

USN WEAPONS



AMERICAN WEAPONS

Mk. 14 Submarine Torpedo

The **Mark 14 Torpedo** was the U.S. Navy's standard submarine-launched torpedo of World War II. Although this weapon was plagued with many problems which crippled its performance at the beginning of the war, the Mk. 14 played a major role in the devastating blow U.S. Navy submarines dealt to the Japanese naval and merchant marine forces during the Pacific War. Approximately 4,000,000 tons of Japanese shipping were sunk by the Mk 14 torpedo.

The Mk. 14 was designed in 1930 to replace the Mk. 10, which had been in service since World War One and was standard in the older S-boats. Although the same diameter, it was longer, at 20.5 ft (6.25 m) and incompatible with older 15.25 ft (4.65m) torpedo tubes. To go with the Mk. 14's fairly small warhead, it introduced the sophisticated new Mk. 6 combined contact & magnetic influence exploder, designed to break ships' backs by causing explosions beneath them.



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Mk. 14 Submarine Torpedo

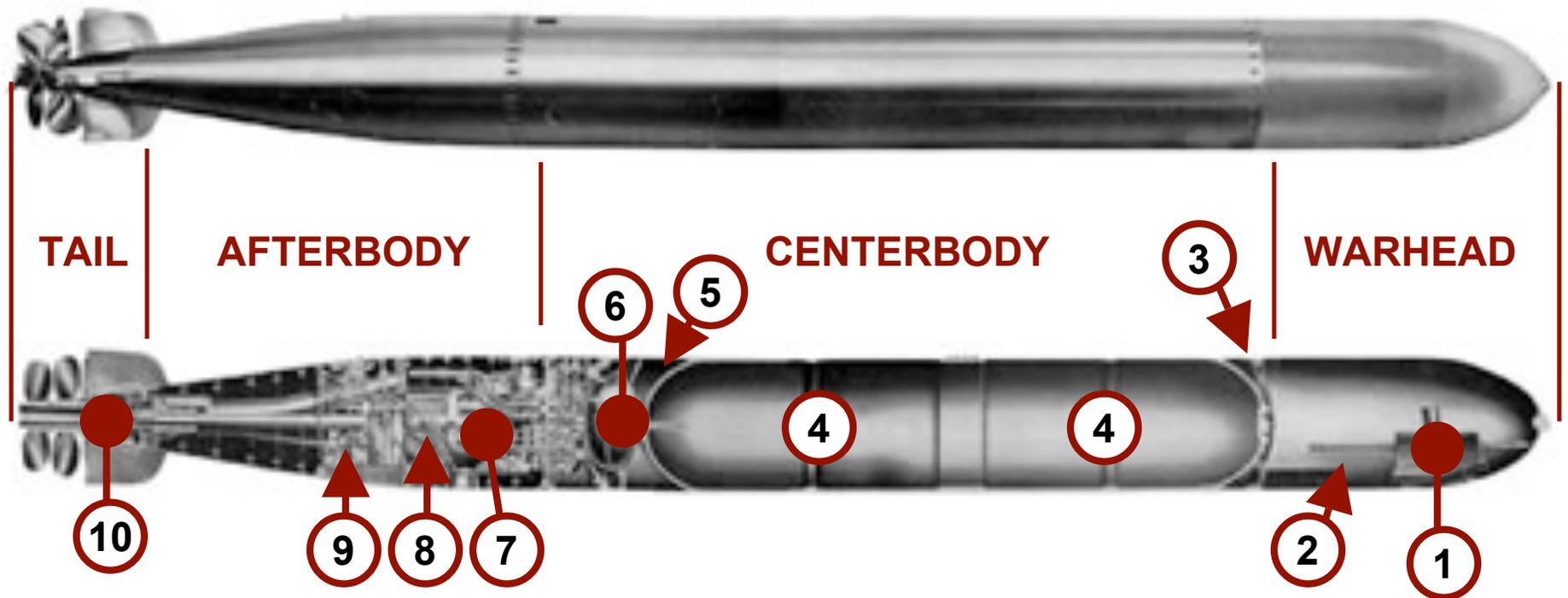


<i>Dimensions:</i>	
Diameter:	21"
Length Overall:	246" (20.5 ft)
Length of Warhead:	47.28"
Length of Centerbody:	116.16"
Length of Afterbody:	63.38"
Length of Tail:	19.9"
<i>Weights:</i>	
Complete: <i>(ready to fire, war shot)</i>	3,073 lbs.
Mk 16-1 Warhead: <i>(Pre/Early war)</i>	507 lbs. TNT
Mk 16-1 Warhead:	643 lbs. Torpex
Mk 16-4 Warhead:	666 lbs. Torpex
Fuel:	28.5 lbs.
Water:	83 lbs.
Oil:	24.4 lbs.

<i>Propulsion:</i>	
Type:	Steam Turbine / Wet-Heater
Turbine Speed:	L.P. 8,531 RPM / H.P. 12,123 RPM
Shaft HP:	L.P. 102 - 105 / H.P. 325 - 340
Reduction Ratio:	8.98:1
Propellers:	Counter-rotating Twin Props
Propeller RPM:	L.P. 950 / H.P. 1,350
<i>Performance:</i>	
Speed:	L.P. 31.5 knots / H.P. 46 knots
Range:	L.P. 9,000 yards / H.P. 4,500 yards
Total Run:	L.P. 10,200 yards / H.P. 5,800yards.

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Mk. 14 Submarine Torpedo



#1	Mk. 6 Exploder	#6	Fuel Flask
#2	Core Rod	#7	Main Engine
#3	Blow Valve	#8	Depth Mechanism
#4	Air Flask	#9	Gyro Mechanism
#5	Water Compartment	#10	Control Valve

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Mk. 16 Warhead

The Mark 14 torpedo is provided with a **Mark 16 Warhead**. The Mk. 16 is ogival in shape at its forward end, and cylindrical in its after part. A nose ring is provided at the forward end of the shell to facilitate handling. The shell itself is made of phosphor bronze. The warhead shell serves as a container to house the high-explosive charge and the exploder mechanism.

