

UNCLASSIFIED CATALOG OF ENEMY ORDNANCE MATERIÉL ERRATA

A number of changes, largely in nomenclature and specifications, have been made in the Catalog from time to time, but many sets are in circulation without these changes. The following errata should be marked on the pages indicated if not already made in your Catalog.

Volume I—German Section

- Page 16—Heading should read **S.P. Heavy Field Howitzer (On French Lorraine Chassis)**.
- Page 17—Heading should read **Ammunition Carrier (On French Lorraine Chassis)**.
- Page 21—Sub-head should read **Pz. Jäg. 38 für 7.62 cm Pak 36 (r) (Sd. Kfz. 139)**.
- Page 28—Under "Specifications" the weight should be 26.5 tons instead of 22 tons.
- Page 29—In sub-head, instead of figure "142," read 142/2.
In the first and second paragraphs, instead of "Pz. Kw.," read **Pz. Kpfw.**
Under "Specifications" the weight should be 27 tons instead of 22 tons.
- Page 32—Under "Specifications" the weight should be 26 tons instead of 24 tons.
- Page 33—Sub-head should read **Stu. G. IV ("Brumm-bür) für 15 cm Stu. H. 43 (Sd. Kfz. 166)**.
Under "Specifications" the Armament should read **Stu. H. 43 (15 cm s.I.G. 33)**.
- Page 34—Heading should read **S.P. Antitank Gun "Rhinoceros" (formerly "Hornet")**.
Sub-head should read **Pz. Jäg. III/IV ("Nashorn") für 8.8 cm Pak 43/1 (Sf) (Sd. Kfz. 164)**.
End of first paragraph should read **Comparative figures for weight and maximum road speed of "Hornet" and "Ferdinand" are: 25 tons and 22 m.p.h., 72 tons and 12½ m.p.h., respectively.**
Under "Specifications" the weight should be 25 tons instead of 28 tons.
- Page 37—Sub-head should read **Pz. Kpfw. "Panther" (7.5 cm Kw. K. 42-L/70) (Sd. Kfz. 171)**.
Second line of first paragraph should read 47 tons instead of 50 tons.
Under "Specifications" the weight should be 47 tons instead of 50 tons. The armament should read **7.5 cm Kw. K. 42—1 M. G. 34**.
- Page 38—Sub-head should read **Pz. Kpfw. "Tiger" (8.8 cm Kw. K. 36-L/56) (Sd. Kfz. 181)**.
Under "Specifications" the weight should be 63 tons instead of 60 tons.
- Page 39—Heading should read **S.P. Antitank Gun—"Elephant" (formerly "Ferdinand")**.
Sub-head should read **Pz. Jäg. "Tiger" (P) "Elefant" für 8.8 cm Pak 43/2 (Sd. Kfz. 184)**.
In first line read 72 tons instead of 80 tons.
In line eight of first paragraph read 2 2/5 inches instead of 6½ inches.
Under "Specifications" the weight should be 72 tons instead of 80 tons. Side armor should read 60 mm instead of 160 mm. Armament should read **8.8 cm Pak 43/2—M. G. 34**.
- Page 40—Sub-head should read **Pz. Jäg. "Tiger" für 12.8 cm Pak 44 (Sd. Kfz. 186)**.
Under "Specifications" armament should read 12.8 cm Pak 44.

- Page 46—Sub-head should read **l. gp. Mun. Trsp. Kw. (Sd. Kfz. 252)**.
- Page 74.43—Sub-head of first vehicle should read **Fernschr. Kw. (Kfz. 72/1)**.
- Page 74.84—German nomenclature of first vehicle should read **mittlerer Anhänger mit Betriebsstoffkesselanlage (o)**.
- Page 101—Sub-head should read **21 cm Mrs. mit Mrs. Laf. 18**.
In last paragraph instead of "17 cm Mrs." read **17 cm K. mit Mrs. Laf. 18**.
- Page 105—Sub-head should read **15 cm s. F. H. 18**.
- Page 107—Sub-head should read **10 cm K. 18**.
First line of first paragraph should read **The 10 cm Field Gun K. 18. . . .**
Under "Specifications" muzzle velocity should be **2,660 f/s**.
- Page 109—Under "Specifications" weight of projectile should read **H.E. 33.2 lb**.
- Page 111—Under "Specifications" weight of projectile should read **(H.E.) 20.35 lb.; (A.P.) 20.75 lb**.
- Page 113—Sub-head should read **8.8 cm Pak 43/41**.
First paragraph should read **The Pak 43/41 instead of Pak 43**.
In line three of the last paragraph read **Pak 43/41 instead of Pak 43**.
- Page 117—Under "Specifications" delete **Weight (firing position) . . . 3,040 lb**.
- Page 123—First line in first paragraph should read **The 7.5 cm Pak 41, Germany's latest . . .**
- Page 125—Picture shown does not pertain to this item.
- Page 134—Sub-head should read **2 cm s PzB (Solothurn s/8-1100)**.
- Page 136—Under "Specifications" rate of fire should read **220 rounds (practical), 450 (theoretical)**.
- Page 207—Sub-head should read **7.92 mm Karabine 98K (Mauser-Kar. 98K)**.
- Page 210—Sub-head should read **7.92 mm PzB 35 (p)**.
- Page 214—Sub-head should read **7.92 mm M. G. 34/41**.
- Page 217—Sub-head should read **8.8 cm Raketenpanzerbüchse 43 (8.8 cm R PzB 43)—8.8 cm Raketenpanzerbüchse 54 (8.8 cm R PzB 54)**.
Last word in first line should be spelled **Raketenpanzerbüchse**.
Add to the end of first paragraph: **An improved model with a face shield is known as 8.8 cm R PzB 54**.
- Page 218—Sub-head should read **Panzerfaust**.
The first paragraph should read **The German rocket grenade, "Panzerfaust" (literally "armor fist"). . . .**
Add the following as a fourth paragraph: **Three models of the Panzerfaust exist with the following German nomenclature:**
Panzerfaust 30
Panzerfaust Klein 30
Panzerfaust 60
- Page 306—Sub-head should read **3.7 cm Stielgranate 41**.
- Volume II—Japanese Section
- Page 114 (Page 113 in later editions). Under "Specifications" Traverse should read **46°**. (This page refers to the 75 mm Field Gun, Model 95 (1935).)

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FULL-TRACKED ARMORED CAR



Pz. Sp. Wg. II Luchs (Sd. Kfz. 123)—"Lynx"

UNCLASSIFIED



This vehicle, one model of which is shown above, is called an armored car by the Germans. Production began in 1941 and continued through 1943. Models VK 1201, VK 1202, and VK 1303 were manufactured by Maschienenfabrik Augsburg-Nurnberg.

The box-shaped superstructure is built in with the hull chassis. The thickness of armor of the Lynx is 30 mm on the front of the turret and hull and 20 mm on the turret and hull sides. One gasoline tank located inside on the right holds 83 gallons.

Track guards are provided well over the sprockets and idlers only. The turret roof slopes down towards the front and terminates in a cylindrical shape. The engine compartment is at the rear. Old models had smoke projectors, three on each side which were electrically operated. New model 1303 has no such provision.

Throat microphones were used for intra tank communication. Periscopes and an optical sighting device are provided in the turret.

The suspension consists of torsion bar straddle-mounted Christie type bogie wheels with center guide steel track, front drive sprocket and rear idler.

The first two models were equipped with *Dreislufenlenkung*, three-step clutch type steering, while Model VK 1303 has the same system as the Panther—*Einradien-Lenkgetriebe*, one radius steering. Evolution of this vehicle stems from development of the Pz. Kpfw. II, Models D and E. It is believed that this vehicle served its main purpose in perfecting one radius steering.

The transmission is synchromesh selective and adapts itself to the steering mechanism. There are seven speeds forward and one reverse; synchromesh cones are provided for all gear ratios except low and reverse.

SPECIFICATIONS

Weight	12.9 tons
Length (overall)	15 ft., 2 ins.
Width (overall)	8 ft., 1½ ins.
Height (overall)	7 ft., 3 ins.
Ground clearance	16 ins.
Tread centers	6 ft., 10 ins.
Ground contact	7 ft., 3 ins.
Width of track	14 ins.
Pitch of track	
Track links	67
Fording depth	4 ft., 7 ins.
Theoretical radius of action	
Roads	155 miles
Cross-country	93 miles
Speed	
Roads	50 m.p.h.
Cross-Country	25-30 m.p.h.
Armor	
Front	30 mm
Sides	20 mm
Armament.....	One 2 cm Kw. K. 38 and one 7.92 mm M. G. 34
Ammunition (Rds.)....	400 (2 cm); 1,200 (M. G. 34)
Engine	178 British B.H.P.
Transmission.....	Synchromesh, 7 speeds forward; 1 reverse
Steering.....	One radius double drive epicyclic
Crew	4

SELF PROPELLED ANTITANK GUN

GERMAN



Pz. Jäg. 38 für 7.5 cm Pak 39 (L/48)

UNCLASSIFIED



The chassis of this self-propelled antitank gun is a modified version of the chassis for the Czech Model 38 tank. (See page 18.) The lower nose of the hull is 60 mm thick set at 40° and interlocked with the sides and upper nose plate. The upper nose plate is 60 mm thick. It is positioned at an angle of 60° and extends to the top of the superstructure. Brinell hardness is approximately 240. All-welded construction is employed except in attaching roof and superstructure rear plates which are bolted on for reasons of accessibility. The two latter plates are 8 mm horizontal and 8 mm at 70° respectively. The side superstructure plates are 20 mm set at 40° with a brinell hardness of approximately 195. The hull floor plate is 10 mm. Side apron plates of 5 mm give added protection against high explosive shell fire.

The 7.5 cm Pak 39 (L/48), mounted 15 inches to the right of the hull center line, has an improved type of recoil mechanism. This allows the muzzle brake to be discarded. Elevation is from -6° to +10°. Traverse overall is 16° (-11° right -5° left). A new type machine gun mount is built in the roof. The machine gun is fitted with a periscopic sight and extended trigger, and may be traversed in any direction and fired from within. A Sfl ZF 1a sight and an episcopes is provided for the main gunner. The sight projects through the roof. The loader has an episcopes fitted in the rear portion of his hatch fixed at 6 o'clock.

The steering mechanism is the usual controlled differential type which allows curves of 29½ foot radius without "steering losses." Curves of smaller radius are obtained by using the track brakes of the additional clutch brake system also provided.

There are two fuel tanks with a total capacity of 85 gallons. Ground pressure is 11.9 pounds per square inch. The power to weight ratio is approximately 9 HP per ton. The Fu 5 radio is fitted. Commanders equipments carry an additional Fu 8.

SPECIFICATIONS

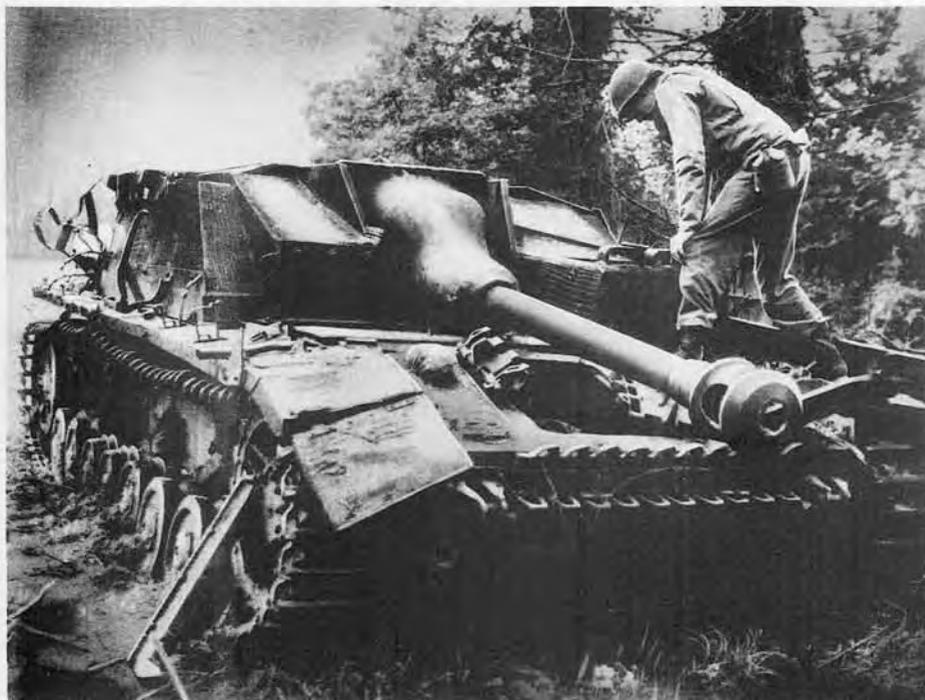
Weight in action	17.6 tons
Length (overall excluding gun)....	15 ft., 11 ins.
Width (overall)	8 ft., 7½ ins.
Height (overall)	6 ft., 10½ ins.
Ground clearance	1 ft., 4¾ ins.
Tread centers	6 ft., 10½ ins.
Ground contact	8 ft., 11½ ins.
Width of track	1 ft., 1¾ ins.
Pitch of track	4.1 ins.
Track links	96
Fording depth	2 ft., 11 ins.
Theoretical radius of action	
Roads	100 miles
Cross-country	50 miles
Speed	
Roads	16 m.p.h.
Cross-country	9 m.p.h.
Armor	
Hull nose plate (lower)	60 mm at 40°
Hull side plate	20 mm undercut 15°
Hull tail plate	20 mm at 15°
Glacis plate (upper nose)	60 mm at 60°
Superstructure side plates.....	20 mm at 40°
Superstructure rear plate.....	8 mm at 70°
Gun mantlet	30 mm rounded
Armament.....	7.5 cm Pak 39 (L/48); one M. G. 34; one M. G. 44.
Ammunition (Rds.).....	7.5 cm gun, 41 rds.; M. G. 34, 600 rds.;* M. G. 44, 180 rds.
Engine.....	Czech EPA (Type TZJ), 6-cyl., inline, 158 hp. at 2,600 r.p.m.
Transmission.....	5 speeds forward, 1 reverse
Steering	Epicyclic, clutch brake type
Crew	4

*In addition to the ammunition mentioned above, 12 rounds of signal ammunition, 20 egg hand grenades, 24 grenades, and 6 smoke candles are carried.

UNCLASSIFIED



Stu. G. IV für 7.5 cm Stu. K. 40 (L/48)



This equipment, consisting of the 7.5 cm Stu. K. 40 (L/48) mounted on the Pz. Kpfw. IV chassis, represents a further development in German assault guns. The design follows that of its predecessor, the Stu. G. 40, mounted on the Pz. Kpfw. III chassis, with the exception that in the later equipment the usual keystone gun mantlet has been replaced by a cast steel mantlet with curved surfaces to offer the maximum projectile deflection. The mantlet, 130 mm thick, houses the buffer and recuperator.

Armor protection has been increased by the addition of slabs of concrete six inches thick attached to the front plate and the roof over the driver's compartment by means of wire. The rest of the armor is the same as that provided for the Pz. Kpfw. IV.

The division of chassis space follows the usual design for this type of vehicle, with the driver's compartment in the front, the fighting compartment in the center, and the engine compartment in the rear.

The gun, the Stu. K. 40 (L/48), with muzzle brake, is a lengthened version of the Stu. K. 40 (L/43) and is similar in design and performance to the Kw. K. 40 (L/48).

In the inset above is shown the 7.5 cm Stu. K. 40 (L/48) mounted on the Pz. Kpfw. III chassis which also has the improved type of rounded gun mantlet.

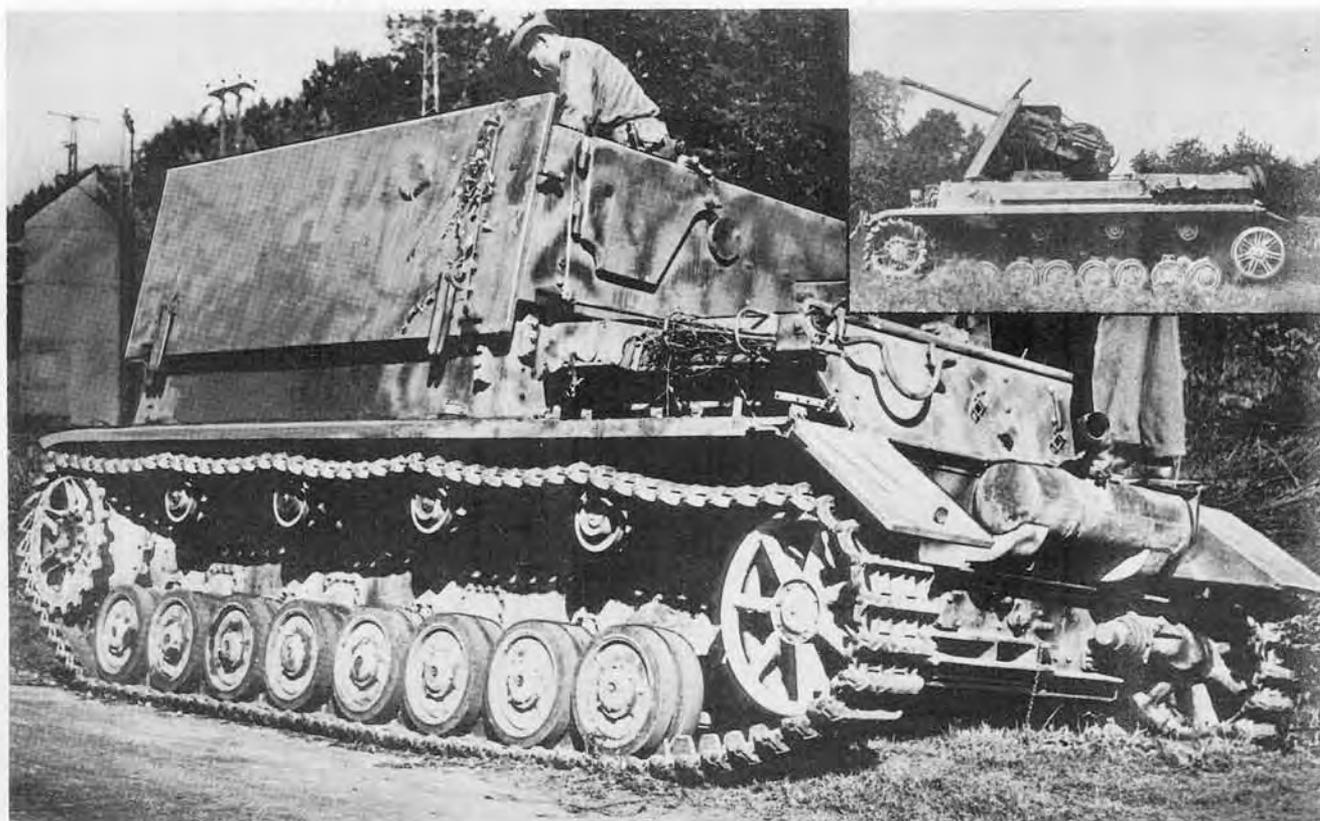
SPECIFICATIONS

Weight	
Length	19 ft., 4 ins.
Width	9 ft., 7 ins.
Height	
Ground clearance	15 ins.
Tread centers	7 ft., 11 ins.
Ground contact	11 ft., 6 ins.
Width of track	15 ins.
Pitch of track	4¾ ins.
Track links	98
Fording depth	3 ft.
Theoretical radius of action	
Roads	130 miles
Cross-country	80 miles
Speed	
Roads	28 m.p.h.
Cross-country	15 m.p.h.
Armor	
Front nose plate	75 mm
Sides	30 mm
Armament	7.5 cm Stu. K. 40 (L/48)
Ammunitions (Rds.)	
Engine	Maybach HL 120 TRM, 320 hp.
Transmission.....	Synchromesh—6 speeds forward, 1 reverse.
Steering	Epicyclic, clutch brake
Crew	5

SELF-PROPELLED ANTI-AIRCRAFT GUN

Pz. Kpfw. IV (3.7 cm Flak 43)

GERMAN



This equipment consists of the standard Pz. Kpfw. IV chassis adapted to mount the 3.7 cm Flak 43. It is essentially an anti-aircraft weapon, although the gun may be depressed for use against ground targets.

The superstructure is especially designed for the second purpose. The side and rear walls of the structure are two spaced 15 mm armor plates nine feet long, eight feet, eight inches wide, and four feet high. The sides can be pushed outwards and downwards to a horizontal position to permit fire against ground targets or to extend the area of the loading platform.

The 3.7 cm Flak 43, which has a 360° traverse and 90° elevation, is centrally mounted on a pedestal. It is hung from a single trunnion on the right through which passes the feed and ejection aperture. The monobloc barrel is fitted with a combination muzzle brake and flash hider. Both elevating and traversing handwheels are located to the right of the gun. A hydromatic-spring buffer with variable recoil is situated below the barrel, and two return springs lie side by side above the barrel. A tri-sectional gun shield sloped at 30° to the vertical is provided. The center section is 9 mm thick and two side sections each 6 mm thick. The height of the shield, measured up the slope, is four feet, 3½ inches. The gun is fed horizontally from the left by clips of eight rounds each which are placed on a fixed loading tray.

The muzzle velocity of the 3.7 cm Flak 43 is reported as 2,750 f/s, and its theoretical rate of fire 250 rounds per minute. The ammunition issue laid down per equipment is reported as 1,600 rounds, 1,280 high explosive and 320 armor piercing.

An official German document states that the standard sight for this gun will be the Schwebedorvisor.

SPECIFICATIONS

Weight	26 tons (est.)
Length	19 ft., 4 ins.
Width	9 ft., 7 ins.
Height	
Ground clearance	15 ins.
Tread centers	7 ft., 11 ins.
Ground contact	11 ft., 6 ins.
Width of track	15 ins.
Pitch of track	4¼ ins.
Track links	98
Fording depth	3 ft.
Theoretical radius of action	
Roads	130 miles
Cross-country	80 miles
Speed	
Roads	25 m.p.h.
Cross-country	15 m.p.h.
Armor	
Front plate	50 mm
Sides	30 mm
Armament	3.7 cm Flak 43
Ammunition (Rds.)	1,600
Engine.....	Maybach HL 120 TRM, 320 hp.
Transmission.....	Synchromesh—6 speeds forward, 1 reverse.
Steering	Epicyclic, clutch brake
Crew	7

SELF PROPELLED ANTITANK GUN

UNCLASSIFIED

GERMAN



Pz. Jäg. IV für 7.5 cm Stu. K. 42 (L/70) Sd. Kfz. 162



This self-propelled antitank gun consists of the 7.5 cm Stu. K. 42 (L/70) mounted on a modified Pz. Kpfw. IV chassis.

The vehicle is of all-welded construction except that the fighting compartment roof is bolted. The upper and lower nose plates are interlocked with each other and with the hull sides. The upper nose plate, set at an angle of 45° to the vertical, has a thickness of 80 mm. The lower nose plate, set at an angle of 55° to the vertical, has a thickness of 45 mm. The superstructure front plate is interlocked with the superstructure side plates and additional strength is provided by two brackets which are welded into recesses in the hull sides and bolted to plates welded to the superstructure front.

The crew compartment occupies the front three-quarters of the vehicle and accommodates a crew of five. The remaining quarter houses the engine which is the standard Maybach HL 120 as fitted in the Pz. Kpfw. IV.

The gun, which has no muzzle brake, is ballistically similar to the 7.5 cm Kw. K. 42 as mounted on the Pz. Kpfw. Panther. It is located eight inches to the right of the hull center line. The hydraulic buffer and hydropneumatic recuperator are mounted above the piece, the buffer being on the left. The recoil gear is protected by a cast mantlet with curved outer surfaces. Stowage is provided for 55 rounds of ammunition, all except four being stowed horizontally.

A port is provided in the superstructure front plate to the right of the 7.5 cm gun, behind which is a small machine gun ball mounting, five inches in diameter.

SPECIFICATIONS

Weight (approx.)	28 tons
Length	19 ft., 9½ ins.
Width	10 ft., 4¾ ins.
Height	6 ft., 5 ins.
Ground clearance	15 ins.
Tread centers	8 ft., 1¼ ins.
Ground contact	11 ft., 6 ins.
Width of track	15 ins.
Pitch of track	4¾ ins.
Track links	98
Fording depth	3 ft.
Theoretical radius of action	
Roads	130 miles
Cross-country	80 miles
Speed	
Roads	28 m.p.h.
Cross-country	15 m.p.h.
Armor	
Superstructure, front....	80 mm at 50° to vertical
Superstructure, sides (fighting compartment)	40 mm at 30°
Gun Mantlet	150 mm (rounded)
Upper nose plate	80 mm at 45°
Lower Nose plate	45 mm at 55°
Hull sides	30 mm (vertical)
Armament.....	7.5 cm Stu. K. 42 (L/70); one M. G.
Ammunition (Rds.)	55
Engine	Maybach HL 120 TRM, 320 hp.
Transmission.....	Synchromesh—6 speeds forward, 1 reverse
Steering	Epicyclic, clutch brake
Crew	5

UNCLASSIFIED

ANTIAIRCRAFT GUN ON MEDIUM TANK CHASSIS

Pz. Kpfw. IV für 2 cm Flakvierling 38

UNCLASSIFIED



This equipment consists of the four-barreled 2 cm (.79 in.) anti-aircraft gun mounted on the Pz. Kpfw. IV chassis. The gun has been mounted in an open topped, nine-sided turret. Elevation is from 10° to 90° and traverse is 360°.

The gun is the normal 2 cm Flakvierling 38 with the triangular base removed. Two guns are mounted on either side of the cradle. The guns are fired by a set of foot pedals; each pedal operates the trigger mechanism of the two diametrically opposite guns. The weapon is traversed and elevated manually by the gunner who also aims and fires it.

The 2 cm Flakvierling 38 is supported by two four-inch I-beams which are located 15 inches below the normal tank turret ring. The I-beams are in the center below the turret opening and extend across the width of the tank chassis.

There is no traversing rack on the turret ring. A rod from the gun upper carriage supports the gunner's seat and is fastened by a U-bolt to the turret to form a connection between the gun mount and the turret armor. At the front of each side of the upper carriage is a collapsible rod which also can be fastened to the turret armor. In this manner, the gun mount and turret traverse together.

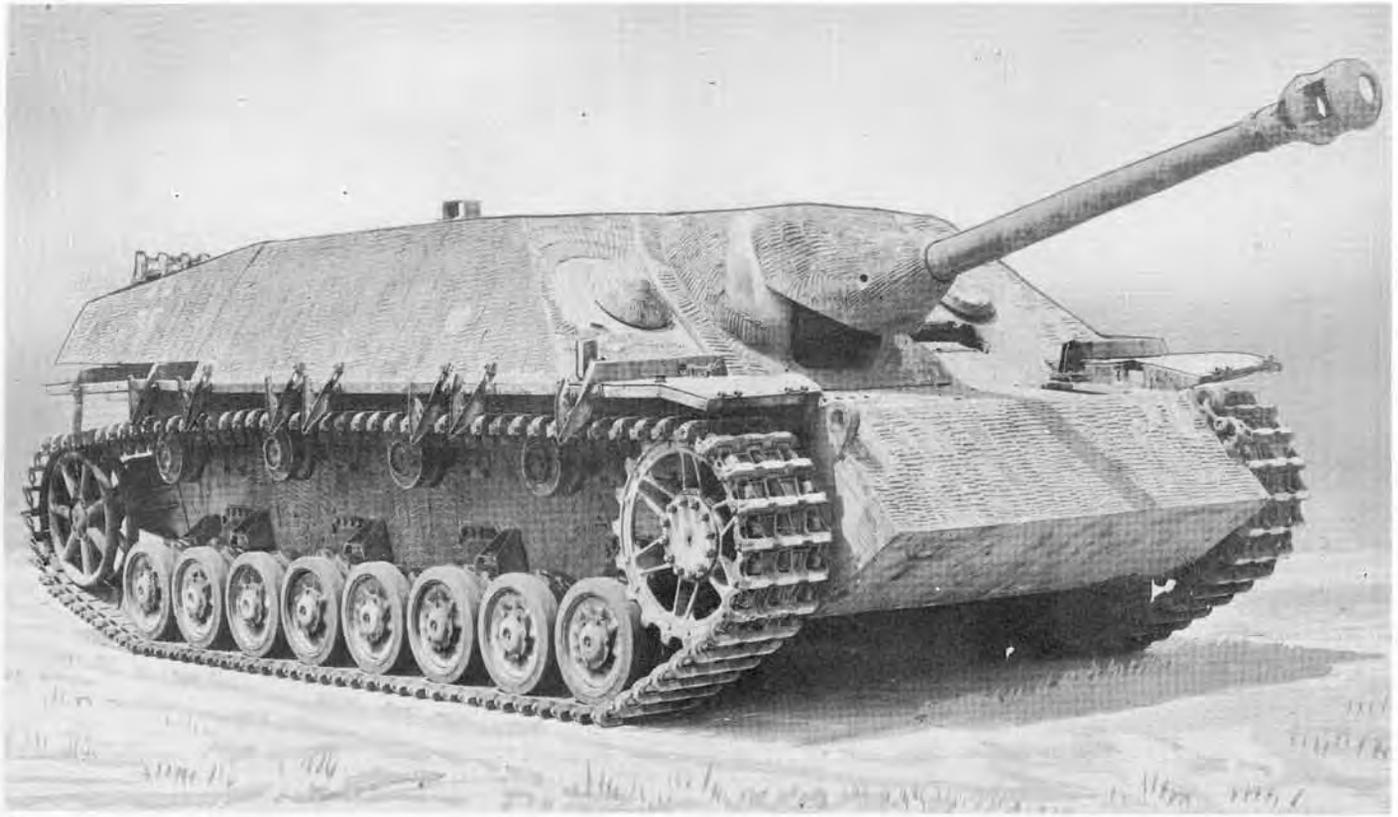
The turret is 43 inches high, 6 feet, 6 inches wide, and 8 feet long. The armor plate is 15 mm thick. Each side of the turret is composed of two plates of equal dimensions welded together. The top plates are sloped at an angle of approximately 30 degrees and the bottom plates are undercut at the same angle.

SPECIFICATIONS

Weight	26 tons (estimated)
Length	19 ft., 4 ins.
Width	9 ft., 8 ins.
Height	9 ft.
Ground clearance	15 ins.
Tread centers	7 ft., 10 ⁷ / ₈ ins.
Ground contact	11 ft., 6 ins.
Width of track	15 ins.
Pitch of track	4 ³ / ₄ ins.
Track links	98
Fording depth	3 ft.
Theoretical radius of action:	
Roads	130 miles
Cross country	80 miles
Speed:	
Roads	25 m.p.h.
Cross country	15 m.p.h.
Armor:	
Front plate of superstructure—	85 mm at 10° to vertical
Sides of superstructure—	30 mm
Armanent	2 cm Flakvierling 38
Ammunition H.E. Shell, tracer; H.E.—Incendiary; A.P. shell, tracer.	
Rounds	16 clips in turret (20 rds in each) 15 boxes in tank.
Engine	Maybach HL 120 TRM, 320 hp.
Transmission—	
Synchronesh—	5 speeds forward, 1 reverse
Steering	Epicyclic, clutch brake
Crew	5

SELF-PROPELLED ANTITANK GUN

Pz. Jäg. IV für 7.5 cm Pak 39 (L/48)



This equipment consists of a Pz. Jäg. IV chassis upon which is mounted a 7.5 cm Pak 39 (L/48). The chassis is a modified Pz. Kpfw. IV, designed to mount either the 7.5 cm Pak 39 (L/48) or the 7.5 cm Stu. K. 42 (L/70).

The chassis has upper and lower nose plates sloped at 45° and 57° respectively. The all-welded construction of the hull is retained, and this structure is strengthened by limited interlocking of the front plates. The main armament is mounted in the sloping front plate of a squat all-welded superstructure, and is offset 8 inches to the off-side of the center line. The mounting is of gimbal type, and is protected externally by a heavy casting. The superstructure is bolted through angle sections to the lower hull. The sloping sides of the superstructure are extended beyond the vertical hull sides over the width of the tracks, and the rear edges of the floor of the sponsons so formed are locked upon the hull angle section. The rear superstructure and engine cover plates are similar to those of the Pz. Kpfw. IV. Spaced plates of 5 mm armor are bolted to brackets welded to the basic side plates of the rear superstructure sides. The armor is treated with Zimmerit. Mechanically, the vehicle is similar to the Pz. Kpfw. IV, but with small modifications. The final spur gear carries 41 teeth instead of the 40 on the tank. The final drive sprockets are of cast steel with webs of flat section instead of the rounded spokes of the tank sprockets.

SPECIFICATIONS

Weight	
Length	19 ft., 4 ins.
Width	9 ft., 7 ins.
Height	
Ground clearance	15 ins.
Tread centers	7 ft., 11 ins.
Ground contact	11 ft., 6 ins.
Width of track	15 ins.
Pitch of track	4¾ ins.
Track links	98
Fording depth	3 ft.
Theoretical radius of action:	
Roads	130 miles
Cross country	80 miles
Speed:	
Roads	28 m.p.h.
Cross country	15 m.p.h.
Armor:	
Front plate of superstructure—	
60 mm at 50° angle	
Sides of superstructure—	
30 mm at 30° angle	
Armament	7.5 cm Pak 39 (L/48)
Ammunition (Rds.)	
Engine	Maybach HL 120 TRM, 320 hp.
Transmission	
Synchronesh—8 speeds forward, 1 reverse	
Steering	Epicyclic, clutch brake
Crew	5



Pz. Jäg. "Panther" für 8.8 cm Pak 43 3 (Sd. Kfz. 173)



The standard Model A Panther chassis is used for building this vehicle. The vehicle embodies all of the engineering principles and methods of design accumulated by the Germans up to the time of its production, and is quite effective as an antitank or assault weapon.

The hull and fighting compartment are of all welded construction. The fighting compartment is 45 inches in height at the front and 57 inches at the rear. The length of the roof is 93 inches and the width 72 inches.

The steering mechanism, "one radius steering," is new. It is unnecessary to engage the transmission in order to turn or traverse the tank through 360 degrees. The use of either steering lever will traverse the tank in a small radius or on the spot. The annulus gear of each of the two epicyclics is driven by the transmission output shaft and is subject to seven speeds forward and one reverse. The sun gears are held stationary on the straightaway by steering brakes. In making a turn, the inside sun gear is released to rotate backward for a sharper turn, the inside sun gear is driven by engagement through a steering clutch with the engine.

The vehicle is armed with the 8.8 cm Pak 43/3 gun in a massive cast steel mantlet which is flexibly mounted in a cast steel ring welded to the front plate. Traverse is 11 degrees. Stowage is provided for 29 rounds of each of two types of ammunition. One M. G. 34 is ball mounted in the front plate to the right. Driver's vision is by periscope. Fuel capacity is 193 gallons, of which 34 gallons are held in auxiliary.

SPECIFICATIONS

Weight	45 tons
Length (overall) Including gun	28 ft., 4 ins.
Excluding gun	22 ft., 8 ins.
Width (overall)	10 ft., 10 ins.
Height (overall)	9 ft., 10 ins.
Ground clearance	21 ins.
Tread centers	8 ft., 7½ ins.
Ground contact	12 ft., 9½ ins.
Width of track	26 ins.
Pitch of track	6 ins.
Track links	67
Fording depth	67 ins.
Theoretical radius of action	
Roads	124 miles
Cross-country	62 miles
Speed	
Roads	34 m.p.h.
Cross-country	15-18 m.p.h.
Armor	
Front plate	80 mm at 55° to the vertical
Sides	45 mm at 30° to the vertical
Rear	40 mm at 30° to the vertical
Top	17 mm at 85° to the vertical
Armament.....	8.8 cm Pak 43/3 (MV 3,280 t/s. A.P.C.B.C.), M. G. 34
Ammunition (Rds.)	58 (8.8 cm)
Engine.....	Maybach HL 230 P 30 V12 gasoline
Transmission.....	Synchromesh 7 speeds forward, 1 reverse
Steering.....	One radius double drive epicyclic
Crew	5

HEAVY TANK ("KING TIGER" or "ROYAL TIGER")

GERMAN 

Pz. Kpfw. VI (B) "Tiger" für 88 cm Kw. K. 43 L/71 (Sd. Kfz. 182)



This heavy tank designed for defensive warfare or for penetrating strong lines of defense made its combat appearance in 1944. It is distinguished by heavy frontal armor and by the employment of the heaviest German gun to be used in a turret with 360° traverse—the 8.8 cm Kw. K. 43 (L/71). This gun has a muzzle velocity of 3,280 f/s, and firing an A.P.C.B.C. projectile weighing 22.4 pounds against 30° homogenous plate has a reported penetration of 6.3 inches at 1,000 yards.

The hull and superstructure are of single-skin welded construction with interlocked joints. The hull front is formed of a single sloping plate 150 mm thick, and a lower nose plate 100 mm thick. Each of these plates is set at an angle of 50° from the vertical, resembling in design the Panther rather than the earlier Tiger. The pannier side plates, 80 mm thick, are set at a 25° angle and also resemble those of the Panther. The turret is located sufficiently back of the angle of deflection to be clear of direct hits on the front plate. The rounded front is 180 mm thick.

At the rear of the vehicle is a Maybach 60°, V-12, gasoline engine of 600 horsepower. The transmission, steering, and final drive are similar to those of the Tiger E. The suspension is made up of nine torsion bars on each side to carry the tank on steel tired road wheels. Five of these overlap the four internal ones. Every alternate track link has two ground contact bars.

This tank mounts the 8.8 cm Kw. K. 43 (L/71), two M. G. 34's, an anti-aircraft machine gun, and a smoke projector. A commander's version of this tank was also manufactured.

The transport trailer for this tank is described on page 62.2.

SPECIFICATIONS

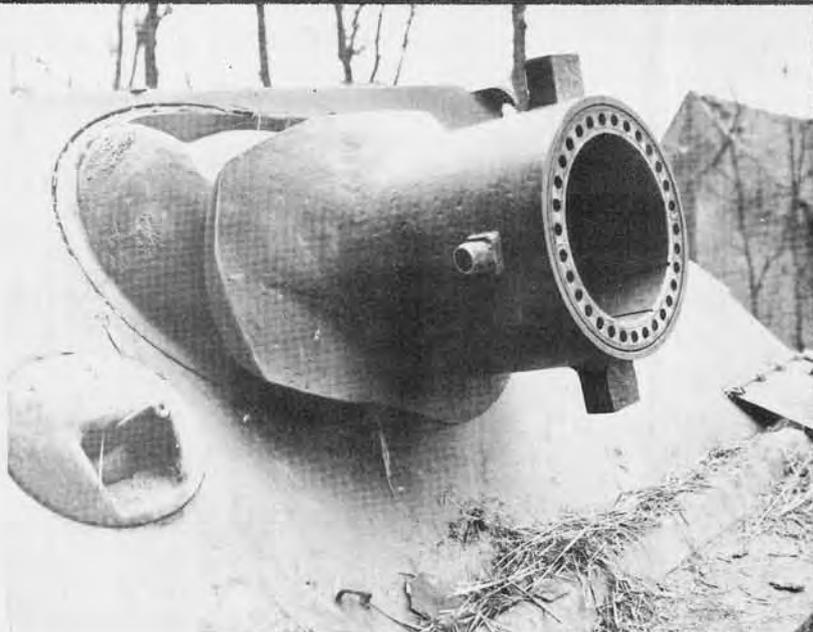
Weight	75 tons
Length	23 ft., 10 ins.
Width (overall)	12 ft., 7 ins.
Height	10 ft., 2 ins.
Ground clearance	1 ft., 5 ins.
Tread centers	9 ft., 4 ins.
Ground contact	
Width of track	32.5 ins.
Pitch of track	5.9 ins.
Track links	90
Fording depth	69 ins.
Theoretical radius of action	
Roads	106
Cross-country	
Speed	
Roads	23.6 m.p.h.
Cross-country	10 m.p.h.
Armor	
Front glacis plate	150 mm
Sides	80 mm
Armament.....	(1) 8.8 cm Kw. K. 43; (2) 7.92 mm M.G.'s; (1) A.A. M.G.; (1) smoke projector
Ammunition (Rds.)—88 mm	80
Engine	Maybach HL 230
Transmission	8 forward speeds; 4 reverse
Steering.....	Controlled differential, hydraulically operated
Crew	5

38 cm ROCKET PROJECTOR ON TIGER E CHASSIS

GERMAN



Sturmmörser



Top: General view of Sturmmörser. Above: The Raketenwerfer 61 as mounted on vehicle. Right: The projector, showing method of rifling.

A DESCRIPTION OF THIS EQUIPMENT APPEARS ON THE FOLLOWING PAGE.

38 cm ROCKET PROJECTOR ON TIGER E CHASSIS

GERMAN



Sturmmörser

This equipment consists of a 38 cm rocket projector (Raketen Werfer 61) mounted on a modified Model E Tiger I chassis (see p. 38). A heavy rectangular superstructure of the type used on the German self-propelled guns replaces the normal superstructure and turret of the Model E. The rocket projector is mounted in the front plate of the superstructure, offset to the right of center. The superstructure is made of rolled armor plates and is of welded construction with the side plates interlocked with the front and rear plates. A heavy strip of armor is used to reinforce the joint between the front plate and glacis plate on the outside. Armor thickness varies from 40 mm to 150 mm.

The main armament, which fires a splined projectile 58.6 inches long (see page 354.2), differs radically in design and construction from any weapon previously examined. The barrel consists of a cast outer jacket, and a spaced liner of 1/2-inch steel. The latter, which is 74 1/4 inches long, is rifled, having nine grooves with right hand twist, one turn in 17.6 calibers. At the extreme rear, the grooves widen to aid in positioning splines near the base of the projectile. The liner is held in place by four steel blocks at the rear, and a perforated ring at the muzzle end. This ring has 31 equally spaced holes around its face. The breech mechanism is a horizontal sliding plate 2-5/16 inches thick opening from left to right.

The propellant gases are deflected between the tube and liner by an unusual obturator, and escape through a perforated ring at the muzzle. The metal obturator comprising a thin "L" shaped outer ring, a heavier "L" shaped perforated inner ring, and a spacer ring, fits into a circular recess in the front face of the breech plate. When the projectile is fired, the propellant gases pass through the ports to the chamber between the inner and outer rings. The face of the outer ring is forced against the rear face of the tube, and the sides against the recess in the breech plate, thereby obtaining the gas seal.

SPECIFICATIONS

(VEHICLE)

Weight (in action) (estimated).....	68 tons
Length (overall)	20 ft., 8 1/2 ins.
Width (overall)	12 ft., 3 ins.
Height (overall including stowage crane)	11 ft., 4 ins.
Height (overall less stowage crane)	9 ft., 3 ins.
Ground clearance	17 ins.
Tread centers	9 ft., 3 1/2 ins.
Ground contact	12 ft., 6 ins.
Width of track	28 1/2 ins.—20 1/2 ins.
Pitch of track	5 1/8 ins.
Track links	96
Fording depth	70 ins.
Theoretical radius of action	
Roads	87 miles
Cross-country	53 miles
Speed	
Roads	25 miles
Cross-country	15 miles
Superstructure Armor	
Front plate	150 mm at 45° to vertical
Projector mantlet (average).....	69 mm rounded
Projector shield (average).....	150 mm rounded
Side plates	84 mm at 20° to vertical
Rear plate	84 mm at 10° to vertical
Top plate	40 mm
Spherical cradle	100 mm rounded
Ammunition (Rds.)	12
Engine	Maybach HL 210, V-12, 630 hp.
Transmission.....	Preselector, hydraulic—8 speeds forward, 4 reverse
Steering.....	Controlled differential, hydraulic
Crew (unconfirmed)	7

(PROJECTOR)

Caliber	380 mm (14.96 ins.)
Length of tube	81 1/8 ins.
Length of liner	74 1/4 ins.
Thickness of liner	1/2"
No. of grooves	9
Width of grooves	0.4 in.
Width of grooves at rear	1.06 in.
Depth of grooves	0.2 in.
Twist of grooves.....	Right hand, one turn in 17.6 caliber
Max. range (horizontal)	6,179 yds.
Firing mechanism	Continuous-pull
Traverse	20°
Elevation (approx.)	85°
Depression (approx.)	0°
Ammunition.....	H.E. (R. Sprenggranate 4581) HEAT (R. Hollandungsgranat 4592)
Wt. of projectile*	761 lbs.
*Weight zones are marked to the nearest 5 kg. (12 lbs.)	

PHOTOGRAPHS OF THIS EQUIPMENT APPEAR ON THE PRECEDING PAGE. THE ROCKET IS DESCRIBED ON PAGE 354.2.

S.P. ANTITANK GUN—"Elephant"

Pz. Jäg. "Tiger" (P) "Elefant" für 8.8 cm Pak 43/2 (Sd. Kfz. 184)



The "Elephant," weighing 72 tons, was the first of German heavy self-propelled antitank guns to be manufactured. It was designed and built under the supervision of Dr. Ferdinand Porsche and was first introduced under the name of "Ferdinand" in the Summer of 1943. The vehicle is actually improvised to utilize an unsuccessful tank produced by Dr. Porsche. Ninety of these vehicles were so converted. The armor is approximately 8 inches thick in the front of the hull and the sloping fighting compartment. The sides of the hull are 2½ inches, the fighting compartment 3¾ inches thick; while the rear plates of the hull are 4 1/3 inches, and the fighting compartment 3 1/3 inches. The roof of the fighting compartment and belly plates are approximately 1½ inches thick.

The "Elephant" is powered by two 12-cylinder Maybach H.L. 120 T.R.M. engines mounted centrally in the hull. From the engine the drive is taken forward directly to generators and thence to electric driving motors having a capacity of 230 Kw. at 1,300 r.p.m. which are mounted across the rear of the vehicle, under the floor of the fighting cab.

The suspension consists of six dual bogie wheels 26¾ inches in diameter on each side, mounted in pairs on stub axles which are bolted and welded to the hull; rear drive sprocket, and front idler. There are no return rollers.

The armament consists of a long-barreled 8.8 cm gun, with muzzle brake. It has an overall length of 22 feet, 11.63 inches, of which 13 feet, 1½ inches projects beyond the mantlet. The gun is mounted on trunnions 8.8 cm in diameter which are located inside the ball joint in the front armor plate of the fighting compartment. The maximum elevation of the piece is 25°; traverse is 12° left and right.

SPECIFICATIONS

Weight	72 tons
Length	22 ft., 11 ins.
Width	11 ft., 5¼ ins.
Height	9 ft., 10 ins.
Ground clearance	19½ ins.
Tread centers	
Ground contact	
Width of track	25½ ins.
Pitch of track	5 ins.
Track links	
Fording depth	
Theoretical radius of action	
Roads	65 miles
Cross-country	35 miles
Speed	
Road	12.5 m.p.h.
Cross-country	6.9 m.p.h.
Armor	
Front plate	200 mm
Sides (hull)	60 mm
Armament.....	8.8 cm Pak 43/2 MG 34
Ammunition	8.8 cm gun—70-90 rds. MG—2,000 rds.
Engine.....	2 Maybach HL 120 TRM, 320 hp. each
Transmission.....	Gas-electric, D.C. current, 650 amps. @ 385 volts.
Steering	Field control
Crew	6

SELF-PROPELLED GUN

GERMAN



Pz. Jäg. Tiger für 12.8 cm PJK 44 (Sd. Kfz. 186)



The Jägdtiger was the most formidable self-propelled anti-tank gun used by the Germans. It consists of a 12.8 cm PJK 44 (L/55) (less muzzle brake), mounted on a Tiger B chassis.

The hull consists of the normal Tiger B with a built-up superstructure to form a fixed turret. The front plate of the superstructure is 250 mm thick and slopes back at 15° to the vertical. It is made of one solid piece of cast steel armor. The sides of the superstructure are made in one piece with the sloped sides of the fixed turret and, like the Tiger B, are 80 mm thick sloped at 25 degrees. The rear plate of the superstructure is also 80 mm thick with a 10° slope.

The main armament consists of a 12.8 cm PJK 44 set in the center of the front plate of the built-up superstructure. It has a cast, bell-shaped gun shield similar in design to that of the 8.8 cm Kw. K. 43 on the Tiger B. The spherical housing of the gun cradle mounting pivots on a steel ball. The gun is electrically fired and has a vertical sliding breechblock. Separate loading ammunition is used, and the same cartridge case is utilized for armor piercing and high explosive rounds.

With A.P.C. ammunition, penetration of approximately 6 inches of armor at 1,000 yards at 30° is effected; with A.P.C.B.C. ammunition, the penetration is approximately 8 inches.

SPECIFICATIONS

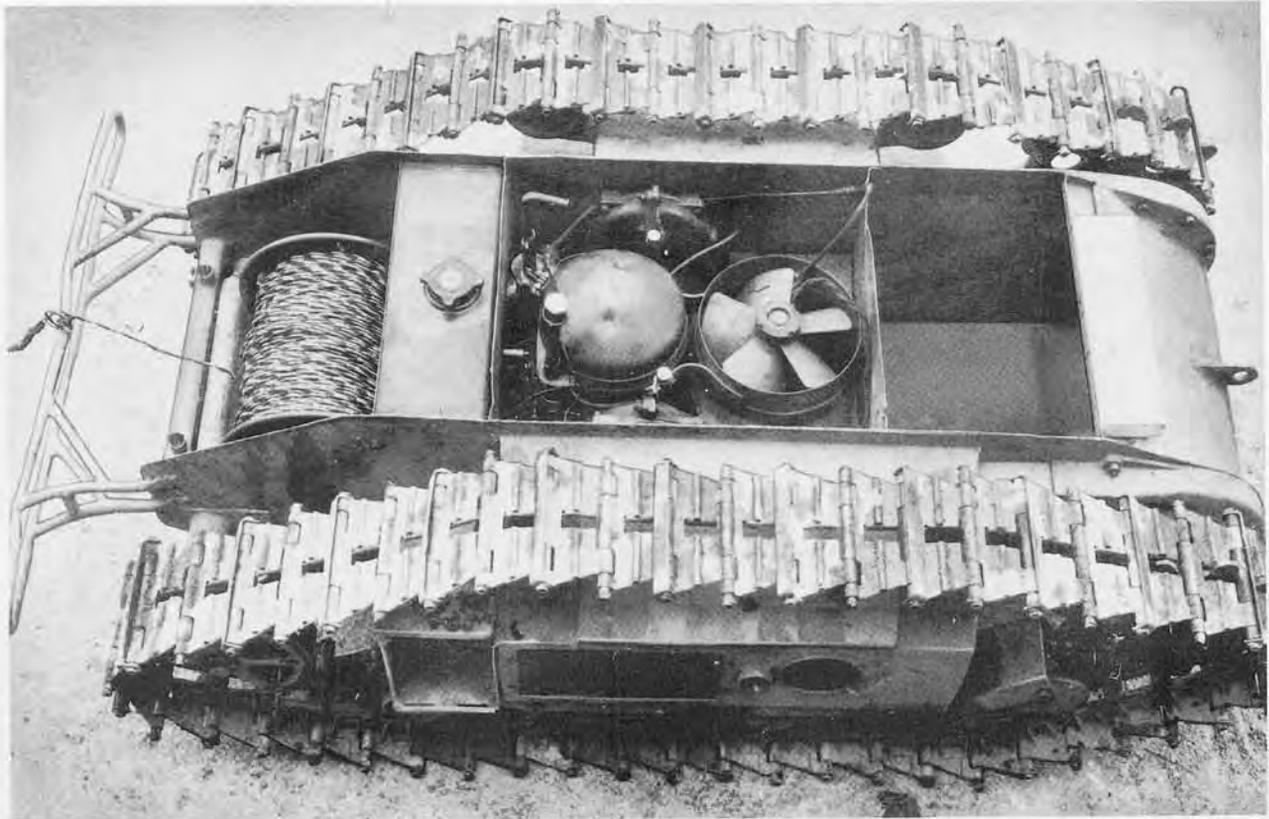
Weight	77 tons
Length (overall)	23 ft., 11 ins.
Width (overall)	12 ft., 7 ins.
Height (overall)	9 ft., 3 ins.
Ground clearance	19 ins.
Tread centers	103/110 ins.
Ground contact	13 ft., 4 ins.
Width of track	26/31½ ins.
Pitch of track	5.9 ins.
Track links	92 (46 double shoes)
Fording depth	69 ins.
Theoretical radius of action:	
Roads	106 miles
Cross country	75 miles
Speed:	
Roads	23.6 m.p.h.
Cross country	10 m.p.h.
Armor:	
Front plate of superstructure—	
250 mm at 15° to vertical	
Sides of superstructure—	
80 mm at 25° to vertical	
Armament	12.8 cm PJK 44
Ammunition	A.P.C.; A.P.C.B.C.
Engine	Maybach HL 230
Transmission	8 speeds forward; 4 reverse
Steering	Two radius system
Crew	6

CABLE-CONTROLLED DEMOLITION VEHICLE

GERMAN



"Goliath—B I"



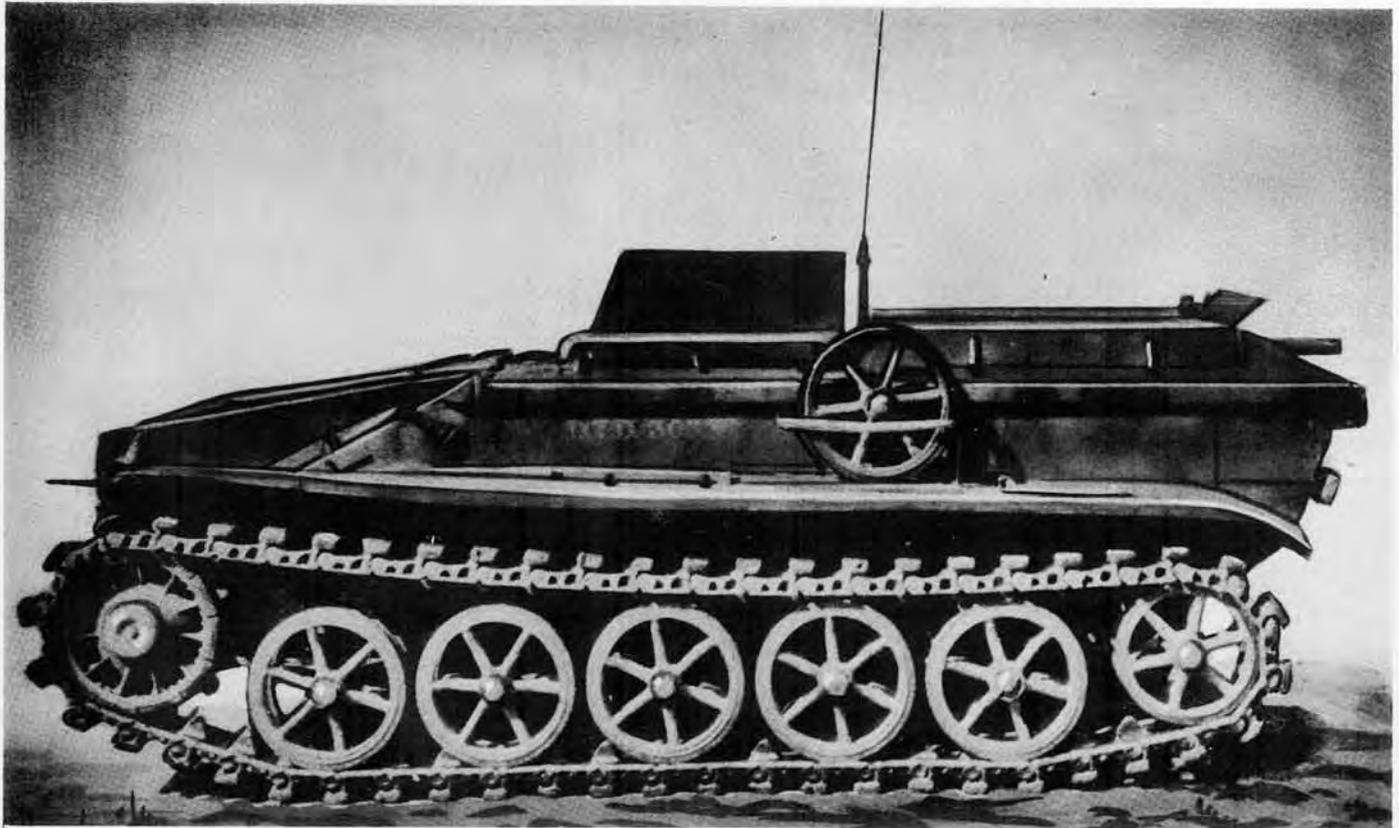
This miniature tank, weighing less than 700 pounds, is controlled by a 2000-foot electric cable from a hand control box carried in the rear. It is used to send a demolition charge to a point at which detonation destroys the tank as well as the target. The hull is fabricated from a mild 16 gauge steel with front upper and lower sloping plates 9 mm thick. These are set at 48 degrees and 50 degrees to the vertical. The hull contains three compartments. The rear compartment houses the cable and drum; the central compartment houses the power unit and control mechanism; and the front compartment contains the high explosive charge.

The power plant consists of a 2-cylinder, 2-cycle air-cooled engine. Ignition is by coil and 6 volt battery. The power is transferred through chain drives to each track by means of electromagnetic clutches. The total reduction from the clutches to the sprocket is 9.33:1. Steering is accomplished by breaking the circuit to the side to which the turn is to be made. This releases the magnetic clutch, cutting the power from the engine for that side of the vehicle. The suspension consists of five small bogie wheels on the bottom with two return rollers on top, and an idler wheel at the rear. Each bogie is independently sprung by coil springs. The chain driven sprocket is at the front of the vehicle. The track is 6 5/16 inches wide, with a simple grouser placed on every other track pin.

This vehicle carries an estimated 100-125 pounds of explosive, and has sufficient power to operate on practically all types of terrain. The control cable consists of three strands, in pairs, two for steering, and the third for setting off the detonator. In operation, the engines are started by a hand crank, the clutches engaged, and the tank then handled from the control box through the cable. Another version of this tank is powered by two electric motors.

SPECIFICATIONS

Weight	650 lbs.
Length	5 ft., 3 ins.
Width	2 ft., 10 ins.
Height	2 ft.
Ground clearance	5¼ ins.
Tread centers	2 ft., 3 ins.
Ground contact	2 ft., 6½ ins.
Width of track	6 5/16 ins.
Pitch of track	2 13/16 ins.
Track links	47
Theoretical radius of action	770 yds.
Speed	4 to 6 m.p.h.
Armor	
Front plate (upper and lower nose).....	9 mm
Hull	16 gauge steel
Armament.....(100-125 est.) pound explosive charge	
Engine	Inline, 2 cylinder, 2 cycle
Transmission.....	Chain drive, through electric magnetic clutch.
Steering.....	Controlled by two electric clutches



This vehicle is designed to convey a heavy demolition charge to a selected tactical objective, at which point the load may be dropped, the vehicle retracted, and the charge detonated. While it may be driven near the target, its special feature is the remote radio-control with which it may be operated after the driver leaves. Its chief use is to demolish pillboxes and strongpoints.

The hull, which is of one piece welded construction, is divided into three compartments. The engine, radio equipment, and hydraulic mechanism are contained in the rear compartment, the transmission units in one of the forward compartments, and the driver's controls and instruments in the other. Three overlapping flaps of 8 mm armor protect the top of the driver's compartment.

The vehicle is powered by a 6-cylinder, inline, water-cooled, gasoline engine, similar to commercial types. It develops approximately 80 horsepower and is supplied by two fuel tanks with a combined capacity of 28.6 gallons.

From the engine, the drive is taken forward through a fluid coupling to the gear box. Two speeds forward and two speeds reverse are provided by high and low range gears. Power is transmitted to the forward sprockets through a train of four spur gears. Suspension is on torsion bars. There are five double rubber-tired bogie wheels on each side. The cast steel center guide tracks have detachable rubber pads and are 7¾ inches wide.

An 800-pound explosive charge is carried in a container on the sloping front. Drop arms hinged to the sides of the front permit the warhead to be lowered to the ground, jettisoned, and the vehicle withdrawn from the destructive arc before the charge is detonated by means of a time fuze or electric detonator.

Radio control of the vehicle is effected by transmitting a carrier of frequency between 24 Mc/s and 25 Mc/s which is amplitude modulated by audio frequency tones. The transmitter power is approximately 4 watts.

SPECIFICATIONS

Weight	4 tons
Length	12 ft.
Width	6 ft.
Height (including driver's shield).....	4 ft., 7 ins.
Ground clearance	12 ins.
Tread centers	5 ft., 2 ins.
Ground contact	5 ft., 10.5 ins.
Width of track	7.75 ins.
Track links	50
Pitch of track	5.5 ins.
Armor	
Front plate	10 mm
Sides	13 mm (5 mm + 8 mm)
Armament	800-lb. explosive charge
Engine.....	6-cylinder, O. H. V. gasoline, 80 horsepower.
Transmission.....	1 fwd, 1 reverse with high and low range—hydraulic clutch.
Steering.....	Epicyclic steering brakes either man- ually or hydraulically controlled.
Crew	1
RADIO EQUIPMENT	
Type receiver	Superheterodyne
Frequency	24,600 kilocycles
Local oscillator	Crystal controlled
Intermediate frequency	464 kilocycles
Tubes	
Receiver.....	1 ECH 11 Mixer-Oscillator
	1 EF 13 Fixed i-f amplifier
	1 EBF 11 second i-f AVC, Second detector
	2 EF 12 Audio amplifiers
Filter unit.....	5 EF 12 Relay control
	1 EF 13 Relay control
Power supply.....	12 v. storage battery with dynamotor
Voltage	Plate—200 v. Filament—6 v.

8-WHEELED ARMORED CAR

GERMAN 

s. Pz. Sp. Wg. (5 cm) Sd. Kfz. 234/2



This armored car is basically the 8-wheeled Model Sd. Kfz. 234 equipped with a 12-cylinder, 75°, air-cooled diesel engine. The armor plate on the front of the turret, superstructure, and hull is heavier than that of earlier models. The vehicle, itself, is also about three tons heavier.

The main armament consists of the 5 cm tank gun, Kw. K. 39/1, fitted with a muzzle brake. This gun has a muzzle velocity of 2,700 f/s, with A. P. ammunition. Its penetration performance with A. P. C. ammunition is estimated at 2.2 inches at 30° from 1,000 yards.

The mantlet is cast in one piece somewhat similar in appearance to that on the latest assault guns, but the casting also includes the coaxial machine gun. This design gives greater protection than the older types. The gun has a vertical sliding block and is of the semi-automatic type. A spring type equilibrator is mounted on the right hand side between the cradle and the turret top plate. The hydropneumatic recoil mechanism is mounted in the mantlet on top of the piece. Elevation is from -7° to $+25^\circ$. Six smoke projectors are mounted, three on each side of the turret.

The front of the turret is protected by 30 mm armor set at an angle of 20° from the vertical. The sides and rear have 10 mm armor set at 25° , and the top plate is of the same thickness. The gun mantlet is rounded, and is 40 to 100 mm thick. The front of the superstructure has 30 mm armor set at a 35° angle, and the sides 10 mm at 30° . The nose plates of the hull are 30 mm thick, the upper plate being set at a 55° angle and the lower at 30° . The glacis plate is 17 mm at 70° and the sides of the hull 9 mm at 30° .

SPECIFICATIONS

Weight	11.5 tons
Length (overall with gun at 12 o'clock) ..	22 ft., 4 ins.
Length (overall with gun at 6 o'clock) ..	19 ft., 8 ins.
Width	7 ft., 10 ins.
Height	7 ft., 6 ins.
Ground clearance	1 ft., 2 ins.
Tread centers	6 ft., 4 $\frac{3}{4}$ ins.
Wheelbase	13 ft., 5 $\frac{1}{2}$ ins.
Tire size	8.27 x 16
Fuel tank	89 gal. capacity
Fording depth	4 ft., 7 ins.
Speed (maximum)	50 m.p.h.
Engine.....	12-cylinder, 75°, air-cooled diesel. 217 BHP at 2250 engine r.p.m.
Bore and stroke	110 mm/130 mm
Ignition	Diesel
Battery	
Transmission.....	6 speeds forward; 6 reverse
Steering	(Dual control) worm and nut
Crew	4

HALFTRACKED ARMORED CAR

GERMAN



leichtes Schützenpanzerwagen (2 cm) (Sd. Kfz. 250/9)



This vehicle, adapted from the light armored personnel carrier, mounts the 2 cm tank gun, Kw. K. 38, and is effective for reconnaissance, action against lightly armored ground targets, protection of troop and supply trains, and as a personnel and supply carrier.

It differs from the basic vehicle principally in the addition of an armored turret which has been found in three forms: 10, 8, and 6-sided. The turret is of truncated cone shape and is similar to that used in the German 4-wheeled armored cars. The turret has no roof, but instead is provided with a wire mesh grill as anti-grenade protection.

The gun is mounted in the center with a 7.92 mm M. G. 34 on the left, and a telescopic sight on the right. The armament is controlled by one man who sits in a seat suspended from the right rear of the turret. A single handwheel controls traverse and elevation, or, by use of a small lever, the gun may be locked in a horizontal position. Counterbalance is maintained by two spring equilibrators, one mounted on each side. The turret is mounted on a ring permitting traverse through 360 degrees. Access to the turret is through a large entrance door in the left rear of the superstructure. The vehicle is provided with a transmitter-receiver, Fu. Spr. f, with intercommunicating facilities.

SPECIFICATIONS

Weight (approx.)	6 tons
Trailer load capacity	
Length	15 ft.
Width	6 ft., 5 ins.
Height	6 ft., 10 $\frac{1}{4}$ ins.
Ground clearance	11 ins.
Tread centers	5 ft., 5 ins.
Ground contact	3 ft., 11 ins.
Track width	10 $\frac{1}{4}$ ins.
Track links	38
Fuel tank	20-25 gals.
Fuel consumption	
Fording depth	27 ins.
Speed	35 m.p.h.
Engine.....	6 cylinder Maybach; Water-cooled, 100 hp.
Bore and stroke	90 x 110 mm
Ignition	Bosch magneto
Battery	12 volt
Transmission.....	Semi-automatic, preselective type. 7 speeds forward, 3 reverse.
Steering	Front wheel—track epicyclic
Crew	3
Armament.....	1 20 mm tank gun (Kw. K. 38) 1 7.92 mm machine gun (M. G. 34)
Armor	
Front plate (approx.)	15 mm
Side plate (approx.)	6 mm
Rear plate (approx.)	8 mm

ARMORED FLAMETHROWER VEHICLE



m. Flammpanzerwagen (Sd. Kfz. 251/16)



This flame-throwing vehicle is employed in association with more heavily armored panzer units. It is an adaptation of the medium armored personnel carrier on which have been mounted the various items of equipment required.

There are two large projectors mounted well back on either side of the vehicle in V-shaped shields. Each of these has a nozzle .55 inch in diameter, and a traverse of 160 degrees. The third flamethrower takes the form of the cartridge ignition projector used in the small portable flamethrower Model 42, on the end of 33 feet of hose, connecting it to the propulsion unit and fuel tank through the back of the vehicle. The nozzle of this projector is .28 inch in diameter.

Fuel propulsion is by a pump driven by a small gasoline engine supplied by a 5½-gallon tank which will run the engine for two hours. One hundred and fifty-four gallons of fuel for the flamethrowers is carried. This allows about eighty bursts of one or two seconds' duration each.

The effective range of the large flamethrowers is about 40 yards; that of the portable unit about 30 yards.

1,850 gallons of fuel are carried in the three 3-ton lorries of platoon transport. This is sufficient for two refuels for all six flamethrower vehicles of the flamethrower platoon.

The crew of the vehicle consists of one vehicle loader who also acts as wireless operator and machine gunner, two flamethrower operators, and a driver.

SPECIFICATIONS

Weight (approx.)	8 tons
Trailer load capacity	3.3 tons
Length	19 ft.
Width	7 ft.
Height	7 ft.
Ground clearance	12 ins.
Tread centers	5 ft., 3 ins.
Ground contact	5 ft., 11 ins.
Track width	11 ins.
Track links	55
Fuel tank	42.5 gals.
Fuel consumption	5 miles per gal.
Fording depth	20 ins.
Speed	30 m.p.h.
Engine.....	Maybach, NL 42 TUKRR, 100 hp.
Bore and stroke	90 x 110 mm
Ignition	Magneto
Battery	12 volt
Transmission.....	4 speeds forward, 1 reverse. High and low range.
Steering.....	Front wheel and track epicyclic
Crew	4
Armor	
Radiator cover	7.5 mm at 81 degrees
Sides	8.5 mm at 55-60 degrees
Front plate	15 mm at 55 degrees
Armament.....	2 large flamethrowers 1 portable flamethrower 2 7.92 mm M. G. 34's

TRIPLE MACHINE GUN ON SEMITRACKED VEHICLE



M. G. 151/15 und M. G. 151/20 Drilling auf m. S. P. W. (Sd Kfz. 251/21)



This is the 3-ton, armored semitrack mounting triple 15 mm or 20 mm heavy machine guns of the Model 151 aircraft type. The equipment is an assault weapon intended for ground combat, and engagement of low flying aircraft is a secondary role.

The three guns, which are cocked manually and percussion fired, are set coaxially and in the same plane. Each gun is held in a standard MG 151 aircraft cradle, less the body extension. The cradles are bolted to a common block on the top bracket of the pedestal, pivoting on trunnions for elevation and depression. The top bracket is bolted to a bottom conical skirt and the whole rotates freely on a cone pedestal fixed to the floor of the vehicle. Elevation (-5° to 49°) and traverse (360°) are shoulder controlled by the firer. A brake locking device is provided for traverse.

The guns, capable of firing 700 r.p.m. each, are belt fed, the belts being contained in steel boxes, one for each gun. A total of 3,000 rounds of ammunition in belts is carried in the vehicle. Penetration of A. P. projectiles fired from the 15 mm MG 151 is reported as 18 mm from 100 meters at 30 degrees.

Sighting apparatus consists of a telescopic sight with a magnification of 3 and a field of view of 8 degrees; a cartwheel type antiaircraft sight, and a hand periscope with a magnification of 8 and a field of view of 7.5 degrees.

A further description of the components of this equipment is available on pages 45 and 252.

SPECIFICATIONS

Weight	8 tons
Trailer load capacity	3.3 tons
Length	19 ft.
Width	7 ft.
Height	
Ground clearance	12 ins.
Tread centers	5 ft., 3 ins.
Ground contact	5 ft., 11 ins.
Track width	11 ins.
Track links	55
Radius of action	186 miles
Fuel tank	42.5 gals.
Fuel consumption (roads)	5 miles per gal.
Fording depth	20 ins.
Speed	30 m.p.h.
Engine	Maybach, NL 42 TUKRR
Bore and stroke	90 x 110 mm
Horsepower	100
Ignition	Bosch magneto
Battery	12 volt
Transmission.....	4 speeds forward, 1 reverse. High and low range.
Steering.....	Front wheel and track epicyclic
Crew	4

SELF-PROPELLED ROCKET PROJECTOR

GERMAN



15 cm Panzerwerfer 42 (Sd. Kfz. N. W. 41)



The chassis of this self-propelled rocket projector follows the half-track design but differs materially from the standard German half-track series of prime movers.

A standard commercial chassis manufactured by Opel (Chevrolet) has been modified to carry a spacious armored body of welded plates. The hull thus formed provides a firm and stable firing platform, and permits of easy mass production. The armor is intended only for protection against small arms fire of .30 caliber. The rear wheels and springs of the original truck chassis have been displaced by a track assembly, prefabricated and then bolted to the original frame. The original rear end differential has been retained but the drive shaft has been shortened and the assembly moved forward to mount the drive sprockets. The hydraulic brake system is retained only for the front wheels. A separate cable for each sprocket brake is connected to two hand levers mounted to the right of the driver's seat. Normal steering is assisted by the sprocket brake when necessary.

The rocket projector consists of ten tubes mounted in two layers of five each. Provision is made for a simple optical sight, and for hand wheels for a maximum of 80° elevation and a maximum traverse of 290°. The projectiles are the same as those fired from the 15 cm Nebelwerfer 41 and can be electrically fired, singly or ripple, by means of a squib placed in each round. They are loaded with high explosive, smoke, and chemical warfare ammunition.

Auxiliary weapons include one 7.92 mm machine gun, M. G. 34, and three 9 mm submachine guns. Ammunition stowage is provided for ten extra rockets, 2,000 rounds for the M. G. 34, and 2,000 rounds for the submachine guns.

SPECIFICATIONS

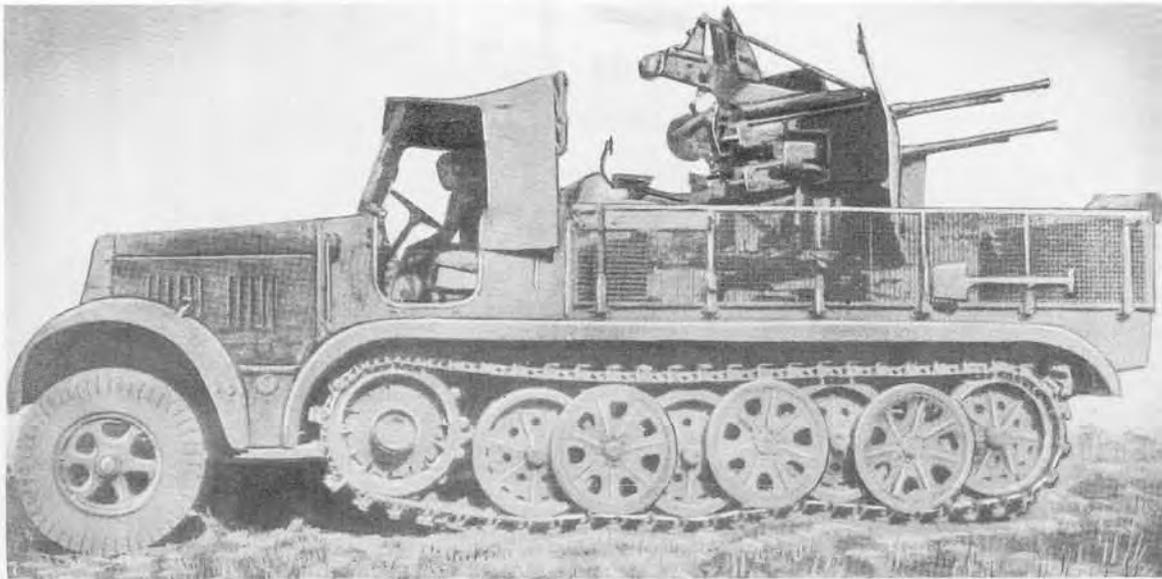
Weight (net)	13,558 lb.
Trailer load capacity	2,425 lb.
Length (overall)	19 ft. 5 ins.
Width (overall)	7 ft., 2 ins.
Wheel base (approx.)	130 ins.
Height (overall)	8 ft., 6 ins.
Armor	5/32 ins. to 5/16 ins.
Ground clearance (minimum)	10 ins.
Tread centers	5 ft. 2 ins./5 ft. 11½ ins.
Ground contact (tracks)	78 ins.
Track width	10¼ ins.
Track links	82
Fuel tank	22.4 gals.
Fuel consumption	Unknown
Fording depth	32 ins.
Speed	25 m.p.h.
Engine	Open (Chevrolet) 6 cyl. O.H.V.
Displacement	220 cu. ins.
Horsepower	67 U.S.A.
Ignition	Bosch 12 Volt (Coil)
Battery	12 Volt with special heater
Transmission	5 speeds forward, 1 reverse
Steering	Normal assisted by differential brake
Crew	3

A.A./A.T. GUN ON SEMITRACK CHASSIS

GERMAN



m. Zgkw. 8 t Sd. Kfz. 7 (2 cm Flakvierling 38)



The 2 cm Flakvierling 38 has been mounted, as illustrated above, on the chassis of the 8-ton medium semitrack prime mover described on page 54. Details of the weapon and its performance may be found on page 133.

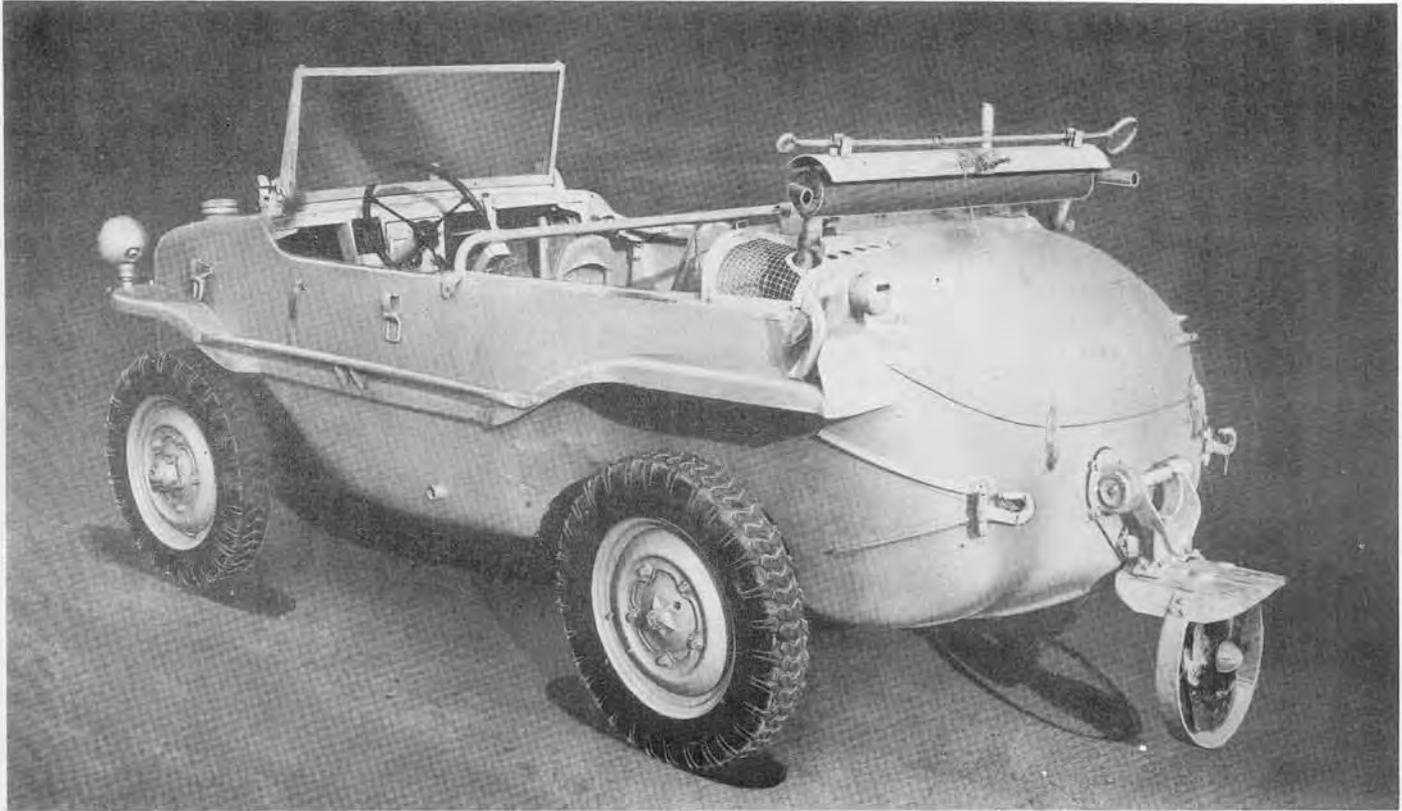
ANTIAIRCRAFT GUN ON SEMITRACK CHASSIS

m. Zgkw. 8 t Sd. Kfz. 7 (3.7 cm Flak 36)



The 3.7 cm Flak 36 has also been mounted on the chassis of the 8-ton medium prime mover described on page 54. Data on the weapon may be found on page 130.1.

Kfz. 2 S



The basic construction of this vehicle is identical with that of the standard type 82 Volkswagen. Front wheel drive has been added to the ingenious positive lock differential rear drive already employed and removes all objections to its poor cross-country performance.

The steering assembly and the front wheel suspension are placed outside a watertight bulkhead.

A rubber sealed stuffing box is used for the front wheel drive shaft. In the rear the suspension is mounted outside the watertight hull. The only openings are for each drive shaft. These are entirely hooded by two bellows type rubber boots that sheath the axle allowing movement in all directions.

Shock absorbers are provided for each wheel. In the front they are mounted outside the hull. In the rear, a watertight shaft extends through the hull from shock absorber to wheel.

Normal grease seals on the rear axle keep water from seeping into the differential and transmission assemblies.

The transmission, transfer case and the positive locking differential comprise a unit assembly secured to the floor at its extreme rear end. A power takeoff has been added to the normal transmission to provide front wheel drive. A cross-country gear position is also provided. It is an extra low gear necessitating the normal transmission be kept in neutral position when used.

The clutch is a dry single disc foot operated type. The propeller assembly is mounted on a spring-loaded hinge that is positioned in the rear directly in line with the hand crank pulley. It incorporates a slip clutch to eliminate damage to the propeller blades by underwater obstructions. Engagement direct with the engine is made through a dog clutch sealed by a rubber bushing on the engine side.

SPECIFICATIONS

Weight	2,040 lbs.
Loading capacity	960 lbs.
Length (overall—propeller down)	150 ins.
(overall—propeller up)	140 ins.
Width (overall)	55 ins.
Height (overall to top of windshield).....	57 ins.
(overall less windshield)	38 ins.
Ground clearance	11.5 ins.
Tread centers	47 ins.
Wheelbase	78 ins.
Tire size	5.25 x16—one spare
Fuel tank	13 gallons, 70 octane
Fuel consumption (land)	20 m.p.g.
(water)	Unknown
Fording depth	Unlimited
Speed (land)	46.5 m.p.h.
(water)	7.5 m.p.h.
Engine.....	4 cyl. horizontally opposed, air-cooled
Horsepower	24.5 at 3,300 r.p.m.
Ignition	Bosch, 6 volt coil
Battery	6 volt
Transmission	4 speeds forward, 1 reverse
Steering	Normal—front wheels

AMPHIBIOUS 1/4-TON TRUCK. MODEL 1942

GERMAN 

Trippel S. G. 6 Schwimmkraftwagen



Development of this vehicle began prior to 1939 at the Trippelwerke Hamburg Saar. According to German press reports, in 1941 Mr. Hans Trippel, the inventor, made improvements over his earlier models as a result of experiments and his plant prepared to go into mass production. The above vehicle was manufactured in 1942. Field examination shows that the application of its design to combined land and water transportation is successful. Simplicity of design throughout makes it possible to produce the vehicle in large quantities very easily.

The body is arranged with a front engine compartment, a center crew compartment, and a rear stowage compartment. Water sealing is accomplished by means of rubber seals throughout. The only openings in the rear of the body are for the wheel and propeller drive and for the shafts of the shock absorbers. In the front of the body there are three openings on each side as follows: one for the shock absorber rod, the radius rod, and for the wheel drive.

Four-wheel drive with independent double coil spring suspension contributes to the cross-country mobility which is said to be remarkable. The shock absorbers are mounted inside the hull and connect with the suspension through an auxiliary shaft that is stuffing box sealed.

A special transmission is provided with three speeds forward and one reverse for highways plus three speeds forward and one reverse for cross-country and a forward and reverse gear for operation in the water. The three-bladed propeller is lowered to position when in the water and is protected inside the body work when on land. Steering is accomplished by front wheels. A one-shot lubrication system is operated from the dash.

SPECIFICATIONS

Weight (net)	3,860 lb.
Cargo capacity (land)	2,400 lb.
Cargo capacity (water)	2,100 lb.
Length (overall)	190 ins.
Width (overall)	71 ins.
Height (overall—top of windshield).....	74 ins.
Ground clearance	15 ins.
Tread center to center	58½ ins.
Tire (Continental, cross-country type)	6.00 x 18 ins.
Wheel base	98 ins.
Freeboard	12 ins.
Speed (highway)	44 m.p.h.
Speed (water)	6-10 m.p.h.
Radius of action (land)	130 miles
Radius of action (water)	46 miles
Fuel tank	15½ gal.
Fuel consumption (land)	9.7 m.p.g.
Fuel consumption (water)	4.35 m.p.g.
Engine.....	Double radiator, water-cooled, details unknown.
Brakes	4-wheel hydraulic
Crew	5
Ignition and Electrical System.....	12-volt Bosch



The portable Gantry Crane was manufactured in 1942 by J. S. Fries & Son, Frankfurt, Germany. It has a capacity of 33,000 pounds, and is used by field tank maintenance units in removing turrets and engines from heavy German tanks.

With a crew of eight men, the crane can be erected from traveling position to the operating position in an estimated time of twenty minutes. When the crane is in the operating position, it can be moved on its bogies on hard surface ground, or it can be run on rails that engage the flanges on the inside of the bogie wheels.

The equipment has a tendency to be top heavy in the traveling position. It is easily erected to the operating position because of its jack-knife tubular legs which are equipped with wire cable tackle blocks and manual winch.

The bridge is fabricated from welded "I" beams and angle iron shapes. The hoisting winch and motor assembly are permanently mounted at one end of the bridge. The motor, a ten-horsepower, three-phase, fifty-cycle 220/380-volt squirrel cage induction type, is equipped with magnetic friction brake and a two-station start-and-stop starter.

The hoisting block, a twin sheave type using a six-37-strand three-quarter-inch galvanized cable, can be raised or lowered manually when power is off.

The trolley is supported by four ball bearing flanged wheels and has ball bearing equipped sheaves. The trolley is traversed manually by a chain.

SPECIFICATIONS

Weight	17,250 lb.
Weight on front wheels	9,170 lb.
Weight on rear wheels	8,180 lb.
Length (overall)	48 ft.
Length of bridge	30 ft., 5 ins.
Length of bridge track	23 ft., 9 ins.
Length of drawbar	11 ft.
Width (overall)	7 ft., 4½ ins.
Width of bridge	3 ft., 3 ins.
Height (overall)	22 ft., 8 ins.
Height in traveling position	8 ft., 2 ins.
Height of bridge	2 ft., 7½ ins.
Center to center of bridge track.....	2 ft., 3 ins.
Tread centers (front)	5 ft.
Tread centers (rear)	6 ft., 8 ins.
Ground clearance at axles	1 ft.
Ground clearance at bogie wheels.....	5½ ins.
Tire size	34 x 7 (8.00 x 20)
Bogie wheel size.....	150 x 410 mm - 5.9 in. x 16.1 in.
Capacity	15 tons.

