboxes from the embrasures and blind sides. The 76mm gun blasted holes through the steel doors, causing casualties to any enemy inside the boxes."
Second Lieutenant *Jack Bennet,* F Company, 41st Armored Infantry Regiment

738

"An artillery concentration on and around pillbox drove enemy bazooka teams into pillbox. The tanks deployed on line, with infantry following, then fired A.P. ammunition at pillboxes. Tanks lifted fire and then the infantry surrounded pillboxes and drove out prisoners."
First Lieutenant *Mike Levitsky*, A Company, 41st Armored Infantry Regiment

739

"When tanks operated with infantry, the tanks would lay down a base of fire with 75 APC and machine gun fire and the accompanying 105mm assault tank of the assault gun platoon would fire 105mm HE with T105 concrete smashing fuse. This fire would continue on the embrasures until the enemy came out or until the infantry were within 25 yards of the pillbox, when the tank fore would cease and the tank maneuver on beyond the box to protect the assault units as they assaulted the box."
Lieutenant Colonel *William D. Duncan*, 743rd Tank Battalion

740

Assault Teams

741

"…Each member of an assault team must know not only his own weapon and his own mission, but the weapon and mission of everyone else on the team. That is, he must be familiar with flame throwers, demolition charges, rocket launchers, and so on. Sometimes each rifle platoon is assigned a fixed zone of responsibility. Each pillbox becomes a phase line for coordination and reorganization. In many instances a single platoon, by firing at the embrasures, will cause two or three German pillboxes to 'button up.' However, the Germans often will continue to fire through small slits in the embrasures. The fact that pillboxes are mutually supporting very definitely is something to remember. This is why our plans always include fire on flanking pillboxes, as well as on those which are to be assaulted…"
***The Intelligence Bulletin*, Vol. III, No. 5: January 1945**

742

"We trained according to the War Department principles, which call for placing small arms on the apertures, working men up close to use bangalores to blow wire, cook 'em with flame-throwers, and then place charges against the pillbox itself. We kept small arms on the apertures. We did not use the flame-throwers at all, but found that bazookas were highly effective at 100-yard range. It was the bazookas more than anything else that reduced the pillboxes."
Captain *Richard J. Wood*, S-3, 2nd Battalion, 117th Infantry Regiment

743

Above: caption: "U.S. soldiers fire a bazooka into a pillbox in the Siegfried Line"

"Pole charges which can be carried by assault platoons cannot destroy a pillbox but may blow in the rear door or the armored shield of the gun embrasure…In the assault of pillboxes the engineers were employed with bangalore torpedoes and pole charges with the assault platoon. The use of such charges was not found necessary if the tanks could fire into the rear door."
Report of the 30th Infantry Division

744

Use of Smoke

745

"…The saying that a blind man cannot shoot straight can be equally true of German pillboxes. While it is not always possible or desirable to use smoke, a pillbox which has received smoke and white phosphorus from 81mm mortars and artillery is at a great disadvantage when the actual assault takes place…"
***The Intelligence Bulletin,* Vol. III, No. 5: January 1945**

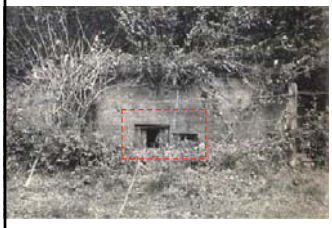
746

Infantry and Direct Supporting Fire

747

"…Supporting weapons, such as tanks, which have been placing direct fire on pillbox apertures should cease fire without signal as soon as the infantry comes within 25 yards of the pillbox. The Germans are likely to keep an aperture closed if the infantrymen nearest it take it under fire immediately. If two flanking groups of three or four men each take up positions in the rear of the pillbox, they can cover the rear entrance and apertures. If the support squad locates the embrasures in the supporting pillboxes and keeps them covered with fire, German capabilities are reduced proportionately. The rest of the company or platoon should move past the pillbox and secure the ground beyond it, to protect the assault team while the latter does its job…"
***The Intelligence Bulletin,* Vol. III, No. 5: January 1945**

748



"By aiming for the embrasures heavy machine guns were able to keep the enemy down and also hit some between the eyes, as did the riflemen."
Lieutenant Colonel *Robert E. Frankland,* First Battalion, 17th Infantry Regiment
Left: pillbox embrasures

749

"An officer PW stated that every time an embrasure was opened to fire MG's, the gunner got shot so they had to keep ports closed: that our use of pole charges and tactics of sneaking in behind pillboxes to attack and our method of reducing pillboxes and delivery of small arms fire is excellent."
Lieutenant Colonel *W.M. Johnson,* Commanding 117th Infantry Regiment, 30th Infantry Division

750

"Officer PW's expressed amazement at the accuracy of our riflemen in the manner in which enemy soldiers and weapons were picked off thru the pillbox apertures by our riflemen."
Lieutenant *Kline,* IPW Team, 30th Infantry Division

751

Possible Surrender

752

"…We have a man work his way close to the pillbox, so that he can throw in a fragmentation grenade or white phosphorus grenade. When there is a quiet moment, he shouts, 'Kamerad?' and 'Wir schutzen nicht!' ('We won't shoot!'). Often the occupants of the pillbox will give up at this stage. If they don't surrender, use of rifle grenades or the bazooka against the steel doors or apertures may have the desired effect. For safety's sake, other riflemen cover all fire ports while this is going on…"
***The Intelligence Bulletin,* Vol. III, No. 5: January 1945**
753
Above: caption: "This U.S. soldier is peering into an abandoned German pillbox"

Digging Them Out

754

"…If the Germans refuse to surrender, some of our men work their way to the blind side of the pillbox and blow the embrasures with TNT. After this, working from the top, we place a pole charge against the door. We never allow anyone to enter the excavated area behind the pillbox, inasmuch as the Germans always cover it by means of a small embrasure built especially for this purpose. In no circumstance do we allow anyone to enter the pillbox to take prisoners. We make them come to us. Sometimes they claim that they are injured, but we have found that after a second charge of TNT they somehow manage to walk out. Antipersonnel mines may be found in the approaches to pillboxes. We always keep half an eye on the ground, just in case…"
***The Intelligence Bulletin,* Vol. III, No. 5: January 1945**

755

Other Methods

756

"…We have found that when the preceding measures fail, Siegfried Line pillboxes may be susceptible to still other assault methods. A demolition charge can be used, tanks can blast in the rear of the pillboxes, or a tank dozer can cover the door and embrasures with dirt. The use of tank dozers may not prove successful in the future because the Jerries are planting mines, some of them activated by remote control, as a countermeasure. The one time we used a flame thrower and a pole charge together, the combination started a fire inside the pillbox. Some ammunition got going, and the resulting confusion was all in our favor…"
***The Intelligence Bulletin,* Vol. III, No. 5: January 1945**

757

"Satchel charges did not prove of value; in one instance we placed a 25-pound charge against the rear door of a pillbox and it hardly blew the door out of line."
Major *B. Emmons*, 2 nd Battalion, 117th Infantry Regiment

758

"We seal the pillboxes with the tank dozer only as a temporary measure. Our engineers follow us up and weld the doors shut. We found that dozing alone is ineffective, as is the method of blowing the handles off the doors. The tank dozer always drew unusually heavy enemy fire and was put out of action three time during the operation."
Lieutenant Colonel *J.E. Wynne*, 67th Armored Regiment

759

"We have had no occasion to use flame throwers against pillboxes as the Germans defend mostly from the trenches on the outside. Yesterday we had captured a pillbox and by operating the flame throwers through the embrasure and around the corners we cleared out the fire trenches."
Captain *Wayne*, Executive Officer, First Battalion, 119th Infantry Regiment

760

White-Phosphorous Grenades

761

"…After an embrasure has been blown out, the Germans often will remain in the pillbox until they have been persuaded to leave by a flame thrower or by hand grenades. A hand grenade in the ventilator of a pillbox sometimes stuns the Boche, but a white-phosphorus grenade in the same air shaft is likely to prove a great little reviver…"
***The Intelligence Bulletin,* Vol. III, No. 5: January 1945**
Above: caption: "A front view of a captured pillbox in the Siegfried Line"

762

Precaution

763

"…Even if the enemy surrenders, there may be some men who will not come out. Keeping the pillbox covered and throwing a grenade into each room before entering it is our favorite way of preventing further trouble…"
***The Intelligence Bulletin,* Vol. III, No. 5: January 1945**
Left: caption: "Rear view of a well camouflaged German pillbox, part of the Siegfried Line defenses near Aachen." Four years of neglect during the high-tide of German conquest had made for superb camouflage.

764

Making Pillboxes Useless

765

"…The Germans try to reoccupy pillboxes whenever possible. For this reason we believe in demolishing the fortifications immediately. Six pillboxes in our portion of the Line have had to be taken three times. Merely blowing apertures and doors is not enough to make pillboxes untenable. We find that they must be completely destroyed right down to the ground. If even one wall is left standing, the Germans may use it as a place to fight from. This is why we like to have men follow close behind us with the necessary equipment to destroy the pillboxes completely…"
***The Intelligence Bulletin,* Vol. III, No. 5: January 1945**

766

Readiness to Meet Counterattacks

767

"…After a pillbox has been taken, deployment to the front and flank is a reasonable precaution against a German counterattack. We find it necessary to be ready for the rain of German mortar and artillery, fire which always follows our capture of a pillbox. Bunching up around prisoners is a dangerous business. Since Jerry is quite prepared to shoot his own men rather than let them be taken prisoner, it's a good trick to send them to the rear as quickly as possible. At least one hour before nightfall is a good time to halt an attack - and even earlier, if possible - inasmuch as it's absolutely necessary to set up a proper defense. The Germans will launch a strong counterattack right after dark, and if you are not well organized, they will push you off your hard-won ground. When we intend to occupy a position, our men dig in, choosing spots around and between the pillboxes. If we use a pillbox as a rest position, to relieve our men from their fighting positions, we take care not to let an enemy counterattack catch us bunched up inside it. German combat patrols sometimes send one or two men around our flank to knock out our machine guns when the counterattack is being made from the front. The enemy hope that we'll be so interested in firing to the front, to meet the main attack, that we'll neglect to watch our flanks and rear…"
***The Intelligence Bulletin,* Vol. III, No. 5: January 1945**

768

When the Counterattack Comes

769

"…German counterattacks have been made after nightfall, and have been preceded by a lot of shouting and talking. This is supposed to be nerve-wracking. However, when our troops have organized their positions well and are thoroughly alert, it is the enemy who suffers, instead. We have had success with 60mm illuminating shells in lighting up these attacks. We hold our fire until Jerry comes in close, and then we cut him down in our final protective line. We use plenty of grenades, both fragmentation and white phosphorus. And when Jerry retreats, we follow him with fire and with fragmentation rifle grenades…"

***The Intelligence Bulletin,* Vol. III, No. 5: January 1945**

770

A Rifle Company vs. Three Pillboxes

771

"…On 15 September our rifle company attacked a hill on which there were three pillboxes. Because of heavy fog, our tank destroyers could not fire; nevertheless, at 0730 we were within 50 yards of the pillboxes. We moved sufficiently near the pillboxes to place fire on the apertures, causing them to close. This took a BAR and a couple of riflemen. When the apertures were closed, we moved around to the rear of the pillboxes. Those men who were not part of the assault section moved out beyond the pillboxes and secured the hill which was our objective. The assault teams were left to reduce the pillboxes. These teams then closed in on the pillboxes from the rear. We called for the Germans to surrender, but they fired a few scattered rounds in return. We then fired two bazooka rounds into the door at the rear of each pillbox. In the case of two of the pillboxes, the bazooka and a couple of hand grenades thrown through the doors brought the Germans out into the open. We collected four prisoners from one box and six from the other. The Germans in the third pillbox refused to come out. This presented a bit of a problem. A couple of bazooka rounds fired at the door, as well as a couple of hand grenades thrown through the door, merely drove the Jerries from one room to another. Finally they were driven into the room when the aperture was. A short burst of the flame thrower changed their minds about surrendering…"

***The Intelligence Bulletin,* Vol. III, No. 5: January 1945**

772

Applicability of Training

773

"…The pillboxes were admirably sited to take full advantage of the defensive potential of the terrain. Their reduction, however, and the surrender of their occupants was realized through a variety of very simple but militarily sound methods. The elaborate, concrete strongpoint reduction technique as used on the Atlantic Wall and as taught at the Engineer and Infantry schools in the United States was neither used nor applicable. In reducing the pillboxes, small arms fire through embrasures played an important part…Virtually as many methods were used as units engaged. All were simple and involved the same basic principle of a straight infantry assault on any small defended knoll. The most effective was probably the infantry platoon supported by 3 or 4 tanks working closely together with no special equipment other than a bazooka…"

Lieutenant Colonel *Thomas L. Crystal Jr.,* Asst. G-2, XIX Corps

774

"The careful training had little relation to the actual way in which the pillboxes were reduced."
Major *Ben T. Ammons,* S-3, 2nd Battalion, 117th Infantry Regiment

775

Conclusions

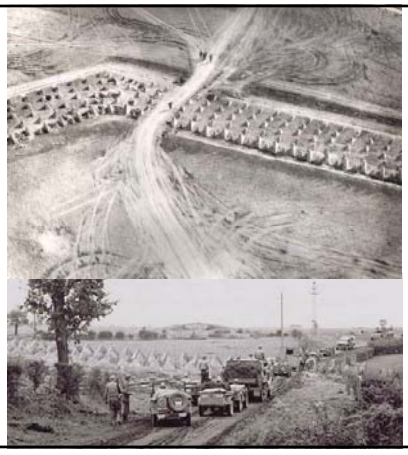
776

"…The successful assault on and penetration completely through the concrete pillbox portion of the Siegfried Line is a great tribute to the aggressive attacking ability of the American infantry and armor soldier. It is likewise another proof of the well known military principle, that no defensive barrier is any better than the troops that defend it…"
Lieutenant Colonel *Thomas L. Crystal Jr.,* Asst. G-2, XIX Corps

777

"…Whether or not the Siegfried Line could have been held against us if the Germans had been able to defend it in the manner in which it was designed to be defended will happily be only a historian's conjecture. The incontrovertible truth is that American infantry successfully penetrated the line in the present circumstances. What is now left of the pillboxes that constituted the line in the Corps sector is today insufficient to support even GI Joe's skimpy laundry."
Lieutenant Colonel *Thomas L. Crystal Jr.,* Asst. G-2, XIX Corps
Above: caption: "American engineers set explosives on captured Siegfried Line dragon's teeth to make an opening for armored vehicles"

778



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Left: caption: "Churchill on the Siegfried Line, 1945." In March 1945, *Winston Churchill* visited the American Ninth Army, which formed a part of Field Marshal Bernard Montgomery's Twenty-first Army Group. Shown are Churchill, *Bernard Montgomery*, Chief of the Imperial General Staff *Alan Brooke* and the Ninth Army's com-mander, General *William H. Simpson*. The men are inspecting dragon's teeth anti-tank defenses on the *Siegfried Line* inside the borders of Germany.