The Mark 16 warhead uses the Mk. 6 combined contact & magnetic influence exploder. The exploder mechanism fits in a cavity in the bottom of the forward end of the warhead. When the torpedo is launched, the exploder mechanism is in a “safe” condition. It cannot explode the booster charge, even if its detonator explodes accidentally.

During the first few hundred feet of the torpedo’s run, the exploder mechanism arms itself. When the torpedo reaches a safe distance from the firing ship, the exploder is completely armed. It will then detonate the main charge when the torpedo strikes any solid object.



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Mk. 6 Magnetic Exploder

Operation of the Mk. 6 Exploder

The exploder is really two exploders in one. A contact portion consists of an inertial ball and electrical contact (*Note: Later war development*). The influence portion consists of a voltage sensing coil, a voltage triggering thyatron, a capacitor, a solenoid and an inertia ring. Since the influence exploder is intended to detonate the charge immediately below a ship's keel the running depth of the torpedo is important and therefore that mechanism represents the third portion of the exploder.

The portions are described below in inverse order.

Depth Control

A hydrostatic sensor acts off of sea pressure and a linkage to the horizontal planes keeps the torpedo on desired depth. This is it in its simplest form, however, the problem gets complicated fast. Just as lift is created on the upper surface of an airplane wing by creating a partial vacuum, so the torpedo moving through water creates different water pressures along the side of the torpedo. The faster the torpedo, the greater the pressure difference. If the calibrated depth mismatches the real depth because of the difference between hydrostatic pressure and hydrodynamic pressure the torpedo is going to run off depth.

Extracted from: <http://www.submarineresearch.com/bull29.html>

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Mk. 6 Magnetic Exploder

Operation of the Mk. 6 Exploder ***(Continued)***

Influence Exploder

This exploder operates on the influence that a ship's hull has on the Earth's magnetic field. A ship's hull made of ferrous metal should cause a ripple in the Earth's field and when this is picked up by the exploder the sensing coil induces a voltage. The voltage triggers a thyatron which discharges a capacitor into a solenoid. The solenoid operates a lever which displaces an inertia ring which triggers the mechanical exploder. Once again, all this sounds in order, but a complication comes into account with variations in the Earth's magnetic field.