LARGE CALIBER ARTILLERY*



Gun	Type of Car. and Traverse	Weight of Equipment (lb.)	Length of Barrel in Calibers	PROJECTILE			Weight (lbs.)	Remarks
				Max. Range (yds.)	Muzzle Vel. (ft./sec.)	Type**		
15 cm K. in Mrs. Laf.			45	26,000	2,730	H.E. (15 cm K. gr. 18)	94.6	Probably used on platform for coast defense
15 cm K. 18 (149 mm)	Mod. Box Trail 12°	28,459	55	27,040	2,840	H.E. (15 cm K. gr. 18)	94.6	
15 cm K. 39 (149 mm)	Split Trail 60°	27,280	55.4	27,040	2,840	H.E. (15 cm K. gr. 18)	94.6	Probably mfd. by Krupp
17 cm K. in Mrs. Laf. 18	Mod. Box Trail 16°	38,500	50	32,370	3,035	H.E.B.C. (17 cm K. gr. 38 Hb.)	138	Krupp, Essen
21 cm Mrs. 18	Mod. Box Trail 16°	36,700	31	18,300	1,854	H.E. (21 cm gr. 18)	249	Krupp, Essen
21 cm K. 38	Field 360°	78,000	50	37,200	2,870	H.E. (21 cm K. gr. 38)	265	360° on platform. Krupp, Essen
21 cm K. 39	Field 360°	74,800	45	32,800	2,620	H.E. (21 cm gr. 40)	278	Skoda design
21 cm K. 39/40								Both reported to be very similar to 21 cm K. 39
21 cm K. 39/41								Muzzle brake fitted
21 cm K. 42				37,000	2,820			Skoda design similar to 21 cm K. 39
24 cm H. 39	Field 360°	59,400	28	19,700	1,970	H.E. (24 cm gr. 39)	365	Later version of 24 cm H. 39
24 cm H. 39/40								
24 cm K. 3 (238 mm)	6°	119,000	46 (55?)	41,000	3,248	H.E. (24 cm gr. 35)	331	
24 cm K. 18 (238 mm)	Field 6°	118,800	55	40,500	3,180		332	Fires splined projectile, Rheinmetal Borsig
28 cm H.L./12	Static 360°	111,000	12	11,400	1,150	H.E. (28 cm Sprgr. L./3.5 m. Bdz.)	770	Uses DeBange Type obturator. Obsolete except for coastal defense
28 cm Kst. H.	Static 360°	81,500	12	12,500	1,243	H.E. (28 cm Sprgr. L./3.5 m. Bdz.)	770	Similar to 28 cm. H.L./12. Fires same projectile
35.5 cm M. 1	Field	165,000		21,900	1,870	Anticoncrete (35.5 cm gr. Be.)	825	
42 cm Gamma Mrs.	Static 45°	308,000	16	15,500	1,485	Anticoncrete (s. Gr. Be.)	2,249 2,253	Similar to last war equipment
61.5 cm Mrs.		264,000	8	15,300	1,380	Anticoncrete (gaschosse L./4.1 für Karl gerät)	4,400	Reported to have an auxiliary 54 cm barrel
15 cm K. (E)	Rly. 360°	167,000	40	25,200	2,800	H.E. (15 cm K. gr. 18)	94.6	Naval design. Krupp. Same projectile as 15 cm K. 18
17 cm K. (E)	Rly. 360°	176,000	40	29,200	2,870	H.E.B.C. (17 cm Sprgr. L./4.7 Kz. m. Hb.)	138	Naval design. Krupp
20 cm K. (E) (203 mm)	Rly. Turntable 360°	189,500	55	40,000	3,030	H.E.B.C. (20.3 cm Sprgr. L./4.7 m. Hb.)	247	Naval design. Also known as 20 cm S. K. C./34
21 cm K. 12 (E)	Rly.	744,000	196	131,000	5,330	H.E.B.C. (21 cm gr. 35 m. Hb.)	236	Splined projectile. Differences are not known
21 cm K. 12V (E)	Rly.							Believed to involve an alteration of the rifling
21 cm K. 12N (E)	Rly.							
24 cm Th. Br. K (E) (238 mm)	Rly. 1°	207,000	35	22,200	2,210	H.E.B.C. (24 cm Sprgr. L./4.5 Bdz. u Kz. m. Hb. ung)	328	Sister piece to "Theodor Kanone"
24 cm Th. K. (E) (238 mm)	Rly.	209,000	40 (48?)	29,000	2,660	H.E.B.C. (24 cm Sprgr. L./4.2 m. Bdz. u Kz. m. Hb.)	330	"Theodor Kanone" Naval design
28 cm Ks. Br. K. (E)	Rly.	262,000	40	32,300	2,690	H.E.B.C. (28 cm Sprgr. L./4.1 Kz. m. Hb.)	529	Naval design
28 cm lg. Br. K. (E)	Rly.	271,000	45	40,500	2,820	H.E.B.C. (28 cm Sprgr. L./4.4 m. Bdz. u Kz. m. Hb.)	626	Naval design
28 cm s. Br. K. (E)	Rly.	286,000	50	40,500	2,880	H.E.B.C. (28 cm Sprgr. L./4.4 m. Bdz. u Kz. m. Hb.)	626	Naval design
28 cm Br. N. K. (E)	Rly.	330,000		50,200	3,260	H.E.B.C. (28 cm Gr. 39 m. Hb.)	496	Probably splined projectile
28 cm K. 5 (E)	Rly. 1° Turntable 360°	480,000	76	63,000	3,670	H.E.B.C. (28 cm Gr. 35)	550	Weight does not include turntable. Fires splined projectile. Also reported to fire a rocket assisted shell (28 cm R. Gr. L/4.7) with range of 53 miles.
28 cm K. 5/1 (E)						H.E.B.C. (28 cm Gr. 42)		Differences from 28 cm
28 cm K. 5/2 (E)						H.E.B.C. (28 cm Gr. 42)		K5 are unknown
38 cm Siegfried K. (E)	Rly. Turntable 360°		55 (52?)	61,000	3,450	H.E.B.C. (38 cm Sprgr. L./4.5) (Si)	1,096	Naval design. Also fires a 1,764 lb. shell with maximum range of 46,000 yds.
40 cm K. (E) (406 mm)	Rly.	710,000	50	49,000	3,450	H.E. (40 cm gr. 40)	1,320 2,100	Naval design—Adolf. K.
80 cm Gustav Geschütz		2,750,000	35	51,500	2,790		16,700	Also known as 80 cm

*Almost all the data given have not been verified by tests performed by any Allied government and information from sources available varies considerably in reliability and degree of confirmation.

**Of the several types of projectiles fired by each weapon, only one believed to give maximum range is listed.

RAILWAY GUN

28 cm K5 (E)



The German 28 cm K5 (E) has an unconfirmed range of 31 miles and fires a pre-engraved projectile weighing approximately 550 pounds. It is fired from a turntable affording a 360° traverse.

The gun has a 70-foot 8-inch barrel held in a sleeve-type cradle. The barrel recoil mechanism, fitted between two arms projecting downward from the cradle, consists of two hydropneumatic cylinders and a single hydraulic buffer cylinder. The cradle is supported by trunnions which rest in bearings on top of a box-like frame, of girder construction, which in turn is supported on two pintles resting in bearings in the center of two 12-wheel trucks. The front pintle bearing rides in a rail on the front truck and can be positioned six inches either side of center, thereby allowing a car traverse of approximately 1°.

The equipment in effect has a double recoil action. Besides the barrel recoil which is approximately 32 inches, the gun car recoils. It is coupled to the front of the turntable platform by a hydraulic buffer and a hydropneumatic counterrecoil mechanism which returns the car to battery position.

A turntable platform is transported as part of the equipment and in transport forms a flat car with a 103-foot bed resting on two 8-wheel trucks.

A central jack helps support the tremendous weight of the gun and carriage which amounts to around 230 tons and also serves as a central pivot for the turntable.

The powder chamber is approximately 10 feet 5 inches long. Obturation is obtained by means of a short brass cartridge case and the breech is closed with a horizontal sliding type of breech-block. Firing is of the percussion type.

SPECIFICATIONS

Caliber	280 mm (11 ins.)
Length of barrel	70 ft., 8 ins.
Length of tube	67 ft., 5 ins.
Length of rifling	57 ft.
Rifling	Right Hand uniform twist
Weight of barrel (Leopold)*	187,880 lb.
Length of car	95 ft., 7 ins.
Length of carriage	69 ft., 8 ins.
Width of carriage (overall)	8 ft., 8½ ins.
Number of grooves	12
Width of grooves	⅝ in.
Depth of grooves	17/64 in.
Max. range	54,680 yds.**
Traverse on turntable	360°
Carriage traverse (approx.)	½° R; ½° L
Elevation (estimated)	50°
Ammunition.....	Separate loading—steel spined projectile
Weight of projectile (approx.).....	550 lb.

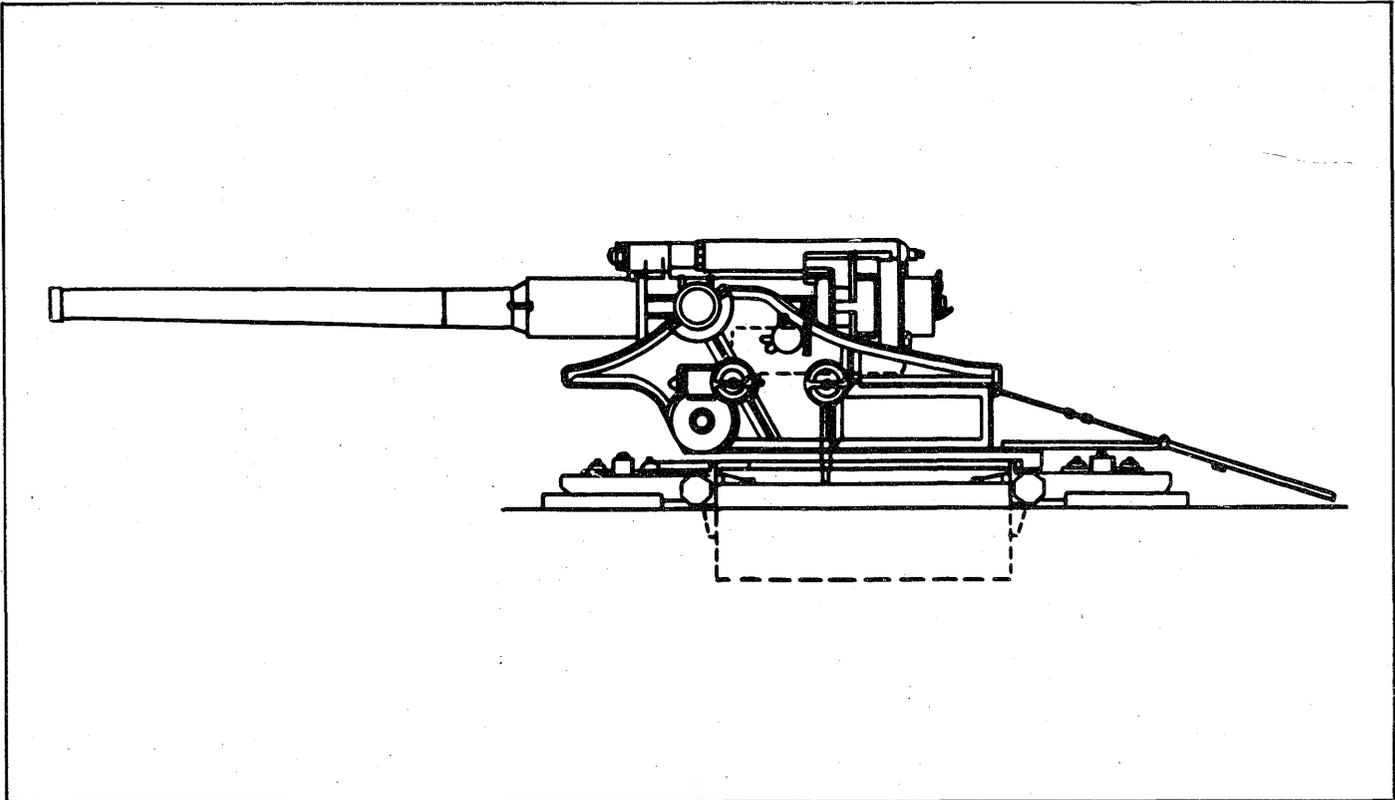
*Two of these guns were found in Italy; one was called "Leopold," and the other "Robert." The weight of the barrel on the latter model is 187,165 pounds.

**Not verified.

HEAVY FIELD GUN

GERMAN 

21 cm K. 39



The 21 cm heavy field gun (K. 39), an original Skoda design, was taken over by the German Army shortly after the invasion of Czechoslovakia. For transport, the equipment may be broken down into three loads, each of which is mounted on two 2-wheeled, pneumatic-tired bogies.

The piece consists of an autofrettaged monobloc barrel and loose liner, and a breech ring. The breechblock is of the interrupted screw threaded type, incorporating an obturator pad, obturator spindle and percussion firing lock. On recoil, the piece slides in a cylindrical sleeve in the cradle.

The upper carriage is fitted to a turntable which revolves on a ball race mounted in the platform. The platform consists of a rectangular sheet steel box which is dug into the ground. Four removable arms located at the corners of the platform support it by bearing on the ground by means of special feet. During transport, the arms are lowered and serve to support the platform on its bogies.

The traversing and elevating mechanisms, each with two-speed gearing, are operated from handwheels on the left of the carriage.

Four types of ammunition are used in the gun: the original Czech high explosive shell; a German version of the same shell with the base fuze omitted; an anti-concrete shell with ballistic cap and base fuze; and an armor-piercing shell with base fuze. It is loaded at 8° elevation with the help of a special 2-wheeled shell trolley.

There are two other versions of the weapon, the K. 39/40 and the 39/41. Although the two later models are modifications of the original Skoda design, they do not differ in main performance details.

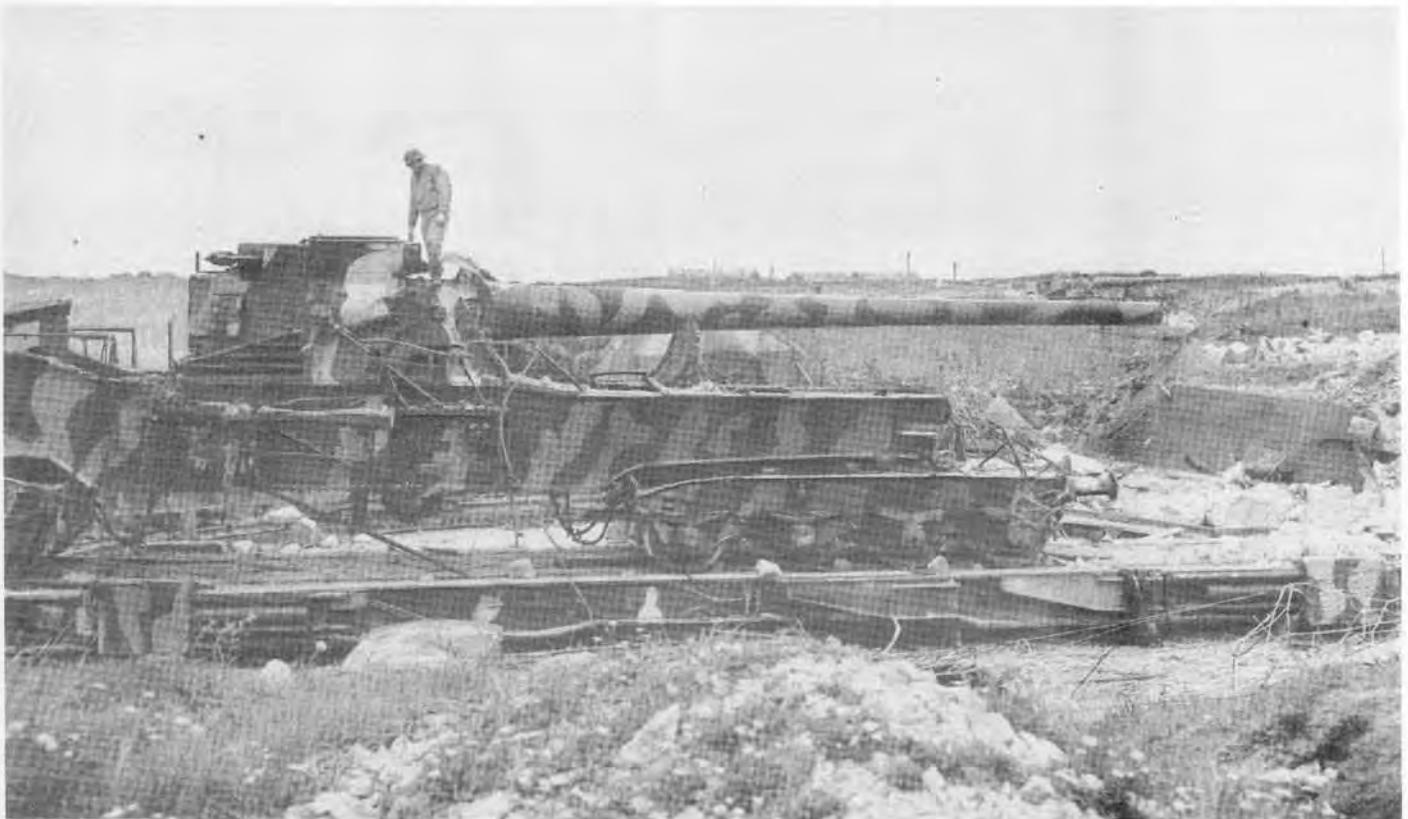
SPECIFICATIONS

Caliber	210 mm (8.27 ins.)
Weight (traveling position) Three loads approx. 16½ tons each	
Weight (firing position)	37.2 tons
Length of barrel including breech ring....	31.3 ft.
Muzzle velocity (max.)	2,625 f/s
Max. range (horizontal)	32,800 yds.
Traverse	360°
Wt. of max. charge	82.8 lbs.
Elevation	45°
Depression	-4°
Ammunition	H.E.; Anti-concrete; A.P.
Wt. of projectile	All 298 lbs.

RAILWAY GUN

20 cm K. (E)

GERMAN



Batteries of these railway guns in concrete emplacements were found on both the Cherbourg and Brest Peninsulas in France. Equipment consisted of the gun, carriage, turntable, power plant and electrical operating unit, and ammunition car.

The piece is of the built-up type, consisting of a tube and two jackets. It is screwed into the breech ring. The breechblock is of the horizontal sliding wedge type. The hydropneumatic recoil system has two cylinders located under the carriage; the pistons are fastened to the lower end of the breech ring.

The carriage, when mounted on a turntable, has a traverse of 360 degrees; it is estimated that elevation is from 0 to 840 mils. The turntable, consisting of two sections bolted together, rotates on a central pivot and a portable circular track. Four wheels at each end of the turntable support it on the track. Electric motors are geared through these wheels to rotate the piece in azimuth. It is very similar to the 28 cm K. 5 (E) reported on page 100.2.

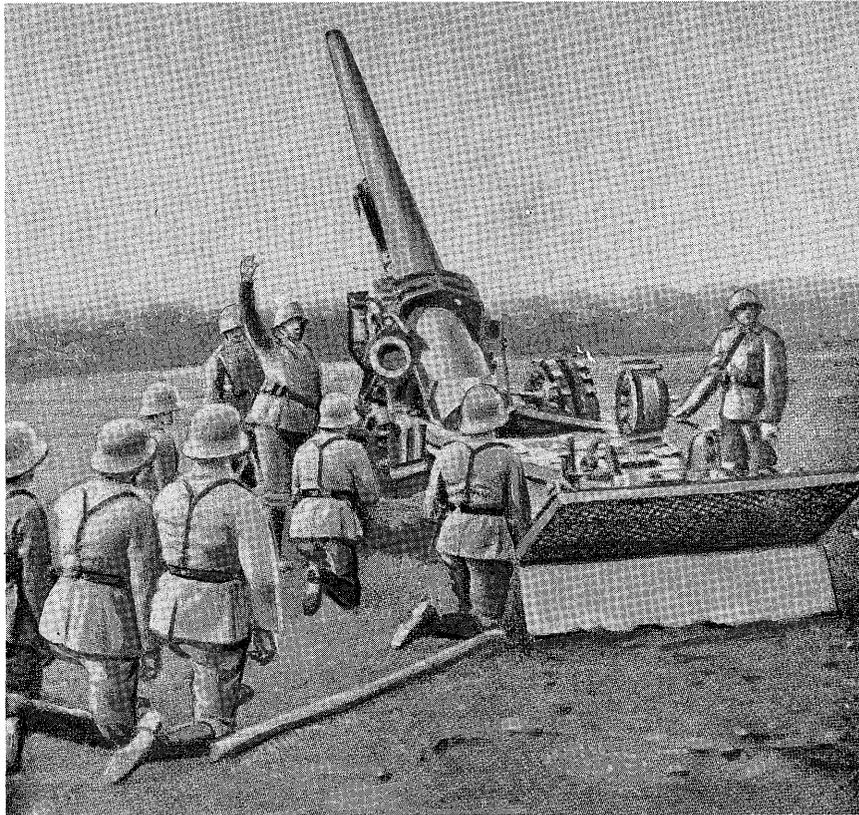
A small ammunition car, equipped with a removable roof, is mounted on trucks and runs on a two-rail track which is built in as a part of the turntable track.

SPECIFICATIONS

Weight of gun	45,500 lbs.
Weight of carriage w/ gun	189,000 lbs.
Caliber	203 mm (7.982 ins.)
Weight (firing position)	92.5 tons
Length (traveling position)	63 ft. (approx.)
Height (traveling position)	13 ft.
Height (firing position) .....	.....
Width (overall)	13 ft. (approx.)
Track	Std. railway gage 56½ ins.
Length of tube	30 ft., 7 ins.
Length of tube and breech	32 ft., 8½ ins.
Length of rifling	22 ft.
Rifling	Uniform R.H. twist
No. of grooves	64
Width of grooves	0.188 in. (approx.)
Depth of grooves .....	.125 in. (approx.)
Width of lands .....	.....
Muzzle velocity (shell)	2,800 f/s
Range (est.)	36,000 yds.
Traverse (on turntable)	360°
Elevation (estimated)	47°
Depression	0°
Length of recoil (from recoil index slide)	25½ ins.
Ammunition	APCBC, APBC, HE, Practice, Illuminating with parachute
Wt. of projectile	259 lbs.
Wt. of propellant (max. charge)	96.5 lbs.

HEAVY FIELD GUN

15 cm K. 16



The 15 cm K. 16 differs from other German 15 cm guns by reason of its appreciably heavier projectile. The ammunition employed in the K. 16 is not interchangeable with other guns of the caliber.

This weapon is generally regarded as obsolete, although it may be employed as a coast defense weapon or in some other static role. The piece may be used on the 21 cm Howitzer carriage and then may be known as 15 cm K in Mrs. Laf.

Features of the 15 cm K. 16 are: the location of the buffer and recuperator below the piece; a large three-ribbed collar which surrounds the piece just forward of the breech ring; a cylindrical breech ring; and a box-type trail terminating in a spade of massive dimensions.

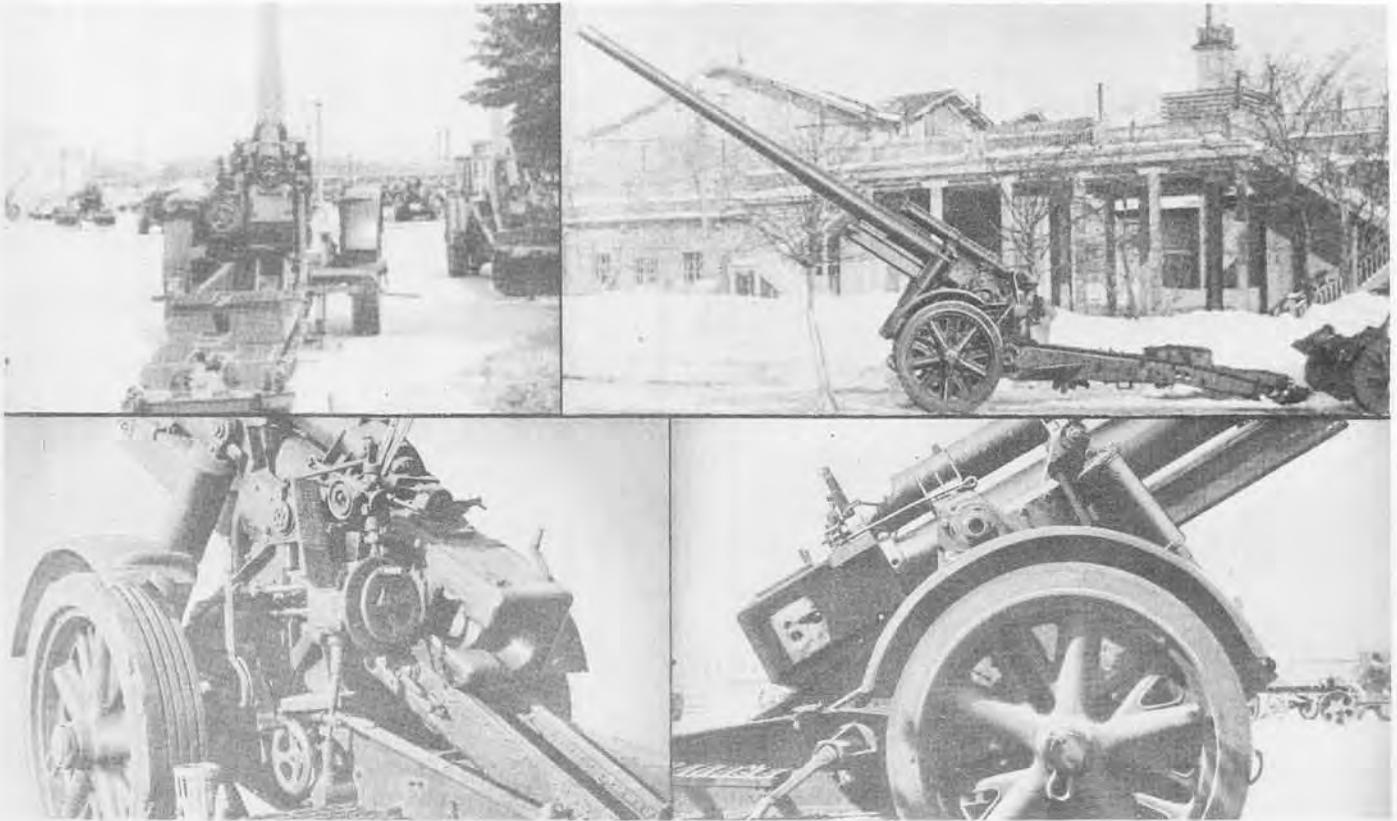
SPECIFICATIONS

Caliber	150 mm (5.9 ins.)
Weight in action	24,000 lbs.
Length of piece	248 ins.
Elevation	42°
Depression	—3°
Traverse	8°
Maximum range	21,370 yds.*
Maximum muzzle velocity	2,480 f/s*
Ammunition	H. E. Capped
Weight of projectile	113 lb.
Propellant	
	16 lb. Ngl R.P. plus 3 oz. igniter powder
	26 lb. Ngl R.P. plus 3 oz. igniter powder
	29 lb. Ngl R.P. plus 3 oz. igniter powder

*Not verified.

MEDIUM FIELD GUN

15 cm K. 18



This weapon was being replaced by the 15 cm K. 39 during the closing months of the European war. For transport, the K. 18 may be broken down into two loads and drawn by either horse or truck.

The built-up tube consists of a main tube, breech jacket, and breech ring. Rifling is a 6° constant twist. Hydraulic recoil and hydropneumatic counterrecoil cylinders are of standard German design. The buffer is located below, and the recuperator above the piece.

A rectangular breech ring has a crank-operated horizontal sliding type breechblock opening to the right. Two pneumatic, push-type equilibrators are incorporated in the design.

Elevation and depression are accomplished by means of an off-center elevating arc which is operated by a handwheel on the left side of the piece. The traversing handwheel is also located on the left.

The carriage is mounted on two rubber-tired wheels and has a hollow, box-type trail allowing a total traverse of 12 degrees.

The ammunition is semi-fixed; there are three charges.

SPECIFICATIONS

Caliber	149 mm
Weight (firing position)	28,400 lbs.
Maximum chamber pressure....	41,200 lbs./sq. in.
Length of barrel	323 ins.
Twist of rifling, constant	6°
Length of rifling	253 ins.
Volume of chamber	1,770 cu. in.
Muzzle velocity	2,840 f/s
Max. range (horizontal)	27,000 yds.
Traverse	12°
Elevation	43°
Depression	2°
Length of recoil	1,450 mm
Ammunition types—HE; anticoncrete	
Weight of max. charge	42.5 lbs.
Weight of projectile (HE)	94.6 lbs.

MEDIUM FIELD GUN

15 cm K. 39



Barrel, above, not shown in normal travel position

The K. 39 was gradually replacing the K. 18 as Germany's standard medium mobile artillery weapon. It is basically the same design as the earlier model, and has an identical range, muzzle velocity, and chamber pressure. Modifications to the piece, while extensive, were confined largely to the carriage, which resembles the 15 cm s. F. H. 18, page 105.

The tube is approximately two inches longer than that of the K. 18, and the rifling was changed from a 6° constant twist to a variable one, increasing from 4° 17' to 5° 59'. The breech mechanism is of the horizontal sliding block type. The hydraulic recoil cylinder is apparently the same as that on the K. 18, but the hydro-pneumatic counterrecoil cylinder is shorter and larger in diameter than that of the earlier model. Length of recoil varies from 1250 mm to 1500 mm (49.2 inches to 59.2 inches). The equilibrators of both the K. 18 and the K. 39 are of the push type, but those on the K. 39 are spring activated. Elevation and traverse are accomplished in much the same manner, changes being principally in the location of the handwheels. A rigid gunners' platform constructed of a non-skid open steel lattice work is bolted to the upper carriage. Although awkward in appearance, it performs the function for which it was intended without hampering the movements of the crew about the gun.

Traverse has been increased from 12° to 60° by the use of a split trail with detachable spades instead of the box-type trail used on the K. 18.

SPECIFICATIONS

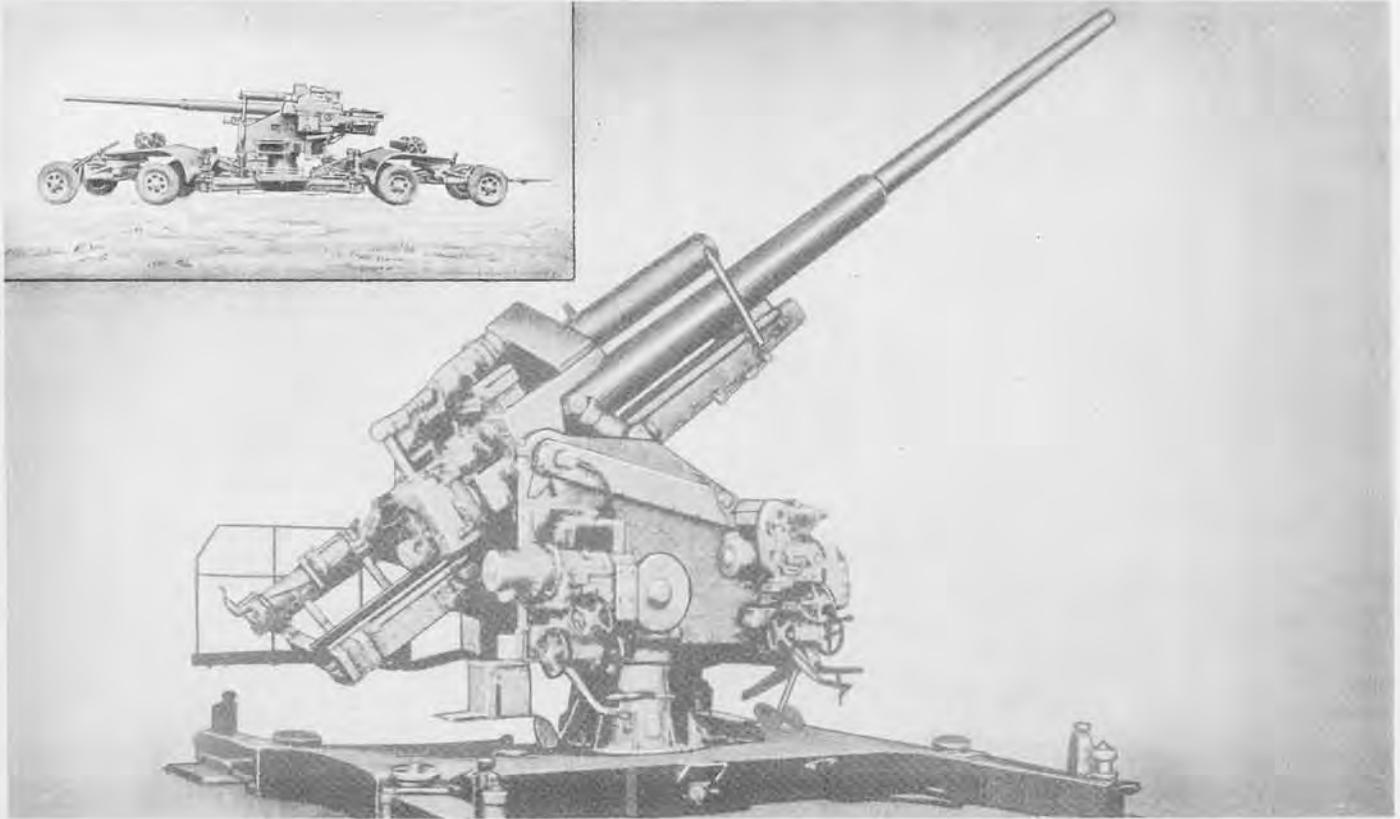
Caliber	149 mm
Weight (traveling position)	
Weight (firing position)	27,300 lbs.
Length (traveling position)	
Length (firing position)	
Height (traveling position)	
Height (firing position)	
Width (overall)	
Width of trail spread	
Twist of rifling—increasing	4° 17' to 5°
Length of barrel	325 ins.
Length of rifling	256.6 ins.
Volume of chamber	1,829 cu. ins.
Muzzle velocity	2,840 f/s
Max. range (horizontal)	24.7 km
Rate of fire	
Traverse	60°
Elevation	45°
Depression	4°
Length of recoil (max.)	1,500 mm
Ammunition types—H.E.; anticoncrete, APHE	
Weight of max. charge	41.2 lbs.
Weight of projectile (HE)	94.6 lbs.

HEAVY ANTI-AIRCRAFT GUN

GERMAN



12.8 cm Flak 40



This weapon, together with the 8.8 cm Flak 41, is Germany's standard heavy anti-aircraft gun. There are four different type mounts used with the gun: mobile, static, railway, and a twin mounting. When used with the latter, the equipment is known as the 12.8 cm Flakzwillig.

In construction and appearance this weapon resembles the 10.5 cm anti-aircraft gun described on page 109. The barrel consists of a three-piece tube with jacket and sleeve. The breech mechanism is of the horizontal sliding block type, and an electric firing device is used. A hydropneumatic recuperator is located above the barrel, and a hydraulic buffer below.

Elevating and traversing may be operated either by power or by handwheels; are located on the right side of the equipment with the layers seated facing the gun. A machine fuze setting gear and loading and ramming gear identical with those of the 10.5 cm Flak are used.

The static mounting is a pedestal type secured to a concrete base. The cradle pivots in trunnions mounted at the extreme rear of the upper carriage, and almost in line with the breechblock. A large box-like construction, located underneath the buffer and forward of the elevating arc, contains the oil motors. The equilibrators extend from an anchoring just forward of the trunnions to the forward edge of the casing containing the oil motors.

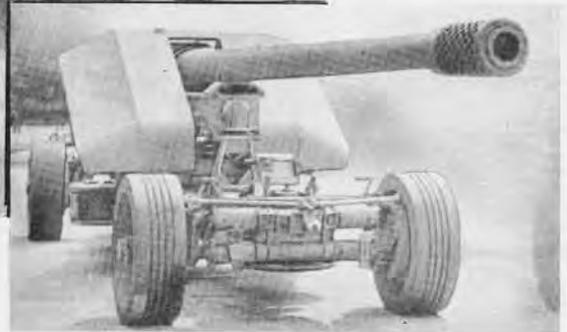
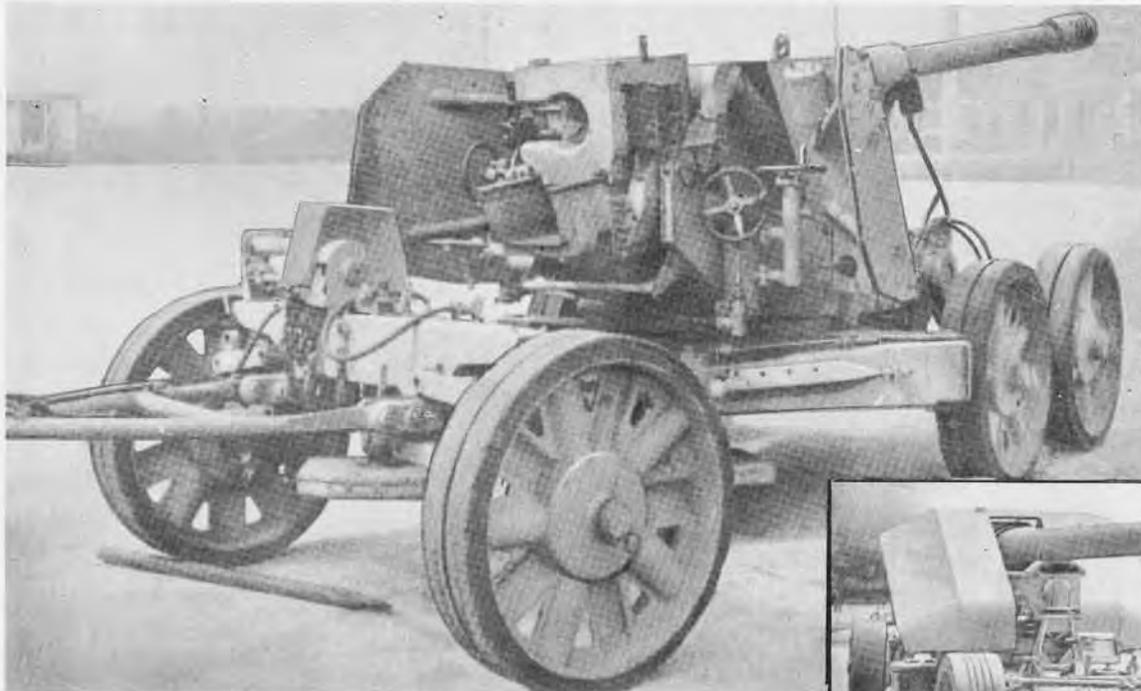
The gun being extremely high off the ground, platforms for the gun crew are provided. The gun is fitted to receive firing data by remote control transmission. A normal panoramic sight is provided as well as an antitank sight.

SPECIFICATIONS

Caliber	12.8 cm (5.04 ins.)
Weight (static mount)	28,600 lbs.
Weight (traveling position)	59,400 lbs.
Mobile mount	
Weight (firing position)	37,400 lbs.
Mobile mount	
Length (traveling position)	49 ft. overall
Length (firing position)	29 ft. overall
Height (traveling position)	
Height (firing position)	
Height of trunnions (firing position)	7 $\frac{1}{2}$ ft.
Width (overall)	
Length of piece	308.5 ins. (61 calibers)
Length of rifling	255.13 ins.
Twist of rifling (increasing)	3° 20' to 5° 30'
No. of grooves	40
Width of grooves (forward section)	0.26 in.
(center section)	0.25 in.
Depth of grooves	0.06 in.
Width of lands (forward section)	0.13 in.
(center section)	0.14 in.
Muzzle velocity (H.E. shell)	2,886 f/s
Max. range (horizontal)	20,950 meters (22,910 yds.)
Max. ceiling at 85°	14,800 meters (48,555 ft.)
Rate of fire	12 r.p.m.
Traverse	360°
Elevation	88°
Depression	-3°
Length of recoil	from 36 to 51 ins.
Ammunition	A.P.C., H.E.
Wt. of complete round (approx.)	106 lbs.
Wt. of H.E. projectile (12.8 cm Sprgr. Patr. I. 4.5)	57 lbs.
Wt. of A.P.H.E. projectile (12.8 cm Pzgr. Patr.)	58.13 lbs.

MEDIUM FIELD GUN

12.8 cm K. 44



Left: Rheinmetall Model; Right: Krupp Model.

There are two versions of the 12.8 cm dual purpose, anti-tank/field gun, one manufactured by Rheinmetall and the other by Krupp. The Rheinmetall model has a slightly longer breech ring; the carriage has one rear axle and two front axles, whereas the Krupp model has one rear and one front axle. Reports indicate that there may be a third version designated 12.8 cm K. 81.

The tube, of monobloc construction, is equipped with a cylindrical muzzle brake having perforations on both sides. The muzzle brake of the Krupp model is shorter and has the greater number of perforations. The manually operated breechblock is of the horizontal sliding type.

A variable hydropneumatic recoil mechanism is provided, the recoil and recuperator cylinder being carried within the cradle. Two hydropneumatic equilibrators, one on either side of the tube, compensate for muzzle preponderance.

The piece is mounted on a cruciform platform. The carriage, which incorporates torsion bar suspension, is jacked off the wheels in firing and, with the outriggers extended, a 360° traverse may be obtained. Elevating and traversing handwheels are fitted to both sides of the carriage, and a seat for the gunner is provided on the left.

A single shield is used with the Krupp gun, while the Rheinmetall version is equipped with a spaced shield. Both types, however, are angular in appearance and the sides are swept back towards the rear.

SPECIFICATIONS

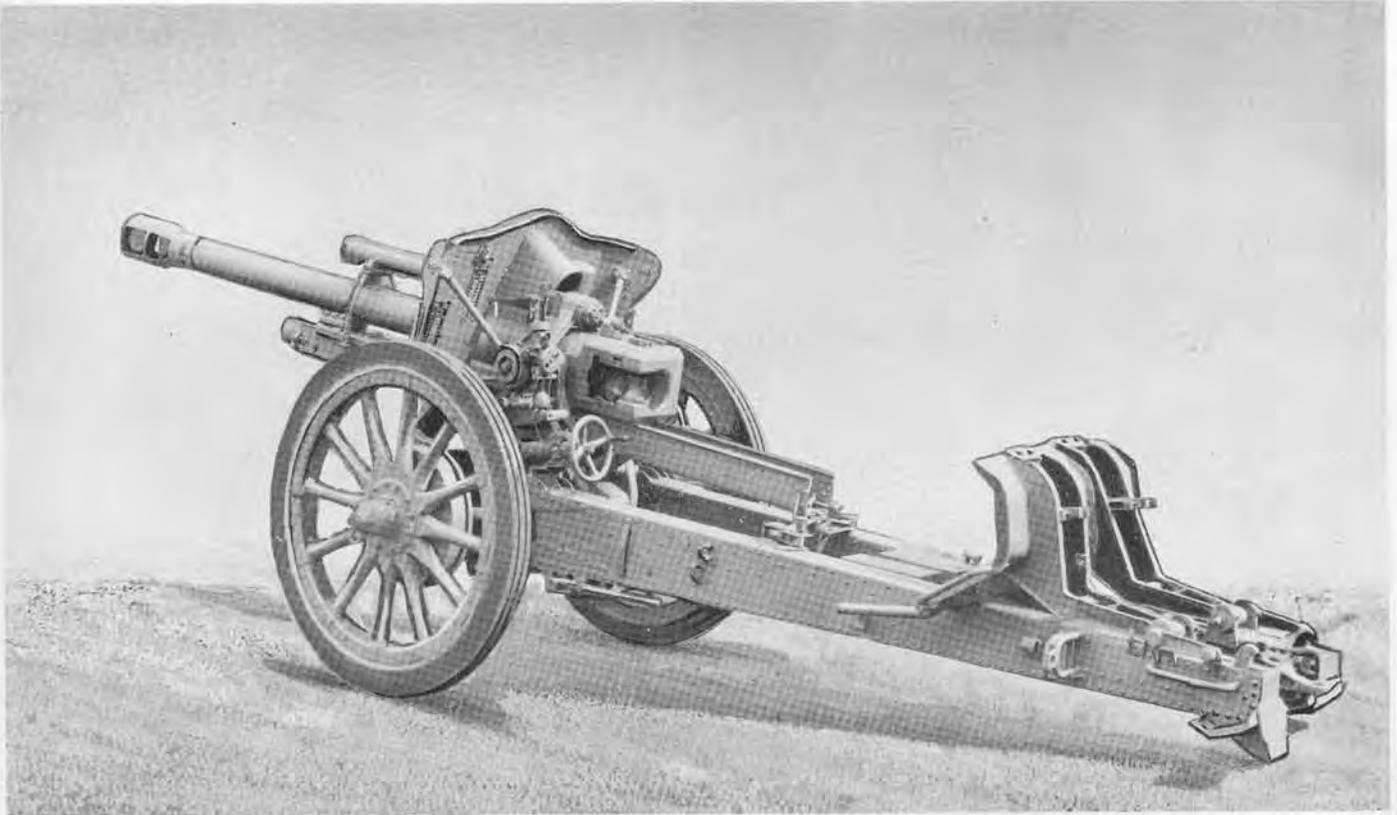
	Rheinmetall	Krupp
Length of gun (including muzzle brake and breech ring)	312½ ins.	299 ins.
Length of gun (including breech ring).....	277½ ins.	277½ ins.
Length of chamber (from rifling)	41¾ ins.	41¾ ins.
Length of rifling.....	219½ ins.	219½ ins.
Overall length (traveling position)	not determined	433 ins.
Overall width (traveling position)	108¼ ins.	98 ins.
Overall height (traveling position)	81 ins.	90 ins.

LIGHT FIELD HOWITZER

GERMAN



10.5 cm l. F. H. 18 (M)



In order to obtain longer range, the 105 mm German Howitzer l. F. H. 18 was modified so that the muzzle velocity of the weapon could be increased. The Germans accomplished this by preparing a new propellant charge (Fern ladung—long range charge) which increases the muzzle velocity from approximately 1,542 feet per second to 1,772 feet per second, and the range from approximately 11,670 yards to 13,500 yards. To compensate for the increased velocity and the resulting recoil, the Germans found it necessary to add a muzzle brake. It was also necessary to slightly modify the recoil mechanism and to increase the nitrogen pressure in the counterrecoil cylinders from 730 pounds per square inch to 854 pounds per square inch. To differentiate between the two models, the letter "M" (Mündungsbremse—Muzzle Brake) was added to the old nomenclature, hence the later model is known as the l. F. H. 18 (M).

The tube is of monobloc construction. The weapon has a continuous pull firing mechanism and a breech mechanism of the horizontal sliding type. The carriage, of riveted and welded steel, is equipped with split trails, folding spades, wooden wheels with rubber tires, and a protective armor shield 4 mm thick. It also has hand operated friction brakes.

SPECIFICATIONS

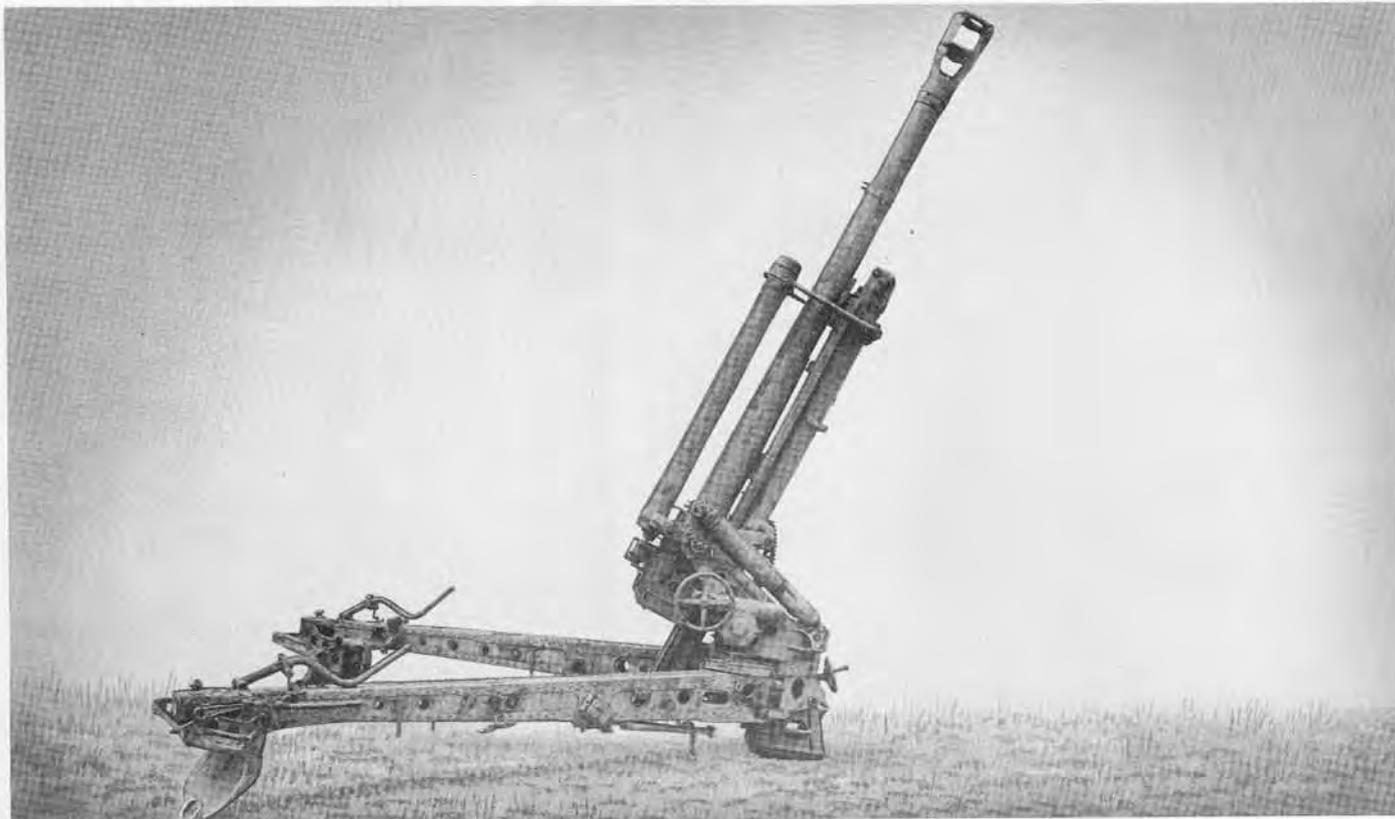
Caliber	105 mm (4.13 ins.)
Weight (traveling position)	4,255 lbs.
Weight (firing position)	
Length (traveling position)	19 ft., 6 ins.
Length (firing position).....	20 ft., 5 ins. (at 0° elev.)
Height (traveling position)	5 ft., 9 ins.
Height (firing position)	5 ft., 9 ins.
Width (overall)	6 ft., 6½ ins.
Width of trail spread	15 ft., 10 ins.
Length of bore	25.7 cal.
No. of grooves	32—R.H. Progressive Twist
Width of grooves	
Depth of grooves	
Width of lands	
Muzzle velocity (maximum)	1,772 f/s*
Max. range (horizontal) (Reported).....	13,500 yds.
Traverse	56°
Elevation	40°
Depression	7°
Length of recoil	39.3 ins.—46.8 ins.
Ammunition.....	H.E. w/P.D. Fuze; Hollow Charge; Smoke; A.P.; Incendiary
Wt. of projectile..	32¾ lb. (Long Range H.E. Shell)

*Reports indicate that a special long range H.E. shell weighing approximately 32¾ lb. is used with the super charge to obtain this muzzle velocity.

MOUNTAIN HOWITZER

GERMAN 

10.5 cm Geb. H. 40



The 10.5 cm Geb. H. 40, introduced into the German Army in 1942, is the companion piece to the 7.5 cm Geb. G. 36 described on page 118. Its design is basically the same as that of the 10.5 cm le. F. H. 18 (M). The weapon can be split into nine loads for transport.

The barrel, of monobloc construction, is fitted with a double baffle muzzle brake with wide side flanges; the breech mechanism is of the horizontal sliding block type. A hydraulic buffer is built into the cradle on which the barrel slides in recoil, and a hydro-pneumatic recuperator is mounted above the barrel.

The split trail carriage has trails of riveted box construction which are fitted with large detachable spades. It is mounted on wheels of cast light alloy with detachable rims and solid rubber tires. The wheels are mounted on stub axles fitted to the trail legs and remain parallel to the legs when they are opened. Internal expanding brakes, adjusted by a handwheel from the front, are fitted to both wheels. The traversing and elevating handwheels are located on the left and right sides of the carriage respectively.

There are two range drum scales: one in mils ranging from 0 to 1,250; the other in meters ranging from 0 to 1,500 for hollow charge ammunition and from 1,500 to 9,675 for high explosive shells, both with charge 6 in the lower register.

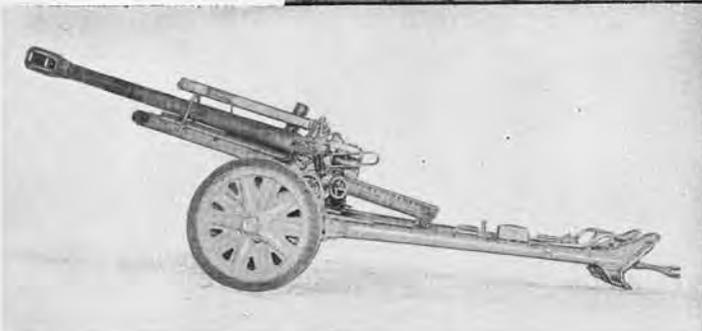
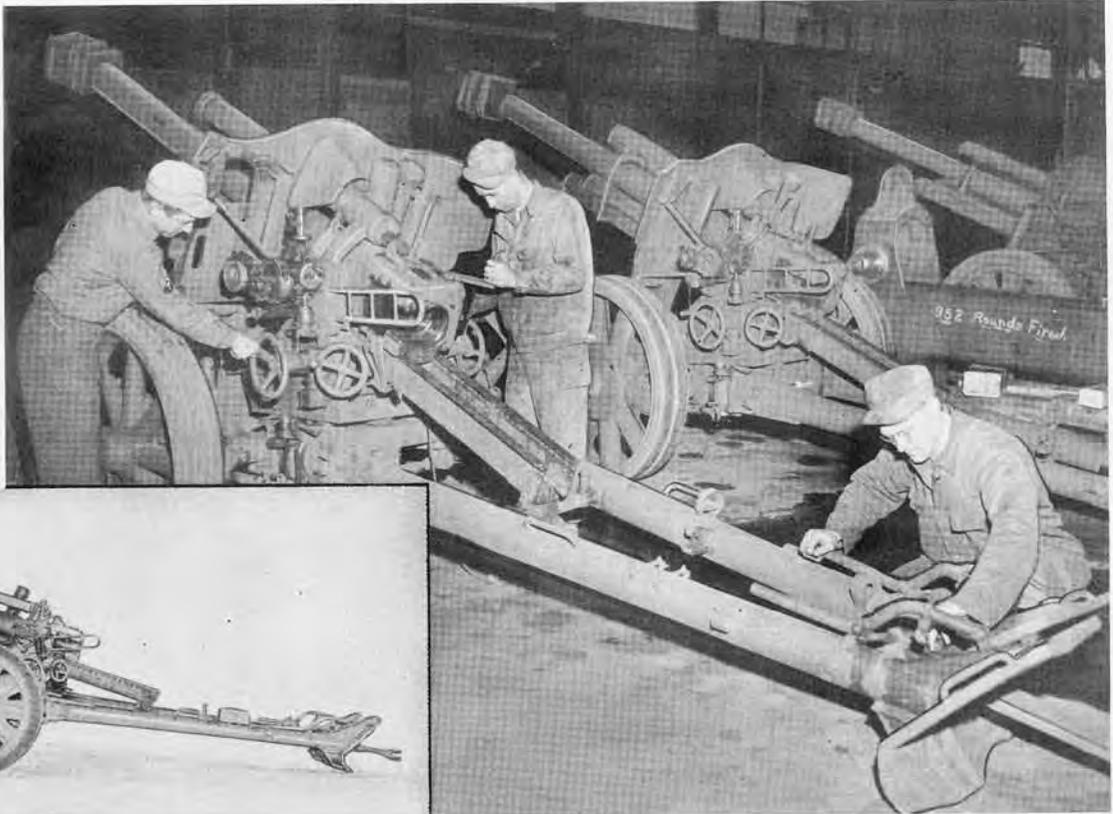
SPECIFICATIONS

Caliber	105 mm (4.14 ins.)
Weight (traveling position)	
Weight (firing position)	3,660 lb.
Length of piece	10 ft., 4 ins.
Length (firing position)	18 ft., 6 ins.
Height (traveling position)	
Height (firing position)	4 ft., 11 ins.
Width (overall)	4 ft., 6 ins.
Width of trail spread.....	
Length of bore	9 ft., 5 ins.
No. of grooves	32
Width of grooves	
Depth of grooves	
Width of lands	
Muzzle velocity	1,870 f/s
Max. range (horizontal)	13,807 yds. (Chg. 7)
Max. range (vertical)	
Rate of fire	
Traverse	25°, 20' left and right
Elevation	70°
Depression	-4°, 47'
Length of recoil (variable)....	19.7 ins. to 49.2 ins.
Ammunition.....	10.5 cm F.H. Gr. Al. (32 lb.)*
	10.5 cm F.H. Gr. 38 Al.
	10.5 cm F.H. Gr. Buntrauch (32 lb.)
	10.5 cm 39 rot HL/A and HL/B
	(25.8 lb.)—Chg. 6 only.
	10.5 cm 39 rot AL/C

*A star shell is also reported to be fired with Charge 6.

LIGHT FIELD HOWITZER

10.5 cm le. F. H. 18/40



Feeling the need of a weapon having the performance characteristics of the le. F. H. 18 (M) but lighter in weight, the Germans brought out, early in 1944, a modified version mounted on the carriage of the 7.5 cm Pak 40. This carriage was used because at that time it was in large scale production and required a minimum amount of modification to adapt it for use with the howitzer.

The piece, of monobloc construction with a removable breech ring, is fitted with a double baffle muzzle brake having projecting wings welded on to give it the increased efficiency necessary for the lightened carriage.

The breech mechanism is a manually operated horizontal sliding block type. The firing mechanism is of the percussion type with the lever on the left side of the cradle.

The cradle is a rectangular box design. A single hydro-pneumatic equilibrator is attached to the right side of the cradle. The recoil is a hydropneumatic type, independent system.

The elevating handwheel and firing mechanism are now so located on the left hand side of the carriage that the layer can carry out the three operations of traversing, elevating, and firing, making the weapon suitable for direct fire.

The suspension consists of two torsion bars each extending the full width of the carriage body. As the two pieces are ballistically identical, the le. F. H. 18 (M) and the le. F. H. 18/40 use the same range tables.

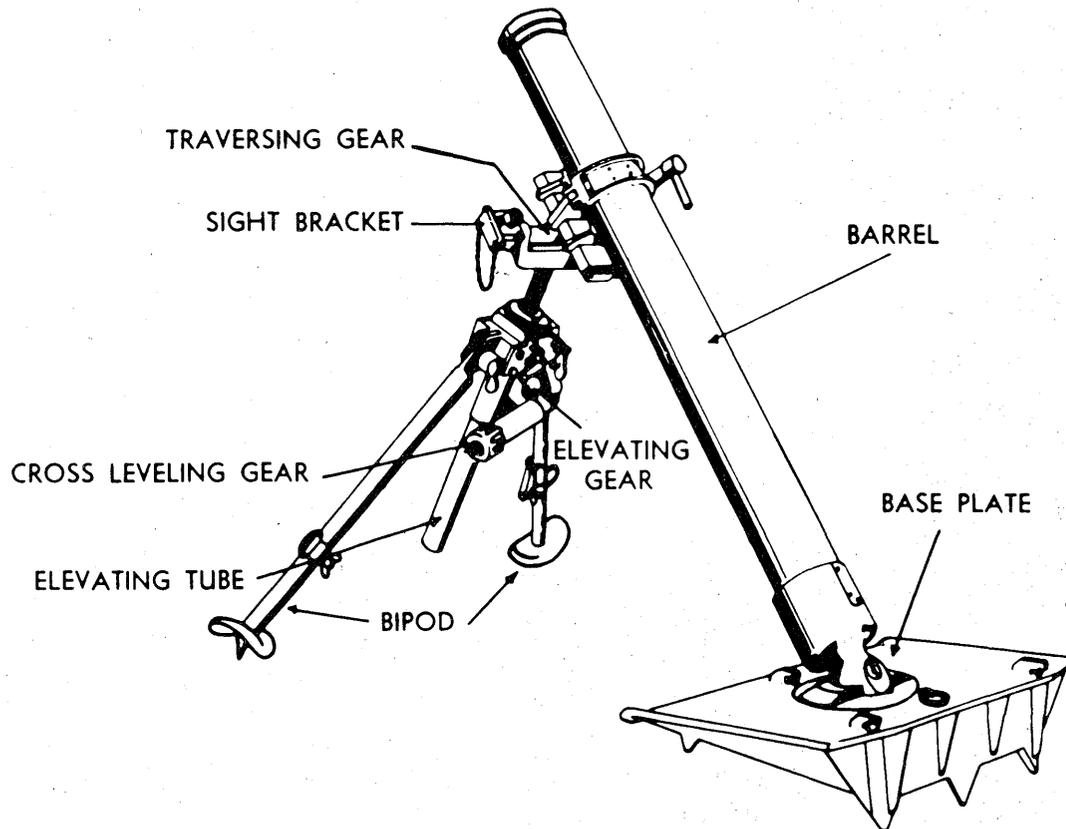
A normal type of German artillery field sight is used for laying.

SPECIFICATIONS

Caliber	105 mm (4.13 ins.)
Weight (firing position)	4,322 lbs.
Length (overall)	20 ft. 2 ins.
Height (overall)	6 ft.
Height (firing position)	
Width (overall)	6 ft. 11 ins.
Length of barrel excluding muzzle brake	115.75 ins.
Length of tube	106.66 ins.
Length of rifling	93.06 ins.
Rifling	Increasing twist; 1 in. 23 to 1 in. 17 $\frac{3}{4}$
No. of grooves	32
Width of grooves	0.220 in.
Depth of grooves	0.04 in.
Muzzle velocity (H.E. long range shell) ..	1,772 f/s
Wt. of projectile	32 lbs., 11 ozs.
Max. range (horizontal)	13,479 yds.
Max. range (vertical)	
Max. pressure	34,000 lbs./sq. in.
Rate of fire	
Traverse	56°
Elevation	40°
Depression	6°
Length of recoil	
Ammunition	H.E.; H.E./I; Incendiary; Smoke; Star Shell; Prop. Leaflet Shell; Hollow Charge; Indicator Shell.

SMOKE MORTAR

10 cm Nebelwerfer 35



The 10 cm Nebelwerfer, standard smoke and chemical mortar in use by the German Army, has also been used, to some extent, by airborne troops. It is serviced by five men and transported on a two-wheeled handcart.

Although the standard ammunition for the weapon is a 16-pound smoke shell designated Wurfgranate 35, a 19-lb. high explosive shell, Wurfgranate 40 is also used.

The mortar, which is merely a heavier and larger model of the German 8 cm mortar, consists of a barrel, bipod, and baseplate constructed on the usual mortar lines. The traversing gear, however, is unusual in that the traversing screw is housed in a sleeve which is supported by the two ends of a box-shaped yoke secured to the top of the elevating screw.

SPECIFICATIONS

Caliber	105 mm (4.1 ins.)
Weight in action	228 lb.
Weight of barrel	72 lb.
Weight of bipod	73 lb.
Weight of baseplate	83 lb.
Method of operation.....	Muzzle loaded; percussion fired
Maximum range	3,300 yds.*
Rate of fire	12-15 rds./min.
Ammunition.....	H.E. and Smoke
Weight of shell	16 lb. (Wurfgranate 35) Smoke 19 lb. (Wurfgranate 40) H.E.
Transport	2-wheeled handcart

*Not verified.

SMOKE MORTAR

10 cm Nebelwerfer 40



This weapon is designed for either smoke, chemical, or high explosive ammunition.

The smooth-bored tube of monobloc construction is independent of the breech and breech block. When the piece is loaded, both breech and breech block remain stationary, and the back end of the tube moves outward in a vertical direction in grooves cut into the inside of the legs of the breech block. During this operation, the tube pivots about its trunnions located midway between the muzzle and breech ends. There is no spring tension in the breech mechanism so that its movement is entirely manual. The piece is fired by percussion, a spring-driven firing pin being located in the breech block. The firing lever is located just below the breech operating lever.

There are two recoil cylinders, one located on either side of the tube. The cylinders are anchored to the ends of the frame, and the pistons attached to the sides of the breech. The counterrecoil system is located above the tube. Its cylinder is attached to the frame, and the piston to the yoke. Apparently both the recoil and the counterrecoil system is hydropneumatic.

The weapon is fired from the base plate (missing in photo) and wheels. In order to traverse the piece, it is pivoted about a ball and socket joint in the base plate by means of an axle traversing mechanism of ordinary design. Elevation is controlled by two parallel arcs which travel on pinions geared to and rotated by the elevating handwheel. Both traversing and elevating handwheels are located on the left side, as is also the sight bracket.

SPECIFICATIONS

Caliber	105 mm (4.1 in.)
Weight (traveling position)	
Weight (firing position)	1,730 lb.
Length (traveling position)	
Length (firing position)	
Length of barrel	(16 calcs.) 66 ins.
Height (traveling position)	
Height (firing position)	
Width (overall)	
Width of trail spread	
Length of bore	}Smooth bore
No. of grooves	
Width of grooves	
Depth of grooves	
Width of lands	
Muzzle velocity	426-1,380 f/s**
Max. range (horizontal)	6,810 yds.**
Min. range (horizontal)	1,668 yds.
Max. range (vertical)	
Rate of fire	8-10 rds./min.
Traverse	14°
Elevation	45°-85°
Depression	
Length of recoil	
Ammunition	H.E.; Smoke; Chemical*
Wt. of projectile	H.E.—(20.6 lbs.) Smoke—21.9 lbs.)

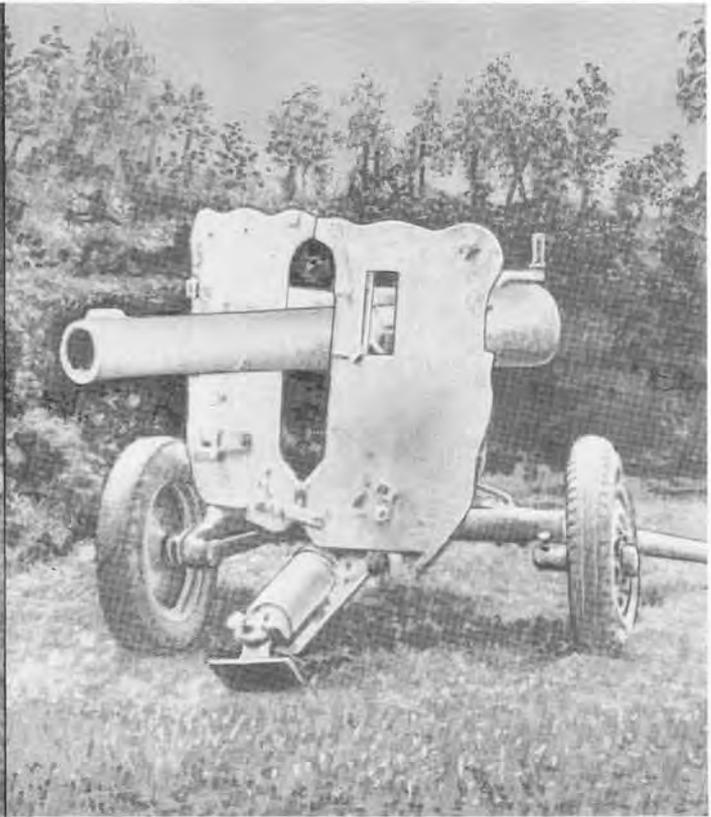
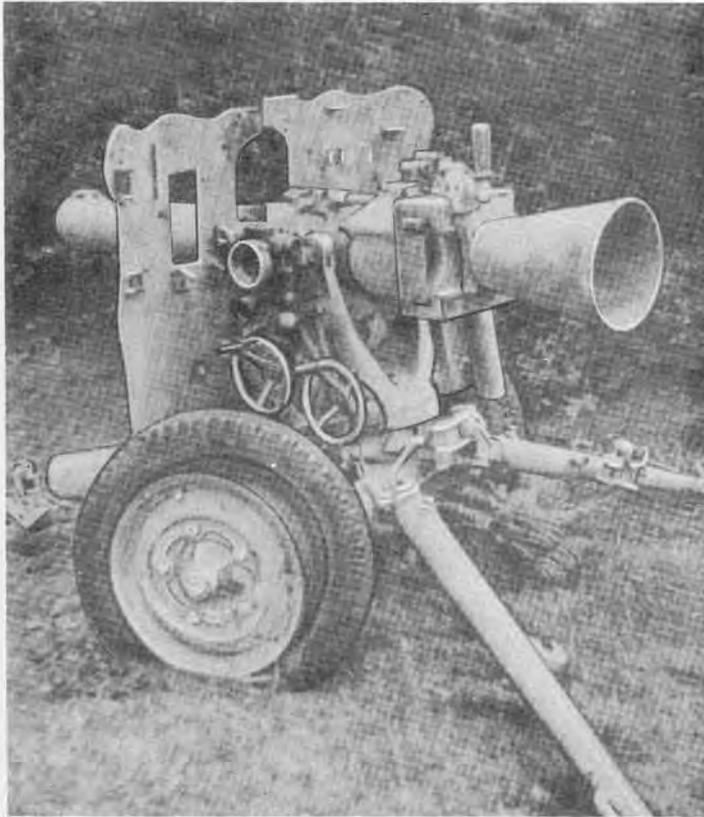
*No chemical ammunition has ever been captured, although it is believed that the gun is designed for that type of shell.

**Not verified.

RECOILLESS GUN

10.5 cm L. G. 42 and 42/1

GERMAN



This weapon represents modifications of the 10.5 cm L. G. 40 described on page 110. It is a product of Rheinmetall, and was introduced into the German Army in 1943.

The principal changes are as follows: the venturi tube has three steel strips spirally welded to the inner lip presumably to offset torque; elevation of the equipment examined was limited to approximately 30° by a fixed stop; the carriage has been completely changed—it now consists of a single tubular axle to which wheel spindles and three folding trail legs are fitted; a horizontal sliding type breechblock (resembling that of the 7.5 cm L. G. 40) has been installed; the weight has been increased by approximately one-third; the design of the shield differs from the earlier model; the percussion firing mechanism has been retained on top of the breechring necessitating the use of a cartridge case with a side primer.

Maximum range is approximately the same as the 10.5 cm L. G. 40 and both models use the same range table. The equipment has been designed to break down into five loads for use as pack or airborne artillery. The two models, 10.5 cm L. G. 42 and L. G. 42/1, differ principally in weight.

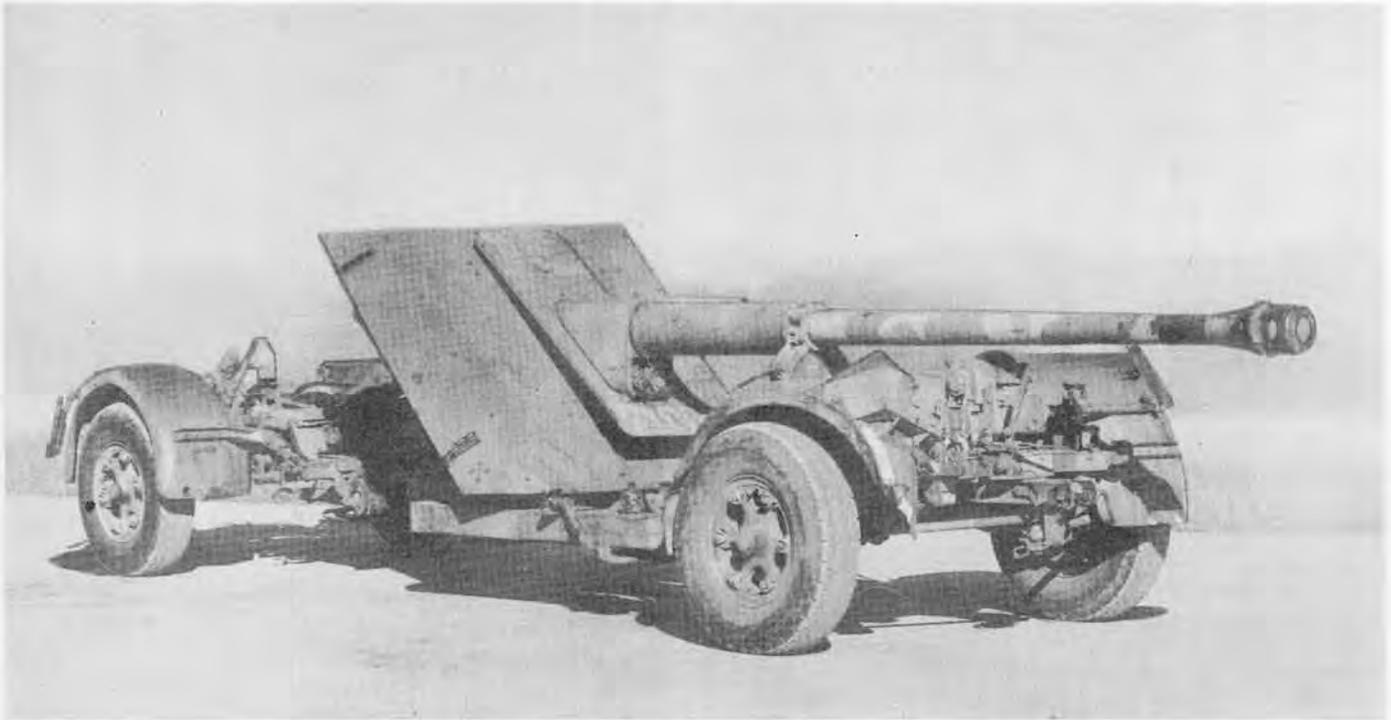
As in the case of the 7.5 cm L. G. 40 and 10.5 cm L. G. 40, the characteristic feature of this weapon is the lack of recoil attained by allowing part of the propellant gases to escape to the rear through a venturi tube. The resulting blast creates a danger zone approximately 20 yards wide and 50 yards long to the sides and rear of the gun. The sharp sound of the discharge through the venturi tube makes it necessary for the gun crew to use ear plugs.

SPECIFICATIONS

Length of piece (including breech ring and venturi)	72.28 ins.
Length of rifling	31.41 ins.
Twist of rifling	10°
No. of grooves	32
Length of venturi tube	18.18 ins.
Length of chamber	18.93 ins.
Capacity of chamber	9.5 pints
Weight in action (L. G. 42)	1,217 lbs.
(L. G. 42/1)	1,191 lbs.
Elevation	15° to 42°
Traverse	
at elevations up to 12°	360°
at elevations over 12°	71°
Ammunition.....	H.E., H. E. I., Hollow Charge, Smoke.
Muzzle velocity (H.E. Shell)	1,099 f/s
Maximum range	8,694

ANTITANK GUN

8.8 cm Pak 43



The 8.8 cm Pak 43 is an electrically fired, semiautomatic gun, mounted on a cruciform platform (Kreuzlafette) and transported on two single axle limbers similar to those used on the 8.8 cm Flak 18. It has a very low silhouette, on wheels the height to the top of the shield is 5 feet, 6 inches, and to the trunnions, 4 feet. When emplaced it is 12 inches lower.

The gun can be fired from its wheels without extending the side legs, if the direction of fire does not exceed 30° either side of the longitudinal girders. If the direction of fire is greater than 30°, the side legs must be extended and the pads brought firmly in contact with the ground. There is an automatic electric cut-out to the firing gear which restricts elevation to 12° on early equipments and 16° on later equipments when firing over the mounting legs.

There are several other versions of the Pak 43. The Pak 43/41 (page 113) has a two-wheeled carriage with split trails. The Pak 43/1 (page 34) is a self-propelled gun called the "Rhinoceros." Its chassis is a combination of a Pz. Kw. III and Pz. Kw. IV. The Pak 43/2 (page 39) is a self-propelled gun called the "Elephant"; it is also mounted on the chassis of the Panther (Pz. Kw. V). All of these guns use the same ammunition and have the same ballistic characteristics.

SPECIFICATIONS

Caliber	88 mm (3.46 ins.)
Weight (traveling position)	13,000 lb.
Weight (firing position)	7,900 lb.
Length (traveling position)	
Length (firing position)	
Height (traveling position)	5 ft., 6 ins.
Height (firing position)	4 ft., 6 ins.
Width (overall)	
Length of barrel (w/o muzzle brake).....	247.5 ins.
Length of bore	236.9 ins.
No. of grooves	32
Width of grooves .....	.202 in.
Depth of grooves .....	.048 in.
Width of lands .....	.134 in.
Muzzle Velocity (A.P.C.B.C. shell)	3,280 f/s
(H.E. shell)	2,460 f/s
Max. range (horizontal).....	17,500 yds. (H.E. shell)*
Max. range (vertical)	
Rate of fire	
Traverse	360°
Elevation	40°
Depression	-8°
Length of recoil (normal)	47.5 ins.
Ammunition	A.P.C.B.C.—H. E.
Wt. of projectile	(H.E.) 20.68 lbs.**
	(A.P.C.B.C.) 22 lbs.

*Unconfirmed

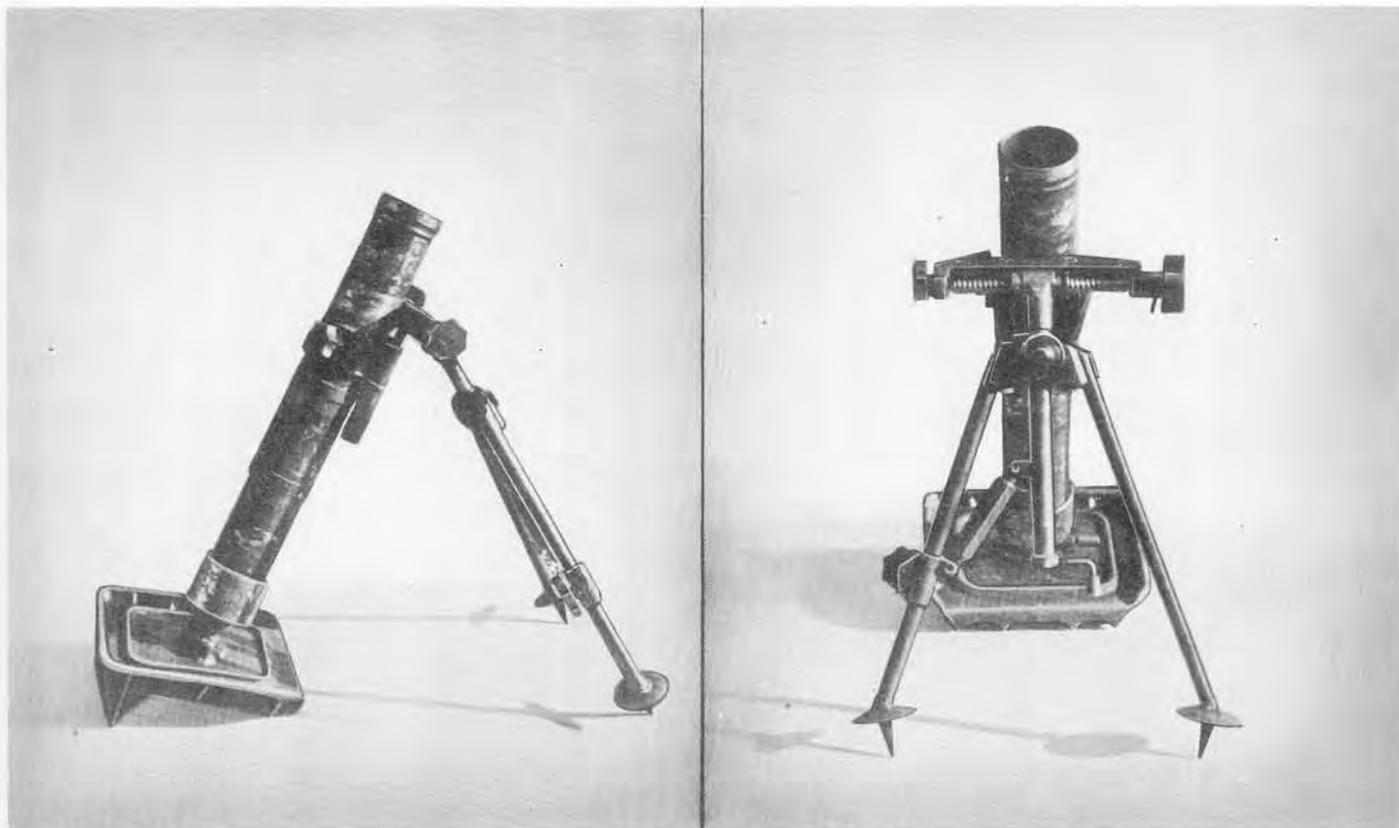
**AP 40 round (tungsten carbide core)

Pzgr. Patr. 40/43	16 lb.
Gr. Patr. 39 HL/A and B	16.8 lb.

SHORT MORTAR

Kz. 8 cm. Gr. W. 42

GERMAN



This weapon is of the same general design as the standard 8 cm mortar (s. Gr. W. 34) described on page 114. It is, however, shorter and lighter. It differs from the original weapon in the following respects:

The Model 42 has a shorter barrel with no striker control bolt at the base. It has a smaller baseplate, square in shape, with no carrying handle. The barrel is fastened to the baseplate by a spring catch. It also has a smaller bipod.

The elevating handle is situated at the base of the elevating column between the bipod legs. The cross levelling screw is halfway down the elevating column, and is connected to the left bipod leg by a sliding screw clamp.

The sight is situated on the left side of the traversing screw. Ammunition fired is the same as for the 8 cm s. Gr. W. 34.

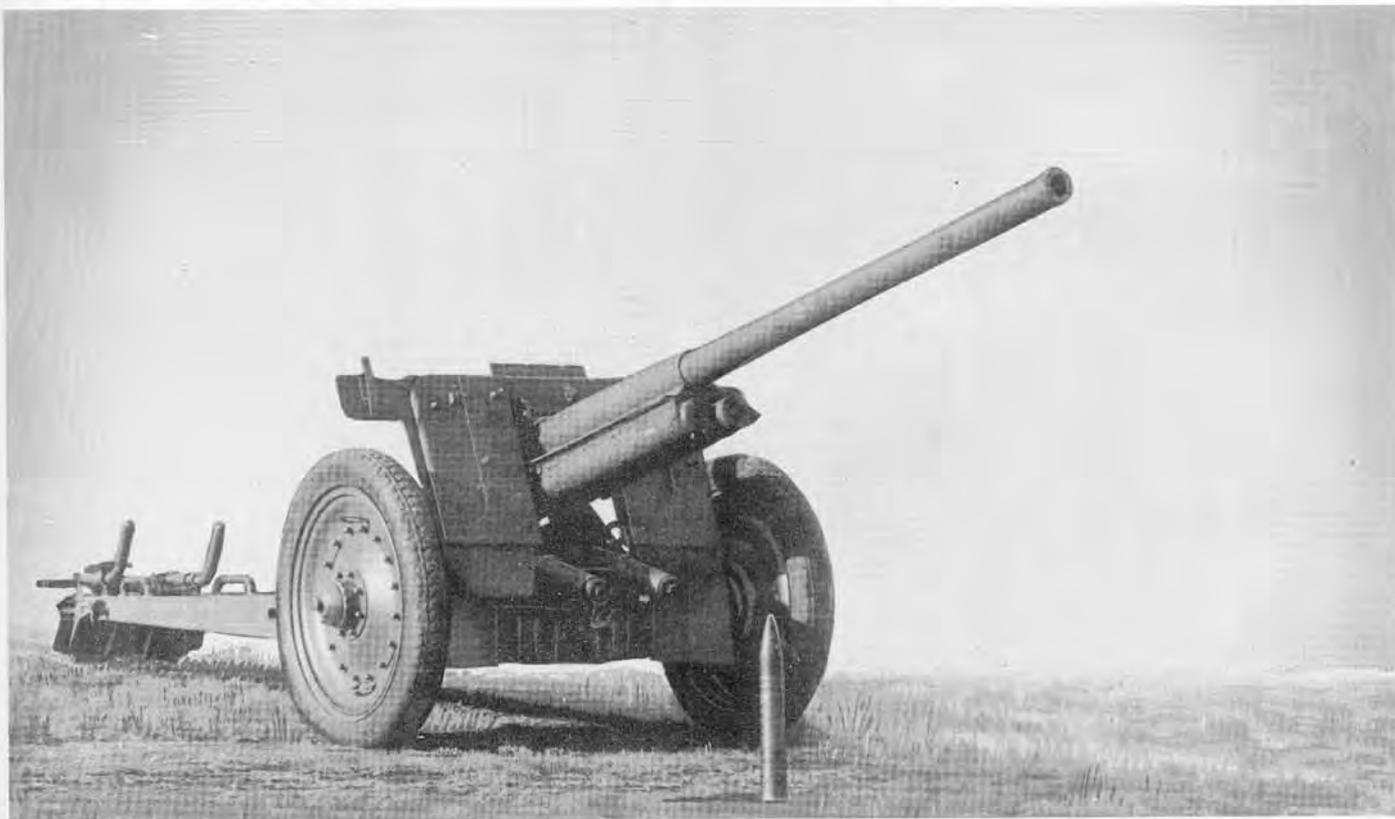
A firing table printed on a steel plate is clamped to the tube.

SPECIFICATIONS

Caliber	81 mm (3.2 ins.)
Weight in firing position	62 lbs.
Length of barrel, overall	29.5 ins.
Length of bore	25.5 ins.
Size of baseplate	12 ins. x 12½ ins.
Principle of operation.....	Muzzle loaded; percussion fired (only)
Elevation	47° to 88°
Maximum range	1,200 yds.
Ammunition.....	Same as for 8 cm s. Gr. W. 34

FIELD GUN (Ex-Russian)

7.62 cm Feldkanone 36 (r)



The 7.62 cm F. K. 36 (r) is a gun of Russian design and manufacture. The Germans captured so many pieces during the early months of the invasion of Russia that they were adopted by the German Army both in the original form for standard divisional field guns and as antitank guns known as the 7.62 cm Pak 36 (r) described on page 116.