782

Insuperable Obstacles Overcome

783

"…This successful attack against the 'Siegfried Line' should be treated largely as a tribute to the superb fighting ability of our infantry and armored soldiers, well supported by artillery and engineers, intelligently led in a well-planned action. It has demonstrated that through planning, determined leadership and aggressiveness in battle, can overcome what otherwise seems to be insuperable obstacles…"
Major General *Raymond S. McLain* – XIX Corps, U.S. Army

784

785

786

Part 11

I Hate War

787

"…It is to the late Andre Maginot, ex-War Minister of the French Republic and veteran of the First World War, that credit for these amazing fortresses must go. Lying wounded and despairing in a 1917 base hospital, Maginot, a sergeant of artillery, stared at the bullet-pocked ceiling above him, gritted his teeth and groaned with pain. 'I hate war,' he muttered. 'I abhor it.'…"

***Mechanix Illustrated,* February 1940**

Left: caption: "Andre Maginot, wearing the medals he received for valor as a soldier in the Great War." A number of military officers were involved in the creation of the *Maginot Line,* although the Ministers of War received most of the credit. *Paul Painleve*, (Minister of War), is actually the man who did the most towards pushing the government to approve its construction (although the defensive line received the name of his successor in the War Ministry; *Andre Maginot*).

788

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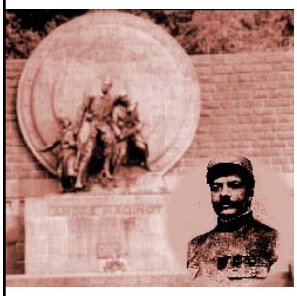

***Andre Maginot* was a lawyer who chose to pursue a political career. After his 1910 election to the *Chamber of Deputies,* he had advanced to the position of Undersecretary of War by the eve of hostilities, but chose to serve in the ranks as an enlisted man. Stationed near Verdun, he was promoted to sergeant for his calm under fire. In November 1917, his knee was shattered thus, he returned to government service. In the interwar years, he was a champion for World War veterans like himself. For his lifetime of service to France, he was honored with one of the most impressive monuments on the Verdun battlefield.**

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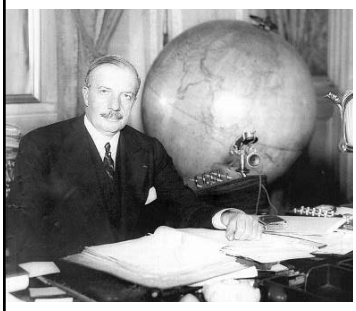


"…Eighteen years later, in a meeting of France's Supreme Council of National Defense, Maginot, the new war minister, 6 feet 2 inches of man, rose to his feet, outlined on a map the French border from Luxemburg to Switzerland and stated his position coldly and determinedly. 'We must build a wall along here,' he said, 'that the devil himself can't break through!' The result: the Maginot and, later, the Siegfried line…"
Mechanix Illustrated, **February 1940**
Left: caption: "Andre Maginot – Minister of War, 1929"

794

795

"…In a time of peace, you might cross and re-cross the Maginot fortifications and see nothing but rolling hills, dense thickets and an occasional peasant's shelter. If you were particularly observant, you might note a scattering of small, dome-shaped mounds protruding from the earth, mounds which - in any other locality - would certainly be taken for underground reservoirs or drainage tanks. Far from drainage tanks, these mounds mark almost the only visible evidence of the greatest fortifications in the history of France! These are pill-boxes, heavily armed, constantly manned - and facing east. What looked like an ordinary thicket turns out to be an enormous cruel mass of twisted barbed wire, and what might have been taken for a peasant's shelter is, in reality, a block-house, with walls 60 inches of cement and steel and blended into the color of the hillside.
Mechanix Illustrated, **February 1940**
Above: caption: "Cross-section of the famous Maginot line"

796

797

"…Of the two great bulwarks, the French Maginot line would seem to have whatever slight advantage exists. Begun ten years ago, it has cost France $300,000,000 and has taken all of the intervening years to complete. It is modern, it is thorough, it is highly scientific. The German counterpart, on the other hand, is a product of feverish building over the short space of the last year and a half, with the natural weaknesses of hasty construction deemed certain to appear under fire…"
Mechanix Illustrated, **February 1940**

798

The Maginot Line's fortifications were built to various degrees/strengths. The dotted line/s on the map at left delineate the weak (a/k/a "Rural") fortifications running across Germany's main/natural invasion route; Belgium, which falls within the open land of the "European Plain." In fact, during the Cold War that followed WWII, it was always envisioned that the plains of Europe would host the battles of WWIII.

799

Troika

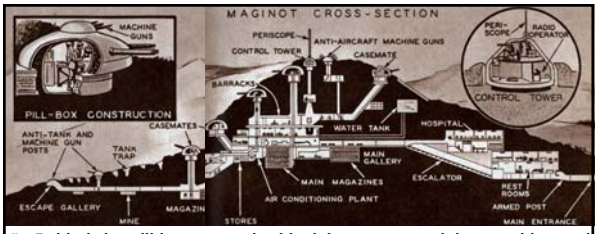
800

"…The Maginot defenses really comprise three parts. The first consists of the pill-boxes - the dome-shaped mounds - built along the base of the hillside. Although connected with the other fortifications by underground passageways, each pill-box is a separate unit, isolated, to be sold out to the invader at the highest price. It is manned with the very latest type machine guns that can fire for 24 hours without a stop. It has sanitary facilities and is stocked with ammunition, food and water; for it is its purpose to impede the enemy, discourage his advance and then surrender only when its occupants are dead. For volunteer 'suicide squads' will man these outposts…"

***Mechanix Illustrated,* February 1940**

801

Above: caption: "Pill-Box Construction"

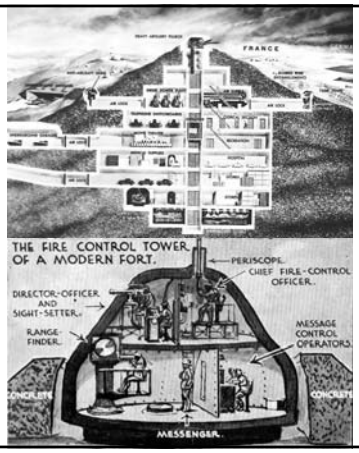


"…Behind the pill-boxes are the block-houses, containing machine and field guns and connected with each other, and the rear, by subterranean tunnels. They, too, are independent units, capable of standing on their own and - when pill-boxes have fallen - of setting off mines in the passages between these units in order to cut off access through that quarter. The third part of the line also consists of block-houses, only this time they contain more powerful defenses - 75 and 155 millimeter cannon (3- and 6-inch) - radio stations, observation posts, field headquarters, and so on…"

***Mechanix Illustrated,* February 1940**

802

Above: caption: "Inside of a typical sector of the line"



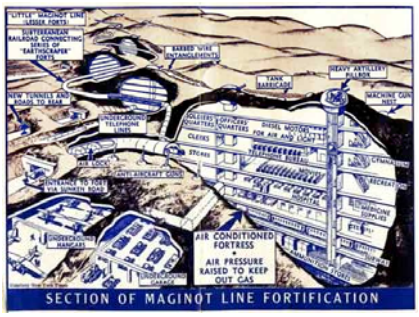
803

"…But these are but surface manifestations of the great Maginot defenses, and, like an iceberg, France's newest forts are 7/8ths under the surface. Behind the three front lines, and deep in the bowels of the earth, are the living quarters and administration divisions of the defenders. Thus, as fast as front line troops grow weary, fresh detachments are ready and able to go into service. And should the enemy penetrate the three outer walls, he is met back of the lines by brigade after brigade of well-equipped fighters who pour out of the cavernous reaches of the underworld from all sides…"

***Mechanix Illustrated,* February 1940**

804

Left: caption: "French troops passing through a tunnel of the Maginot line, more than 100 feet below the surface"



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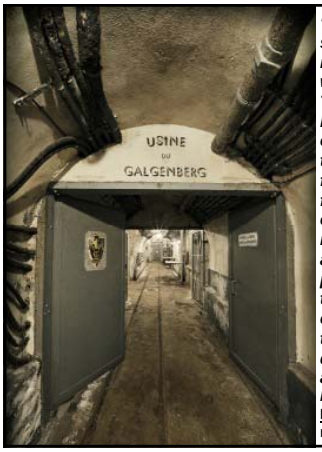
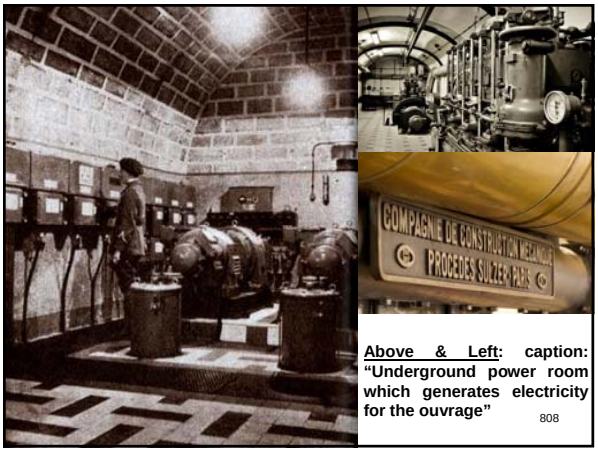


"…Within the heart of the hillsides, an army can live for months in the ingenious recesses of which Andre Maginot dreamed. There are comfortable steel-lined barracks, air-conditioned and strengthened to withstand five times the assault put upon them in their first tests. There are escalators from one level to another, kitchens, hospitals, ammunition dumps, reservoirs - even wine cellars and recreation rooms. Telephone cables are steel-insulated to withstand the shock of high explosive, and when they fail there is the radio. If that goes dead, then pigeons go into action…"
***Mechanix illustrated,* February 1940**
Left: caption: "Usine (power room) in ouvrage Galgenberg"

807



Above & Left: caption: "Underground power room which generates electricity for the ouvrage"

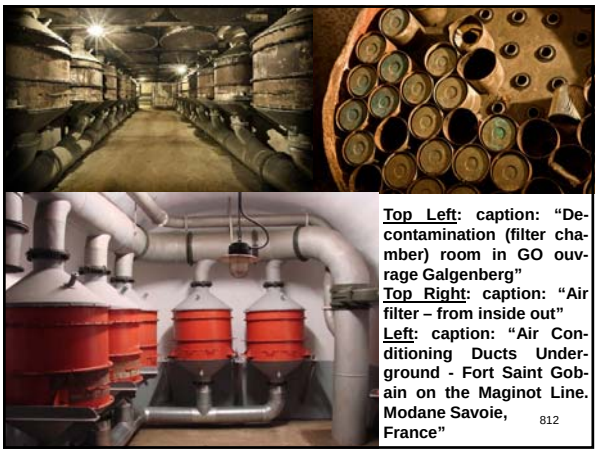
808

809

810

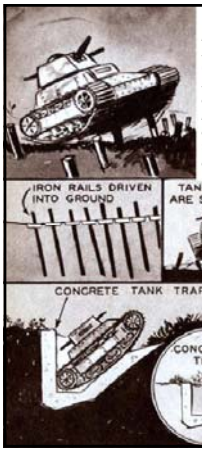
"…The fact that the superstructures are located on hilltops minimizes the poison gas nuisance. Gas needs dry weather and low, windless country; but, even if it came, the Maginot line would be ready for it. Guns are set in water-tight jackets and embrasures that defy the entry of gas; and the smoke and fumes from gun discharges within the fortifications are ingeniously disposed of through ducts which permit exit but not entrance. The air in these defenses, aided by pressure, is as pure as that of a mountain cave…"
Mechanix Illustrated, February 1940
Above: caption: "A French fort, part of the Maginot Line"

811



Top Left: caption: "Decontamination (filter chamber) room in GO ouvrage Galgenberg"
Top Right: caption: "Air filter – from inside out"
Left: caption: "Air Conditioning Ducts Underground - Fort Saint Gobain on the Maginot Line. Modane Savoie, France"

812



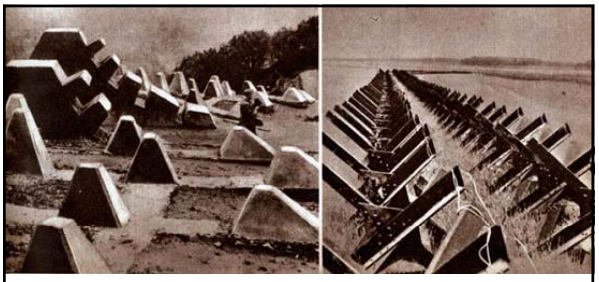
"…As safe as they are inside, the inhabitants of both the Maginot and Siegfried lines are amply protected on the surface. Andre Maginot, as well as his rivals across the German border, realized that such defenses might be surmounted or crushed easily by the fast and powerful tanks of the war that was to come, and this angle has been taken into consideration. Machine gun nests, block-houses and other defensive works are skirted by a veritable morass of tank traps. Thousands of steel rails, set end upright in solid concrete and steel, and with their upper ends protruding at different heights out of the earth, stand like a garden of irregular bean poles to impale the fastest tank and strip its belt tracks. If an enemy driver successfully skirts this 'asparagus,' and is not disabled by the withering anti-tank cross-fire which besets him from pillboxes and block-houses on all sides, his troubles have just begun. For he will find that the most solid earth will turn out to be a deep, wedged-shaped pit, concealed by grass and underbrush, and into which he will sink out of action…"
Mechanix illustrated, February 1940
Left: caption: "The drawings show the methods used to foil the advance of oncoming tanks – iron rails driven into the ground, and cleverly concealed pits into which tanks fall and are rendered useless"

813

814

"…In the meantime, the infantry is having its troubles in jungles of barbed-wire, carefully woven and supported in days of peace, when things can be done carefully and devilishly. In some instances, these nests of wire are even electrified to put the crusher on any army that dared to try to pass or cut them. In this latter respect, the German and French defenses are much the same and present no dissimilarity to the casual observer. The German 'asparagus' protrusions are different only in that the rails have been encased in concrete and stretch in columns of four for miles and miles along the border. They were built by Fritz Todt, German road expert, who drove an army of 500,000 workers for more than a year before completing the project last Summer…"
Mechanix Illustrated, February 1940

815



Above L&R: caption: "The two photographs above show how Germany expects to keep the giant French tanks at bay. The one at the left shows a line of concrete tank traps, while the one directly below shows a double barricade of crossed angle iron."