Contact Exploder

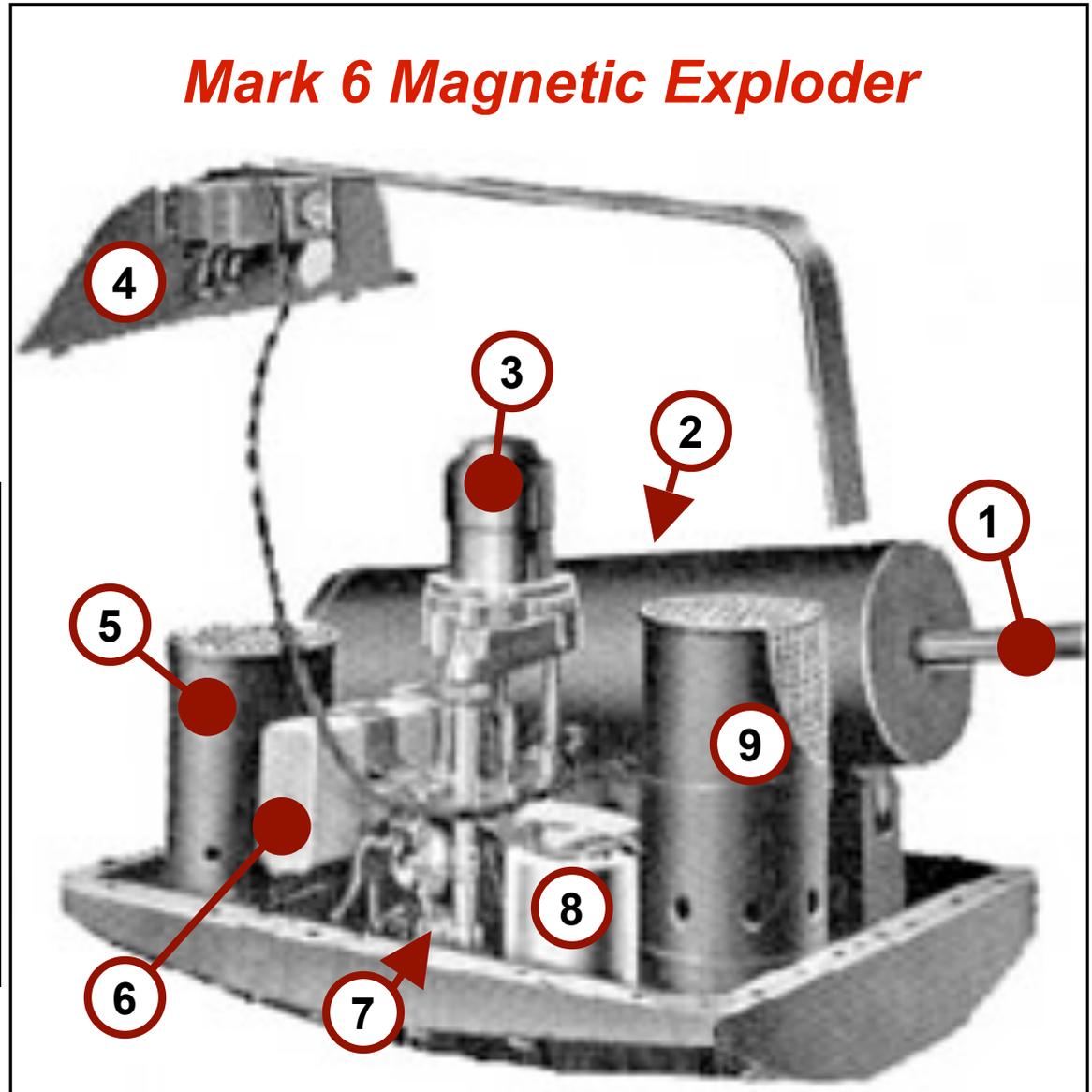
The contact exploder portion is much simpler than the influence portion. It is simply a ball on a spring which is centered within a hollowed frame. At the forward end of the mechanism is an electrical contact. When the ball is displaced forward by an inertial shock it pushes against the contact and this causes an electrical impulse to the exploder trigger. The problem is the sensitivity of the ball to shock. If the shock is too much it destroys the mechanism before the ball can do its job.