Both weapons have the same general characteristics: built-up tubes fitted in reinforcing jackets, vertical sliding breech blocks, hydropneumatic recoil mechanisms, and split trail carriages. In addition to a number of minor changes, the principal difference is in the much greater chamber length of the Pak 36 (r)—28.25 inches compared with 15.20 inches, and the addition of a muzzle brake to the Pak 36 (r).

The breech mechanism may be operated either by hand or semi-automatically. Extractors housed in the breech ring are operated by cams when the block opens. A hand control on the left side of the breech ring is provided in case the cartridge fails to eject. The firing mechanism is a continuous pull type.

SPECIFICATIONS

Caliber	76.2 mm (3 ins.)
Weight (complete)	3,619 lb.
Weight (firing position)	3,564 lb.
Length (overall)	22 ft. 6¼ ins.
Length of gun	153 ins.
Height (traveling position)	
Height (firing position)	
Width (overall)	
Width of trail spread	
Length of rifling	120 ins.
Length of tube	12 ft. 2 ins.
No. of grooves	32 R.H. Polygroove form; Twist-1 in 25 Uniform
Width of grooves	0.196 in. (5 mm)
Depth of grooves	0.033 in. (0.84 mm)
Width of lands	0.078 in. (2 mm)
Muzzle velocity (A.P.H.E. shell)	2,249 f/s (H.E. -2,335 f/s)
Max. range (horizontal) (A.P.-H.E.).....	14,000 yds.
Rate of fire	
Traverse	60°
Elevation	72°
Depression	4°
Length of recoil (average) H.E.-A.P.H.E.—	31.1 ins.
Ammunition	H.E.-A.P.H.E.-A.P. 40
Wt. of Projectile	H.E.—13.45 lbs. A.P.H.E.—14.2 lbs. A.P. 40—9.2 lbs.

MOUNTAIN HOWITZER

7.5 cm Gebirgs Kanone 15 (Geb. K. 15)



This 7.5 cm light mountain howitzer used extensively by the German Army is an original Skoda design. The same weapon, designated 75/13, was also used by the Italians. Both armies provided their own ammunition in addition to some Czech and Austrian rounds also utilized. Types of ammunition include high explosive, hollow charge, shrapnel, and armor piercing.

The piece is wholly enclosed within a slipper which moves on a cradle extending the whole length of the piece. Breech mechanism is of the horizontal sliding block type. The recoil mechanism, contained within the cradle, consists of a hydraulic buffer and spring recuperator. A 50/50 mixture of water and glycerine is used in the buffer; quantity is approximately one-half gallon.

The carriage has wooden wheels and modified box-type trails which curve downward towards the rear. A fixed spade is attached at the rear of the trail. The shield is in two parts: a fixed upper section and a hinged lower one. It is frequently removed altogether when the howitzer is in firing position.

For mountain transport, the equipment may be broken down into seven animal loads as follows: upper carriage, slides, cradle, piece, trail and wheels, upper shield, and lower shield. The various sections are carried by mules.

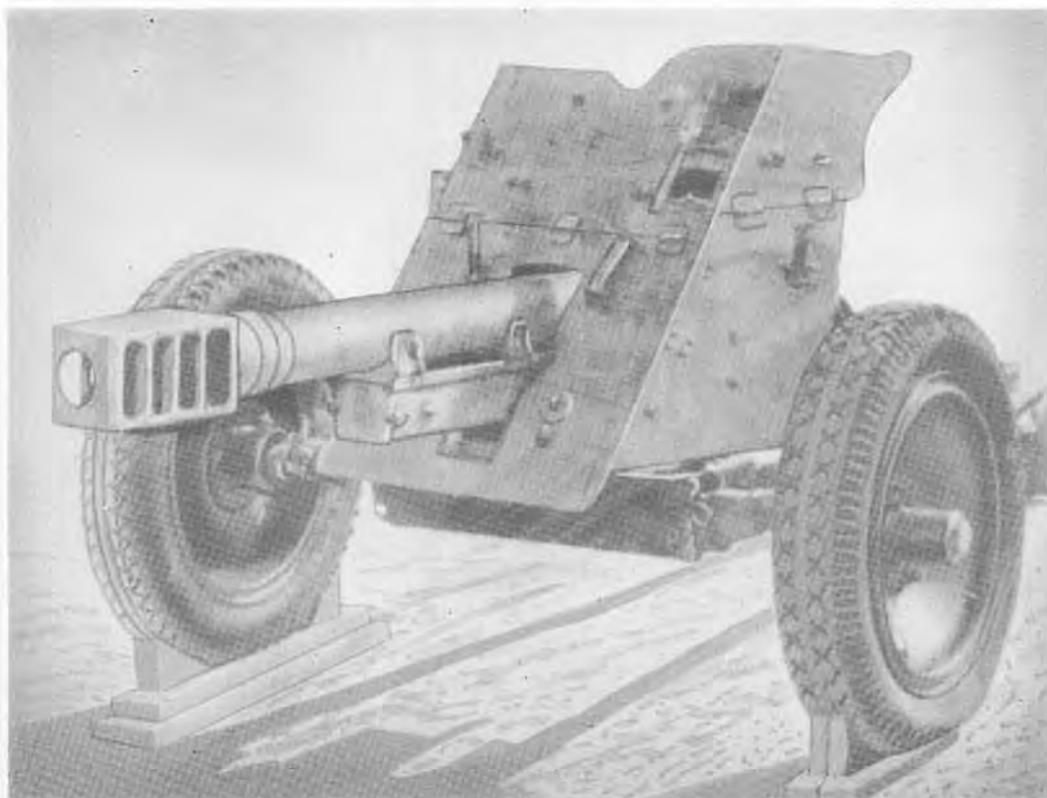
SPECIFICATIONS

Caliber	75 mm (2.95 ins.)
Weight (traveling position)	2,449 lbs.
Weight (firing position)	1,351 lbs.
Length (traveling position)	
Length (firing position)	
Height (firing position)	
Height of trunnions	27.7 ins.
Width of carriage	37.4 ins.
Length of bore.....	13 cal.
Length of barrel and breech ring.....	43.8 ins.
Rifling	R.H. polygroove plain section
Length of rifling	31.2 ins.
No. of grooves	28
Width of grooves	5 mm
Depth of grooves .....	.68 mm
Width of lands	3.5 mm
Muzzle velocity (H.E. shell)	1,270 f/s
Wt. of projectile	12 lbs.
Max. range (horizontal)	7,270 yds.
Max. range (vertical)	
Rate of fire	
Traverse	7°
Elevation	50°
Depression	-10°
Length of recoil (max.)	35.4 ins.
Ammunition	H. E. & Hollow Charge

LIGHT INFANTRY HOWITZER

GERMAN 

7.5 cm I. G. 37



The 7.5 cm I. G. 37, formerly known as the 7.5 cm Pak 37, consists of a short barreled piece fitted with a muzzle brake, and mounted on the carriage of the obsolete 3.7 cm antitank gun. The equipment has been utilized as a close support infantry weapon.

The barrel of monobloc construction is $20\frac{1}{2}$ calibers long. The muzzle brake is in the shape of a rectangular box with four baffles, each at approximately a 45° angle deflecting to the rear. There is a hydrospring recoil mechanism and a breech mechanism of the vertical sliding wedge type. The latter has no provision for semi-automatic operation. A percussion type firing mechanism is cocked automatically when the breech is closed, and the gun is fired by pressing a plunger on the elevating handwheel. There is an auxiliary firing lever on the left side of the breech ring.

The carriage, which is mounted on two rubber-tired wheels, has split tubular trails. The shield is in two main parts, the upper shield and the lower shield. The lower part hinges upward when travelling, and is swung downward when the weapon is in the firing position. The upper shield is in two sections, the upper half being hinged. This section can be folded forward in order to give a lower silhouette.

Traversing, elevating, and sighting are accomplished by one man. Direct sighting is obtained by means of a telescope. A quadrant plane is located on top of the breech ring, and there is also a range drum graduated for firing semi-fixed high explosive and fixed hollow charge ammunition. With the present fire control equipment, the maximum effective range is 2,900 yards.

SPECIFICATIONS

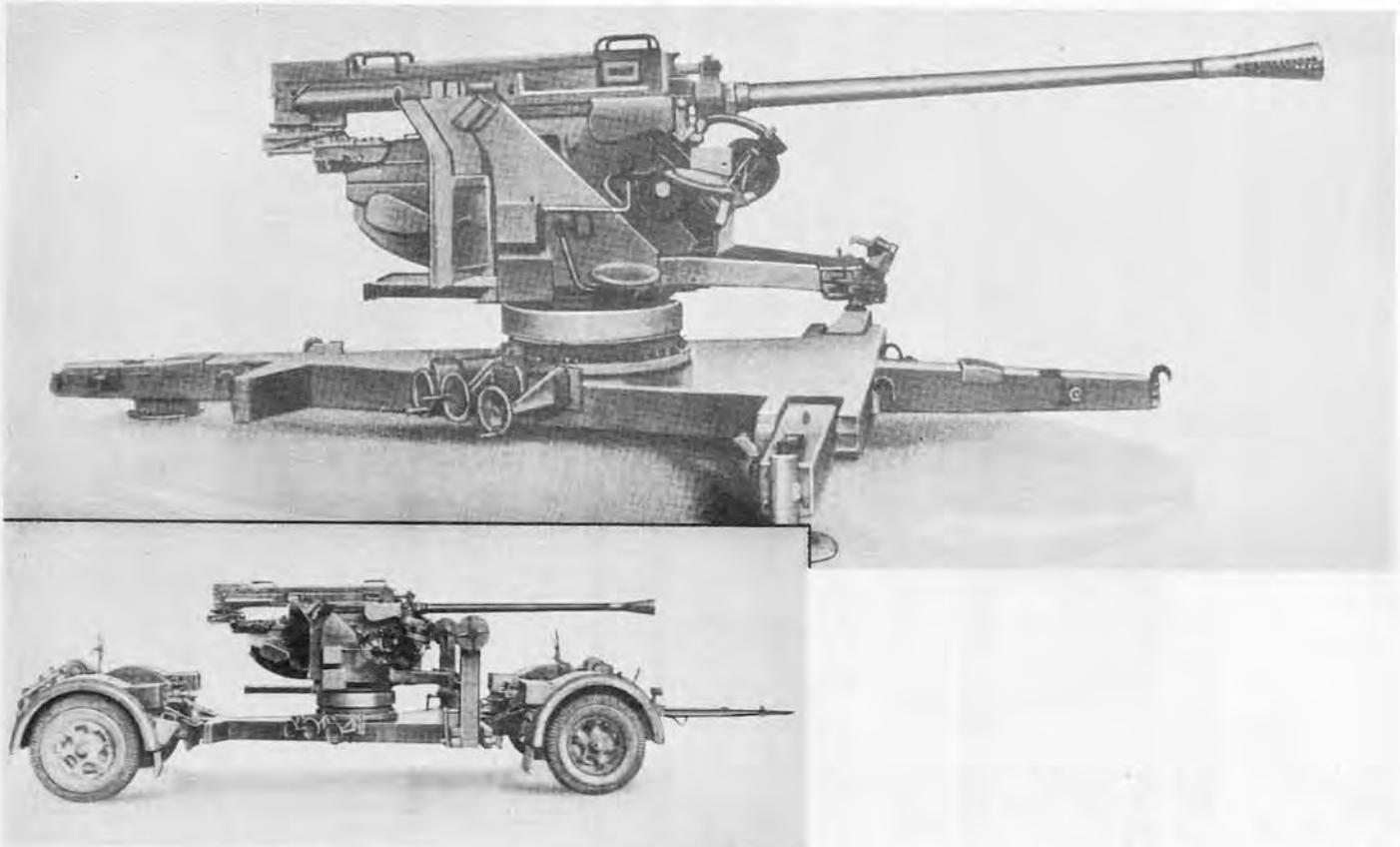
Caliber	75 mm (2.95 ins.)
Weight (traveling position)	
Weight (firing position)	1,124 lbs.
Length (traveling position)	11 ft., 7 ins.
Length (firing position)	11 ft., 1 in.
Height (shield lowered)	38 ins.
Height (shield raised)	$46\frac{1}{4}$ ins.
Width (overall)	5 ft., $3\frac{1}{2}$ ins.
Width of trail spread	9 ft., 1 in.
Length of rifling	$42\frac{3}{4}$ ins.
Rifling	R. H. twist
No. of grooves	24
Muzzle velocity (H.E. shell)	920 f/s*
Max. range	5,630 yds.
Max. range (present fire control).....	2,900 yds.
Traverse	60°
Elevation	$22\frac{1}{2}^\circ$
Depression	5°
Tires	Pneumatic—6.00 x 20
Length of recoil (max.)	17 ins.
Ammunition	H. E., Hollow Charge
Wt. of projectile...H. E., I. Gr. 18—13.2 lbs.	
HE-AT, I. Gr. 38HI/A—6.6 lbs.	
*Muzzle velocity with hollow charge ammunition is 1,165 f/s. Range, 5,410 yds.	

ANTIAIRCRAFT GUN

GERMAN



5 cm Flak 41



This gas-operated, automatic, anti-aircraft gun is transported on two-wheeled transporters. To put the gun into action, the platform is lowered from the transporters by means of winding gear. The two transverse legs are lowered and the platform is roughly leveled with jacks. The final leveling is done with leveling screws in the base ring of the mounting. The barrel is removable for easy replacement in the field. The right hand twist of the rifling increases from one in $36\frac{1}{2}$ to one in 30 calibers.

The breech mechanism is similar to that of the 3.7 cm Flak 43. It differs in that the breech block drops into the closed position from the open position. The dropping of the block allows buttress guides on the block to engage with similar guides on the jacket. This locks the block in the firing position and prevents any rearward movement. The feed mechanism is operated by the recoil of the breech casing. The recuperator consists of two spiral springs which are mounted side by side in the cradle. The buffer is mounted centrally in the cradle.

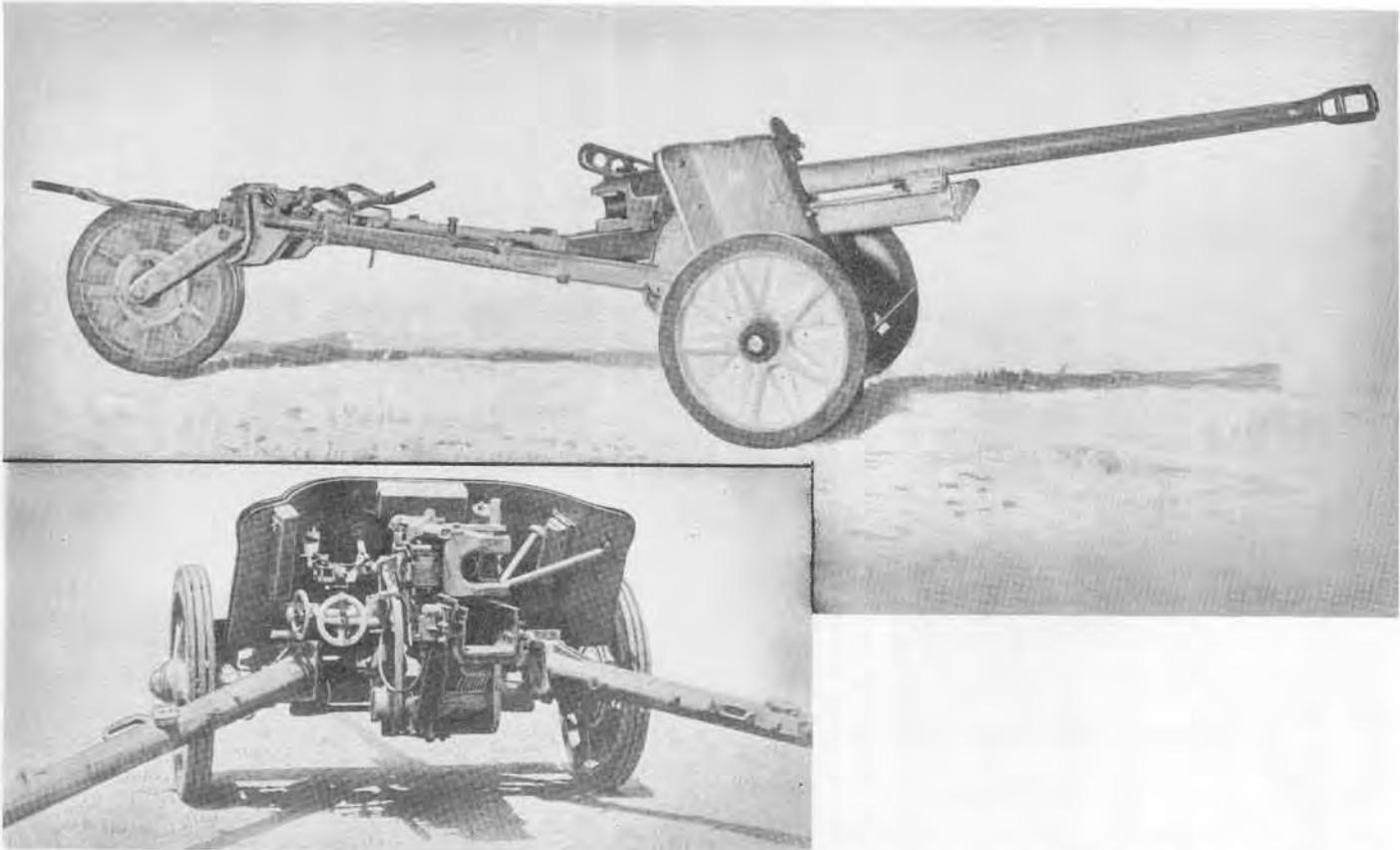
The traversing gear and the sight are on the right hand side of the mounting. The sight bracket is connected by means of a parallel motion link to a cross shaft. Here it is keyed to a pointer on the elevation scale. The gun elevating gear is on the left side of the mounting. This is also connected to a pointer on the elevation scale. The layer keeps the two pointers in line and the gun is laid at the same angle of elevation as the sight.

SPECIFICATIONS

Caliber	5 cm (1.97 ins.)
Weight (traveling position)	7.18 tons
Weight (firing position)	4.30 tons
Length (traveling position)	27 ft., 5.5 ins.
Length (firing position)	19 ft., 10 ins.
Height (traveling position)	7 ft., 1 in.
Height (firing position)	7 ft., 4 ins.
Width (overall—traveling)	7 ft., 10 ins.
Width of trail spread	
Length of gun (incl. muzzle brake).....	184.5 ins.
Length of gun (excl. muzzle brake).....	170.8 ins.
Length of rifling	117.28 ins.
No. of grooves	20
Width of grooves	0.160 in.
Depth of grooves	0.020 in.
Width of lands	
Muzzle velocity (H.E. shell)	2,756 f/s
Firing mechanism protrusion	0.1 in.
Max. range (horizontal), APCBC	11,300 yds.
Max. range (vertical), APCBC	8,600 yds.
Effective ceiling	10,000 ft.
Rate of fire	130 r.p.m.
Traverse	360°
Elevation	90°
Depression	—10°
Length of recoil	7 ins. (approx.)
Ammunition.....	H.E. 41/tracer; Incendiary/H.E. 41/tracer; A.P.C.B.C. 42
Wt. of projectile.....	H.E.—4.8 lbs. A.P.—4.87 lbs.
Tracer burn out point	
Short (8 sec.)	2,740-3,750 yds.
Long (18 sec.)	5,400-6,120 yds.

ANTITANK GUN

5 cm Pak 38



The 5 cm Pak 38, introduced during the 1941 campaigns in Greece and Egypt, was developed to combat the more heavily armored vehicles of the Allies.

The gun has a barrel of monobloc construction, threaded at the muzzle for attaching a two-baffled muzzle brake. Because of the position of the breech-operating cam, a minimum length of recoil of approximately 18½ inches is needed to operate the semi-automatic breech mechanism which is of the sliding horizontal block type. The recoil recuperator system is hydropneumatic.

The carriage, constructed of welded steel, is mounted on metal disk wheels with solid rubber tires. Torsion bar suspension is automatically locked when the tubular trails are spread. A 5 mm spaced armor shield and single apron protect the gun crew. The left side of the shield has a sighting port.

There are five types of ammunition fired from the Pak 38: an armor-piercing capped, high-explosive projectile; a high-explosive shell; an A.P.-H.E. (uncapped) shell; a tungsten carbide core arrowhead type projectile (A.P. 40), and a stick grenade similar to the 3.7 cm grenade described on page 306.

SPECIFICATIONS

Caliber	50 mm (1.97 ins.)
Weight (complete)	2,015 lbs. (approx.)
Length of gun (overall)	15 ft., 3 ins.
Length of barrel (overall)	9 ft., 3 ins.
Width C-C	5 ft., 1 in.
Carriage.....	Welded steel w/solid rubber tires and tubular trails
Breech mechanism.....	Horizontal sliding block
Recoil mechanism	Hydropneumatic
Rifling	20 lands & grooves; right-hand twist
Muzzle velocity	
A.P.C.-H.E.	4.5 lb.—2600 f/s
H.E.	4.0 lb.—1800 f/s
Elevation	22°
Depression	—4°
Traverse	80°
Sights	Straight tube telescope
Ammunition.....	A.P.; A.P.C.; H.E.; A.P. 40
Penetration	

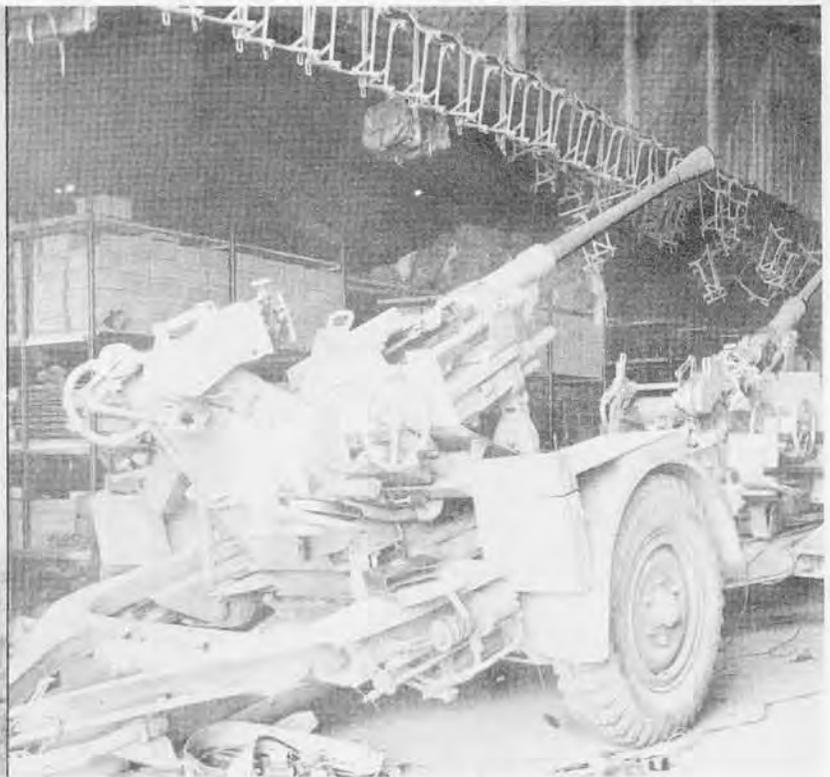
Range Yards	Thickness of armor in mm	
	30°	Normal
500	2.6	3.1
700	2.4	2.9
1000	2.2	2.6
1200	2.0	2.5

ANTI-AIRCRAFT GUN

3.7 cm Flak 18 and 36



THE 3.7 cm FLAK 18



THE 3.7 cm FLAK 36

The performance of both the Flak 18 and the Flak 36 are approximately the same, the latter being the lighter and the more mobile version. The weapon is transported on a trailer; the chassis consisting of a "U" shaped steel frame mounted on two pneumatic tires. The weapon and its firing mount may be detached from the chassis by the aid of two winches. In firing position the mount rests on three adjustable firing pads. There are three seats provided; two for the gun pointers and one for the ammunition loader.

The gun has a monobloc tube. The firing mechanism is operated by recoil and residual pressure of gas in a manner similar to the 2 cm Flak 38.

The recoil mechanism is located inside the trough-shaped cradle with the buffer above and the recuperator below. Traversing and elevating mechanisms are operated by handwheels; the former providing a 360° traverse with 35½ turns, and the latter giving a rate of about 4° for each turn. The gun is fired by means for a foot pedal connected to the trigger by a system of levers.

Armor-piercing ammunition is provided in addition to the regular high explosive ammunition, permitting the guns to be employed as antitank weapons.

SPECIFICATIONS

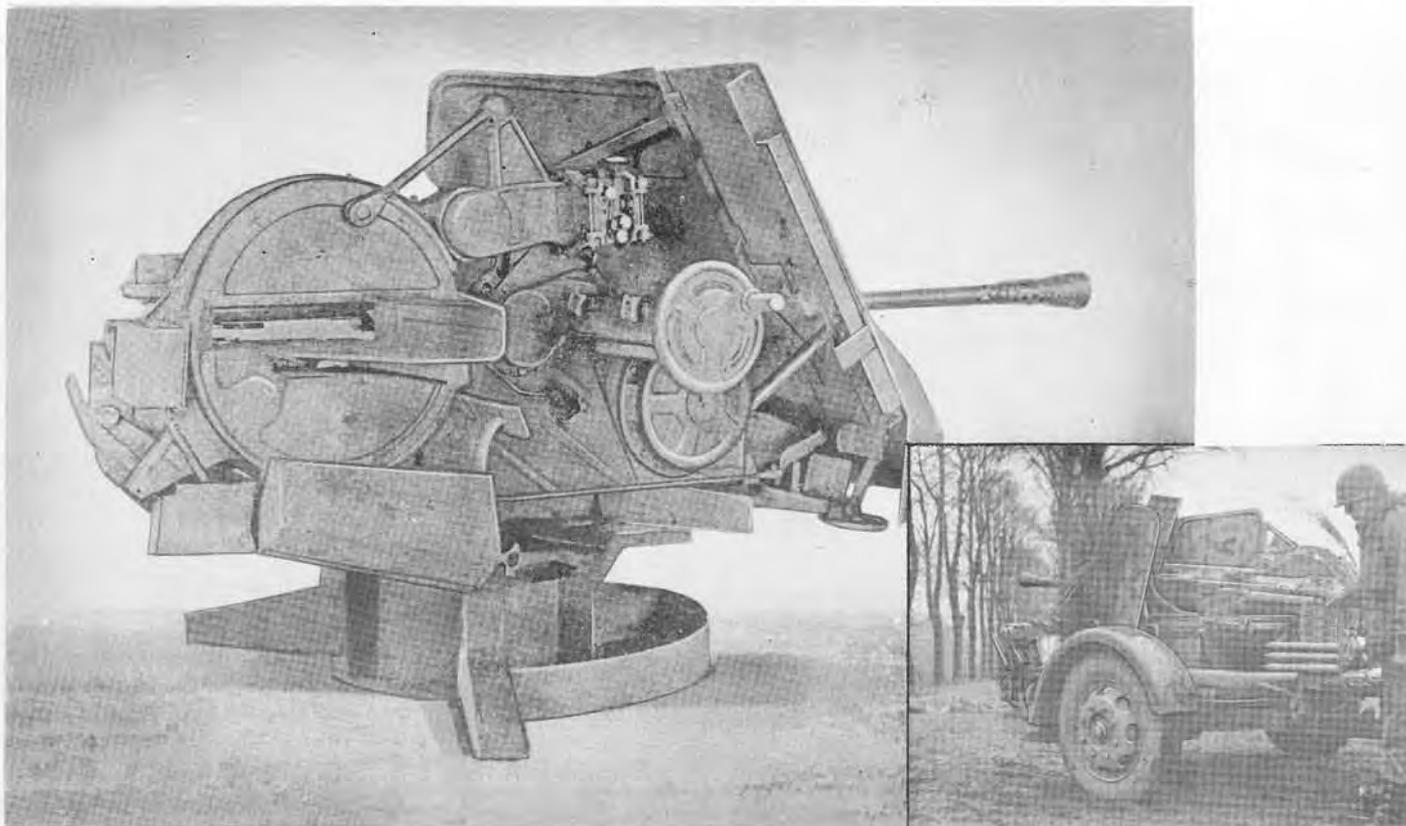
Caliber	37 mm (1.45 ins.)
Weight (traveling position)	Flak 36—5,290 lbs.
Weight (firing position)	Flak 36—3,430 lbs.
Length of piece (including flash hider)....	129 ins.
Length of rifling	71 ins.
Height of trunnions	44 ins.
Width (overall)	
Length of bore	
No. of grooves.....	20—R.H. plain section, Twist, increasing (1 in 50 to 1 in 40)
Width of grooves	0.197 in.
Depth of grooves	0.02 in.
Width of lands	0.08 in.
Muzzle velocity (H.E. Shell)	2,610 f/s*
Max. range (vertical)	13,775 ft.*
Max. range (horizontal)	7,080 yds.*
Effective ceiling	5,000 ft.*
Rate of fire (practical)	80 r.p.m.
Traverse	360°
Elevation	85°
Depression	—5°
Length of recoil	
Ammunition	A.P., H.E.
Wt. of projectile.....	A.P.—1.5 lb. H.E.—1.4 lb.

*Not verified.

ANTIAIRCRAFT GUN

GERMAN 

3.7 cm Flak 43



The 3.7 cm Flak 43, a light, fully-automatic, gas-operated anti-aircraft weapon, may be statically emplaced, transported on a mobile mounting, or mounted on a self-propelled chassis. The gun consists of a removable, monobloc barrel fitted with a muzzle brake with six elongated ports and multi-perforated flash eliminator, and a breech casing which houses the breech mechanism. The gun is fed horizontally from the left in clips of eight rounds from a fixed loading tray, and is operated by the recoil of the gun itself. A hydro-spring buffer with variable recoil is located below the barrel, and two return springs lie side by side above the barrel.

Mounting is of the pedestal type, the gun being hung from a single-ring type trunnion on the right. The feed to the gun is mounted through the ring and on the axis of the trunnion, making unnecessary any alteration in the position of the center of gravity of the gun and other elevating parts with variation in the quantity of ammunition in the clips and feed mechanism. Elevating and traversing handwheels are both on the right of the gun, the former being vertical and the latter horizontal.

The equipment, which is of low build, is fitted with a shield varying in thickness from 9 mm at the center to 6 mm at the outer edges. The shield slopes backward at a 30° angle and is 4.2 feet high. In the middle is a space through which the mantlet elevates and depresses. A twin version of the 3.7 cm Flak 43 also exists. It is known as the 3.7 cm Flakzwilling 43.

The weapon fires only the single rotating band projectiles.

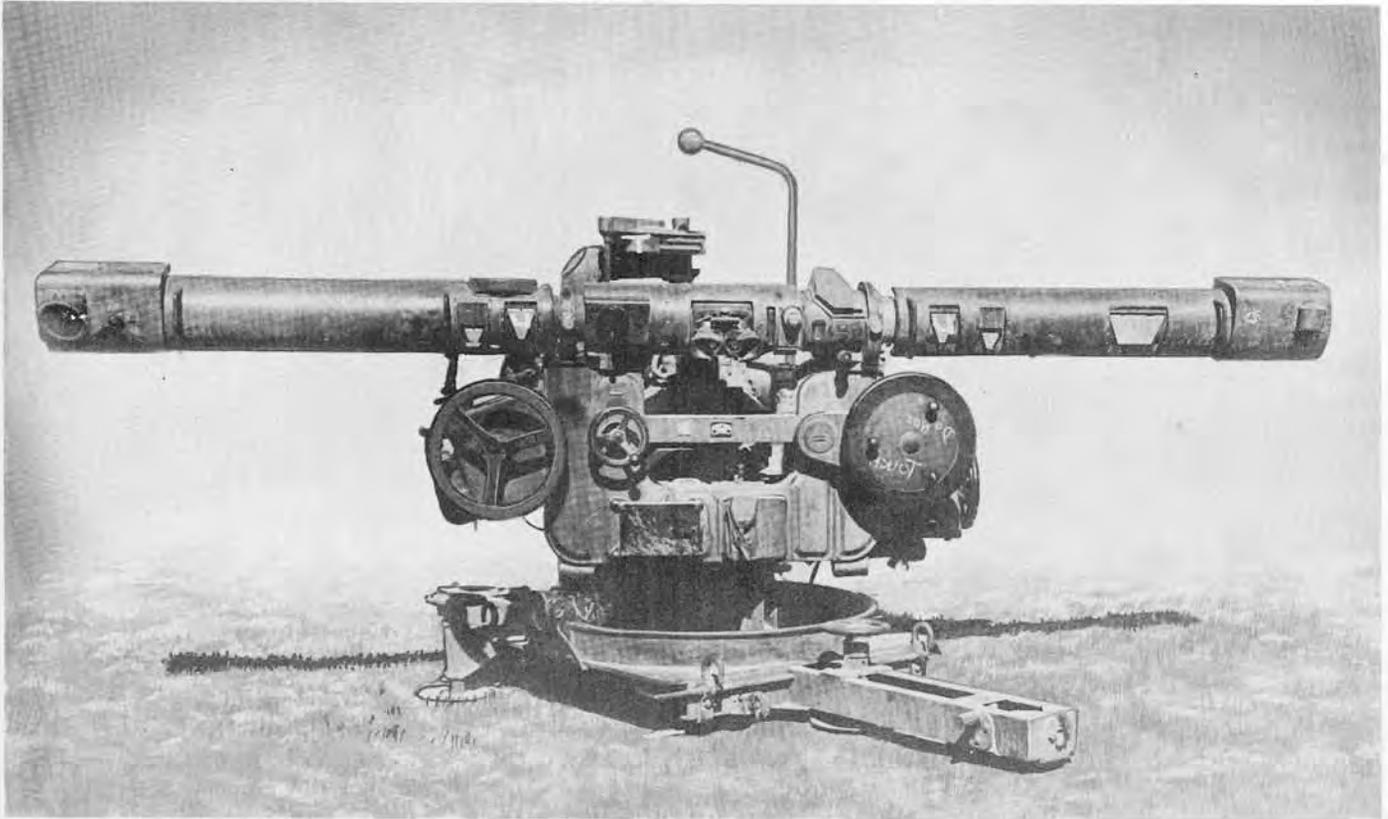
SPECIFICATIONS

Caliber	37 mm (1.45 ins.)
Weight (traveling position)	4,180 lbs.
Weight (firing position)	2,750 lbs.
Length (traveling position)	
Length (firing position)	
Height (traveling position)	
Height of trunnion	29.9 ins.
Length of piece (excluding muzzle brake) ..	9.68 ft.
Length of muzzle brake	14.96 ins.
Length of bore	7 ft.
No. of grooves	20
Width of grooves	
Depth of grooves	
Width of lands	
Muzzle velocity (HE shell)	2,750 f/s
Max. range (horizontal)	7,200 yds. (approx.)
Effective range (vertical)	9,000 ft. (approx.)
Rate of fire (theoretical)	250 rds./min.
(practical)	150 rds./min.
Traverse	360°
Elevation	90°
Depression	-6°
Type of recoil	Variable
Ammunition	AP/HE; H.E.; HE/T-HE/I/T; HE/I and HE/I/short T

ANTIAIRCRAFT DIRECTOR

GERMAN 

Kommando-Gerät 36



The Kommando-Gerät 36 is a goniographic director, thus differing from directors which operate on plan prediction or angular travel methods. The present instrument measures target course and speed and solves the problem by setting up to scale in ground plan the various distances involved. Ballistic data are obtained from graphical drums; varying heights are accepted, and corrections can be applied for wind, drift, displacement, dead time, and variations in muzzle velocity.

The instrument which has a built-in range finder is large and heavy and has a 4-wheeled traveling carriage for mobile use. A crew of thirteen men is required to operate it.

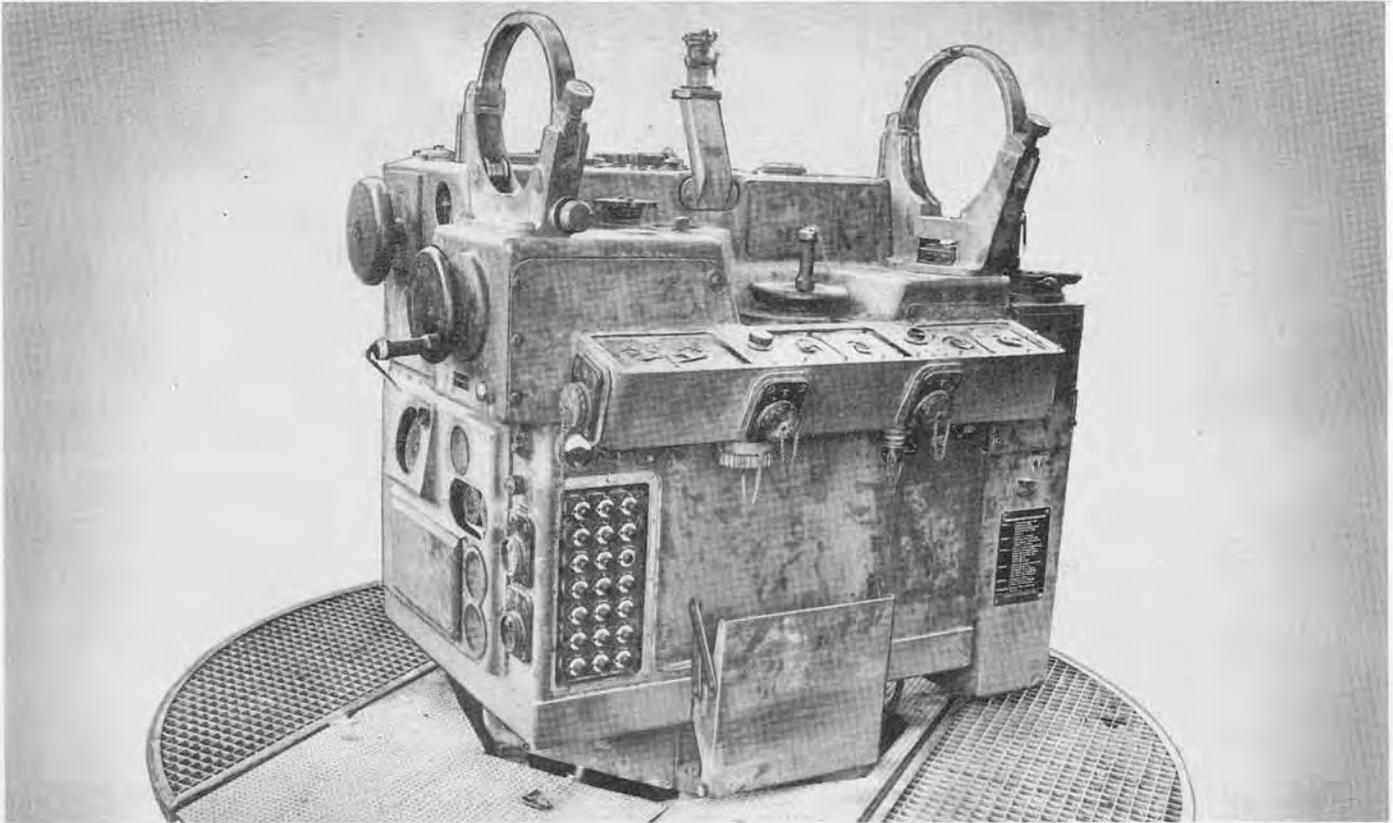
Readings must be called out to the appropriate operator on the director. Information is passed from one operator to another by voice and via a telephone system.

The instrument is manufactured by Zeiss and displays excellent workmanship. This director, however, has been criticized by fire control experts for poor coordination of basic design and for the excessive number of men needed to operate it.

ANTIAIRCRAFT DIRECTOR

GERMAN 

Kommando-Gerät 40



The Kommando-Gerät 40 is a director used principally for major caliber weapons such as the 8.8 cm and 10.5 cm anti-aircraft guns. However, by installing the proper ballistic cams, it may be used with any type of gun.

The director is operated by five men. Two are required to track in azimuth and elevation; a third sets in slant range by means of a 4-meter base stereo range finder mounted on the director; the fourth man sets in horizontal angle of approach; and the fifth man operates various switches. Data are transmitted to the guns for reception by a signal-light manual follow-up system. A trailer equipped with devices for lifting the director is used for transport.

The Kommando-Gerät 40 computes continuously Case III data (for invisible targets) by a target speed and angle of approach method, and can handle diving and curving target courses. The time from initial pickup to first round is estimated to be 20 or 30 seconds. When shifting to a new target in the vicinity of the target previously tracked and flying an approximately parallel course, as little as 10 seconds may be required.

A change in course which requires a change in operating procedure upsets firing data for only a few seconds. In principle, the director will predict correctly for a target flying at constant speed with a constant rate of change of altitude and constant curvature. The stability is not affected by gradual changes in course.

After an abrupt change in speed, altitude rate, or course azimuth, about 10 to 15 seconds are required to evaluate the new course.

SPECIFICATIONS

Azimuth	No limit
Elevation	-1.5° to 90.5°
Slant range	1,200 to 18,000 m
Present horizontal range	570 to 14,500 m
Future horizontal range	570 to 14,500 m
Future altitude	-500 to 12,000 m
Present altitude	0 to 12,000 m
Ground speed of target	0 to 300 m/s
Vertical speed of target	0 to 200 m/s
Horizontal travel during time of flight	0 to 6,000 m
Lateral deflection	±1,065 mils
Course azimuth correction	±1,600 mils
Altitude prediction	±3,000 m
Maximum tracking rates	
Azimuth	±130 mils/sec.,
Slewing	±700 mils/sec.
Elevation	±105 mils/sec.
Time of flight	0 to 30 sec.
Horizontal parallax	500 m
Vertical parallax	±210 m
Fuze dead time	0 to 10 sec.
Wind velocity	0 to 28 m/s
Muzzle velocity....	24 numbers (Gebrauchsstufe)
d σ	±60/16°
dA,	±70 mils
dF due to dead time	±5 secs.
dF due to MV and wind	±5 secs.

Sight Mounts for Howitzers

MOUNTS: The telescope mounts of all three howitzers are of the same basic design. All are of the azimuth compensating type and automatically compensate for trunnion cant when cross-levelled. The angle of site mechanism has a scale graduated from 100 to 500 mils with 300 mils representing normal.

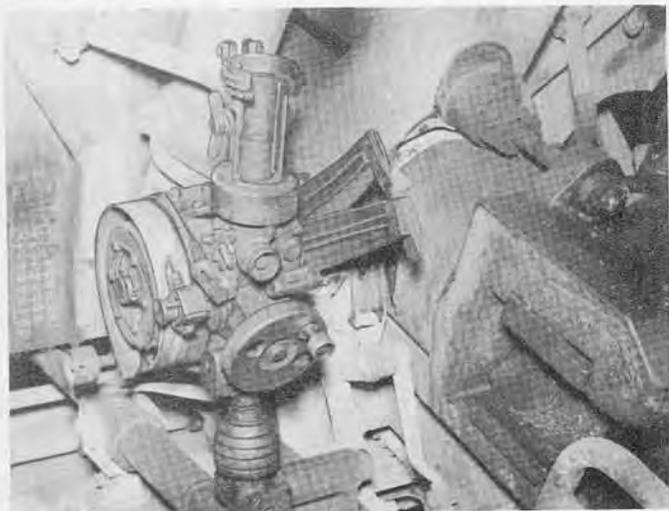
OPERATION: Range or super-elevation is introduced by turning the large handwheel below the bracket for the panoramic telescope. Operation of this knob causes the range drum to be rotated past the index and the index arm to be moved through an angle equal to super-elevation.

Angle of site is introduced by two operations. The first operation is to offset the angle of site level vial an amount equal and opposite to the angle of site. This is done by turning the small knob between the super-elevation handwheel and panoramic telescope bracket. The second operation is to rotate the telescope mount by means of the knurled knob beneath the super-elevation handwheel until the angle of site level is again on a horizontal plane. This second step moves the index arm an additional amount and positions it in an angle equal to quadrant elevation.

The second index arm which is actuated by the gun is brought into agreement with the first index arm by elevating the gun. The gun is then laid for quadrant elevation.

It is necessary to operate the angle of site mechanism on the panoramic telescope to bring the line of sight back on its original plane.

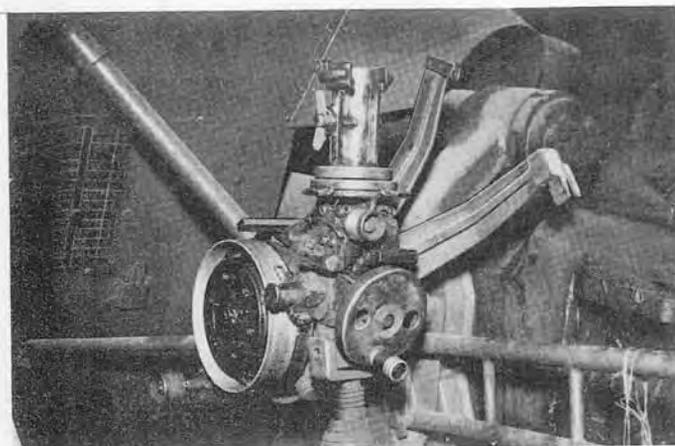
7.5 cm le. F. K. 18



Sight Mount for 7.5 cm Howitzer

RANGE DRUM GRADUATION: The range drum above has two scales: an elevation mil scale numbered from 0 to 800, divided into two mil units, and a range scale graduated in hectometers and numbered from 1 to 15.

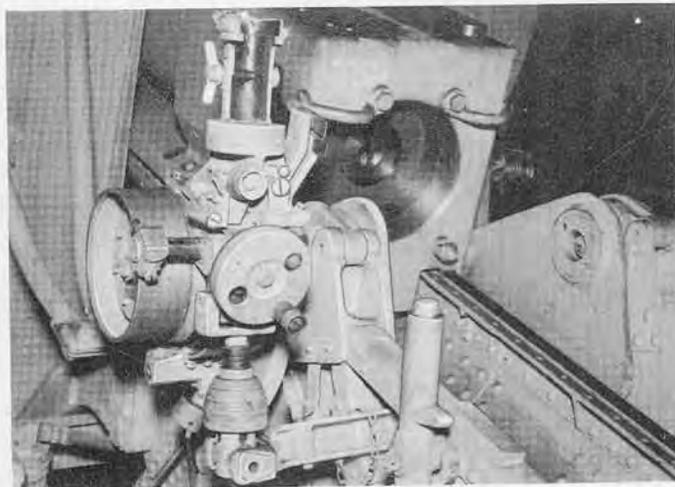
10.5 cm le. F. H. 18



Sight Mount for 10.5 cm Howitzer

RANGE DRUM GRADUATION: The mil scale on the range drum for the above instrument is graduated in the same manner as for the 7.5 cm howitzer. The range scale is graduated for zone 5; the scale is divided into 50 meter units from 100 to 9150 meters.

15 cm s. I. G. 33

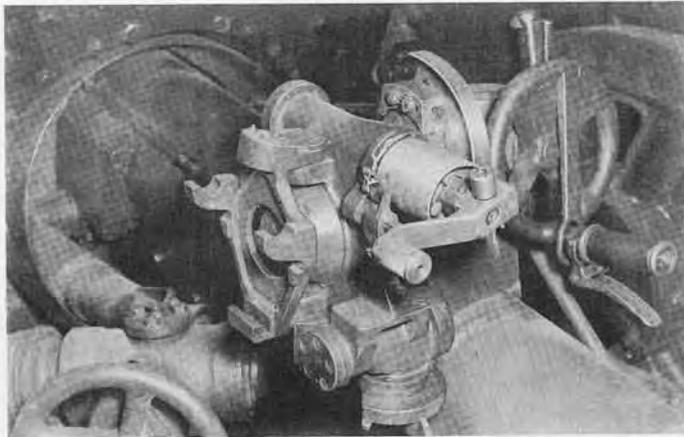


Sight Mount for 15 cm Howitzer

RANGE DRUM GRADUATION: In addition to the 0 to 800 mil scale on the above instrument there is a second mil scale, filled with red, placed to the right of the 0-800 scale. This second scale is graduated in 2 mil steps from 800 to 1330 mils. The range scale is preceded by the Roman Numeral I and is divided in increments of 25 meters from 25 to 1475 meters.

Sight Mounts for Antitank Guns

7.5 cm Pak 41

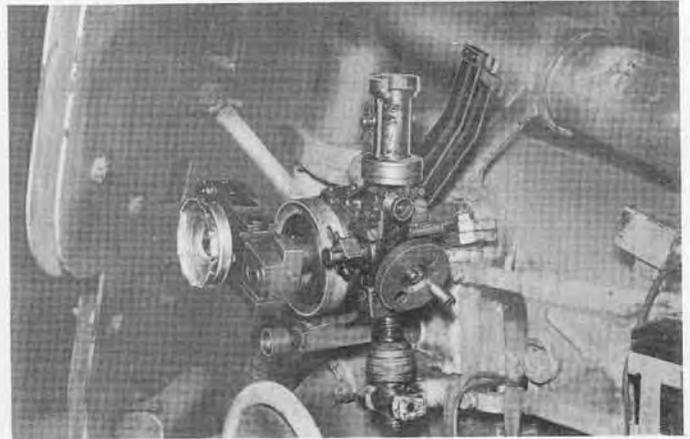


Sight Mount for 7.5/5.5 cm A. T. Gun

RANGE SCALES: There are five scales engraved about the periphery of the range drum. The first is an elevation scale graduated from 0 to 80 mils. The other four are range scales, numbered from 0 to III and graduated from 0 to 4200, 3800, 3400, and 3200 meters respectively. The range scale on the sector is graduated for ranges from 0 to 1500 meters.

TELESCOPE MOUNT: The telescope mount for the 7.5/5.5 is of simple construction. There is a range drum with its axis parallel to the axis of the telescope and a range scale inscribed on an arc that is located on the right side of the telescope mount. A deflection mechanism is located below the range setting handle.

8.8 cm Pak 43/41

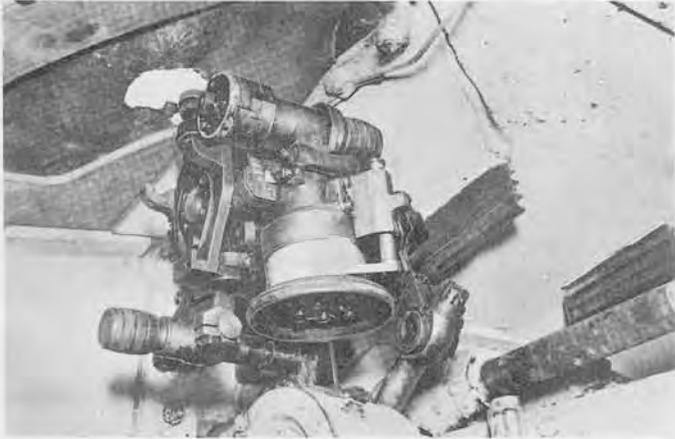


Sight Mount for 8.8 cm A. T. Gun

RANGE DRUM GRADUATION: The range drum has three scales engraved about its periphery. These scales, from left to right are: an elevation scale in steps of 2 mils from 0 to 800; a range scale marked for 8.8 cm Sp. Gr. L/4.7 with limits of 0 to 5500 meters; and a range scale marked 8.8 cm Sp. Gr. 39H1 with limits of 0 to 3000 meters.

TELESCOPE MOUNTS: There are two telescope mounts mounted side by side on the left side of the weapon. The first telescope mount is of the rocking bar type and is designed primarily for anti-tank use. There is no deflection mechanism apparent on the available model. The range drum is graduated from 0 to 4000 meters. The second telescope mount is of the same general design as that used with the 7.5 cm, 10.5 cm and 15 cm howitzers. Both its use and operation are also the same.

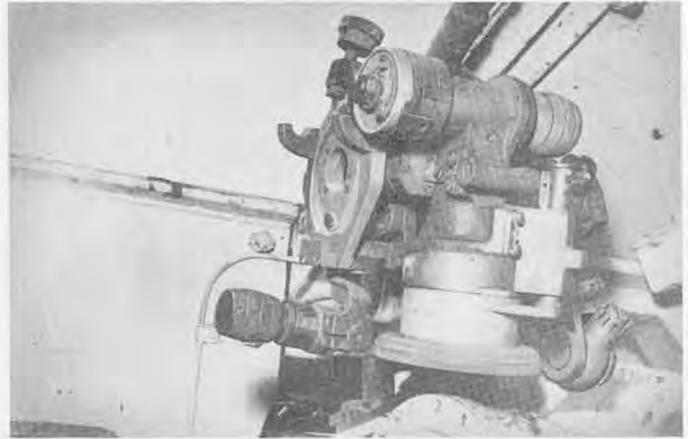
Sight Mounts for Self-Propelled Artillery



Sight Mount for 7.5 cm (Stu. K. 40) S. P. on Pz. Kpfw. III chassis F8, w/o rotary cupola

RANGE SCALES: In the above sight mounts there are four scales engraved about the periphery of a vertical range drum. The first scale, used for the Pzgr. 40, is graduated from 300 to 1400 meters; the second for the Spr. is graduated from 100 to 3300 meters, and the third for the Pzgr. 39, is graduated from 200 to 2400 meters. The fourth scale on the drum is a micrometer for the elevation scale located immediately to the right and above the telescope bracket. The elevation scale is graduated in units of 100 mils from 0 to 500.

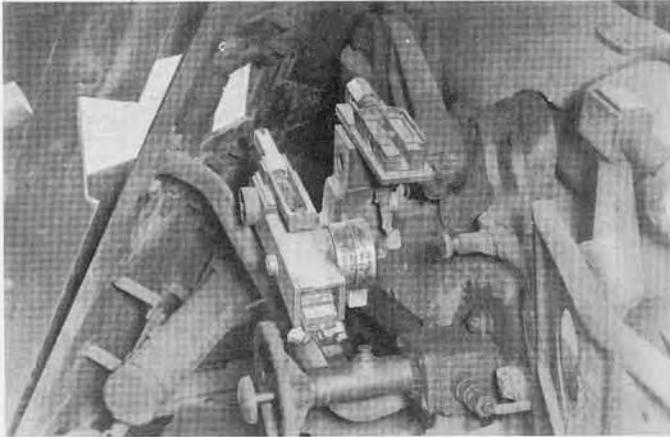
MOUNTS: The telescope mount for the 7.5 cm Stu. K. 40 is attached to a bracket to the left of the weapon and is connected by a linkage bar so that elevation of the weapon is relayed to the telescope mount. The mount does not automatically compensate for trunnion



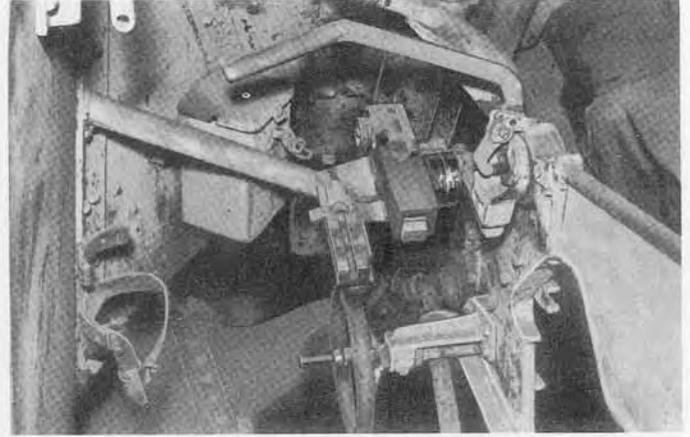
Sight Mount for 7.5 cm (Stu. K. 40) S. P. on Pz. Kpfw. III chassis

cant. The telescope used with mounts of this type is of periscopic design and has a removable head. Quadrant elevation is obtained by placing the range drum index in agreement with the proper scale and depressing the telescope mount through the super-elevation angle necessary for the range and then elevating the gun until the apex of the triangle on the telescope reticle is superimposed on the target. There is no angle of site mechanism on the telescope mount, nor is there a longitudinal level vial or index arm to indicate when the gun has been moved through an angle equal to the original movement of the telescope mount. Deflection is introduced by operating the knurled knob at the top-right of the instrument. The deflection scale is graduated in increments of one mil from 0 to 20 on each side of zero.

Sight Mounts for Self-Propelled Artillery



Sight Mount for 7.5 cm Pak 40 mounted on 38 (t) Czech chassis

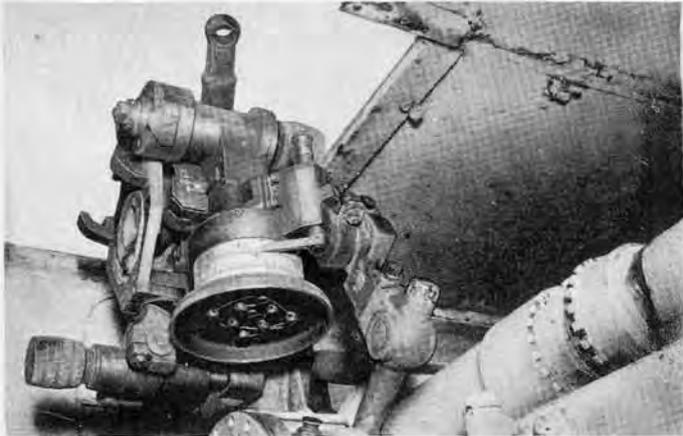


Sight Mount for 7.62 cm Pak 36 (r) mounted on 38 (t) Czech chassis

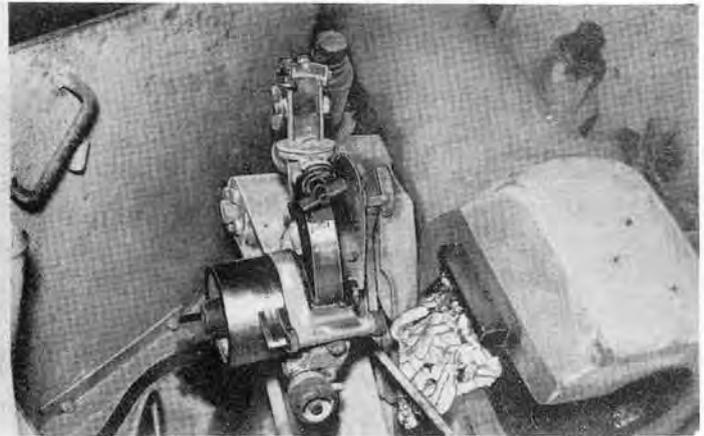
MOUNTS: The telescope mounts for these two guns are of the same general design, the only differences being in the ballistic cam and markings on the range drum. They are of the rocking bar type and have a range drum graduated for the various types of ammuni-

tion used in the weapons. A three power, straight tube telescope is used as the sighting component. For indirect fire, a panoramic telescope, the *Aushilfsrichmittel* 38 can be fitted.

Sight Mounts for Self-Propelled Artillery



Sight Mount for 10.5 cm (Stu. H. 42) on Pz. Kpfw. III chassis



Sight Mount for 15 cm s. F. H. 13 on Lorraine chassis

Sight Mount for 10.5 cm (Stu. H. 42) on Pz. Kpfw. III chassis. **RANGE SCALES:** There are three scales engraved above the range drum: the top scale is the elevation micrometer for the elevation scale which is graduated from 0 to 300 mils; the next, a range scale, used with the Spr. F. H. Gr., is graduated from 100 to 3300 meters; and the third scale, for the 10.5 cm Gr. 39 HL/A. HL 18, is graduated from 400 to 1500 meters.

MOUNT: The telescope mount for the 10.5 cm Stu. H. 42 is basically the same as the telescope mount for the 7.5 cm Stu. K. 40. The principles of operation are identical.

Sight Mount for 15 cm s. F. H. 13 on Lorraine chassis. **RANGE DRUM:** The range drum is quite broad, but there are only two scales on it. The first is a range scale graduated from 100 to 8150 meters. The inner scale is engraved from 0 to 800 mils in 2 mil steps. An elevation scale graduated in units of 100 mils is engraved on a plate fastened to the left trunnion bearing.

This scale in conjunction with a pointer actuated by the gun trunnion indicates the angle of elevation imparted to the gun.

MOUNT: The telescope mount for the 15 cm s. F. H. is not an azimuth compensating type. A panoramic telescope bracket is attached to a rack gear and is moved through vertical angles by operation of the knurled knob in the center of the range drum. Angle of site is introduced by turning a wing nut immediately below the telescope bracket. The angle of site scale is engraved about a spiral groove cut into a plate; the index is fitted with a lug that fits in the groove and raises up or down as the scale is turned. Operation of the angle of site mechanism when the range mechanism is locked causes the panoramic telescope to be tilted through an angle equal and opposite to the angle of site. The mount is cross-leveled by turning the wing nut below and forward of the range drum. There is no level vial to indicate a horizontal plane.

PANORAMIC TELESCOPES 16 AND 16/18

GERMAN 

Rundblickfernrohr 16 (Rbl. F. 16)

Rundblickfernrohr 16/18 (Rbl. F. 16/18)

The Panoramic Telescope Rbl. F. 16, which has been replaced by the Rbl. F. 32 and 36, is still used on the 7.5 cm l. I. G. 18. It is a 4-power, fixed-focus type with a cross level and longitudinal level for checking the alignment when the telescope and bracket are secure to the mount. Since the levels are not readily visible in this position, a mirror is provided on the telescope. The elevation scale and micrometer of the head resembles those of the standard telescope, Rbl. F. 32. The azimuth scale is graduated in 100-mil intervals and numbered from 0 to 64. The azimuth micrometer scale is graduated in units of one mil. The throwout and locking mechanism is the same as that of the usual type of panoramic telescope.

The Model 16/18, shown herewith, is very similar to the 16.



MORTAR SIGHT

This instrument is designed to be used for laying the German 81 mm Mortar in azimuth and elevation. It embodies means for obtaining right or left lateral deflection, elevation or depression, and a collimator sight for sighting on an aiming point.

The elevation scale is graduated from 0 to 16, representing 0 to 1600 mils. The lateral deflection scale is graduated from 0 to 64. The collimator sight consists of a reticle having horizontal and vertical translucent slits located at the focal length of a single eye lens. The grooves on the top and side of the collimator are used as an open sight.

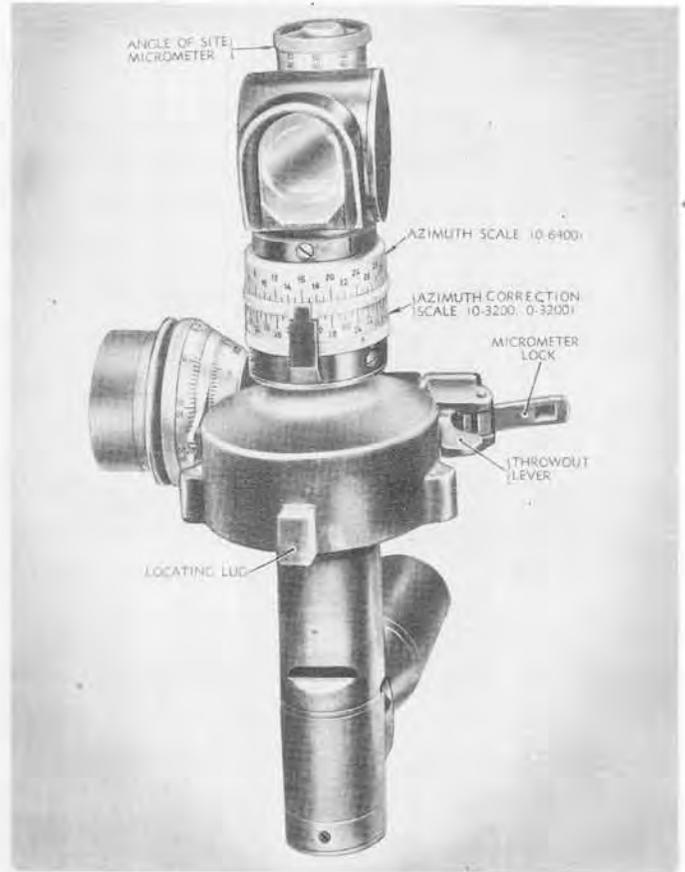
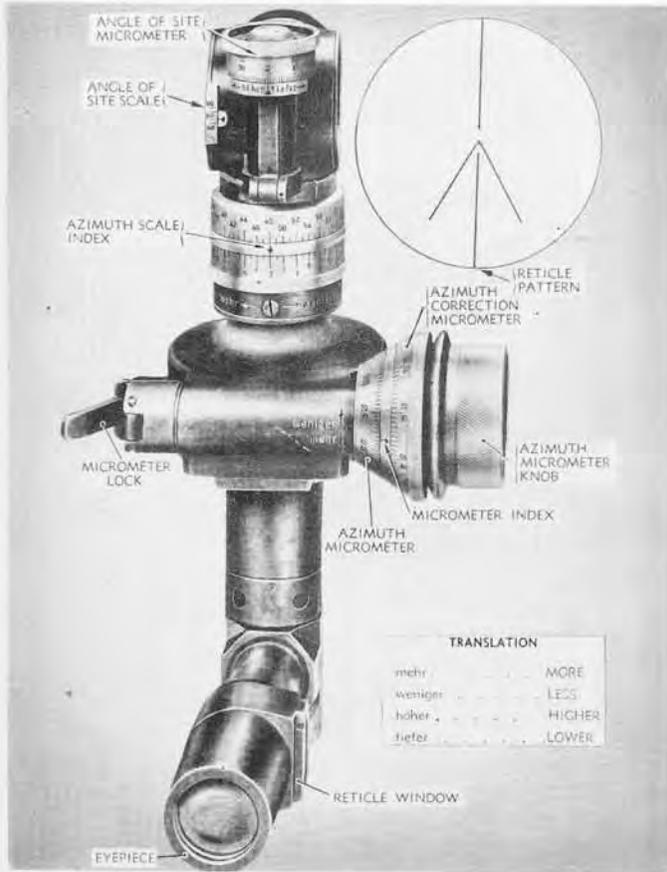


PANORAMIC TELESCOPE 32

GERMAN



Rundblickfernrohr 32 (Rbl. F. 32)



This panoramic telescope is used on all standard field equipment. It is a 4-power, fixed-focus type with a field of view of 10 degrees. The line of sight may be raised or lowered by rotation of the angle of site knob. The angle of site scale is graduated from 100 mils to 500 mils (300 mils in normal). The angle of site micrometer is graduated in mils from 0 to 100 mils. The azimuth scales on the vertical barrel of the telescope are graduated in 100-mil intervals; the upper scale, 0 to 64, is fixed in relation to the rotating head. The lower has two semi-circular scales numbered 0 to 32 and can be rotated independently of the rotating head. A knurled portion permits adjustment. The azimuth micrometer includes two scales graduated in mils from 0 to 100 mils. The outer scale can be rotated independently of the azimuth worm. Evidently the fixed azimuth scale and micrometer are used for initial laying of the piece and the second scale and micrometer are then zeroed and used to measure base deflection. A throw-out lever is provided for rapid setting in azimuth. A locking lever locks the azimuth micrometer in any setting. The reticle pattern is shown above.

The existence of Panoramic Telescopes 36 and 37 has been confirmed. They are believed to be very similar to the Rbl. F. 32.

SPECIFICATIONS

Power 4X
 Field of view 10°
 Weight 5 lbs.



AUXILIARY QUADRANT SIGHT 38

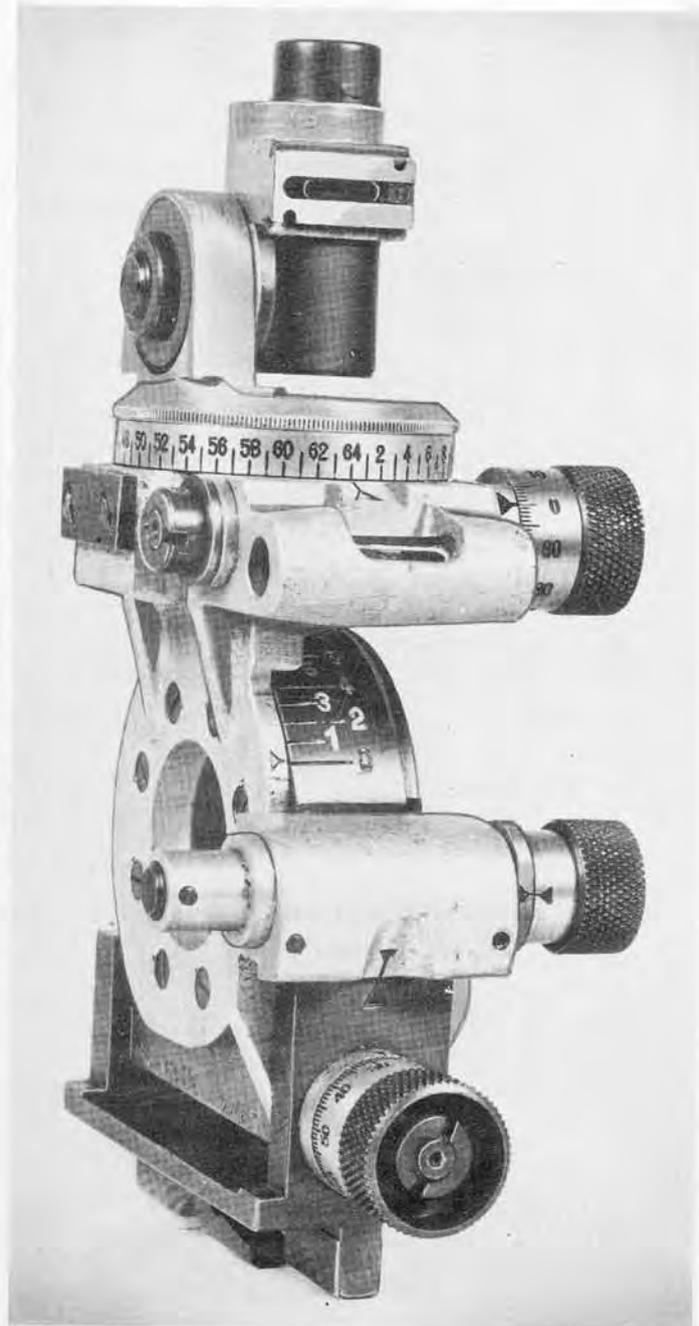
Aushilfsrichtmittel 38

This quadrant sight is called a "substitute aiming device" by the Germans. It will fit into the sight mount found on the 7.62 cm Pak 36 (r), the 5 cm Pak 38, and the 7.5 cm Pak 40. The device has apparently been designed as a cheap instrument for indirect laying and may be used with any weapon having a suitable adapter.

The elevating worm wheel housing fits into the adapter bracket and is retained by the elevation worm wheel. The telescope bracket, which is made of cast aluminum, is fastened to the elevation worm wheel by holding screws. The cross-level vial and longitudinal level vial are part of the telescope bracket assembly.

The cross leveling mechanism consists of a worm meshed with a worm wheel segment cut on the adapter bracket. Turning the cross leveling knob causes the telescope bracket and elevation worm wheel assembly to be tilted in relation to the adapter bracket. The azimuth mechanism consists of a worm and worm wheel provided with a rather unique anti-back-lash arrangement.

Both the elevation and azimuth scales are divided into increments of 100 mils, and each is supplemented with a micrometer for 1 mil settings. The elevation scale is graduated from 0 to 1300 mils. There is a simple elbow telescope with a reticle design consisting of a large inverted "V" and two vertical lines such as is found in the German panoramic telescopes.



SPECIFICATIONS

Power of telescope	3 diameters
Field of view of telescope	8°
Overall height of instrument	8 1/8 ins.
Overall width of instrument	3 1/4 ins.
Complete weight of instrument	3 lbs., 12 ozs.

Rbl. F. 40



The Rundblickfernrohr 40 is believed to have been designed for use with the 7.5 cm L. G. 40 or the 10.5 cm L. G. 42. A carrying case and two night lighting devices employed with the instrument were also recovered.

This is a panoramic artillery sight, consisting of an upright section approximately five inches long, supporting an objective head which has a full 360° traverse, and an eye piece approximately four inches long set at an angle to the base. The eye piece traverses approximately 200°, permitting the operator to use the sight from different positions. A knob graduated in mils

and numbered on each ten mils is located near the center of the upright section and traverses the objective head. The lower section of the objective head is graduated in hundred mils, the even hundreds being numbered. By pressing a small lever near the adjusting knob, free traverse of the head for quick spotting is possible.

An adjustment for elevation is controlled by a knob on top of the objective head which is graduated in hundredths and numbered on each tenth mil graduation.

An unusual feature in this sight is that the adjusting knobs are click mounted to enable adjustments to be made at night without light.

Two night lighting devices are provided with the sight. One mounts on the left side of the eye piece and illuminates the reticle with a red light which is regulated by an aperture in the attachment. The other is worn by the operator for reading graduations on the sight and has an aperture selection for either clear or red light. It is held in place on the forehead of the operator by an elastic strap.

Weight of the sight is approximately 2½ pounds.

Rbl. F. Flak

The Rbl. Flak is used with heavy antiaircraft guns for indirect fire against ground targets and for reciprocal laying. A modified type is designed for use with the predictor.

When mounted in their respective sockets with the azimuth scales set to zero, the line of sight of the panoramic telescope on the predictor is 180° from that of the predictor telescope. The reason for the eyepiece of the gun sight being 90° from the axis of the gun is for convenience as the operator can stand at the right side of the gun and look into the sight at right angles to the axis of the gun. This sight is 9.3 inches in height.



27 mm DOUBLE BARREL SIGNAL PISTOL

GERMAN 

27 mm Doppel Schuss



The 27 mm double barrel signal pistol is unique in that the basic parts such as the trigger, trigger-guard, lever release, hammer assembly and switch lever, as well as all pins, are made of steel; the remaining parts, with the exception of the wooden forestock and hand grips, are made of an aluminum alloy.

The firing mechanism is of the continuous pull type incorporating concealed hammers. A switch lever is located on the top rear of the pistol frame to control the firing mechanism. By use of this lever, either one of the two barrels, or both, can be fired by action of the trigger. Turning the lever to the left allows only the left barrel to be fired; turning it to the right allows only the right barrel to be fired. With the lever in the center position, both barrels fire simultaneously. Breaking of the piece is accomplished by pushing forward the release lever which is located just forward of the trigger guard. Indicator pins located in the breech plate show whether the respective barrels are loaded. A safety lever is located on the left side of the receiver. The words "Feuer" and "Sicher" indicate the two positions of Fire and Safe.

Another model, a double barrel air force signal pistol of somewhat similar design, is pictured in the inset above.

SPECIFICATIONS

Weight	3 1/8 lbs.
Length	13 7/8 ins.
Ammunition types	
Weight of barrel	
Length of barrel	9 1/2 ins.
Rifling	(smooth bore)
Muzzle energy	
Maximum range	

*Signal cartridge with single star—max. vertical range 260 ft.

SUBMACHINE GUN

GERMAN



7.92 mm M. P. 43, M. P. 43/1, M. P. 44 (Sturmgewehr 44)



7.92 Submachine Gun: Top, M. P. 43; Center, M. P. 43/1; Bottom, M. P. 44

The German M. P. 43 is an automatic, air-cooled, gas-operated, magazine-fed shoulder weapon, firing from a closed bolt and a locked breech. Provision is made for both full-automatic and semi-automatic fire. For full-automatic fire, the trigger must be held back until all rounds in the magazine have been fired; for semi-automatic fire, the trigger must be released after each round. However, German official sources say that full automatic fire will be used only in emergency.

Despite the fact that it is of cheap construction, made chiefly of steel stampings, the M. P. 43 is a very serviceable weapon. It is believed that the gun was developed from the 7.92 mm M. Kb. 42 (machine carbine 42) inasmuch as the general design is quite similar, and the same type of ammunition is used. However, the M. P. 43 has a shorter barrel and gas cylinder, and has no bayonet as does the M. Kb. 42.

The receiver, frame, gas cylinder, jacket, and front sight hood are made from steel stampings. As all pins in the trigger mechanism are riveted in, it cannot be disassembled, although a complete trigger assembly may be very quickly inserted. The gas piston assembly, bolt, hammer, barrel and gas cylinder are machined parts.

The gas piston assembly consists of a piston, piston rod, and slide which appear to be machined from one piece with a stamped handle inserted. The stock and pistol grips are of low grade wood. The curved magazine is inserted from the bottom, and the fired cartridge cases are ejected on the right.

The various models of this weapon, including the M. P. 43, M. P. 43/1, and M. P. 44, have been officially designated M. P. 44. A recent official German order changed the nomenclature to Sturmgewehr 44.

SPECIFICATIONS

Caliber	7.92 mm (.312 in.)
Weight (with empty magazine).....	10 lb., 1 oz.
Length (overall)	3 ft., 1 in.
Length of barrel	16.2 ins.
Sight radius	
Principle of operation	gas
Feeding device	Curved magazine
Capacity of feeding device	30 rounds
Cooling system	air
Ammunition types	
	7.92 mm Postolen Patronen Semi AP., M.P. 43
Effective rate of fire	
(automatic)	100 to 120 rds./min.
(semi-automatic)	40 to 50 rds./min.
Type of sight.....	Leaf sight graduated from 100 to 800 meters
Rifling	
Twist	R. H.
No. of grooves	
Chamber pressure	
Muzzle velocity (approx.)	2250 f/s
Muzzle energy	
Maximum range	
Effective range	400 yds.

CARBINE

7.92 mm Gewehr 33/40

GERMAN 



This carbine, a typical Mauser, is very similar to the latest model of the Kar 98K. It is a manually operated, air-cooled, clip-fed shoulder weapon, having a laminated wood stock, a large metal butt plate to protect the stock when grenades are launched, and a sling mounted on the left-hand side.

The Gewehr 33/40 and the Kar 98K have interchangeable bolts. The most obvious differences are found in the length, weight, hand guards, and bolt handles.

The present weapon has an overall length of 39½ inches as compared to the 43½ inches of the Kar 98K. The barrel length is 19¾ inches instead of 23½ inches. The carbine weighs 7 pounds 11 ounces; the rifle 9 pounds. The hand guard on the Gewehr 33/40 extends behind the rear sight and covers a greater percentage of the barrel than the one on the Kar 98K. The bolt handle on the carbine is turned down uniformly forming a semi-circle, and the knob on the end of the handle has been hollowed out and milled flat on the underside to reduce weight. On the Kar 98K, the bolt handle slopes down abruptly at right angles and the knob is solid.

SPECIFICATIONS

Caliber	7.92 mm (.312 in.)
Weight	7 lbs., 11 ozs.
Length (overall)	39½ ins.
Principle of operation.....	Manually operated, bolt action
Feeding device.....	Clip-fed, hand-loaded magazine
Capacity of feeding device.....	5 rounds
Cooling system	Air
Ammunition	All 7.92 mm Mauser Types
Type of sight.....	Inverted "V" or barleycorn front sight with hood protector and tangent leaf rear sight graduated from 100 to 1,000 meters.
Length of barrel	19¾ ins.
Length of rifling	
Rifling	
Twist	Uniform R. H.
No. of grooves	4
Muzzle velocity	2,509 f/s

SEMIAUTOMATIC RIFLE

GERMAN



7.92 mm Gewehr 41 (M)



The Gewehr 41 (M) is a self-loading, gas-operated, clip-fed, air-cooled shoulder weapon. It is basically the same as the Gewehr 41 (W) except for several changes that have been made in the manufacture and appearance.

Most of the parts of the Gewehr 41 (M) are machined pieces with the exception of the magazine well, follower, piston rod and butt plate. The majority of the machined pieces have had no further finishing, but are of a very high quality. The upper band, lower band, magazine well, magazine follower, trigger guard, piston rod, dust cover and butt plate of the Gewehr 41 (M) are stamped pieces.

The differences between the Gewehr 41 (M) and the Gewehr 41 (W) are as follows: the piston rod of the G. 41 (M) terminates in a yoke, the two arms of which extend rearward and contact the bolt head. The piston rod of the G. 41 (W) is one piece and is in direct contact with the bolt retractor slide. The handguard of the G. 41 (M) is made of wood unlike that of the G. 41 (W) which is plastic.

SPECIFICATIONS

Caliber	7.92 mm (.312 in.)
Weight	10 lb., 13 oz.
Length without bayonet	46½ ins.
Principle of operation	Gas
Feeding device	Vertical box-type magazine
Capacity of feeding device	10 rounds
Cooling system	Air
Ammunition used	All 7.92 mm Mauser types
Type of sight.....	Inverted V blade type front sight; tangent leaf rear sight; graduated 200 to 1,200 meters.
Length of barrel	21½ ins.
Rifling	
Twist	Uniform R. H. twist
Form	
No. of grooves	4
Depth of grooves	
Width of grooves	
Chamber pressure	
Muzzle velocity	
Muzzle energy	
Maximum range	
Effective range	

SEMI-AUTOMATIC RIFLE

7.92 mm Karabiner 43 (Kar. 43)



The Karabiner 43, a gas-operated, semi-automatic, magazine-fed, air-cooled shoulder weapon, is basically the same in design as the Gewehr 41 (W) described on page 208. Two notable changes found in the later weapon are a modified gas operation and a change in manufacturing policy.

This weapon utilizes a gas vent and gas piston, a method used for the first time in German small arms weapons in the Fallschirmjäger Gewehr 42. The improved gas operation insures more positive operation, and malfunctions due to carbonization are less likely to occur.

A great deal of effort was put into an attempt to reduce the time and expense in the manufacture of this weapon. In order to accomplish this, forgings and stampings were used in as many parts as was practical. Machined or ground surfaces are found only where necessary to insure proper operation. The bolt, bolt channel, and contacting surfaces of the trigger group are included in these. Such surfaces as the outside of the receiver, the top of the retractor slide, and the non-contacting surfaces of the trigger group are left untouched.

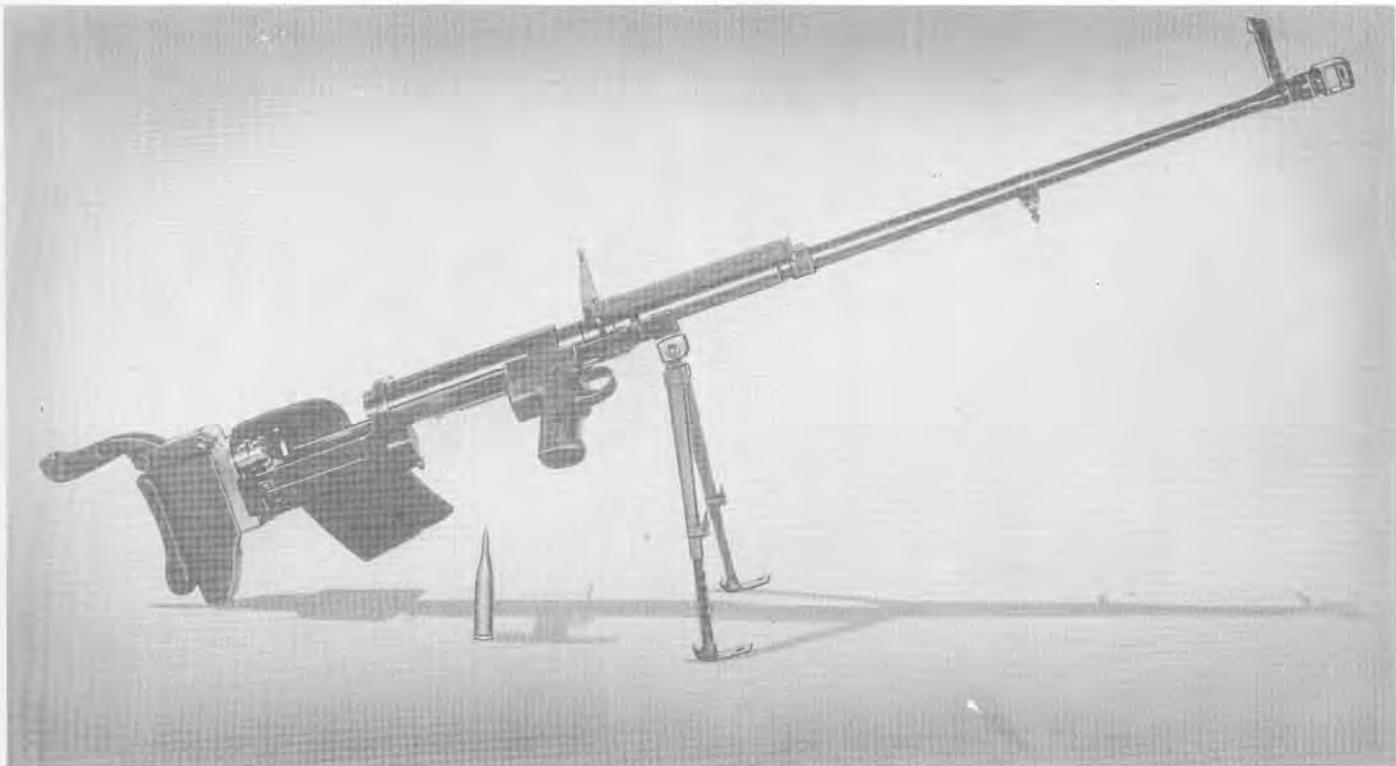
Several other slight changes were made, the most notable being the use of a ten-round, detachable box-type magazine; the addition of a threaded section on the muzzle making it possible to attach a flash hider or an adapter which is used with blank ammunition; the omission of the bayonet stud; and the addition of a telescopic sight base indicating that the Kar. 43 is intended for use as a special weapon. The weapon is lighter and better balanced than the Gewehr 41 (W) due to the elimination of the gas trap assembly at the muzzle and the long piston rod.

SPECIFICATIONS

Caliber	7.92 mm (.312 in.)
Weight	8 lb., 9 oz.
Length	44 1/4 ins.
Principle of operation	Gas
Feeding device.....	Detachable box-type magazine
Capacity of feeding device.....	10 rounds
Cooling system	Air
Ammunition used	All 7.92 mm Mauser types
Type of sight.....	Parallel sided, flat top blade type front sight. Tangent leaf rear sight graduated from 100 to 1,200 meters. Telescopic sight base at rear of right side of receiver.
Length of barrel	22 ins.
Rifling	
Twist	Uniform R. H.
Form	
No. of grooves	4
Depth of grooves	
Width of grooves	
Chamber pressure	
Muzzle velocity	
Muzzle energy	
Maximum range	
Effective range	

ANTITANK RIFLE

7.92 mm M SS 41



This antitank weapon, a manually operated, magazine-fed, air-cooled, high-velocity rifle which was standardized for production in 1941, fires the same necked-down cartridge as the Panzerbüchse 39. Although classified as an antitank rifle, the use of heavier armor on modern tanks has rendered the weapon effective against lightly-armored vehicles only.