816

817

Above: caption: "The Vaunted Siegfried Line"
Left: caption: "Westwall construction - Todt Organization. Siegfried Line, Germany,1938."

818

819

"…With this minor difference, and despite the denials of Adolf Hitler, the German West Wall - as the Siegfried line is called in the Reich - is almost a copy of the Maginot fortifications. There are reputed to be almost 600 of the hillside, pillbox forts of the Maginot type on German soil, all complete with living quarters, air conditioning, latest type armanents, plumbing, telephones, radio and recreation facilities. The German barricades extend more than 400 miles along the frontier, are drilled - in some places - as much as 30 miles into German territory, and are said by Der Feuhrer to be able to withstand any attack, whether from air, by tank, by gas or heavy artillery…"
***Mechanix Illustrated,* February 1940**

820

"…The British have deprecated the efficiency of the German line on several occasions. According to their reports, the subterranean dugouts of the Germans may be able to thwart any human enemy but were flooded by the high waters of the Rhine last Summer, forcing a hasty evacuation. Furthermore, they say, the German soldiers are unhappy underground because of the fact that the galleries are crammed to overcrowding with ammunition, the air conditioning doesn't work and ventilation is bad, and there has been a marked shortage of food, forcing the troops to come out and show their hideaways…"
***Mechanix illustrated,* February 1940**
Left: caption: "A mountain dugout on the Siegfried line"

821

"…Regardless of these rumors, however, it is apparent that both teams have power aplenty to stave off attack from all sides, and neutral observers are of the opinion that this new war really may be the war to end wars. They point out that, with neither side able to gain any ground on the other, they will have to resort to air raids and bombing of non-combatants, and eventually - like invincible knights of King Arthur - both sides will battle to exhaustion. And the conflict will be at an end…"
***Mechanix Illustrated,* February 1940**

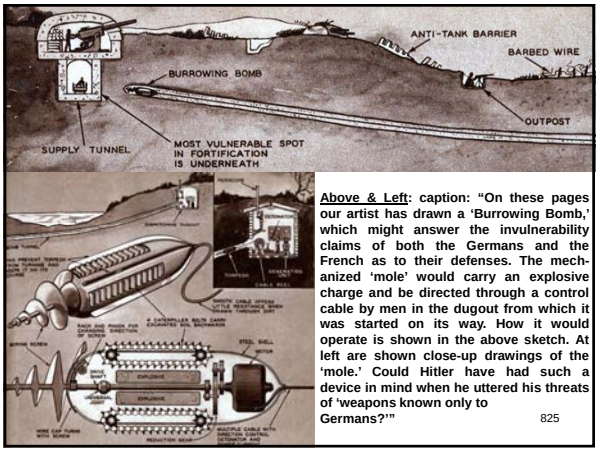
822

Known Only to Germans

823

"…But man's best laid plans sometimes go awry. Both Germany and the Allies are rumored to have some secret and amazing weapons which they are saving till the real scrap begins. If these rumors are true, then guesswork goes out the window. The question is, however - Have the boys got such weapons?
***Mechanix illustrated,* February 1940**

824



Above & Left: caption: "On these pages our artist has drawn a 'Burrowing Bomb,' which might answer the invulnerability claims of both the Germans and the French as to their defenses. The mechanized 'mole' would carry an explosive charge and be directed through a control cable by men in the dugout from which it was started on its way. How it would operate is shown in the above sketch. At left are shown close-up drawings of the 'mole.' Could Hitler have had such a device in mind when he uttered his threats of 'weapons known only to Germans?'"

825

Gustav and Dora

826

Above: in 1936, Hitler asked artillery-maker *Gustav Krupp* to build an artillery piece to defeat the new French *Maginot Line*. Krupp suggested a giant cannon with an 80cm (31-inch) caliber. Hitler ordered two. Built in Germany in 1941 by *Friedrich Krupp A.G.*, these gigantic guns were created with the sole purpose in mind of destroying the fortifications of the Maginot Line. Both a ten-thousand pound and a sixteen-thousand pound (concrete-piercing) 800mm projectile were designed for the gun which had a range of twenty-nine miles (47km). Named "Gustav" and "Dora," the two railway guns weighed 1,350-tons each.

827

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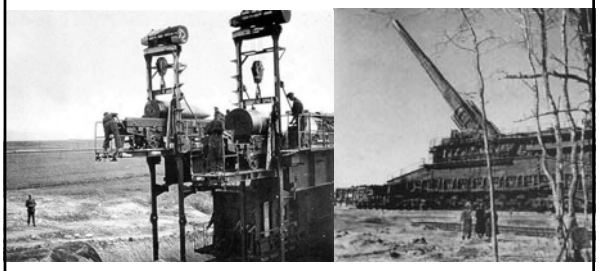

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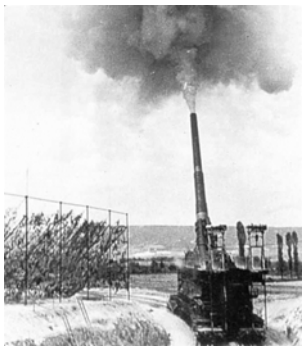


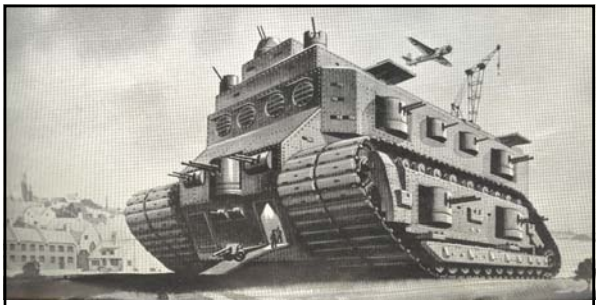
830

Gustav was captured by American forces (above), but Dora was destroyed by the Wehrmacht in 1945 to avoid capture by the Red Army.

831

Going Mobile

832



Above: caption: "Movable Maginot Line - it is a mobile fort, complete with plane launching capacity, two dozen cannon, a crane and a host of other apparatus." This conceptual mobile fortress featured loudspeakers (mounted on the front of the fort) to instill fear with loud noise (in a similar manner to the sirens mounted on *Stuka* dive bombers). Appearing in a British pamphlet entitled: *The Brains to Win* (published during the *Battle of Britain*), it featured not only a mobile fort, but a floating fort and other technological breakthroughs that would ensure the Allied victory in the dark days of 1940.

833

834

Above: caption: "The largest tank ever made: the French Char 2C (a/k/a "FCM 2C"), developed during WWI, used between 1921 and 1940. Only ten were built. This 69-ton tank was 33-ft 8-in long, 13-feet 5-inches high and 9-feet 10-inches wide and had a 75mm gun and four 8mm machine guns."

835

836

Many historians have argued that the enormous cost of the *Maginot Line* diverted funds from mechanization of the French army's mobile forces, resulting in the defeat of 1940. However, the fact remains that no strong and/or influential proponent of mechanized warfare challenged those who advocated the investment of funds in fixed fortifications. *Charles de Gaulle* unsuccessfully tried to influence his superiors into creating an armored strike force in the 1930s. Even so, by 1940, the French tank force was not only comparable to Germany's, many of its tanks were of superior design and quality. However, the French armored and mechanized divisions were in a state of reorganization and still not fully prepared for their new role in offensive actions. Thus, the funds used for the Maginot Line did not prevent the creation of a strong armored force in the 1930s. French military doctrine after WWI focused on the defense of France, inhibiting the development of an offensive doctrine for their mechanized forces, as championed by WWI veteran of trench warfare, Charles de Gaulle.

837

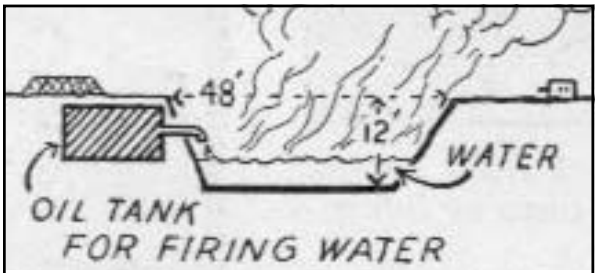
Left: caption: "Captain Charles de Gaulle in a trench, late 1915"

In 1937-38, then Colonel *Charles de Gaulle* commanded an experimental armored unit: the *507eme Regiment de Chars de Combat* (on the right in the photograph at left, next to his tank which he named "Yorktown"). De Gaulle had all of the Renault D2s in the regiment named after famous battles in which the French army played a significant part (including the *American Revolution*).

838

Great Walls of Fire

839



"Rumania has girded herself, like a medieval castle, with a vast moat stretching for 750 miles along its northern and western borders which, at the moment of invasion, can be turned into a river of flaming oil. For more than a year 150,000 Rumanians worked to construct the system of canals, locks to regulate the flow of water at various points, storage tanks for oil, and valves from which the oil can be released on the surface of the water as set ablaze, raising a wall of fire between the defenders and the invaders…"

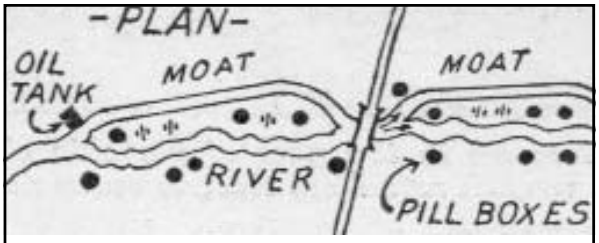
840

***Popular Mechanics*, August 1940**

"…There are three main sections of the moat, the longest running about 400 miles from Hotin on the River Dniester to Cetatea Alba on the Black Sea. The canals are fifty feet wide and twelve feet deep, connected with the Dniester and three of its tributaries to use their water and to form a continuous channel to the sea. This section divides the Rumanian province of Bessarabia from Soviet Russia. A second section runs from Hotin to Vijnita, connecting the Dniester and the River Prut, about 100 miles long. This part forms a barrier against what formerly was Polish territory, at a point from which either Germany or Soviet Russia might strike south into Rumania. Western Rumania is guarded naturally by the Carpathian mountains, but south of them the moat resumes in a 250-mile series of canals along the Hungarian frontier from Satu-Mare to Arad, using the waters of the Szamos, Crisul and Maros rivers…"
***Popular Mechanics,* August 1940**

841

842



"…In addition to the moat of fire, the outbreak of war would be a signal for closing the steel gates which form tank barriers at the highways from Hungary into Rumania. Back of the canal system are trenches, fortifications and 'pill boxes' connected with underground corridors…"
***Popular Mechanics,* August 1940**
RE: whether or not the Romanian "Moat of Fire" would have stemmed a German attack is questionable. In the end, Romania formed a strategic alliance with Nazi Germany, negating the need for the moat.

843

"…One section of the canal system was tested not long ago in a realistic rehearsal of a large-scale invasion at the Hungarian frontier. Crude oil was turned into the moat and set ablaze, while the fortifications were pounded heavily with artillery. The defenses fulfilled the expectations of the military experts. One especial advantage of the use of oil is that it freezes at much lower temperature than water and therefore could be used in the moat even during rigorous winters characteristic of southeastern Europe."
***Popular Mechanics,* August 1940**

844

Part 12

Sitzkrieg

845

Then and Now

846

"No one can understand as well as you veterans of 1917 – '18 what I have to tell. I was seeing with your eyes. You were there in the spirit of memory as I rode over the roads where we had marched over our battlefields. Over there – Then and Now. The Then to us had been the training camps to the days when our drives clinched the victory. Some of us saw the Rhine. The Now for all of us is the tragedy of a world in which the sword has been unsheathed, and millions face conditions worse than death…"

RE: excerpt from an article authored by war correspondent *Frederick Palmer* that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "I Was There!"

847

"…For my Now of this story I shall start with a column of marching French soldiers I saw out of a car window on my way from Rome to Paris late in February. They were swinging along just as we did some twenty-two years ago. Possibly it would be a surprise to you that they were not in horizon blue, but in Khaki. Except the air forces both the French and British armies were in Khaki…"

RE: excerpt from an article authored by war correspondent *Frederick Palmer* that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "I Was There!"

Left: caption: "The French soldier of 1940"

848

"…Six months of war, and not a single bomb had been dropped on Paris – no great bombing raids by either army – just reconnaissance flights and the 'dogfights' in the air with which we are familiar. It was war, yet it was not war. No such steady drain of casualties as the ambulances brought in from the trenches in the quietest periods all through the World War. A few trickled in from the clash of patrols in No Man's Land…"

RE: excerpt from an article authored by war correspondent *Frederick Palmer* that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "I Was There!"