Extracted from: <http://www.submarineresearch.com/bull29.html>

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Mk. 6 Magnetic Exploder



Mark 6 Magnetic Exploder



#1	Core Rod
#2	Pickup Coil
#3	Detonator
#4	Ball Switch Assembly
#5	Voltage Regulator Tube
#6	Capacitor
#7	Delay Device
#8	Solenoid
#9	Thyratron Tube

The Great Torpedo Scandal

The USN had serious issues with their torpedoes from the beginning of the war through mid-1943. For a year and a half, submariners put their lives on the line to make torpedo attacks with faulty, untested equipment that produced failure rates of over 70%. It is unknown how many lives were lost, or how long the war was extended due to this issue.

This issue was completely avoidable, and can be placed squarely on the shoulders of a few USN officers who placed their own self-aggrandizement and interests over the lives of their men, and the needs of the service and their country. None of these officers were ever punished for their criminally negligent actions. Instead, submariners were blamed for their equipment failures, careers were destroyed, and submariners died trying to prosecute attacks with faulty torpedoes.

The USN Mark 14 torpedo suffered from four major flaws;

- 1. RUNNING DEPTH... *torpedoes consistently ran deeper than set***
- 2. FAULTY MAGNETIC EXPLODER...*did not work, or fired prematurely***
- 3. FAULTY CONTACT EXPLODER...*did not work properly***
- 4. CIRCULAR RUNS...*torpedoes circled back at the firing submarine***

The Great Torpedo Scandal

1. **DEPTH KEEPING**

- (a) Warheads were 200 lbs. **HEAVIER** than practise heads, causing the wartime torpedo to run with a head down trim. Fleet tests in Australia found an 11 foot depth error. It was not until Aug'42 that a compromise of 10' was agreed and a trim repair kit was issued to the fleet later in that year.
- (b) The **DEPTH SENSOR** was poorly located and designed for a slower running torpedo. The pressure gradient over the torpedo surface at higher speeds gave the wrong feedback. The sensor was later relocated to a neutral position.

- 2. The **MAGNETIC EXPLODER MK 6** was based on two false premises. *First*, that the earth's magnetic field was essentially the same everywhere. *Second*, that a steel-hulled ship is going to disturb that field. In fact, the earth's magnetic field varies considerably. Degaussing or demagnetizing a ship's hull was done routinely once magnetic mines were introduced. RAdm Christie had participated in the development of the magnetic exploder and resisted disablement until Dec'43.
- 3. The conventional **CONTACT EXPLODER** was designed for the older Mk 10 torpedo. The newer, faster, 46 knot, Mk 14 torpedo had higher inertial impacts that would cause the firing pin to distort and misfire.
- 4. There were numerous reports of the Mark XIV running erratically and circling back on the firing boat (**CIRCULAR RUNNING TORPEDOES**). This sank at least one sub, the *USS TULLIBEE*, for certain. This issue was never resolved in the Mk 14 torpedo.

The Great Torpedo Scandal

The following observations reflect the opinions of writers on the subject:

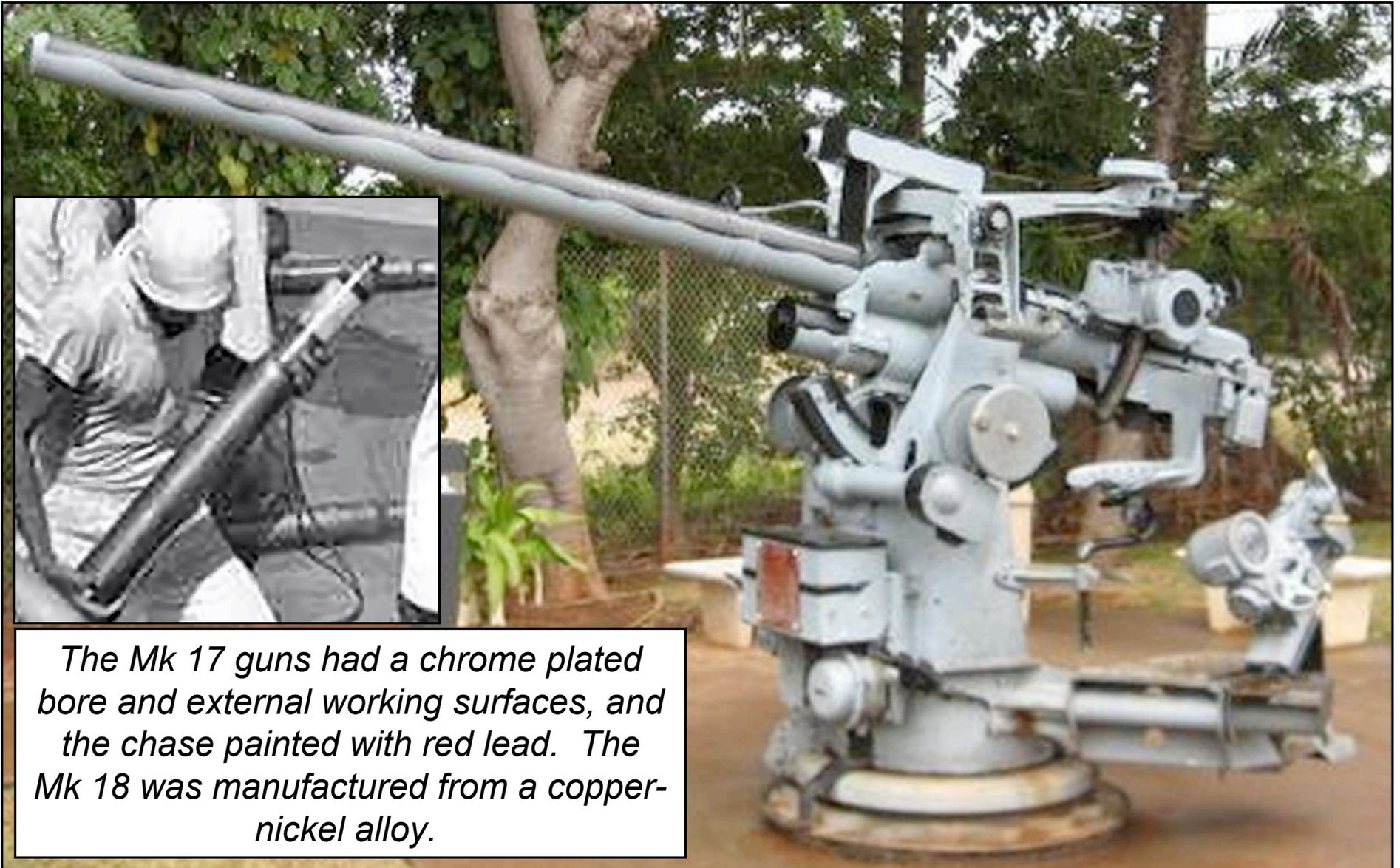
Edwin Gray, (The Devil's Device); ***". . .the unhappy saga of the Mark 14 torpedo and its Mark VI exploder is perhaps a perfect example of the mayhem that can be created when experts bury their heads in the sand and steadfastly refuse to face the facts."***

Robert Gannon, (Hellions of the Deep); ***"America entered the war with torpedoes far inferior to those of the enemy, and the fault lay squarely with the United States Bureau of Ordnance. It was ineffectual in research and development, inept in testing. It was inadequate in manufacturing, and feeble in its supervision of Newport. It was wanting in collegiality with the rest of the Navy, and it failed to trust those fighting under the Pacific surface."***

Clay Blair Jr. (Silent Victory); ***"That. . .desk-bound staffers refused to listen to suggestions and criticisms from those they had sent into combat with this weapon seems, in retrospect, incomprehensively stubborn and stupid . . .The torpedo scandal of the U.S. submarine force in World War II was one the worst in the history of any kind of warfare."***

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3"/50 Submarine Gun



The Mk 17 guns had a chrome plated bore and external working surfaces, and the chase painted with red lead. The Mk 18 was manufactured from a copper-nickel alloy.