A hinged bipod similar to that of the MG 34 is attached to the front of the receiver jacket. It folds forward for convenience in carrying. The gun is also equipped with carrying handle and sling; the former is fitted to the top of the barrel group, and the latter is attached on the right side at the bipod and back plate assembly.

A "U" type rear sight and an adjustable front sight of the square block type fold to the rear when not in use.

The gun is put in a "Safe" position by pulling the barrel housing lock extension $\frac{1}{4}$ -inch to the rear so that its rear alignment mark is aligned with the mark "S" on the barrel housing lock. When in this position, the trigger cannot be pulled, nor can the action be opened. If the trigger is pulled while the action is not entirely closed, the gun will not fire. It is necessary to release the trigger and pull it again in order to release the sear. When the magazine is empty, the action is kept open by the protrusion of the magazine follower which stops the rearward movement of the barrel housing.

SPECIFICATIONS

Caliber	7.92 mm (.312 in.)
Weight (with empty magazine)	29 $\frac{3}{4}$ lbs.
Length (overall)	59 $\frac{1}{4}$ ins.
Sight radius	30 $\frac{15}{16}$ ins.
Principle of operation	Manually operated
Feeding device	Magazine
Capacity of feeding device	6 rounds
Cooling system	Air
Ammunition types.....	13 mm case necked down to 7.92 mm. Same as used in the PZ B39. See Page 211.)
Rate of fire.....	.....
Type of sight.....	"U" type rear sight; square block type front sight.
Weight of barrel (w/fittings).....	13 $\frac{1}{4}$ lbs.
Length of barrel	43 $\frac{3}{8}$ ins.
Length of rifling .....	.....
Rifling	
Twist	R. H.
Form .....	.....
No. of grooves	4
Depth of grooves .....	.....
Width of grooves .....	.....
Muzzle velocity (estimated)	3,540 f/s
Type of mount	Bipod

UNDERCOVER AIMING AND FIRING APPARATUS

GERMAN



Deckungszielgerät für le. 34 u. 42 Dezetgerät



The apparatus shown attached to the 7.92 mm M G 42.

This device is an undercover aiming apparatus for firing the standard machine guns from foxholes, trenches, or depressions in the ground. It permits the user to aim the weapon without exposing himself to enemy fire.

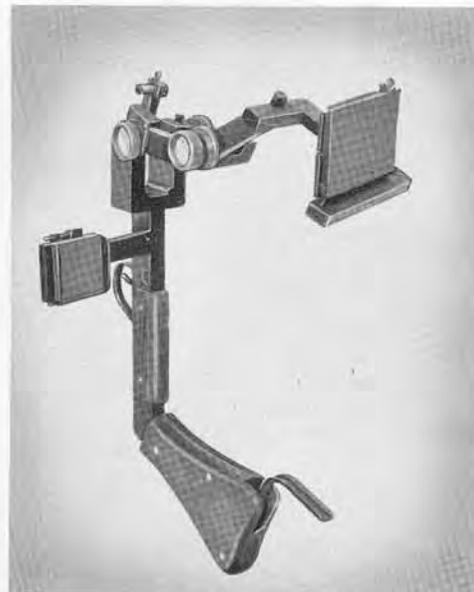
Construction is of welded steel boxwork, and consists of a shaft with a shoulder stock at the lower end and a securing arm which extends from the upper part of the shaft to the receiver of the weapon. Three milled edge clamping screws secure the device to the weapon. Two mirrors through which the weapon is aimed are lined up so as to utilize the standard sights. One mirror is mounted on the shaft and the other on an extension of the securing arm above and to the rear of the buffer group.

The firing mechanism is a simple linkage that enables the machine gun to be fired from a trigger on the instrument. It is necessary to have a different linkage for the MG 34 than with the MG 42. These are obtained by positioning the connecting bar in the trigger linkage. A window on the connecting bar shows when the desired linkage is obtained. The trigger linkage may also be positioned to make use of the semiautomatic arrangement on the MG 34, if desired.

The field of vision at 1,000 meters (1,093 yards) is about 200 meters (218 yards) broad. This can be increased by 100 meters (109 yards) by moving the head to the left or right. In the same manner, vertical vision which is 100 meters at 1,000 meters can be increased.

SPECIFICATIONS

Height	24 ins.
Maximum width	9 ins.
Weight	7½ lbs.



The undercover aiming and firing apparatus not attached to gun.

AIRCRAFT MACHINE GUN



30 mm Mk. 108 A-3



The Mk. 108 A-3 is an automatic, air cooled, belt-fed weapon operated by blowback and firing electrically from an open bolt. Initial cocking and initial depression of the sear to release the bolt are accomplished by compressed air. The gun is mounted on its side, and fires through the propeller hub in ME 109 G fighters. It is attached at the forward end of the receiver to a blast tube which extends through the engine. This gun is unusual in being a blowback operated, low muzzle velocity weapon.

Sixty rounds of ammunition are fed by means of a disintegrating belt from an ammunition can mounted above the gun. On release of the sear, the bolt travels forward under the action of two driving springs. A projection on top of the bolt passes through the ring extracting a round and forcing it into the chamber. After firing the empty cartridge case reseats itself in its link. The ejection is accomplished by pawls actuated by camming grooves cut in the top of the bolt. Position of a new round takes place by the same action. A feature of the gun is the fact that the barrel and receiver do not move in recoil, the entire force of which is taken up by the rearward motion of the bolt against driving springs which act as buffers on recoil. There is no locking action between the barrel and bolt at any time.

All ammunition found to date has been high explosive, high explosive-tracer, incendiary and incendiary tracer. It is doubtful if the muzzle velocity is high enough for the effective use of armor piercing ammunition.

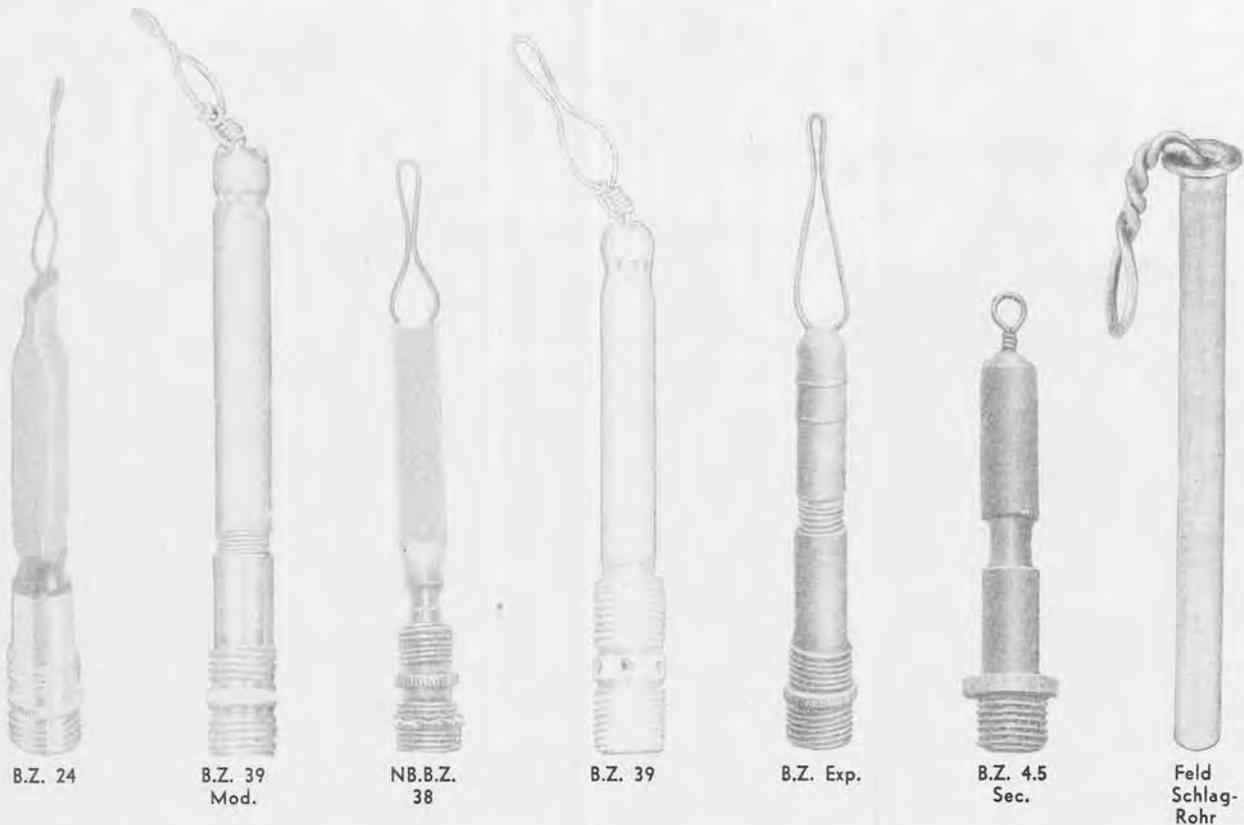
SPECIFICATIONS

Caliber	29.6 mm (1.17 in.)
Weight (total)	265 lb.
Weight of gun	136 lb.
Weight of mount	28 lb.
Weight of ammunition can	36 lb.
Weight of ammunition (60 rounds)	65 lb.
Weight of recoiling parts	24½ lb.
Length of gun with blast tube	7 ft. 6¾ ins.
Length of gun	3 ft. 5¼ ins.
Length of barrel	21½ ins.
Number of lands and grooves	16
Maximum length of recoil of bolt	11½ ins.
Rate of fire	500 rds./min.
Muzzle velocity (approx.).....	H.E.—1,650 f/s.*

*Not verified

Practically all German mines, including antitank and antipersonnel mines and booby traps, are fired by one or more of several standard igniters. Mines and prepared charges have one or more holes drilled and threaded to receive these igniters. Hand Grenades also employ igniters of the friction, pull, and pressure types. These specialized firing devices are divided by structure and function into friction, pull, and pressure igniters, and a miscellaneous group including such special devices as the tilt, rupture, chemical, and time delay types. A number of the styles most commonly employed by the German army are pictured on the following pages; a few examples are described as representative of each group.

Friction Igniters



Friction Igniters



Zdschn. Anz.
29



Zdschn. Anz.
39



Reiss-
zunder



Reibzunder
West



N.B.Z. 29



French
Friction
Igniter

Friction Igniter B.Z.E. (Brenzünder Ei)

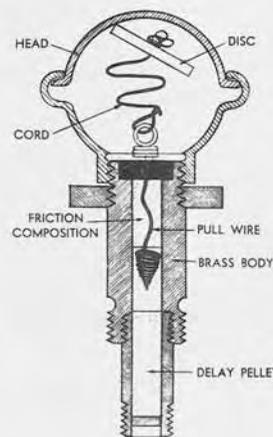


This igniter, which is used in the German egg grenades, resembles the Zdschn. Anz. 39. The B.Z.E. type has different colored caps indicating various lengths of delay in the delay pellets. Red indicates 1 second delay, blue, 4.5 seconds; yellow, 7 seconds; and white, 10 seconds. The blue-capped igniters are used in the

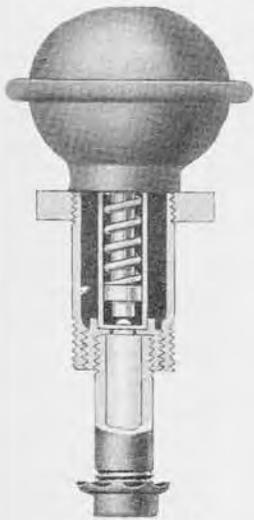
egg grenades, and the yellow-capped with prepared or hollow charges. Red and white-capped igniters are seldom used.

The Germans have at times booby-trapped these igniters by removing the delay pellet, which is usually screwed into the base of the igniter, and by replacing the igniter in the grenade. The igniters normally fitted with delays have right-hand threads on the caps which differentiate them at night from the left-hand threaded, grey-capped fuze igniter, Zdschn. Anz. 39.

In order to operate the device, the cap is unscrewed and the string given a sharp jerk, pulling the wire through the friction composition.



Pull Igniters



Spring-loaded
B.Z.E.



Zu.Z.Z. 35
(Pull and
tension release)



Zu.Z.Z. 35
Mod.
(Pull only)



Z.Z. 42



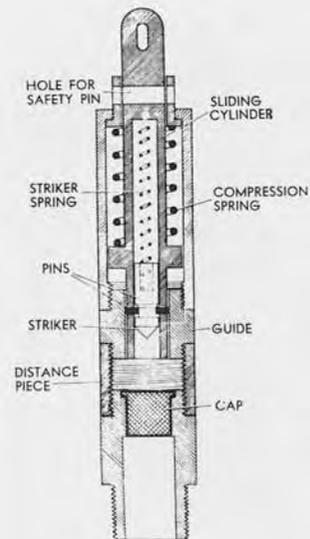
French
Pull
Igniter
1939

Pull Igniter Z.Z. 35 (Zugzünder 35)

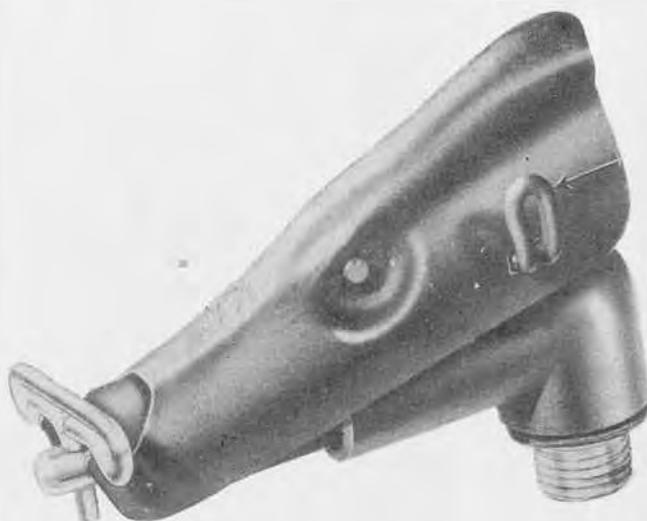


This brass igniter is used with the stock mine and occasionally with the "S" mine. It is also commonly used with booby traps.

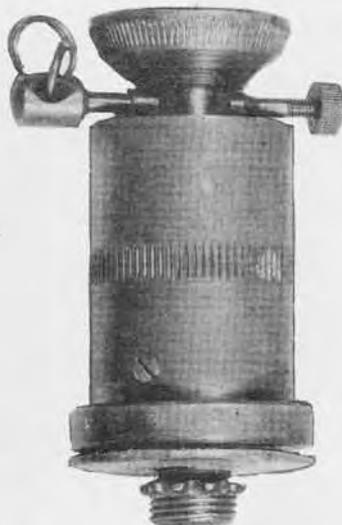
The igniter is provided with a safety pin which is inserted through the inner of the two holes in the end of the spring-loaded striker. A trip wire is attached to the outer hole at the end of the striker. In normal use, it is screwed into one of the anti-lifting wells of a mine, a trip wire is attached, and the safety pin is withdrawn.



Pressure Igniters



Hebelzünder 44
(Used with Glasmine 43)



D.Z. 35 (B)



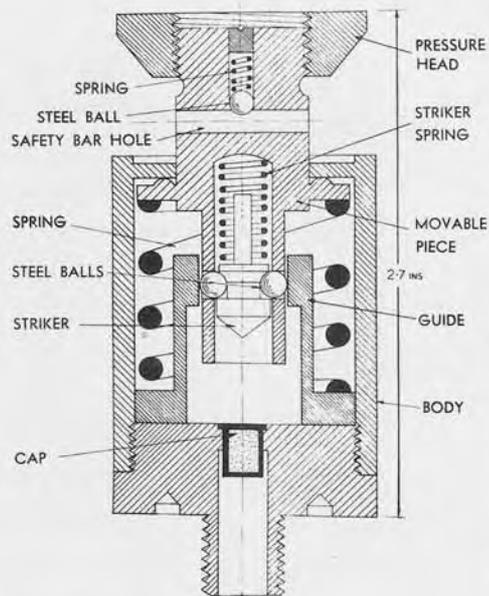
French A.T.

Pressure Igniter D. Z. 35 "A"



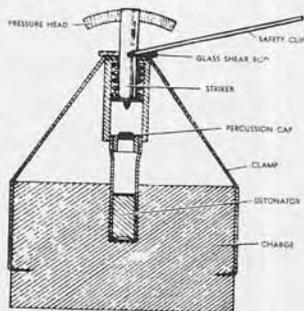
This igniter is designed for use with improvised mines and booby traps. The igniter consists of a white metal body housing the ball-release, spring-loaded striker assembly. The igniter is provided with a safety pin through the head of the plunger.

To operate, after withdrawal of the safety pin, the igniter is fired by pressure on the pressure piece which depresses the plunger until the steel balls are free to escape into the recess in the guide. The spring-loaded striker is released against the percussion cap. A pressure of 130-160 pounds is necessary to fire the igniter.

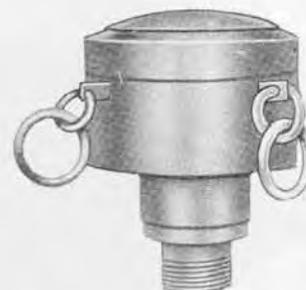




Pressure Igniters



Weissmann



Z. D. Z. 29
(Push or Pull Type used with T. Mi. 29.)



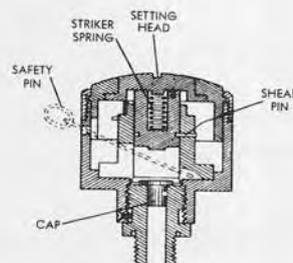
530 (e)



P.X. 38



S.Mi.Z. 44



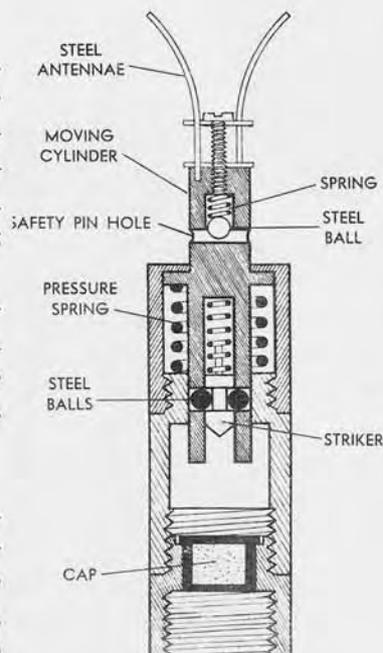
Z. D. Z. 29

Pressure Igniter S. Mi. Z. 35



This is the standard igniter used in the "S" mine. It consists of a white metal body, housing the spring-loaded, ball-release type striker assembly. The igniter is provided with a safety pin through the plunger just above the top of the igniter body. There are three pressure prongs attached to the top of the plunger and held in place by a screw. The mine is usually buried with just the prongs of the igniter above the ground.

When the safety pin is removed, a pressure of 15 or 20 pounds is necessary to depress the plunger until the striker retaining balls are freed in the lower recess, releasing the striker.



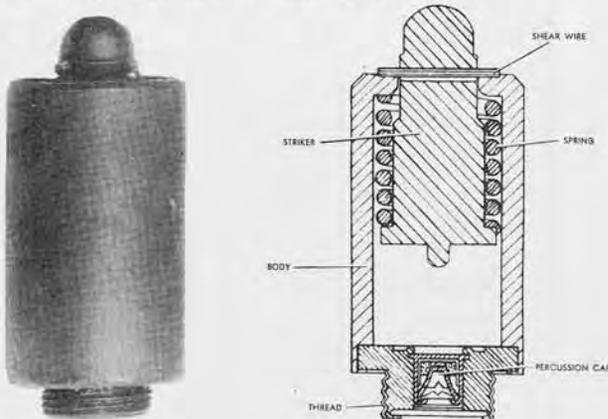


Pressure Igniter T. Mi. Z. 35



This metal igniter is used with the Tellermine 35 and 35 (steel). On the top of the igniter is a setting screw with a red dot which may be turned to coincide with a white groove marked "sicher" (safe), or to a red groove marked "scharf" (armed). This screw is connected to an arming spindle inside the igniter. When set at "scharf," a flange is turned out of the striker recess putting all the strain of the spring-loaded striker on the small shear wire holding the striker to the striker guide. There is a safety bolt which, in the safe position, passes through a hole in the top of the striker.

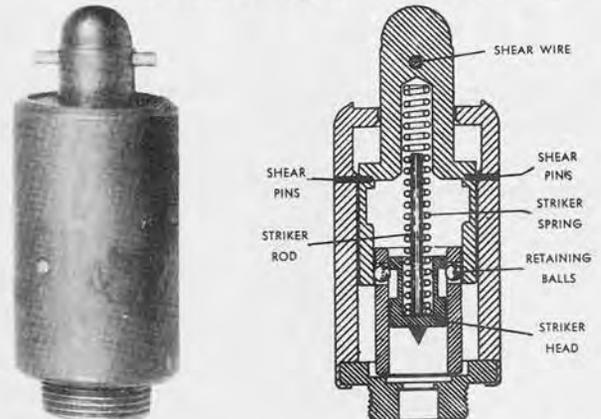
Pressure Igniter T. Mi. Z. 42



This igniter, used in the Tellermine 35 (steel), 42, and 43, consists of a cylindrical, steel-shelled body housing a simple steel striker retained against the pressure of a steel spring by a thick shear wire which passes through a hole in the top of the striker, the ends resting on the top of the igniter body. There is no safety pin. This igniter is sometimes manufactured with the detonator attached.

In operation, pressure on the mine cover presses against the striker head, shearing the wire and releasing the striker.

Pressure Igniter T. Mi. Z. 43

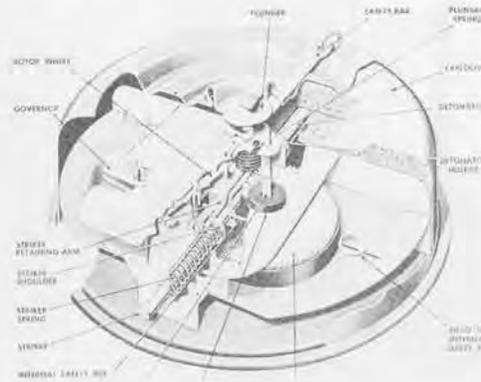


Externally this igniter resembles the T. Mi. Z. 42, but the head (actually a sleeve) is a little longer, and the shear wire is located a quarter inch above the igniter body. Once installed, this igniter cannot be disarmed. When the cover of the Tellermine is screwed down, the sleeve shears the two brass pins holding it to the body. Further pressure forces the sleeve down until the two steel balls escape into the upper recess and release the striker. If an attempt is made to unscrew the mine cover, the sleeve rises, letting the balls escape into the lower recess, releasing the striker.

Pressure Release Device E.Z. 44

This device consists of a thin-shelled, round steel body, 5 inches in diameter and 1.75 inches high, housing a simple clockwork mechanism and a one-half pound charge. It is designed to be laid under mines, but may also be used as a booby trap.

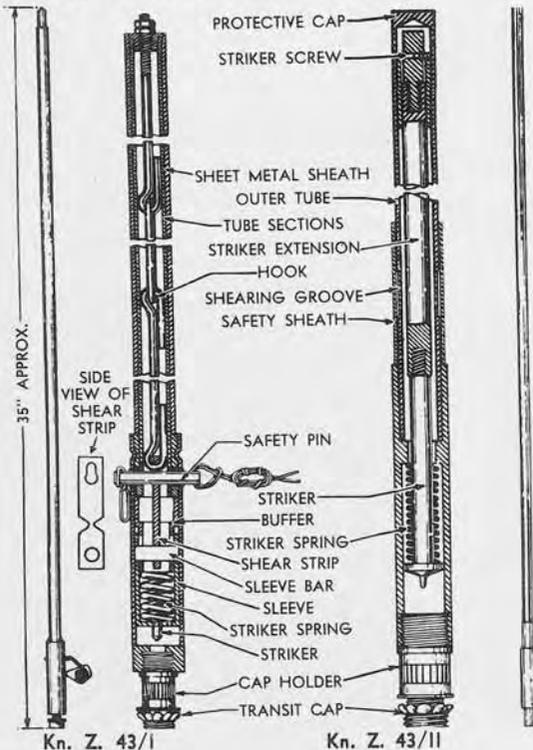
On the top is a small pressure plate connected to a hinged arm holding the spring-loaded striker back. A safety bar runs through the pressure piece into one of the clockwork wheels, preventing the wheel from turning. The mechanism is wound up with a special key and a weight of at least 10 pounds placed on



the pressure piece; then the safety bar is pulled out starting the clockwork. As the mainspring unwinds, it pushes the safety pin from the hole in the striker. The mine is then armed and the only thing holding the striker back is the hinged arm held down by the pressure piece against a compressed spring. When the weight is lifted from the pressure piece, the hinged arm moves up, freeing the striker.

Once this device is armed under an object, it cannot be disarmed or neutralized.

Rupture Igniters 43/I and 43/II

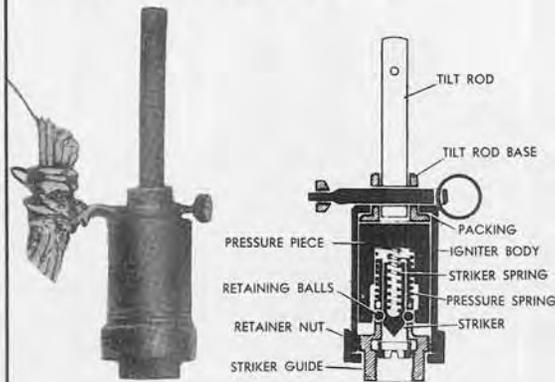


Each of these igniters is approximately 35 inches in length including the elongated staff. Either type is screwed vertically into any standard igniter socket and is designed to initiate the mine when tilted.

Kn. Z. 43/I has a staff made up of 5 sections containing a chain of hooks, the bottom one engaging the shear strip in the igniter. Sideways pressure on the staff causes the hooks to pull the shear strip upwards, raising the sleeve bar, sleeve, and spring, rupturing the shear strip and releasing the spring-loaded striker.

Kn. Z. 43/II is featured by a striker extension made of brittle plastic enclosed in an outer tube with a shear groove towards its lower end. Sideways pressure breaks the outer tube at the shearing groove and breaks the striker extension, releasing the spring-loaded striker.

Tilt Igniters 43A and 43B

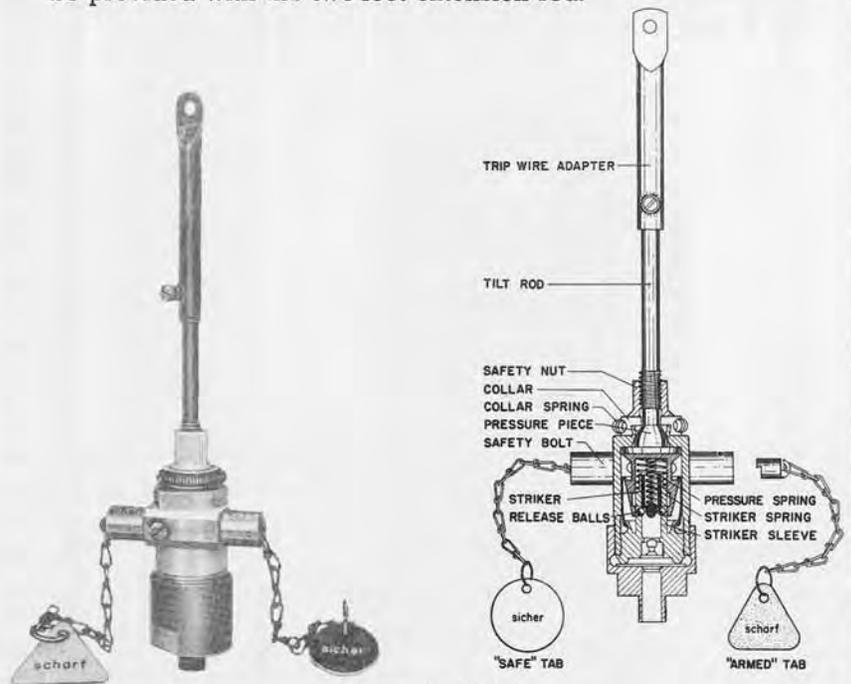


Kippzunder 43 (A)

This igniter, designed to fire when the tilt rod is pushed or tilted in any direction, has standard German threads, permitting its use in any igniter well. It has been found screwed into the bottom well of Tellermines laid upside-down and buried in the ground, the tilt rod extension extending into the air about two feet.

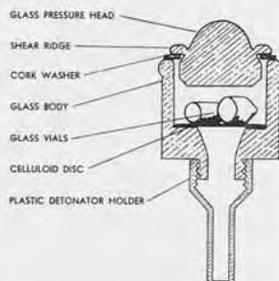
The igniter is armed by removing the safety pin. When the tilt rod is moved, the base rod tilts inside the igniter body, depressing the pressure piece and pressure spring, allowing the retaining balls to escape into the recess which releases the spring-loaded striker. A pressure of 15 or 20 pounds will set off the igniter.

Igniter 43B is similar to the preceding except for the method of arming and the safety device. A safety bolt runs horizontally through the igniter body. At each end of the bolt is a detachable chain with a metal tag on the end. One tag is round, marked "sicher" (safe); the other is triangular, marked "scharf" (armed). When the igniter is armed, the "scharf" chain is pulled out. This positions the bolt in such a manner that the pressure piece will be depressed when the rod is tilted. The igniter may have a trip wire attached to the tilt rod or it may be provided with the two-foot extension rod.



Kippzunder 43 (B)

Topf Mine Chemical Igniter

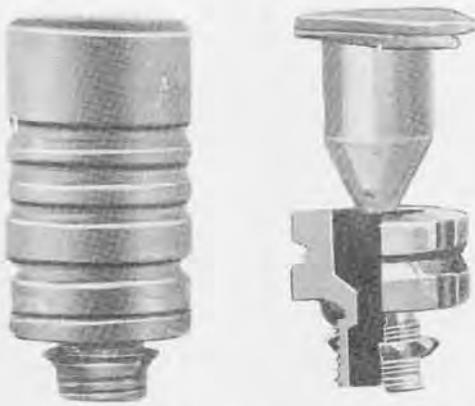


This chemical igniter, used in the Topfmine, is an entirely non-metallic pressure type without a safety device. It consists of a hemispherical pressure head fitted into a hollow glass body. The body screws into a plastic detonator holder. Two glass vials, one containing sodium and potassium as a liquid alloy and the other ethyl nitrate, are fastened within the body to a celluloid disc by adhesive tape.

When the pressure plate of the mine is sheared under a load of about 330 pounds, the head of the igniter shears along its ridge and crushes the glass vials. The resulting chemical reaction causes a flash which sets off the detonator.



Buck Chemical Igniter



The Buck Chemical Igniter consists of a soft metal shell containing a glass vial of sulphuric acid surrounded by a white, sugar-like powder containing potassium chlorate. The base of the

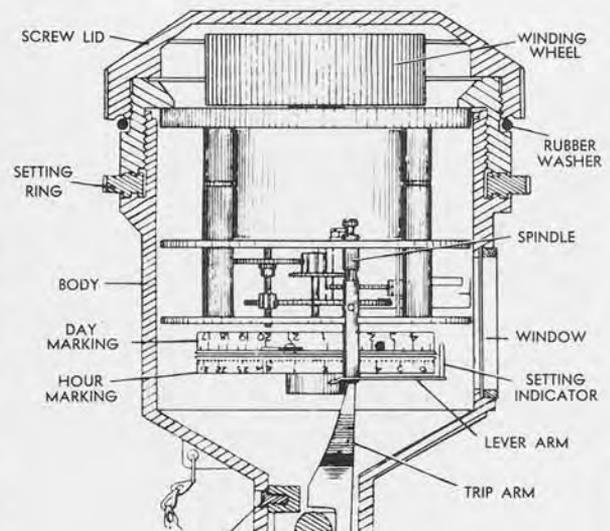
igniter is threaded to fit in the activating well of any German mine with a standard thread. In operation, when the soft metal shell is crushed, the glass vial breaks, and the acid coming in contact with the powder produces a chemical reaction which ignites the mixture, sending a flame down to the detonator. There is no safety.

A newer version of this igniter differs from the old type in that it is shorter and contains a glass vial of purple chemical instead of sulphuric acid.

21-Day Clockwork Igniter J. Feder 504



This igniter, which can be set to go off at any time up to 21 days, is accurate to within 5 minutes in the maximum time limit. It is housed in a white metal case, threaded to take a lid. The mechanism is set by means of a wheel under the lid. Two metal rings are visible through a glass window in the side of the igniter. One wheel, numbered in red, indicates the number of days desired to elapse before the striker is released; the other, numbered in black, is for the hours. The setting ring, marked "Steht" (stop) and "Geht" (go) is located just above the window. A combined safety and arming hole is in the striker "neck" just below the clockwork housing. The arming screw, marked "scharf" is attached to a chain; the safety screw marked "blind" is carried in the hole.

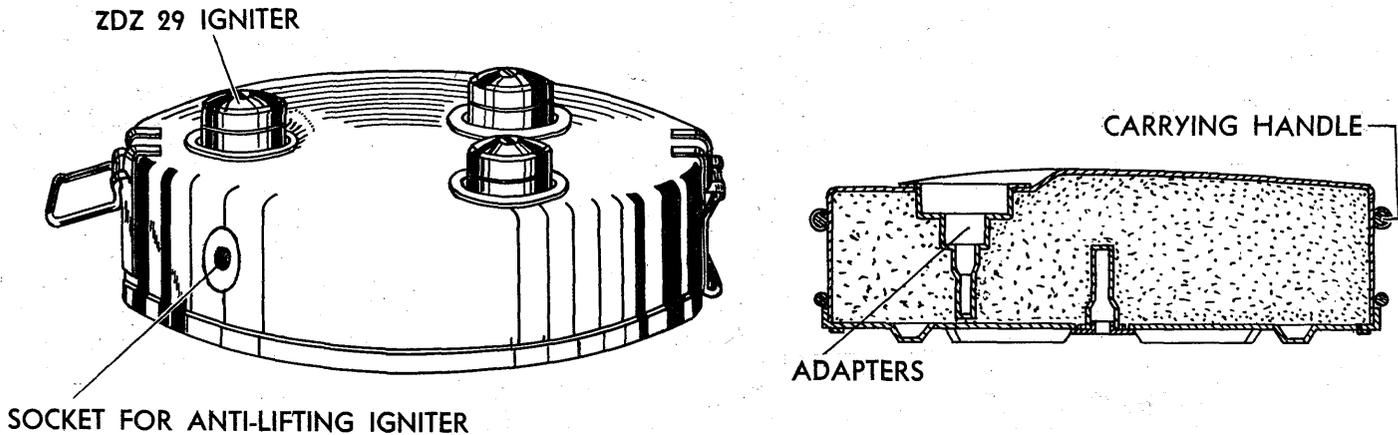


ANTITANK MINE

GERMAN



T. Mi. 29



The German Mine, T. Mi. 29, is a light antitank mine having a total weight of 13¼ pounds. It is 10 inches in diameter, 2¾ inches high, and contains a 10 pound charge of cast T.N.T. Outside, the mine is painted olive green; all internal surfaces are shellacked.

The zinc casing comprises two sections: the top, 3/64-inch thick, slides into the base which is 1/32-inch thick, and is secured by eight tabs which pass through slots in the base and are then bent over and soft soldered. Two steel carrying handles shaped to fit close to the case when folded are held by brass strips.

The top is slightly domed and has three adapters sweated into shallow recesses. The adapters have sockets to take the standard German igniters, ZDZ 29. There are three additional sockets provided for fitting anti-lifting igniters: two are in the side of the casing, diametrically opposite one another and four inches to the right of the center of each handle; the other is in the center of the base. In addition to being sweated into the casing, each socket is secured by two brass pins which fit into slots on either side of the hole in the mine casing.

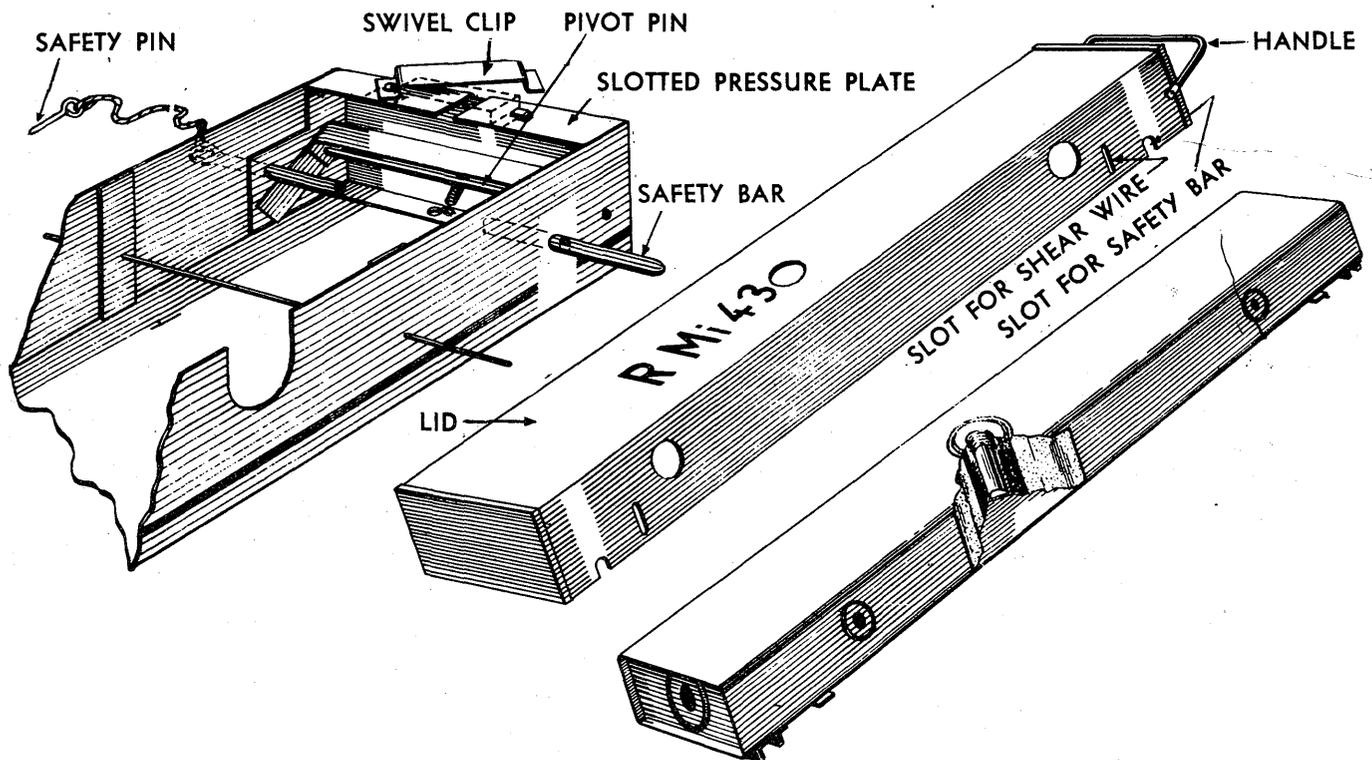
The ZDZ 29 can function as either a push or pull igniter. When it is used as a pressure igniter, there is a choice of two settings allowing the mine to fire under medium or heavy loads. The operation depends respectively on the shear of one or two pins acting as detents to a spring-loaded striker pellet. When in use as a pull igniter, the operation depends upon the withdrawal of one detent pin from the spring-loaded striker pellet.

The igniter is held in a "safe" position by the insertion of a safety key into a slot in the main body. The key slides under the striker pellet, preventing the striker from moving until the key is withdrawn.

ANTITANK MINE

Riegel Mine 43 (R.-Mi. 43)
Sprengriegel 43 (Spr. R. 43)

GERMAN



The Sprengriegel 43 or "high-explosive bar mine" is used in open country, on roads, and in minefields. It consists of three main parts: a metal encased charge of TNT, a sheet steel tray, and a lid which acts as a pressure plate on the charge.

The charge is provided with five igniter sockets: two for the main igniters (Type Z. Z. 42) are located in the ends of the charge and are recessed so that only the ends of the igniters show when they are fitted and laid; the other three are for the new tilt igniter 43 (Ki. Z. 43) or other antilifting or trip-wire igniters. One of the latter three sockets is located in the top center of the charge; the other two are in one side five inches from the ends. By reversing one of the main igniters with its wings below the end pressure plate, it will function as an antilifting device. The mine may also be fired electrically by remote control.

The tray is equipped with shear wires which are threaded through reinforcing strips welded to the inner sides of the tray. The ends of the tray are folded over on top to form slotted pressure plates to actuate the Z. Z. 42 igniters fitted to each end of the charge. Near each end are holes through which safety bars are threaded to keep the charge clear of the shear wires in the unarmed position. A thin red line painted along the sides of the tray one-half inch from the bottom indicates the correct position of the lid when the mine is armed.

The lid of spot welded sheet steel construction is equipped with a handle at one end. It, too, is fitted with holes to correspond with the sockets, shear wires, and safety bars.

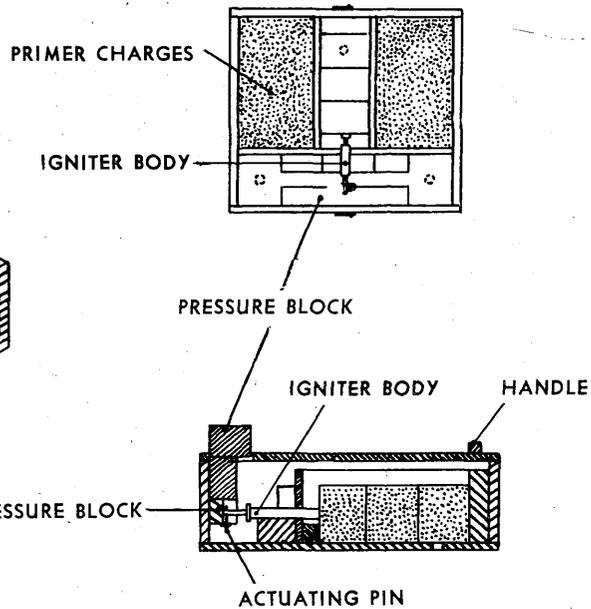
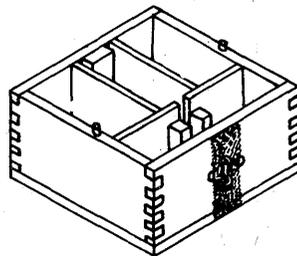
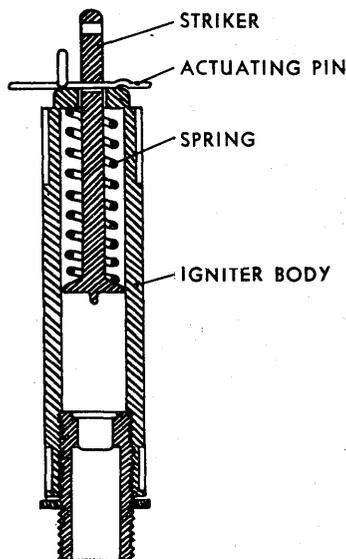
A pressure of about 440 pounds at either end, or 880 pounds in the center of the mine forces the lid and charge down, shearing the wires and actuating the igniters which set off the main charge.

SPECIFICATIONS

Overall length	31½ ins.
Overall width	3¼ ins.
Height (laid)	3½ ins.
Total weight (approx.)	20.5 lb.
Color	Light khaki
Thickness of casing (approx.) .....	.04 in.
Weight of charge	8.8 lb.
Main igniters	Type Z. Z. 42
Firing pressure (ends)	440 lb.
Firing pressure (center)	880 lb.

WOODEN BOX MINE

Holzmine 42



Z. Z. 42
FUZE

The body of the German Holzmine 42 consists of a wooden box of 3/4-inch lumber divided into four compartments by removable partitions. The two side compartments contain the main explosive filling; the central compartment the 7-ounce primer charges; and the end compartment the operating mechanism.

The main filling consists of two charges of 50/50 Amatol covered with a bitumastic substance as a protection against water. While it is believed that several different types of primer charges are used, three Sprengkorper 28 charges are presumed to be standard for the mine.

The end compartment contains a shearing flange secured to the outside wall by two 3/8-inch wooden dowels. It is provided with a central slot to receive the end of the striker. The igniter rest consists of a small block of wood with a U-shaped piece cut out at the top, and screwed to the base from the underside.

When the mine is armed, the feet of the pressure block rest on the shear flange, in which position the head of the pressure block projects about two inches above the lid. During transit, the pressure block is reversed so that the feet rest on blocks in the bottom of the box.

A pressure of approximately 200 pounds on the pressure block shears the dowels securing the shear flange to the outer wall of the mine and forces the flange down onto the igniter pin which is withdrawn freeing the spring-loaded striker. The fuze used is the standard German Z. Z. 42.

The Holzmine 42 has also been used as a booby trap by employing an anti-lifting device. This device which is fitted into a hole underneath the central compartment is believed to consist of a Z. Z. 35 fuze screwed into a 7-ounce charge.

SPECIFICATIONS

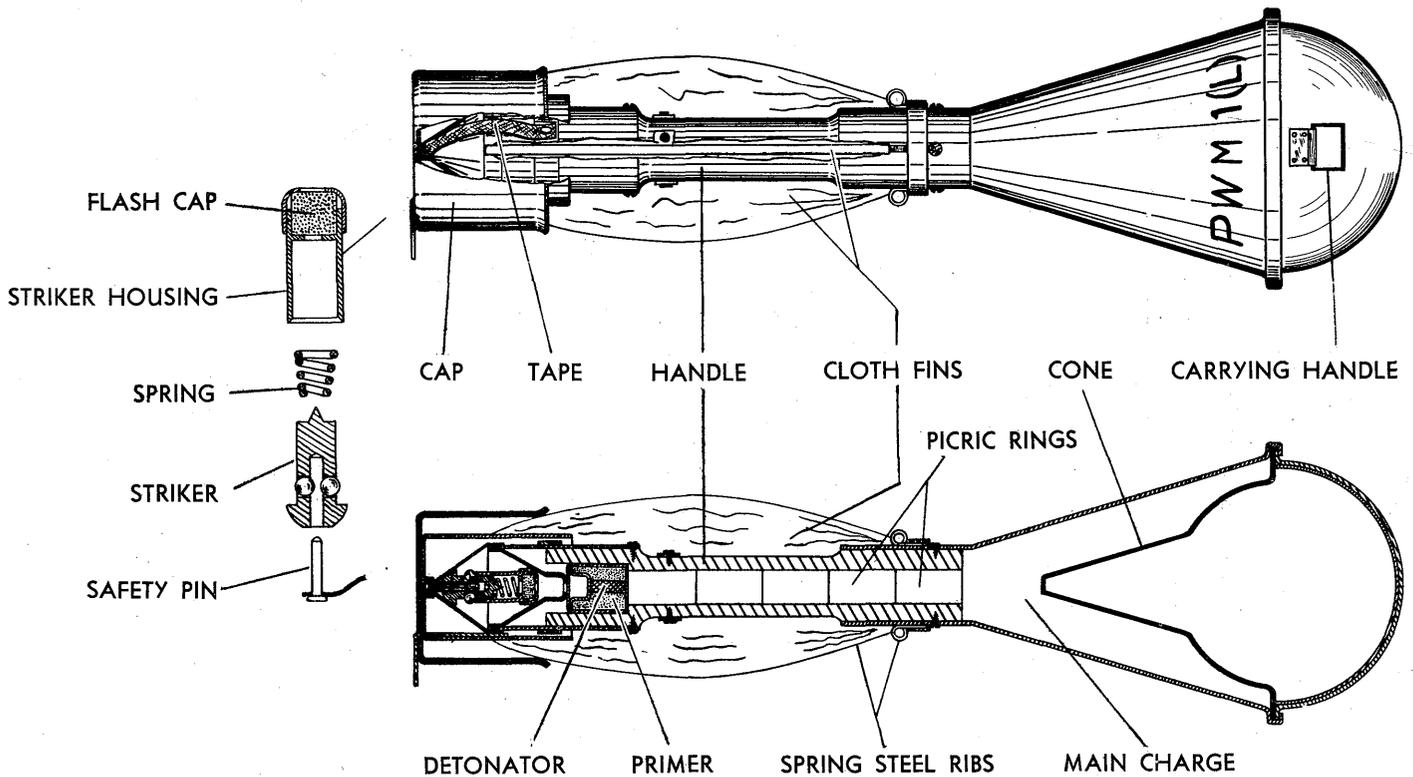
Internal dimensions	11.4 x 10.7 x 3.2 ins.
Size of lid	13 x 12 x 3/4 ins.
Size of aperture in lid	6.4 x 2.5 ins.
Pressure block (without feet)....	6 x 2.4 x 2.4 ins.
Size of compartments:	
Main charges	4.5 x 7.7 ins.
Priming charges	1.7 x 6.8 ins.
Thickness of partitions .....	.19 in.
Size of shearing flange	7.6 x 1.25 x .5 ins.
Size of slot in shearing flange .....	.27 x .67 in.
Size of wooden blocks..	3.1 x .78 x .86 ins. deep
Main explosive	Amatol 50/50
Total weight of explosive	11.9 lb.
Total weight of mine	18 lb.

HOLLOW CHARGE ANTITANK HAND GRENADE

GERMAN



Panzerwurfmine (L)



The Panzerwurfmine (L) consists of a metal body and a wooden handle to which four canvas fins are attached. The grenade is intended to be thrown by hand, and is armed by the removal of a metal cap at the base of the handle. This cap not only acts as a fuze cover, but also serves to hold the fins close against the handle of the grenade before throwing.

The body is made in two pieces crimped together and attached to the handle by a metal band. It contains an 18½ oz. filling of 50/50 R.D.X./T.N.T. cast around a hollow charge liner made of pressed steel.

A sensitive impact fuze consisting of a striker, a creep spring, and two steel balls is located in the base of the handle. The two balls fit into a recess in the striker and are held outward by a safety pin fitting between them, causing them to bear against the top of the striker housing and preventing the striker from moving down onto the primer. Beneath the primer in the base of the handle is a detonator and a picric acid booster. A small length of tape is attached to the safety pin at one end, and is held in at the other end by the metal cap and a semicircular clip attached to one fin and fitting around the handle.

When the grenade is thrown, the fins which are attached to the handle by steel ribs open out umbrella fashion, and the clip attached to one fin is pulled away from the housing. This action releases the tape which unwinds and pulls the safety pin out of the striker. During flight, the two steel balls move in, freeing the striker which compresses the creep spring on impact, setting off the primer, detonator, booster, and main filling.

SPECIFICATIONS

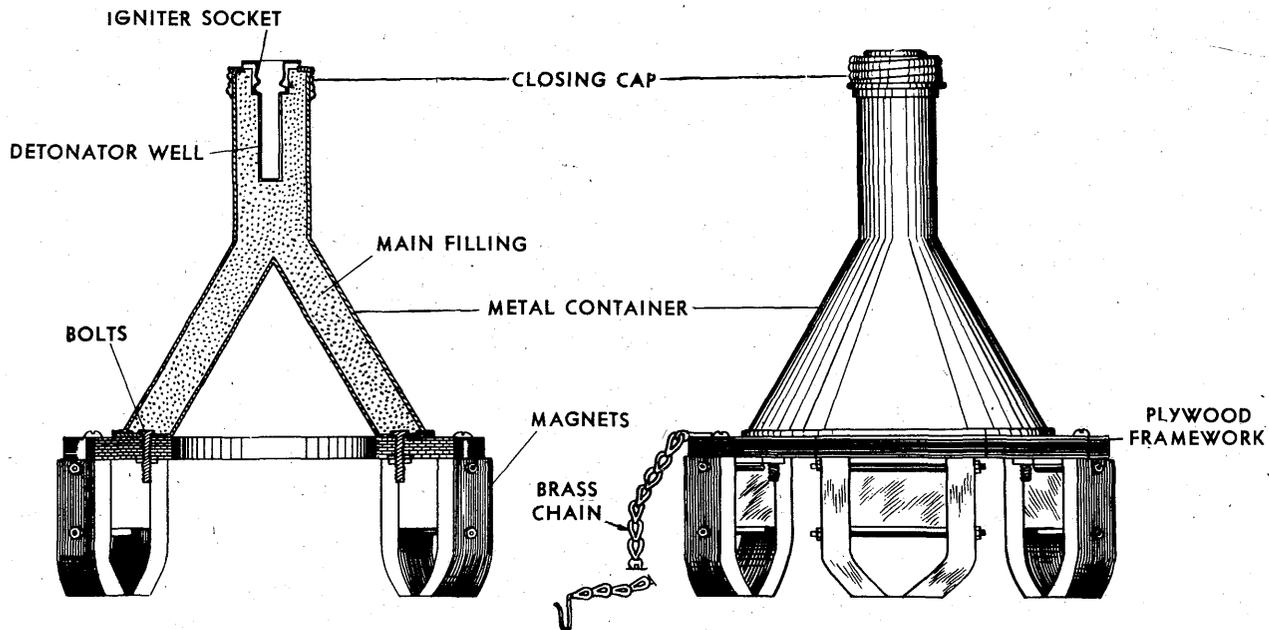
Overall length	21 ins.
Length of body	9 ins.
Length of fins	11 ins.
Diameter of body	4½ ins.
Weight (approx.)	3 lb.
Filling	Cast R.D.X./T.N.T.
Color of body	Grey

MAGNETIC HOLLOW CHARGE ANTITANK MINE

GERMAN



Haft-Hohlladung 3 Kg.



The German magnetic, hollow-charge, antitank mine, designed for use by tank-hunting squads, consists of a main filling of TNT in a pressed metal container of conical shape. The conical container has an elongated apex threaded externally at its upper end to receive a closing cap. The closing cap is fitted with a detonator well, and threaded internally to receive a standard (B. Z. E.) friction igniter which has a 4.5 second delay.

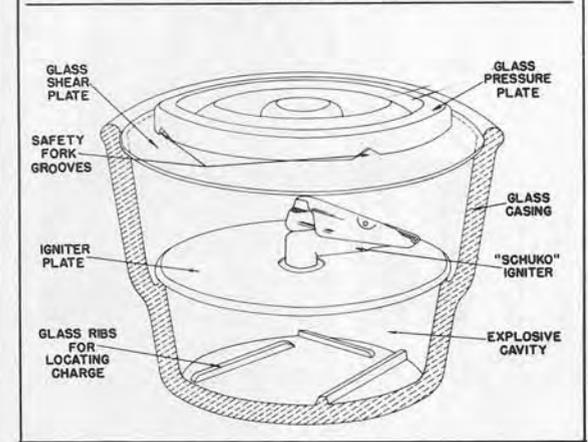
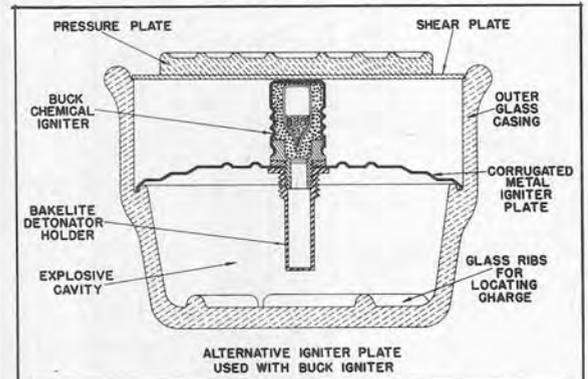
The base of the cone is attached to a plywood framework. Three horseshoe type magnets, sufficiently powerful to cause the mine to adhere to a vertical surface, are fixed to the bottom of the frame. During transit, the magnets are fitted with a keeper. A brass chain terminating in a hook is also attached to the frame.

SPECIFICATIONS

Weight of live charge	7 lbs., 12½ oz.
Weight of explosive (TNT)	1 lb., 15½ oz.
Weight of booster (Pentrite)	3 oz.
Height of charge	10¾ ins.
Height of bursting charge container.....	7¾ ins.
Height of magnets	2¾ ins.
Height of apex of hollow cone	6 7/16 ins.
Diameter of base of hollow cone	4 3/16 ins.

GLASS MINE (ANTIPERSONNEL)

Glasmine 43 (f)



The mine consists of an outer glass casing, the upper portion of which is $\frac{1}{4}$ -inch thick and the lower portion $\frac{2}{5}$ -inch thick. The external diameter at the base is $4\frac{1}{2}$ inches and at the top, 6 inches at the widest part.

A grooved shoulder on the inside of the case, about 2 inches from the bottom, supports the igniter plate. The mine may employ either a Buck chemical igniter or a new mechanized igniter, the Schuko. When the latter is used, the igniter plate consists of a thin sheet metal plate, which has a central hole for the igniter. When the Buck igniter is used, however, an igniter plate having the same diameter and igniter hole but of stronger design is employed. Around the top of the case is a grooved ledge which supports a thin glass shear plate approximately $\frac{1}{32}$ -inch thick.

A moulded glass pressure plate of $\frac{3}{4}$ -inch extreme thickness and $4\frac{1}{2}$ inches in diameter rests on the shear plate. There are two parallel grooves on the underside of the pressure plate which are designed to accept a metal safety fork that will bridge the outer edge of the mine and support the pressure plate until such time as the mine is laid. The two prongs are then withdrawn through the two grooves arming the mine. This fork is not supplied with the mine but is improvised by units.

Four raised strips moulded in the bottom of the mine are spaced so as to take a standard 200 gm. charge (Sprengkorper 28). When sufficient pressure (40 lbs.) is applied to the glass pressure plate, the shear plate is broken and crushes the top of the Buck igniter or trips the actuating lever of the Schuko igniter, depending on which is employed.

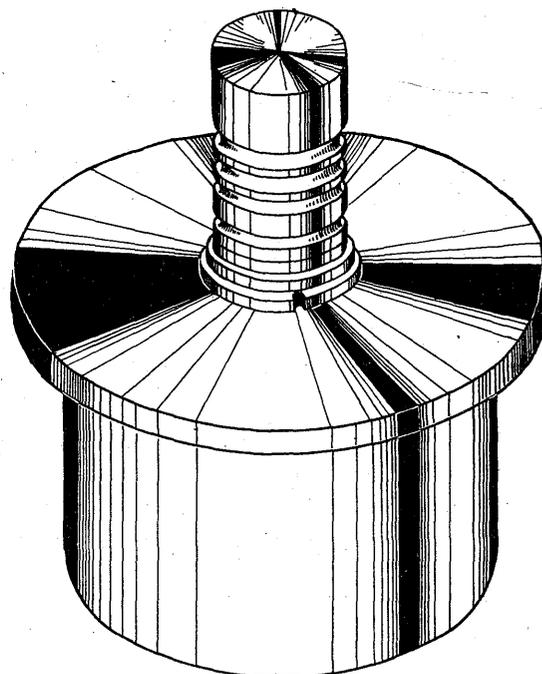
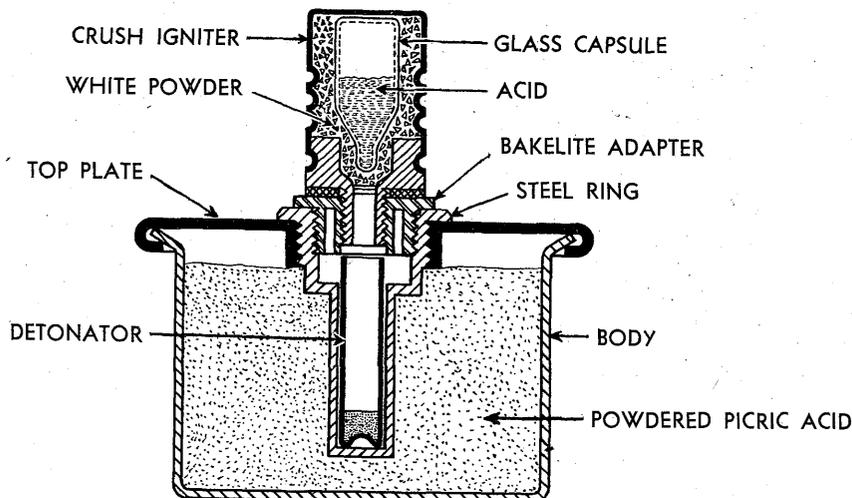
SPECIFICATIONS

Weight of standard charge	200 gm
External diameter at top	6 ins.
External diameter at base	4.5 ins.
Height to lip of container	4.2 ins.
Thickness of casing (upper) .....	.25 in.
Thickness of casing (lower) .....	.4 in.

ANTIPERSONNEL MINE

GERMAN 

Behelfs-Schützenmine S. 150



The German Behelfs-Schützenmine S. 150, known to allied troops in the field as the "Pot Mine," "Picric Pot," "Mustard Pot," or "Jerry Mine," consists of a cylindrical body, a top plate, and a crush igniter.

The body, which is made of pressed steel, contains a 5¼ oz. explosive charge of powdered picric acid. A chemical crush-actuated igniter is screwed into the mine by means of a brass or plastic adapter which fits into the top of the body. A synthetic rubber washer is provided between igniter and adapter for waterproofing the mine. The igniter, known as the German Buck Igniter (Chemischer Zünder Buck) consists of a thin metal drum with circumferential grooves to reduce its resistance against vertical pressure. It contains a glass ampule half filled with acid and surrounded by a white powdered flash composition. A small brass detonator (German Nr. 8) is inserted into the detonator pocket.

A moderate pressure on the top of the igniter crushes the metal drum and the glass inside it. The acid pours into the white powder, and a flash resulting from their chemical interaction sets off the detonator which in turn sets off the mine.

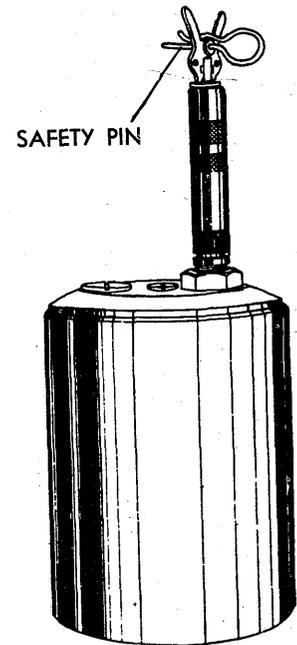
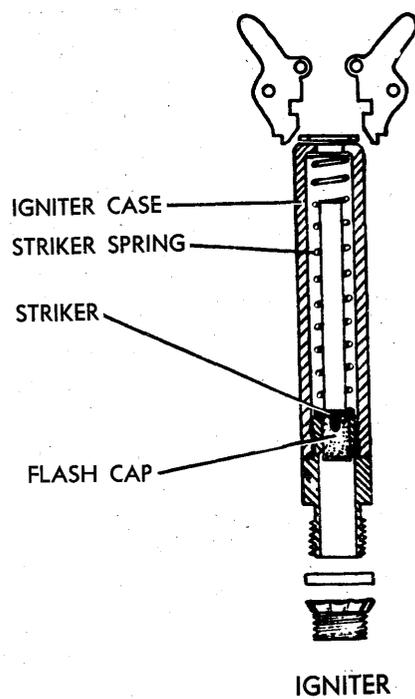
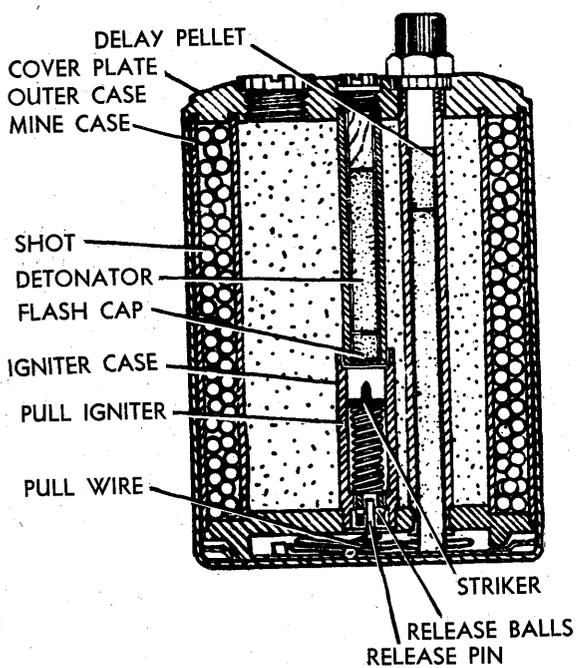
SPECIFICATIONS

Height of body	2 ins.
Diameter of body	2½ ins.
Diameter of top plate	3 ins.
Height of igniter	1½ ins.
Diameter of igniter	¾ in.
Depth of detonator pocket	1½ ins.
Total weight	12½ ozs.
Weight of igniter with adapter	1 oz.
Explosive charge	Powered picric acid (5¼ oz. approx.)
Color	Mustard brown

ANTIPERSONNEL MINE

GERMAN 

S. Mi. 44 mit S. Mi. Z. 44



This anti-personnel mine is basically the same, both in construction and operation, as the S. Mi. 35 described on page 305. It consists of an outer casing and an inner cylinder which contains a T.N.T. charge surrounded by small shot. There are three threaded openings in the cover plate: one is used for pouring the charge into the mine; the second, which takes a S. Mi. Z. 44 igniter, opens into a tube containing a 4.5 second delay pellet and a propellant consisting of three grams of fast burning gun powder; the third which is closed by a wooden plug leads into a tube containing a detonator, a flash cap, and a pull igniter. The pull igniter, located at the base of the tube, contains a spring-loaded striker held in place by two steel balls which are prevented from moving by a pin in the base of the igniter. The pin is attached to the base of the outer case by approximately three feet of coiled wire.

The S. Mi. Z. 44 is a percussion igniter differing from the usual percussion type in that it has two small wings which, when forced outward by pressure from above or tension through trip wires from the side, release the spring-loaded striker to fire the cap. A pressure of 21 pounds or a tension of 14 pounds will actuate the igniter.

Operation of the igniter initiates the 4.5-second delay pellet which fires the propellant throwing the mine upwards. When the coiled wire is fully extended (about 2½ feet above ground level) it pulls the pin from the igniter, enabling the retaining balls to move inward and release the striker to fire the flash cap, detonator, and bursting charge.

SPECIFICATIONS

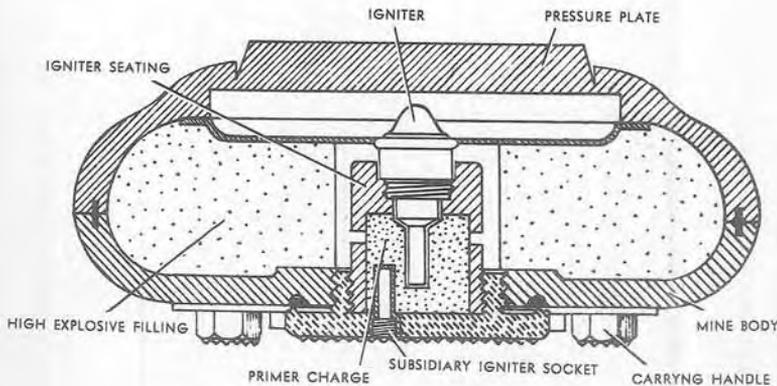
Height	5½ ins.
Height with igniter	8¾ ins.
Diameter	4 ins.
Weight	8.8 lb.
Color	Camouflage yellow

ANTITANK MINE

GERMAN



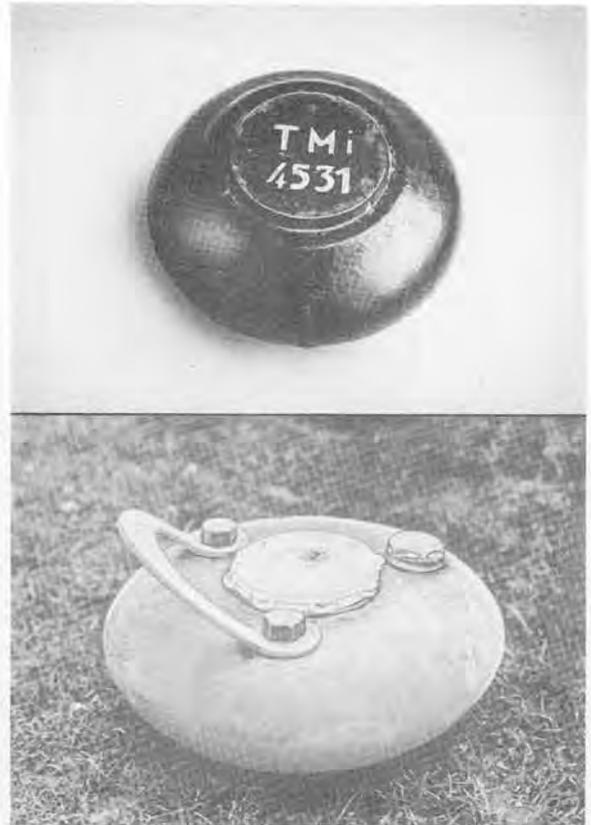
Topf Mine



Above: A cross-section of the antitank topf mine showing principal parts.

Upper right: Top view.

Lower right: Bottom view showing carrying handle.



The Topf Mine, a completely non-metallic, waterproof, anti-tank mine, consists of a circular body filled with a 12½-pound charge of TNT, a primer plug assembly, and an igniter. The top of the mine is flat, with a fixed pressure plate in the center slightly higher than the surface; a 4½-inch circular recess located in the bottom takes the primer plug and igniter assembly. The outer casing is made of a hard pulp-like material covered with pitch. The mine rests on three glass studs; two of the studs secure a pasteboard carrying handle, while the third, which is sometimes larger than the two others, is used as a filler plug.

The primer plug assembly consists of a glass screw cap and a cylindrical wooden booster holder, the top of which has a deep threaded recess to take the Topf Mine Igniter. A subsidiary igniter socket in the glass cap leads to the booster charge, and is threaded to take a standard igniter.

The Topf Mine Igniter, which is made of glass, has no safety device. It comprises a cylindrical glass body 3 mm thick; a solid glass pressure head, hemispherical in shape and two small glass ampules, one of which contains sodium and potassium as a liquid alloy and the other ethyl nitrate. The ampules are held in position by a black celluloid disc. A thin bakelite detonator well is provided.

The mine is activated by a pressure of at least 330 pounds, which forces the pressure plate down onto the igniter head and thereby breaking the two glass ampules. A flash results, setting off the detonator, booster, and main charge. If a standard igniter is used, the mine must be laid upside down.

SPECIFICATIONS

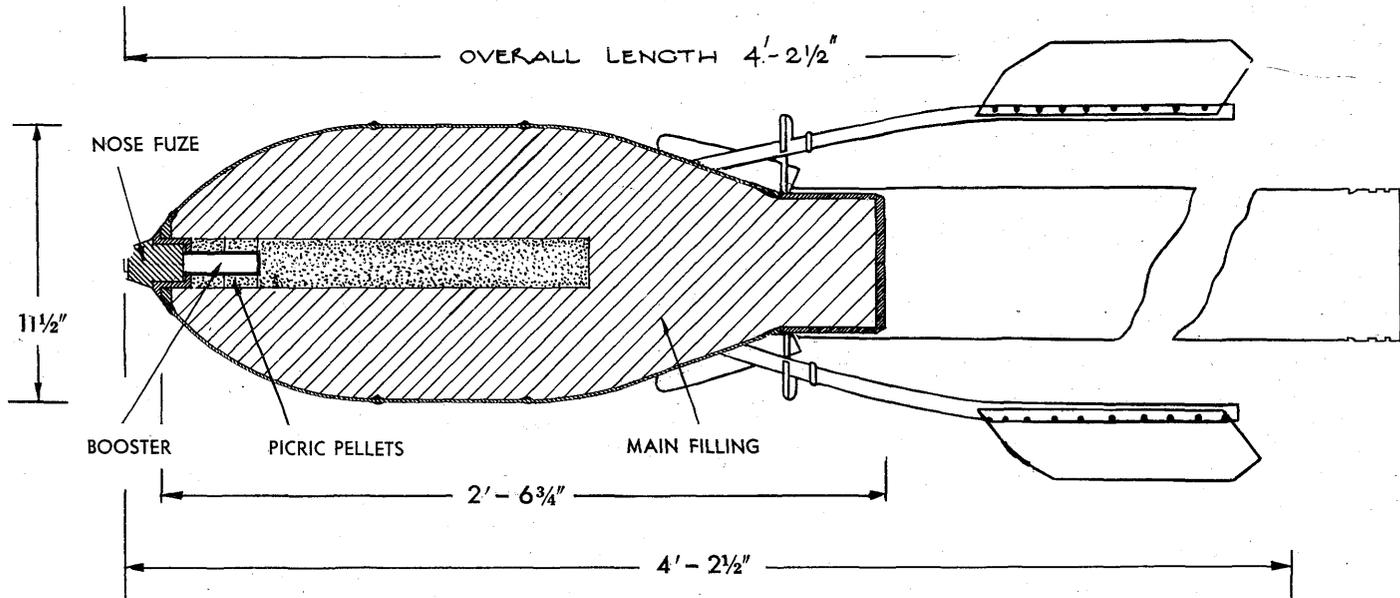
Diameter of mine	12½ ins.
Height of mine	5½ ins.
Weight (complete)	20 lbs.
Weight in crate	29 lbs.
Filling	TNT
Weight of filling	12½ lbs.
Firing pressure	330 lbs.
Height of igniter (including cap)	3½ ins.
Diameter of igniter body	1½ ins.
Shear pressure of igniter	132 lbs.
Overall height of primer plug assembly...	3.1 ins.
Diameter of primer holder	2½ ins.
Diameter of glass cap	4.6 ins.

15 cm STICK GRENADE

GERMAN



15 cm Stielgranate



The German 15 cm high explosive Stick Grenade is reported to be used with the 15 cm heavy infantry gun, s. I. G. 33. Its prime purpose is for demolition, and for clearing minefields and wire obstacles. Of welded steel construction, the bomb has a 1/8-inch case consisting of three main parts: the nose, a cylindrical center piece, and a tapered rear piece. Both the nose and the base are reinforced with steel rings welded to the casing. The ring in the nose is tapped to receive the fuze adaptor; that in the base to accommodate a steel cup. This cup, which has machined surfaces, is 3/8-inch thick at the base and 3/16-inch at the sides. A stick unit which leaves the bomb approximately 150 yards from the muzzle of the gun fits over the cup. According to reports, the unit weighs 22.2 kg. (49 lb.) and the propelling charge 5.5 (12 1/8 lb.).

The main filling consists of approximately 60 pounds of poured 50/50 Amatol. A 2-inch cylindrical booster charge made up of compressed T.N.T. pellets is located in the center of the main filling about 15 inches from the booster; two normal annular picric pellets surround the booster. The bomb is fitted with a percussion type nose fuze, Wgr. Z.36, which is also reported as being used in the German 20 cm Spigot Mortar Bomb. The tail, of unusual construction, has three tubular steel sockets equally spaced around the bomb and projecting from the rear portion of the casing at an angle of 20° to the main axis. These sockets receive tubular bars to which the sheet steel tubular fins are attached. The bars are bent in order to bring the fins parallel to the main axis and also to provide clearance of the muzzle of the gun. In addition there are six 5/32-inch steel plate fins welded to the casing and spaced in pairs between the tubular sockets.

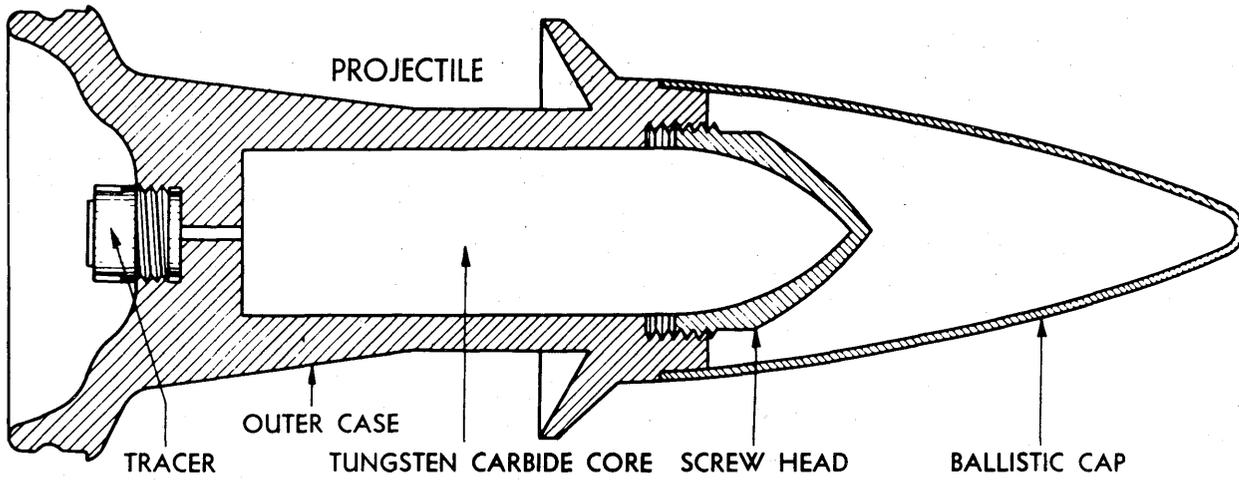
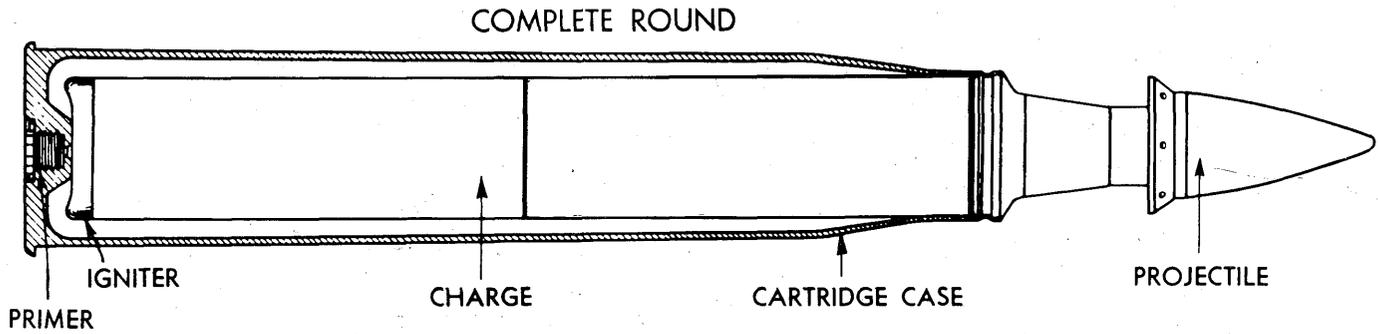
SPECIFICATIONS

Overall length	50 1/2 ins.
Overall length (excluding tail fins & fuze)	30 3/4 ins.
Diameter (maximum)	1 1/2 ins.
Thickness of casing	1/8 in.
Total weight (approx.)	105 lb.
Weight of filling (approx.)	60 lb.
Color	Field grey

7.5 cm PAK 41 ARMOR-PIERCING AMMUNITION

GERMAN 

7.5/5.5 cm Pzgr. Patr. 41 (W)



This round is designed for use in the 7.5/5.5 cm Pak 41 tapered bore antitank gun described on page 123 of this volume. It is an armor piercing tracer projectile of Gerlich design with the nomenclature 7.5 cm Pzgr. Patr. 41 (w).

The projectile consists of an outer case, a tungsten carbide core 1.16 inch in diameter, a screw head, a ballistic cap, and a tracer. It is fired from a regular cartridge consisting of cartridge case 6344, primer C/12n. A. St., an igniter of pyroxylin porous powder, and the propelling charge of diglycol tubular powder.

SPECIFICATIONS

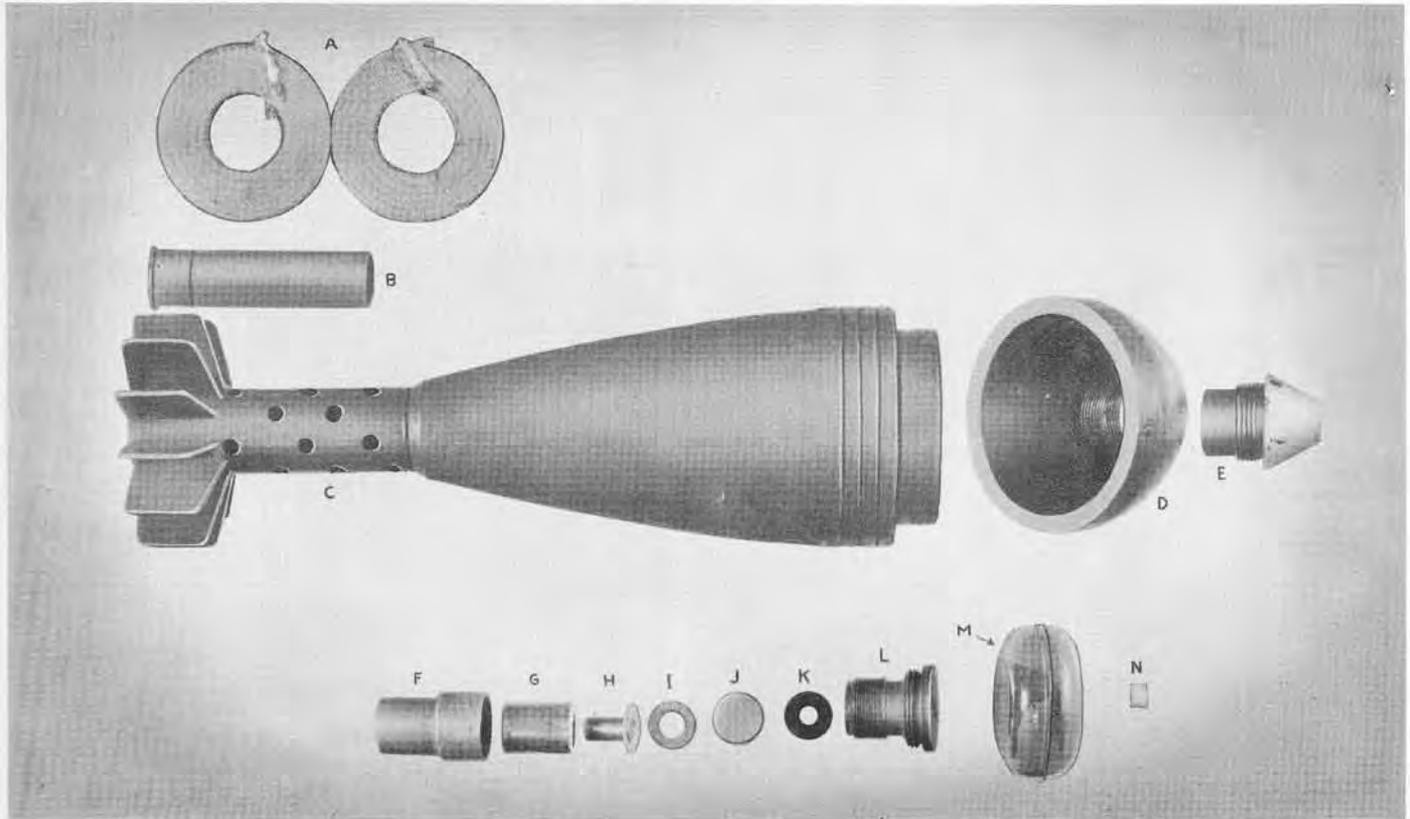
Total weight of round	16.65 lb.
Total length of round	29.8 ins.
Weight of projectile	5.68 lb.
Weight of tungsten carbide core	2.01 lb.
Diameter of core	1.16 ins.
Weight of propellant charge	5.4 lb.

8 cm MORTAR SHELL—"Bouncing Betty"

GERMAN



8 cm Wurfgranate 39



The 8 cm Wgr. 39 consists of a nose fuze, front cap, rear body, and tail assembly. The body, which is separated from the cap at the ogive, has a standard shape and TNT filling. The cast nose cap fits over a cylindrical boss, concentric with the longitudinal axis of the projectile. This cap is secured to the boss by four shear pins that extend through the cap and the boss. The seam where the two parts are joined is then shellacked to form a watertight seal.

An impact type, nondelay fuze is screwed into the cap; inside the cap is a plastic container of about 1½ ounces of smokeless powder. Under the charge, screwed into the projectile body, is an iron plug with a small axial hole through it. This plug separates the smokeless powder charge from the combination delay pellet and booster which is in an aluminum container.

The tail assembly is a standard type, having the usual base charge, ring increments, and fin assembly.

Upon impact, the nondelay fuze ignites the smokeless powder charge, sending a flash through the hole in the separating plug, setting off the delay pellet. The explosion from the first charge shears the pins holding the nose cap to the projectile body, and throws the shell from 5 to 10 feet into the air. In the meantime, the booster detonates the main TNT bursting charge at approximately the moment when the projectile is at the height of its bounce. This gives the effect of an air burst without the use of a precision time fuze. Height of the burst is governed by the angle of the shell axis with the ground at the time of impact.

KEY TO PARTS

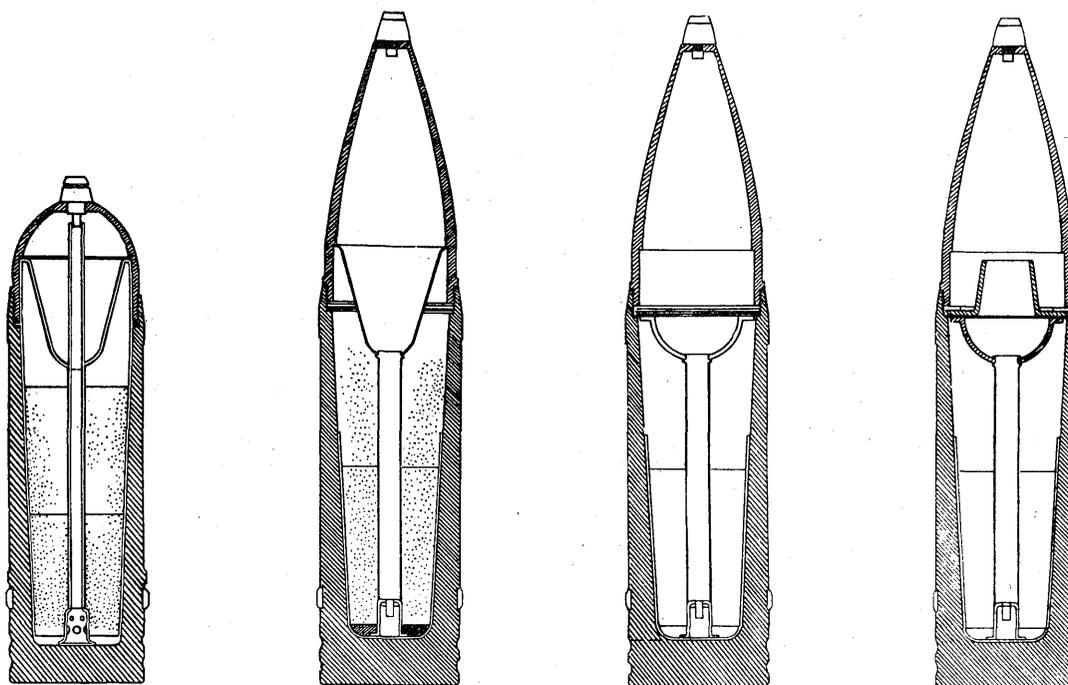
- (A) Propellant increments
- (B) Propellant cartridge
- (C) Projectile body
- (D) False ogive
- (E) Point ignition fuze—Wgr. Z 38 st
- (F) Booster well
- (G) Booster capsule
- (H) Delay type detonator
- (I) Paper washer
- (J) Paper diaphragm
- (K) Plastic washer
- (L) Booster well adapter
- (M) Ejector capsule
- (N) Ejector capsule igniter

HOLLOW CHARGE AMMUNITION

GERMAN



10.5 cm HL, HL/A, HL/B, HL/C



Type HL

Type HL/A

Type HL/B

Type HL/C

There are four known variations of the 10.5 cm (105 mm) Hollow charge ammunition fired from the German 10.5 cm le. F. H. 18 series:

Type HL has a deep conical cavity, a short ogive, and flash tube extending through the shaped cavity to the fuze booster. All types have an additional detonator booster combination at the base of the flash tube.