849

The period between the defeat of Poland (in October 1939) and the German invasion of Norway (in April 1940) is often referred to as the "Phony War" or "Sitting War" ("Sitzkrieg," in German). Not much was happening. The French stiffened their defenses while the British moved troops to the continent. The British wanted to send the RAF to bomb targets inside Germany, but were persuaded not to by the French who feared German reprisal. The major activity consisted of dueling propaganda messages blared from loud speakers across the German and French lines. The French, feeling secure behind their *Maginot Line*, were ready to fight WWI all over again – a war of defense. Hitler had other ideas. In order to secure his northern flank, Germany invaded Norway and Denmark on April 9th 1940.

Left T&B: French soldiers on guard (top) and in convoy (bottom) during the Sitzkrieg

850

851

The Place to Be

852

"…I spoke to a man in uniform who wore the World War ribbon, and, telling him I had been in France in our Army in 1918, I asked if I might join his group around the cafe table… 'My oldest son, he is in a good place,' said the veteran. 'He is in the Maginot Line. That's the place to be, under thick roofs of cement – better than our old dugouts, hein?' 'And you?' I asked. 'I am in the reserve – guard duty. In case of a big battle I might be in it on the front line again. But the youngsters think we old fellows are back numbers. We had no Maginot Line. The youngsters are bored by marking time. I'm not. I know what real war is. I pray they may never know.' But they were to know – and how!…"

RE: excerpt from an article authored by war correspondent *Frederick Palmer* that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "I Was There!"

Left: caption: "French Grande Guerre 1914-1918 Commemorative Ribbon and Medal"

853

Above: caption: "French soldiers in the Maginot Line get beer as it is passed from tap through a small opening in a concrete wall (1940)"

Left: caption: "Soldiers of the 51st Highland Division wearing gasmasks while on duty in a fort on the Maginot Line in France, 3 November 1939"

854

Above: popular board game based on the hit song "We're Going to Hang Out the Washing on the Siegfried Line" (written by a captain in the BEF and used as a morale booster in the early stages of WWII).

Left: caption: "Germany's underground series of fortifications that protect her western frontier are known as the the Siegfried Line, also the 'Limes.' The picture shows a German soldier inside the fort, climbing up the ladder to the firing step while his buddy closes the door. The Maginot Line of France is immediately opposite."

855

WE'RE GOING TO HANG OUT THE WASHING ON THE SIEGFRIED LINE
Kennedy & Carr

Mother, dear, I write to you from somewhere in France
Hoping this finds you well
Sergeant says I'm doing fine: a soldier and a half
Here's a song that we all sing, it will make you laugh

Chorus
We're going to hang out the washing
On the Siegfried Line
Have you any dirty washing Mother dear?
We're going to hang out the washing
On the Siegfried Line
Cos the washing day is here
Whether the weather may be wet or fine
We'll just rub along without a care
We're going to hang out the washing
On the Siegfried Line
If the Siegfried Line's still there!

Chorus

Everybody's mucking in and doing their job
Wearing a great big smile
Everybody's got to keep their spirits up today
If you want to keep it this way, here's a song to sing

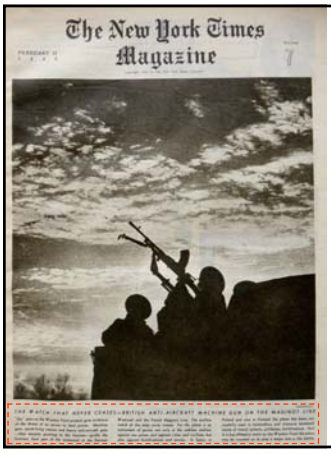
Chorus

(music)

Whether the weather may be wet or fine
We'll just rub along without a care
We're going to hang out the washing
On the Siegfried Line
If the Siegfried Line's still there!

856

857



Left: caption: "The Watch That Never Ceases – British Anti-Aircraft Machine Gun on the Maginot Line. 'Sky' guns on the Western front present grim evidence of the threat of air power to land power. Machine guns, quick-firing cannon and heavy anti-aircraft guns – their muzzles pointing to the heavens – girdle the frontiers, form part of the armament of the German Westwall and the French Maginot Line. The endless watch of the skies never ceases. For the plane is an instrument of power not only in the ruthless warfare against sea power and against cities and civilians but also against fortifications and armies. In Spain, Poland and now in Finland the plane has been successfully used in tremendous and intensive bombardments of trench systems, pillboxes, fortifications. And if a big offensive starts on the Western Front the plane may be counted on to play a major role in the battle."

***The New York Times Magazine*, February 25th 1940**

858

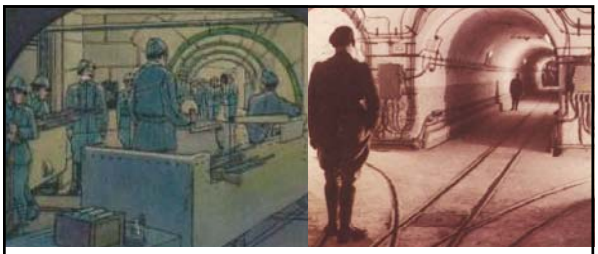
"…Ride out with me in a car, in those days when winter was drawing to a close, over familiar ground to our old Lorraine sector. Ruined villages and towns long since rebuilt, but otherwise here was the France the A.E.F. knew in war time…Estaminets, villages, farmhouses with the familiar manure piles, and the people were the same. Again I went to a little restaurant in a back street where Madame had served me when I was in a billet nearby…She felt quite secure, as did all the people I met – secure behind the wonderful Maginot Line. The door was fast locked against the ancient enemy. It was Security, the most treasured word in the language…"

RE: excerpt from an article authored by war correspondent *Frederick Palmer* that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "I Was There!"

Left: caption: "Built between 1932 and 1938, the Fort of Sainte-Agnes contained the most powerful concentration of artillery all along the Maginot Line"

Right: caption: "Heavy French artillery of the Maginot Line firing, May 1940"

859

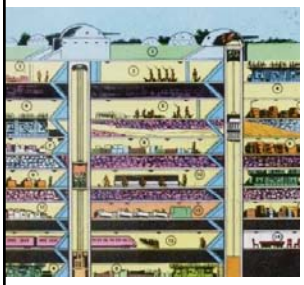


Left: caption: "Along the border where France and Germany touch for 200 miles the French have been building since 1929 the world's greatest fortifications, known as the 'Maginot Line.' It is directly opposite the rapidly building German 'Siegfried Line.' On September 7, 1938, a new order sent trained infantry reserve troops to the Maginot Line. The picture shows Maginot soldiers marching down one of the long concrete tunnels."

Right: caption: "French soldiers stand guard in a Maginot Line tunnel deep under the hills of eastern France. Note the tracks running down the center of each tunnel and their intersection."

860

861



"…The French might be given to holding to their old ways, but into that long rampart they had incorporated everything engineering skill and scientific defense could devise. It was called impregnable. It looked so – as much so as a sheer ten-foot stone wall with a top of broken glass against scaling by a small boy who wanted a ripe peach from the orchard it enclosed…"

RE: excerpt from an article authored by war correspondent *Frederick Palmer* that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "I Was There!"

862

"…All the set guns in their fixed positions, all the fields of barbed wire and tank obstacles faced the Rhine to meet a frontal attack. Occasionally, a skeptic whispered the question, 'What if an invading army should get behind the Maginot Line?' which for the most part could fire in only one frontal direction. And this was to happen…"

RE: excerpt from an article authored by war correspondent *Frederick Palmer* that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "I Was There!"

Above: caption: "French troops march up to the grass-sown hilltop at Rochonvillers, part of the Maginot line"

863

"…From France I went to England, where even more than in France it was war and yet not war. It was still being called a phony war and a microphony war…The British had their Maginot Line – the sea. They felt secure in the vastly superior power of their navy…"

RE: excerpt from an article authored by war correspondent *Frederick Palmer* that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "I Was There!"

864

"…Next, this war tourist of a Legionnaire was back across the English Channel with the British Expeditionary Force…They had gone in heavily for tanks and motorization of all kinds. No neigh of an army mule ever welcomed the dawn. No soldier had to walk. All soldiers rode in tanks or on trucks…The British had the last word in modern armament…"
RE: excerpt from an article authored by war correspondent *Frederick Palmer* that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "I Was There!"

865

A Different Kind of War

866

"…Just consider this kind of a war – that is, before war really began. On the British main front line I did not hear a single shot fired. Any soldier who fired one would have created as much commotion as though you shot off a revolver in the main street of your home town…For no enemy was in front of the main British line, though up in the Saar British troops were between French divisions and did have patrol action. The main British line faced the Belgian frontier. Belgium was a neutral, at peace. There were only Belgians to shoot at and if one bullet had hit a Belgian, it would have made an incident to show it was the Allies and not the Germans about to invade Belgium…"
RE: excerpt from an article authored by war correspondent *Frederick Palmer* that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "I Was There!"

867

"…This was a strange enough situation, but I pass on to the big surprise. I had the idea, as had the rest of the world, that the mighty Maginot Line had been extended from the end of the French frontier all the way to the English Channel along the Belgian frontier. But this was not so. The fact that it was not is one feature but not the great one which explains what happened…"
RE: excerpt from an article authored by war correspondent *Frederick Palmer* that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "I Was There!"
<u>Left</u>: caption: "Map of French and German borders"

868

What Will Hitler Do?

869

"…As this war moves out of the dank inactivity of winter months on the Western front into the ominous breezes of early spring, a war-stricken world strains in a fever of anxiety for conclusive indications of Hitler's 1940 major war plans…"
RE: excerpt from a March 1940 *Click* magazine article authored by General *Ared White*
<u>Left</u>: caption: "Pondering war maps while his military experts explain them is the man who is generally credited with the dubious honor of plunging Europe into the second great conflict of this troubled century. Although the maps show several theoretical courses open to Hitler's armies, practical warfare narrows down the possible paths they may follow."

870

"…Will Hitler:
a) Attempt some face-saving formula under which the nations at war can find new hope of peaceful settlement? Or-
b) Press the war at all costs towards the goal of a German Victory?
Those two major questions break down into numerous queries of how the feuhrer will proceed in carrying out either determination…"
RE: excerpt from a March 1940 *Click* magazine article authored by General *Ared White*

871

"…Searching peace moves against the pattern of past German war activity, it can be set down as unlikely that Hitler will consider, during this year, any peace plan that fails to leave Germany in the place of vantage and Hitler the hero. Since there are no present indications that the Allies are willing to accept any such peace as that, peace moves this spring may be European war propaganda…"
RE: excerpt from a March 1940 *Click* magazine article authored by General *Ared White*

872

"…If he decides to fight on, will Hitler:
1) Hurl his armies against the Maginot line in a vast-scale offensive intended to crush the French and British armies?
2) Speed his highly mobile armies through Belgium and Holland in an attempt to break the little Maginot line and cut the British off from the French, at the same time establishing submarine and air bases on the North Sea for further attacks on the British isles?
3) Attack through Switzerland in the region of Basle to turn the French right flank? Attack at the same time through Italy, with Italian support?
4) Continue to operate with Russia in adventures of conquest among the Scandinavian and Baltic countries?
5) Sit tight defensively behind his Siegfried line while consolidating and digesting conquered regions, at the same time vigorously pressing submarine and bombing assaults on Britain's sea power?
6) Attack England with the full might of the German air forces in a series of massed blows?
RE: excerpt from a March 1940 *Click* magazine article authored by General *Ared White*

873

A Million Men or More

874

"…Let us weigh, in the order named above, those principal courses open to Hitler as the war approaches its second year:
1) Attack the Maginot line? He might launch attacks to feel out the Maginot line, but unless there are some undisclosed weaknesses in that line, or unless Hitler has some new surprise weapon, it would cost a million men, or more, to break through. The cost of half a million lives did not yield Verdun to the Kaiser in the first World War. A mass attack on the Maginot line for the purpose of seeking a military decision on the French western front is unlikely this spring…"
RE: excerpt from a March 1940 *Click* magazine article authored by General *Ared White*

875

"…2) Attacks through Belgium or Holland? The German army broke its back trying to cut the British off from the French in the first World War, when there was no little Maginot line to break. If Belgium or Holland is crushed this Spring, it will be with the object of establishing bases on the North Sea. The advantages to be gained against England do not appear to warrant all that effort at this time…"
RE: excerpt from a March 1940 *Click* magazine article authored by General *Ared White*

876

"…3) Through Switzerland or Italy? The terrain north of the Swiss frontier, which the writer has observed in detail from Basle north through the Vosges, does not invite such an envelopment. Even if Italy would permit it, an invasion of France through Italy does not offer rich military dividends…"
RE: excerpt from a March 1940 *Click* magazine article authored by General *Ared White*

877

Water on the Hitler Wheel

878

"…4) Cooperate with Russia in further conquests? Despite current predictions of the Russian complication, the German ego will be little inclined to fear Russia. In World War I, Russia's great armies fought Germany on the eastern front. Now Russia is useful. In victory, with her conquered domains consolidated, Germany could figure on dealing with Russia in future years. Therefore, if the Russian advance, after running its course in Finland, moves deeper and deeper into the Scandinavian group or cuts far into Rumania, it all analyzes out to water on the Hitler Wheel, even though the great Russian ambition is a warm water sea outlet and eventual world dominion…"
RE: excerpt from a March 1940 *Click* magazine article authored by General *Ared White*

879

Most Logical Course

880

"…5) Sit tight? Hitler, with exception of colonies, has re-gained the principal land lost in the World War. Germany has yet to digest these gains. Therefore Hitler's most logical course, if the Allies leave the war initiative in his hands, is to sit tight behind the Siegfried line as long as possible, the while he hammers at British sea power with his submarines and bombers and consolidates conquered lands. If, by this course, he seriously cripples Britain's Navy and merchant marine and strangles Britain's supply, the Allies ultimately will be forced into taking the offensive or seeking peace on Hitler's terms. Meanwhile, more intensive warfare would be delayed…"
RE: excerpt from a March 1940 *Click* magazine article authored by General *Ared White*

881

The Red Ledger of War

882

"…6) Attack with his vast air armada? Attacks so far on England's navy yards and vital installations have been by relatively small forces in contrast with his furious assaults on Poland by thousands of bombers. Hitler may strike more and more furiously with his air fleets, marking Britain off into a war checkerboard and hurling vast flights in simultaneous assaults on critical points and installations. In the red ledger of war, success here would pay Hitler heavy dividends against Germany's dominant foe – Great Britain…"

RE: excerpt from a March 1940 *Click* magazine article authored by General *Ared White*

883

Above: caption: "Hitler's Six Paths to victory or to military suicide…It is unlikely that the Nazi leader will attempt steps 1, 2 or 3...Hitler has his eyes on the rich oil fields and supply region of Rumania as well as the iron mines and wealth of the Scandinavian countries. That is why maneuver No. 4 takes on added significance. No. 5 is a face-saving tactic and No.6 might bring success."