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3"/50 Submarine Gun

Although considered to be dual-purpose weapons, these guns had limited effectiveness in either role, as they fired light-weight shells and were manually operated. The 3"/50 caliber was replaced by the heavier 4"/50 Mark 12 gun in 1942.

As a direct fire weapon, the small 13 pound projectiles used in the 3"/50 had a reputation of bouncing off U-boats and merchant vessel light plating. As an AA weapon, the tiny HE payload, relatively low rate of fire, and manual operation made the weapon almost useless against fast-moving aircraft. On 6 April 43 the British Frigate Goodall attempted to scuttle a damaged tanker by firing 36 rounds of armor-piercing ammunition into the light-plated hull.

The gunnery officer observed at least 20 ricochet off without penetrating. Frustrated with the 3"/50's performance, the crew finally sank the tanker with shallow depth charges.



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3"/50 Submarine Gun

3"/50 SUBMARINE GUN	
Service Designation:	USN 3"/50 (7.62 cm) Marks 17, 18, 21 (Wet Mount)
Date In Service:	1915 - 1944
Gun Weight:	1,760 lbs. (798 kg)
Gun Length:	159.7 in (4.055 m)
Bore diameter:	3.0" / 7.62cm
Elevation:	-15 / +85 degrees
Firing cycle:	15 – 20 rounds per minute
Approximate Barrel Life:	3000 - 4300 rounds
Range @ 43 degrees:	14,600 yards (13,350 m)
AA Ceiling:	30,400 feet (9,270 m)
AMMUNITION	
Type:	Fixed
Ammunition type:	AP, HC, AA, and Illumination
Projectile weight:	13 lbs. (5.9kg) / 24 lbs. (10.9kg) complete cartridge
Velocity:	2,700 fps (823 mps)
Bursting Charge	AP - 0.3 lbs. (0.14 kg) Explosive D HC - 0.74 lbs. (0.34 kg) Cast TNT AA - 0.74 lbs. (0.34 kg) Cast TNT

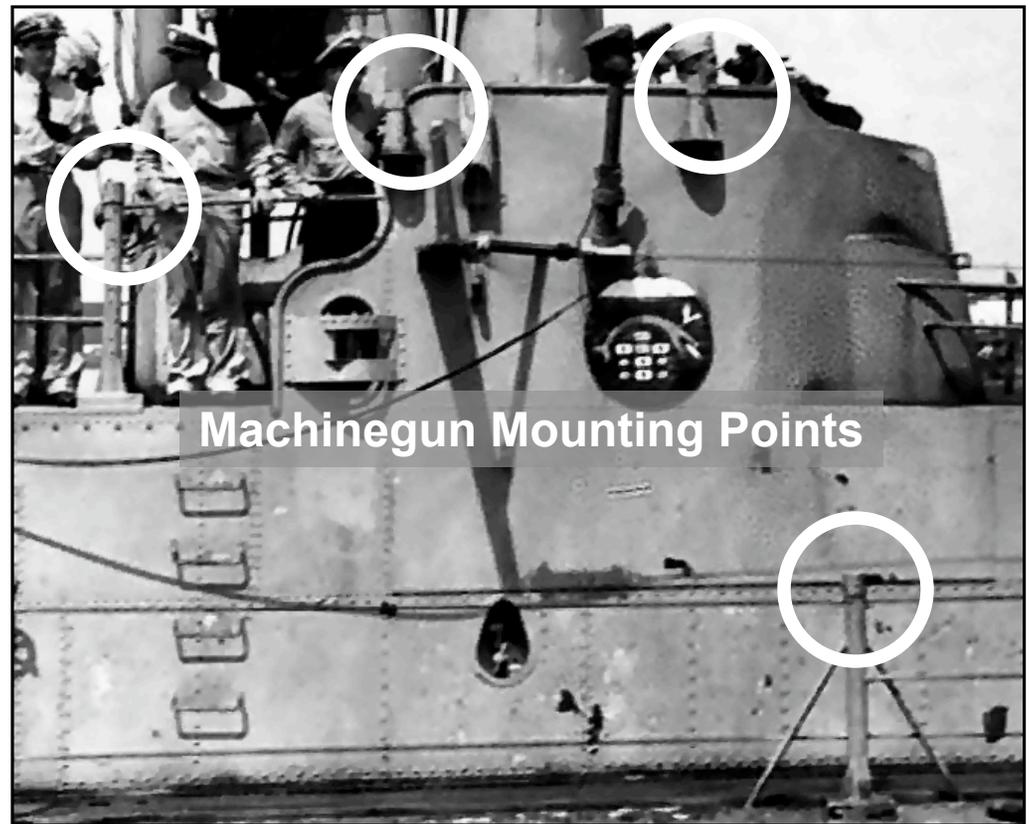
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Machine Guns