Type HL/A has the same shaped cavity but has a larger diameter flash tube that is attached to the apex of cavity liner by a pressed collar, and does not extend into the cavity. This type has a long ogive.

The principal difference between types HL/A and HL/B is in a shallower, hemispherical-shaped cavity. The principal difference between types HL/B and HL/C is the addition of a funnel-like steel washer inverted over the cavity. This funnel is supposed to counteract the effects of centrifugal force on the hollow charge jet.

The explosive filler is pressed into two pellets in types HL/A, HL/B, and type HL/C. Explosive fillers in all rounds are inclosed in waxed paper cartons. The metal ogive screws into the projectile, holding all components of the filler in place.

The aluminum fuze (AZ 38) carries the primer detonator. It is armed by centrifugal force and contains no other safety features. It functions by a "spit" from the booster, which travels down the central tube and initiates the base booster, and hence the main bursting charge.

ESSENTIAL MODIFICATIONS

Type HL/A: (a) Lengthened nose-piece (ogive), giving greater standoff. (b) Elimination of flash tube between fuze and apex of cavity and larger diameter of flash tube.

Type HL/B: (a) Further increase of standoff obtained by shortening the HE filler. Nose piece is identical with that of Type HL/A. (b) Hemispherical cavity instead of rounded cone. (c) HE filling RDX/WAX, instead of RDX/WAX/TNT.

Type HL/C: Introduction of a washer, shaped like an inverted funnel in front of the cavity. Otherwise, types B and C are essentially identical.

SPECIFICATIONS

	HL	HL/A	HL/B	HL/C
Weight of projectile as fired:	25.8 lb.	27.1 lb.	26.6 lb.	27.2 lb.
H.E. filling, carton, wax:	4.6875 lb.	3.5 lb.	3.255 lb.	
Empty shell:	22.55 lb.	22.937 lb.	22.315 lb.	
Collar ("funnel")				.5195 lb.
Muzzle velocity f/s*	1375	1360	1360	1360

Estimated performance at normal against Homogeneous armor.

Type HL/A—170 mm (static) 105 mm (dynamic)

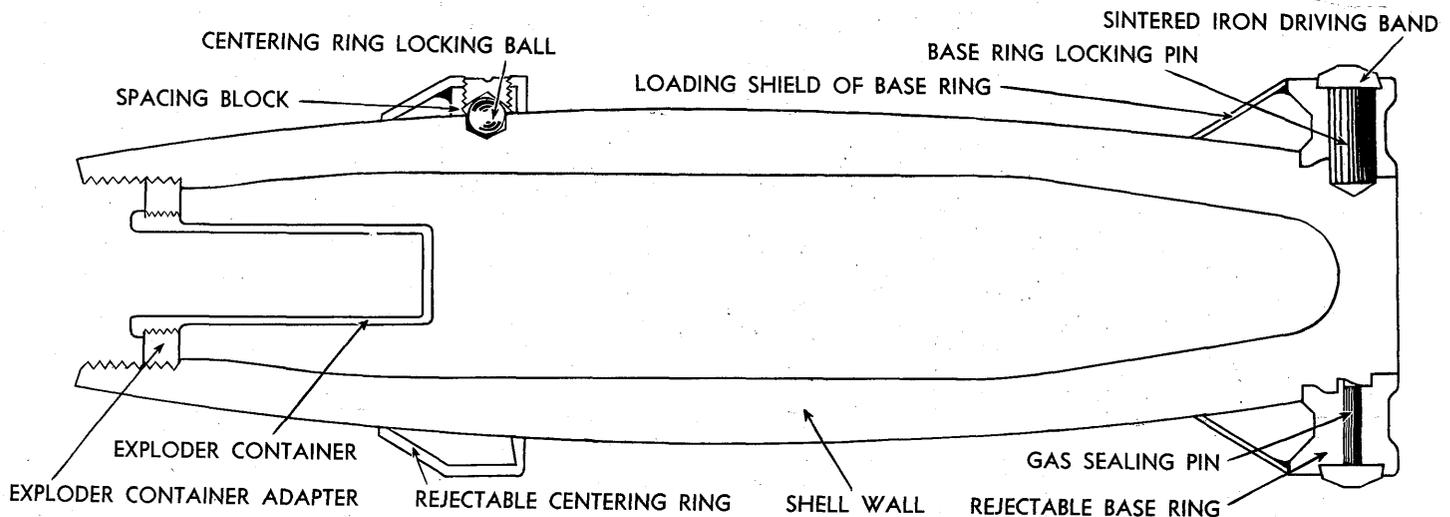
Type HL/B—155 mm (static) 100 mm (dynamic)

Type HL/C—155 mm (static) 100 mm (dynamic)
(From German claims)

*Firing with charge five which is normally used.

10.5 cm "SABOT" TYPE H. E. SHELL

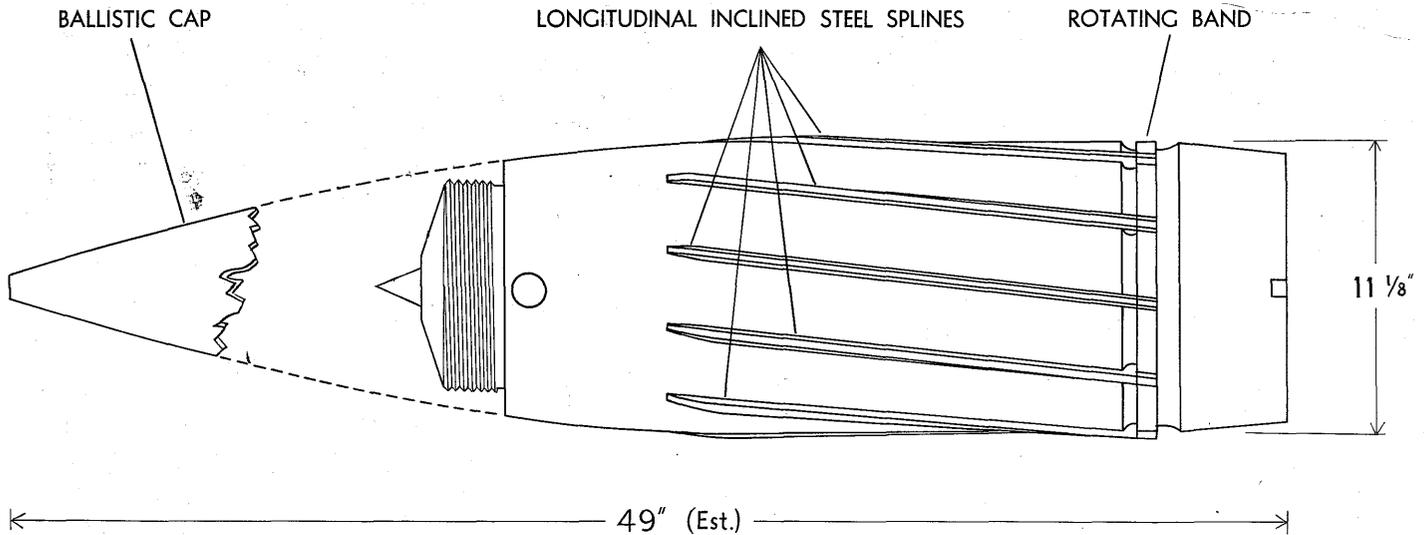
GERMAN 



This new type projectile consists of an 8.8 cm streamlined shell body fitted with centering and rotating band rings which permit it to be fired from a 10.5 cm weapon. Both the centering ring and rotating band ring are so designed that they become detached from the shell body under the influence of centrifugal force on leaving the muzzle of the gun. The advantage of such a design, provided it functions properly, is that a lighter weight projectile of smaller diameter is fired from a 10.5 cm weapon instead of the normal 10.5 cm projectile. The effect is to give a higher muzzle velocity and longer range for the 8.8 cm streamlined shell body than would be obtained with the standard 10.5 cm high explosive projectile. However, the effectiveness is reduced due to lower weight of projectile.

One disadvantage of this type of shell lies in the possibility of injury to friendly troops when the centering rings and rotating band are cast from the projectile. The centrifugal force would make these pieces into dangerous missiles.

The complete weight of the projectile is 23 pounds. Projectiles examined have been filled with a high explosive charge, and fitted with a percussion type nose fuze (AZ 23v.). The 15 cm shell of similar design employs the same fuze. The explosive trains of these projectiles are similar to those for the usual type of German high explosive shell.



This pre-engraved projectile recovered in Italy is used for long range bombardment. It has longitudinal inclined steel splines and a single one-inch-wide copper band that acts as a gas seal. The splines are set at a slight angle to the axis of the projectile and are 19.2 inches in length. In loading the projectile, the splines are lined up with the rifling of the gun tube. The shell is 33 inches in length, exclusive of the windshield. Fragments indicate that the windshield would add an extra two feet to the length.

A nose percussion fuze (AZ 35 K) and a base fuze (BD Z 35K) are fitted. The Germans are reputed to have four types of 28 cm railway guns able to employ this type of projectile. They are: 28 cm Br. N. Kan E.; 28 cm K. 5 (E); 28 cm K. 5/1 (E); and 28 cm K. 5/2 (E).

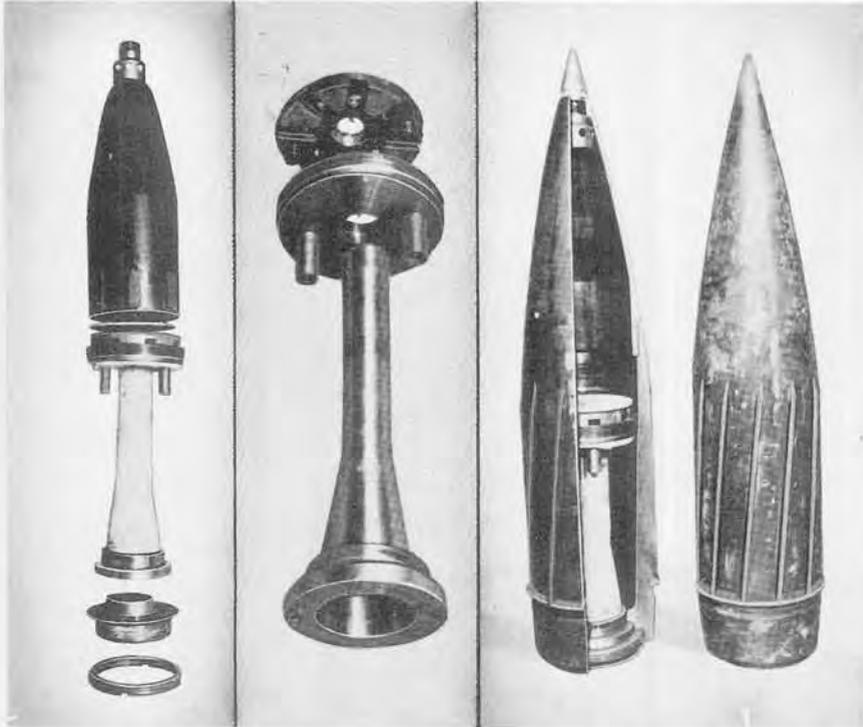
SPECIFICATIONS

Caliber	280 mm (11.023 ins.)
Weight (approx.)	550 lbs.
Length (excluding windshield)	33 ins.

ROCKET ASSISTED PRERIFLED PROJECTILE

GERMAN 

28 cm R. Gr. 4331



Top, left, forward body (ogive) and venturi tube; center, venturi assembly without spun glass sleeve; right, forward body assembled to main body, showing prerifling; at right, assembly with cast explosive charge.

This high explosive projectile is fired from the 28 cm K. 5 (E) railway gun, and is prerifled in the same manner as the 28 cm Gr. 35 described on page 312. The outstanding feature of this new projectile is an increase in range from 67,800 yards to 93,100 yards—nearly 53 miles. This increase of 37% over the maximum range for the standard high explosive round is the result of energy supplied to the projectile by the addition of rocket propellant powder which is ignited 19 seconds after leaving the gun. After building up sufficient pressure to shear the lip on the base plug, the rocket propellant located in the ogive of the projectile discharges through a central venturi tube.

On the main body there are 12 steel splines set at the angle of rifling. The forward body (ogive) is threaded externally to screw into the main body and internally at its nose to receive the fuze and a rocket propellant ignition system. The venturi tube which extends from the base of the projectile to its middle section is secured by being screwed into the fuze and venturi adapter. A spun glass sleeve insulates the venturi tube from the explosive charge which is cast on the resulting assembly. A Zt. Z. S/30 time fuze set to operate 19 seconds after the projectile is fired is screwed into the nose of the projectile. Two percussion fuzes, AZ 4331, are located in the venturi adapter. These are armed by the burning of the rocket propelling charge through a powder pellet incorporated in the fuze. The rocket propellant is moulded as one piece, and extending through it are eight longitudinal holes $\frac{3}{4}$ -inch in diameter, located around a circular hole $1\frac{1}{2}$ -inch in diameter.

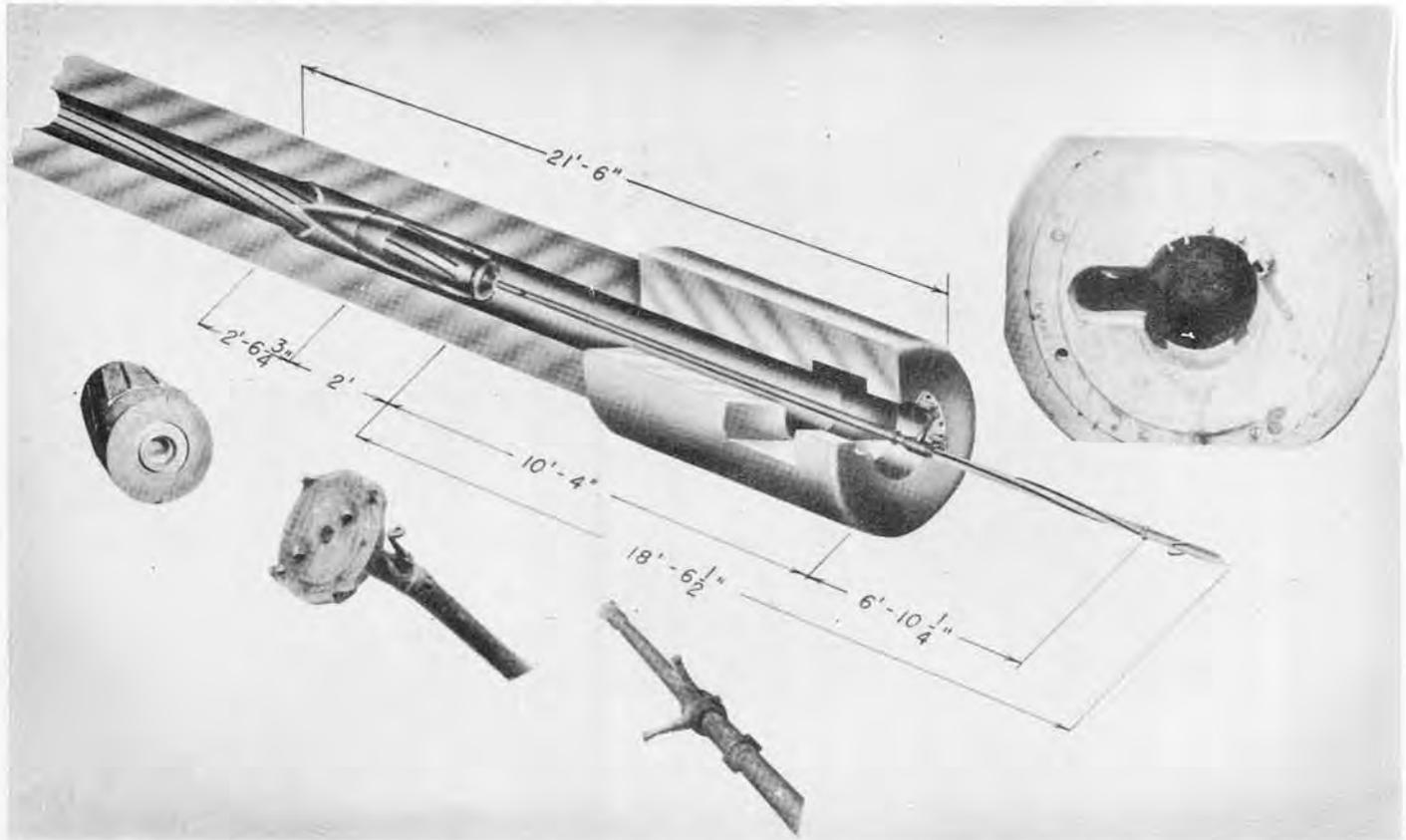


SPECIFICATIONS

Length of projectile (less fuze)	48.79 ins.
Diameter of ribs	11.70 ins.
Diameter of rotating band	11.85 ins.
Diameter of body	11.10 ins.
Total weight	545 $\frac{1}{4}$ lbs.
Rocket propellant weight	43 lbs.
Explosive weight	30 $\frac{1}{4}$ lbs.
Maximum range	93,100 yds.

METHOD OF RAMMING AND INDEXING SPLINED PROJECTILE

GERMAN 



Indexing and ramming the 28 cm prerifled projectile in the German railway gun, 28 cm K5 (E), is accomplished with the aid of the rammer which, by gripping the base of the shell, allows the projectile to be indexed during its final travel through the powder chamber. Fitted centrally in the flat head of the rammer are two claws, reversed to each other and held outwardly by spring tension. A circular undercut recess in the base of the projectile receives these two claws holding the base of the shell against the face of the rammer. Two keyways milled in the periphery of the base of the shell receive corresponding lugs on the face of the rammer and hold the members in rotation. Four evenly spaced lugs projecting longitudinally from the face of the rammer fit over the sides of the base of the projectile and hold the two in a transverse direction.

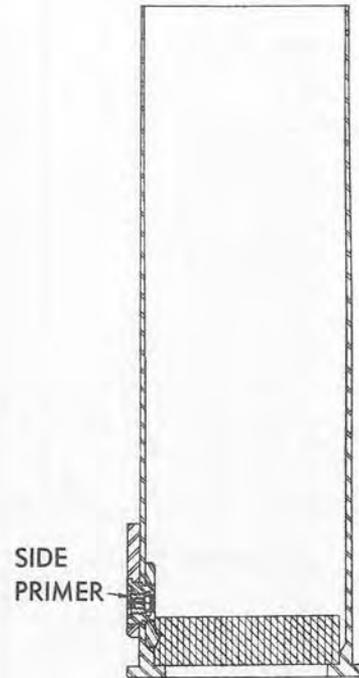
The head is fitted by a universal joint to the rammer, the front portion of which is a plain two-inch shaft approximately ten feet long and the rear portion machined with four longitudinal splines set at the same angle as the rifling of the tube. Over the splined portion of the rammer, which is 6 feet, 10 1/4 inches long, slides a collar fitted with two radially projecting horns set at approximately 75 degrees. The last 16 1/4 inches of the rammer are not splined and the extremity threaded, in all proba-

bility to receive a transverse handle. A lever which depresses the claws to release the head from the base of the projectile is fitted to the rear portion of the shaft.

A bracket bolted in the rear face of the breech ring has the function of receiving in two longitudinal keyways, the extremities of the two radial horns of the sliding collar.

In operation, the rammer is held securely to the base of the projectile and the shell is rammed through the powder chamber until the two horns of the sliding collar, in its forward position along the splines, engage in the two matching keyways of the bracket fitted to the rear of the breech ring. At this point, the shell, which still has approximately 2 feet, 6 3/4 inches to travel before the leading edge of the splines engage in the grooves of the rifling, is indexed and during the remaining forward travel of ramming remains indexed by virtue of the sliding collar which being held against rotation causes the rammer sliding through it to rotate at the same twist as the rifling.

The position of the two horns can be adjusted in relation to the body of the collar and once set for a particular gun, no further adjustments are necessary. A scale etched on the spline portion of the rammer indicates the depth of ramming from 2,850 to 4,050 centimeters for the 28 cm K5 (E).

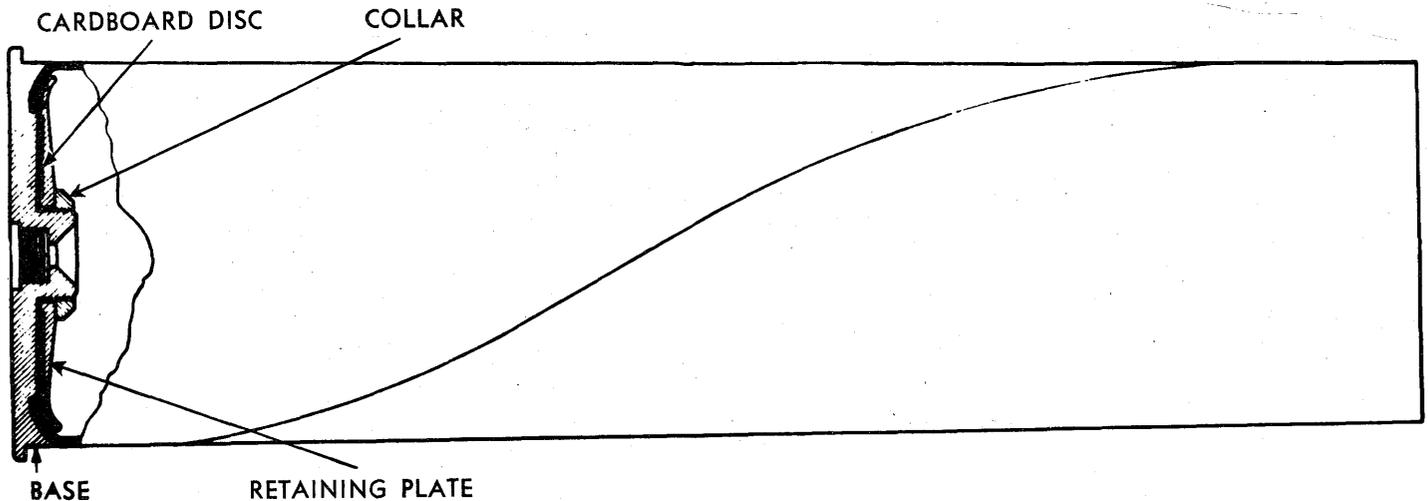


The German Recoilless Gun, versions of which are described on pages 110 and 119, operates without a recoil or counterrecoil mechanism. This is made possible by a design which allows the propelling gases to escape to the rear when the weapon is fired. This unusual design of brass coated steel cartridge case, which makes possible an unexpectedly long range for such a weapon, is provided with a primer in its side and a plastic base insert. This plastic base insert, 1.12 inch thick, momentarily withstands the pressure of the ignited propellant and then disintegrates, being blown out the rear of the weapon along with the released propellant gases.

The propelling charge and igniter are made up to suit side ignition. The propellant is contained in a cylindrical bag; the igniter bag is in the form of a cap, and fits over the end of the propellant bag. The igniter composition is contained in pockets formed between the outer fabric and the lining by quilting the bag. There are twelve pockets around the side and six in the end. The propellant is a flashless composition of the normal "Gudol" type and the igniter composition is the normal porous chopped cord.

SPECIFICATIONS

Propellant weight	8.9 lbs.
Propellant analysis	
Nitrocellulose (N-12.34%)	34.47%
Nitroguanidine	33.81%
Diethylene Glycol dinitrate	30.22%
Graphite	0.14%
Potassium Sulphate	1.36%
Propellant bag	Viscose rayon
Cartridge case.....	Brass coated, 1010 type steel
Thickness of brass coating	0.0001 in.
Base insert	Phenol-formaldehyde resin



This is a large caliber steel cartridge case of different design from those customarily used by the Germans. The body is a wound cylinder made of 0.084 inch thick sheet steel three and four turns thick and turned under at the base to fit into a base assembly. The base assembly is provided with a retaining plate, screwed collar, and a disc which seals the cartridge case and prevents the escape of gases through the base. The disc is of cardboard; all the other parts are of steel.

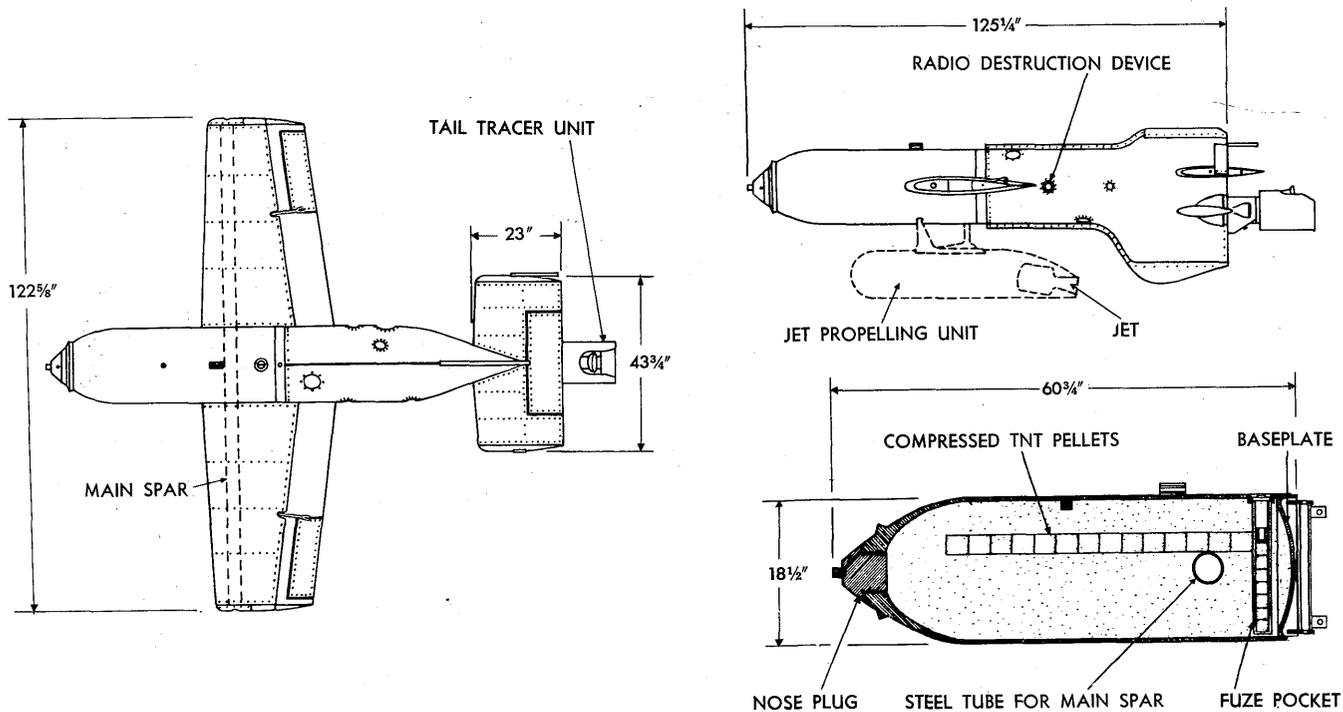
A shallow spiral groove, about 0.003 inch deep and .23 inch wide, is rolled into the inner surface of the body under such pressure as to show the marks of the groove on the outer surface of the case. A layer of black wax is used between the overlapping coils of the body to assist waterproofing. The upper surface of the cardboard disc is also covered with black wax. It appears that this case is manufactured by coiling the sheet approximately to shape, placing the body in a die and rolling to shape with an internal roller. The base, retaining plate, and screwed collar have completely machined surfaces. All the parts have a thin surface film of oxide for protection from corrosion. This is not completely effective.

The Vickers Diamond Hardness of the body increases from about 105 near the base to 133 near the mouth. It is approximately 222 across the base except in the primer boss where it is about 280. On the retaining plate the V. D. H. varies from 160 at the center to 172 on the rim. The screwed collar is 175 V. D. H.

RADIO-CONTROLLED GLIDER BOMB



H. s. 293



The German high explosive bomb, H. s. 293, is a radio-controlled, jet-propelled glider, designed primarily for use against merchant ships and naval craft. It is usually released when the plane is in level flight at an altitude of from 3,000 to 5,000 feet, and at a distance of from 3 to 5 miles from the target. However, the bomb is not launched directly at the target, but is released during flight on a course parallel to that of the target. Upon release, the jet propulsion automatically goes into action, and thereafter the flight of the bomb is controlled from the airplane by radio. It is apparently aimed by eye alone and, as an aid to visibility, the tail is provided with flares and an electric lamp for night use.

H. s. 293 is made up of six main parts: the bomb which forms the forward part of the fuselage; the rear portion of the fuselage containing the radio control unit, a gyro, and a destructor; the jet propulsion unit (slung from the base of the bomb); the wings, or planes; the tail plane; and the tail tracer unit. The bomb case is of forged steel and is filled with approximately 600 pounds of 60/40 poured Amatol. A cylinder of compressed T.N.T. pellets lies in this filling, running forward from the fuze pocket. The control unit consists of a radio receiver, a motor generator, and a relay unit. A radio destruction device is located directly under the radio receiver and consists of a small charge with a clockwork fuze.

Propulsion is accomplished by means of a bi-liquid rocket unit. Wings and tail planes are of aerofoil section and the skin is of thin sheet alloy. Ailerons are provided for lateral control, and an elevator is concealed in the tail plane. Five flare candles burning consecutively make up the tail tracer unit.

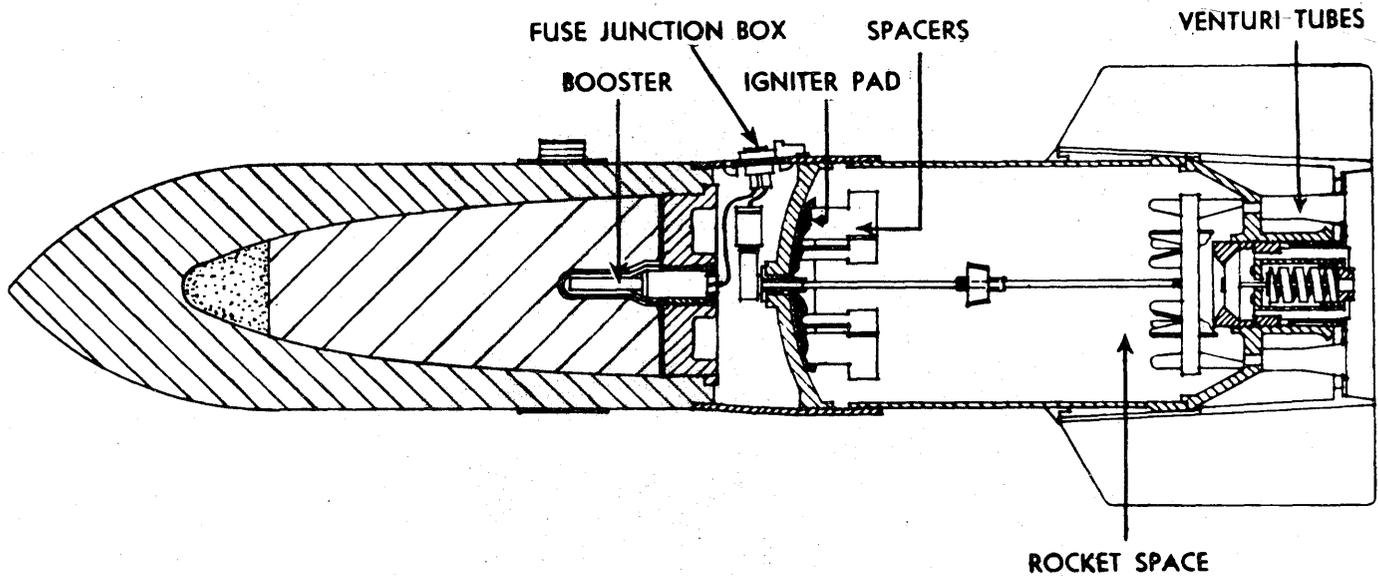
SPECIFICATIONS

Overall length	148 ins.
Length of bomb	60 3/4 ins.
Diameter of bomb	18 1/2 ins.
Total weight (approx.)	1,980 lbs.
Span of mainplanes	122 5/8 ins.
Span of tailplanes	43 3/4 ins.
Diameter of jet-propulsion unit (approx.) ..	12 ins.
Weight of bomb (approx.)	1,320 lbs.
Color	Sky-blue

ROCKET-PROPELLED BOMB



PC 1000 Rs



The German 1,000 kg. (actual wt. 2,176 lb.) armor-piercing bomb (PC 1000 Rs) is a rocket-propelled type designed primarily for use against ships or similar targets. The rocket, which is used to increase terminal velocity and armor penetration qualities of the bomb, consist of 19 sticks of propellant contained in a separate compartment at the base of the bomb. Gases generated by the propellant escape from the rocket container through six propulsion venturi tubes which are sealed with pitch until combustion is effected. The compartment is provided with a spring-loaded pressure release valve at the base. It is reported that the minimum height for release is 4,000 ft., and that the rocket burns for approximately three seconds after ignition, leaving a trail of flame 150 ft. long.

The bomb which is filled with alternate layers of good and poor quality TNT, and a very pure cast TNT in an aluminum container in the nose, is fuzed through the baseplate. A charging head, located in a distance piece between the bomb and the rocket container, has a junction box with connections leading to a pyrotechnic and an impact fuze through two pin plugs. These plugs are colored black and red respectively. The pyrotechnic fuze has a 2½-second delay, and consists of an igniter bridge (which functions when an electrical impulse from the charging plate is received at the time of the bomb's release), and a pyrotechnic train calculated to give a safe interval between the time of release and ignition of the rocket element.

The bomb fuze, of the electrical impact type, is also armed by the electrical impulse from the charging head.

There are three other bombs of the same general type: PC 500 Rs; a lighter version of the PC 1000 Rs; PC 1000 Rs Ex, for practice or experimental use (it has no main filling, no baseplate or bomb fuze and the weight is made up by the extra thickness of the bomb casing); and the PC 1800 Rs.

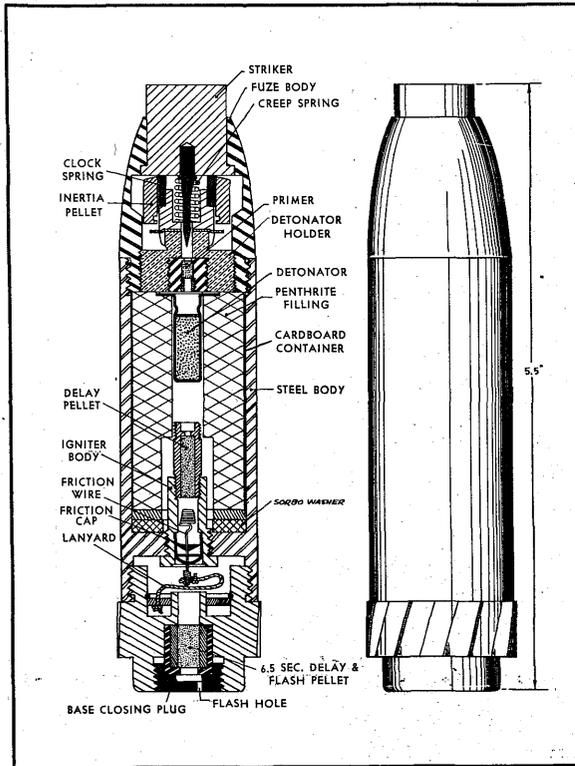
SPECIFICATIONS

Total weight	2,176 lbs.
Weight of case	1,470 lbs.
Weight of explosive	119 lbs.
Overall length	7 ft., 2¾ ins.
Length of bomb	3 ft., 9 ins.
Diameter of bomb	1 ft., 3½ ins.
Diameter of tail fins	
Large	2 ft., 4 ins.
Small	1 ft., 10 ins.
Dimensions of Propellant	
6.....	22½ ins. long x 2 15/16 ins. diameter
12.....	20¾ ins. long x 2 15/16 ins. diameter
1.....	11¼ ins. long x 2 15/16 ins. diameter
Filling	T.N.T.
Color	Sky-blue

ANTIPERSONNEL RIFLE OR HAND GRENADE



Gewehr-Sprenggranate

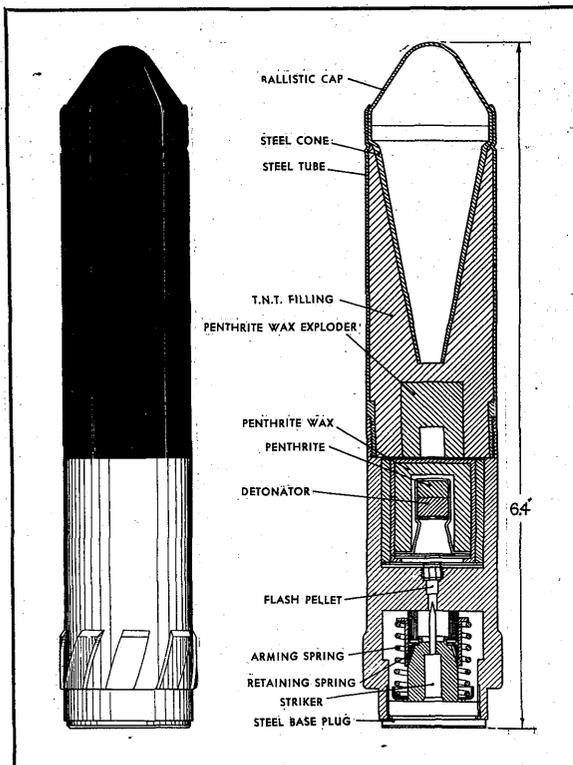


This grenade consists of a tubular steel body containing an explosive filler of penthrite wax, a detonator, a direct action nose fuze, a delay friction igniter, and a base assembly containing a self-destructing system. A diaphragm near the bottom of the grenade is threaded centrally to receive the friction igniter. The fuze and base assemblies are not integral parts of the grenade, but are screwed into the nose and base respectively. If the nose fuze does not function properly, the grenade is self-destructive. On firing, the flash from the propelling cartridge enters a hole in the base closing plug and ignites a 6.5 second delay pellet contained in a brass holder. This fires the friction igniter which gives an additional delay of 4.5 seconds before setting off the detonator. The grenade may also be used as a hand grenade by removing the base assembly and pulling a cord attached to the friction igniter.

Overall length	5.5 ins.	Explosive filler	PETN/Wax
Maximum diameter	1.2 ins.	Weight of filler	1.1 oz.
Color.....	Black body; aluminium fuze and base	Maximum range	550 yds.
Total weight	9 ozs.	Delay	Self-destructing—11 sec. Friction igniter—4.5 sec. Impact—no delay

ANTITANK RIFLE GRENADE

Gewehr Panzergranate



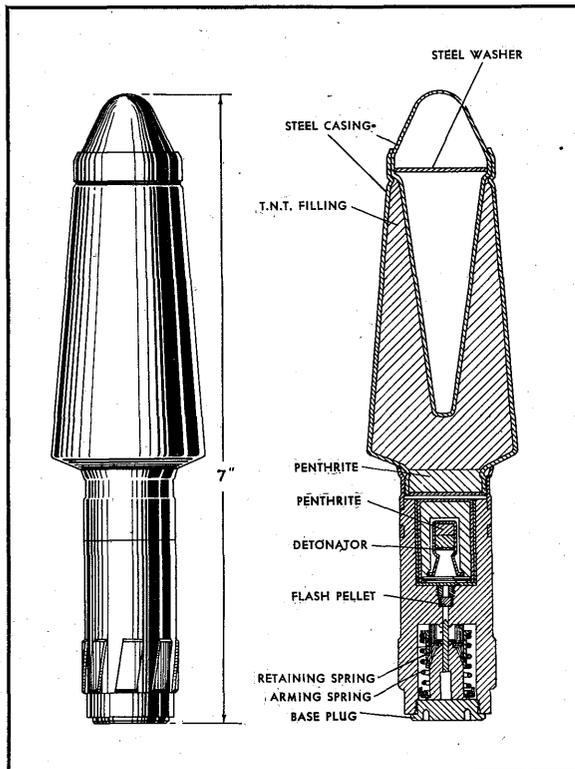
The Gewehr Panzergranate is constructed in two parts, the head and the stem. The head, a seamless steel tube fitted with a light ballistic cap, contains a hollow charge cone and an explosive filling of T.N.T. A cavity is provided in the rear portion of the main filling to take an exploder of penthrite wax. The stem of light alloy or aluminum is screwed onto the head of the grenade. It is divided into two compartments. The upper portion contains the booster which consists of a detonator surrounded by a penthrite wax filling contained in a light alloy case. The percussion type fuze is located in the lower part of the stem. In the septum is a small flash pellet held in place by a perforated screw plug. A pre-engraved driving band is formed on the outside of the grenade approximately 1/4 inch from the base. The entire assembly is closed by a base plug which positions the fuze by a stem which fits into a recess in the rear of the striker body.

Overall length	6.4 ins.	Filler	T.N.T./Cyclonite
Maximum diameter	1 3/16 ins.	Weight of filler.....	1.75 ozs.
Color....	Black body; aluminum stem	Range	50 yds.
Total weight	8.8 ozs.		

H.E.A.T. (Hollow Charge) RIFLE GRENADE

GERMAN 

Gross Gewehr Panzergranate

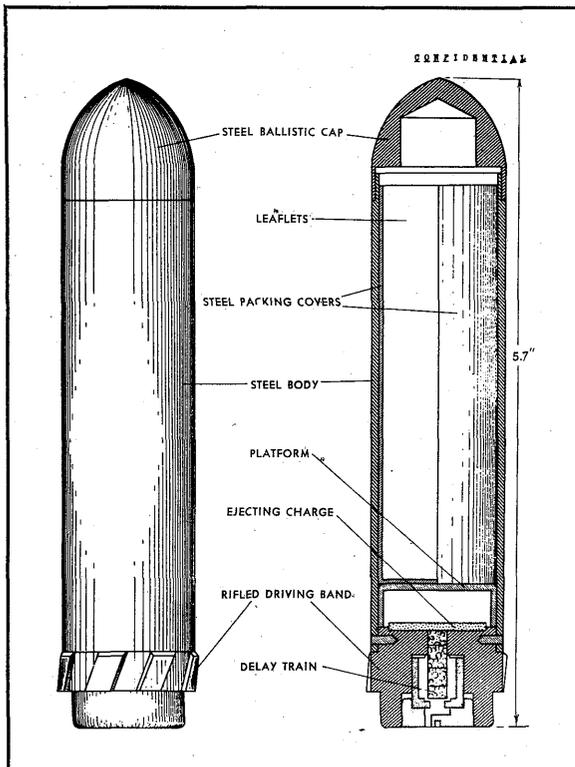


This grenade, while larger and of slightly different contour than that described on the preceding page, is basically the same in construction and operation. The body of pressed steel contains a steel cone around which the T.N.T. filler is cast, and at the bottom of the filler is an exploder pellet of penthrite wax. Two types of stem may be used, one entirely of light alloy and the other of plastic with a steel shank by which it is screwed onto the body. The booster assembly and the percussion type fuze are both located in the stem divided by a perforated septum which contains a small flash pellet. At the base of the stem is a rifled band which corresponds to the rifling on the discharger. The assembly is closed by a base plug.

Overall length	7 ins.	Weight of filler.....	4½ ozs.
Maximum diameter	1¾ ins.	Filler	T.N.T./Cyclonite
Color	Black overall	Range (maximum)	100 yds.
Total weight	13½ ozs.		

PROPAGANDA RIFLE GRENADE

Gewehr Propaganda Granate



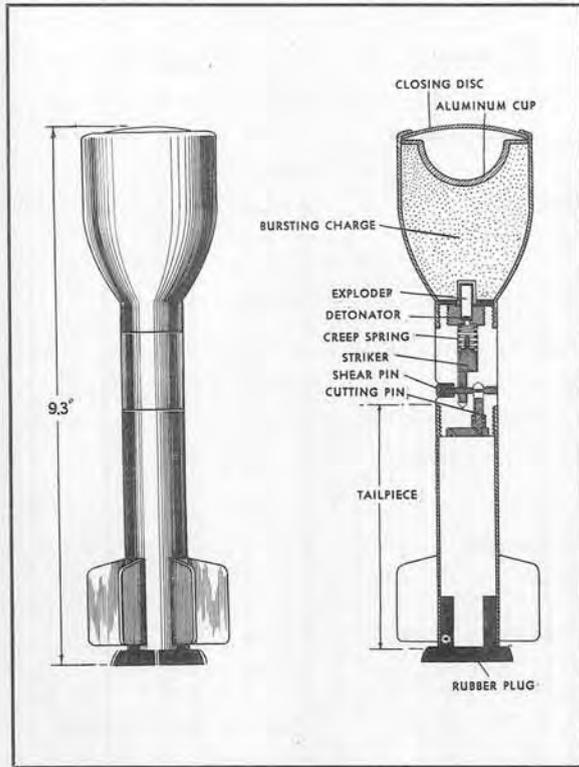
This grenade which is used for propaganda purposes consists of a cylindrical steel body with a pre-rifled base and a removable ballistic cap. The base of the grenade contains a 9-second delay fuze and an ejecting charge covered by a cardboard disc to prevent moisture from causing deterioration. Leaflets are inserted in two steel packing covers held loosely inside the case, and then the case and cap are varnished to protect them from rust. On firing, the flash from the propelling cartridge ignites the fuze and approximately 9 seconds later the ejecting charge explodes, blowing off the cap and forcing the leaflets out of the nose of the projectile.

Overall length	5.7 ins.	Delay	9 sec.
Total weight	8 ozs.	Range	500 yds.
Weight without leaflets.....	7 ozs.		

H.E.A.T. (Hollow Charge) GRENADE



Schuss Gr. P-40



This grenade consists of a bell-shaped body of thin steel with a slightly convex aluminum closing disc, a graze fuze which screws into a cylindrical projection welded to the base of the body, and a finned tail unit. The bursting charge of cyclonite wax is cast around an aluminum hollow charge liner which is hemispherical in shape. A detonator and intermedial exploder are contained in an aluminum magazine which fits into the base of the main explosive cavity. The tail unit screws onto the base of the fuze housing and consists of a drawn-steel tube with six vanes formed in pairs. The cartridge is of the 7.92 mm small arm type with an undyed hollow wooden bullet.

Overall length	9.3 ins.	Markings.....	Blue band round projection at base of body
Maximum diameter	2.4 ins.	Length of body	3.1 ins.
Color	Olive green	Filler	Cyclonite/Wax

H.E.A.T. (Hollow Charge) RIFLE GRENADE

Gross Panzergranate 61 and 46



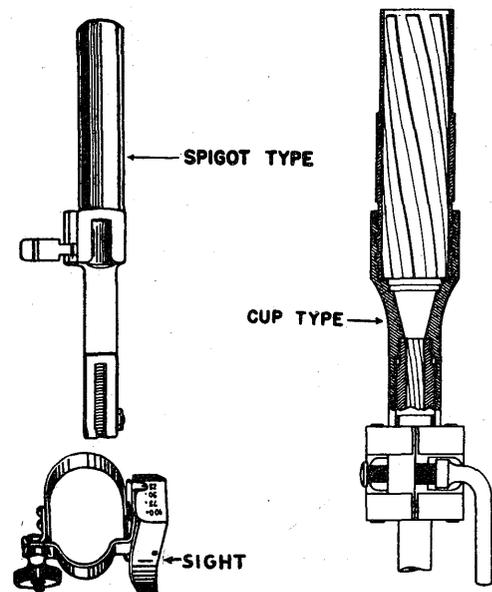
Two additional H.E.A.T. (hollow charge) armor piercing rifle grenades have recently been recovered and are illustrated herewith. They bear the designations G. Pz. Gr. 61 and G. Pz. Gr. 46. The numerals "61" and "46" refer to the diameter of the explosive head in millimeters. The maximum range of the "61" is 218 yards. Static fired at normal, the "61" is reported to penetrate to 4.96 inches of homogeneous armor plate; the "46" is reported to penetrate 3.54 inches of the same plate.

"61"	"46"		
Total weight	1 lb., 4.25 ozs.	Total weight	14.65 ozs.
Weight of H. E. filling.....	8.89 ozs.	Weight of H. E. filling....	5.16 ozs.
Weight of booster explosive	.24 oz.	Weight of booster explosive	.24 oz.
Weight of propelling cartridge powder	27 grains	Weight of propelling cartridge powder	27 grains

Cartridge for	German Name	Powder Filling Nz. T. P. (1.4;2:0.5/0:25) grams	Markings	Remarks
Large A. P. Grenade	G. Treib. Patr. für Gr. G. Pzgr.	1.9	Black wooden bullet	
Propaganda Grenade	G. Kart. für G. Propgr.	1.7	Red ring	In the future to be used only for Rifle Propaganda Grenade
Propaganda Grenade (Old Type)	G. Kart. (Alter Art) für G. Propgr.	1.7	Red ring	Obsolete
Small A. P. Grenade	G. Kart. für G. Pzgr.	1.1	Black ring	Packed attached to grenade
Small A. P. Grenade	G. Kart. (Alter Art) für G. Pzgr.	1.1	Black ring (partly)	Obsolete
H. E. Grenade	G. Kart. für G. Sprgr.	1.0	Yellow ring	In the future to be used only for H. E. grenade
H. E. Grenade	G. Kart. (Alter Art) für G. Sprgr.	1.0	Yellow ring (partly)	Obsolete
H. E. Grenade (Old Type)	G. Kart. (Alter Art) für G. Sprgr.	0.85		Packed attached to grenade

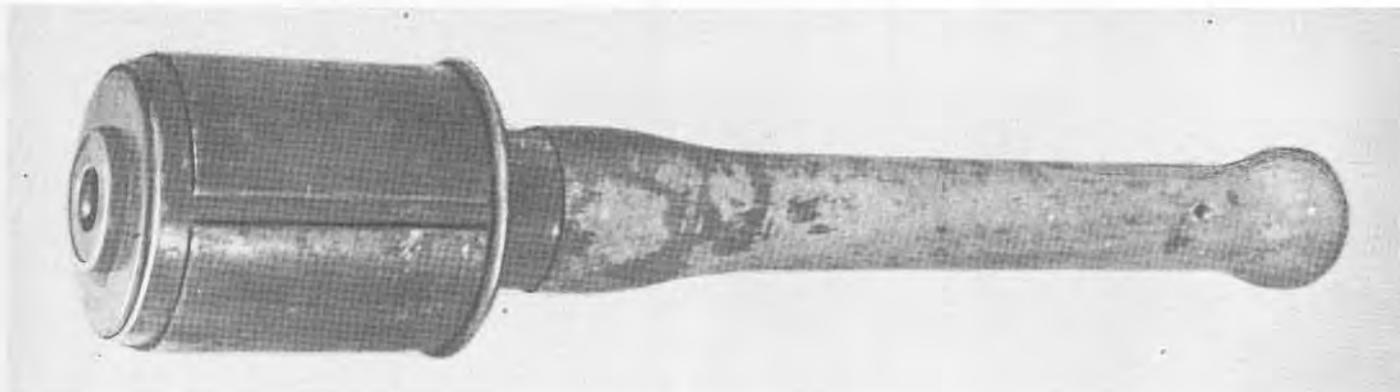
RIFLE DISCHARGERS

The two standard German rifle dischargers are the cup type (Schiebsbecher) and the spigot type. The former is made of steel and consists of a rifled barrel which screws into a holder fitted with a clamp for attaching it to the rifle barrel. There are no gas ports, and varying ranges are obtained by altering the elevation of the rifle by the aid of the sighting attachment. The latter type consists of a hollow tubular spigot about one inch in diameter, terminating in a part resembling the hilt of a bayonet. It is fitted to the rifle in the same manner as a bayonet, and is locked in position by a spring-loaded bolt. The hollow tailpiece of the grenade is fitted over the spigot, and on firing the propelling cartridge, the gasses pass out of the barrel of the rifle through the spigot and into the hollow tailpiece to propel the grenade. Both a swing-over blade front sight and a rear sight are provided.



NEW TYPE STICK HAND GRENADE

Stielhandgranate 43

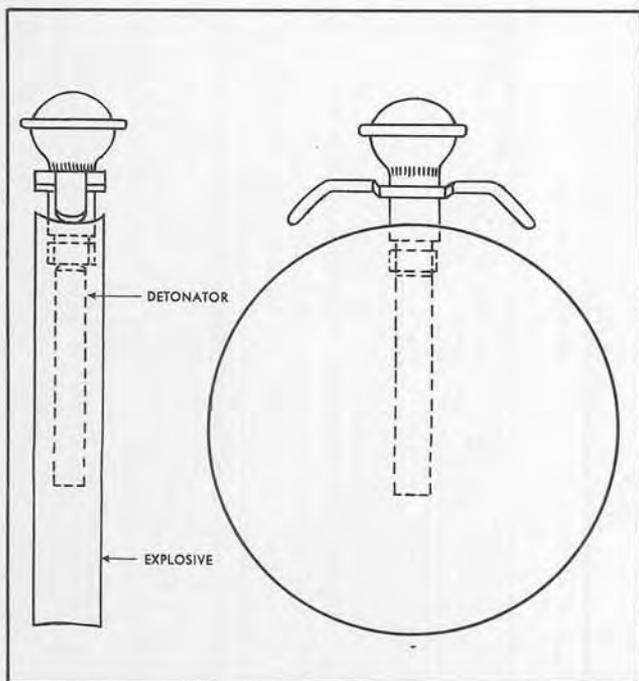


The new type German Stick Grenade, consisting of a head filled with TNT, a smooth fragmentation sleeve, fitted over the head, and a detachable wooden handle, is a modification of the standard Stielhandgranate 24 described on page 321.

The later model, however, does not have a friction

igniter operated by a cord running through the handle. Instead, the detonator and 4½-second delay igniter similar to that used with the egg grenade, are screwed into the top of the explosive head. The grenade may be thrown with or without the handle. Arming and priming are the same as for the egg grenade.

OFFENSIVE DISC TYPE GRENADE



This grenade, a new type of offensive weapon, has no outer casing or cover, but consists merely of a disc cut from a pre-cast or pressed pellet of explosive, and an igniter. The disc, which is believed to be R.D.X./wax, is 3 5/16 inches in diameter and 17/32 inches thick. It is drilled to receive the igniter and detonator.

A standard friction igniter with a delay of approximately six seconds, and a detonator (Sprengkapsel 08) are used.

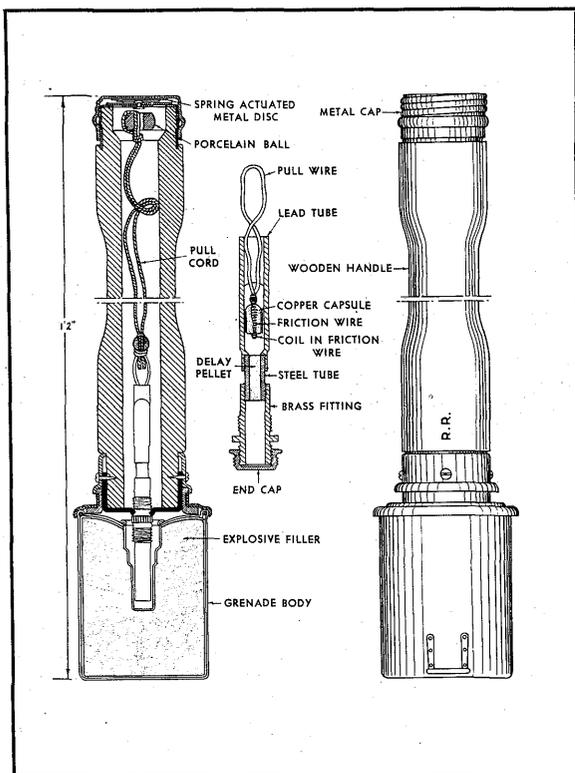
SPECIFICATIONS

Diameter of disc	3 5/16 ins.
Thickness of disc	17/32 in.
Explosive	R.D.X./wax
Color	Chocolate

STICK HAND GRENADE MODELS 24 AND 39

GERMAN 

Stielhandgranaten 24 u. 39



The head of this grenade is a thin steel casing containing the explosive filler. This is screwed onto a hollow wooden handle through the center of which runs a double length of cord. This cord connects at the forward end to a friction pull igniter (B. Z. 24) and at the rear to a porcelain ball in a metal cap. In operation, the cap is removed, the porcelain ball pulled, and the missile thrown to detonate after a 4-5 second delay.

MODEL 24

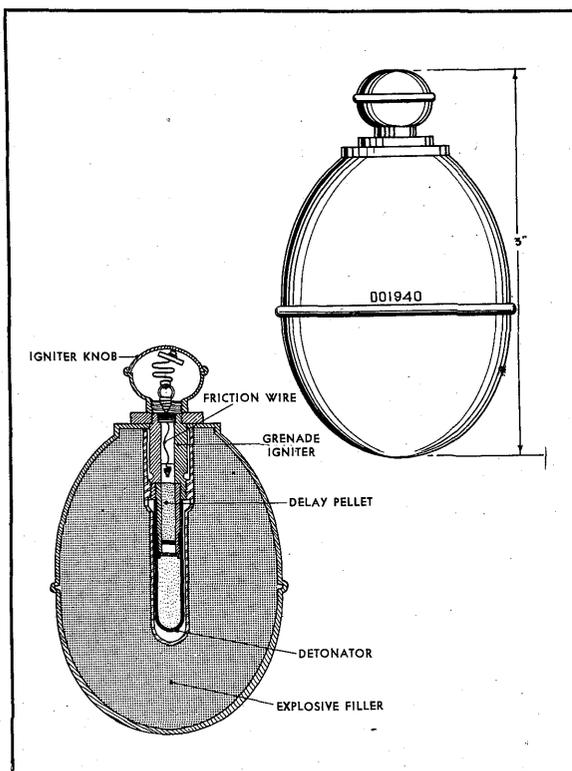
Overall length 1 ft., 2 ins.
 Diameter of body 2 3/4 ins.
 Color of body Olive drab
 Weight 1 lb., 5 oz.
 Weight of explosive filler... 6 ozs.
 Explosive filler T.N.T.
 Igniter B. Z. 24
 Delay 4-5 sec.

MODEL 39

Overall length 1 ft., 4 ins.
 Color Olive drab
 Weight 1 lb., 6 ozs.
 Weight of explosive filler... 7 ozs.
 Igniter B. Z. 24
 Delay 4-5 sec.

EGG-TYPE HAND GRENADE MODEL 39

Eierhandgranate 39



This grenade consists of a thin egg-shaped case filled with an explosive charge, and a friction type igniter with a delay pellet. The upper end of the friction wire in the igniter is attached to a disc in the head which screws on to the top of the body. In operation, the head is unscrewed and pulled, drawing the wire through the friction composition and igniting the delay pellet. After a delay of from 4 to 5 seconds the pellet initiates the detonator which in turn sets off the explosive filler.

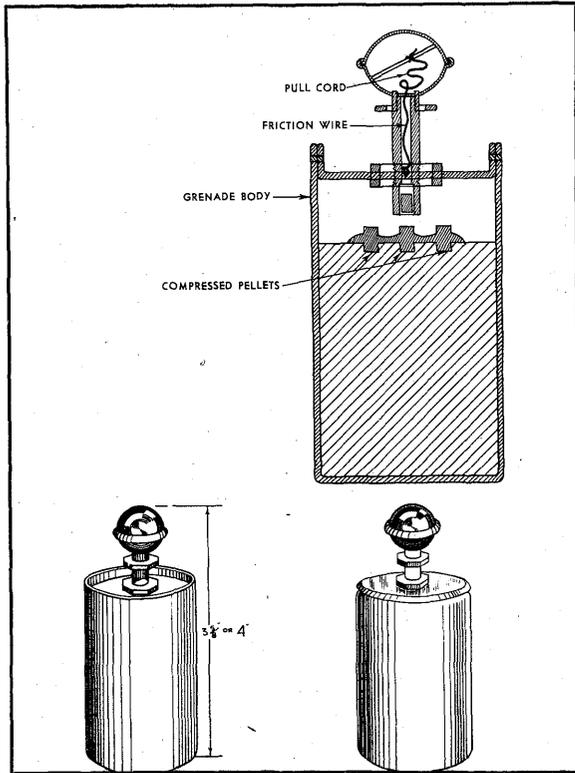
This type hand grenade has been used as a booby trap by fitting a non-delay friction igniter which can be identified by its left-hand threads.

Overall length 3 ins.
 Maximum diameter 2 ins.
 Color.....Black body with blue igniter head

Weight of explosive filler 3.85 oz.
 Weight 12 ozs.
 Igniter B. Z. 39
 Delay 4-5 sec.

SHAVING STICK GRENADE

GERMAN 

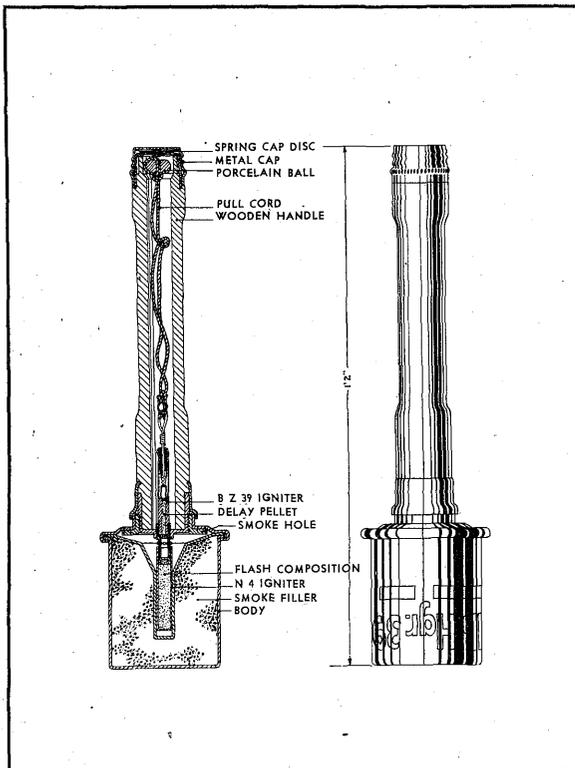


This is a thin-cased offensive type grenade with a B. Z. E. friction igniter screwed into the top. The cylindrical body is made of aluminum and painted yellow. There are two models of this grenade, one 3 $\frac{3}{8}$ inches long and the other 4 inches long. This grenade may also be used as a booby trap by the insertion of a D. Z. 35 Pressure Igniter. To operate the grenade, the head of the igniter is unscrewed and pulled, drawing the wire through the friction composition and igniting the delay pellet. The grenade is then thrown and after a 4-5 second delay, the delay element initiates the detonator.

Overall length.....	3 $\frac{3}{8}$ or 4 ins.	Maximum diameter	2 ins.
Color.....	Yellow body with blue igniter head	Igniter	B. Z. E.
		Delay	4-5 sec.

SMOKE HAND GRENADE 39

Nebelhandgranate 39



This grenade closely resembles the high explosive stick grenade 24 in external form and size. However, instead of the high explosive filling this grenade is filled with a smoke mixture. There are eight holes in the base of the head through which the smoke escapes. The handle has three horizontal corrugations at the screw cap end to assist in differentiation by touch. Upon activation, smoke is emitted for a period of two minutes, forming an effective screen for machine gun nests and pillboxes.

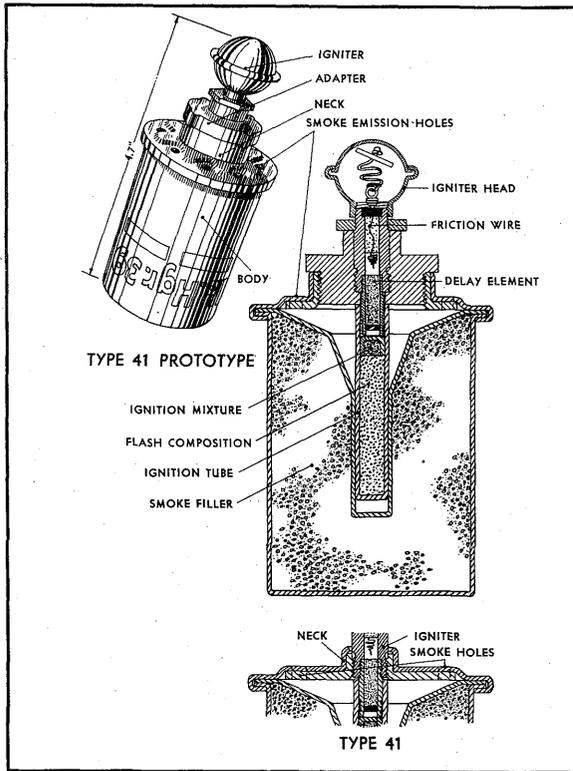
Total weight	1 lb., 14 ozs.	Color	Olive drab
Overall length	14 ins.	Markings.....	White band 8 inches wide around center of handle and lettering Nb. Hgr. 39 stencilled in white around the body above a broken white band.
Igniter	B. Z. 39		
Delay			
N 4 ignition tube	7 sec.		
Filling.....	(HC) mixture zinc and hexachlorethane		

SMOKE HAND GRENADE 41 AND PROTOTYPE

GERMAN



Nebelhandgranate 41



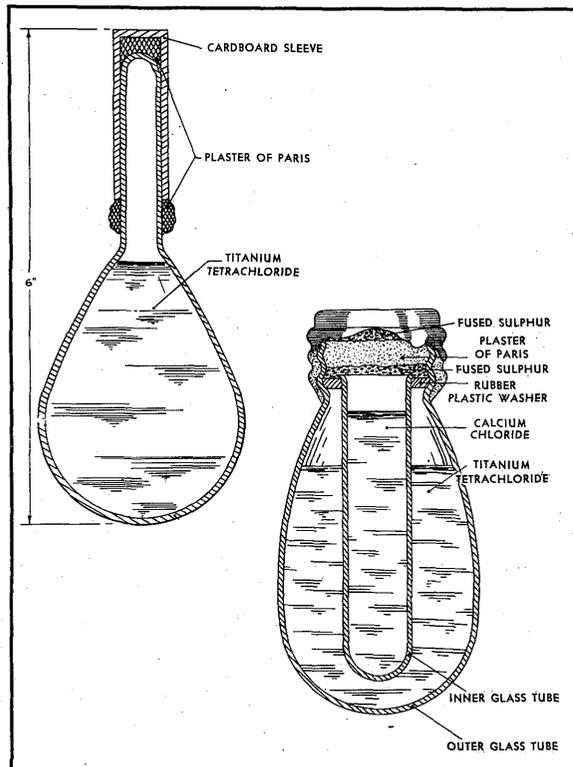
The prototype of this grenade is comprised of the body of the smoke hand grenade 39 with a synthetic resin adapter to hold the B. Z. E. igniter. The Model 41 is of similar construction but the body has been modified so that the igniter fits into a small central neck without the use of an adapter. There are only two smoke holes instead of eight. The friction igniter operates with a 4-5 second delay, setting off a 2-minute smoke discharge.

Overall length 4.7 ins.
 Maximum diameter 2.3 ins.
 Color Olive drab
 Total weight 21 ozs.

Filling.....(HC) type mixture. Zinc and Hexachlorethane
 Igniter B. Z. E.
 Delay
 N4 Ignition tube 4-5 sec.

SMOKE GRENADES

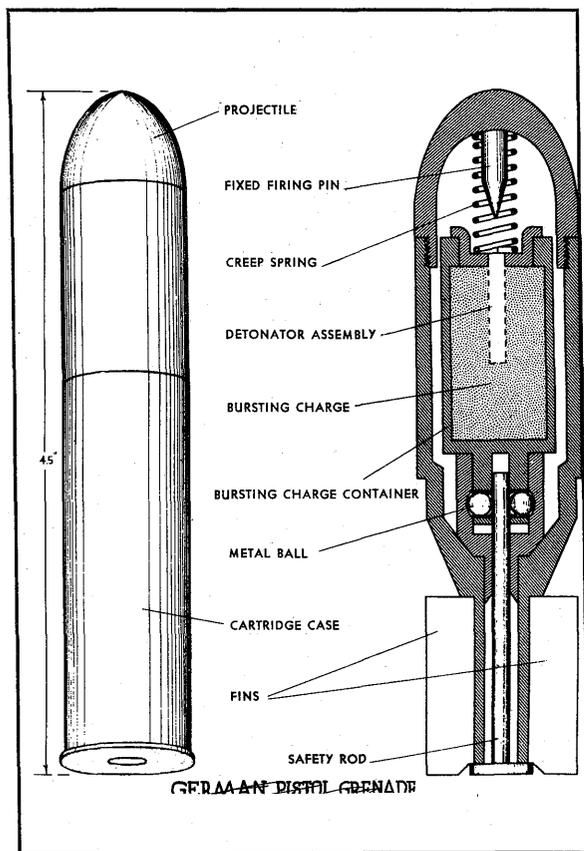
Blendkörper 1H u. 2H



These grenades are made in the form of glass flasks. Model 1H is a single container; Model 2H includes an inner glass tube filled with a solution of calcium chloride. The body of each grenade is filled with titanium tetrachloride which vaporizes upon contact with the air. The calcium chloride permits the second model to operate at low relative humidity, whereas the first model produces a thin fog unless the air is quite moist. Both models discharge upon impact with any hard object.

1H
 Overall length 6 ins.
 Maximum diameter 2½ ins.
 Total weight 13.2 ozs.
 Filling.....(FM) Titanium Tetrachloride
 Weight of filling..... 10.6 ozs.

2H
 Overall length 4.8 ins.
 Maximum diameter 2½ ins.
 Total weight 17 ozs.
 Filling & filling weight
 Outer flask..... 10 oz. titanium tetrachloride
 Inner flask...1.3 oz. aqueous solution of calcium chloride

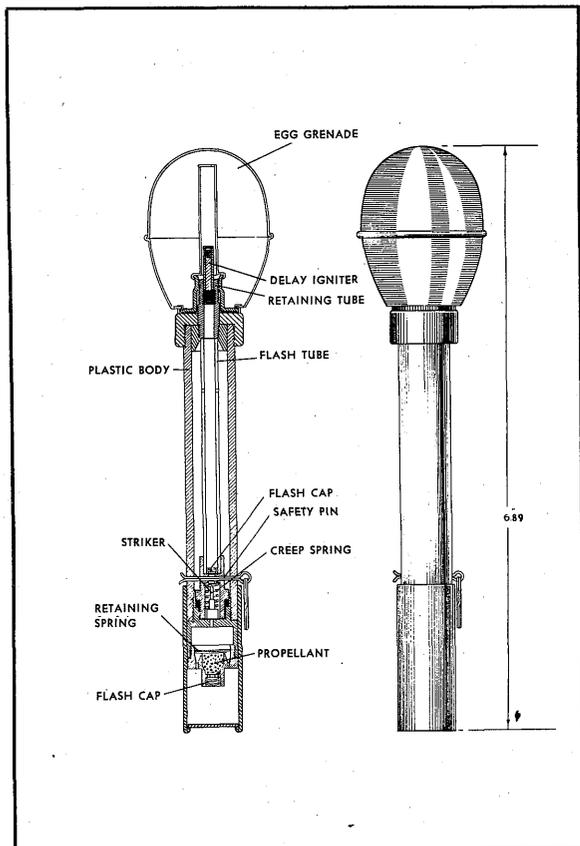


PISTOL GRENADE

26 mm Wurfgranaat Patrone 326 Leuchtpistole

This grenade, consisting of a rounded nose cap screwed to a cylindrical body, is equipped with four fins which are fixed to the base of the body. A brass or aluminum cartridge crimped to the grenade completes the assembly. A case containing the detonator and main filling is separated from a fixed firing pin in the nose of the grenade by a creep spring. The case is prevented from moving forward before firing by two metal balls in the base of the carrier. An arming rod inserted between the two balls prevents them from moving. This is forced out of the base by setback about ten or twelve yards after the grenade leaves the muzzle of the gun. The balls then slide out of their grooves and the case is free to move against the firing pin, exploding the grenade on impact.

Overall length	4.5 ins.	Weight of projectile.....	3.2 ozs.
Maximum diameter	1 in.	Filler	T.N.T.
Color	Yellow	Weight of filler	0.25 oz.
Weight of complete round	4.2 ozs.		



PISTOL GRENADE

Wurfkörper Leuchtpistole

This pistol grenade is formed by adding to the egg-type hand grenade (Eierhandgranate 39) a plastic stem to which it is attached by a retaining tube. The tube contains the delay igniter at the forward end inside the grenade. An alloy flash tube connects this to the fuze which is located in the base of the stem. The fuze is separated from the primer by a safety pin which is pulled out before the grenade is placed in the pistol barrel. Upon firing, the firing pin strikes the primer which sets off the delay igniter, detonating the explosive charge after a delay of 4.5 seconds.

Overall length	6.89 ins.	Delay	4.5 sec.
Maximum diameter	3 ins.	Range	80 yds.
Color	Olive green		

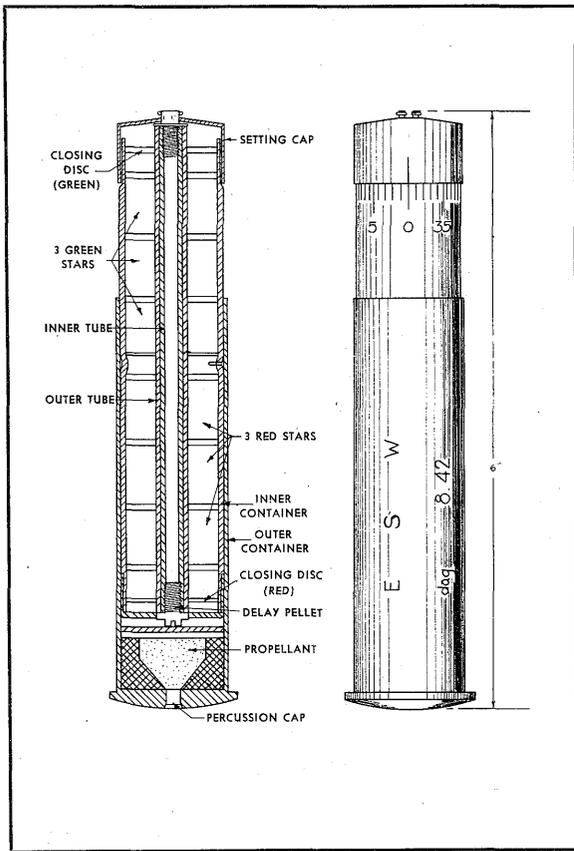
27 mm MULTI-STAR SIGNAL CARTRIDGE

The cartridge consists of a light alloy outer container complete with the propelling charge and an inner container in which there are six star units. Running through the center of the star units is an assembly of two brass tubes with selector holes for the six choices of settings. The inner tube contains gunpowder and is closed by a plug which contains a delay pellet. In firing, the inner container is propelled and after the delay pellet has burned through, the flash passes immediately along the whole length of the inner tube, igniting and ejecting the stars in accordance with the setting.

Overall length 5 3/4 ins. Filling.....Propellant & pyrotechnic
 Maximum diameter 1.06 ins.

Star combinations and dial settings:

3 red	1 red	3 red	1 red	2 red	2 red
3 green	2 green	1 green	3 green	2 green	1 green
(0-2)	(7-8)	(14-15)	(21-22)	(27-29)	(34-35)

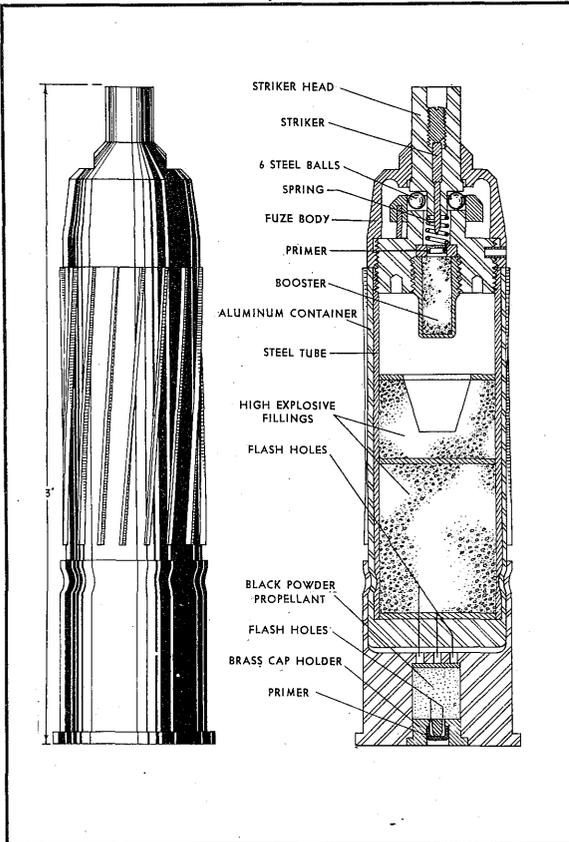


H. E. CARTRIDGE FOR 27 mm GRENADE PISTOL

Sprengpatrone für Kampfpistole

This grenade consists of a die cast aluminum container which encases a steel tube containing the explosive charge. Into the steel tube is screwed a direct action nose fuze with a protruding striker head. The striker is held away from the detonator by six steel balls kept in position by a steel collar supported on three aluminum pins. The creep spring separates the striker and primer beneath which is a booster separated from the main filling by an empty air space. The black powder propelling charge is contained in a cup with a lead Styphnate primer. The grenade has grooves on the aluminum body fitting the rifling of the Kampfpistole from which it is discharged.

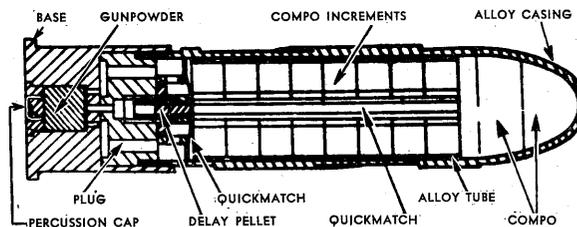
Overall length 3 ins. FillerPETN/Wax
 ColorUnpainted aluminum Weight of filler77 oz.
 Weight of complete round.... 5 ozs. Propellant..Graphited black powder
 Weight of projectile 3 1/2 ozs.



SMOKE

Nebelpatrone für Kampfpistole

This grenade is similar in appearance and construction to the high explosive grenade except that it contains a smoke generator instead of an explosive filler. It is fitted with a percussion type nose fuze which has a charge of gunpowder located just below the flash cap instead of a detonator. The projectile functions on impact and the gunpowder, ignited by the flash cap, ejects the smoke generator from the body of the grenade and at the same time ignites it. The projectile may be recognized by the following stencilled marking on the base of the cartridge case: NEBEL. Z.



INDICATOR

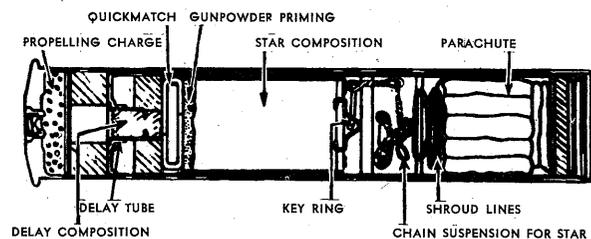
Deutpatrone für Kampfpistole

The indicator grenade is similar externally to the smoke and high explosive grenades except for the head which is parabolic. There is no fuze. The smoke train, a puff of red-dish-brown smoke, is fired by the flash from the propellant. The indicator system begins to function when the projectile has been in flight for about two seconds. The weight of the complete round is 4.5 ounces; that of the grenade itself, 3 ounces. The marking on the base of the cartridge case is: DEUT. Z.

ILLUMINATING STAR ON PARACHUTE

Fallschirm Leuchtpatrone für Kampfpistole

This type grenade has the same general contours as the two others previously described. It has a black bakelite head and a screwed-on base plug which is perforated to hold a gunpowder pellet. Inside the grenade, directly above the plug is an illuminating star to which a parachute is attached. On firing, the flash from the propellant ignites the gunpowder pellet, which, after a brief delay, ignites the star. The bakelite head is blown off, and the star ejected. The grenade may be identified by the stencilling "F. Leucht. Z." on the base of the cartridge case.



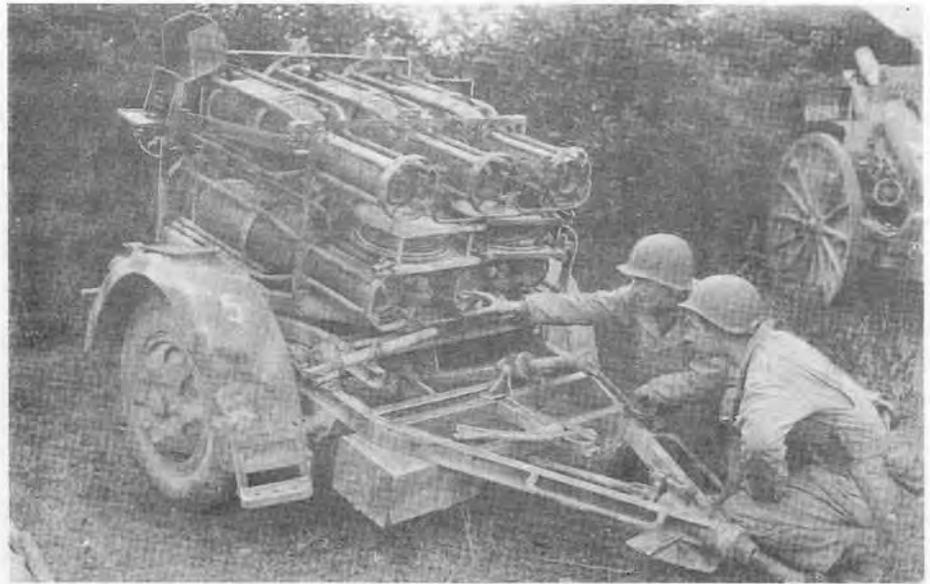
ROCKET PROJECTOR

28/32 cm Nebelwerfer 41

This rocket projector fires the 28 cm high explosive rocket (page 354) and the 32 cm incendiary rocket (page 353). Ranges are given below.

This device, which functionally does not differ from the 15 cm and 21 cm Nebelwerfers, consists of six projectors grouped in two tiers of three each, mounted on a two-wheel trailer. The cages are constructed of round steel bars shaped to the outside contours of the 32 cm rocket. Detachable liners for the forward end of the projectors permit the use of 28 cm rockets. The portion of the projector holding the propelling chamber remains the same for both rounds.

The firing mechanism is electric. Traverse (approximately 30°) and elevation (from 0 to 45°) are by means of cranks.



The piece is fired from its mounting and is held in position by two jacks in front and a small spadelike

arrangement in the rear.

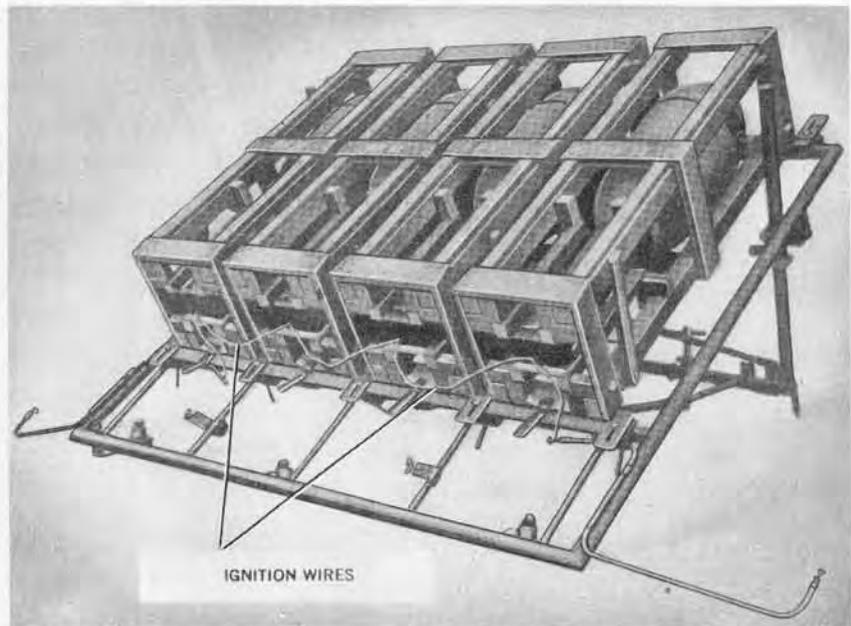
The equipment weighs approximately 2,460 lbs.

TRANSPORTABLE ROCKET PROJECTORS

28/32 cm schweres Wurfgerät 40 and 41

These two rocket projectors, or ramps, differ from each other only in construction details and in the material used. The Schweres Wurfgerät 40 is made of wood and weighs 115 pounds; the 41 model is of metal, weighing 243 pounds. Each is designed to carry four crates of the 32 cm incendiary rocket (page 353) or the 28 cm high explosive rocket (page 354).

Either model is adjustable for elevation. Firing is accomplished by the hand electric firing system pro-



vided for the crates themselves. Maximum ranges for these projectors are identical: 2,106 yards for

the 28cm Wurfkörper Spr. and 2,406 yards for the 32 cm Wurfkörper M. Fl. 50.