884

Part 13

Fall of France

885

What Happened

886

"…After the start of the war last September the Allies hastened to make a substitute in extension of the Maginot Line. Some of us remember how concrete pill boxes for machine guns appeared in the later period of the World War. These were the forerunners of those being built along the Belgian frontier during the last winter. When the British soldiers were not drilling they became day laborers. The only cessation from the grind some had through the winter was when it was too cold to pour concrete to make little pillboxes for the machine guns and bigger pillboxes for the big guns of the artillery – hundred and hundreds of pillboxes, many yet unfinished when the Blitzkrieg came…"

RE: excerpt from an article authored by war correspondent *Frederick Palmer* that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "I Was There!"

887

"…Other soldiers had a holiday when they got bronchitis, flu, pneumonia, rheumatism or lumbago in the course of the excavations for tank traps or in timbering them. These tank traps were not the concrete pyramids of the German Siegfried Line or the old railroad rails set perpendicularly in the earth of the Maginot Line. The enemy tank which approached the kind of trap the British were building went down the timbered slope on one side of the deep ditch and then against the perpendicular wall of timbering on the other side which seemed bound to stop it. There were miles upon miles of these timbered pits. And all this costly, Herculean effort was to be waste – utter waste…"

RE: excerpt from an article authored by war correspondent *Frederick Palmer* that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "I Was There!"

Left: caption: "French soldiers building an anti-tank ditch"

888

Action at Last

889

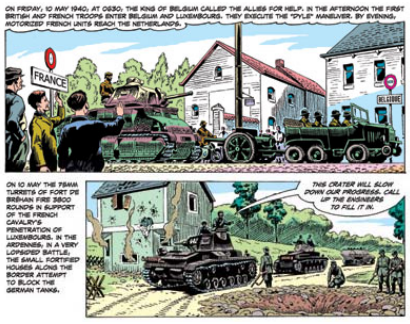
"…Work and drill and life back of the fortified lines continued up to the end of the long lull before the breaking of the storm with the German invasion of Belgium and Holland. Never was there such a lull – never such a storm. Those who went over the top had a likeness in the lull before the lightning barrage and the shell and machine-gun fire they met in their advance. After the German rush swept over the Dutch and Belgian frontiers – then what? The British sped with tanks, guns and trucks across into Belgium, leaving their new defense line behind them. No longer diggers and concrete pourers, they were eager soldiers off the leash for action at last…"

RE: excerpt from an article authored by war correspondent *Frederick Palmer* that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "I Was There!"

890

In the early morning hours of May 10th 1940, the Germans unleashed their Blitzkrieg against the Netherlands and Belgium. The attack sent the defending troops reeling and the roads overflowed with refugees fleeing the fighting. French and British troops rushing to the front were caught in the headlong retreat and were pushed back. German *Stuka* dive-bombers filled the sky, sirens wailing as they dived then strafed the retreating mix of civilians and soldiers with machine-gun fire. The Allies fought bravely, but the force of this new "Lightning War" was overwhelming. In England, the invasion forced Prime Minister *Neville Chamberlain* to resign, to be replaced by *Winston Churchill*.

891



892

893

"…Now we are close up. Before dawn we are dug in, crouched in foxholes and none too soon, for with the dawn a barrage cracks down on us. Our artillery blazes back, but those gunners are really good. Their counter-battery makes our guns limber up and change position frequently. We lie there and take the shelling, and it isn't any easier than it used to be. But soon our batteries spoil the accuracy of the foe's fire…"

RE: excerpt from an article that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "Teamwork Did It," which provided a first-hand account by the Germans themselves of the 1940 Blitzkrieg war in Belgium and France

Above L&R: caption: "French (left) and German (right) artillerymen in action during the Battle of France – May 1940"

894

895

896

897

A Tough Nut to Crack

898

"…Prepare to attack. It is a tough nut we have to crack. Concrete emplacements, machine-gun nests with flanking fire, tank traps and barriers of iron rails set in concrete, and barbed wire entanglements on a dominating crest which must be approached through a depression 800 meters wide. And we have only an infantry battalion with two rifle companies to deliver the assault!..."

RE: excerpt from an article that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "Teamwork Did It," which provided a first-hand account by the Germans themselves of the 1940 Blitzkrieg war in Belgium and France

899

Thunder Overhead

900

"…But we are to have help. Thunder overhead, and here comes a whole squadron of our bombers. They swoop, motors roaring, sirens shrieking. Hits or not, that racket must be ruinous to the lads over there. Tons of high explosives are dropped, black geysers spurt high into the air. Only one bomber is downed by anti-aircraft. Yet still our attack is withheld. We are to risk no more lives than we must. Our planes and artillery give it to 'em again…"

RE: excerpt from an article that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "Teamwork Did It," which provided a first-hand account by the Germans themselves of the 1940 Blitzkrieg war in Belgium and France

<u>Above L&R</u>: caption: "The Ju 87 'Stuka' dive-bomber was used extensively in Blitzkrieg operations"

901

"…And now we are off. Our heavy machine-gun platoon, along with light infantry cannon, opens on their machine-gun nests. Our three anti-tank guns spit shells at their observation turrets. Under this fire we advance by rushes. Flanking machine-gun fire catches us, but we burrow into the soft earth of a potato patch…"

RE: excerpt from an article that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "Teamwork Did It," which provided a first-hand account by the Germans themselves of the 1940 Blitzkrieg war in Belgium and France

902

"…Crash-bang! Our artillery, damn it, is firing short into us. Green rockets up, quick! Good! The fire is lifted. Up and at 'em! The sinking sun is red behind us, but the town to the rear of the foe is as crimson with flames and the blasts of shells. Our right platoon cuts through the wire, finds a gap in their line. In one hour and ten minutes since the launching of the assault, the concrete fort is ours…"

RE: excerpt from an article that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "Teamwork Did It," which provided a first-hand account by the Germans themselves of the 1940 Blitzkrieg war in Belgium and France

<u>Left</u>: caption: "The crew of a French bunker of the Maginot Line surrenders to German troops in June 1940"

903

<u>Right</u>: caption: "Blitzkrieg soldiers of the Wehrmacht"

During the early stages of the 1940 *Battle of France*, the German invaders avoided the main *Maginot Line* forts. A few Maginot petit ouvrages - the weaker, unconnected blockhouses of the *Maginot Line Extension* were attacked. The Wehrmacht was able to overpower them quickly. German propaganda made the most of these victories at places like *La Ferte*. The story would be quite different when the Wehrmacht threw its full force against the gros ouvages of the Maginot Line.

<u>Left</u>: caption: "France's Fortified Region of Belfort, the eastern extension of the Maginot Line fortifications, surrenders to German Forces. 1940"

904

905

906

907

908

Battle of Flanders

909

"…Now, let's look at the other side of the new defense line away from the fighting in Belgium which was to become the separate Battle of Flanders…"

RE: excerpt from an article authored by war correspondent *Frederick Palmer* that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "I Was There!"

910

The Hinge

911

"…We are at the hinge between the extension and the Maginot Line itself, at Montmedy on the Meuse River near Sedan. Here was the objective towards which we Yanks fought our way in 1918 yard by yard, in the Battle of the Meuse-Argonne…In 1940 the Germans had their turn to pay back in kind in the eternal European liquidation of racial and national grudges…"

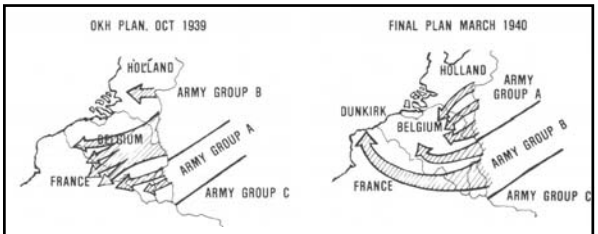
RE: excerpt from an article authored by war correspondent *Frederick Palmer* that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "I Was There!"

Left: caption: "Map of the Battle of Meuse-Argonne"

Right: caption: "U.S. soldiers of 2nd Division engaged in the Argonne Forest"

912

913

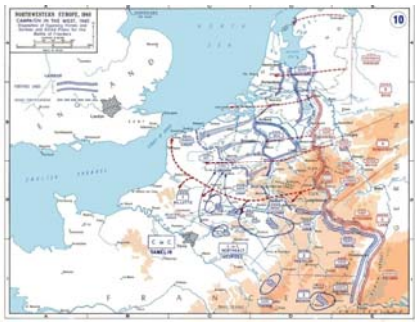


"…With the troops Hitler had rushed through the helpless little Duchy of Luxembourg he struck at the hinge in an avalanche of force. The French Ninth Army cracked in a rout after failing to destroy the bridges over the Meuse. This German host had broken the hinge. It poured quickly through the breach it had made. What was before it? A stretch sixty miles in depth undefended except for a few troops guarding supplies, and the local French police – and this in the rear of the Allied armies in Flanders…"

RE: excerpt from an article authored by war correspondent *Frederick Palmer* that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "I Was There!"

914

Above: caption: "The Invasion of France 1940: The Plans"



915

"…We have been in Corps Reserve, but tonight we are marching up to relieve troops in the line. A motorcycle courier roars back from up ahead with orders for our battalion commander. We move faster through the night, and the word for silence passes down the ranks. The gloom of forest shrouds us. As we emerge from it, we discern dark heaps on the ground – enemy dead, the first our young soldiers have seen. The lads eye the bodies nervously and glance towards us World War veterans. To us it is an old story. Our calm bearing steadies the youngsters…"

RE: excerpt from an article that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "Teamwork Did It," which provided a first-hand account by the Germans themselves of the 1940 Blitzkrieg war in Belgium and France

916

917

A Mighty Host

918

"…Motorcyclists actually rode ahead of the German tanks as freely as French motorists on holiday. The tanks rumbled over the roads and spread out over the fields unmolested by any anti-tank guns. Low flying planes swept the roads with machine-gun fire while others bombed towns and villages, causing panic among the civilian population…"

RE: excerpt from an article authored by war correspondent *Frederick Palmer* that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "I Was There!"

919

920

"…As this host swept on, what was happening in Flanders? There another German host swept through the Belgians' own Maginot Line. The Allies had to fall back among the fear-crazed refugees, unable to maintain teamwork or to get their anti-tank and anti-aircraft guns into effective action. In using his planes and tanks Hitler made the most of his obsolete planes; they had their part in a new variety of barrage – a barrage of bombs ahead of the tanks and the artillery barrage to cover the advance of the German infantry…"

RE: excerpt from an article authored by war correspondent *Frederick Palmer* that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "I Was There!"

Left: caption: "French soldiers study a map during the German advance into France in the Spring of 1940"

921

"…Now I saw train load after train load of the same old 40 and 8 cars bearing French soldiers with their tanks and guns on flat cars along the coastal railroad as reinforcements to stem the tide in Flanders. But too late. The German sweep between the Allied armies in Flanders and Paris was more than half way to the sea. Now the 40 and 8 cars were speeding back – as fast as French military trains could speed between passenger trains loaded with refugees – before the Germans reached the coastal railroad. When it was cut the British army was cut off from its main ports of supply. Its retreat to join the main French army to the south was blocked…"

RE: excerpt from an article authored by war correspondent *Frederick Palmer* that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "I Was There!"

922

923

Only One Way Out

924

The Wehrmacht had defied military doctrine, skirting the *Maginot Line* and advancing deep into France through Luxembourg and the *Ardennes* forest. The German onslaught moved with lightning speed as German tanks fought their way north, to secure the coastal ports and annihilate the trapped Allied armies. The Germans reached the *English Channel* on May 21st 1940, cutting-off and enveloping the Allied armies. 925

"…Being encircled, French and British regiments in Flanders were fighting desperately, losing as many as half and even two-thirds of their numbers. The Belgians' commissariat had utterly broken down. The British too were running extremely short of food. Then King Leopold surrendered and the weary British sought to fill the resultant gap under a hurricane of fire…"
RE: excerpt from an article authored by war correspondent *Frederick Palmer* that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "I Was There!" 926

"…For the British only one way out was left, and that was to leave their guns and tanks and equipment as booty for the enemy and evacuate all of their surviving soldiers they could back to Britain…"
RE: excerpt from an article authored by war correspondent *Frederick Palmer* that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "I Was There!" 927
Above: caption: "The evacuation of Flanders"

928

Inexplicably (some believe as a peace overture to England), Hitler called a halt to the Panzer Divisions' advance. The reprieve lasted 48 hours, long enough for the British to defend Dunkirk and evacuate (with whatever seaworthy craft they could gather) what remained of the Allied armies.
Left: caption: "German Panzer troops reach the French coast, June 10, 1940 (photo taken by E. Rommel)"
Right: caption: "Those that remained: British and French prisoners are marched into internment at Dunkirk" 929

There Was Chaos

930

"…Thus two separate battles were raging at the same time, one north and one south of the defense line on which the British had labored through the winter. The German sweep to the north soon had Arras, the British Army Headquarters town. G.H.Q. too was on the move not to be cut off from the army in Flanders. Telephone lines were broken. There was chaos...One battle was hopeless for the Allies. What of the other? This the French must fight alone south of Paris. They still had immense numbers of troops in reserve. But could they form them up in time?..."

RE: excerpt from an article authored by war correspondent *Frederick Palmer* that app-eared in the August 1940 issue of *The American Legion Magazine* entitled: "I Was There!"