Machine Guns were used early war on submarines as anti-aircraft guns, but they were nearly useless in that role. They were replaced as rapidly as possible with the 20 mm Oerlikon AA MG.

There were at least four main types of machineguns used: The Browning 0.50 HMG in both air-cooled and water-cooled versions using belt feed, the air-cooled Browning 0.30 MG using belt feed, and the Lewis gun with pan type magazines.

Fleet submarines all had mounting points fitted at various locations. The guns and ammunition were stored in pressure-proof containers near the mounts.



**M2HB .50 Caliber
Machine Gun**

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Machine Guns



Watercooled 0.50
Caliber MG Mount

0.30 Caliber
Lewis MG

USS GATO (SS-212)
Late 1942

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.50 Caliber Machine Gun

M2HB .50 Caliber Machine Gun

Designation:	0.50" (12.7 mm) M2 Browning Machine Gun (BMG)
Date In Service:	1932
Caliber:	.50 (12.7 mm)
Gun Weight:	57.8 kg (128 lbs); barrel 81 lbs, tripod 44 lbs
Gun Length (OA):	165.4 cm (65.1 in), (barrel 45 in)
Operation:	recoil operated, air or water-cooled Selective Fire
Rate Of Fire:	400 – 550 RPM

Ammunition

Type:	Fixed / 110-round metallic link belt
Weight of Round:	bullet 710 gr / charge 235 gr
Projectile Types:	AP / Incendiary / Tracer
Muzzle Velocity:	853.4 mps (2930 fps)
Effective Range:	2287m (2500 yds)



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.30 Caliber Machine Gun



.30 Caliber Machine Gun

Designation:	M1919A4 .30 Caliber Air Cooled Machine Gun
Date In Service:	1919
Gun Weight:	18.5 kg (41 lbs) with tripod
Gun Length oa:	104.1 cm (41 in)
Rate Of Fire:	400 - 550 RPM
Effective Range:	1000m (1100 yds)
Ammunition	
Caliber:	.30-06
Type:	Fixed / 250-round belt
Projectile Types:	Ball / AP / Incendiary / Tracer
Muzzle Velocity:	853.4 mps (2800 fps)



.30 Caliber Machine Gun

Designation:	U.S. Lewis Machine Gun Caliber .30, Model 1917
Date In Service:	1917
Operation:	Full automatic, Gas operated Air Cooled
Gun Weight:	25.5 lbs. Bipod: 3 lbs.
Gun Length (OA):	51 in
Caliber:	.30-06
Rate Of Fire:	550 RPM (cyclic)
Effective Range:	600 yds

Ammunition

Type:	Fixed / 47 -97 rd. drum
Projectile Types:	Ball / AP / Incendiary / Tracer
Muzzle Velocity:	853.4 mps (2800 fps)

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2 x Lewis Guns Mounted on the Bridge