Schweres Wurfrahmen 40

This rocket projector is designed for use on half-tracked armored personnel carriers. The principal feature of the device is the carrier plate, three of which are mounted on each side of the half-track. Each is adjustable for elevation of 5° to 45°, and is believed to be equipped with an elevating scale. The actual projector consists of the crate in which the 28 cm or 32 cm rocket is packed, and which may be secured to the plates. Reports indicate that each vehicle carries six rounds, five of which are 28 cm high explosive and one 32 cm incendiary. Range figures are identical to those applying to the



Schweres Wurfgerät 40 and 41 and the 28/32 cm Nebelwerfer 41.

armored semi-track (m. gp. Zgkw.) fitted with rocket projectors as described above.

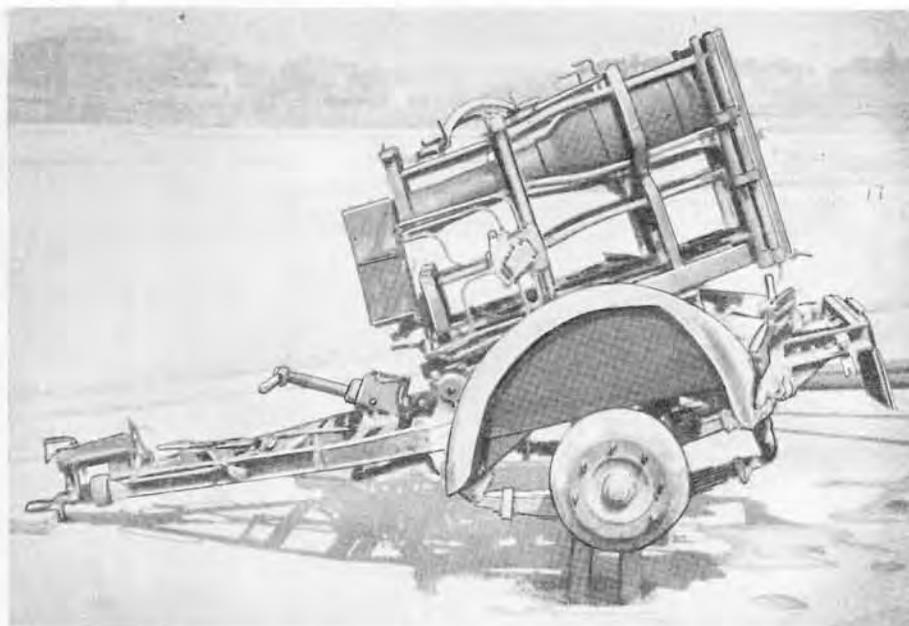
The photos above show the 3-ton

ROCKET PROJECTOR 30 cm Nebelwerfer 42

This rocket projector very closely resembles the 28/32 cm Nebelwerfer 41. The individual projectors are of similar construction, each one being shaped to the contours of the standard 30 cm rocket ammunition. The rear portion, however, is considerably larger than that of the 28/32 cm projector to accommodate the larger propelling chamber of the 30 cm rocket. As a result of the heavier charge, this rocket achieves a range of 4,976 yards.

Both traversing and elevating mechanisms are identical with those of the 28/32 cm piece. Total traverse is 30 degrees, and elevation is 45 degrees. The firing mechanism is electric with a contact box located at the right side of the piece.

A sight bracket is located at the



rear of the framework.

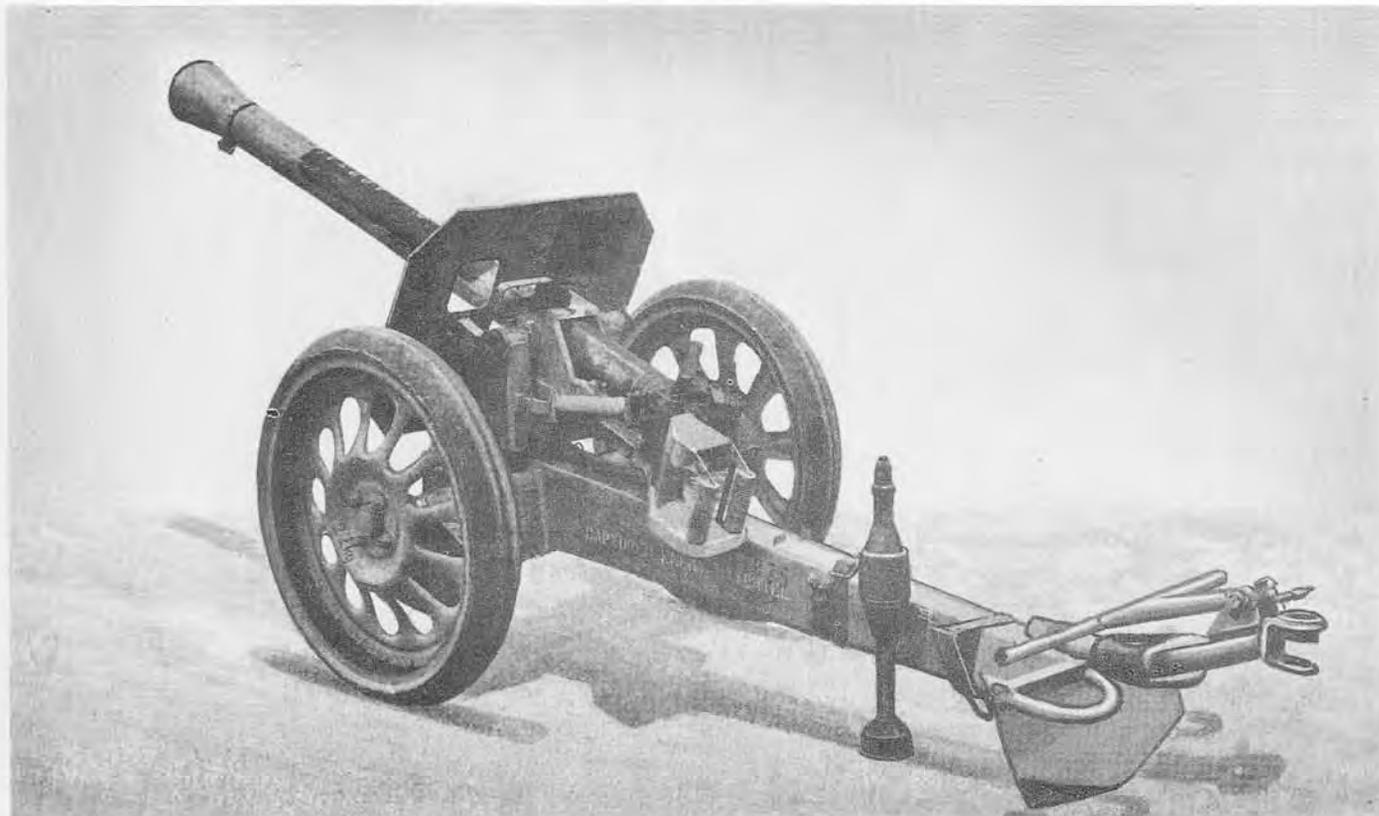
There is a small spade under the frame in the rear, but no other evi-

dence of supports.

The ammunition for this projector is described on page 354.1.

ROCKET LAUNCHER

8.8 cm Raketenwerfer 43 ("Püppchen")



This weapon is a closed breech rocket launcher which fires a rocket projectile. It is transported on a two-wheeled carriage, and may be fired from the carriage or from firing segments to lower the silhouette. If necessary, it may be readily disassembled into seven loads for transport. A cone-shaped gas deflector is fitted over but does not protrude beyond the muzzle.

The piece is aimed by grasping two handles fitted to the left rear of the cradle and aligning the open sights on the target. The rear sight is adjustable from 180 to 700 meters.

The launcher fires from a closed breech which is operated by a handle on top of the breech ring. Opening of the breech cocks the hammer which is held in firing position by a sear. When the projectile has been inserted and the breech closed, a squeeze of the right handle depresses the sear, releasing the hammer. A safety device fitted to the left of the firing pin in the center of the breechblock must be turned to "F" position before the launcher can be fired. An additional safety feature prevents the hammer from striking the firing pin unless the breech is fully closed. The small shock of recoil developed by the rocket gases against the closed breech is transmitted directly to the spade.

Ammunition used with the rocket launcher is a modified version of the 8.8 cm rocket projectile, having a percussion primer instead of the electric type. The rocket is fitted with a base plate with a protruding rim to seat the round in the tube. The base plate and primer are the only parts of the round which are extracted after firing.

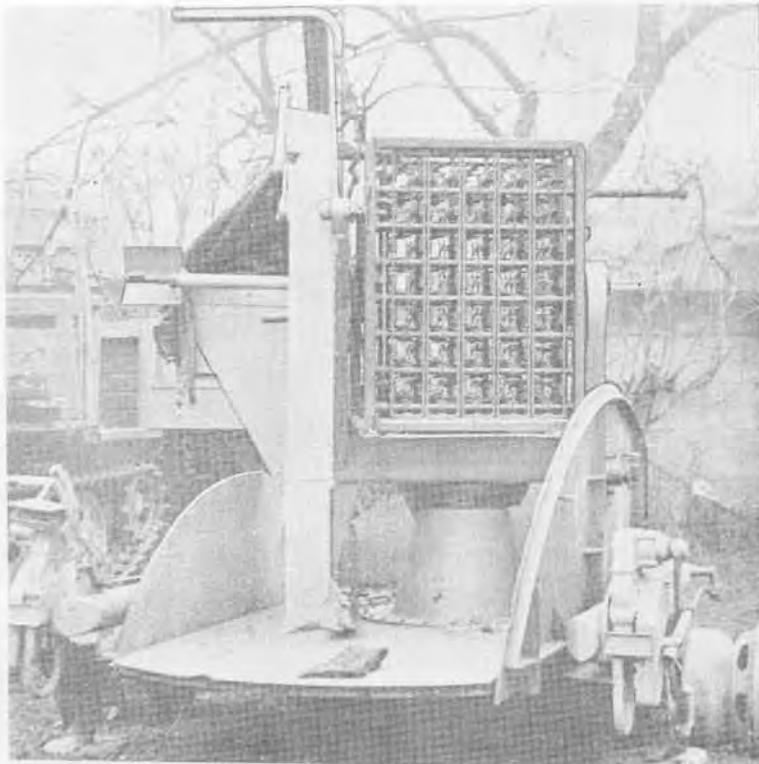
SPECIFICATIONS

Caliber	88 mm (3.46 ins.)
Weight (firing position)	315 lbs.
Length of weapon (overall)	9 ft., 9 ins.
Length of barrel	63 ins.
Height (traveling position).....	2 ft., 11 ins.
Height (on segments)	1 ft., 7½ ins.
Width (overall)	3 ft., 4 ins.
Length of bore	}Smooth bore
No. of grooves	
Width of grooves	
Depth of grooves	
Width of lands	}
Muzzle velocity .....		460 f/s*
Max. range (horizontal) (limited by sight)	765 yds.
Rate of fire .....	.....
Traverse on wheels: Right (max.).....	28°
Left (max.)	28°
Traverse on firing segments	360°
Elevation	23°
Depression	14°
Length of recoil	none
Ammunition	8.8 cm R. Pz. B. Gr. 4312
Wt. of projectile	5 lbs., 13 ozs.

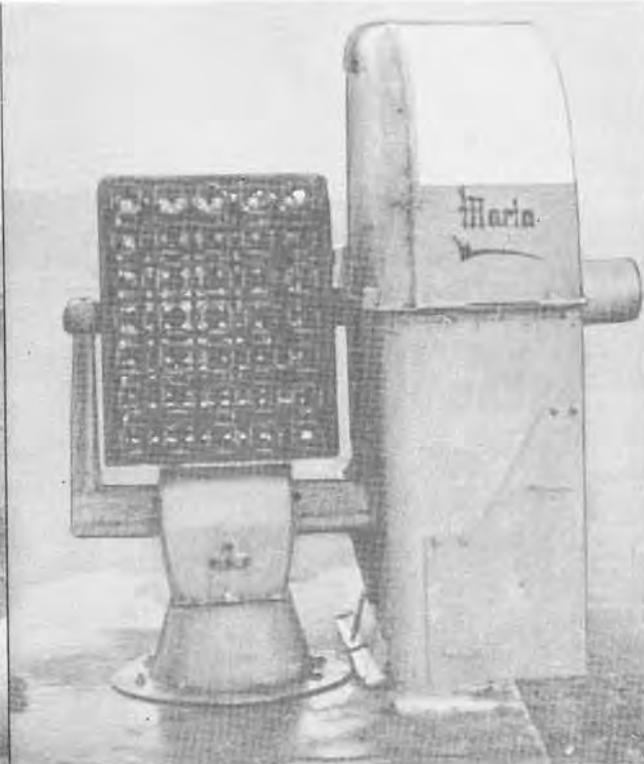
*Not verified.

MULTIPLE ROCKET LAUNCHER

7.3 cm "Föhn"



MOBILE TYPE MOUNT



FIXED TYPE MOUNT

This multiple rocket launcher, used for antiaircraft barrage purposes and known as the "Föhn" is of different design from any other weapon of its type used by the Germans. Launching sites were located along river fronts, indicating the use of this weapon against river crossings. There are 35 individual launchers, each 31 inches long and approximately 7.3 cm square, assembled in 5 horizontal and 7 vertical rows. The rockets are fired by hammer type firing pins mounted on horizontal shafts. All 35 of the pins are actuated by a single trigger. The whole assembly measures 32 inches from top to bottom, and 23 inches from side to side. A simple clamp at the rear of the racks holds the rockets in position until firing takes place. The frame of the assembly is made of 3/16-inch metal.

A trunnion, set in each side of this framework, rests upon arms extending up from the pedestal base. The weapon, with its pedestal base, is used with either a mobile or fixed mount. When used as a mobile mount, the launcher is fitted with a circular metal folding platform mounted on a 2-wheeled trailer. The fixed launchers are not provided with the folding platform, and it is believed that they are normally set up more or less permanently on sheet iron platforms.

The sight, trigger mechanism, and elevating and traversing mechanisms are mounted on the inside of a metal protective shield located on the left side of the launcher. Elevation is from -10° to 90° . The upper part of the front wall of the shield is made of transparent plastic for sighting purposes.

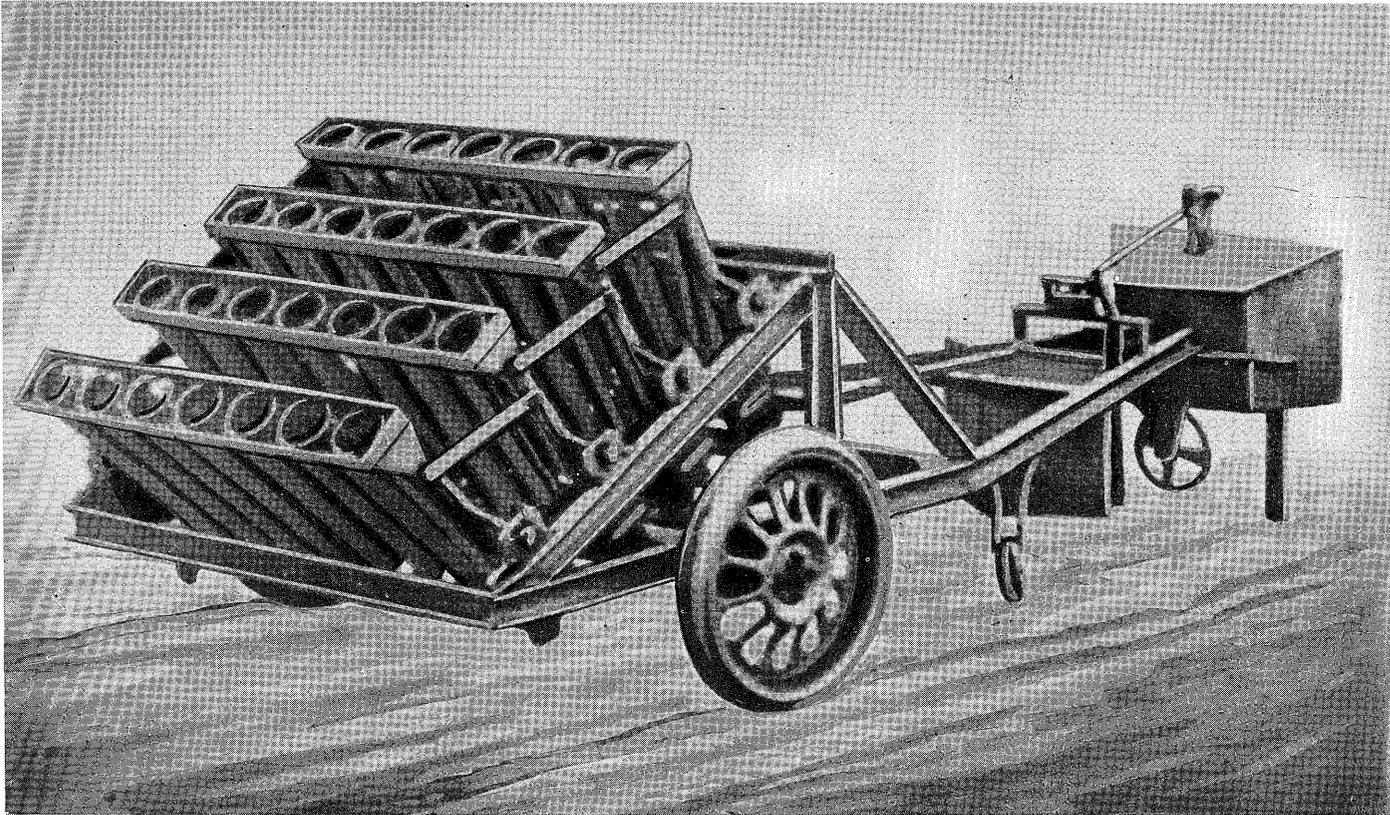
The 7.3 cm Raketen Sprenggranate, used with the launcher, is a spin stabilized rocket fitted with a nose percussion fuze and a self-destroying delay element ignited by the burning propellant.

SPECIFICATIONS

Traverse	360°
Elevation	90°
Depression	-10°

Ammunition

7.3 cm R. Sprgr. (H.E.)	
Weight of complete round	6 lbs.
Weight of propellant	1.19 lb.
Weight of explosive charge	0.62 lb.
Type of explosive	"95"
(RDX/TNT/WAX = 55/40/5)	



This projector consists of 28 projector rails mounted in four rows of seven each, at the forward end of a long, low carriage. The projectors are constructed of welded T-section steel bar. Each row is a separate assembly, and is bolted to an inclined welded steel superstructure built above the carriage. The projectors are displaced from the center both for line and elevation to give dispersement of fire. Each row is fired as a unit by means of a bar provided with a firing hammer and striker for each projector. Each of the four bars may be separately cocked, and all may be fired by one pull of the firing cable from the central point.

The carriage consists of a framework of U-section steel extended well to the rear, where it terminates in a protected control point containing the elevating handwheel, the firing cable, and two handgrips for traverse. A 1 cm thick (0.39 inches) protection shield is provided. There are two metal-rimmed, rubber sprung detachable wheels 27 inches in diameter. The equipment can be traversed about a fixed center pivot or about its wheels. The center pivot is locked into a bracket welded to the center of the axle-tree and rear support is provided by two steel rollers welded on the under side of the carriage.

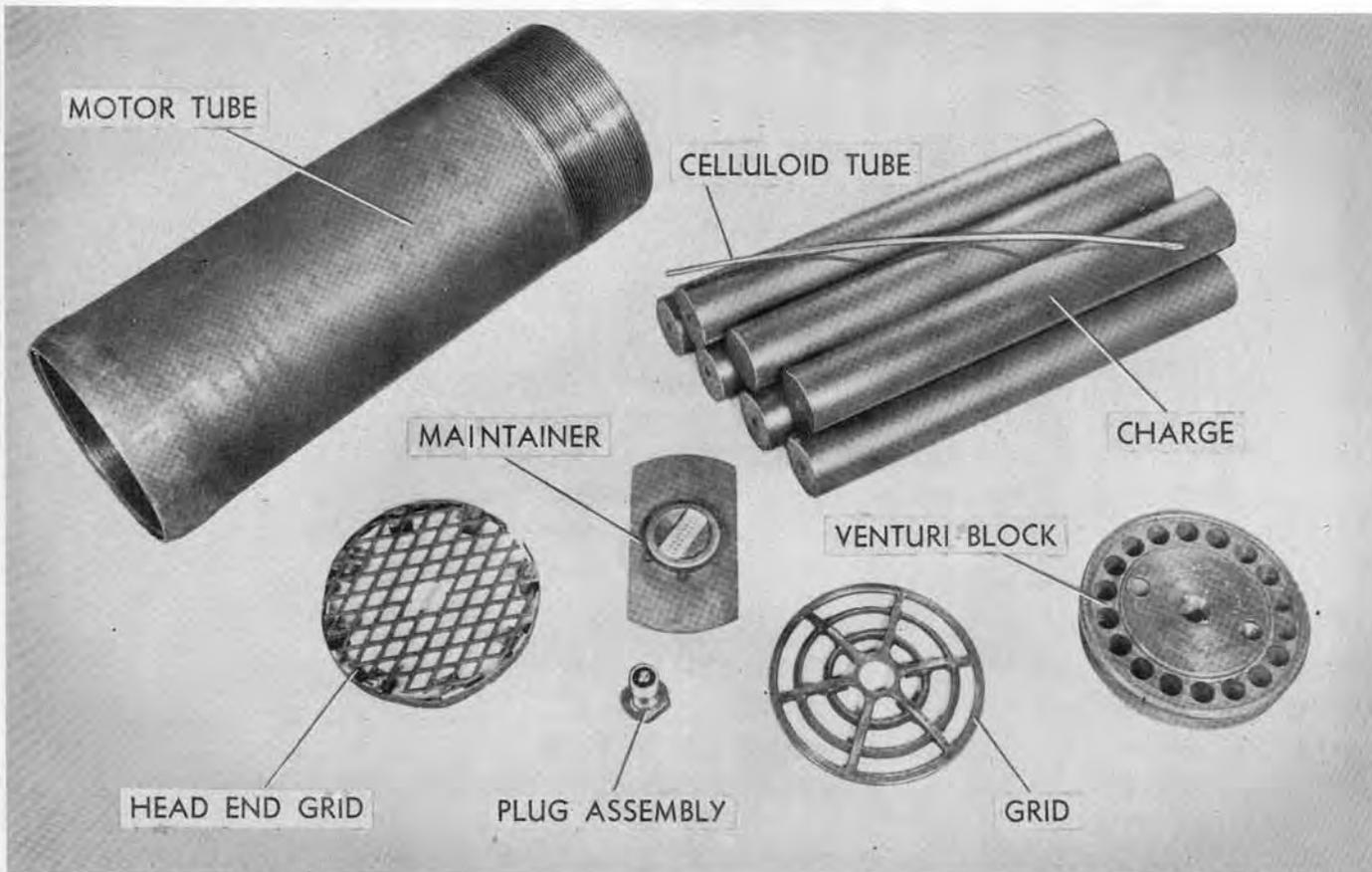
Each row of projectors is independently trunnioned and all four are elevated together by means of a linkage through a chain drive from the handwheel.

SPECIFICATIONS

Overall length (approx.)	14 ft.
Overall width	5 ft., 11 ins.
Track (wheel center to center).....	5 ft., 7 $\frac{7}{8}$ ins.
Width of each projector frame	49 ins.
Depth of each projector frame	5 $\frac{3}{4}$ ins.
Maximum height (above center pivot platform)	3 ft., 4 ins.
Maximum height (on road wheels).....	4 ft., 5 ins.
Elevation (approx.)	55°
Depression (approx.)	4°

30 cm ROCKET

30 cm Wurfkörper 42 Spreng



This rocket is packed in a wooden crate from which it may be fired in the same manner as the 28 cm rocket described on page 354. It is also fired from a rocket projector consisting of six welded metal frames mounted on a two-wheeled, split trailed carriage described on page 350.

This model has been selected to illustrate the construction of the motor assembly of a typical rotating rocket. The motor tube is 0.43 inch thick, closed at one end, and threaded inside to take the venturi block. Eighteen venturis are drilled in this solid block. The throat diameter of each venturi is 0.365 inch with an exit section of approximately 0.82 inch in diameter. The axes of the venturis are inclined at an angle of $12^{\circ} 42'$ so that the effluent gases cause the round to rotate. A threaded hole in the center takes the primer unit.

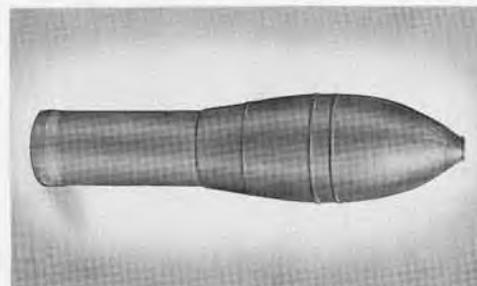
Seven tubular sticks make up the propellant charge composed of nitrocellulose and diglycol dinitrate.

The sticks are supported at the venturi end on a grid. The center stick contains a length of quickmatch in a celluloid tube, and ending in a primed maintainer pellet. A small primer unit screwed into the steel venturi plug flashes directly on to the gun powder pellet at the end of the celluloid tube.

This motor unit is similar to that of the 15 cm Wurfgranate. However, because of the heavier charge in the 30 cm ammunition, the metal mesh has been introduced to prevent the maintainer pellet from being crushed by the central stick of the propellant charge if the rocket is dropped.

SPECIFICATIONS

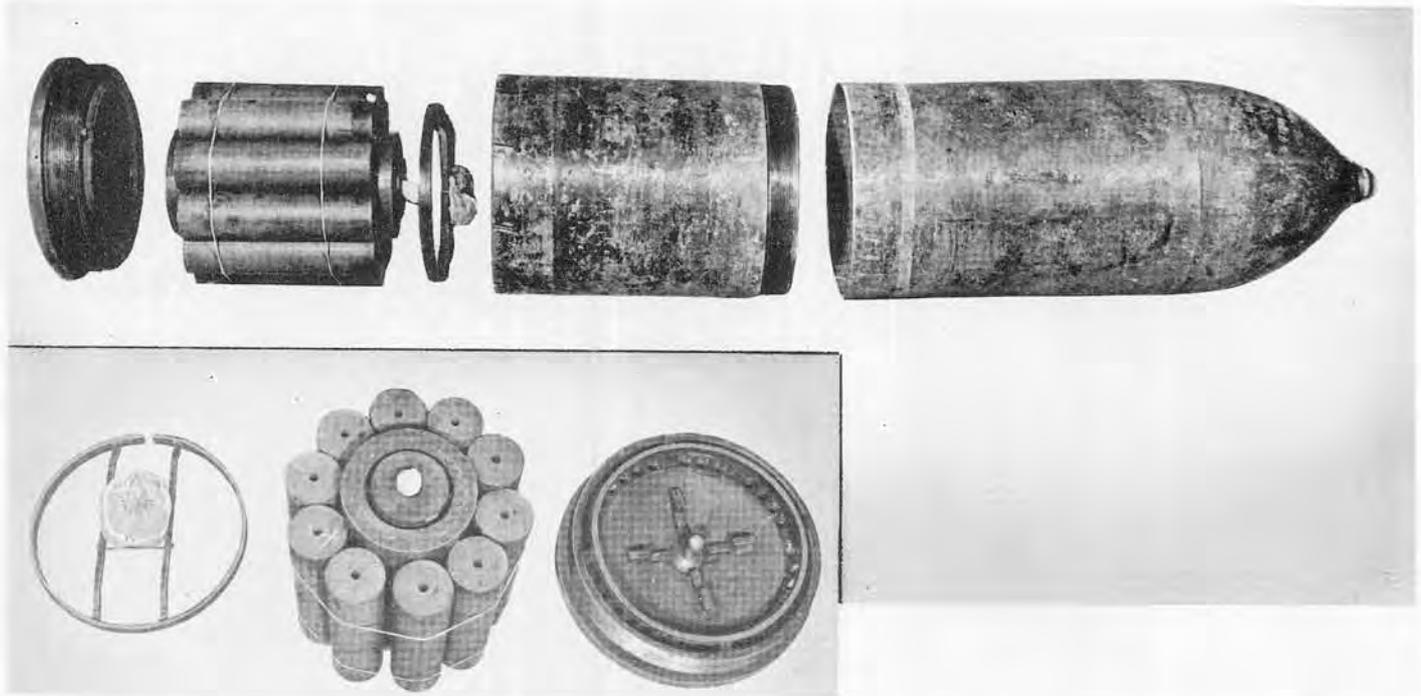
Weight of filled motor unit.....	129 lbs., 10 ozs.
Weight of filled bomb.....	146 lbs., 4 ozs.
Weight of propellant charge....	33 lbs., 3 $\frac{3}{4}$ ozs.
Length (overall)	47 ins.
Length of bomb	28.5 ins.
Length of motor tube	22.5 ins.
Diameter of bomb	11.8 ins.
External diameter of motor tube	8.56 ins.
Length of propellant charge	18.4 ins.
Burnt velocity	754 f/s
Range, maximum	4,976 yds.



ROCKET PROJECTILE FOR RAKETENWERFER 61

GERMAN 

38 cm R. Sprgr. 4581



This projectile is fired from the Raketenwerfer 61 (see pages 38.3 and 38.4). It shows a radical departure from standard spin-stabilized rocket design by the use of insert splines at the after end of the motor body. These splines, fitting into the rifling of the projector liner, aid in giving an initial spin to the projectile.

The rocket consists of three main assemblies: the high explosive body, motor body, and nozzle assembly.

The high explosive body of two-piece welded construction is threaded internally at its after end to receive the motor body. The booster pocket and fuze adapter assembly is welded in position at the nose of the high explosive body. The bourrelet is located just behind the welded junction of the ogive and the cylindrical section.

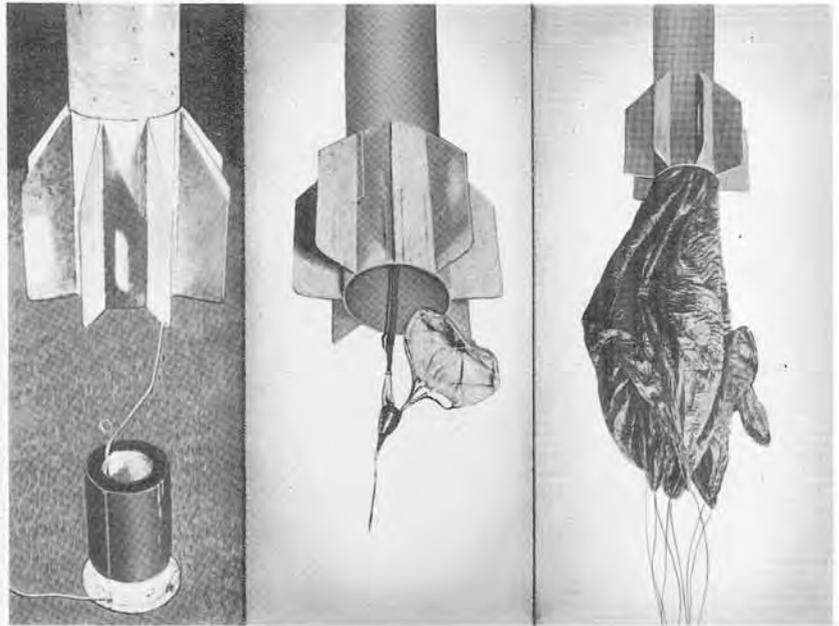
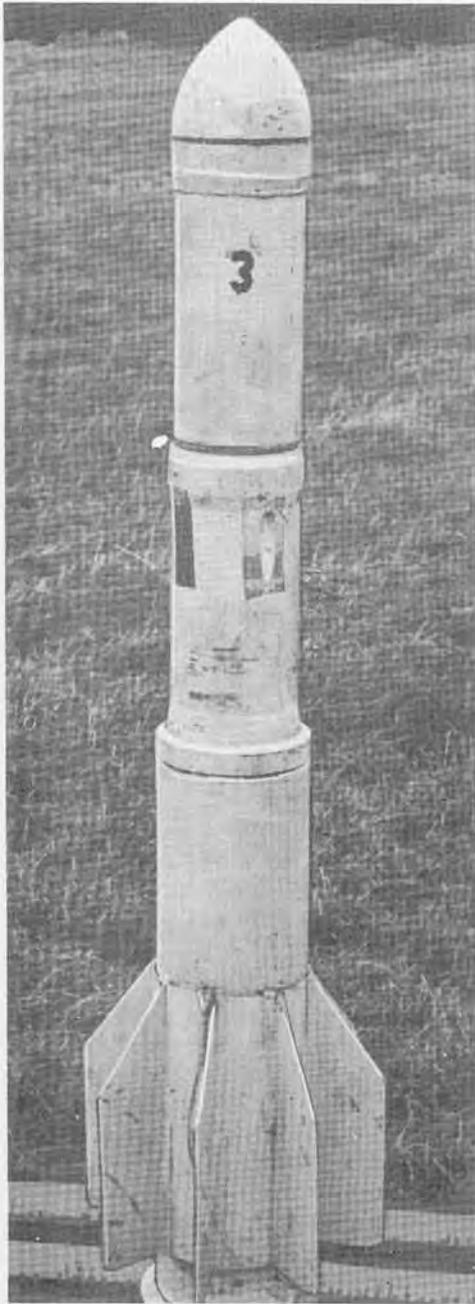
The motor body is threaded externally to screw into the high explosive body and internally to receive the nozzle assembly. Both the explosive body and nozzle assembly are secured by means of two diametrically opposed set screws. Nine grooves for the splines are machined into the base of the periphery of the motor body. The high explosive body is filled with 270 pounds of the German explosive charge 13A, which is 50/50 poured amatol.

The 32 venturi holes in the nozzle plate are set at an angle of 14° to the axis of the rocket. In the center of the nozzle plate there is a threaded hole to receive the igniter primer for the rocket propellant.

A rear spacer ring welded to the nozzle plate aids in the positioning of the outer row of propellant charges.

SPECIFICATIONS

Caliber	38 cm (15 ins. approx.)
Total weight of rocket	761 lbs.
Overall length (not including fuze).....	56.68 ins.
Diameter of bourrelet	14.94 ins.
Maximum range	6,179 yds.
Weight of explosive charge	270 lbs.
Weight of propellant charge	88.5 lbs.
Fuze	Point detonating
Weapon from which fired	Raketenwerfer 61



This is an antiaircraft rocket projectile containing a parachute to which is attached a length of cable, designed for use in large numbers to form a barrage against low flying aircraft. The projectile consists of four parts: nose piece, propellant chamber, parachute housing, and cable housing and tail unit.

The nose piece is ogival in shape and screws onto the forward end of the propellant chamber. It contains a TNT destructive charge, weighing approximately 2.3 pounds, and initiated by means of a delay fuze connected to the propellant chamber.

This is a steel cylinder closed at the forward end and threaded externally at the rear end to fit into the parachute housing. Four drillings in the forward end of the parachute housing form the venturi through which the propelling gases escape.

At the forward end of the parachute housing is a TNT charge, weighing approximately 2 pounds. Below this charge are located the main and pilot parachutes which are attached to the forward end of the cable. The cable housing is constructed in two parts, the lower of which remains on the ground when the rocket is launched. The upper portion has a finned tail unit which fits over the lower portion of the cable housing. The 1/8-inch cable, attached at its forward end to the parachute, is coiled the length of the cable housing and passes through a hole in the lower portion to a ground anchor.

After launching, the projectile continues upwards until the whole of the cable has been uncoiled; the parachute is then pulled out of the parachute housing and remains suspended in the air until dragged to earth by the weight of the cable. The rocket casing continues in flight until a delay igniter initiates the destructive charge in the nose of the projectile.

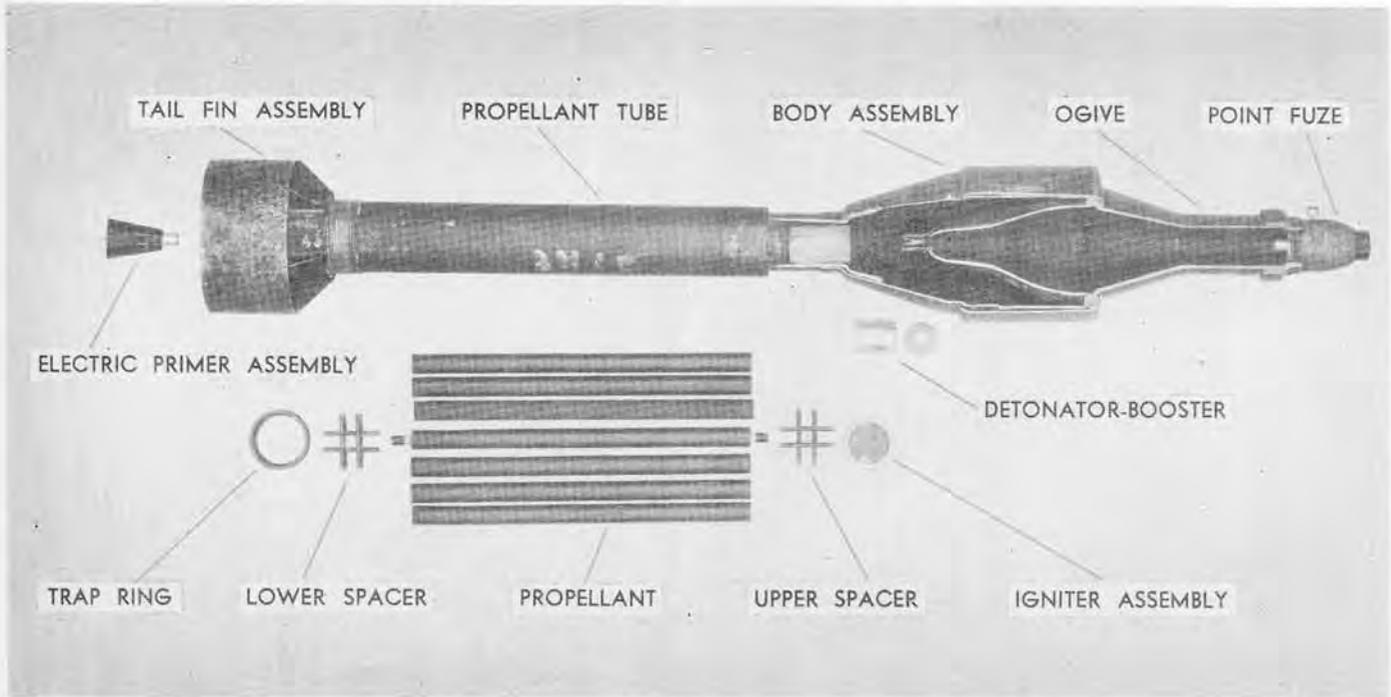
SPECIFICATIONS

Total weight (approx.)	150 lbs.
Weight of parachute housing (containing parachutes and H.E. charge)....	28 lbs., 1 oz.
Weight of fins and cable housing	90 lbs., 4 ozs.
Weight of nose (containing H.E. charge)	4 lbs., 12 ozs.
Weight of rocket motor unit	27 lbs., 11 ozs.
Weight of propellant charge	11 lbs., 10 ozs.
Length of projectile (overall)	58.2 ins.
External diameter (maximum)	7.09 ins.
External diameter of motor tube	5.51 ins.
Internal diameter of motor tube	5.2 ins.
Length of propellant charge	11.7 ins.
Length of cable (approx.)	950 yds.
Diameter of main parachute	11 ft.
Diameter of pilot parachute	6 ins.

HIGH EXPLOSIVE-ANTITANK ROCKET GRENADE

GERMAN 

8.8 cm R. Pz. B. Gr. 4322



This fin stabilized rocket projectile is fired from the German counterpart of the U. S. "Bazooka" (see page 217) and has a maximum effective range of 165 yards. Eight and one-half-inch armor penetration has been obtained in static tests with a standoff of approximately 6½ inches.

The complete round consists of a point fuze high explosive, hollow charge loaded projectile assembled to a steel tube with a venturi and stabilizer assembly attached, containing an igniter, propellant and electric primer. The AZ 5095 fuze is of the point detonating type which in tests gave an approximate fuze functioning time of 0.0002 seconds (impact to detonation). The projectile assembly consists of the following stamped sheet steel parts: a body which contains the bursting charge, an adapter, a collar, a band, and a slightly heavier sheet steel nose. A detonator-booster of the German Kl. Zdlg. 34 NP type is embedded in the bursting charge to the rear of the flash tube. The bursting charge is cyclotol (41.2% TNT, 58.8% cyclonite) weighing 1 lb., 7.2 ozs. The propellant and tube assembly consists of the propellant tube and the seven propellant grains and igniter assembly, located in the forward end which it holds. The seven propellant powder grains are approximately 7.6 inches in length x .45 inch outside diameter, and have a central perforation .22 inch in diameter throughout their length. The composition is 64½% nitrocellulose and 34½% DEGN, with a small percentage of stabilizer.

A new type of ammunition, the R. Pz. B. Gr. 4999 is reported to give good performance up to a range of 220 yards, 25° C. (77° F.).

SPECIFICATIONS

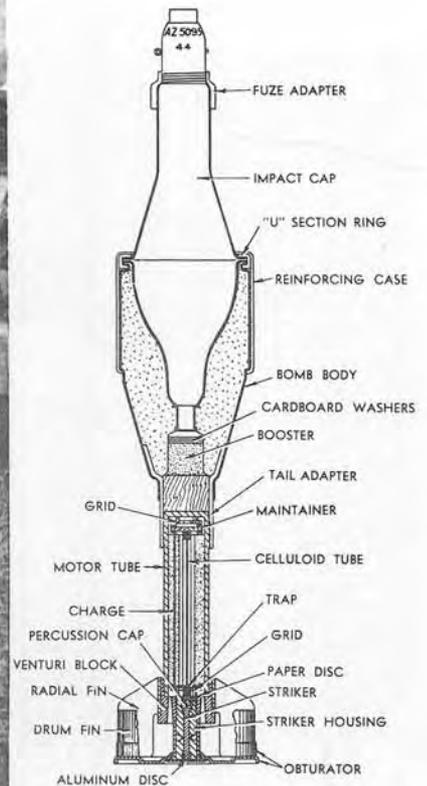
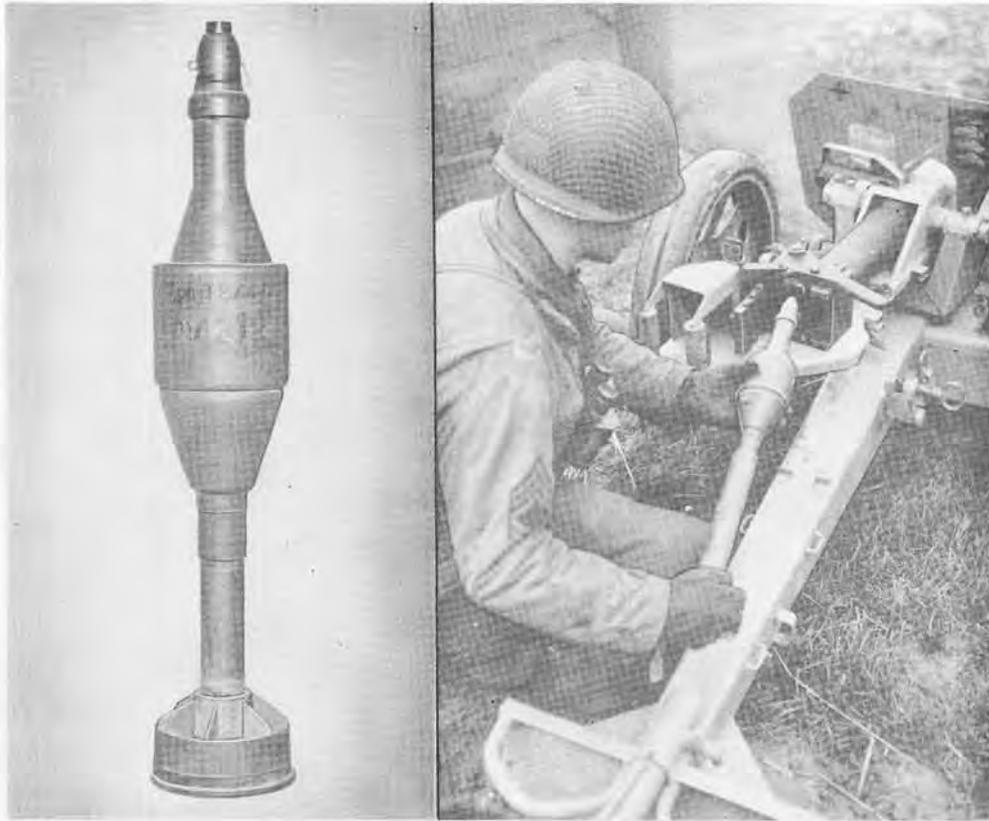
Weight (complete, rocket as fired).....	7.26 lbs.
Weight of high explosive filler	1.47 lbs.
Weight of fuze assembly .....	.175 lb.
Weight of igniter assembly .....	.021 lb.
Weight of propellant charge .....	.382 lb.
Length (overall)	25.56 ins.
Diameter (external)	3.437 ins.
Burnt velocity at 50° F. (approx.)	340 f/s*
Burning distance (approx.)	7 ft.*
Fuze functioning time (approx.).....	.0002 seconds
Maximum pressure	6,910 lbs. per sq. in.*
Maximum thrust	1,716 lbs.*
Impulse	87 lbs. second**
Maximum effective range	165 yds.

* These figures are from firing a single round.

** These values doubtful; only one rocket motor was statically tested with propellant temperature 41° F.

ANTITANK ROCKET GRENADE

8.8 cm R. Pz. B. Gr. 4312



This projectile is fired from the German 8.8 cm Raketenwerfer 43 (Püppchen—see page 352.1). From this weapon, as limited by the sight, a maximum effective range of 700 meters (765 yards) is obtained. The explosive head is identical to that of the rocket fired from the German counterpart of the "Bazooka" (page 357).

The fuze (AZ 5095) functions as follows: the force of set back causes the set-back ring to move rearward, bending the two prongs of the stirrup spring. These prongs, by engaging in the inside groove of the set-back ring prevent the ring from returning forward. Meanwhile, the striker needle is held away from the primer detonator by a flat, coiled clock spring inside the set-back ring. The clock spring unwinds, expanding against the inside of the fuze body, thus providing a slight delay in the arming of the fuze.

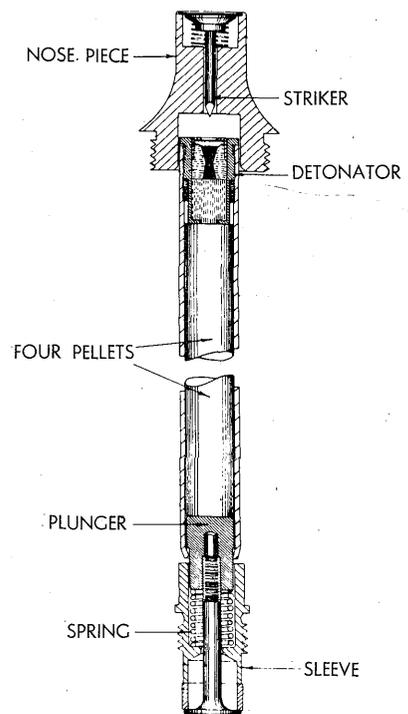
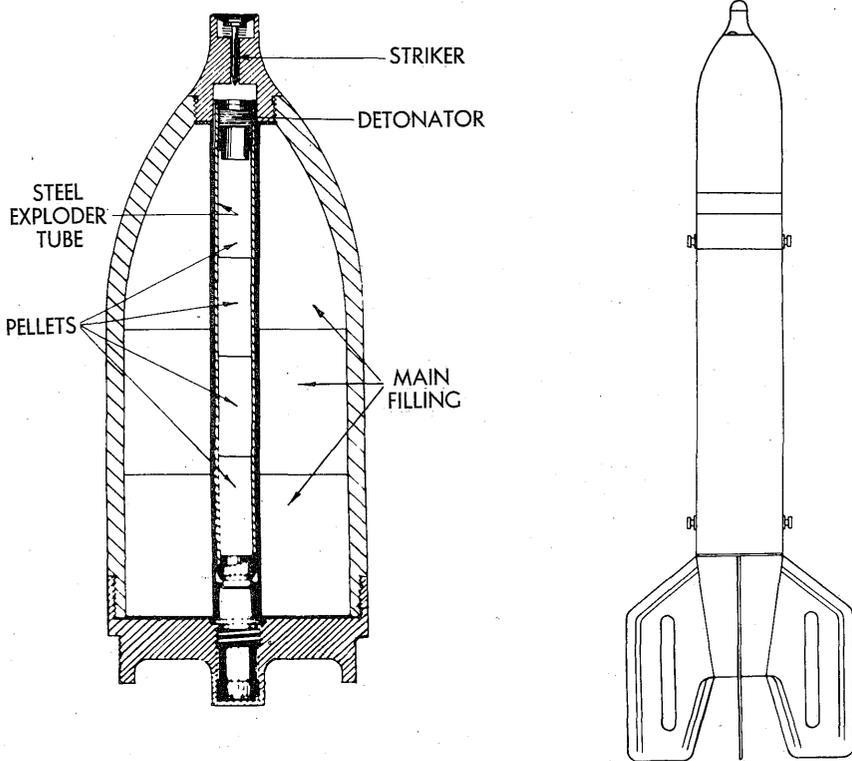
The propellant is a double base powder in the form of a single grain with 14 perforations. There is a hole .364 inch in diameter through the center of the grain. Three lands on the outside of the grain insure an outside burning surface. A triangular-shaped spacer holds the head igniter firmly against the quickmatch. The quickmatch fits in a slight indentation in the head igniter. The primer used in the "Püppchen" rocket is the standard No. 26 percussion primer found in many German artillery fuzes.

SPECIFICATIONS

Weight (complete, as fired).....	5 lbs., 13.06 ozs.
Weight of H.E. filler	1 lb., 7¼ ozs.
Weight of fuze with detonator	3.15 ozs.
Weight of motor and tail assembly..	1 lb., 8.5 ozs.
Weight of propellant	1.63 ozs.
Overall length	19.64 ins.
Length of propellant grain	4.95 ins.
Diameter of propellant grain .....	.85 ins.
External diameter	3.494 ins.

H. E. UNROTATED ROCKET

8 cm Raketen Sprenggranate



H. E. WARHEAD

This rocket is actually 78 mm in diameter. Two features distinguish it from other German rockets: the use of tail fins to secure stability in flight without rotation, and the employment of a novel fuze arming device.

The complete round weighs 15.19 pounds and is nearly 28 inches long. Its two principal components are the nose fuze high explosive war head and the rocket motor tube. The shell is attached by means of an adaptor ring and the motor tube is closed by a cone-shaped assembly carrying the fins and containing the venturi and propellant supporting grid. Six tubular sticks of cordite form the propellant ignited by a circular gun powder igniter set off by a wire ignition bridge. The launcher used is the Mantelrohr.

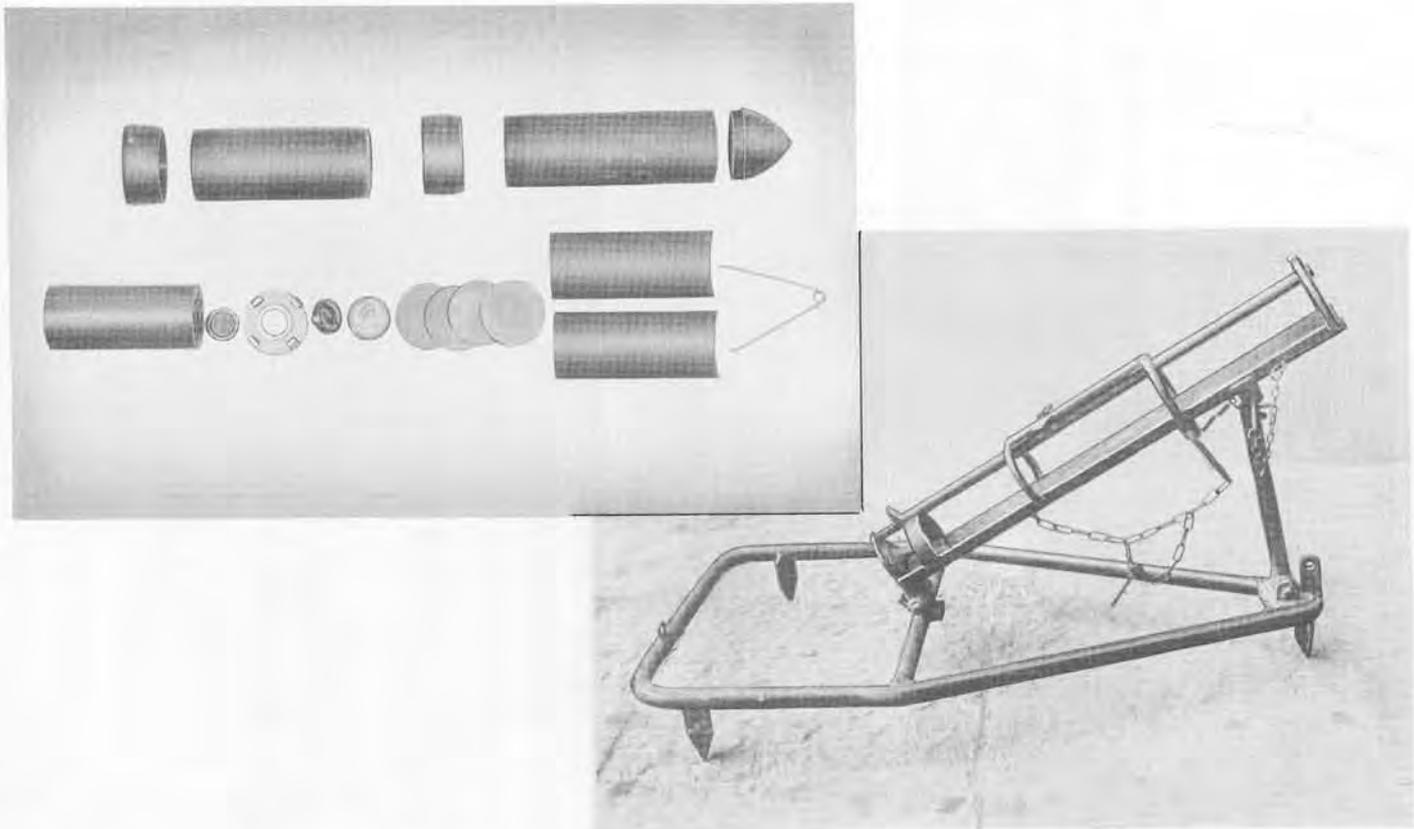
The nose fuze consists of a steel nose piece housing a light alloy striker held by a light spring, a percussion detonator, a magazine containing four pressed pellets, and a thermal arming device. When the rocket is fired, the heat of the propellant gases melts a ring of fusible metal, permitting the detonator and magazine to approach the striker. The main filling of the high explosive head is pressed flake TNT.

FUZE MECHANISM

SPECIFICATIONS

Weight of complete round	15 lbs., 3 oz.
Weight of motor unit with central adaptor..	10 lbs.
Weight of high explosive head with central adaptor	6 lbs., 5 oz.
Weight of high explosive filling.....	1 lb., 5½ oz.
Weight of fuze (approx.)	4 oz.
Weight of propellant sticks	2 lbs., 3 oz.
Length of rocket	27.7 ins.
Ground range (estimated)	6,300 yds.

7.3 cm PROPAGANDA ROCKET PROJECTILE AND LAUNCHER



This is a rocket projectile of conventional design, but having instead of the usual high explosive filling a number of propaganda leaflets in the forward compartment. The projectile consists basically of two steel tubes screwed into a central sleeve. The upper tube carries the propaganda leaflets and is closed at the forward end by a bakelite ballistic cap; a small bursting charge in the sleeve serves to expel the leaflets. The lower tube contains the propellant and is closed at the lower end by a screwed-in base plug.

The leaflets are wrapped around a steel spring and are in turn inclosed in a light metal cylinder split horizontally. The ejection charge for the leaflets is fired by an igniter and a delay train when the split cylinder containing the leaflets is ejected; the spring around which the leaflets are wrapped forces apart the two halves of the cylinder and scatters the leaflets.

The projector used for launching the rocket is of simple design and construction. The base frame is formed of 1¼-inch tubular steel with three spades welded on the underside. A crosspiece of the same tubular steel acts as a brace and also forms a base for the elevation pivot of the rocket guide. This guide consists of a length of 1¾-inch angle iron 29½ inches long.

The launcher is operated on the mortar principle, that is, the rocket is placed on the trough and is held about twenty inches above the striker (which corresponds to the firing pin of a mortar) by a release lever. A cord which the operator may pull from a safe distance leads from the release lever, thereby permitting the rocket to slide down against the striker.

SPECIFICATIONS

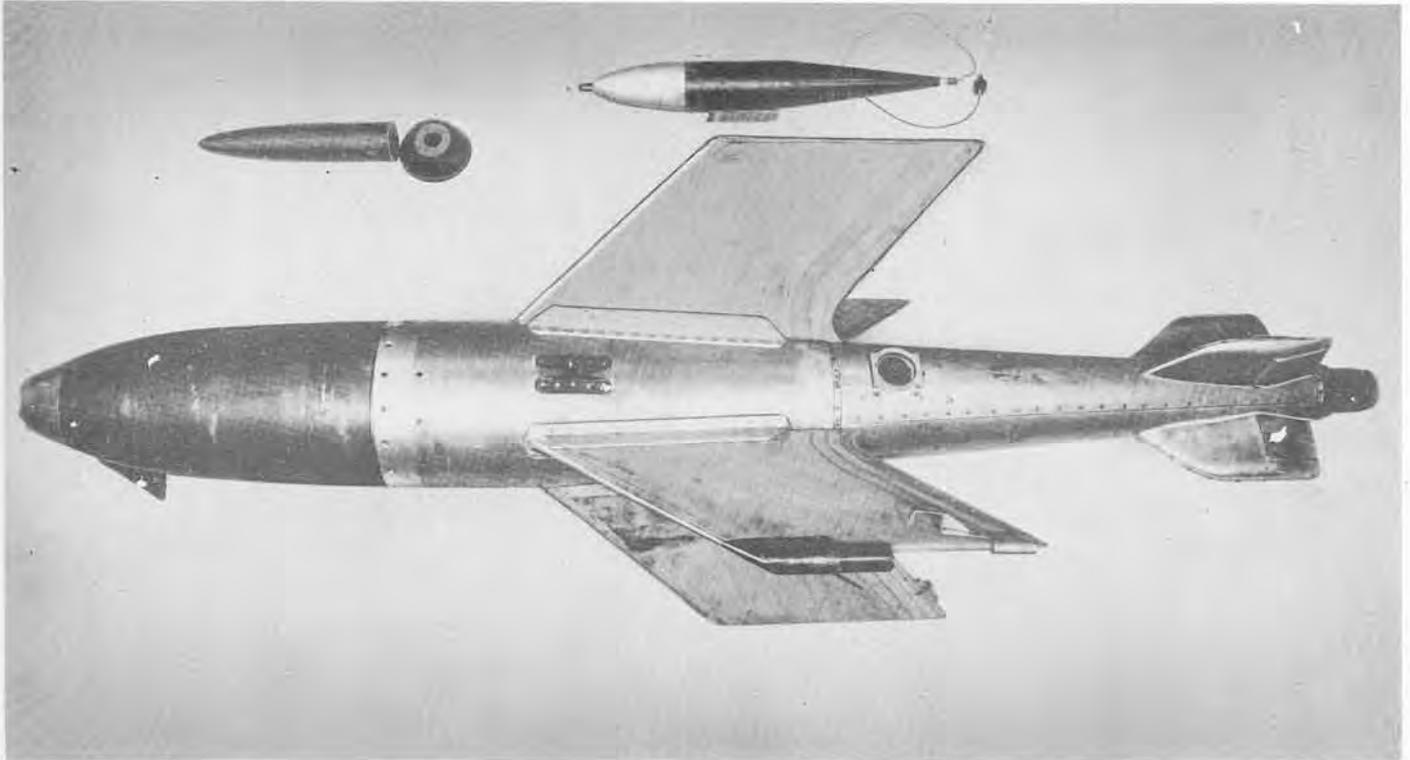
ROCKET

Overall length of complete round.....	16 3/32 ins.
Length of plastic cap	2.21 ins.
Length of message body	6.87 ins.
Length of propellant chamber	4.70 ins.
Length of nozzle assembly	1.30 ins.
Length of stick powder	5.234 ins.
Diameter of stick powder	2.308 ins.
Weight of complete round	6 lbs., 10 oz.
Weight of propellant	1 lb.

LAUNCHER

Overall length	45.7 ins.
Overall width	19.7 ins.
Length of guide	29.5 ins.
Overall height with guide at 45°	28 ins.
Weight	27 lbs.

X 4



The X 4 is an anti-aircraft rocket designed by the Germans to be launched from planes. It was manufactured and reported to have been successfully tested, but never reached the point of combat operation. It is a wire-controlled, rocket-propelled, fin-stabilized missile fitted with a proximity fuze warhead. The propulsion system is a bi-fuel rocket. Stabilization is achieved by means of four large fins fitted to the body of the rocket, and four smaller fins fitted to the tail. The smaller fins bear solenoid-operated control surfaces through which two-dimensional directional control is achieved. These are operated from the parent aircraft by means of a control unit and two insulated wires leading to the rocket. These wires are about 3¼ miles long.

Precise information about the warhead and fuze system has not so far been recovered. The warhead consists of an uncased moulded grain of dinitroglycol-based explosive which depends on high blast effect. The fuze is a combination of acoustic proximity, impact, and self-destructing type. The proximity feature is functioned by aircraft propeller noises and a delay of 1/50-second is provided to enable the missile to approach the target after the acoustic impulse initiates the fuze. The body of the rocket houses the helical aluminum tube fuel tanks and combined two-compartment steel air bottle. The venturi protrudes from the tail portion. The rocket is made to rotate about its axis at the rate of one rotation per second. This permits stabilization in line of flight by a single gyro. The missile is carried on the parent aircraft on a conventional bomb carrier modified for this special purpose.

SPECIFICATIONS *

Length (overall)	200 cm (6 ft., 6¾ ins.)
Length of warhead	45 cm (1 ft., 5¾ ins.)
Diameter of warhead (at base)	22 cm (8.675 ins.)
Total weight before launching	60 kg. (132.3 lbs.)
Weight of warhead	20 kg. (44.1 lbs.)
Fuel.....	4.5 liters (approx.) 98-100% nitric acid
	2 liters (approx.) 57% crude m-xylydine 43% triethylamine
Thrust.....	Initial 270 lbs. to 315 lbs. falling off progressively to 45 to 68 lbs. after 30 seconds.

*Not verified.

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Lewis Machine Gun, Model 92 (1932)	214.1
Heavy Machine Gun, Model 92 (1932)	215
Aircraft Machine Gun, Model 89 (1929)	216

7.92 mm

Double Barrel Flexible Aircraft Machine Guns, Type 100 and Type 1	216.1
Aircraft Machine Gun, Model 98 (1938)	217

8 mm

Automatic Pistol "Nambu"	201
Automatic Pistol, Model 14 (1925)	202
Automatic Pistol, Model 94 (1934)	203
Submachine Gun, Model 100 (1940)	204.1

9 mm

Revolver, Model 26 (1893)	204
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12.7 mm

Aircraft Machine Gun (Browning Type) ...	218
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13 mm

Antiaircraft Machine Gun, Model 93 (1933)	219
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20 mm

Automatic Antitank Rifle, Model 97 (1937)	101
Antiaircraft/Antitank Automatic Cannon, Model 98 (1938)	102
Aircraft Automatic Cannon, Model 1 (1941) Mod. E.	251

25 mm

Dual & Triple A.A./A.T. Automatic Can- non, Model 96 (1936)	103
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35 mm

Pyrotechnic Pistol, Model 10	205
------------------------------------	-----

37 mm

Infantry Gun, Model 11 (1922)	104
Gun, Model 94 (1934)	105

47 mm

Antitank Gun, Model 1 (1941)	106
------------------------------------	-----

50 mm

Grenade Discharger, Model 10 (1921)	118
Grenade Discharger, Model 89 (1929)	119
Mortar, Model 98 (1938)	120

57 mm

Tank Gun, Model 97	106.1
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70 mm

Howitzer, Model 92 (1932)	107
Mortar, Model 11 (1922)	121

75 mm

Field Gun, Model 38 (1905)	108
Regimental Gun, Model 41 (1908)	109
Mobile Field Antiaircraft Gun, Model 88 (1928)	110
Field Gun, Model 90 (1930)	111
Mountain (Pack) Gun, Model 94 (1934)	112
Field Gun, Model 95 (1935)	113

81 mm

Mortar, Model 97 (1937)	122
Mortar, Model 3	122.1
Mortar, Model 99 (1939)	123

90 mm

Mortar, Model 94 (1934)	124
Mortar, Model 97 (1937)	125

105 mm

Howitzer, Model 91 (1931)	114
Gun, Model 92 (1932)	115

150 mm

Howitzer, Model 4 (1915)	116
Howitzer, Model 96 (1936)	117
Mortar, Model 97 (1937)	127

320 mm

Spigot Mortar	126
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The Model 97 Special Medium Tank was first placed in operation in the early spring of 1942. It is a modification of the Model 2597 Medium Tank (see page 9) with a modified turret to accommodate the 47 mm Model 1 (1941) tank gun instead of the normal short-barreled 57 mm gun.

The 47 mm tank gun conforms to the 47 mm Model 1 (1941) antitank gun (page 106) in the dimensions of chamber, caliber, and rifling and its performance is similar. The tank gun, however, has a vertical sliding breechblock, while the antitank gun has the horizontal type. The tank gun has a total traverse of 22° with an elevation from -11° to +17°. It is shoulder-controlled, with geared elevation and depression. However, free movement can be obtained, if desired. Penetration tests on the antitank gun indicate a penetration of 2½ inches of homogeneous plate at normal at a range of 1,050 yards.

The Special Tank is readily recognized by its elongated turret, slightly offset to the right. This turret measures six feet from front to rear and three feet across the rear bulge. There is a door 19" x 16" in the turret back plate, an exit hatch 23" x 16" in the turret top plate, and an observation hatch 25" in diameter in the cupola with a vision port 4" in diameter in the cupola top plate. The gun mantlet of 30 mm thickness, sloped at 10° to the vertical, is bolted to the turret front. A 7.7 mm Model 97 L.M.G. is mounted at the turret rear. Another is mounted in the superstructure front plate at the left of the driver.

The armor plate thickness of the Special Tank is essentially the same as that of its predecessor except that the hull side plates of the former have been increased in thickness to 35 mm.

SPECIFICATIONS

Weight (approx.)	15 tons
Length	18 ft., 1 in.
Width	7 ft., 8 ins.
Height	7 ft., 11 ins.
Ground clearance	14 ins.
Tread centers	6 ft., 7 ins.
Ground contact	11 ft., 7 ins.
Width of track	13 ins.
Pitch of track	4¾ ins.
Track links	96
Fording depth	3 ft., 3 ins.
Theoretical radius of action	
Roads	100 miles
Cross country	
Armor	
Turret front	25 mm at 10° to vertical
Gun mantlet	30 mm cast at 10° to vertical
Front vertical plate.....	25 mm at 10° to vertical
Glacis plate	17 mm at 80° to vertical
Nose plate	15 mm at 62° to vertical
Side superstructure.....	20 mm at 40° to vertical
Side hull plates	35 mm
Top rear plate	12 mm
Armament	
One 47 mm model 1 (194) tank gun; two type 97 light machine guns.	
Ammunition (Rds.)	
104 rounds of 47 mm ammunition; 2,575 rounds of small arms ammunition.	
Engine	
Air-cooled, V-12 diesel.	
Transmission	
Main gear box—4 speeds forward, 1 reverse—high and low ratios.	
Steering	Clutch brake
Crew	5



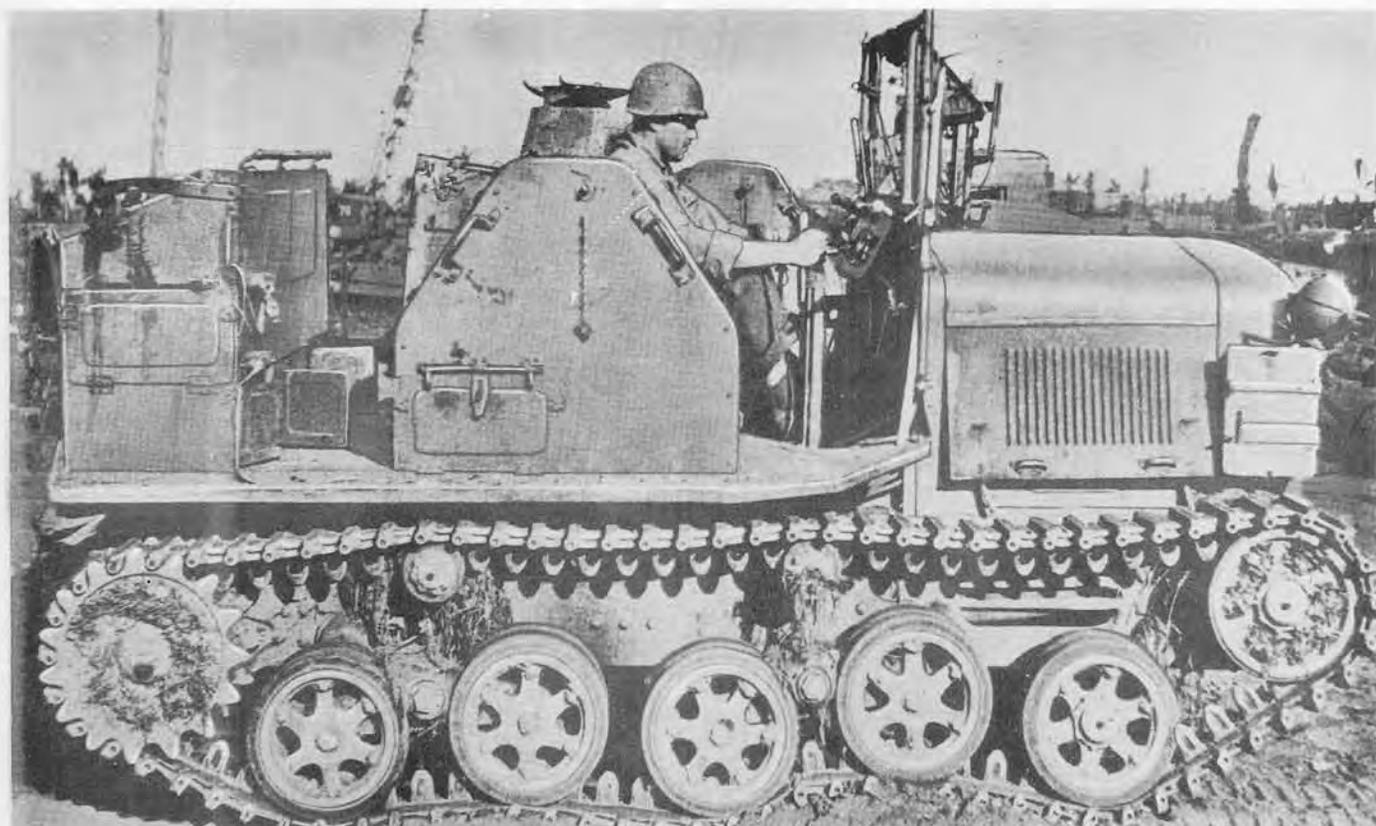
This weapon is the 38 year type (1905) 15 cm howitzer mounted on a medium tank chassis. The chassis resembles that of the Medium Tank Model 2597 (1937), Special, described on page 8.1. The armor is riveted in the characteristic Japanese fashion, and on the chassis is of the same thickness as on the corresponding tank chassis, with a maximum of approximately one inch. On the superstructure, the gun shield has one-inch frontal armor and one-half-inch side armor.

The vehicle uses the standard V12, air-cooled, diesel engine, and the type 97 medium tank suspension, consisting of six dual rubber-tired bogie wheels on each side. The weapon mounted on this vehicle is the type 38 (1905) 15 cm howitzer, a very short weapon. It has an interrupted screw breechblock opening to the right, and uses a percussive primer. The rifling is 58 inches long and has increasing right hand twist. The maximum range of the Field Howitzer is reported as 6,500 yards. The maximum elevation is 30 degrees.

A self-propelled vehicle mounting a gun of 75 mm or 105 mm caliber, employing the same chassis and with a superstructure somewhat resembling the present vehicle has been reported.

SPECIFICATIONS

Weight	15 tons
Length	18 ft.
Width	7 ft., 6 ins.
Height (overall)	93 ins.
Height of chassis	47 ins.
Height of shield	61 ins.
Ground clearance	14 ins.
Tread centers	6 ft., 7 ins.
Ground contact (approx.)	160 ins.
Width of track	13 ins.
Pitch of track	5½ ins.
Track links	96
Fording depth	39 ins.
Theoretical radius of action:	
Roads	100 miles
Cross country	
Speed:	
Roads	25 m.p.h.
Cross country	
Armor: gun shield	
Front plate	1 in.
Sides	½ in.
Armament	15 cm Howitzer, Model 38 (1905)
Ammunition (Rds.)	
Engine	V12, air-cooled, diesel
Transmission—4 speeds forward; 1 reverse (high and low range)	
Steering	clutch brake
Crew	probably 5

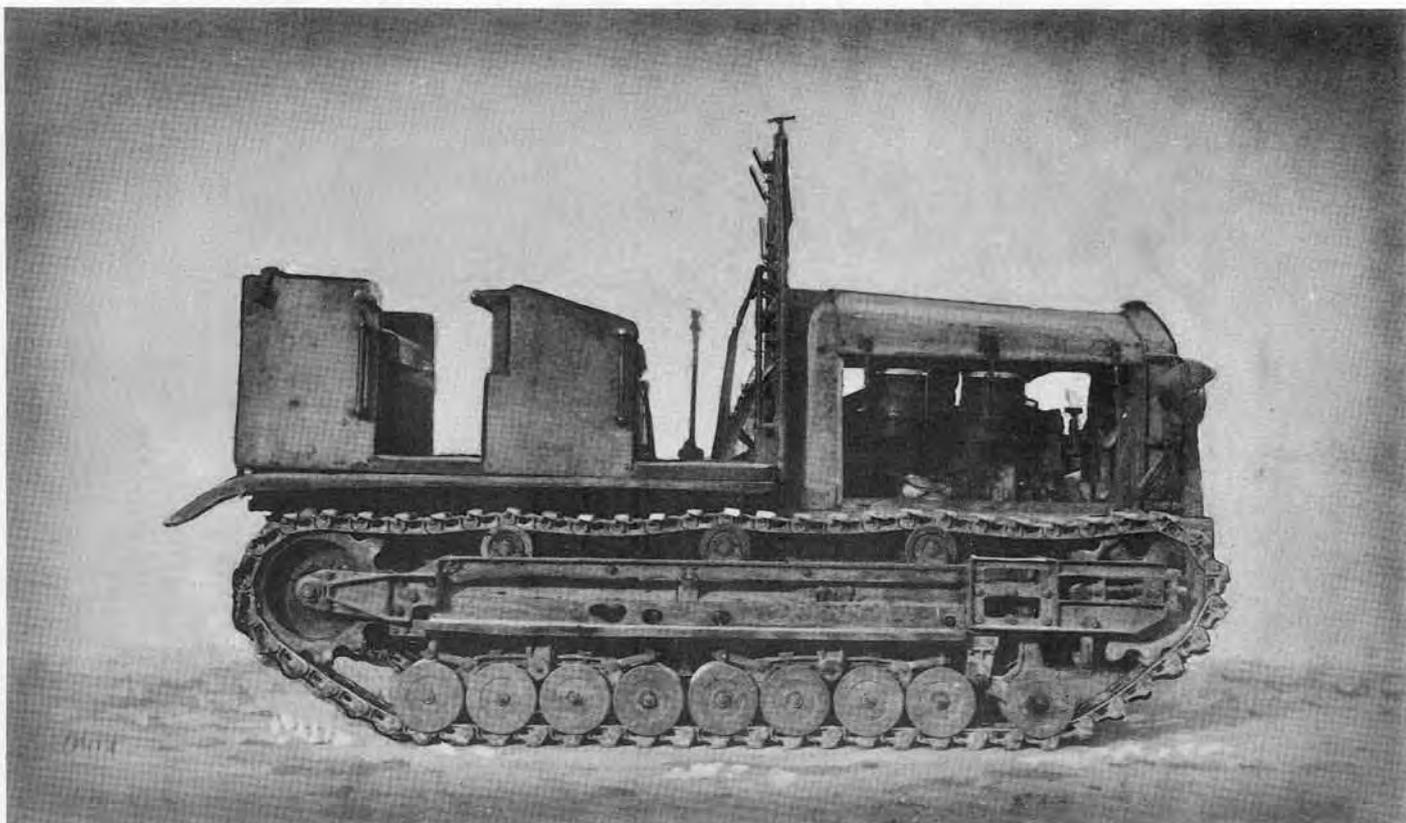


The 4-ton Prime Mover is powered by a 90°, V-8 air-cooled gasoline engine with a cylinder bore of 90 mm and a piston stroke of 125 mm. The normal horsepower is 73 at 1,600 r.p.m.; maximum horsepower is 88. The firing order is 1-8-7-3-6-5-4-2. The electrical system includes a Bosch type magneto (Gesal model); a Bosch R.T.C. 900 LI model, 75-watt generator; a 12-v., 80 amp.-hr. storage battery, and a Bosch 2.5 hp. electric starting motor. The ratio of the final drive is 5.657:1. Clutch brake steering is used and both hand and foot operation applies the brakes. The transmission is the central selector type with 4 speeds forward and 1 reverse.

The vehicle is capable of towing its complement of artillery at 25 m.p.h. There is a main and auxiliary type of lubricating oil pump. Oil pressure is 4.4 to 6.6 lb. of gage pressure when warmed up. A Stromberg UR Z model carburetor is used. The main fuel storage tank has a capacity of 26.6 gals. In addition, there is an auxiliary tank having a capacity of 15.8 gals. A Sirocco type fan provides circulation for the air-cooled engine. A dry two-plate clutch is used. The grade-ascending ability is said to be 30° under the towing load. This vehicle can pivot turn. The winch capacity is 2.2 tons. The theoretical radius of action is 125 miles in 10 hours.

SPECIFICATIONS

Weight	4 tons
Trailer load capacity	
Winch capacity	over 2 tons
Length	12 ft., 5 ins.
Width	6 ft., 1 in.
Height	7 ft., 3 ins.
Ground clearance	11.5 ins.
Tread centers	5 ft., 4 ins.
Ground contact	7 ft., 8 ins.
Track width	10 ins.
Track links	5½ ins.
Fuel tank.....Main, 26.6 gals.; aux., 15.8 gals.	
Fuel consumption	
Fording depth	20 ins.
Speed	25 m.p.h.
Engine	V-8 cyl., air-cooled, gasoline
Bore and stroke.....	90 mm x 125 mm— 3.54 ins. x 4.92 ins.
Horsepower	88 (max.)
Ignition	Magneto
Battery	12 v., 80 amp.-hr.
Transmission.....Selector type	
	4 speeds forward, 1 reverse
Steering	Clutch brake
Crew	6



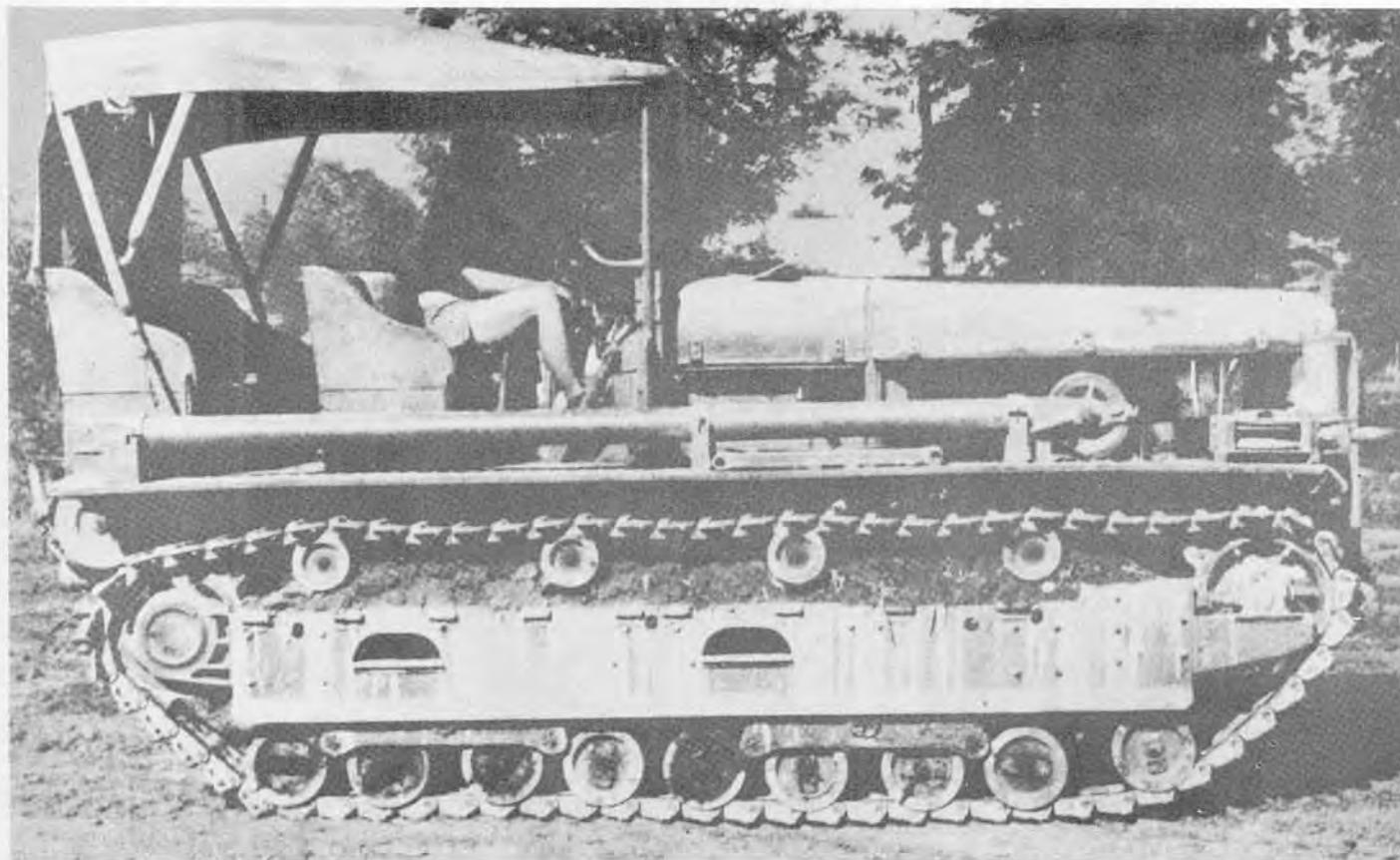
It is reported that there are two variations of this vehicle. Model A is powered by a 6-cylinder in-line L-head Sumida gasoline engine, and Model B by a 6-cylinder in-line air-cooled Isuzu Diesel. As far as may be ascertained, with exception of a modification in radiator design, the general appearance and suspension of these two models is similar.

The Model A engine is an L-head type with the valves on the side. The cylinder bore is 110-mm, the stroke 135 mm, and the compression ratio is 4.5:1. The normal hp. is 64 at 1,200 r.p.m.; the maximum hp. is 98. Ignition is provided by a Bosch high-tension magneto with 12-v. charging generator and two 12-v. 60 amp.-hr. vibration-proof batteries. The electric starting motor is 12-v. with a rating of 2.5 hp. Bevel spur pinion and ring gears have reduction ratios of 2.66 and 5.

The steering system is the clutch brake type with both hand- and foot-operated brakes. The transmission provides four speeds forward and one reverse. The maximum speed is 19 k.p.h. (11.8 m.p.h.). The lubricating oil is distributed by gear pump force-feed system. Oil pressure registers 1.0 kg. (2.2 lb.) at low speed and 2 kg. (4.4 lb.) at 1,100 r.p.m. The oil capacity measures 14.65 liters (3.7 gal.). A vacuum fuel system is used with Stromberg UT 4 model carburetor. The main fuel storage tank holds 125 liters (32 gal.), the auxiliary tank 55 liters (14.5 gal.). Fuel consumption is 17 liters (4.5 gal.) per hour, or 1.05 liters per km. (2.4 mi./gal.). The cooling liquid is circulated by a centrifugal pump from a radiator, which carries 39.5 liters (10.4 gal.). The grade ability of this vehicle pulling a fixed weight is 30°. The winch capacity is 2.5 metric tons (2.8 tons). The winch cable length is 20 meters (65½ ft.).

SPECIFICATIONS

Weight	4.8 Metric tons—5.28 tons
Trailer load capacity....	4.5 Metric tons—4.9 tons
Winch capacity	2.5 Metric tons—2.75 tons
Length	3.55 m—11 ft., 8 ins.
Width	1.71 m— 5 ft., 11 ins.
Height	2.35 m— 7 ft., 8 ins.
Ground clearance .....	.295 m—11.75 ins.
Tread centers	5 ft., 11½ ins.
Ground contact	7 ft., 4½ ins.
Track width	9¾ ins.
Track links	59
Fuel tank	Main, 32 gals.; aux., 14.5 gals.
Fuel consumption	2.4 m.p.g.
Fording depth	24 ins.
Speed	
Hard roads	18 m.p.h.
Cross-country	8 m.p.h.
Engine	Sumida, 6-cyl., gasoline
Bore and stroke.....	110 mm x 135 mm— 433 ins. x 5.31 ins.
Horsepower	64 at 1,200 r.p.m. (normal)
Ignition.....	Bosch high-tension magneto
Battery	2 12-v., 60 amp.-hr.
Transmission	4 speeds forward, 1 reverse
Steering	Clutch brake
Crew	6



This vehicle is powered by a 6-cylinder, in-line, water-cooled gasoline engine with a cylinder bore of 135 mm and piston stroke of 150 mm and a compression ratio of 5.1:1. Normal horsepower is 130 at 1,300 r.p.m.; maximum horsepower, 160 at 1,900 r.p.m. The firing order is 1-5-3-6-2-4. Ignition for the vehicle is distributed by a high-tension type magneto. The electrical system includes charging generator; two 12-v., 80 amp.-hr. batteries, and a 24-v. electric starting motor of 8-hp. capacity.