931

"…The tanks now rolled in a long column through the line of fortifications and on towards the first houses, which had been set alight by our fire. In the moonlight we could see the men of 7th Motorcycle Battalion moving forward on foot beside us…"

***Erwin Rommel* – Panzer Division Commander**

RE: Rommel (who would later gain fame in the North African desert as the "Desert Fox") led the 7th Panzer Division as it crashed through the Belgian defenses into France, skirting the *Maginot Line*. On May 16th 1940, Rommel and his forces raced behind and parallel to the Maginot Line and then turned north to attack the fortifications from behind.

932

"…Occasionally an enemy machine-gun or anti-tank gun fired, but none of their shots came anywhere near us. Our artillery was dropping heavy harassing fire on villages and the road far ahead of the regiment. Gradually the speed increased. Before long we were 500 -1,000 - 2,000 - 3,000 yards into the fortified zone. Engines roared, tank tracks clanked and clattered. Whether or not the enemy was firing was impossible to tell in the ear-splitting noise. We crossed the railway line a mile or so southwest of Solre le Chateau, and then swung north to the main road which was soon reached. Then off along the road and past the first houses…"

***Erwin Rommel* – Panzer Division Commander**

Above L&R: Rommel speaks with a half-track crew (left) and consults maps in the field with his staff (right) – France, May 1940

933

"…The people in the houses were rudely awoken by the din of our tanks, the clatter and roar of tracks and engines. Troops lay bivouacked beside the road, military vehicles stood parked in farmyards and in some places on the road itself. Civilians and French troops, their faces distorted with terror, lay huddled in the ditches, alongside hedges and in every hollow beside the road. We passed refugee columns, the carts abandoned by their owners, who had fled in panic into the fields…"

***Erwin Rommel* – Panzer Division Commander**

Left: caption: "French fleeing south to escape the German offensive – 1940"

934

Top Left: caption: "A destroyed French tank"

Top Right: "Germans examine a captured French armored car"

Left: caption: "A French tank-man surrenders"

935

"The Germans recognized the potential of massed armored forces in conducting rapid, mobile operations, while French armored units were committed to battle in a piecemeal fashion"

***Robert A. Doughty,* Author**

936

Into the Woods…

937

"…On we went, at a steady speed, towards our objective. Every so often a quick glance at the map by a shaded light and a short wireless message to Divisional H.Q. to report the position and thus the success of 25th Panzer Regiment. Every so often a look out of the hatch to assure myself that there was still no resistance and that contact was being maintained to the rear…"

Erwin Rommel **– Panzer Division Commander**

RE: although France's strategy was one of defense rather than offense, it actually had about the same number of armored vehicles on the western front as did Germany

Left: caption: "A German Panzer Division passes through the Ardennes"

Right: caption: "German Light Panzer tank"

938

…and Out of the Woods

939

940

Useless

941

"…By now the Maginot Line had been flanked. It was becoming as useless as the extension along the Belgian frontier. The French faced open warfare when all their plans had been made to hold fast in the Maginot Line…"

RE: excerpt from an article authored by war correspondent ***Frederick Palmer*** **that appeared in the August 1940 issue of** ***The American Legion Magazine*** **entitled: "I Was There!"**

Left: caption: "Germans look at a captured French trench in the Maginot Line"

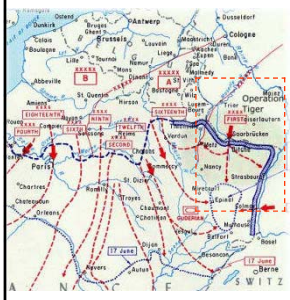
942

Left: caption: "Soldiers of the German Wehrmacht in front of the memorial to the French Minister of War Andre Maginot, after whom the French fortifications on the German-French border were named. Revigny-sur-Ornain, France. June 1940."

943

They Shall Not Pass

944



On June 14th 1940 (the day Paris fell) the German First Army went over to the offensive in "Operation Tiger" and attacked the *Maginot Line* between St. Avoid and Saarbrucken, achieving penetrations in several locations. Three divisions advance through the Maginot Line into the Vosges Mtns.

Left: caption: "German attack in June 1940, France

945

As the Americans would later do in 1944, the Wehrmacht employed a three-pronged strategy for attacking the *Maginot Line*:

1) Weaken the forts defensive capability through concentrated heavy artillery and bombing;

2) Move in close and blind the defenders by destroying apertures with line-of-site fire from high-velocity 88mm cannons;

3) Direct combined arms assault

Left: caption: "44th Infantry destroyed Maginot Line Fortress Simserhof, December 1944"

946

Run Rabbit Run

947

At each main-line *Maginot Line* gros ouvrage, all German assaults failed. Despite superior heavy weapons, the forts went unscathed. Intense barrages by siege cannon (which accurately placed 2K-pound armor-piercing shells on the forts) did no discernable damage. Typically, German assault teams with their shaped charges were unable to get close enough to place them. The French pounded the assailants every move with accurate and deadly artillery barrages from the forts. At *Fort Simserhof*, soldiers from the German 257th Division tried and failed to get close to the fort. German officers stated that they "felt like rabbits trying to run from shotguns," as nearly 15K artillery shells accurately targeted their every move. Vehicles that got close were destroyed. As well, the forts furnished supporting fire to one another, as planned. Every main-line fort held out, without a single French artillery piece neutralized by enemy action.

948

The Germans carefully arrayed powerful howitzers, heavy mortars, 88mm guns, dive-bombers and assault engineers against the ***Maginot Line***. On June 19th 1940, as the battle raged over ***Fort Lembach***, a German 420mm howitzer (above L&R) scored several well-placed rounds on ***Fort Schoenenbourg***, hitting the concrete surface of a combat block which gouged a 70cm deep crater (which represented the greatest damage inflicted by any heavy-artillery piece with a single round against the Maginot Line forts). Other shells bored as much as 20 meters deep into the loamy soil surrounding the ouvrage and detonated as close as five-meters from the underground galleries of the combat blocks. According to the French, the shock was perceived merely as: "a harmless tremor in the passage-way." On June 19 and 20, ***Stuka*** dive bombers also dropped 1,100 lb. bombs on the fort, placing 40% on or near the target. In the following days, some bombers dropped 2,200 lb. bombs. The Luftwaffe continued its attacks on Schoe-nenbourg until June 22nd 1940.

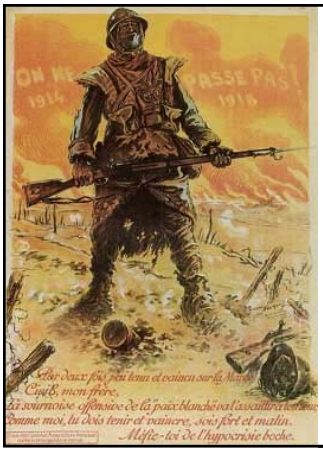
949

950

Above: caption: "German Gen-eralleutnant Kurt Daluege vis-iting the Ouvrage Hackenberg fortification on the Maginot Line near Thionville, Moselle, France, May 1940. The party was entering the munitions en-trance."

Left: caption: "A soldier from the 44th Infantry Division, Seventh Army, inspects the damage inside recently cap-tured Fort Simserhoff, France - a Maginot Line fortification previously held by Germans. Dec. 1944"

951



Left: caption: "***On Ne Passe Pas!*** Propaganda poster by Maurice Neumont." "They shall not pass" (in French: "On ne passe pas") is a slogan used to express de-termination to defend a position against an enemy. It was most famously used during the ***Battle of Verdun*** during WWI by French General ***Robert Nivelle***. It app-eared on propaganda posters (such as the one at left by ***Mau-rice Neumont***) after the ***Second Battle of the Marne***. With war clouds gathering over Europe once again, it was adopted as a motto and uniform badge by units manning the ***Maginot Line***. The phrase was also used by anti-fascists during the 1930s (i.e. during the ***Spanish Civil War***)

952

"They were Lions led by Donkeys"

RE: the German army's opinion of the French army during WWI

Left: caption: "*On Ne Passe Pas!* - on a French medal commemorating the Battle of Verdun"

953

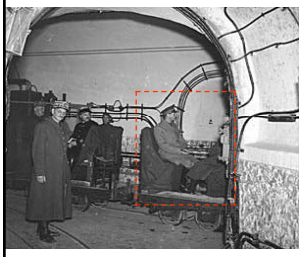
Above: French military "On Ne Passe Pas" Maginot Line badge ("They Shall Not Pass")

954

During the Sitzkrieg, a plethora of dignitaries and journalists visited a carefully selected assortment of positions on the *Maginot Line*. Some of the visitors included the *Duke of Windsor*, *Winston Churchill*, *Anthony Eden* and *Edouard Daladier*. On another occasion, Colonel *Sumner Waite* – American military attache to the French army, visited the fortifications after which he produced numerous, detailed intelligence reports for the U.S. Army.

955

Above: caption: "French and British military officials study a Maginot Line turret"



On December 9th 1939, *King George VI* of England visited the *Hackenberg* and *Mont des Welches* installations, accompanied by French Generals Gamelin, Pretelat and 3rd Army Commander General Conde.

Left: caption: "King George VI (highlighted) touring the Hackenberg ouvrage"

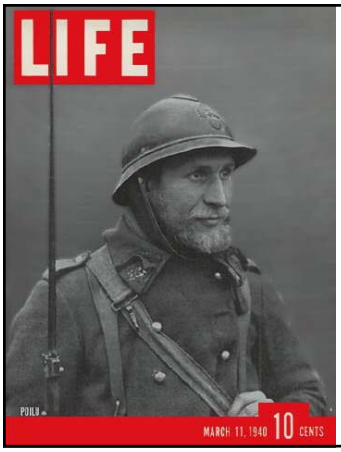
956

The result of the French and foreign media tours were many articles, including photographs, appearing in popular magazines such as *LIFE* and French publications such as *Match* and *L'Illustration.* This flow of positive publicity served to reassure the French and their allies concerning the impregnability of the "Ligne Maginot" (as the French public referred to it). However, British general *Alan Brooke*, who visited the French 9th Army, criticized the un-military attitude and laxness of the troops. He concluded that this behavior was indicative of an army unprepared for the coming storm. By the time the Blitzkrieg arrived on the Maginot Line's doorstep in the spring of 1940, nearly two million French troops manned the fortifications supported by 250K BEF troops.

Left: caption: "French troops of the Maginot Line are transported through a deep underground tunnel"

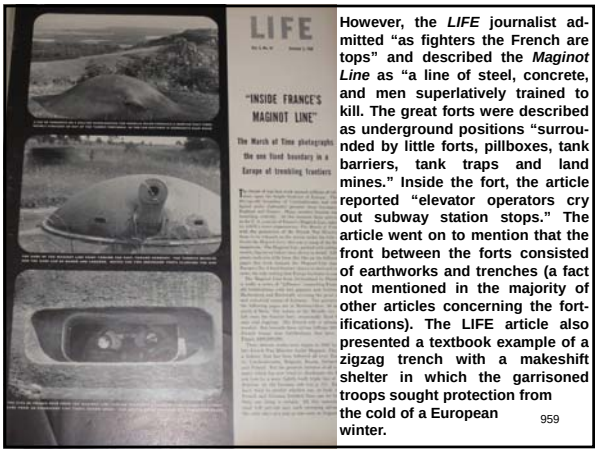
Right: caption: "A visit to a Maginot Line fortification's solarium provides artificial sunlight to these subterranean soldiers"

957



The cover of the March 11th 1940 issue of *LIFE* magazine (left) featured a French soldier ("Poilu") of the 165th Fortress Infantry Regiment standing guard with fixed bayonet. The bearded, untidy French soldiers emanating from the article's accompanying photographs earned the scorn of top British General/s *Alan Brooke* and *Bernard Montgomery.* "Monty" would later attribute the ensuing defeat to the lack of military bearing and slovenly dress of the French soldiers. The sheepskin "coatee" (worn by the French soldiers to keep warm) drew particular scorn from the LIFE reporter, who wrote scathingly that the troops at the front were "not a chic spectacle" and "are allowed a latitude of dress that the British or German Army would never permit."

958



However, the *LIFE* journalist admitted "as fighters the French are tops" and described the *Maginot Line* as "a line of steel, concrete, and men superlatively trained to kill. The great forts were described as underground positions "surrounded by little forts, pillboxes, tank barriers, tank traps and land mines." Inside the fort, the article reported "elevator operators cry out subway station stops." The article went on to mention that the front between the forts consisted of earthworks and trenches (a fact not mentioned in the majority of other articles concerning the fortifications). The LIFE article also presented a textbook example of a zigzag trench with a makeshift shelter in which the garrisoned troops sought protection from the cold of a European winter.

959

960

The Fatal Conclusion

961

"…There on the Somme-Aisne Line, where they made their first stand, they had no such trench system as we knew in the World War. The Germans swinging south, after the gap had been cut through to the coast, were pushing forward their infantry behind their tanks in processions of German and commandeered Belgian and Dutch trucks. The French had time to dig only shallow trenches. They had no barbed wire, in the face of the enemy's lightning barrages. They could not get enough reserves up to form or maintain an intact line. There were always gaps or weak points which gave an opening for a rush of tanks, supported by planes, to break through. And that was the story for the French army to the fatal conclusion…"

RE: excerpt from an article authored by war correspondent *Frederick Palmer* that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "I Was There!"

Left: caption: " A German mechanized column swings along a dirt road"

962

963

Burning Bridges

964

"…From the start the Germans had the jump. They not only had speed and numbers, but they knew how and where to use the numbers. While the Allies were set for the defensive waiting for the blow, the Germans chose where they should strike blow on blow with their smashing concentrations. They applied the old principles of war with the most modern equipment. Generalissimo Gamelin gave them the wide-open opportunity to strike the Allied armies in the rear at the same time as in front. Allied soldiers were sacrificed by a blunder which ranks with that of the general who burned the bridges over a river before his own troops were across…"

RE: excerpt from an article authored by war correspondent *Frederick Palmer* that appeared in the August 1940 issue of *The American Legion Magazine* entitled: "I Was There!"