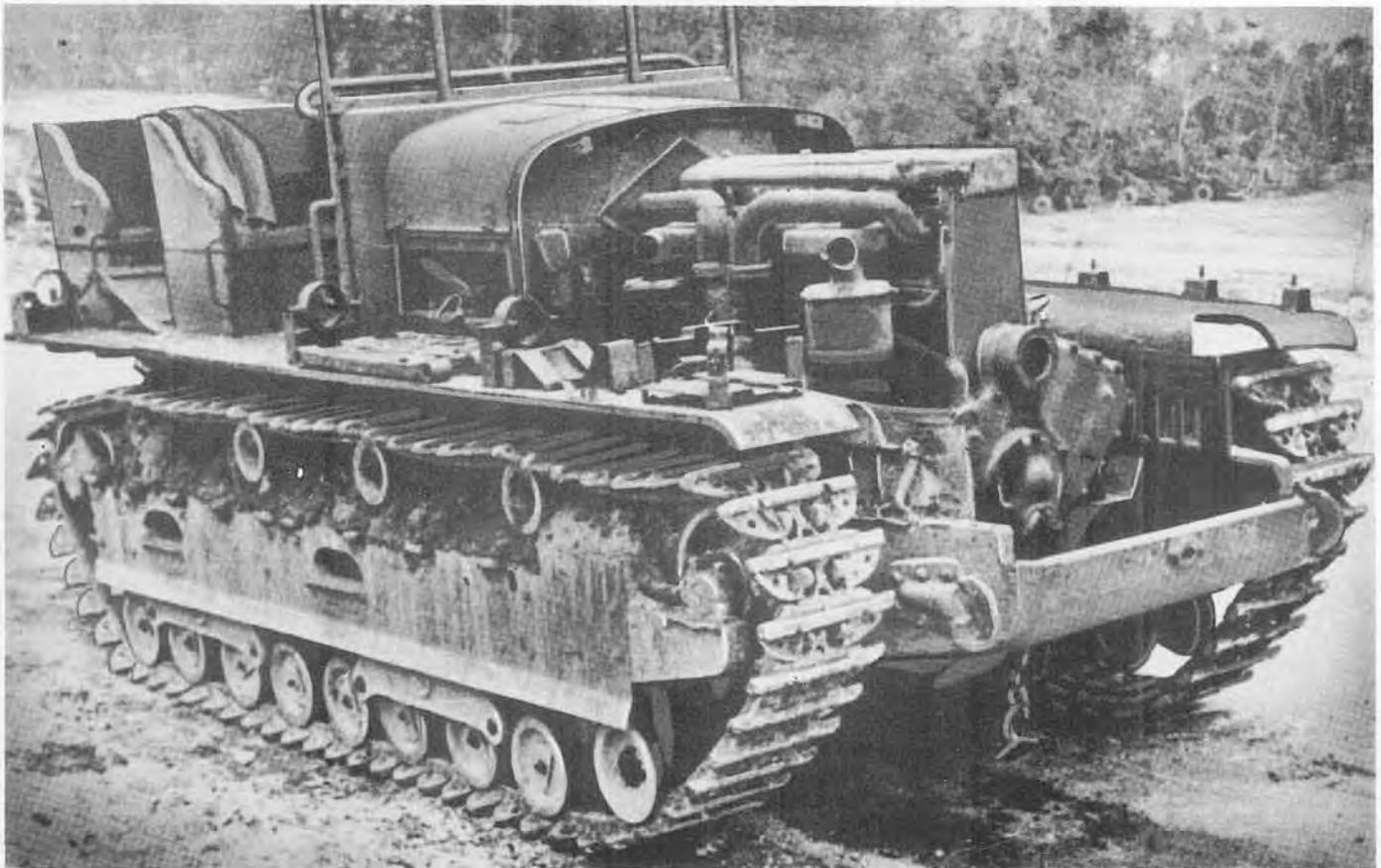
The final drive has a reduction ratio of 2.93:1. A dry multiple plate clutch is used. Both foot- and hand-operated brakes are employed and the vehicle is steered by the clutch brake principle and is said to utilize a locking feature of the control brakes. The transmission is of the synchromesh type with 4 speeds forward and 1 reverse.

Lubricating oil is distributed by gear-type force-feed system through an oil-pressure regulator. The oil-pressure gage registers 29-44 lb. and an oil-level stick is used for checking the crankcase, which has a capacity of 5¾ gals. It has been stated that the fuel feed equipment includes a fuel pump between the carburetor and storage tank and that the heavy-duty type of fuel is forced fed to a NIPPON B 45 model carburetor.

There are two models of fuel storage tanks manufactured for this vehicle—one is the Mitsubishi type with main tank holding 70 gals. and an auxiliary holding 43 gals., and the other is the NIIGATA type main tank holding 50 gals. and an auxiliary tank holding 38 gals. Fuel consumption is stated to be 7.5 gals. per hour. The radiator holds 11 gals., circulated by a pump to the engine block. The grade-ascending ability of this prime mover is quoted as 14 tons up a 15° incline, or 32 tons on a 7½° incline. The winch capacity is 11 tons.

SPECIFICATIONS

Weight	14.3 tons
Trailer load capacity	32 tons
Winch capacity	11.25 tons
Length	16 ft.
Width	7 ft., 6 ins.
Height	9 ft., 3 ins.
Ground clearance	1 ft.
Tread centers	5 ft., 11 ins.
Ground contact	9 ft., 9 ins.
Track width	16½ ins.
Track links	
Fuel tank	Main, 70 gals.; aux., 43 gals.
Fuel consumption .....	.83 m.p.g.
Fording depth	
Speed	6.2 m.p.h.
Engine	6-cyl., water-cooled, gasoline
Bore and stroke.....	135 mm x 150 mm— 5.31 ins. x 5.91 ins.
Horsepower	130 at 1,300 r.p.m.
Ignition	High-tension magneto
Battery	2 12-v., 80 amp.
Transmission.....	Synchromesh
	4 speeds forward, 1 reverse
Steering	Clutch brake
Crew	

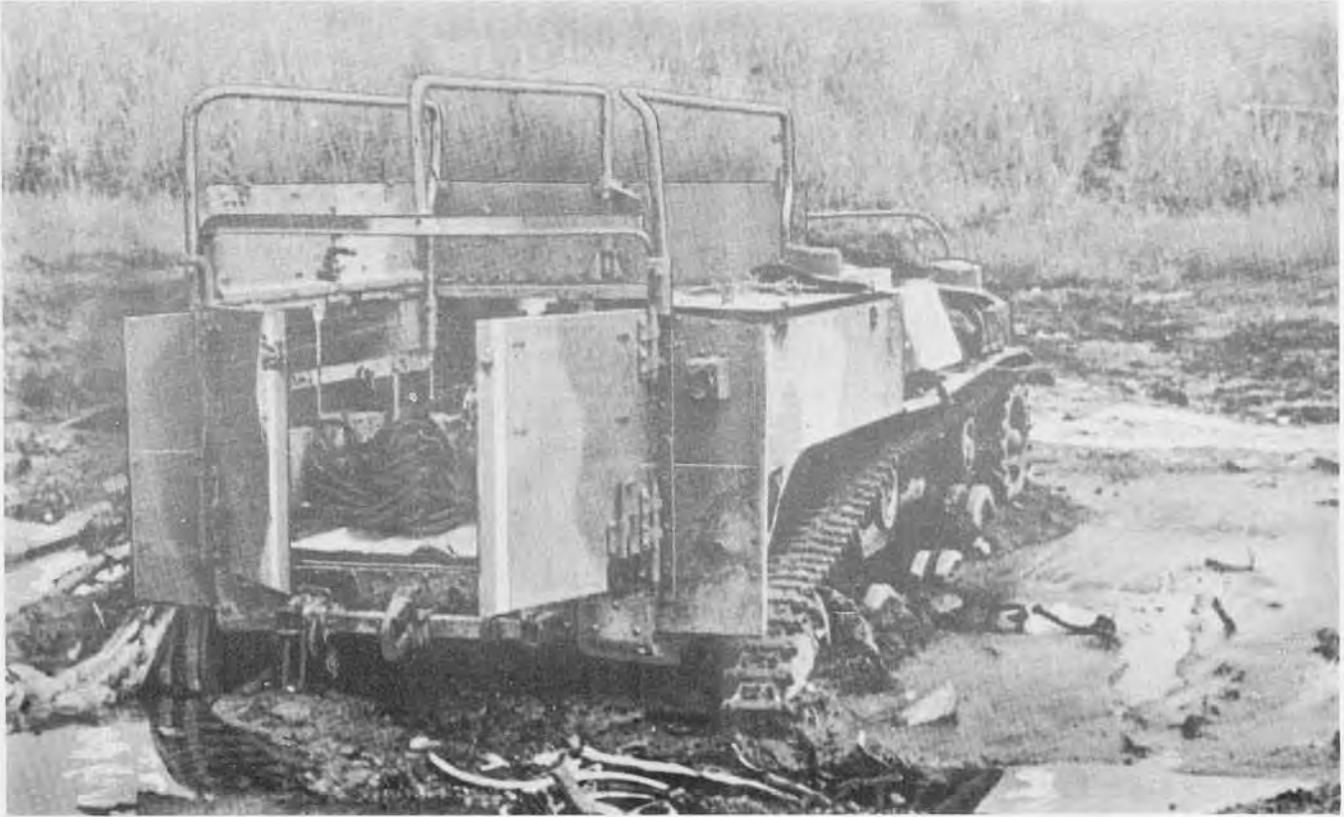


This prime mover makes use of the same chassis as the Model 95A, the only difference being its accommodation of a 6-cylinder, in-line, water-cooled, valve-in-head Diesel engine. The cylinder diameter is 140 mm, the piston stroke 190 mm, and compression ratio 15.5:1. The normal horsepower is rated at 145 at 1,300 r.p.m. Maximum hp. is 165. The firing order is 1-5-3-6-2-4. There is a 24-v., 300-w. capacity charging generator, two 12-v., 80 amp.-hr. batteries, and two 24-v., 6-hp. electric starting motors.

Details are lacking on the reduction gear, which has a ratio of 2.92:1. The steering system is of the clutch brake type assisted on short turns by hand- and foot-operated control brakes, which include a locking feature. The transmission is said to be synchromesh with 4 speeds forward and 1 reverse. The maximum speed is 8.68 m.p.h. A gear-type forced-feed system is used for distributing lubricating oil in the crankcase. An oil pressure gage and oil-level stick are also fitted. Diesel oil fuel is supplied from a total storage capacity of 68 gals. Forty-four liters (11.6 gals.) of water are circulated from the radiator to the engine block with the normal type pump. This vehicle is said to be capable of ascending a 15° grade while towing a 14-ton load, or a 7½° grade pulling a 32-ton load. The winch capacity is 11 tons.

SPECIFICATIONS

Weight	15 tons
Trailer load capacity	32 tons
Winch capacity	11.25 tons
Length	16 ft.
Width	7 ft., 6 ins.
Height	9 ft., 3 ins.
Ground clearance	1 ft.
Tread centers	5 ft., 11 ins.
Ground contact	10 ft., 4 ins.
Track width	16½ ins.
Track links	
Fuel tank	68 gals.
Fuel consumption	
Fording depth	
Speed	8.6 m.p.h.
Engine	6-cyl., water-cooled, Diesel
Bore and stroke.....	140 mm x 190 mm— 5.51 ins. x 7.48 ins.
Horsepower	145 at 1,300 r.p.m.
Ignition	Diesel
Battery	2 12-v., 80 amp./hr.
Transmission.....	Synchromesh— 4 speeds forward, 1 reverse
Steering	Clutch brake
Crew	



The chassis of this Japanese armored prime mover incorporates the better design features of the tankette development shown on pages one to three. This vehicle is an important link in the chain of Japanese transportation of personnel and supply in the large mainland areas. Its construction proves that the Japanese attach considerable importance to the interchange and utilization of standard tank component parts on combat vehicles for greater simplification of their supply problem.

The hull provides for a layout of the engine and power train on the right, while the driver's compartment is located on the left side. A large load and stowage compartment at the rear extends over the tracks. Tubular bows are raised for protective covering and camouflage nets. Double doors open at the rear, below which a towing pintle is attached. There is no main armament; however, there is an observation turret built in the roof of the crew compartment behind the driver. Speaking tubes with ear phones are used for crew communication. Four hinged flap-covered openings provide additional vision for the crew and allow employment of small arms weapons.

The power train in this vehicle is made up of the engine, four-speed and reverse transmission, controlled differential with steering brakes and a final drive single reduction gear. The engine is a four-cylinder in-line diesel with Bosch type automatic fuel injection. A 12-volt ignition system is also provided with spark plugs located in the fuel injection ports. The electrical system utilizes parts standard and interchangeable with other vehicles. Two fuel tanks hold 38 gallons.

SPECIFICATIONS

Weight	5 tons
Length	12 ft., 8 ins.
Width	6 ft., 4 ins.
Height	5 ft., 2 ins.
Ground clearance	14 ins.
Tread centers	
Ground contact	124 ins.
Width of track	8 ins.
Pitch of track	3 ins.
Track links	88
Fording depth	31 ins.
Theoretical radius of action	
Roads	
Cross-country	
Speed	
Roads	28 m.p.h.
Cross-country	
Armor	
Front plate	6 mm
Sides	12 mm
Floor	12 mm
Armament	Small arms weapons
Ammunition (Rds.)	Unknown
Engine	4-cylinder air-cooled OHV Diesel
Transmission	4 speeds forward; 1 reverse
Steering	Controlled differential
Crew	2



This vehicle, in addition to its function as a prime mover and wrecker, may have been used as a tank recovery vehicle. It has a total seating capacity of thirteen men. Two front booms are provided, and a removable boom at the rear. The latter can be attached in such a manner as to act as a brace for the vehicle. The front booms, which are traversed by gears, are moved and operated independently by two different operators. There is a large towing winch behind the driver's seat, and two smaller winches near the front end.

The prime mover/wrecker has been derived in part from components of the Japanese Medium Tank. There are five bogies on each side, four of which are mounted in pairs. Each pair connects to a coil spring, and the front bogie wheel is independently sprung by a separate coil spring. The drive sprocket is smaller than that employed in the Medium Tank.

The vehicle is powered by a 6-cylinder, valve-in-head, air-cooled Diesel engine located in the rear. The engine head is made of aluminum. There are two fuel tanks which have a capacity of thirty gallons each. The clutch, a single plate type, is housed in an aluminum clutch housing. The transmission provides four speeds forward and one in reverse. The power takeoff of the winches is from the transmission. The final drive system is quite unusual in that there are two separate drive shafts, and each track is driven by an independent final drive mechanism. Removable track grousers are supplied for use in difficult terrain.

SPECIFICATIONS

Weight	
Trailer load capacity	
Winch capacity	
Length (overall)	20 ft., 8 ins.
Length (less arms)	17 ft.
Width	7 ft., 5½ ins.
Height	7 ft., 11 ins.
Ground clearance	16 ins.
Tread centers	6 ft., 4 ins.
Ground contact	9 ft., 11 ins.
Track width	12 ins.
Track links	
Fuel tanks	2—30 gals. each
Fuel consumption	
Fording depth	
Speed	
Engine.....	6 cyl. valve in head, air-cooled Diesel
Bore and stroke	5.5 ins. x 6.5 ins.
Horsepower	
Ignition	
Battery	2—12 v.
Transmission.....	4 speeds forward, 1 reverse
Steering	
Crew	13



This vehicle serves as an artillery prime mover and as a personnel carrier for 24 men. It appears to be of recent manufacture, and its first known appearance in combat was during the Leyte campaign in the Philippines.

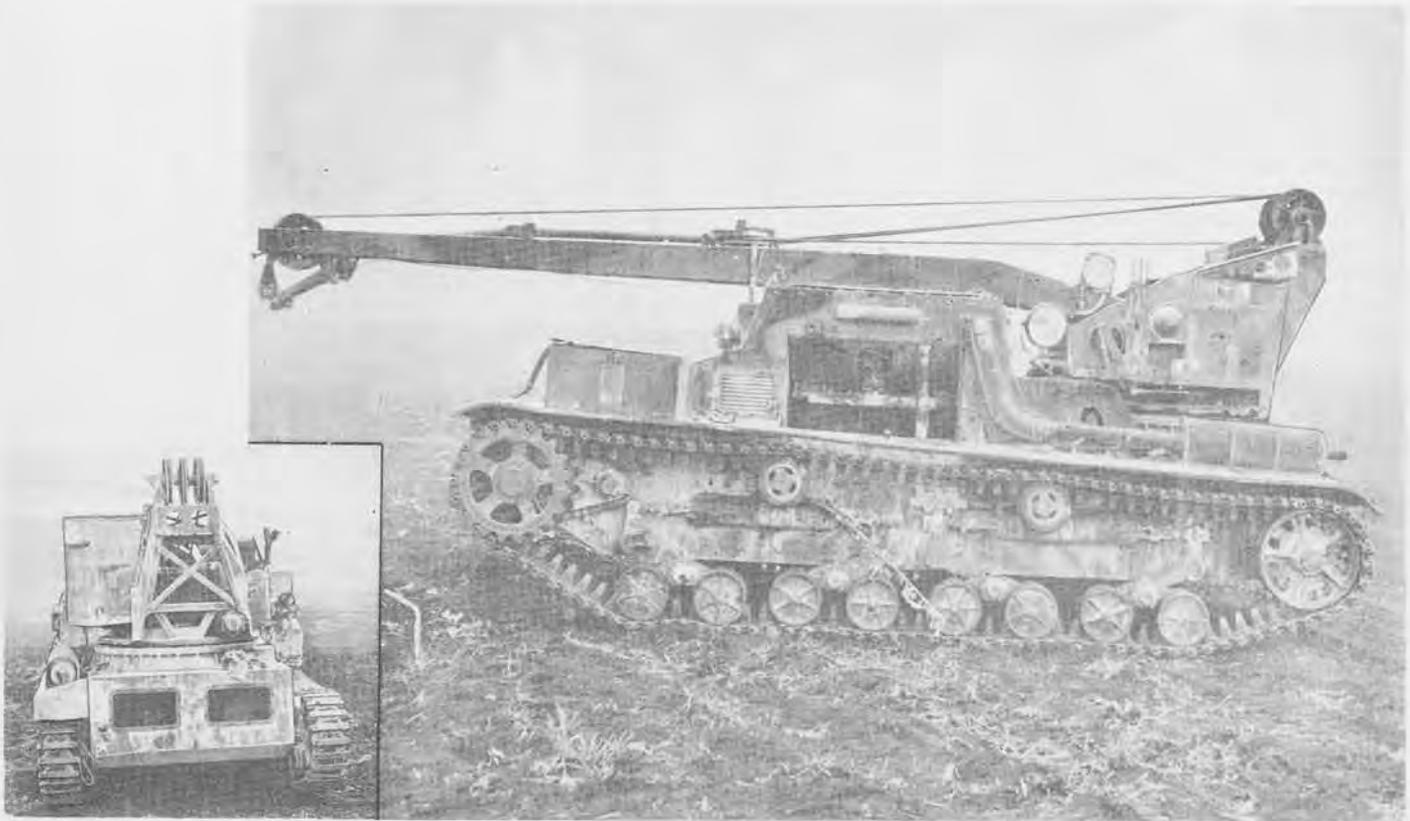
It is a full-tracked vehicle armored with ¼-inch plate throughout. The engine which is located at the right front of the body is a 6-cylinder, in-line, valve-in-head, air-cooled diesel of a type similar to those used in the Model 2595 light tank and the combination prime mover and wrecker. Two fuel tanks provide an estimated total capacity of 50 to 60 gallons.

The tracks and suspension are of the conventional Japanese design, using dual bogie wheels and a steel center guide track. The four bogie wheels, apparently identical with those on the Model 2595 light tank, are mounted on bell cranks and are sprung by horizontal coil springs which are inclosed within the body armor with only the bogie arms exposed. There are two return rollers. The track is driven from the rear. A clutch and brake steering system is used. The transmission provides four speeds forward and one reverse. A high and low transfer case is also provided.

A mount for a 7.7 mm machine gun is located on the left front of the driver's compartment. The vehicle does not mount a winch, but is provided with a spring mounted towing pintle for use as a prime mover. It has a capacity of from 2 to 3 tons if used as a cargo carrier. Maximum speed is reported as approximately 35 miles per hour, with exceptionally good cross-country performance due to the amount of track area in contact with the ground in relation to the weight of the vehicle.

SPECIFICATIONS

Weight	
Length (overall)	15 ft., 9 ins.
Width (overall)	6 ft., 8 ins.
Height	
Ground clearance	
Tread centers	
Ground contact	9 ft., 10 ins.
Width of track	10 ins.
Pitch of track	3-13/16 ins.
Track links	125
Fording depth	
Theoretical radius of action	
Roads	
Cross-country	
Speed (maximum)	35 m.p.h.
Armor (reported)	¼ in.
Armament	7.7 mm machine gun
Ammunition (Rds.)	
Engine.....	6-cylinder, in-line, valve-in-head, diesel.
Transmission.....	4 speeds forward, 1 reverse; high and low range.
Steering.....	Clutch and brake system
Seating capacity	24



REAR VIEW

This is an armored, self-propelled crane designed to retrieve damaged A. F. V.'s up to a weight of about 12 tons. The manufacturing date of one recovered specimen is given as 1941. The crane is mounted towards the rear of the chassis on a platform traversing through 360° on an electrically powered turntable. The crane is powered by the main engine through a drive shaft from the transmission to a gear box and thence through another box to the cable drums. The crane is controlled by three hand levers and three foot control clutches. When not in use, the boom which has a total length of 18 ft., 2 ins., rests on the top of the drive compartment and is held in place by two screw clamps. The conventional Japanese type of suspension is used. Four bell cranks are resisted by four armored compression springs per side. Eight-and-one-half-inch dual steel bogie wheels per side are mounted four inches apart and paired to each bogie. An 18 13/16-inch diameter double-tooth front drive sprocket, a rear idler, two 10 3/4-inch diameter rubber-covered return rollers, and the center guide steel track complete the suspension.

The driver's compartment measures 45 1/2 x 59 inches, and is fitted with a door on the right side. The 6-cylinder, in-line, air-cooled, Ikegai gasoline engine delivers 60 horsepower. The steering system is of the clutch brake principle, a separate spring-loaded clutch being fitted to each track. Two pressed steel fuel tanks are located at the right rear of the hull; an additional one is utilized as the driver's seat. They have a combined estimated capacity of 40 gallons.

SPECIFICATIONS

Weight	8 1/4 tons
Trailer load capacity	
Length	14 ft., 4 1/2 ins.
Width	6 ft., 7 ins.
Height (to top of vehicle)	5 ft., 3 ins.
(to top of jib)	6 ft., 9 ins.
Ground clearance	11 ins.
Tread centers	
Ground contact	11 ft., 4 ins.
Track width	9 3/4 ins.
Track links	
Fuel tank	40 gals. (est.)
Fuel consumption	
Fording depth	
Speed	21 m.p.h.
Engine.....Ikegai, gasoline, 6-cylinder, in-line, air-cooled, 60 hp.	
Transmission	
Steering	Clutch brake
Crew	2
Armor	
Front	1/4 in.
Sides	5/16 in.
Length of cable drums	10 1/4 ins.
Diameter of cable drums	10 1/2 ins.
Diameter of cables	3/4 in. (approx.)
Overall length of boom	18 ft., 2 ins.

"KATO" GENERAL PURPOSE TRACTOR

This is a commercial type wheeled tractor used for general purpose work. The front wheels are 29 x 5 inches and the rear dual wheels are 40 x 10 inches, all fitted with solid rubber tires. The drive is from the rear wheels only, and steering is effected by a worm gear system operating the front wheels. Normal automotive controls are provided, save for a hand throttle. The transmission provides three speeds forward and two in reverse.

The K3 type engine is identical to that used in the "Kato" 70 tractor—a 4-cylinder, valve-in-head, gasoline type. There are two cylinder blocks of two cylinders each instead of a solid cylinder block. The generator, high-tension magneto, and water pump are all linked together with universal joints and driven from a single shaft extending from the timing gear on the right of the engine.

The tractor is fitted with front and rear towing pintles cast solid with the frame.



SPECIFICATIONS

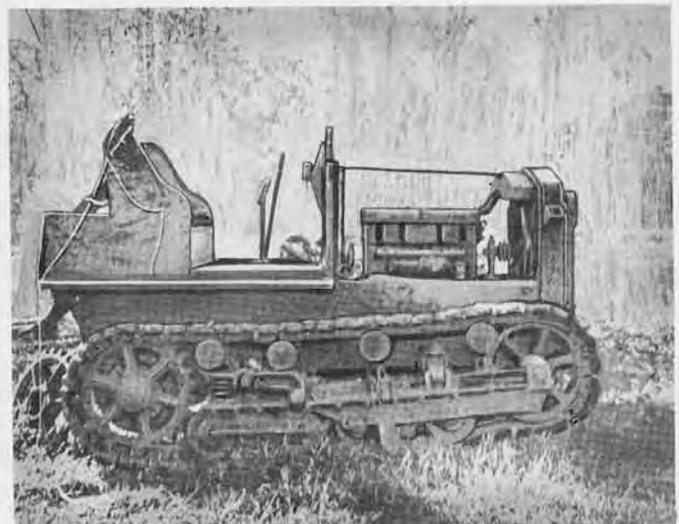
Weight	
Winch capacity	
Length	
Wheel base	90 ins.
Overall width of tractor (rear)	74 ins.
Overall height of tractor	5 ft.
Capacity of fuel tank	30 gals.
Tread centers (front)	63 ins.
Ground clearance	8 ins.
Fuel capacity	(approx.) 30 gals.
Engine	60 h.p. at 1,200 r.p.m.
Bore	121 mm
Stroke	152 mm

"KATO" 70 ARTILLERY TRACTOR

This is a slow speed tractor equipped with a towing hook and is believed to be the standard Japanese artillery prime mover. There are two bogies on each side, each bogie having three bogie wheels, two bearing on the outside and one on the middle of the tractor. Clutch and brake steering are provided. The power plant is a 4-cylinder, water-cooled, gasoline engine. The cylinder block is of two separate sections. Each section is joined into one piece at the top, but the base of each cylinder is separate from all other cylinders.

SPECIFICATIONS

Weight	
Winch capacity	
Length	
Wheel base	85 ins.
Diameter of drive sprocket	26 ins.
Width of track	13 $\frac{3}{4}$ ins.
Length of track in contact with ground	89 ins.
Width of tread (from outside edge of tracks)	67 ins.
Engine	Kato, K-3, 70 h.p.
Bore	4.75 ins.
Stroke	6 ins.

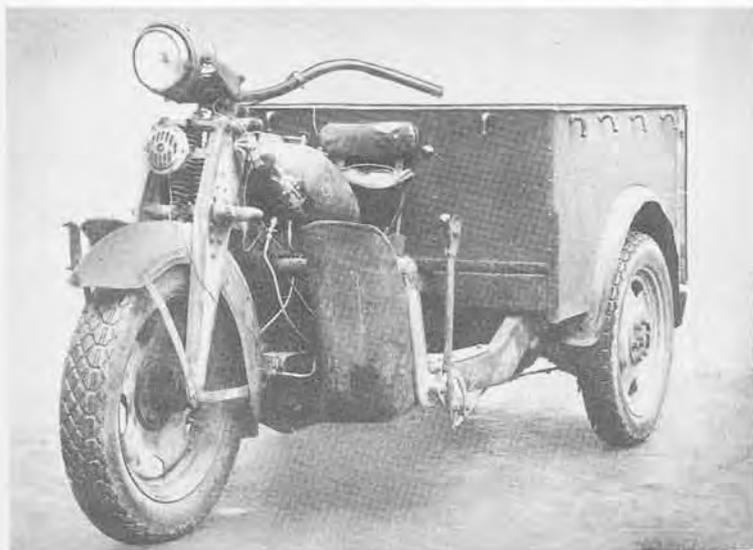




The partial disruption of the Burma railway system has brought into being a very effective locomotive truck. One report states that use of the Japanese locomotive truck has not only aided in the transportation of supplies over damaged rail lines, it has made it possible to carry over the damaged railroad considerably more tonnage than could be moved by the use of locomotives alone.

The "Loco-truck" is a highly specialized vehicle specifically designed to overcome the problem of breaks in the rails. The inner sections of the six wheels are cut to run along rail tracks; the outer sections are designed for tire mounts. On both front and rear of the truck are two permanently attached hydraulic jacks equipped with rollers. To remove the vehicle from the tracks, it is necessary to put one rail under the rear jacks and one under the front jacks at right angles to the tracks, lift the truck off the rails, and roll the truck to the side. The truck is then let down on its wheels, driven past the break in the rail line, and returned to the tracks.

A diesel engine estimated at about 60 horsepower is used to power the vehicle. Overall length, including couplings, is 19 feet, 2 inches and width is 6 feet, 3 inches.



Above: Motor tricycle with light cargo carrier body.

Right: Adapted for use as a small personnel carrier.

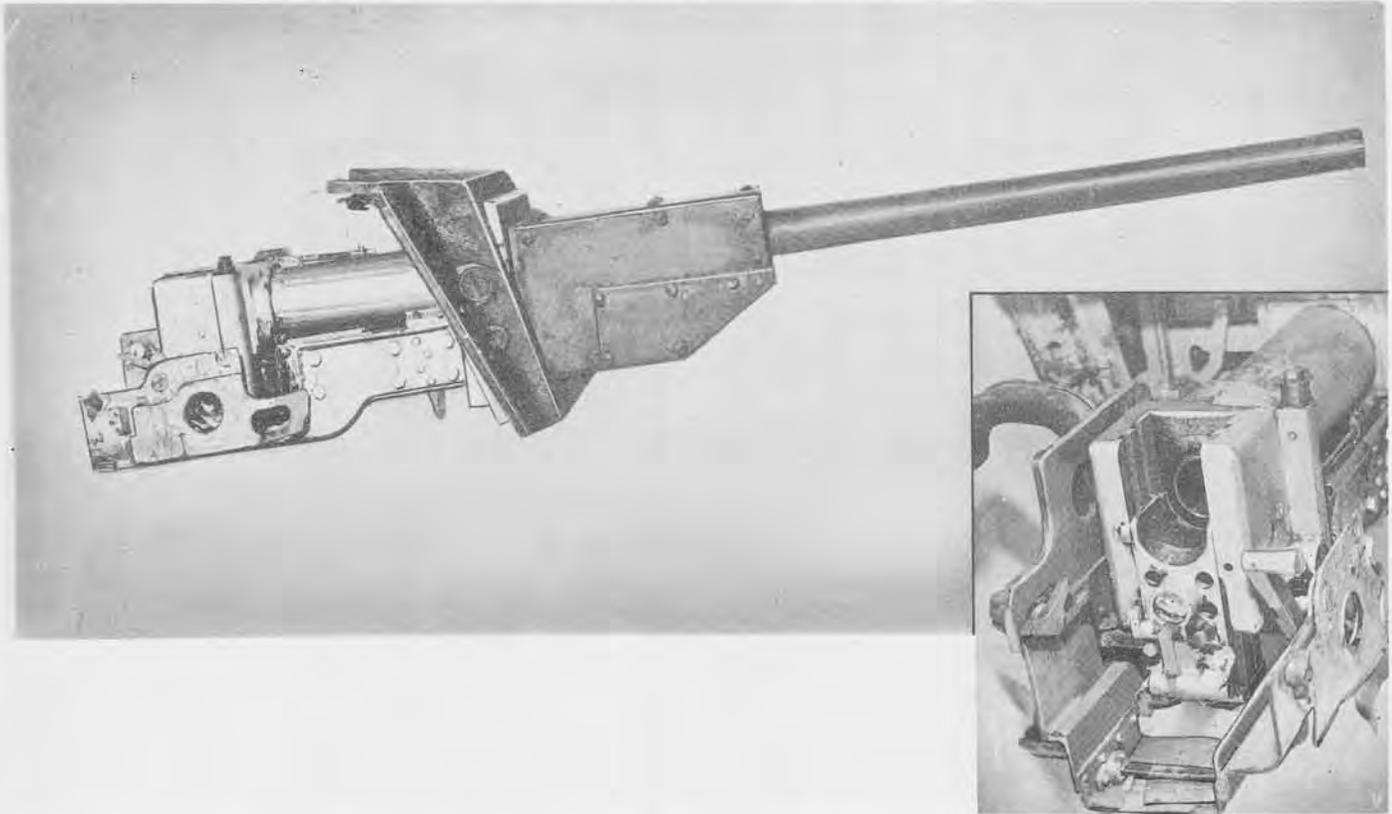
This motor tricycle has been recovered in two adaptations: as a light cargo vehicle and as a small personnel carrier. The motor is a 2-cylinder, V-type, air-cooled, gasoline engine with cooling fins made of ferrous metal. The ignition, of the automotive type, comprises battery, generator, coil, and distributor. Motorcycle type coil springing is used on the front wheels and leaf type springs on the rear part of the vehicle. The automotive type transmission provides three speeds forward and one reverse. Power is transmitted to the rear by a shaft and both rear wheels are driven through a differential. The brakes are mechanical, rod-operated, internal expanding, and operate on the two rear wheels only.

The motor tricycle has been developed as a commercial freight carrier in Japan since 1930. Many commercial versions exist, with engines ranging from 350 cc to 1,000 cc displacement. Lighter types have single-chain drive without differentials, whereas heavier types may have shaft or double-chain drive with differentials. Load capacities vary from 300 to 1,000 pounds. It is believed that the army adopted whatever types were available, and that no standard army model exists.

SPECIFICATIONS

CARGO CARRIER

Weight	1,185 lbs.*
Loading capacity	
Length (overall)	8 ft., 11½ ins.
Length of body	4 ft., 2 ins.
Width (overall)	4 ft., ½ in.
Width of body	3 ft., 8½ ins.
Height (overall)	4 ft., ½ in.
Ground clearance	6 ins.
Tread centers	3 ft., 6¾ ins.
Wheelbase	6 ft., 3 ins.
Tire size	4.75 x 18 ins. 4.75 x 27 ins.
Fuel tank	
Fuel consumption	
Fording depth	
Speed	
Engine.....	2-cylinder, V-type, air-cooled, gasoline
Bore and stroke	
Ignition	
Transmission	3 speeds forward; 1 reverse
*Not verified	



The Japanese Type I (1941) 47 mm tank gun is mounted in the Type 97 Improved Medium Tank, replacing the 57 mm tank gun, a weapon of much lower velocity. The 47 mm tank model is very similar to the Type I, 47 mm antitank gun described on page 106. The breech mechanism, however, is of the semi-automatic, vertical sliding block type instead of the horizontal sliding block type. The barrel, 7 feet, 11½ inches long, is of built-up construction. The firing mechanism is of the percussion hammer type, the recoil mechanism is a hydro-spring type.

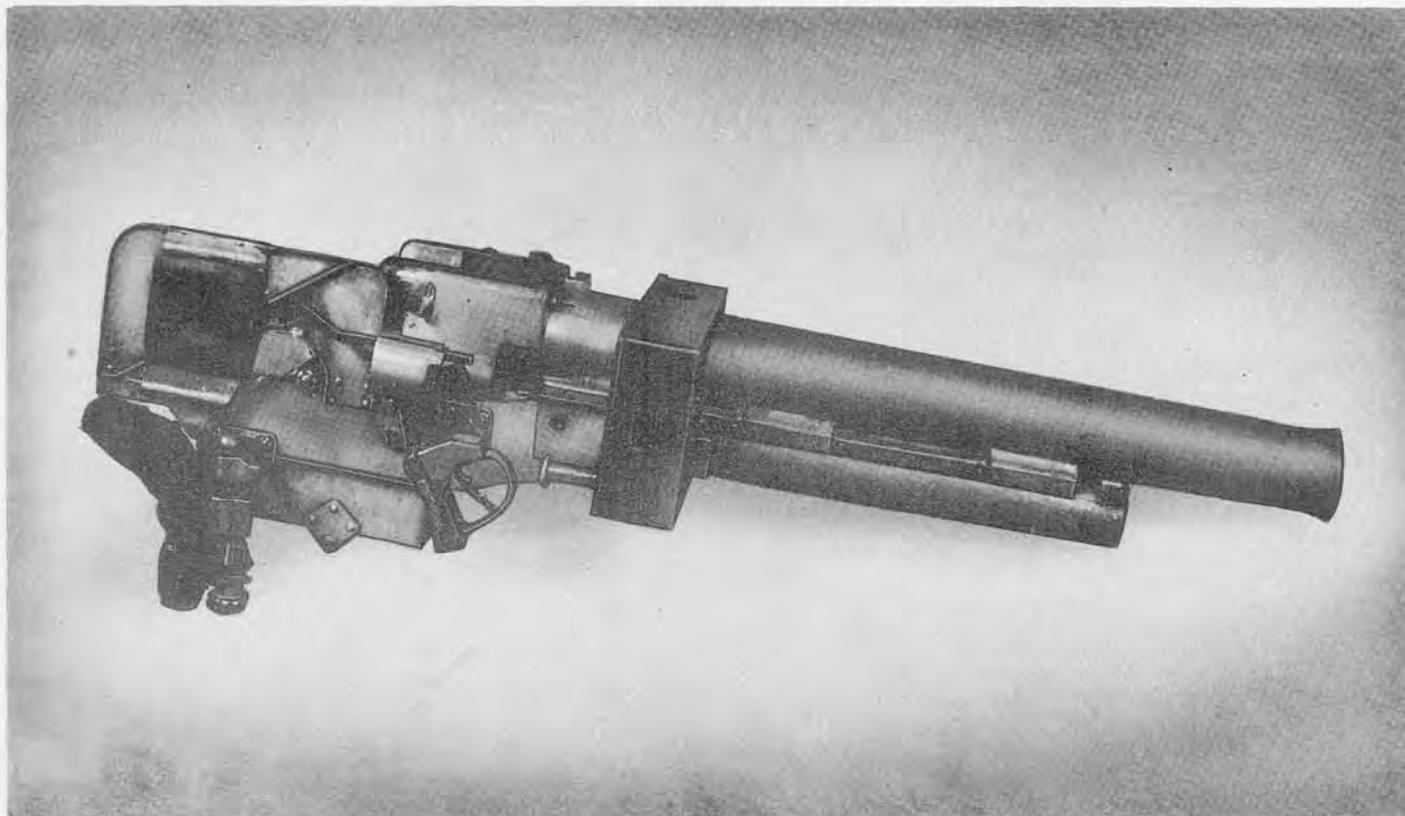
The piece is free mounted in a mantlet in the turret which permits a total traverse of approximately 15 degrees. Elevation and depression of from 8 to 10 degrees may be obtained. The gun fires high explosive and armor-piercing high explosive ammunition.

Two types of telescopic sights for this gun have been recovered. Although different in size and design, they are both 4 power by 14 degrees.

Firing tests on this gun reveal that A.P.H.E. ammunition at 500 yards will penetrate 2.7 inches of homogeneous armor at normal, and 2.2 inches of homogeneous armor at 30° from normal.

SPECIFICATIONS

Caliber	47 mm (1.85 ins.)
Weight	904 lbs.
Length (overall)	9 ft., 7 ins.
Length of tube	7 ft., 11½ ins.
Length of bore (including chamber)	7 ft., ¾ in.
No. of grooves	16
Width of grooves	
Depth of grooves	
Width of lands	
Muzzle velocity (A. P. H. E. shell)	2,700 f/s
Max. range	
Rate of fire	
Traverse	15°
Elevation	8° to 10°
Depression	8° to 10°
Length of recoil	
Ammunition	H. E. and A. P. H. E.
Wt. of projectile (H. E.)	3.08 lbs.
(A. P. H. E.)	3.37 lbs.



This gun, manufactured at Osaka Arsenal in 1939, is mounted on the Japanese Medium Tank Type 97. The tube, of monobloc construction, is fastened to the breech ring by twelve interrupted threads and secured by a lock on the right side of the tube. The breech ring is box-shaped. The breechblock of the vertical sliding type rides in two dovetailed slots in each side of the breech ring, and may be operated manually or semi-automatically.

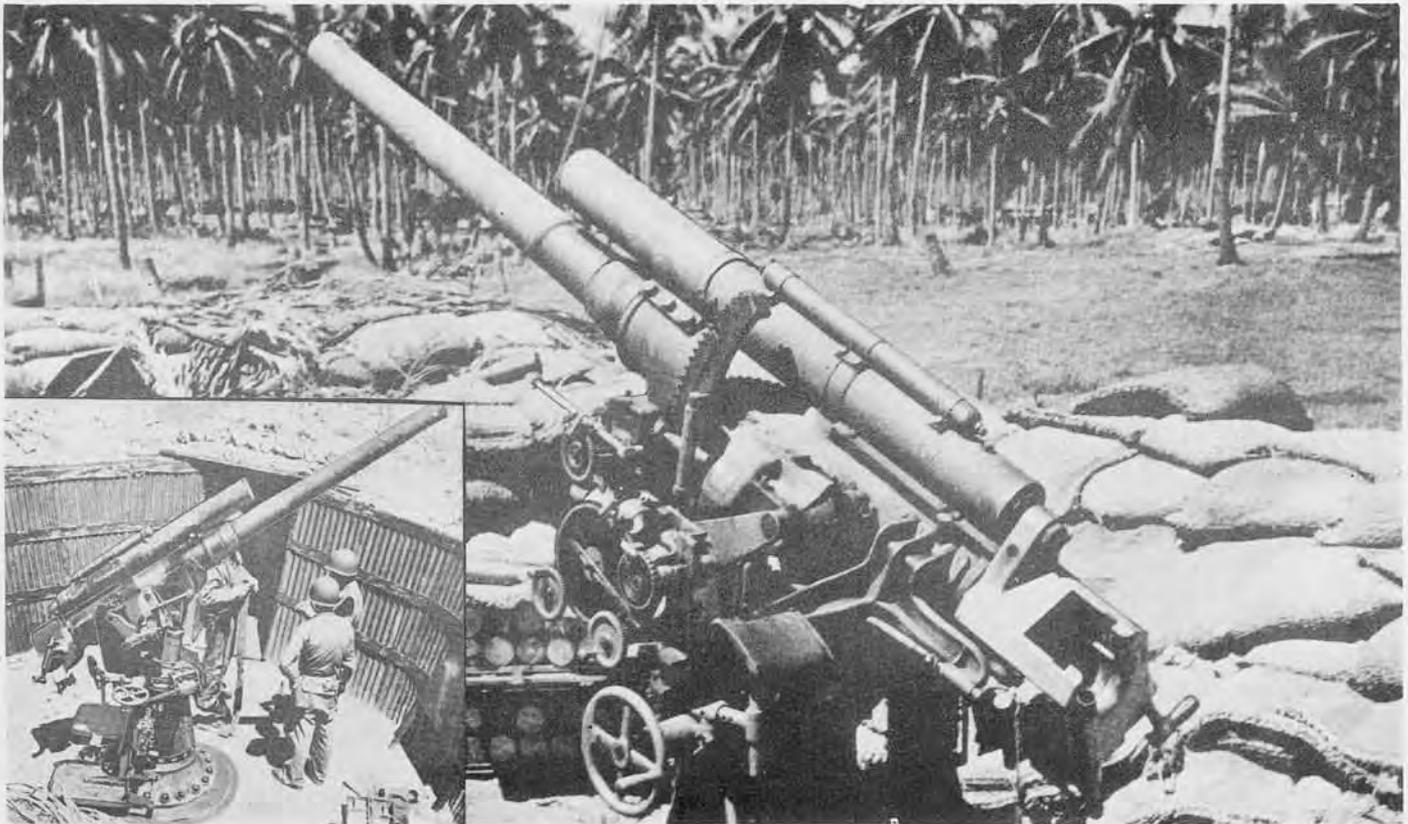
The firing pin is automatically cocked when the breech is opened. The trigger, on the left side of the gunner's shield, is protected by a trigger guard with a pistol grip. The recoil mechanism is a hydro-spring type.

The gun is mounted in the turret of the tank, and has a 360° traverse. It may also be freely elevated or traversed independently of the turret by means of two sets of trunnions. The inner vertical trunnions are set in a heavy steel bracket fitted to the cradle and permit a 5° left and right traverse. The bracket has a sighting window which may be closed for the gunner's protection. The outer horizontal trunnions fit into another steel bracket and give approximately 11° elevation and 9° depression.

Although no sighting equipment was recovered with the gun, the appearance and location of the head rest, shoulder rest, and sight bracket indicate that a straight tube telescope is used.

SPECIFICATIONS

Caliber	57 mm
Weight of tube and breech ring.....	138 lbs.
Weight (firing position)	293.5 lbs.
Length of tube and breech ring.....	41½ ins.
Length (firing position)	
Height (traveling position)	
Height (firing position)	
Width (overall)	
Width of trail spread	
Length of tube and breech ring.....	41½ ins.
Rifling.....	R.H., uniform twist; approx. 1 turn in 28½ cal.
Length of rifling	32.5 ins.
No. of grooves	20
Width of grooves .....	.25 in.
Depth of grooves .....	.039 in.
Width of lands	
Muzzle velocity (shell)	
Max. range (horizontal)	
Max. range (vertical)	
Rate of fire	20 r.p.m.
Traverse.....	360° with turret and 5° right and left independent of turret
Elevation	11°
Depression	9°
Length of recoil	11 ins.
Ammunition	H.E. and A.P.H.E.
Wt. of projectile	



This weapon, previously erroneously called the Type 10, is a naval type antiaircraft gun, mounted on a pedestal which permits a traverse of 360 degrees. The gun tube, of built-up construction, recoils inside a sleeve type cradle. A guide on the bottom of the tube rides in a groove, preventing rotation of the tube. Since the trunnions are located at the rear of the tube, muzzle preponderance is compensated for by an equilibrator inside the pedestal.

A hand-operated, semi-vertical sliding type breechblock and a hydrospring recoil mechanism are used. Recoil and recuperator are located over the tube. A small cylinder above the recoil cylinder is apparently for storing an oil reserve.

The elevating handwheel is located to the left of the weapon, and the traversing handwheel to the right. Two platforms, one on either side attached to the superstructure, allow the layers to move with the gun in traverse.

A bracket on the left of the piece is believed to mount a telescope and range drum.

SPECIFICATIONS

Caliber	76.2 mm (3 ins.)
Weight of gun and mount	5,290 lbs.
Weight of gun	1,100 lbs.
Length of barrel	40 cal.
Length of tube	9 ft., 6 ins.
Height (traveling position)	
Height (firing position)	
Width (overall)	
Length of chamber	1 ft., 8 ins.
Rifling	R. H. twist
No. of grooves	24
Width of grooves	
Depth of grooves	
Width of lands	
Muzzle velocity (H.E. shell)	2,200 f/s
Max. range (horizontal)	
Max. range (vertical)	26,000 ft?
Rate of fire	10 to 12 r.p.m.
Traverse	360°
Elevation	75°
Depression	5°
Length of recoil	
Ammunition	H.E. w/powder train time fuze
Wt. of projectile	12 lb., 11 ozs.



This weapon which was recovered at Rangoon has a barrel of monobloc construction, machined to take a rectangular breech ring. A large threaded brass locking collar holds the breech ring in position. Rifling is right hand twist. The breech mechanism is semi-automatic of the vertical sliding type; the firing mechanism is a percussion type.

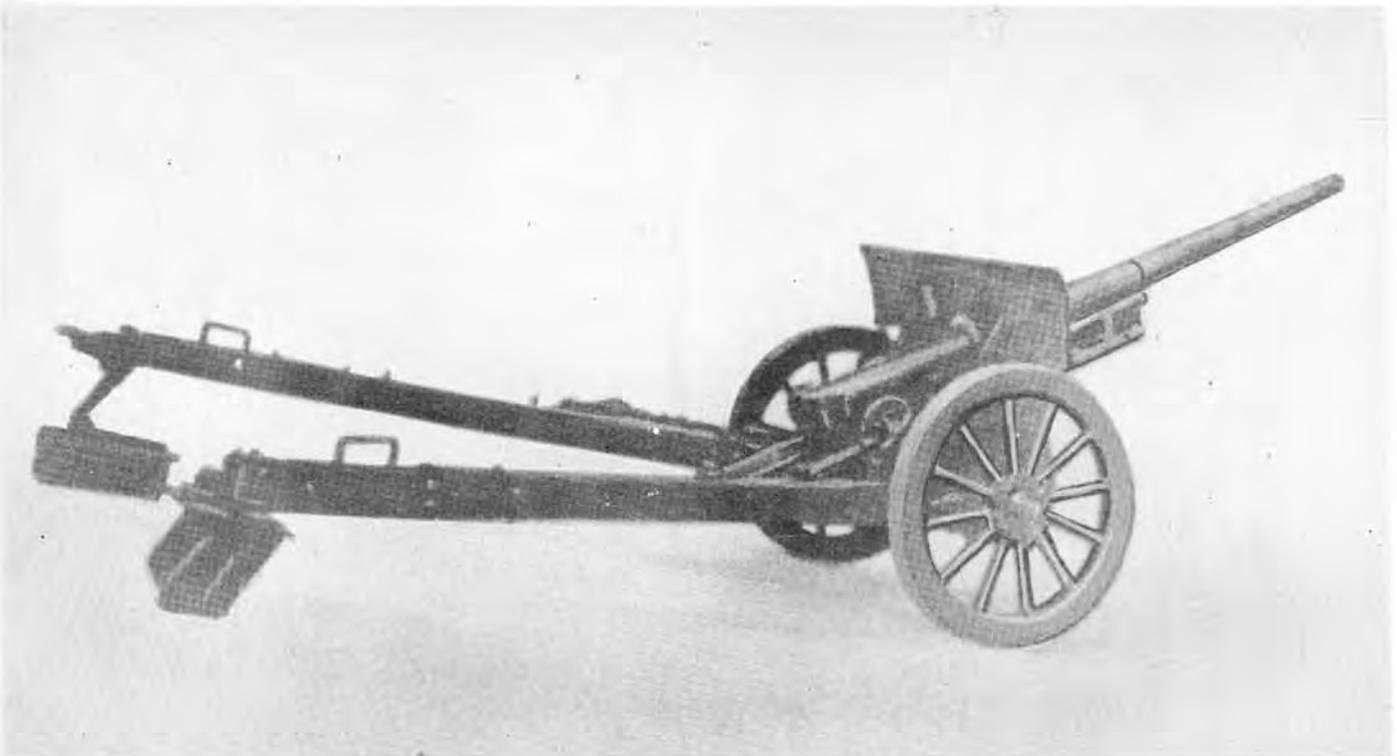
The piece fits in a sleeve type cradle to which are fitted the buffer cylinder, the recuperator cylinders, the trunnions, and the elevating arc. The recoil mechanism is hydropneumatic. Two recuperator cylinders are located one on each side of the recoil cylinder which is centrally mounted above the piece. The elevating arc is mounted under the piece offset slightly to the left. It is operated by a handwheel and crank on the left of the gun, and like the traversing handwheel, on the right of the gun, is forward of the trunnions.

The upper carriage consists of two side plates joined by three cross members, and revolves on a ball race fitted to its base. A pintle, bolted to the center of the base, extends down into a bearing in the pedestal. Three brackets are set at regular intervals around the upper carriage to prevent lateral play. The pedestal is a single cast truncated cone, reinforced internally and externally by six ribs. Twelve bolts secure it to a circular steel base plate.

Follow-the-pointer dials are provided for azimuth, elevation, and fuze setting. Three mechanical fuze-setters are also provided. Some of the guns examined were equipped with open sights of very primitive design.

SPECIFICATIONS

Caliber	88 mm (3.5 ins.)
Weight (complete)	14,560 lbs.
Weight of cradle	1,256 lbs.
Weight of carriage (including elevating & traversing mech.).....	4,894 lbs.
Length (traveling position)	
Length of barrel assembly	255.8 ins.
Height (traveling position)	
Height (firing position)	
Width (overall)	
Length of bore	
No. of grooves	32
Width of grooves	
Depth of grooves	1 mm
Width of lands	
Muzzle velocity (shell)	2,650 f/s
Max. range (horizontal)	
Max. range (vertical)	
Rate of fire	
Traverse	360°
Elevation	80°
Depression	7°
Length of recoil	(approx.) 14-15 ins.
Ammunition	H. E.
Wt. of projectile (H. E.)	(approx.) 18 lbs.



The Japanese 105 mm gun, Type 14, is a medium field weapon mounted on a two-wheeled carriage and drawn by a prime mover. The tube, of built-up construction, is retracted above the trails when in traveling position to provide proper balance. A breech-block of the interrupted screw type is used.

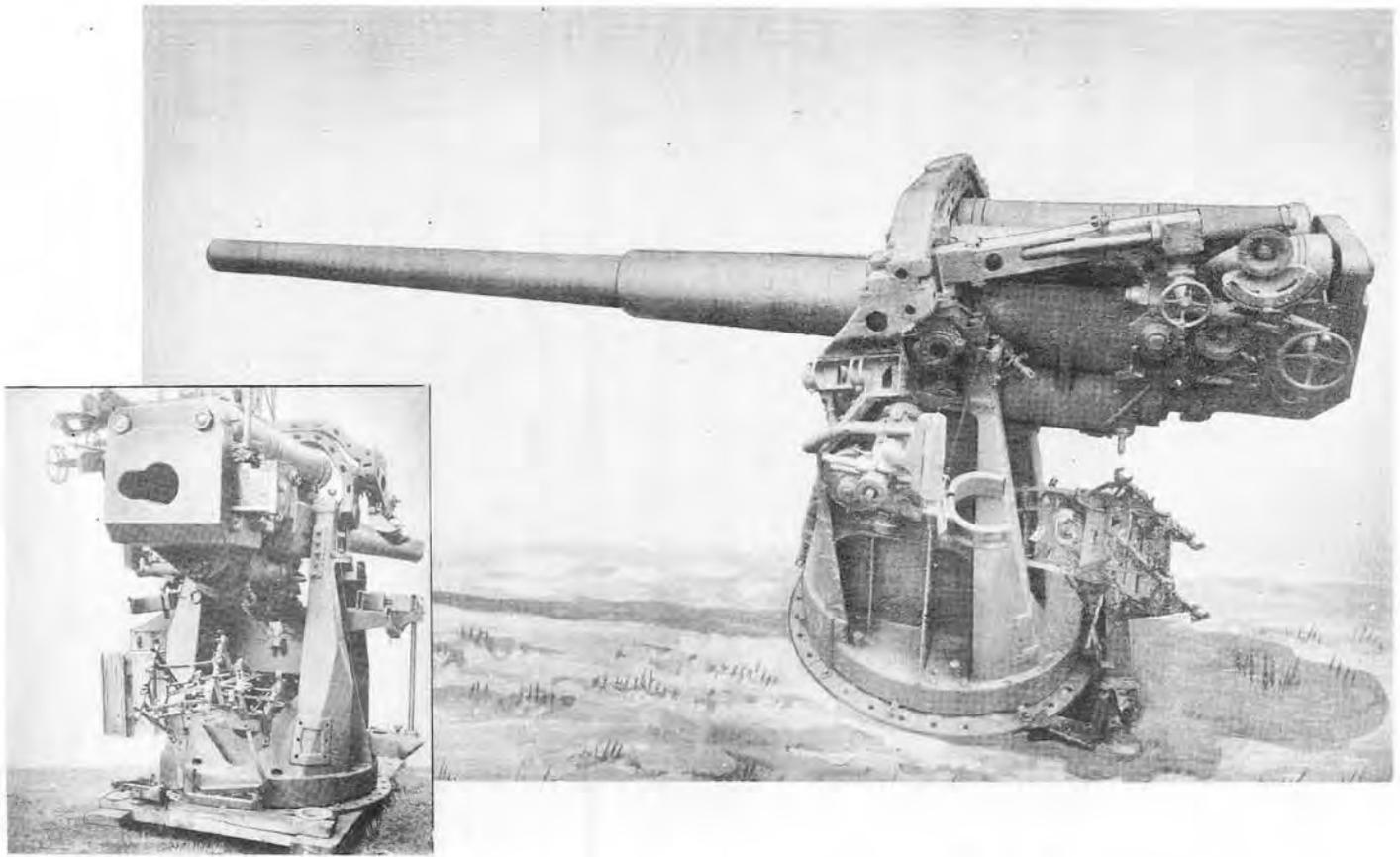
The weapon has split trails which may be adjusted to equalize cant. The wheels are equipped with rubber or steel tires.

The recoil system is the variable, hydropneumatic floating piston type. The fluid passage to the other side of the two air cylinders is suitably interrupted when the elevation is increased.

The traversing mechanism consists of a worm and arc gear. The elevating mechanism is of the arc gear type. A spring equilibrator is attached to the gun, since the trunnion is retracted in relation to the tube. The sighting equipment consists of a panoramic sight and a drum type range scale.

SPECIFICATIONS

Caliber	105 mm (4.13 ins.)
Weight (traveling position)	
Weight (firing position)	
Length (traveling position)	
Length (firing position)	
Height (traveling position)	
Height (firing position)	
Width (overall)	
Width of trail spread	
Length of bore	
No. of grooves	
Width of grooves	
Depth of grooves	
Width of lands	
Muzzle velocity	2,040 f/s
Max. range (horizontal)	16,500 yds.
Max. range (vertical)	
Rate of fire	6-8 r.p.m.
Traverse	30°
Elevation	43°
Depression	5°
Length of recoil	
Ammunition.....	H.E. (long pointed); H.E., Shrapnel, Chemical, A.P.
Wt. of projectile (H.E.)	33 lbs.



This gun is a naval coast defense weapon manufactured at Sasebo Arsenal. It uses semi-fixed ammunition. The barrel is of built-up construction with uniform right hand twist rifling. A manually operated, horizontal sliding block breech mechanism is used. It is unusual in that the block does not pass all the way across the rectangular breech ring. The rear of the breech ring is cut in a keyhole shape. The operator of the elevation handwheel may fire the gun by means of a lever mechanism, or it may be fired by a lanyard attached to the right side of the breechblock.

The recoil system comprizes three cylinders, two located above and one below the barrel.

The mount consists of a rectangular upper carriage which is mounted on a pedestal normally embedded in a solid foundation. A traversing scale is located on the pedestal. The traversing handwheel is in a horizontal position with the vertical shaft engaging a series of gears in the base mount. Platforms attached to the upper pedestal are provided for the gun layers and move in traverse with the gun.

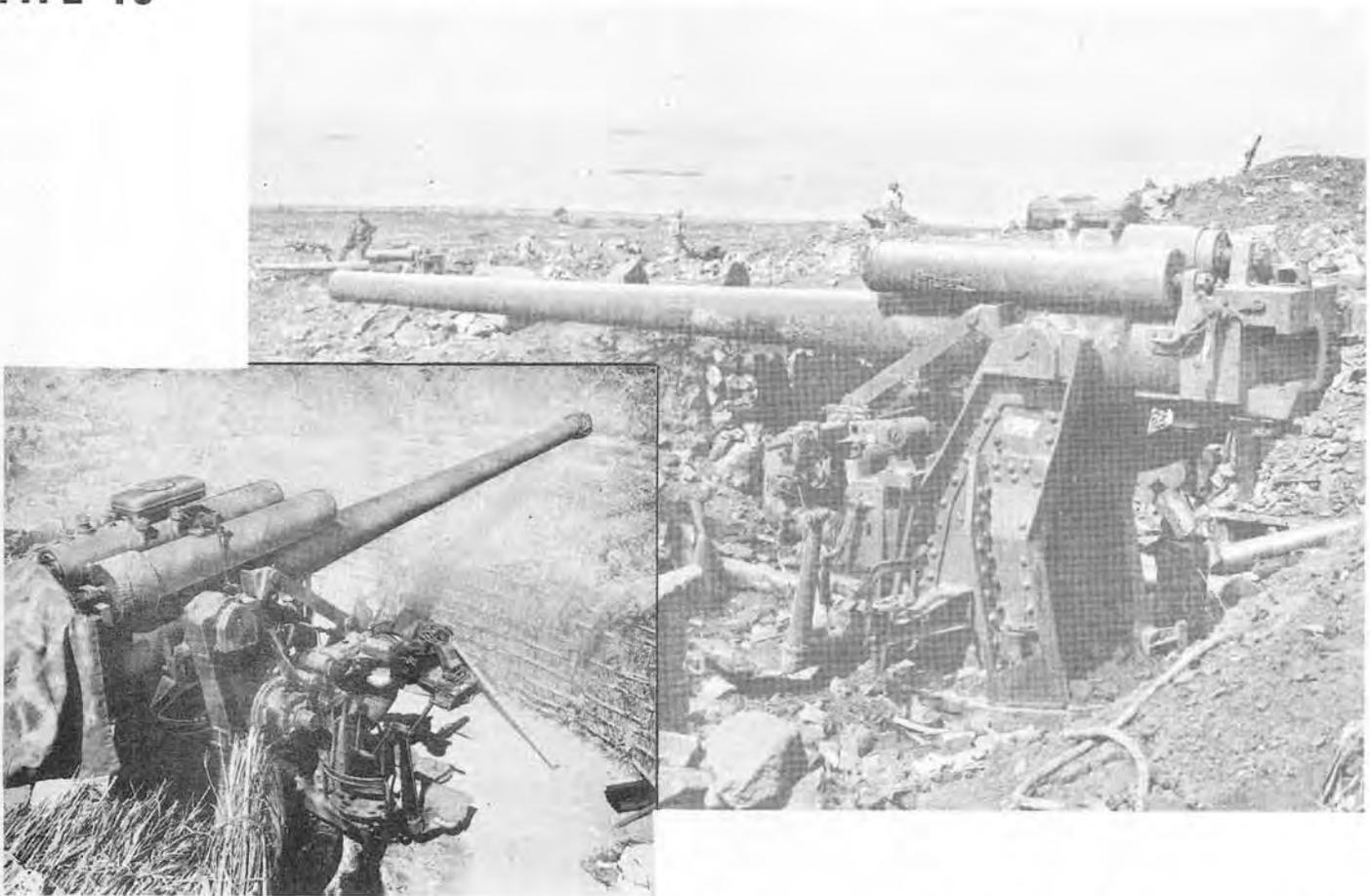
Fire control equipment is of the usual Japanese naval coast defense gun type.

SPECIFICATIONS

Caliber	120 mm (4.72 ins.)
Weight (traveling position)	
Weight (firing position)	
Length of gun (overall)	18 ft., 3¼ ins.
Length of tube	17 ft., 3¾ ins.
Height of gun	6 ft., 11 ins.
Height (firing position)	
Width (overall)	
Length of rifling	14 ft., 8½ ins.
No. of lands	34
Width of grooves	
Depth of grooves	
Width of lands	
Muzzle velocity (H. E. shell)	2,700 f/s
Max. range (horizontal)	
Max. range (vertical)	
Rate of fire	
Traverse	360°
Elevation	50°
Depression	10°
Length of recoil	
Ammunition	H. E.
Wt. of projectile (H. E.)	44.75 lbs.

120 mm, 45 CALIBER, NAVAL DUAL PURPOSE GUN, TYPE 10

JAPANESE 



The Japanese Type 10 dual purpose gun has a 45-caliber barrel of monobloc construction with uniform right hand rifling. A long, narrow rectangular projection on the bottom of the barrel slides in a groove in the sleeve type cradle, preventing the barrel from rotating. The bearing surface for recoil being the machined barrel surface. The cradle is mounted on a pedestal mount which permits a traverse of 360 degrees.

The elevating handwheel is on the right side of the mount, while the traversing handwheel is on the left. An auxiliary handwheel on the left side permits the piece to be elevated and traversed by the gunner. To compensate for muzzle preponderance, a spring pusher type equilibrator is used. The gun is well balanced, and exceptionally easy to elevate. The recoil mechanism is a hydrospring type, the two outside cylinders housing the counterrecoil springs, and the center cylinder the hydraulic mechanism. A semiautomatic horizontal sliding breechblock is used.

The mount is of riveted construction.

SPECIFICATIONS

Caliber	120 mm (4.7 ins.)
Weight (firing position)	6,500 lbs.
Length (gun and mount)	19 ft., 6½ ins.
Length (firing position)	
Height (gun and mount)	7 ft., 8½ ins.
Height (firing position)	
Width (gun and mount)	7 ft., 1 in.
Length of tube	17 ft., 1½ ins.
Length of rifling	14 ft., 9½ ins.
Length of chamber	29.5 ins.
No. of lands	34
Width of grooves	¼ in.
Depth of grooves .....	.050 in.
Width of lands	⅛ in.
Muzzle velocity (shell)	2,700 f/s
Max. range (horizontal)	17,000 yds.
Max. range (vertical)	32,800 ft. (fuze)
Rate of fire	10-12 rds.
Traverse	360°
Elevation	75°
Depression	10°
Length of recoil	19.3 ins.
Ammunition	H.E. shrapnel; H.E. phosphorus
Wt. of projectile	45.75 lbs.



It is believed that this naval coast defense weapon was designed primarily for use against ships, as the fuzes used with the gun's ammunition are not sensitive enough to function satisfactorily upon impact with soft ground. This gun uses separate loading ammunition, and has a standard type mushroom head obturator. The breechblock is the horizontal swinging, interrupted screw type, having three threaded segments with two step threads. A hydropneumatic recoil mechanism is located above the barrel.

A naval pedestal type mount is used. Strips of iron fastened to and radiating from the pedestal are buried in the ground to insure stability. The piece is sometimes fitted in a casemate, the front and sides of which are cast in one piece. The top is rolled plate. A mantlet is fitted to the gun on the inside of the casemate. Gun and casemate are rotated manually, as no power system is provided.

No fire control equipment, with the exception of a telescopic sight mount, was recovered with the gun, and it is believed that the piece is fired by direct laying.

SPECIFICATIONS

Caliber	140 mm (5.5 ins.)
Weight (firing position)	
Length (overall)	23 ft., 8 ins.
Length (firing position)	
Height (firing position)	
Width (overall)	
Length of tube	22 ft., 10½ ins.
Length of rifling	19 ft., 3½ ins.
No. of grooves	42
Width of grooves	
Depth of grooves	0.051 in.
Width of lands	
Muzzle velocity (shell)	850 meters (2,789 ft.) per sec. from range disc on gun
Max. range (horizontal)	17,000 meters (18,598 yds.) from range disc on gun
Rate of fire	
Traverse	360°
Elevation	30°
Depression	—7°
Length of recoil	
Ammunition	
Wt. of projectile (H. E.) Common	83.8 lbs.



This howitzer was captured on Luzon. The emplacement, circular in shape and measuring 33 feet in diameter and 8 feet in depth, was camouflaged by a house on rails which was rolled back when the guns were to be fired. A small garden of banana trees was planted around the emplacement to add to the effect.

The howitzer tube is believed to be a built-up type. The liner is rifled with a uniform right hand twist, calculated to be one turn in 9.4 calibers. Two air flasks are mounted on the carriage for blowing out the tube after firing. Two equilibrators are mounted below the tube. The breech mechanism is an interrupted screw type having 8 segments of 20 threads. A percussion hammer firing mechanism is operated by a lanyard. A short cartridge case is used for obturation.

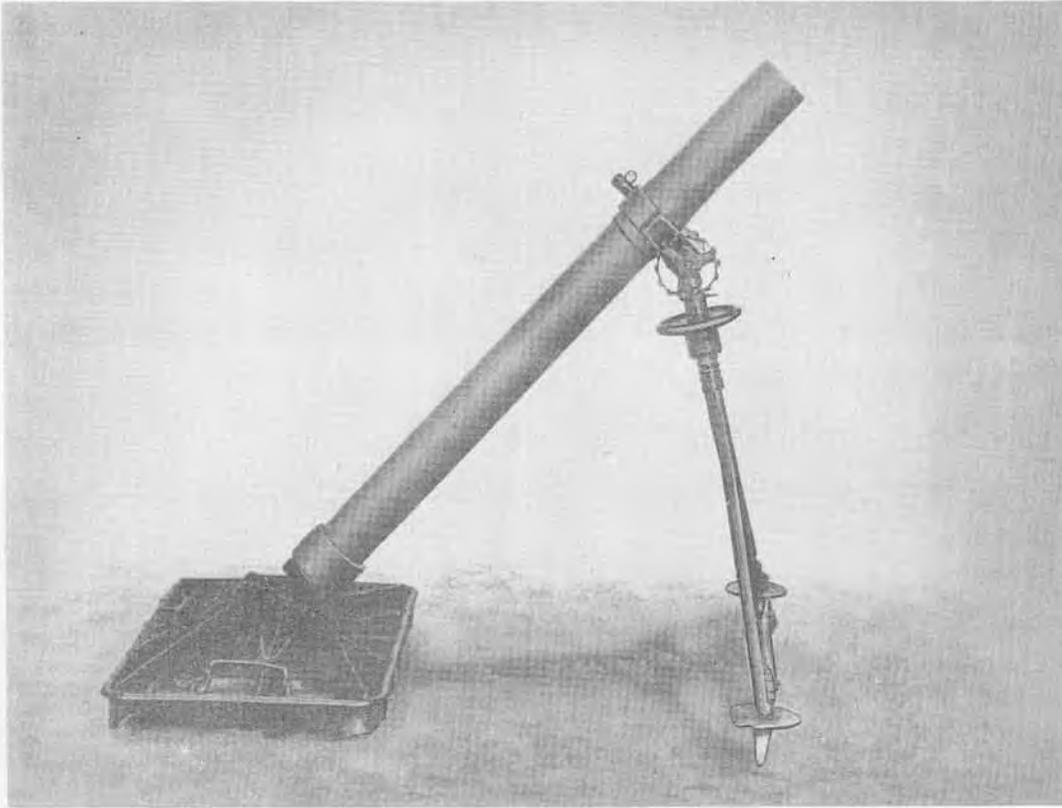
The upper carriage is a rectangular steel frame approximately 18 feet, 9 inches long, and 4 feet, 8 inches wide, fixed to a base plate. The lower carriage is a truncated steel cone embedded in concrete approximately 6 to 8 feet under the ground. The upper carriage baseplate rests on a rail above a worm wheel, fixed to the lower carriage which engages a spur rack fitted to the base of the upper carriage.

The traversing handwheel is mounted in a horizontal position engaging a vertical shaft which terminates in the worm gear. The elevating handwheels, one on either side of the tube, are mounted on the carriage in a vertical position. A direct shaft from the elevating handwheel terminates in a spur gear which engages the elevating arc.

A panoramic sight is mounted on the right side of the gun.

SPECIFICATIONS

Caliber	305 mm (12 ins. approx.)
Weight (firing position)	
Length of tube and breech	16 ft., 6 ins.
Length of carriage base	18 ft., 9 ins.
Width of carriage base	4 ft., 8 ins.
Length (firing position)	
Height (firing position)	
Width (overall)	
Length of bore	
No. of lands	72
Width of grooves	
Depth of grooves	
Width of lands	
Muzzle velocity (shell)	
Max. range (horizontal)—Trans. document	13,000 yds.
Max. range (vertical)	
Rate of fire	
Traverse	360°
Elevation, scale reading.....	70°
Depression, scale reading.....	3°
Length of recoil, scale reading.....	420 mm
Ammunition	
Wt. of projectile—Trans. document.....	970 lbs.



The Japanese 81 mm Mortar, Model 3, is a forerunner of the Model 97 (1937). It was manufactured at the Yokosuka Navy Arsenal in 1943.

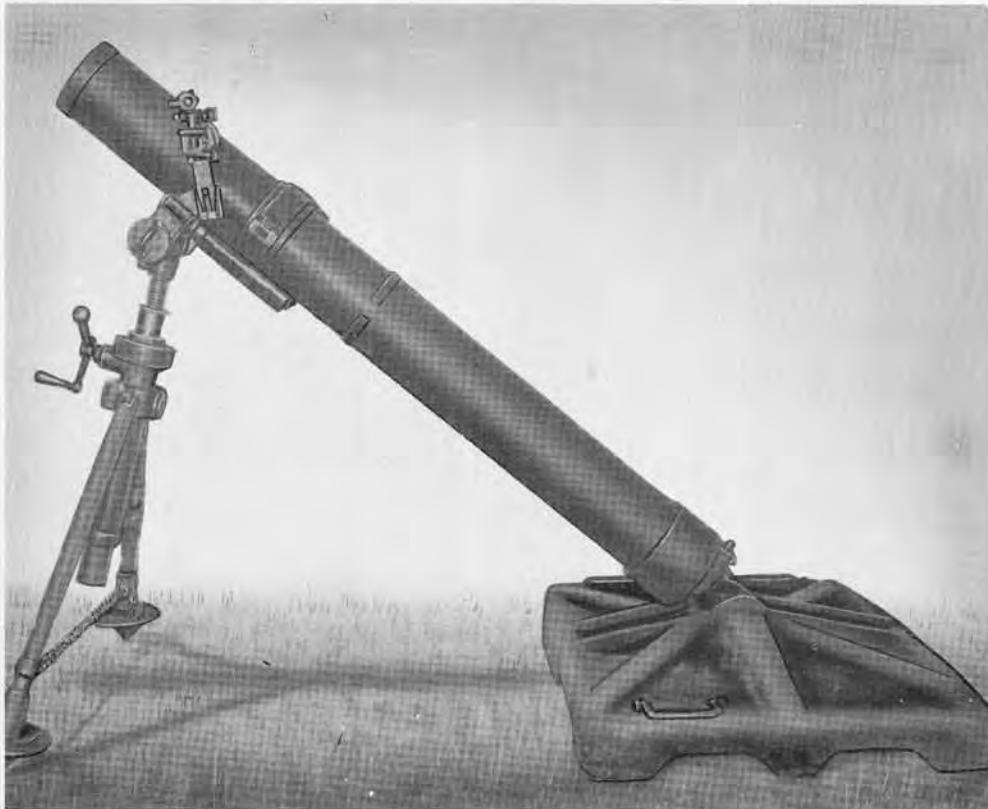
The tube is a smooth-bore type and has two collars machined on the forward part for securing the bipod clamp. The bipod, constructed of light weight tubing, is very unstable. There is no cross leveling device, and rough cross leveling adjustments could be made by breaking the bipod support and moving the leg on the low side inward.

The base plate is relatively heavy, and is believed to be identical with that now used with the 90 mm Mortar, Model 94. It is interchangeable with the base plate for the Model 97.

Both traversing and elevating mechanisms employ the square type threads rather than the usual and more efficient buttress type as used on Model 97. No sight was recovered with the mortar.

SPECIFICATIONS

Weight of tube	47 lbs.
Weight of bipod	25 lbs.
Weight of base plate	95 lbs.



This mortar, of conventional design, is a smooth bore, muzzle-loading weapon referred to by the Japanese as a medium mortar. Although its tactical use is not fully defined, it is known to have been used in fixed concrete emplacements as a part of the island defense system.

The Model 97 is very heavy and sturdily constructed, weighing 770 pounds complete with sight. The breech cap and stud, with assembled firing mechanism, are screwed on in the normal manner. The firing pin may be adjusted to three different positions by means of a cam lock. When the lock is in the rear center position the firing pin is in a safe position; when the lock is turned to the right, the pin is "floating," or, in other words, may be actuated by a sharp blow on the end of the cam shaft. When the firing pin is locked forward, the operation is the same as that of a mortar with a fixed firing pin.

The bipod is of normal construction with but one exception. The elevating screw is actually two concentric screws comparing very favorably with a single screw in stability and overall length. The traversing screw, buffer mechanism, and collar assembly are of the same design as other Model 97 Japanese mortars. The bipod and cradle may be separated for handling.

The base plate is a heavy ribbed stamping of 0.25 inch metal built up by reinforcing ribs welded to the original stamping. It has the usual ball and socket locking arrangement. The sight is a panoramic elbow telescope of three power and thirteen degree field.

SPECIFICATIONS

Caliber	150 mm (5.906 ins.)
Weight (complete)	770 lbs.
Weight of tube	257 lbs.
Weight of bipod & traversing assembly.	
(total)	174.5 lbs.
Weight of sight & extension	1.5 lb.
Weight of baseplate	337 lbs.
Length of tube	75.37 ins.
Length of tube (internal)	66 ins.
Length of baseplate	47.75 ins.
Width of baseplate	35.5 ins.



This director (possibly referred to by the Japanese as Model 97) is a plan prediction type of computer. It is probably used with the Japanese Model 88 (1928) 75 mm antiaircraft gun.

Standard ballistics are obtained from cams; approximations and spot corrections take care of wind effects, muzzle velocity, and air density variations. The director is provided with telescopes, and with electric data receivers for azimuth and angular height, and for altitude or horizontal range.

The director imposes significant limits on altitude and horizontal component rates. The maximum altitude rate is ± 179 miles per hour. The maximum horizontal component rates are 335 miles per hour. It is not known whether it is Japanese practice to orientate their directors with respect to true North; but if that is the case, targets flying in the cardinal directions with ground speeds in excess of 335 miles per hour would be beyond the capability of this director. Such ground speeds, when aided by wind, may be feasible. It should be noted that the director is capable of handling greater speeds if the target does not fly parallel to one of the principal coordinate axes.

Optical tracking is provided on the director proper. An electrical data transmission system provides for the use of an external tracker such as a radar unit.

SPECIFICATIONS

Time of flight	30 secs. max.
Present altitude	0 to 7,655 yds.
Future altitude	-820 to 8,475 yds.
Present horizontal range	0 to 10,936 yds.
Future horizontal range	0 to 10,936 yds.
N-S and E-W rates	± 164 yds./sec.
Altitude rate	± 87 yds./sec.
Lateral deection	± 800 mils.
Horizontal range prediction	$\pm 4,101$ yds.
Altitude prediction	± 820 yds.



This appears to be the latest model of mechanical antiaircraft director made by the Japanese. It has data receivers (selsyns) for azimuth, angle of site, and slant range, probably provided for use with radar equipment. Primary input data may also be obtained by optical tracking by means of telescopes attached to the director and a height finder.

Computation is based on angular rates. The transmitted data is future azimuth, future quadrant elevation, and future fuze. Data is transmitted to each weapon by means of selsyn motors and applied to the weapon by means of a match pointer system resembling that used with the American 90 mm, M1 antiaircraft fire control equipment. It is believed that this instrument is capable of furnishing data for three weapons. It is assumed the azimuth receiver will work with both the 8 cm and the 12 cm Japanese antiaircraft guns.

As compared with other modern directors, it is felt that this instrument is deficient in both design and construction. An angular rate computer is considered too inaccurate for anything other than small or medium caliber automatic tracer controlled antiaircraft fire. Human error is permitted through the curve-following method of introducing time of flight, superelevation, and converting slant range into altitude. A great deal of backlash exists in various gear trains and in the mechanical linkage of the multipliers.

SPECIFICATIONS

Limits as indicated by drums and dials	
Slant range (dial calibration)	40,000 meters
Slant range (limit of movement w/alt. converter)	19,000 meters
Horizontal range	12,500 meters
Altitude	9,000 meters
Quadrant elevation	- 10° to + 90°
Fuze	35 seconds
Dead fuze time	10 seconds
Wind velocity	20 meters/sec.
Azimuth	No limit
Angular rate	Undetermined
Electrical data	
Cycles	50 or 60
Volts	50 or 60
Weapon with which used.....	120 mm, 45 cal. A.A. gun and 80 mm. 40 cal. A.A. gun.
Characteristics	
Height	44¼ ins.
Length	34½ ins.
Date of manufacture	Showa 18 (1943)
Weapon data obtained from drums	
Fuze types (120 mm gun).....	M88 (1928), M89 (1929), M91 (1931)
Muzzle velocity	825 meters/sec.
Fuze types (80 mm gun).....	M89 (1929), 5th year type (1930)
Muzzle velocity	670 meters/sec.



The Japanese multiple power observation telescope has three powers: 33X, 24X, and a third degree of magnification which has not been determined because of the absence of a third eyepiece in the instrument examined. Selection is made by rotating a dome-shaped holder in which the three eyepieces are mounted. This is somewhat similar to the turret head employed in motion picture cameras and to the selective eyepiece head of compound microscopes.

The objective is a compound lens with an air space between the crown and flint components. A modified porro prism is used for the erecting system. The reticle design used with the 24 power eyepiece is a simple cross. The 33 power eyepiece is not equipped with a reticle. No provision is made for an instrument light. An open line sight is provided for quick location of an object in the field of view.

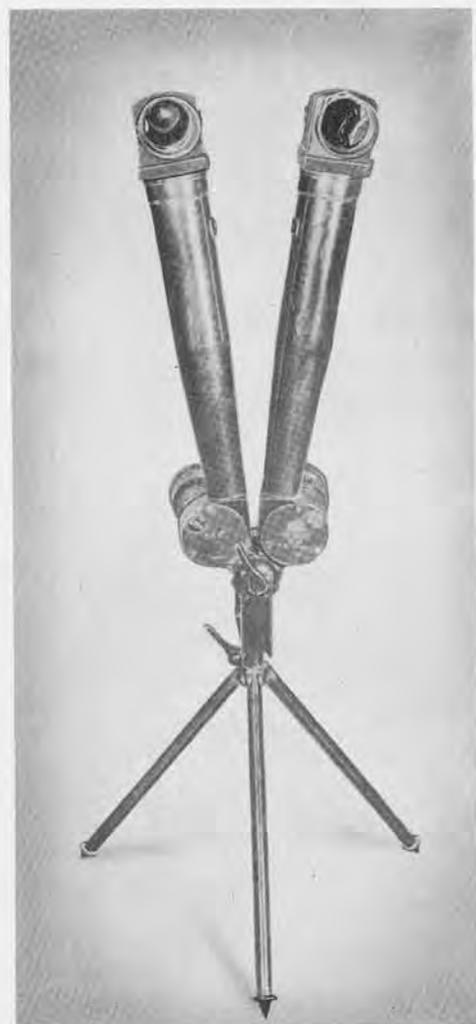
The support which is made largely of machined brass castings has an upper and lower movement. The azimuth scale is graduated from 0 to 360 degrees in 1/2 degree steps; a vernier indicator allows readings of one minute to be made. Leveling is accomplished by adjusting the length of the tripod legs. The elevation arc is graduated in increments of 1/2 degrees to + and -30 degrees from 0. The tripod is of wood with brass fittings.

SPECIFICATIONS

Length of telescopes	24 ins.
Weight of telescopes	12 lbs., 8 ozs.
Height of support	11 1/2 ins.
Distance between trunnions	5 1/4 ins.
Weight of support	13 lbs., 4 ozs.
Length of tripod	38 1/4 ins.
Length of tripod (legs extended)	55 1/2 ins.
Weight of telescope	8 lbs., 8 ozs.



Model 93 Battery Commanders Telescope



Battery Commanders Telescope with Integral Tripod

Model 93, 8 x 6° 15'

This telescope is so constructed that the tubes can be used only in the vertical position. Its primary use is believed to be for observation and correction of artillery fire.

The eyepieces are of the multiple thread focusing type, and the diopter scale is graduated from + 2 to - 3. The reticle design consists of a vertical and horizontal mil scale graduated in increments of one mil from 0 to 30 on each side of 0. A light receptacle for artificial illumination of the reticle is provided.

The telescope is fitted with an angle of site mechanism. The hinge mechanism of the assembly consists of a simple hinge pin and a fitted yoke. The interpupillary mechanism is locked near the base and between the two tubes.

Telescope with Integral Tripod

The general purpose of this instrument is believed to be the observation and correction of fire, used with either machine guns or artillery. Unlike the instrument above, it employs a scissor movement and may, therefore, be used in either a vertical or horizontal position.

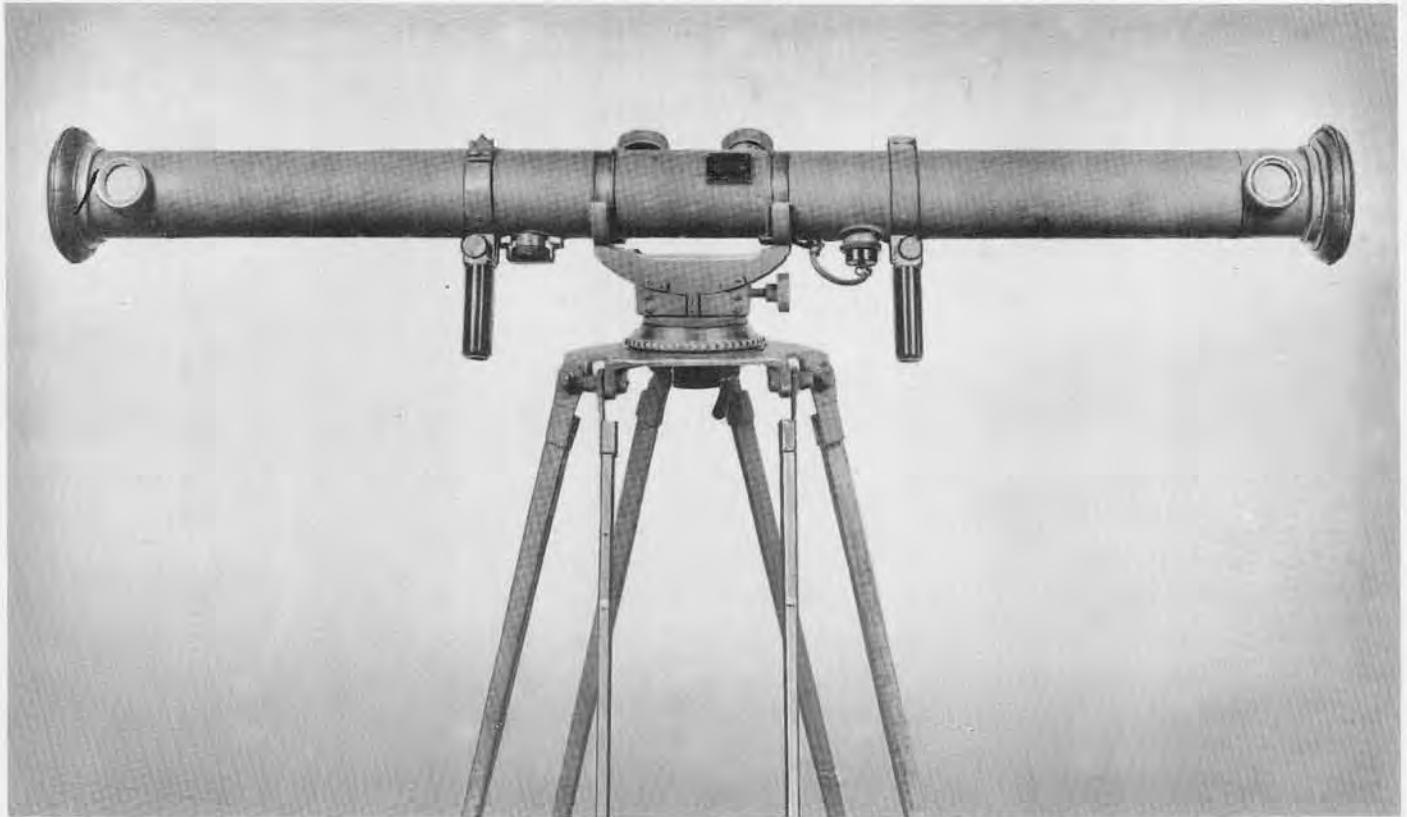
The reticle is the only angle measuring device provided. The limit for horizontal angles is 30 mils to the right and 10 mils to the left of zero. Vertical angles of plus and minus 20 mils can be measured. The 90° prisms are cemented. Minimum and maximum interpupillary distances are 60 mm and 70 mm.