965

Above: caption: "A German tank crossing the Ourcq River"

966

967

"It is with a heavy heart that I tell you today that we must stop fighting"
Marshall *Philippe Petain*
RE: within three weeks after Hitler unleashed his blitzkrieg invasion of the Low Countries and France (on May 10th 1940), a large part of the BEF, accompanied by remnants of the French army, was trapped against the *English Channel* and compelled to flee the continent at Dunkirk. The German advance continued to sweep southward driving before it not only the retreating French army, but an estimated ten million French refugees.

968

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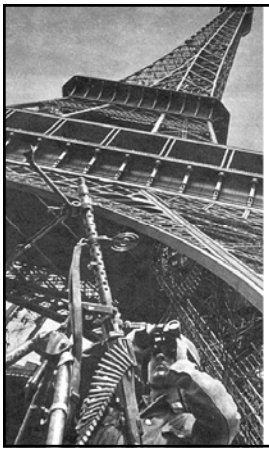


Paris was declared an open city, allowing the Wehrmacht to enter the French capital on June 14th 1940 without resistance. The French government continued the flight southward to Bordeaux, where it disintegrated. A new government was formed with WWI hero Marshall Petain at its head. On June 17th 1940, Petain announced, in a radio broadcast to the French nation, an end to the fighting. This was the final straw that broke the back of the French resistance to the German invasion.

Left: caption: "German sentry mans an aerial machine-gun at the foot of the Eiffel Tower"

970

971

972

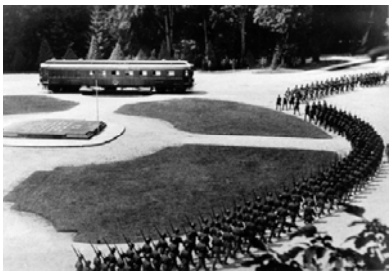
The new French government called on the Germans for an armistice to end the fighting by June 25th. Hitler dictated that the French capitulation take place at Compiegne, a forest north of Paris. This was the site where, twenty-two years earlier, the Germans had signed the Armistice ending WWI. Hitler's intentions were to disgrace the French and avenge the German defeat.

973

974

Left T&B: to further the French humiliation, Hitler ordered that the signing ceremony take place in the same railroad car that hosted the armistice signing ending the First World War. The Armistice was signed on June 22nd 1940. Under its terms, two thirds of France was to be occupied by the German army, the French army was to be disbanded and France was required to bear the cost of the German invasion.

975



976

"The time is now three eighteen p.m. Hitler's personal flag is run up on a small standard in the center of the opening. Also in the center is a great granite block which stands some three feet above the ground. Hitler, followed by the others, walks slowly over to it, steps up, and reads the inscription engraved in great high letters on that block. It says:

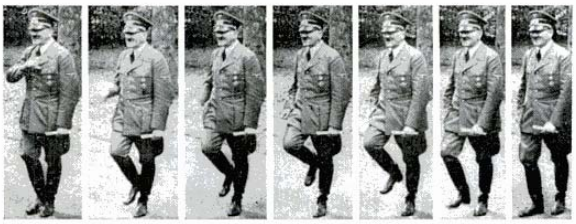
HERE ON THE ELEVENTH OF NOVEMBER 1918 SUCCUMBED THE CRIMINAL PRIDE OF THE GERMAN EMPIRE...VANQUISHED BY THE FREE PEOPLES WHICH IT TRIED TO ENSLAVE.

RE: excerpt from a radio report on the French surrender from *CBS News*

977

"...Hitler reads it and Goring reads it. They all read it, standing there in the June sun and the silence. I look for the expression on Hitler's face. I am but fifty yards from him and see him through my glasses as though he were directly in front of me. I have seen that face many times at the great moments of his life. But today! It is afire with scorn, anger, hate, revenge, triumph. He steps off the monument and contrives to make even this gesture a masterpiece of contempt. He glances back at it, contemptuous, angry - angry, you almost feel, because he cannot wipe out the awful, provoking lettering with one sweep of his high Prussian boot..." 978

RE: excerpt from a radio report on the French surrender from *CBS News*



"…He glances slowly around the clearing, and now, as his eyes meet ours, you grasp the depth of his hatred. But there is triumph there too - revengeful, triumphant hate. Suddenly, as though his face were not giving quite complete expression to his feelings, he throws his whole body into harmony with his mood. He swiftly snaps his hands on his hips, arches his shoulders, plants his feet wide apart. It is a magnificent gesture of defiance, of burning contempt for this place now and all that it has stood for in the twenty-two years since it witnessed the humbling of the German Empire…"

RE: excerpt from a radio report on the French surrender from *CBS News*

979

980

"...It is a grave hour in the life of France. The Frenchmen keep their eyes straight ahead. Their faces are solemn, drawn. They are the picture of tragic dignity…"

RE: excerpt from a radio report on the French surrender from *CBS News*

981

982

Part 14

Epilogue

983

Victory Tour

984

"Three days after the beginning of the armistice we landed at Le Bourget airfield. It was early in the morning, about five-thirty. Three large Mercedes sedans stood waiting. Hitler as usual sat in the front seat beside the chauffeur…We drove through the extensive suburbs directly to the Opera, Charles Garnier's great neobaroque building. It was Hitler's favorite and the first thing he wanted to see…Afterward, we drove past the Madeleine, down the Champs Elysees, on to the Trocadero, and then to the Eiffel Tower, where Hitler ordered another stop. From the Arc de Triomphe with its tomb of the Unknown Sol-dier we drove on to the Invalides, where Hitler stood for a long time at the tomb of Napoleon. Finally, Hitler inspected the Pantheon, whose proportions impressed him…"
Albert Speer (Hitler's Architect)

985

Cast a Giant Shadow

986

"…'Wasn't Paris beautiful? But Berlin must be made far more beautiful. In the past I often considered whether we would not have to destroy Paris,' he continued with great calm, as if he were talking about the most natural thing in the world. 'But when we are finished in Berlin, Paris will only be a shadow. So why should we destroy it?'"
Albert Speer
Left: caption: "Tourist Hitler poses at the Eiffel Tower. Albert Speer is at the left."

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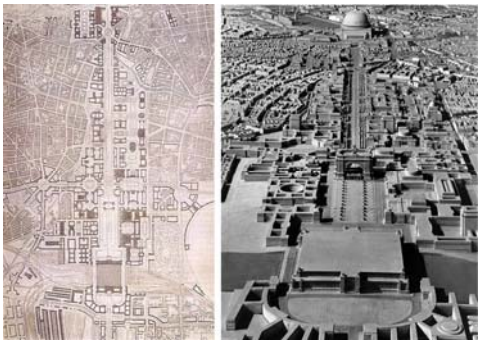

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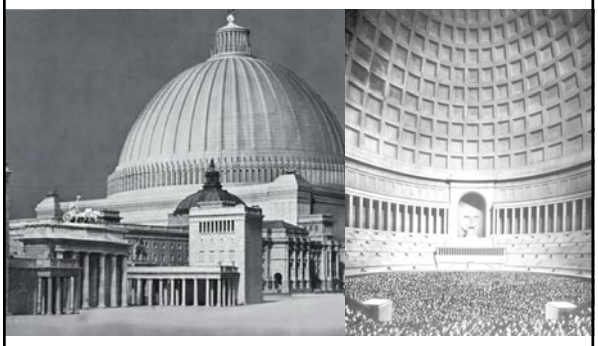

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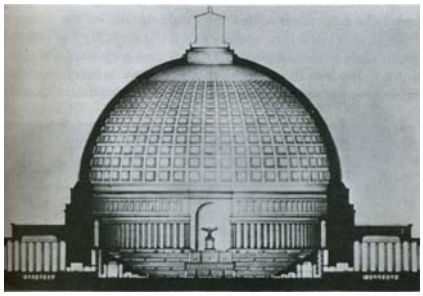

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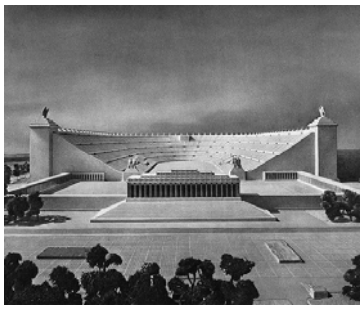

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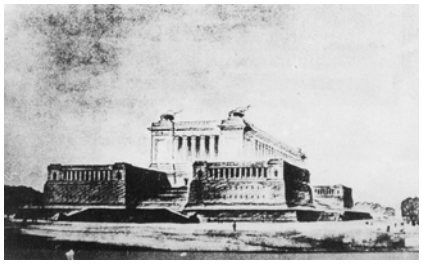

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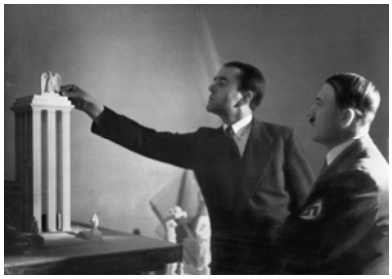

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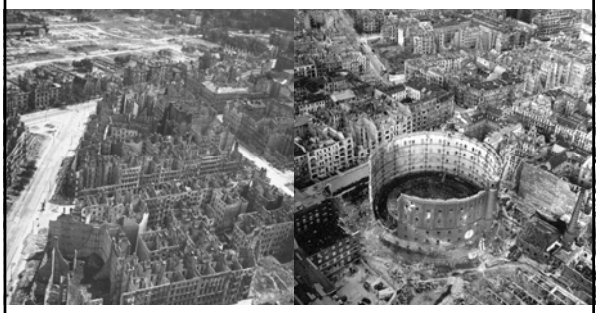

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1000

1001

France Divided

1002

Under the terms of the armistice, France was divided into two sections: *Occupied France* (under direct German control) and *Vichy France* (a quasi-independent territory with 84yo Marshall Petain - hero of the First World War, as its nominal head-of-state (his lieutenant – *Pierre Laval*, held the real power in the Vichy government (executed in 1946).

1003

Cognitive Dissonance (?)

1004

Cog·ni·tive Dis·so·nance – *noun* - the state of having inconsistent thoughts, beliefs, or attitudes, especially as relating to behavioral decisions and attitude change
Dictionary Definition

1005

"A problem for all who think about it is how to explain the amazing mental attitude which seems to prevail today in France. Most Frenchmen seem to regard the total collapse of their country with a resignation that has the appearance of indifference. They are, indeed, dazed by the rapidity of the collapse, but register no violent reaction to so great and unexpected a shock. Soldiers in considerable numbers are being demobilized and returning home, and so, it is felt, the catastrophe cannot be too appalling. The German propaganda machine is working on this state of mind. The R.A.F. attacks upon the aerodromes in the occupied region are used as evidence that the British, who have already deserted their Ally, are now making direct onslaughts on the Frenchman's home. There is little interest among the ordinary people in the maneuvers of the Petain Government. The Marshal himself is not looked upon with any enthusiasm. His achievements as a soldier in the last War are generally recognized, but his last minute entry into politics makes little stir in the Frenchman's heart. On the other hand Laval (a lieutenant of Petain's and the real head of the government), who has never been popular, excites almost general distaste…"
London Times

1006

Cognitive Dissonance: states that contradicting cognitions serve as a driving force that compels the mind to acquire or invent new thoughts or beliefs, or to modify existing beliefs, so as to reduce the amount of dissonance (conflict) between cognitions
Urban Dictionary

1007

Mission Accomplished

1008

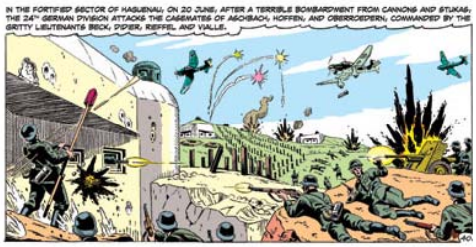
"The line was a failure in the eyes of the average French person. Yet the most modern fortification system of its day actually fulfilled its mission. It obliged the German Wehrmacht to attack through the Belgian plains again, as in 1914, and immobilized part of its forces."
Michael Seramour, **French Author**
Left: caption: "German officers inspect a Maginot Line fortification"

1009

1010

During WWII, many misconceptions about the *Maginot Line* became firmly entrenched. For example, the famous German General *Erwin Rommel* downplayed the line's strength and importance when he jubilantly claimed he had passed through it with ease. In reality, he had not even come near it. Later, in 1944, those American soldiers who passed through some small field works of the Maginot Line confirmed Rommel's assessment. However, those American GIs who ran into German units firmly ensconced in the Line's great forts attested to the Maginot Line's formidability.
Left: caption: "American soldiers at the Maginot Line (Hochwald West Fortress)"

1011



1012

Other Purposes for the *Maginot Line* included:
1. To avoid a surprise attack and to give alarm;
2. To cover the mobilization of the French Army (which took between 2 and 3 weeks);
3. To save manpower (France counted 39 million inhabitants, Germany 70 million);
4. To protect *Alsace* and *Lorraine* (returned to France in 1918) and their industrial basin;
5. To be used as a basis for a counter-offensive;
6. To hold the enemy while the main army could be brought up to reinforce the line;
7. To show a non-aggressive posture and compel the British to help France if Belgium was invaded
Left T&B: Maginot Line fortifications

1013

Despite the best efforts of French military intelligence to promote misconceptions about their fortified line, the Abwehr (German military intelligence) had managed to unravel many of the secrets of the Maginot fortifications by the time war broke out in September 1939. The French believed it was impossible for the Wehrmacht to get through the *Ardennes* with armored divisions. However, German Army Group-B (with one-million men and 1,500 tanks) crossed the "impenetrable" forests of the Ardennes successfully. Once the *Maginot Line* had been flanked and isolated, it had little strategic value. However, most of the *Maginot Line* ouvrages surrendered only *after* the Armistice was signed (on June 22nd 1940)
Left: "Railway turntable, Maginot tunnel"

1014

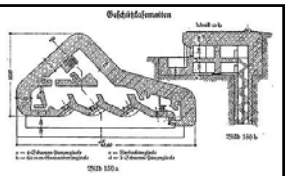

Oberkommando des Heeres
Gen. St. d. H.
Gen. d. Pi. u. Bef. d. Ob. d. H.
Abt. Auswertung fremder Landesbefestigungen

Berlin, den 1. 10. 1941

Denkschrift
über die französische
Landesbefestigung

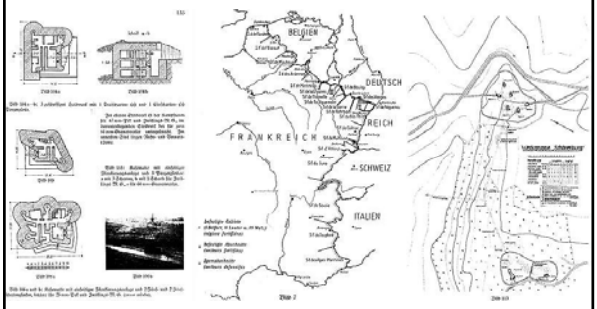
Nur für den Dienstgebrauch!

Berlin 1941
Gedruckt in der Reichsdruckerei



Above & Left: in 1941, a German-language document entitled: "Denkschrift uber die Franzosische Landesbefestigung" (Memorandum on French Fortifications) was produced as a detailed study of the *Maginot Line*; its construction, layout and German attacks to try and capture the line during the 1940 campaign in France. It's the primary source for the German point-of-view of the *Maginot Line* and includes 490 photographs, illustrations, diagrams and maps of the Maginot Line and the Wehrmacht's operations against it.

1015



1016

The main purpose of the *Maginot Line* was to defend against another German attack where the French generals thought it most likely to occur. They decided that since Belgium and Holland were neutral, the Germans would not invade them in order to get to France (despite the fact that the Germans had done precisely that in August 1914). They were sorely mistaken and the Germans did do exactly that, this time with highly mobile forces and fleets of airborne artillery.

1017

1018

Fall Gelb

1019

The invasion of France was code-named "Fall Gelb." According to that plan, the Wehrmacht; organized into three Army Groups (A, B and C), would invade France on May 10th 1940. Army Group A would be delivered through the Ardennes and would provide the main thrust. It was composed of three Armies (the Fourth, Twelfth and Sixteenth) and *Panzer-Group Kleist*, which was to spearhead the advance. To the immediate north of Panzer-Group Kleist was *XV Armeekorps* (under the control of the Fourth Army) with the mission to protect Kleist's right flank. XV Armeekorps was was composed of two panzer divisions (5th and 7th) and one infantry division (32nd).

1020

- 10 May - German forces advance into Holland and Belgium;
- 11 May - German Panzer forces break through Allied defenses at Sedan, effectively by-passing the Maginot Line;
- 13 May - Germans cross River Meuse into France;
- 20 May – General Guderian's tanks reach Abbeville, cutting off Allied forces in Belgium;
- 09 June - Tanks led by General Rommel cross the Seine;
- 16 June - French PM Paul Reynaud resigns; new government formed by Marshal Philippe Petain;
- 22 June - Franco-German armistice signed; northern France occupied, the south-east to remain under control of Petain's government in Vichy

1021

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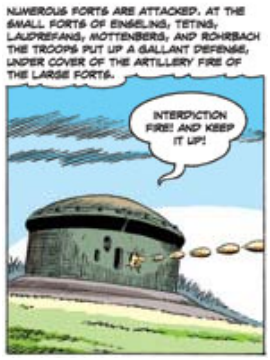

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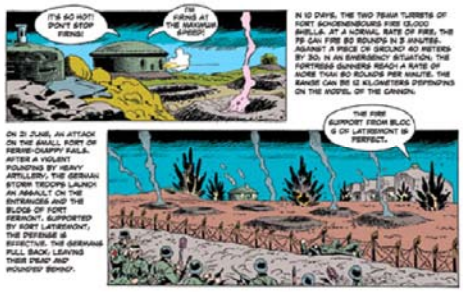


1024

1025

Tainted Honor

1026

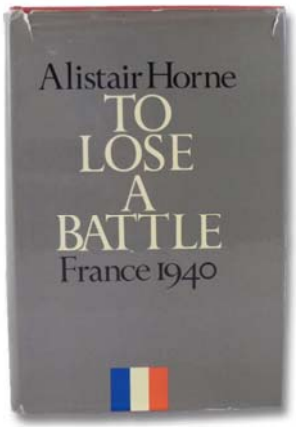
"After the war, as we all know, de Gaulle wanted to wipe out the memory of the debacle. So the focus was on the Resistance and on the Army of Africa, which fought the Germans from 1944. The sacrifice of the soldiers who fought in 1940 was forgotten." 1027
Dominique Lormier, **Historian/Author**

"Morale was not nearly as low as Horne says. People have forgotten that in many places the French fought hard and bravely and put the Germans in real difficulty. The figures speak for themselves. Of the 3,000 tanks the Germans deployed, 1,800 were put out of action. Of 3,500 planes they lost 1,600. In a month of fighting they lost 50,000 dead and more than 160,000 wounded. It was a genuine combat."
Dominique Lormier, **Historian/Author**
RE: many post-WWII historians have focused on the shortcomings of the French armed forces. No doubt, French commanders made terrible strategic errors. For example, they put their best forces into Belgium against the German feint and were dangerously exposed along the vital *Meuse River* at Sedan (which the German tanks had to cross after penetrating the *Ardennes*). 1028
Above: "View of the Meuse in the French Ardennes"

Top: caption: "An overview of the Meuse river as seen from Dinant fortress"
Bottom: caption: "The Meuse river at Houx" 1029

Top: caption: "French 'Char B1' tanks of the 37th Battalion, after they had been destroyed by their own crews on May 16, in Beaumont, just to the north of Froidchapelle."
Bottom: caption: "A German medic gives first aid to an injured soldier" 1030

Above: caption: "French soldiers examine the remains of a German light bomber Heinkel He 111, after it was shot down. France had not fallen yet." The French Air Force was large in size, but most of its planes were woefully out-of-date. On the ground, the concept of modern tank warfare (i.e. the concentrated armored thrusts made by Rommel and Guderian) had yet to be accepted by a French command structure that was still obsessed with infantry tactics. 1031



In his classic treatise on the subject: "To Lose a Battle: France 1940" (left), British historian/author *Alistair Horne* made much of the collapse of morale among the French poilu. Like many writers, he claimed that the memory of 1914-18 still haunted the French leadership which meant there was little appetite for a fight; while the bitter ideological divisions of the 1930s (with far-left and far-right at times battling on the streets of Paris) had sapped the patriotic spirit of the poilu. 1032

1033

At the ***Battle of Hannut*** (which took place in Belgium) French ***Somua*** tanks, though outnumbered, proved every bit as powerful as the Panzers they confronted. The result was a tactical victory for the French. Another memorable event was General de Gaulle's tank charge at Moncornet and the ***Battle of Stonne*** (a village near Sedan which changed hands nearly twenty times over days of bitter fighting). The French army also capably covered the British retreat to Dunkirk, with the result that far more men were successfully evacuated than would otherwise have been possible. As well, there was tough fighting against the Italians in the Alps. On the ***Maginot Line*** itself, only a handful of forts had capitulated by the armistice in mid-June 1940. For many, the greatest injustice has not been the failure to commemorate these minor victories but, rather, the slur on the courage of the individual French fighting-man during the ***Battle of France.***

Left: caption: "French Char D2 tank, 1940" 1034

Right: caption: "12 June 1940: Refugees fleeing during the aerial bombardment of Dunkirk"

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Valor in the Face of the Enemy

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On May 12th 1940, at Amifontaine in Northern France, the pilots of 12 Squadron assembled before their Commanding Officer and were told: "This bridge has got to be destroyed at all costs." When he called for volunteers all pilots stepped forward. With only five aircraft available names were drawn from a hat and with little time to waste, five bombers took off and headed for the target escorted by Hurricanes. The lead aircraft (attacking the ***Veldwezelt Bridge***) was piloted by Flying Officer ***Donald Edward Garland***, a 21yo Irishman. Behind him sat Sergeant ***Thomas Gray***, 25yo, an experienced observer from Devizes. In broad daylight there was no hope of surprising the enemy and with an estimated three-hundred anti-aircraft guns defending the bridge, they knew well what they were in for. As they ran into the target, a seemingly impenetrable wall of deadly fire rose to greet them from the German flak guns. Diving onto the target, bombs were released at the lowest altitude possible. Watching from above, the view of the Hurricane pilots was obscured by the fire and smoke from the defenses but then, remarkably, an explosion was seen as one bomb struck the western truss of the bridge. With the bridge blown, the bomber crews sought to make their escape in aircraft by then badly damaged by enemy fire.

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Both FO Garland (left) and Sgt. Gray (right) were posthumously awarded the ***Victoria Cross*** in recognition of their: "Valor in the Face of the Enemy." They were the first RAF VCs awarded in WWII. 1038

"The bravery and sacrifice of all the crews who attacked the bridges on 12 May 1940 is an inspiration to all those who serve on 12 Squadron today. One can only imagine the terror as they attacked knowing their chances of survival were slim. The determination to not only continue with the attack but to destroy a bridge with an unguided bomb in the face of such withering fire is truly remarkable. As members of this historic squadron we are humbled to be able to participate in this act of remembrance of their action during WWII, particularly as we ourselves prepare for combat operations."

Tornado GR4 pilot Flight Lieutenant *George Le Cornu*, May 2015 1039

Left: the *Victoria Cross*

Whether it was the fighters which broke through the Hurricane cover or the intense ground fire is not certain, but four of the five RAF bombers were shot down (above). As the German blitzkrieg swept through the *Ardennes* forest, the *Low Countries* and around the *Maginot Line*, the Allies sought to use the natural barrier of the *Meuse River* to stop the advance. Despite fierce resistance, the British and French forces had no alternative but to withdraw and the German army was swift to exploit a failure by the Allies to destroy a pair of bridges crossing the *Albert Canal* in Belgium. 1040

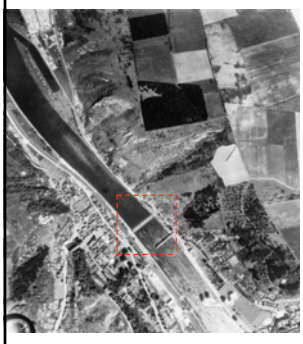
"My father was flying these ancient bombers called Amiots. They were hopelessly old-fashioned. When the Germans put their pontoon over the river Meuse at Sedan, it was vital to throw everything at them. My father had just flown a mission and he was not supposed to go up again. But the thought of his squadron flying into such danger without him was unacceptable. So he stopped one of the Amiots as it was taxiing on the runway, and ordered one of the men off so he could take his place. Of course they were quickly shot down by German flak and my father was killed."

Philippe de Laubier

RE: the heroic death of *Dieudonne de Laubier* – a French Air Force Group Commander, in May 1940 1041

Above: caption: "Amiot 143 Bomber"

1042



Left: caption: "Vertical aerial photograph taken during a bombing attack by Bristol Blenheim Mk IVs of Nos. 15 and 40 Squadrons on the pontoon bridge erected by the 7th Panzer-Division across the River Meuse at Dinant. A salvo of bombs can be seen exploding on engineering workshops on the eastern bank and across the river to the railway lines on the opposite side, (lower center)."

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Above: caption: "German troops with French prisoners crossing the Meuse on 15 May 1940 near Sedan" 1044

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"The French colonial troops fought with extraordinary determination. The anti-tank teams and tank crews performed with courage and caused serious losses."
General *Erwin Rommel*
Left: caption: "Captured French colonial soldiers, France 1940"

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"Despite the major tactical errors of the Allied command, the soldiers put up an obstinate resistance with a spirit of sacrifice worthy of the poilus of 1916."
***Heinz Guderian* – German General**
Above: caption: "KIA in a smashed French position, France 1940"

1048

"These soldiers have been doubly punished. Not only did they lose their lives in the Battle of France, but then they lost the battle of our memories. It is a denial of memory that verges on the taboo. It is time to bring it to a close."
***Charles de Laubier,* Journalist**
RE: in the *Le Monde* newspaper, Charles (grandson of *Dieudonne de Laubier*) has written a call for a national day of commemoration to honor the estimated 90K French dead in the *Battle of France*. Sadly, there is no national memorial for the men who died in defense of France and their story is rarely told (only individual memorials at the ouvrages). Like the *Maginot Line* itself, they remain misunderstood by history.
Left: caption: "Dead French Soldiers, France, 1940"

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One Alone

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"Faced by the bewilderment of my countrymen, by the disintegration of a government in thrall to the enemy, by the fact that the institutions of my country are incapable, at the moment, of functioning, I General de Gaulle, a French soldier and military leader, realize that I now speak for France"

***Charles de Gaulle,* Commander - Free French Forces (1940)**

Left: WWII Free French poster

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"How can anyone be expected to govern a country that has two hundred and forty-six varieties of cheese?"

"Men are of no importance. What counts is who commands."

"The better I get to know men, the more I love dogs"

"I have against me the bourgois, the military and the diplomats, and for me, only the people who take the Metro"

"Deliberation is the work of many men. Action, of one alone."

Left: *Charles Andre Joseph Marie de Gaulle* (1890-1970)

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Above: plaque on the *Eiffel Tower* commemorating August 25th 1944, when Free French troops restored the Tricolor to its rightful place atop the proud tower – symbol of Paris and of the French nation

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On August 25th 2004, Paris remembered the liberation of the French capital sixty years earlier. Ceremonies, which drew thousands of people into the streets, began with six firefighters hoisting the French tricolor atop the *Eiffel Tower*, re-enacting the emotional moments of August 25th 1944, when the Tricolor – the national flag of the French Republic, flew from the flagpole atop the tower's campanile after four years of Nazi occupation.

Left: caption: "Paris firemen display France's tricolor flag on the Eiffel tower balcony in memory of their 1944 colleagues who did it on the day when Paris was liberated from Nazi occupation, August 25th"

1059

Maginot Line - a defensive barrier or strategy that inspires a false sense of security.
***Merriam-Webster* Dictionary**

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