The tripod is simply constructed, light in weight, and sturdy. It comprises an adapter or bracket for the telescope, a tripod head, and three tubular, fixed length legs with small metal shoes.

SPECIFICATIONS

	Model 93	Tel. with Int. Tripod
Power	8 diameters	8 diameters
Field of view	6° 15'	6°
Interobjective distance	3¾ ins.	*
Interpupillary setting	58 to 70 mm	54 to 70 mm
Deviation of light in vertical plane	10 ins.	9 ins.
Diameter of Exit Pupil .....	.2 in.	.15 ins.
Overall length	12¾ ins.	12 ins.
Overall width	6¼ ins.	
Weight	6 lbs., 5 ozs.	2 lbs., 2 ozs.
Length of tripod		11 13/16 ins.
Weight of tripod		11 ozs.

* The interobjective distance with the tubes horizontal, and the interpupillary scale set at 64 mm is 21 ins.; with the tubes vertical, and the interpupillary scale set at 64 mm, the interobjective distance is 5 ins.



This instrument is very similar to the 80 cm base range finder, Keuffel and Esser Model 1918. It also resembles the design of the Barr and Stroud instrument. It is, therefore, assumed that it is used much the same as the American 80 cm base, M1914M1 Range Finder. It is a coincidence type range finder with a split field of view, and is used by light field artillery units.

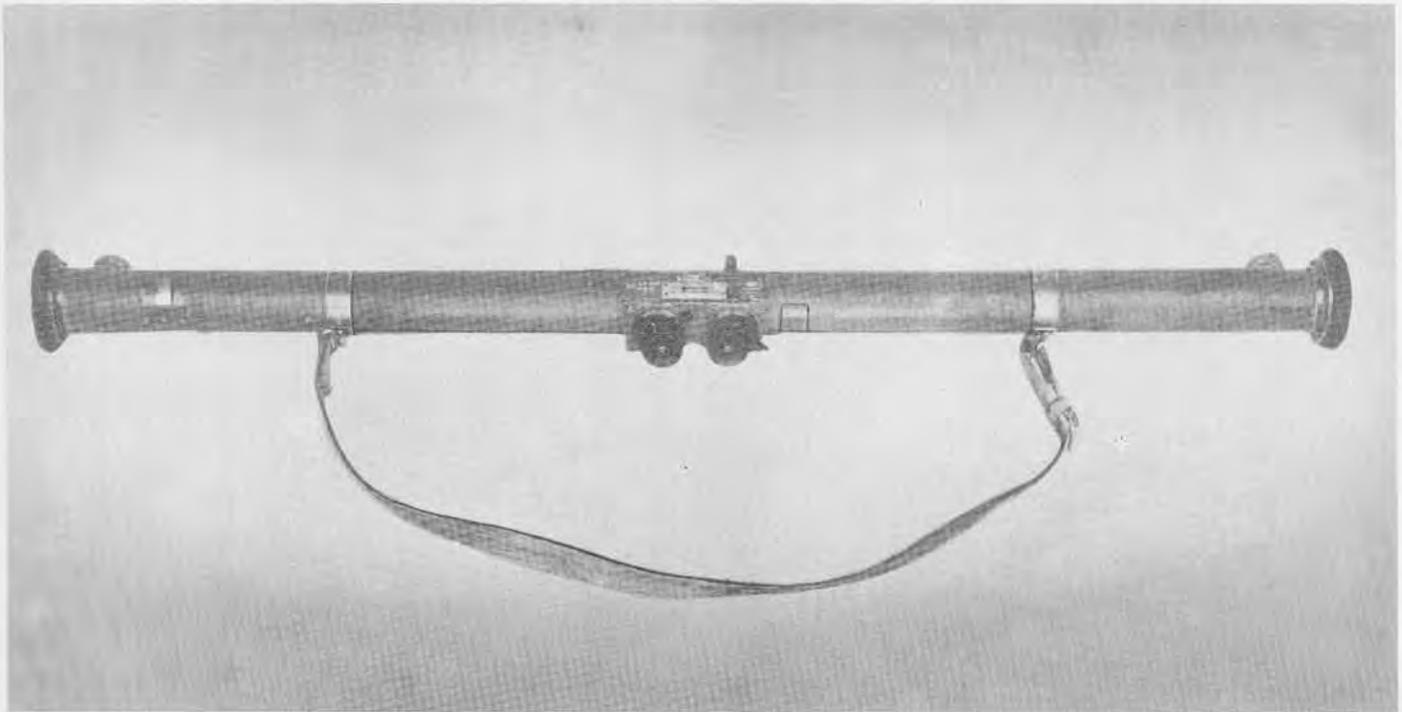
The ocular prism consists of three optical components cemented together resembling the arrangement in the American 1 meter base range finder, M1916. The eyepiece assembly is of the symmetrical type. The halving plate is a thick piece of optical glass with plano parallel surfaces. The measuring wedge and range scale are a single assembly. The latter is illuminated by the light rays entering through the range scale illuminating window, and reflected by a mirror. The objectives, installed as matched pairs are burnished in their cells. The penta prisms and wedge windows resemble those used in American range finders.

An effort has been made, through a bushing in the center of the buffer assemblies, to desiccate the instrument. It is not believed that the eyepiece assemblies can be sufficiently sealed to make this effective.

The tripod is lightly constructed and has no locking device for the legs. The tripod mount permits the range finder to be locked or rotated in azimuth. There is also a leveling device, but no level vial.

SPECIFICATIONS

Base length	75 cm
Magnification	12 power
Range	100 to 10,000 yds.
Field of view	Vertical 2°—horizontal 3°
Weight of range finder	9 lbs.
Weight of carrying case	6 lbs.



This instrument is a one-meter base, stereoscopic, horizontal base rangefinder. Ranges are read directly from the reticles.

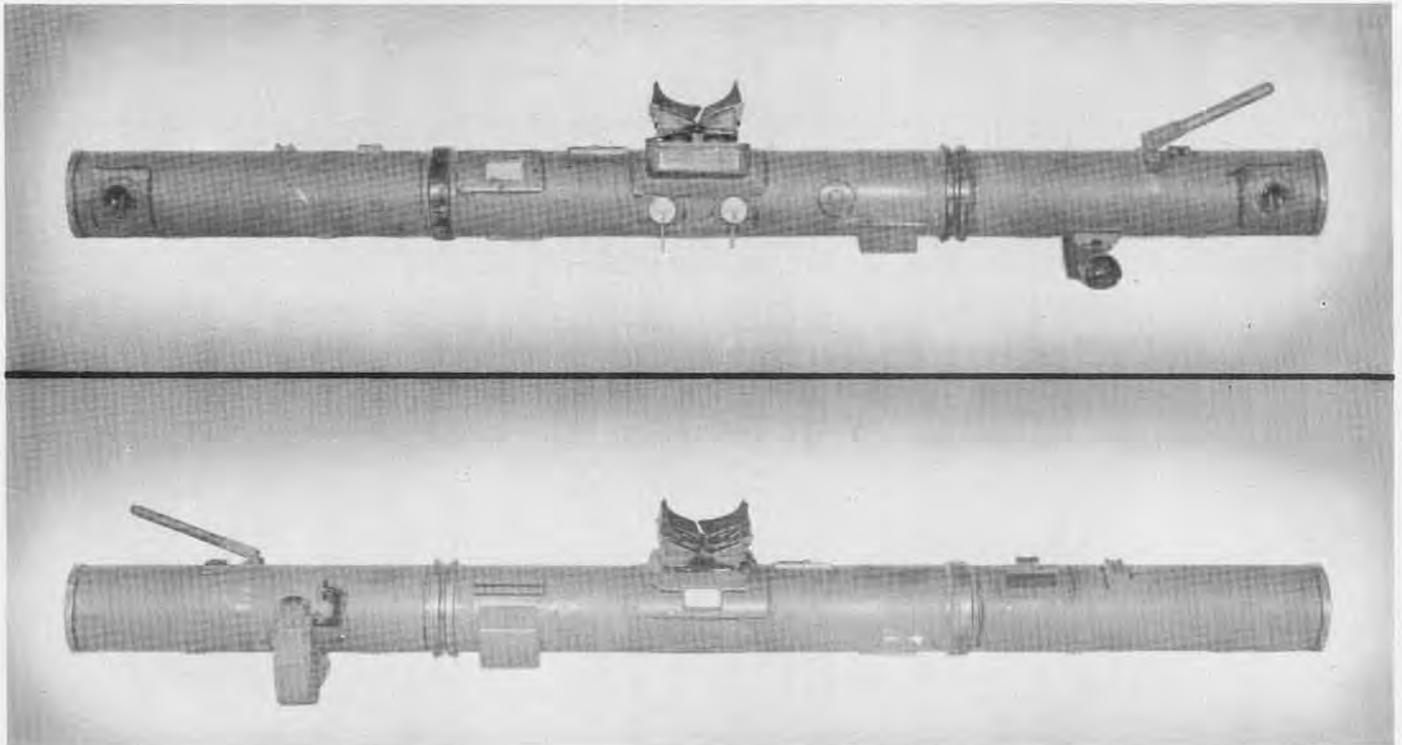
The outer tube is made of cast aluminum. The inner tube, made of seamless steel tubing, is supported in the outer tube by means of a gimbal joint. The height of image knob is located on the right end of the instrument; the range correction knob is on the left side. The lighting window of the reticle is above the eyepiece plate. An auxiliary open sight is located above the right eyepiece.

Uniform adjustment of interpupillary distance is obtained by connecting the two eyepieces with steel tape forming a figure 8. Rhomboid prisms keep the optical axes of the eyepieces in alignment with the reticles. The penta prism assemblies are held to circular plates which may be rotated to eliminate tilt of image and place both images at the same height in the field of view.

SPECIFICATIONS

Power	8 diameters
Field of view	5°
Base length	1 meter
Diopter movement	+ and - 4 diopters
Interpupillary setting	55 to 75 mm
Overall length	43¾ ins.
Weight	6 lbs., 13 ozs.
Serial number	1218
Measuring limits	250 to 8,000 yds.

STEREOSCOPIC 2 METER BASE RANGE FINDER MODEL 97 TYPE 2



This range finder is believed to be designed for use with seacoast defenses. It is provided with an elbow telescope for tracking purposes and a graphical computer for converting slant range to altitude.

A number of its design features are quite similar to those in the Japanese 2 meter base Height Finder. Similarities are noted in the penta prism mounting, central prism assembly, reticle and eyepiece assemblies, night lighting of scales, and the filter assembly. The instrument is constructed with an outer tube, optical tube, and two tubular diaphragms, all of steel. The outer tube is covered with asbestos treated canvas. The tracking telescope provided with this instrument has a power of 10 diameters and a 5 degree field of view. The body is made of cast aluminum. The tracking telescope is attached to the main instrument by means of a dovetail bracket and is locked in place by a spring latch.

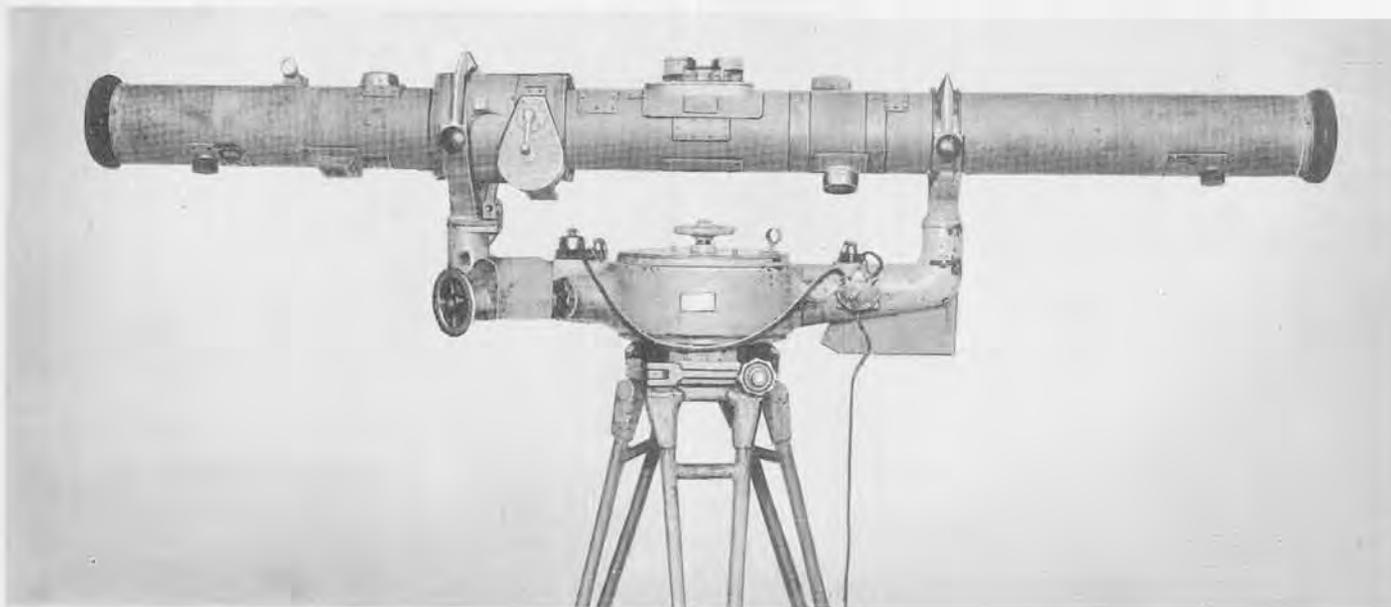
Another accessory, the graphical altitude computer, consists of a pendulum arm inclosed in a circular holder. The pendulum is graduated with a vertical scale in increments of 50 meters from 100 to 1,000 meters, which represents slant range. Angle of site is indicated by a graduated scale on the face of the holder. The cradle has the trunnion bearing arms cast as an integral part of the body. The eyeguard assembly is a copy of the Carl Zeiss design.

SPECIFICATIONS

Power	24
Field of view	Undetermined
Diameter of entrance pupil	1.9 ins.
Diameter of exit pupil .....	.08 ins.
Base length	2 meters
Diopter movement	+ 2 to - 4 diopters
Measuring limits	500 to 20,000 meters
Inter-trunnion distance	35½ ins.
Overall length	86 ins.
Weight	148 lbs.

STEREOSCOPIC 2 METER BASE HEIGHT FINDER, MODEL 93

JAPANESE



While primarily designed for use by antiaircraft batteries, a mining horizontal as well as vertical range. The eyepieces are of range finder of this type may be used by artillery units for determining the focusing type. Interpupillary distances may be set to suit the individual observer by means of a lever located on the right eyepiece. The eyepiece assembly also contains two ray filters.

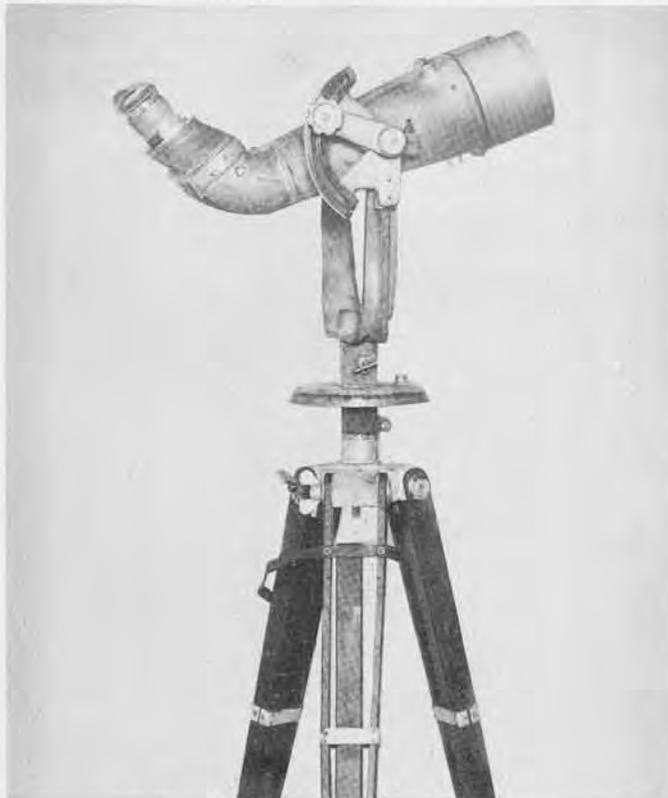
The instrument consists of three major assemblies which are: the Range Finder Table, the Cradle, and the Tripod assembly. The outer tube is made of seamless steel tubing and has seven openings for adjustments. In addition, there are other openings for the eyepiece assembly, wedge windows, infinity correction lens assemblies, range knob, height of image knob, correction wedge assembly, range drum window, and reticle light windows. The optical bar is made of seamless machined steel and represents better machine work than most Japanese fire control instruments.

SPECIFICATIONS

Power	20 diameters
Field of view	2° 15'
Interpupillary setting	56 mm to 74 mm
Diopter adjustment	+ 2 to - 4
Limits of range measuring.....	400 to 20,000 yds.
Base length	2 meters
Overall length	7 ft. 5½ ins.
Weight	201 lbs.
Cradle	
Overall length	36¾ ins.
Distance between trunnions	34 11/16 ins.
Height	23 ins. (approx.)
Weight	162 lbs.
Tripod	
Overall height	32 ins.
Weight	100 lbs.



Observation Binoculars, 85 mm



Aircraft Spotting Binoculars, 100 mm



Aircraft Spotting Binoculars, 120 mm

Observation, 85 mm

These binoculars are used for general observation upon a tripod for which an adapter is provided on the instrument. An elevation scale is etched on the reticle and the 90° prisms are cemented. Two steel bands connect the eyepieces mechanically. Drying bents are contained in each telescope.

Aircraft Spotting, 100 mm

The telescope bodies of this instrument are of cast aluminum; the fittings are of brass. The erecting system consists of a roof angle prism held in position by four screws. The objective is housed in an eccentric adapter. The eyepieces are offset from the main tube. Interocular settings are obtained by rotating the eyepiece housings. There are two drying plugs in the body of each telescope.

Aircraft Spotting, 120 mm

It is believed that this improved model is replacing the 100 mm binoculars described above. The eyepiece assemblies include a rhomboid prism. Interocular distances are varied by rotating the left eyepiece assembly. The erecting system consists of one porro prism and two 90° prisms cemented to the porro system.

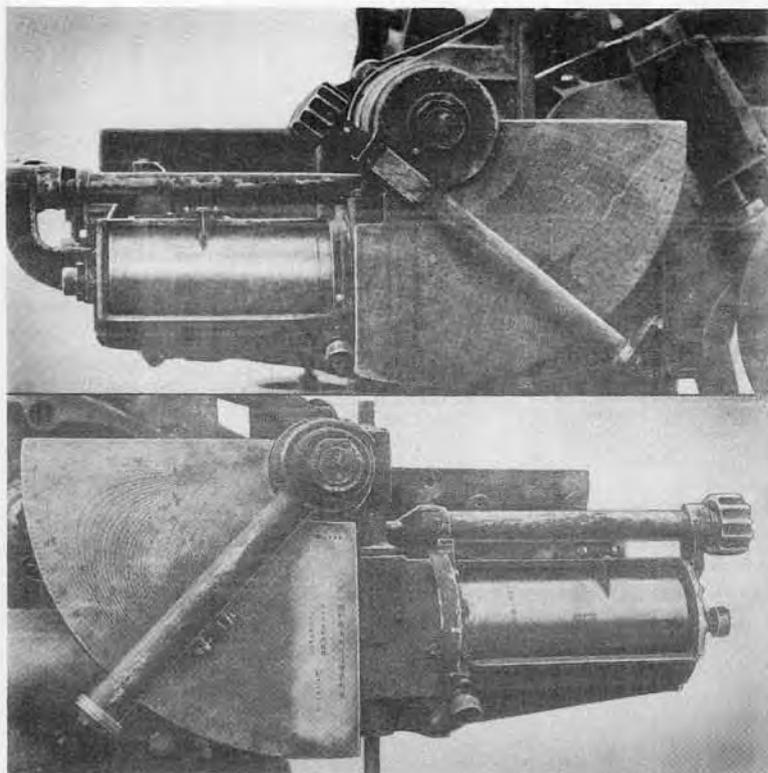
A feature of this instrument is the dehydrating unit consisting of a silk bag of silica gel placed in a perforated metal holder fitted between the two telescope assemblies. Drying vents are also provided.

SPECIFICATIONS

	85 mm	100 mm	120 mm	
Power	15X	15		20X
Field of view	4°	4°		3°
Interobjective distance (approx.)	4 7/16 ins.	5 9/16 ins.		7 ins.
Diopter movement	+ 2 to - 4	+ 2 to - 3		+ 2 to - 4
Interpupillary Movement	60 to 72 mm	60 to 72 mm		58 to 72 mm
Length	18 ins.	21 1/2 ins.		24 ins.
Width	18 1/2 ins.	16 ins.		18 ins.
Weight	21 1/2 lbs.	32 lbs., 12 ozs.		50 lbs., 8 ozs.
Manufacturer.....	Jap. Op. Co.	Jap. Op. Co.		Toyko Optical Mach. Stock Joint Co.
Serial number	915	2254		63

FIRE CONTROL EQUIPMENT

for 75 mm Model 88 (1928) A. A. Gun



Above: Elevation Computing Apparatus

Below: Azimuth Computing Apparatus

These instruments are used with the Mobile Field Antiaircraft Gun described on page 110. The method used to predict the future position of a moving target in space differs from both the angular rate of travel and the linear speed methods, although based on the latter. Antiaircraft installations captured before the middle of 1944 showed very little use of computing directors and remote control systems. The system described herein is apparently all that was available.

The following instruments and computing mechanisms are employed in the system as off-carriage components:

- a. Two-meter-base height and range finder.
- b. Speed and course angle calculator.
- c. Charge (propelling) temperature and wind corrector scale.
- d. Spotting binoculars.

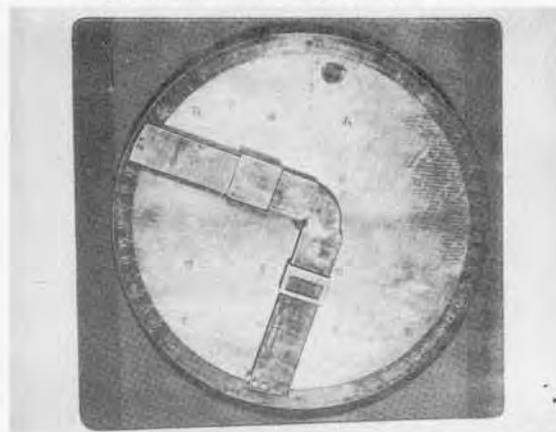
The data computed with the off-carriage components are transmitted orally to the gun where they are manually registered in the on-carriage fire control instruments. The on-carriage components consist of the following:

- a. Elevation computing apparatus.
- b. Azimuth computing apparatus.
- c. Auxiliary elevation and lead corrector disc.
- d. Fuze setter.

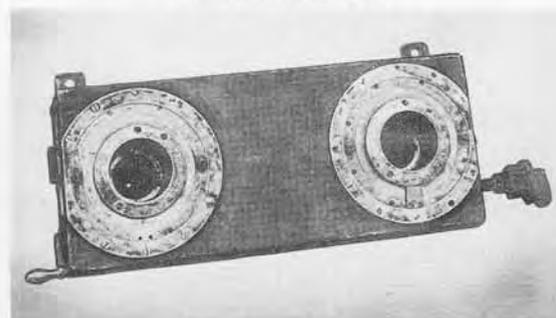
The accompanying illustrations show five of the significant components.



Speed and Course Angle Calculator



Propelling Charge Temperature and Wind Correction Scale



Fuze Setter



On the following three pages are reproduced trajectory charts for six Japanese antiaircraft and dual purpose guns. These were prepared by an Ordnance Technical Intelligence team in the field, and were constructed on the basis of the best available current information, but not on actual tests. It is, therefore, expected that revised charts will be made available as more accurate or detailed information is obtained, and that charts for other artillery pieces will be prepared from time to time.

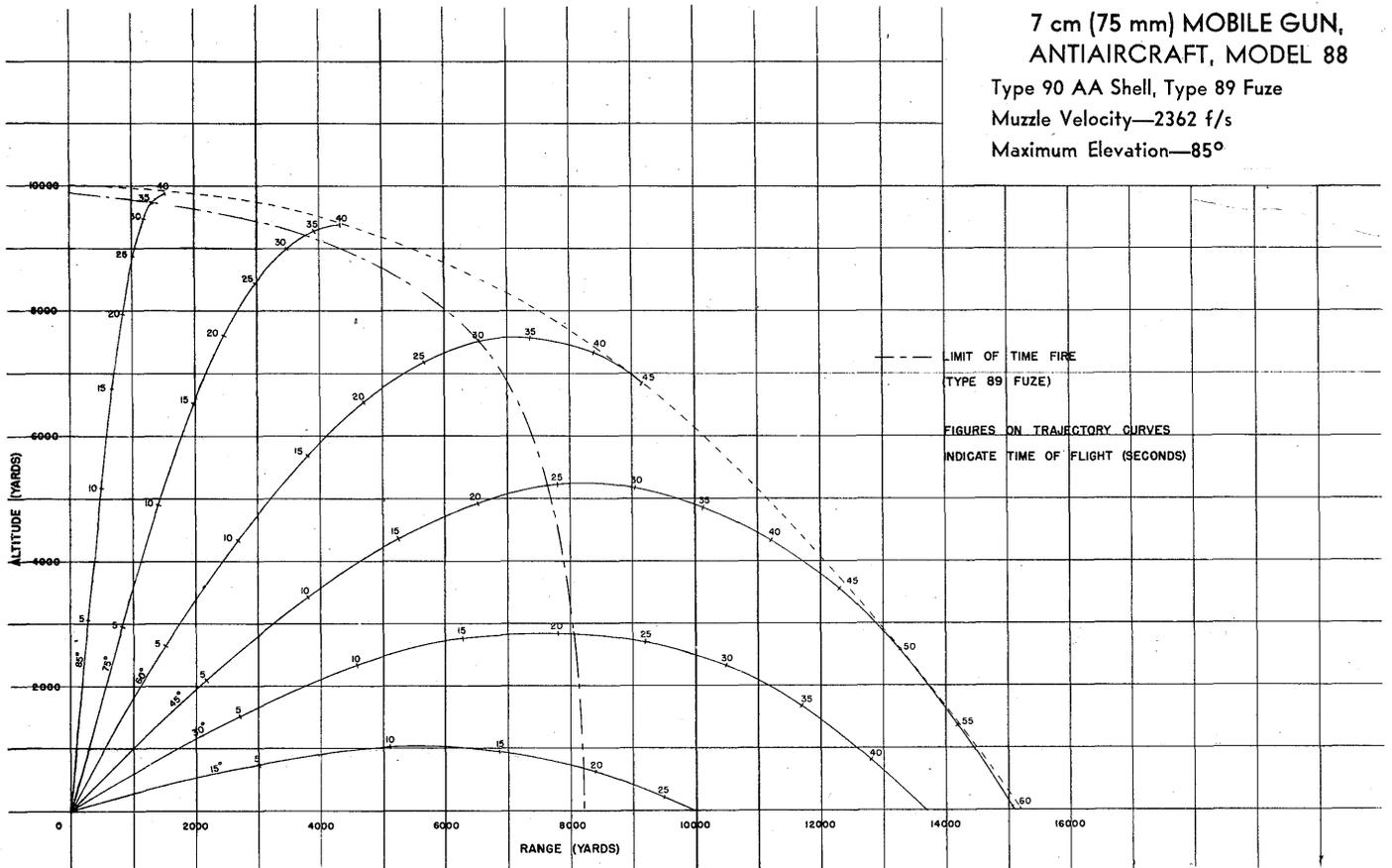
On the charts the limit of time fire is indicated. In all cases where mechanical time fuzes are available, the limit of time fire is based on the maximum setting of the fuze, since the fuze setting of a mechanical time fuze nearly coincides with actual time of flight at all points. For the 7 cm Type 88 antiaircraft gun, the limit of time fire has been taken from documents. The fuze in this case is the Type 89 30-second, powder-train fuze. Here it should be noted that the actual time of flight obtained with the maximum fuze setting varies greatly over the range of elevations, resulting from the inherent variation in burning time of the powder trains along different trajectories. If subsequent intelligence indicates use of a mechanical time fuze for this gun, as for example, with the 8 cm (3") dual purpose gun, the limit of time fire would approximate the locus of points reached in the time of flight corresponding to the maximum setting of the fuze. A later model powder-train fuze (Type 2, 44-seconds) has been reported for the 7 cm gun. Its contour differs from that of the Type 89, so that the trajectories of the shell would be somewhat different from those here reported; no data are available on the ballistic performance of the gun firing shell equipped with the Type 2 fuze, but it is believed that the performance would be slightly poorer since the Type 2 fuze gives a height of ogive somewhat lower than does the Type 89. However, preliminary intelligence indicates that with the Type 2 fuze actual times of flight correspond much more closely to fuze settings than in the case of the Type 89.

TRAJECTORY CHARTS FOR A.A. GUNS

JAPANESE 

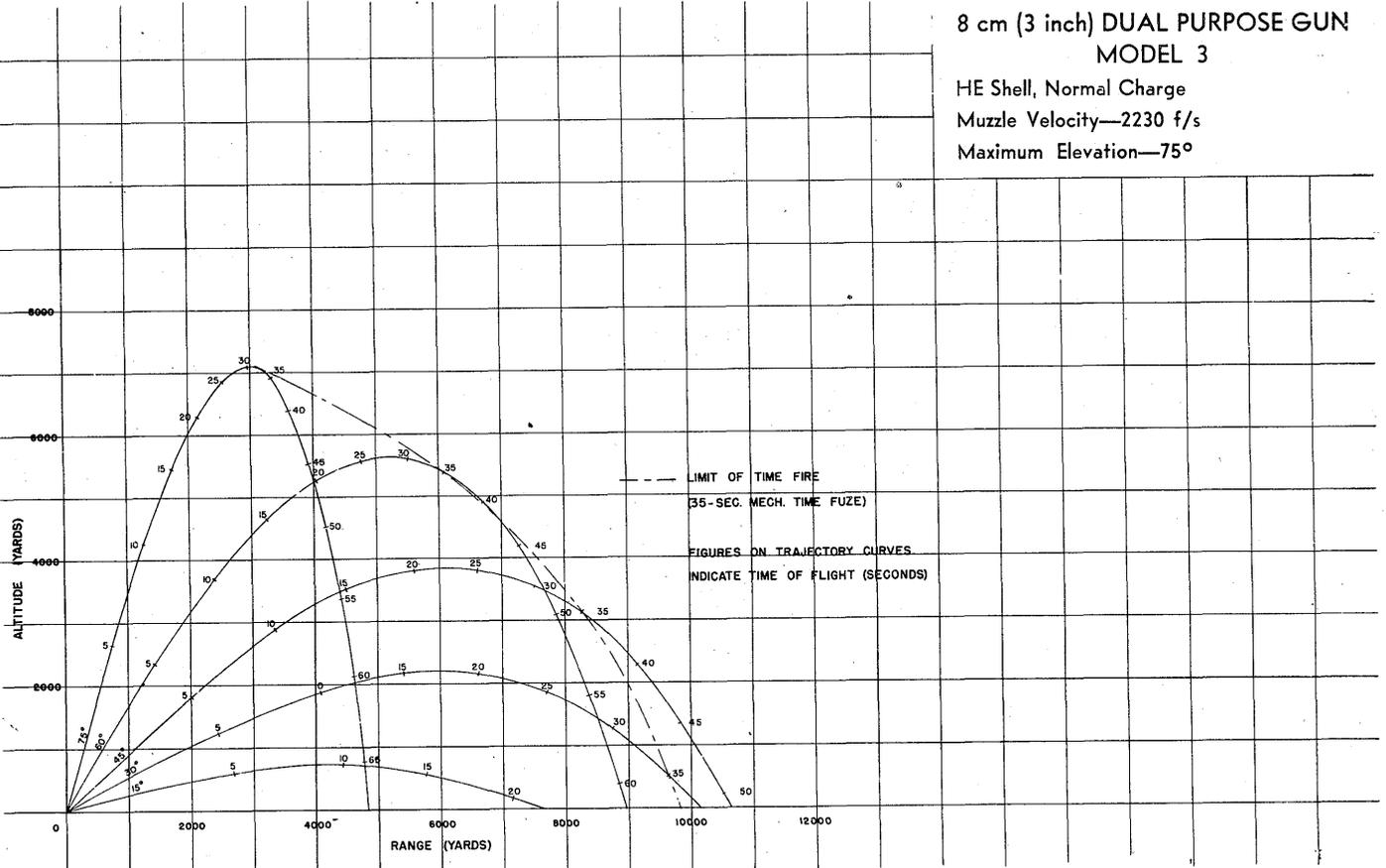
7 cm (75 mm) MOBILE GUN,
ANTI-AIRCRAFT, MODEL 88

Type 90 AA Shell, Type 89 Fuze
Muzzle Velocity—2362 f/s
Maximum Elevation—85°

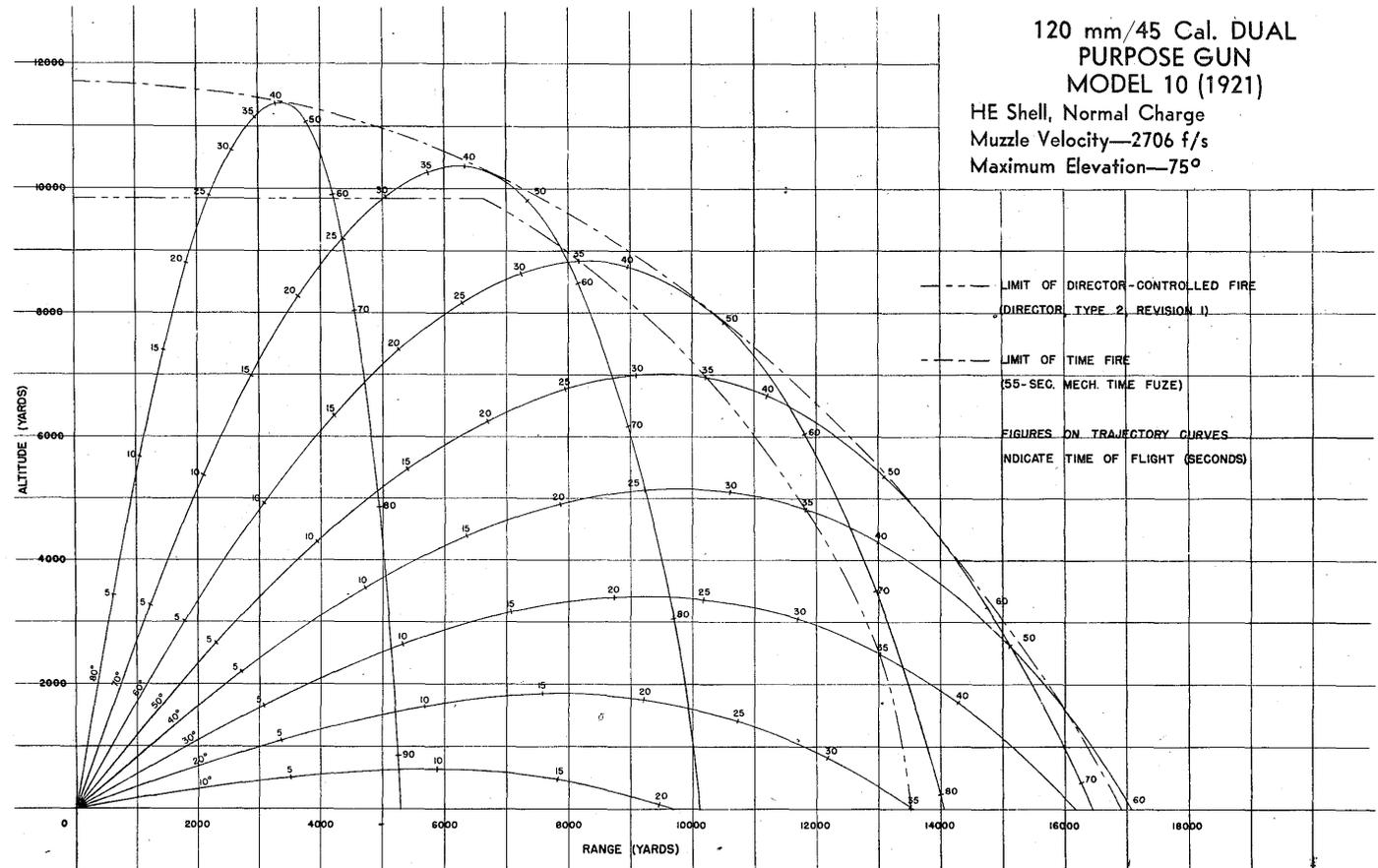
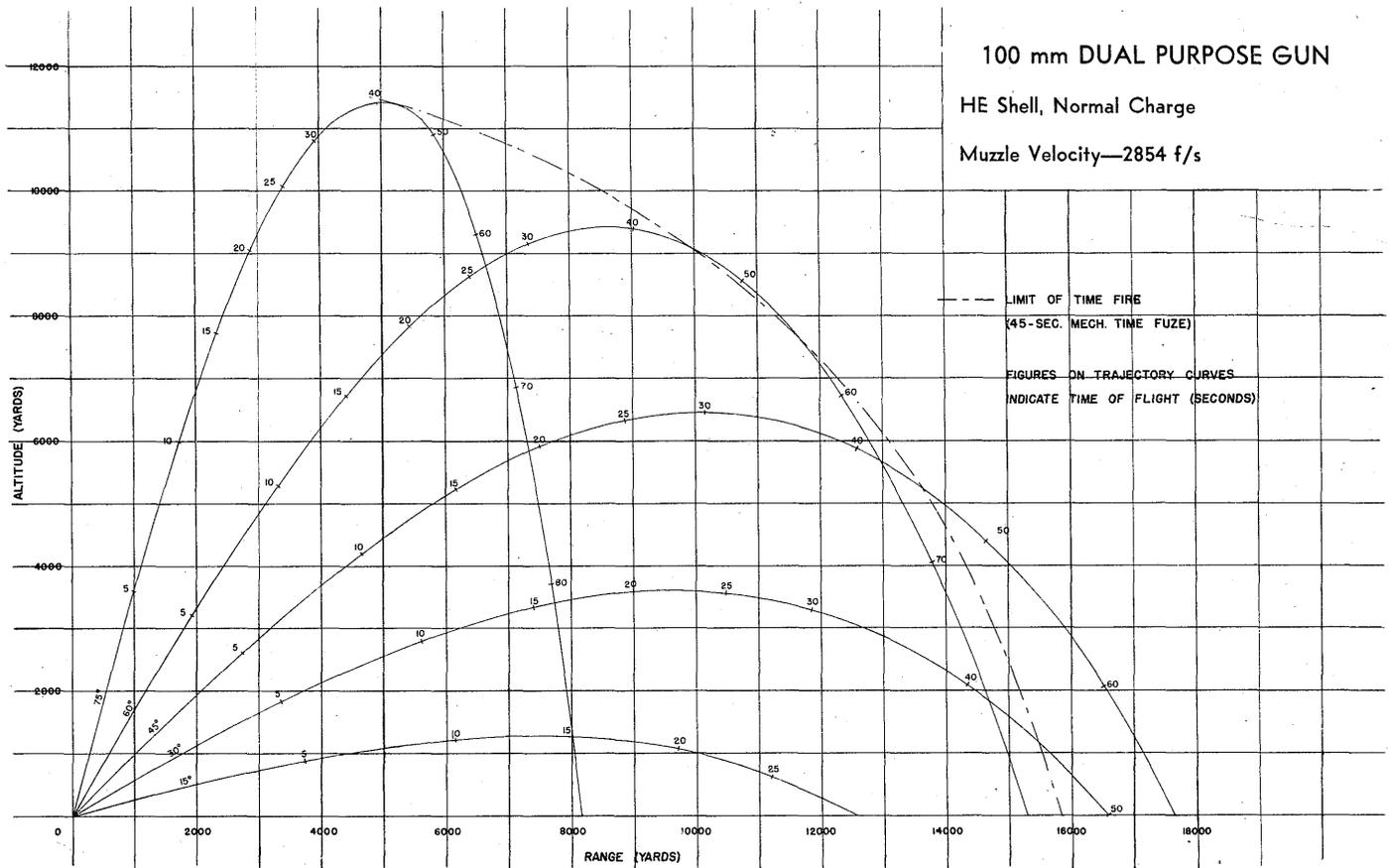


8 cm (3 inch) DUAL PURPOSE GUN
MODEL 3

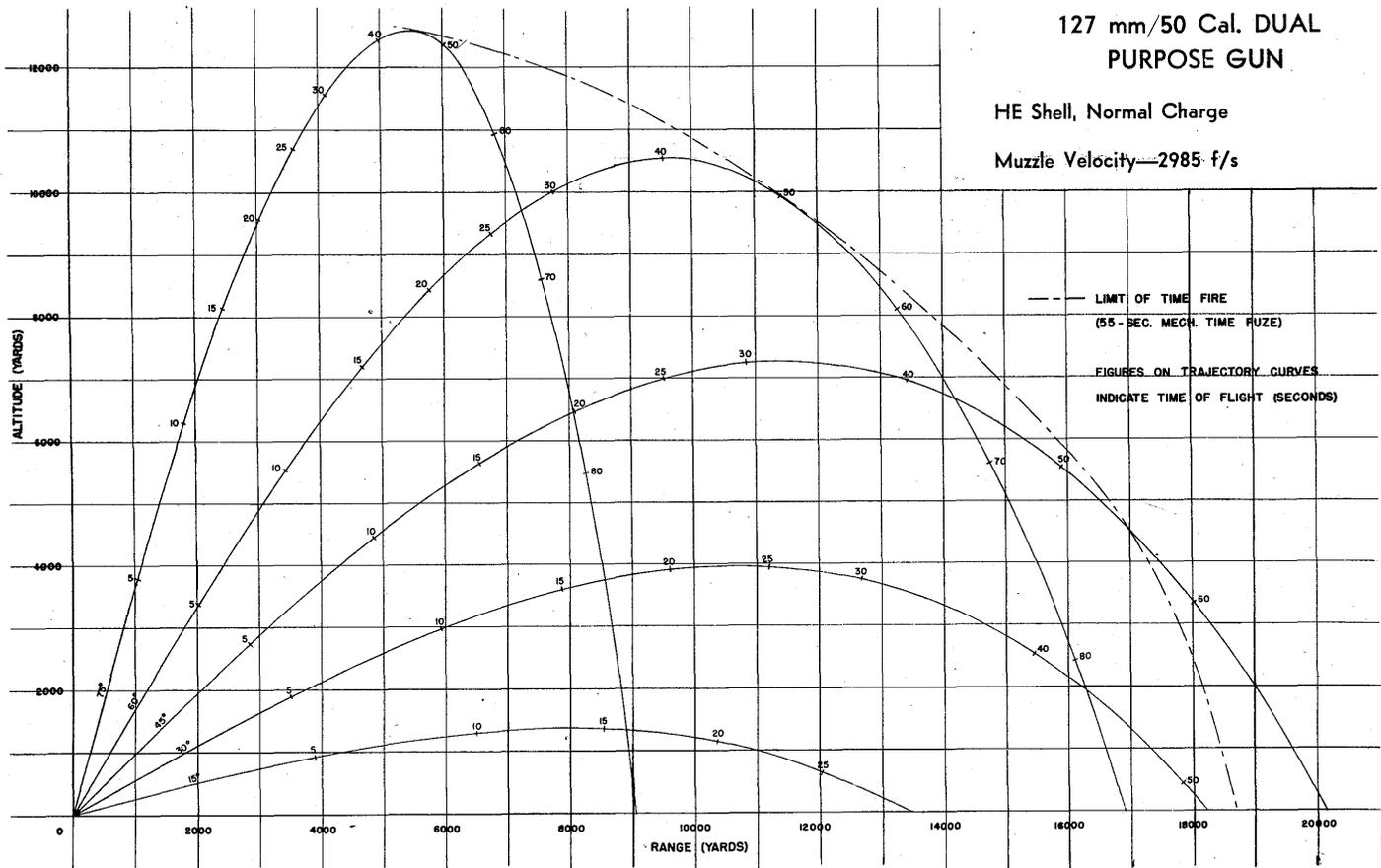
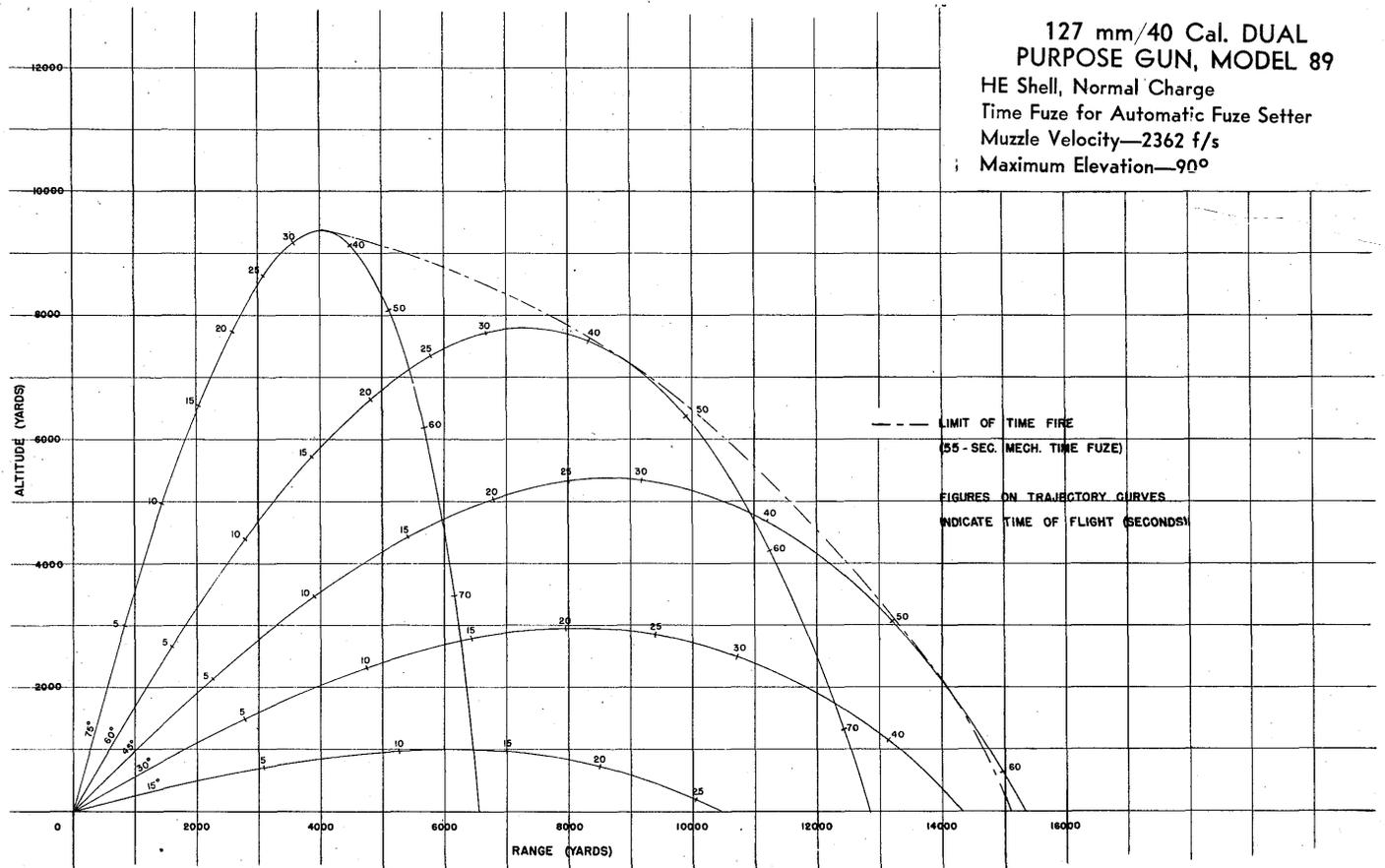
HE Shell, Normal Charge
Muzzle Velocity—2230 f/s
Maximum Elevation—75°



TRAJECTORY CHARTS FOR A.A. GUNS

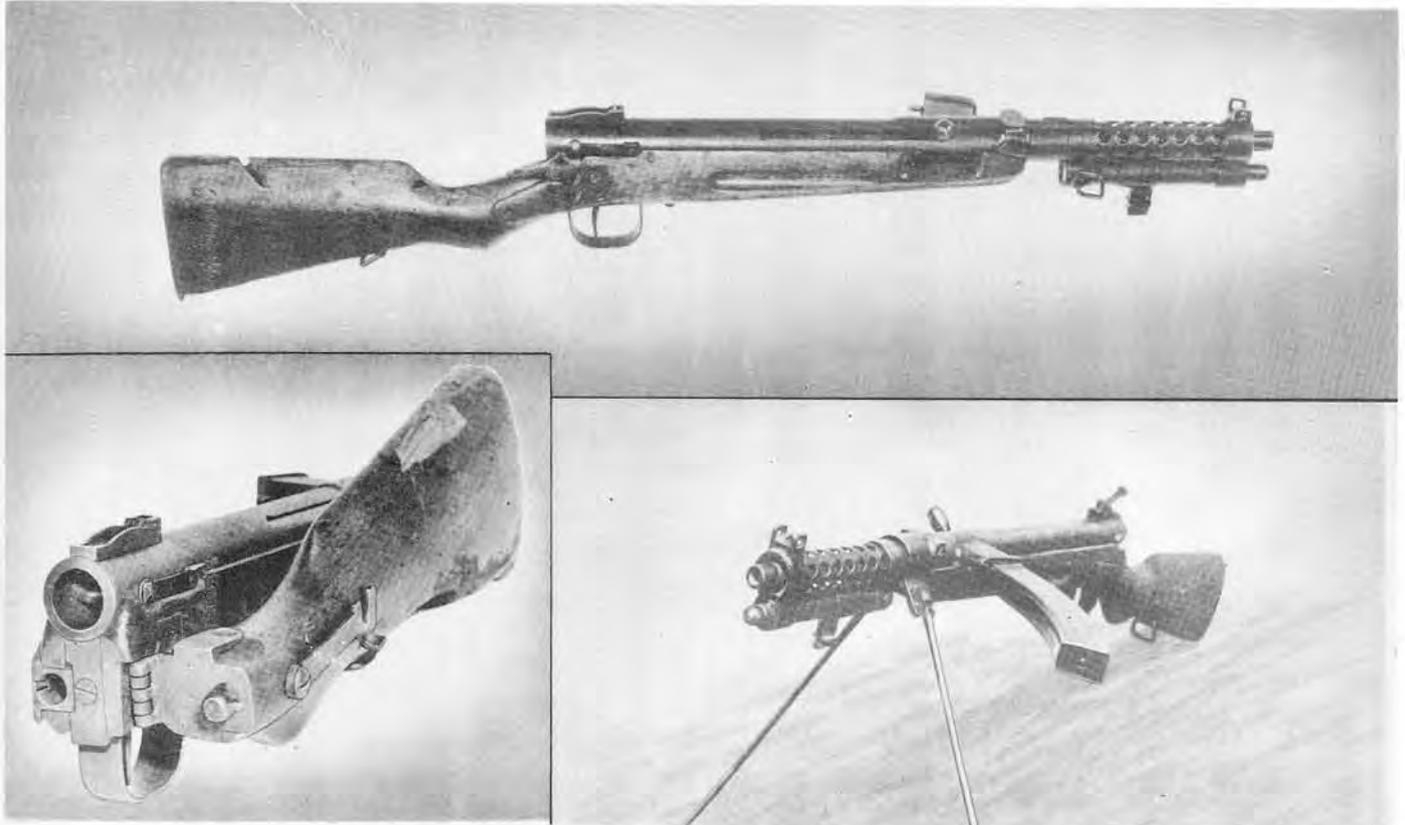


TRAJECTORY CHARTS FOR A.A. GUNS



8 mm PARATROOPER'S SUBMACHINE GUN, TYPE 100 (1940)

JAPANESE 



This Japanese paratrooper's submachine gun is a light, blow-back operated, automatic weapon which fires the regular issue bottle-necked 8 mm pistol cartridge.

The gun, which is provided with a bayonet, also has a folding stock; that is, the stock is cut through just behind the receiver and hinged so that by releasing two locking hooks on the left side, the stock swings to the right and forward 180 degrees at the hinge and parallel with the barrel. The barrel and barrel jacket are held in place by a single screwpin threaded at the base and with a folding wingnut head, enabling changes without tools. The receiver assembly is machined in two units, with the units shrunk fit in final assembly.

Two features of the firing mechanism which are of unusual interest are the fixed firing pin which screws into the face of the bolt, and the feeding and chambering bar which insures that the cartridge is very nearly chambered before the firing pin can touch the primer.

In the illustrations above, the top picture shows the weapon as fired, and the photograph at lower left shows the method of folding. A bipod is frequently used with this gun as illustrated in the photograph at lower right.

SPECIFICATIONS

Caliber	8 mm
Weight (without bayonet, magazine, & sightleaf)	7 lbs., 11 ozs.
Length (stock extended, without bayonet)..	34 ins.
Length (stock extended, with bayonet).....	49 ins.
Length (stock folded, without bayonet)..	22.25 ins.
Sight radius	20 ins.
Principle of operation.....	Blowback, bolt action
Feeding device.....	Curved box magazine; staggered feed type.
Capacity of feeding device	30 rounds
Cooling system	Air
Ammunition types.....	8 mm bottle-necked pistol cartridges
Rate of fire	400-450 r.p.m.
Type of sight	Leaf
Length of barrel	9 ins.
Length of rifling	8.125 ins.
Rifling	
Twist	Uniform R. H., approx. 1 in 12
No. of grooves	6
Muzzle velocity	1,080 f/s



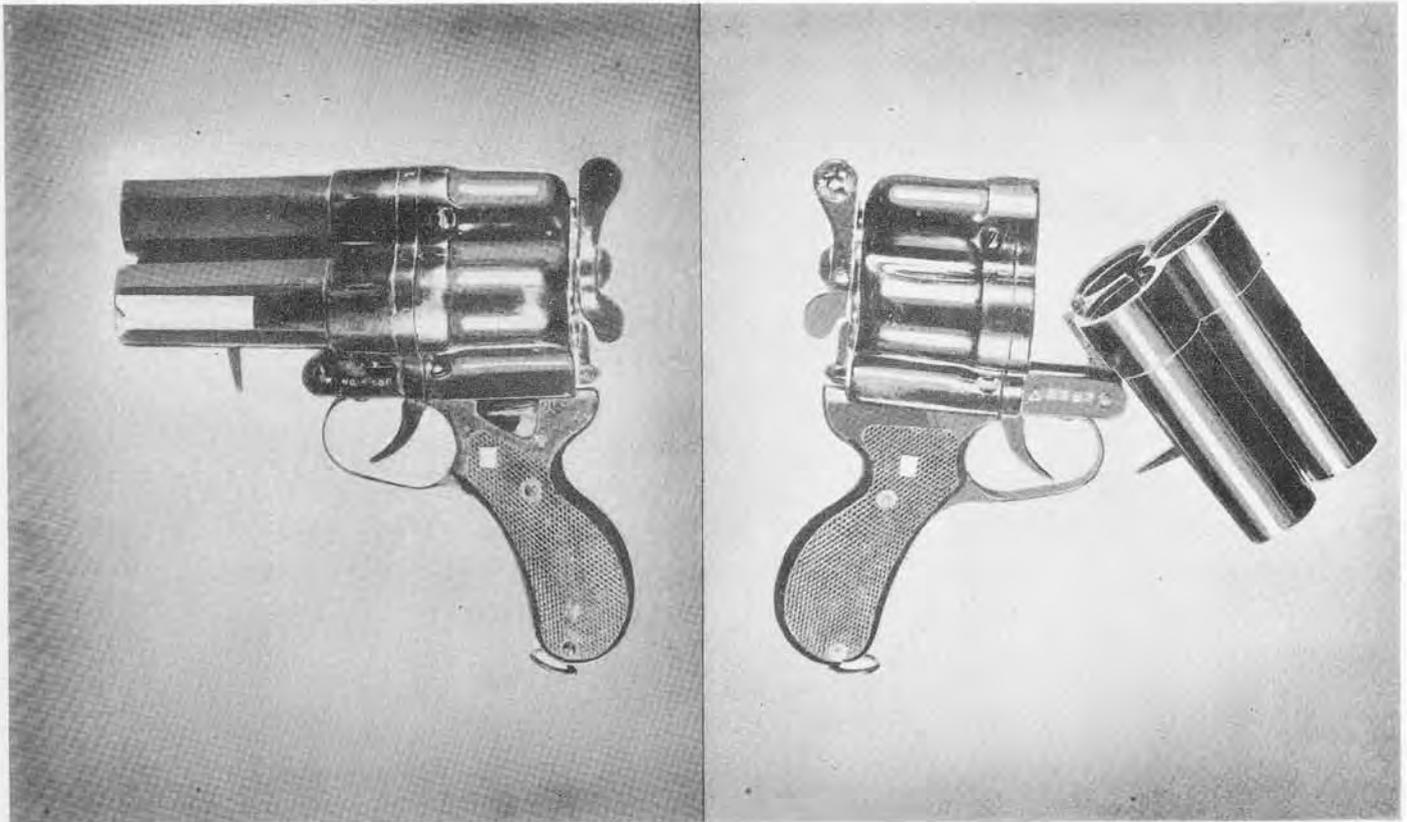
The Japanese 8 mm submachine Gun, Type 100, is an automatic, air-cooled, magazine-fed, straight blowback-operated type, firing from an open bolt. Its basic design strongly resembles that of the German submachine guns. The weapon may be broken down into three main groups: a receiver which contains the bolt and driving spring, a barrel assembly, and a wooden stock assembly containing the trigger and trigger guard. A considerable amount of rough welding is used on the weapon; the front sight, bayonet lug, barrel lock, magazine well, driving spring guide, and trigger guard have all been attached to the rifle by this method. An unusual feature of the gun is a replaceable firing pin which screws into the face of the bolt.

The weapon has a high cyclic rate of fire, estimated between 800 and 1,000 rounds per minute.

It differs from the Type 100 (1940) Paratrooper's rifle, described on page 204.1, in the following respects: it does not have a folding stock; a standard bayonet can be mounted directly on barrel and barrel jacket; and the rear sight is fixed rather than of the sliding ramp type.

SPECIFICATIONS

Caliber	8 mm (.315 in.)
Weight with sling and magazine.....	9 lbs., 2 oz.
Weight of magazine	9 oz.
Length (overall)	36 ins.
Sight radius:	
Principle of operation.....	Straight blowback
Feeding device	Curved box magazine
Capacity of feeding device	30 rounds
Cooling system	Air
Ammunition types	8 mm pistol
Rate of fire (cyclic)	800-1,000 rds. per min. (est.)
Type of sight—Front: Inverted "V"	
	Rear: "V" with small peep additional.
Weight of barrel	
Length of barrel	9-3/16 ins.
Length of rifling	8.3 ins.
Rifling:	
Twist	R. H.
Form	
No. of grooves	6
Muzzle velocity	1,050 f/s
Maximum range	
Effective range	



The triple barrel signal pistol, of naval design, is made of steel with black baked enamel finish and is equipped with plastic grips. It consists of three main parts: the barrel assembly, the firing mechanism housing, and the receiver. The barrels, which are slightly tapered and of the smooth bore type, can be fired only singly. The left barrel is marked with a red stripe, the top barrel with a white stripe, and the right barrel with a green stripe. The various kinds of ammunition used with the weapon (red, white, and green flares) must correspond with the color markings on the barrel. The weapon is carried in a leather holster.

The pistol is opened for loading by pulling forward on the spring-loaded barrel release lever and forcing downward on both ends of the pistol. Movement of the safety lever upward places the gun in the firing position; downward movement of the lever places the gun in the safe position. A counter-clockwise movement of the cocking lever cocks all three spring-loaded firing pins. Each firing pin has its own sear, and movement of the barrel selector lever to the desired stop directs the movement of the trigger to the proper sear, releasing the proper firing pin and firing the round in the selected barrel. The three stops on the barrel selector lever are as follows: the left hand stop for the left hand barrel, the central stop for the top barrel, and the right hand stop for the right hand barrel.

The barrel assembly and firing mechanism recoil on the receiver during firing against the action of a recoil spring located in the receiver.

A double barrel version of this pistol is shown at the right.

SPECIFICATIONS

Weight of pistol	3 lbs., 11 ozs.
Length of barrel (approx.)	4 ins.
Bore diameter at muzzle	26.8 mm
Bore diameter at breech	28.4 mm
Types of ammunition used	Red, white, & green flares





The Japanese 6.5 mm Sniper's Rifle, Model 97, is a manually operated, bolt-action, air-cooled, shoulder weapon similar to the Model 38 (1905) 6.5 mm rifle except for its monopod, turned-down bolt handle, and telescopic sight. The telescopic sight is attached to the left hand side of the receiver by means of a dove-tailed base. It is a fixed focus type of 2.5 power and has a 10° field of vision.

The telescopic sight is approximately seven inches long and is equipped with an eyepiece of soft rubber. The reticle is marked in the following graduations: vertical from 0 to 15, horizontal 20 mils each side of the center, the markings being at 5 mil intervals. The horizontal line intersects the vertical scale at the 3 mark.

The telescopic sight is removable and when not in use is carried in a well constructed canvas case which has a heavy coating of lacquer on the outside for waterproofing. The case is fitted on the inside with a wooden spacer to secure the sight when it is inside. A small pocket to hold the sight cleaning brush is also constructed inside the case.

The rifle is also provided with a folding monopod which is pivoted on the lower band.

SPECIFICATIONS

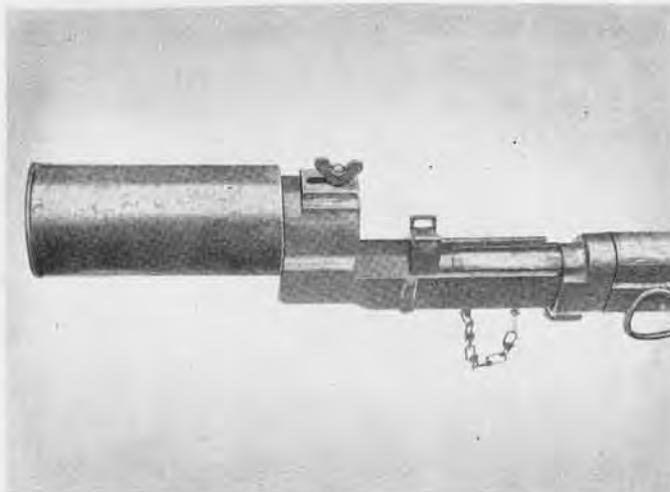
Weight (w/telescopic sight).....	10 lbs., 8 oz.
Length (overall w/o bayonet).....	50.25 ins.
Sight radius	26.9 ins.
Principle of operation	Manual, bolt-action
Feeding device	Box magazine
Capacity of feeding device	5 rounds
Cooling system	Air
Ammunition types.....	Mod. 38, 6.5 mm ball and reduced charge ball
Rate of fire.....	According to dexterity of user
Type of sight	2.5x telescopic sight
Weight of barrel	
Length of barrel	31.4 ins.
Length of rifling	29.1 ins.
Rifling	
Twist	Uniform R.H. one turn in 7.88 ins.
Form	Meiford segmental
No. of grooves	4
Depth of grooves	
Width of grooves	
Chamber pressure	
Muzzle velocity	2,400 ft. per sec.
Muzzle energy	
Maximum range	2,600 yds.
Effective range (approx.)	600 yds.
Type of mount	Folding monopod

There are three distinct types of grenade launchers in use by the Japanese. They are known as the Type 2 or cup type, the Type 100 or Kiska type, and the spigot type.

The Type 2, which is patterned after the German grenade launcher of the same type, fits over the front sight of the rifle and has a short rifled barrel. It fires both the 30 mm and 40 mm hollow charge rifle grenades. This grenade weighs 12½ ounces, is 8 inches long, has a maximum external diameter of 1½ inches, and contains 3.8 ounces of TNT. The grenade, which is armed during flight by a base detonating, set-back actuated fuze, detonates upon impact with the target. It will penetrate 3¾ inches of mild steel plate.



TYPE 2 CUP TYPE LAUNCHER



TYPE 100 LAUNCHER

The Type 100 may be used with either the 6.5 mm Type 38 or the 7.7 mm Type 99 rifle. Ordinary ball ammunition is used to launch the grenade from the rifle (the expanding gas from the fired cartridge is utilized to expel the grenade from the launcher), a feature which enables the rifle to be carried with the launcher attached and ready for use as either a rifle or as a grenade launcher. The Type 99 smooth bodied grenade known as the Kiska grenade is the only type used with the launcher. Ranges up to 100 yards may be obtained.

Overall length	8¾ ins.
Length of grenade tube	4½ ins.
Diameter of grenade tube (interior)	1¾ ins.
Total weight	1 lb., 9 ozs.

The spigot type launcher, which may be used with either the Type 38 or Type 99 rifle, fires the Type 91, Type 3 H.E., and several types of smoke and incendiary grenades. It consists of a rifled barrel threaded to an adapter. The launcher is attached to the rifle at the rear of the front sight mount by two locking arms on the adapter. When a bayonet is fixed to the rifle, additional stability is obtained by the use of a two-pronged lug on the adapter which fits on the bayonet guard.

Length of barrel	150 mm—5.9"
Outside diameter of barrel	27 mm—1"
Inside diameter of barrel	21 mm—.82"
Overall length	107 mm—4.2"
Weight (complete)	15.5 ozs.



SPIGOT TYPE LAUNCHER



The Japanese 6.5 mm Model 3 Heavy Machine Gun, a gas-operated, air-cooled, full-automatic weapon with a comparatively low cyclic rate, although obsolescent, is being recovered in small quantities from battle areas. It is similar to the 7.7 mm Model 92, but is chambered for the 6.5 mm cartridge.

The gas piston and bolt assemblies, and the barrel and barrel sleeve may be interchanged in the two weapons. However, it is impossible to convert the Model 3 for use with the 7.7 mm ammunition as the strip feed port in the Model 3 is one-eighth of an inch narrower than that in the Model 92.

Various machining cuts found in the internal parts of the Model 3 were eliminated in the later model, to provide for ease of production. The oil reservoir is of slightly different shape and probably has a lower capacity than that of the Model 92. The trunnions are of two diameters. The part of the trunnion which contacts the trunnion bearing in the mount is of smaller diameter than that portion which extends beyond the mount. The head thus formed tends to reduce transverse motion.

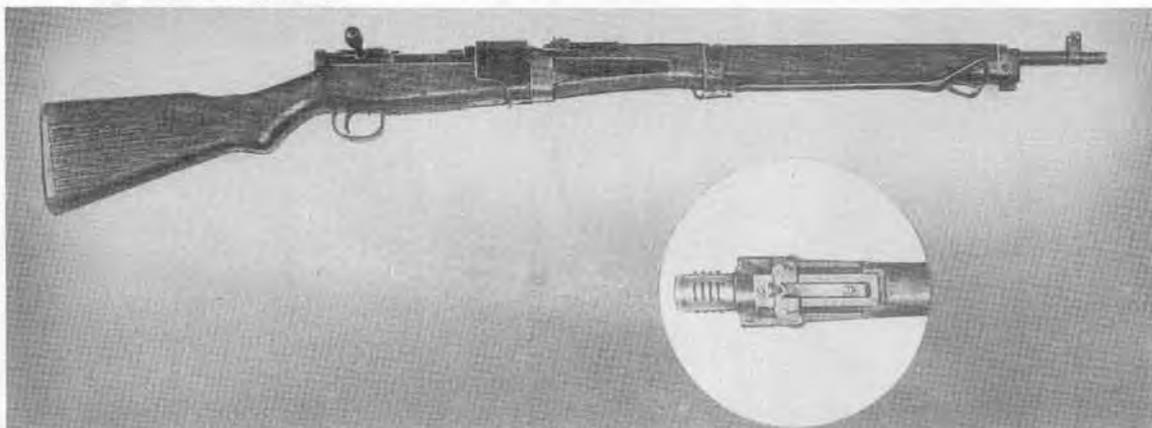
The weapon has conventional spade grips provided with two finger triggers fixed integrally with the trigger lever so that either or both will fire the gun. There is no safety device.

Two rear sights are provided: one, a folding ring type anti-aircraft sight, is attached permanently to the rear top of the receiver; the other, a tangent curve, radius arm type, is offset to the right. The latter sight is graduated from 300 meters to 2,200 meters (328 yards to 2,406 yards). It is believed that a cartwheel type front sight is used, as an adaptor for such a sight is riveted to the front of the cooling jacket.

SPECIFICATIONS

Weight (w/tripod)	122 lbs.
(w/o tripod)	61.7 lbs.
Length	47.2 ins.
Sight radius	23.6 ins.
Principle of operation	Gas
Feeding device	Metal strips
Capacity of feeding device	30 rounds
Cooling system	Air
Ammunition types.....	Mod. 38, 6.5 mm ball ammunition
Rate of fire.....	Cyclic—450-500 r.p.m. Practical—200 r.p.m.
Type of sight.....	Two rear sights: folding ring, anti-aircraft type; tangent curve, radius arm type, grad. 328—2,406 yds.
Weight of barrel	
Length of barrel	29.2 ins.
Length of rifling	26.4 ins.
Rifling	
Twist	Uniform, R.H., one turn in 7.88 ins.
Form	Metford segmental
No. of grooves	4
Depth of grooves	
Width of grooves	
Chamber pressure	58,800 lbs. per sq. in.
Muzzle velocity	2,434 ft. per sec.
Muzzle energy	
Maximum range	4,376 yds.
Effective range	1,500 yds.
Type of mount	Tripod
Elevation	—15° to +9°
Traverse	33.5°

Model 99 (1939)



Model 2 (1942)



Both of the weapons shown above are basically the same as the Japanese 7.7 mm standard infantry rifle, Model 99. They have been designed, however, to incorporate a takedown feature which enables them to be used by paratroop units. Manufactured at Nagoya Arsenal, they are manually-operated, bolt-action, magazine-fed, clip-loaded rifles.

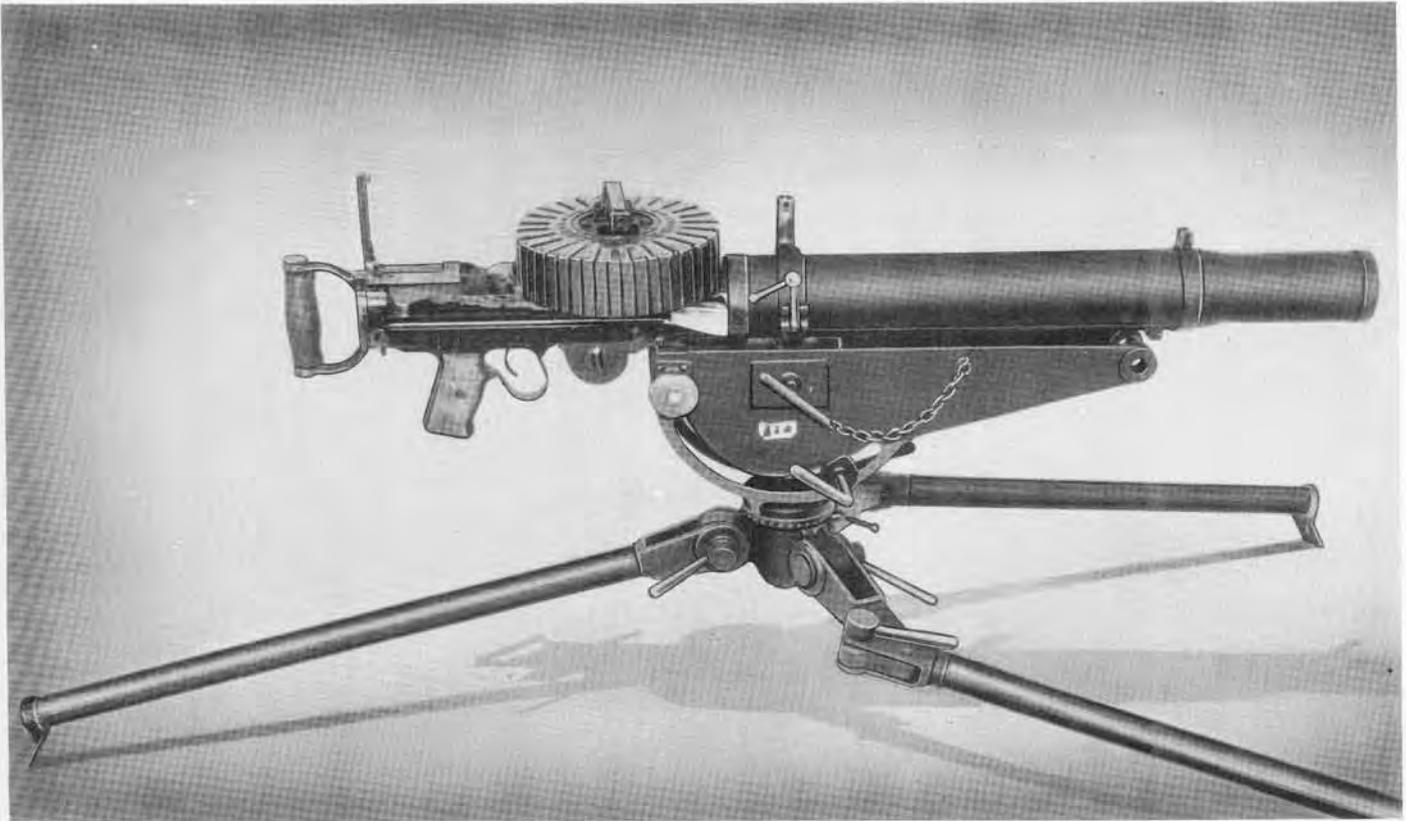
The modified Model 99 differs from the basic weapon in the following respects: the barrel locking adaptor is secured to the receiver; the barrel is secured into the adaptor by interrupted screw threads; the bolt handle is detachable; and the stock is in two parts.

The Model 2, called "Teraju" by the Japanese, is of much better workmanship than the Modified Model 99. The barrel and front end are detached from the stock at the receiver ring. When taken down, the barrel section is 25½ inches long; the stock 20¼ inches. Total weight of the loaded weapon is 8.9 pounds. The takedown system is simple and sturdy. The barrel has a straight, unthreaded shank with a lug on the bottom. The shank fits into a socket in front of the receiver. A tapered locking key passes through the receiver (from right to left) and engages in front of the barrel lug. The key cannot be taken out completely, but may be withdrawn far enough to allow removal of the barrel. It is locked in place by screwing a nut on the right side into the receiver wall.

A spring actuated plunger located in the front end of the buttstock locks the barrel and forestock in position. This plunger must be retracted before the barrel can be rotated for takedown.

SPECIFICATIONS

Weight	8.9 lbs.
Length	44"
Principle of operation	Manual, bolt-operated
Feeding device	Clip
Capacity of feeding device	5 rounds
Ammunition types	Model 99 rimless
Type of sight.....Front: inverted "V" blade on "T" base; Rear: leaf graduated from 328 to 1,640 yds. with aperture sight and aperture battle sight side arms for A.A. fire.	
Weight of barrel	
Length of barrel	25½"
Length of rifling	
Rifling:	
Twist.....	Uniform, right hand; one turn in approx. 10 ins.
Form	Metford segmental
No. of grooves	4
Depth of grooves	
Width of grooves	
Chamber pressure	
Muzzle velocity	2360 f/s
Maximum range	3,000 yds.
Effective range	600 yds.



The Lewis type machine gun is used widely by the Japanese. Markings on a number of these guns found in the New Georgia area indicate that the weapon as used by the Japanese is of naval origin. It is also believed that the gun is used extensively for ship or air base protection as the tripod mount is adaptable for antiaircraft fire.

The Model 92 is of standard Lewis gas-operated, air-cooled, drum-fed design, equipped with a blade front sight and a rear peep-sight calibrated in hundreds of meters from 0 to 17. No allowance is made for windage or drift. Although no antiaircraft sight was discovered with the gun, a mount for such a sight is attached to the weapon.

The gun is mounted on a tripod having tubular steel legs which may be locked at various angles from the vertical. The tripod legs are attached to flat square plates which have holes in the center to accommodate bolts which are used to secure the tripod to the deck of a ship.

The head of the tripod has a 360° traverse. Without removing the gun from the mount, the main portion of the tripod head can be moved from a horizontal to a vertical position, and the gun attached to the top of the head for antiaircraft use. In this position, the limits of elevation are approximately -80° to +85°. Azimuth is calibrated in 2 mil intervals from 0 to 6,400 mils.

7.7 mm rimmed Navy ammunition fed from a 47-round drum is used. Ammunition chests recovered were found to hold 21 loaded drums.

SPECIFICATIONS

Weight gun and tripod	122 lbs.
Length	39 ins.
Principle of operation.....	Lewis gas-operated system
Feeding device	Drum magazine
Capacity of feeding device	47 rounds
Cooling system	Air
Ammunition types.....	7.7 mm full-rimmed ammunition
Rate of fire	Cyclic—600 r.p.m.
Type of sight.....	Blade front sight; rear peepsight calibrated from 0 to 1700 meters
Weight of gun	49 lbs.
Length of barrel	24 ins.
Length of rifling .....	.....
Rifling	
Twist	Uniform, R.H.
Form	Concentric
No. of grooves	4
Depth of grooves .....	.....
Width of grooves .....	.....
Chamber pressure .....	.....
Muzzle velocity	2411 ft. per sec.
Muzzle energy .....	.....
Maximum range	4,000 yds.
Effective range	500 yds.
Type of mount	Tripod
Elevation .....	.....
Ground mount	-15° — +60°
Antiaircraft mount	-80° — +85°
Traverse	360°



This gun incorporates most of the features of the Model 92 Heavy Machine Gun, but is smaller and lighter. A total weight saving of 41 pounds in the gun and tripod mount is achieved. The barrel of the new gun is considerably shorter than that of the Model 92; therefore, the muzzle velocity is probably lower.

Both guns feed from 30-round strips, but the 01 (1941) uses rimless ammunition. The new gun incorporates the following modifications:

The barrel of the Model 01 may be quickly removed. The flash hider is screwed onto the muzzle, eliminating the knurled locking collar used on the older gun. The gas regulating system is similar to that of the 7.7 mm Model 99 (1939) Light Machine Gun. A smaller oil reservoir is used. A new method of attaching the ejection port cover allows easier access to the receiver which should aid in clearing stoppages. Minor changes in the metal sights have been made. A crank-shaped safety is fitted through the top of the sear housing with its handle at the left rear of the receiver. The new tripod is lighter and has different type spades. It also has a different mechanism for elevating the pintle support above the tripod base. The receiver of the Model 01 is lighter.

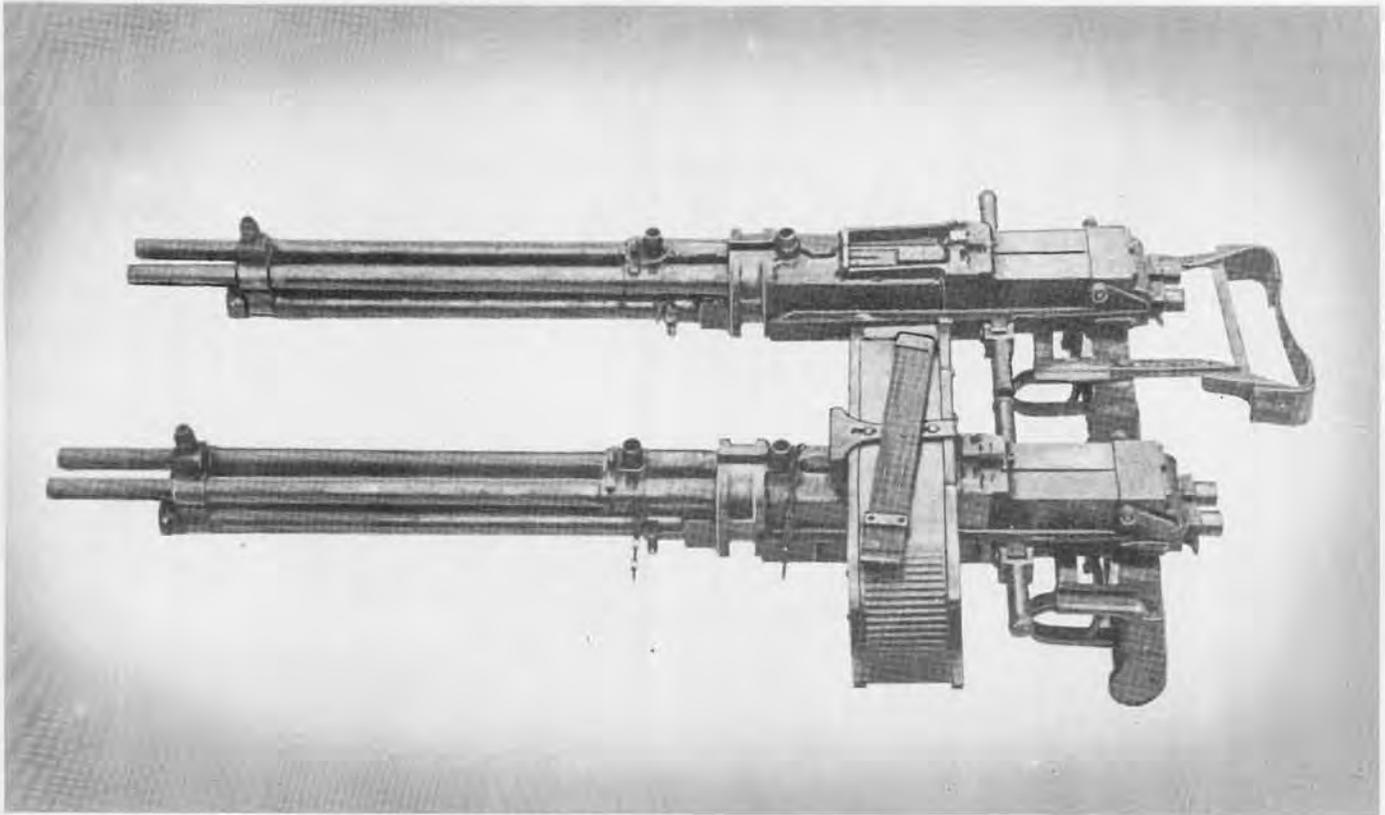
SPECIFICATIONS

Weight (total)	69.9 lbs.
Weight (without mount)	34 lbs., 2 ozs.
Weight of mount	37 lbs.
Weight of tripod	36.3 lbs.
Length (overall w/flash hider)	42 $\frac{3}{8}$ ins.
Length (overall w/o flash hider)	38 ins.
Sight radius .....	.....
Principle of operation	Gas, full-automatic
Feeding device	Metal strips
Capacity of feeding device	30 rounds
Cooling system .....	.....
Ammunition types.....	Model 92 ball, A.P. and tracer (rimless)
Rate of fire (estimated).....	450-500 r.p.m. cyclic 200-250 r.p.m. effective
Type of sight.....	Rear, calibrated from 100 to 2,200 meters.
Weight of barrel	11 lbs., 6 ozs.
Length of barrel	23-3/16 ins.
Length of rifling.....	22 ins.
Rifling	
Twist	R.H.
Form .....	.....
No. of lands	8
No. of grooves .....	.....
Depth of grooves .....	.....
Width of grooves .....	.....
Muzzle velocity .....	.....
Maximum range .....	.....
Effective range .....	.....
Type of mount	Tripod
Elevation .....	.....
Traverse (total—on arc)	45°

DOUBLE BARREL FLEXIBLE AIRCRAFT MACHINE GUNS

MODEL 100 and MODEL 1

JAPANESE



These two weapons which are very similar offer the advantage of two guns being mounted in the space occupied by one gun of normal size, thus saving weight in the gun and mount, and space in the plane. A small ammunition supply making frequent magazine changes necessary is a disadvantage partially for the advantages of the double barrel principle.

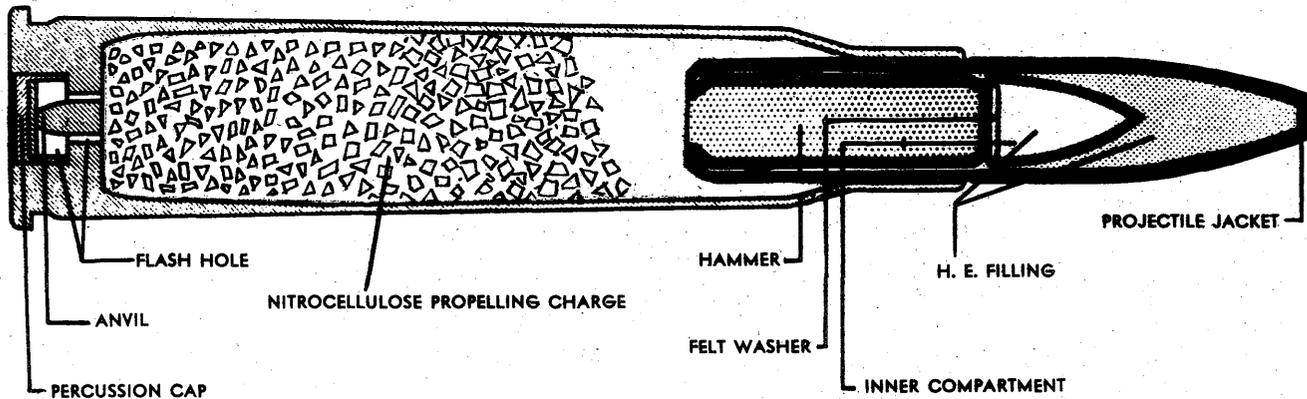
The operating mechanism for both barrels is housed in a single receiver. This is a single forging, milled to house the two separate actions. The magazine opening is cut out of the top of the receiver, the ejection slot out of the bottom. Each action has its own back plate. The gas piston group resembles the Bren light machine gun in design. The bolt is a steel forging well machined. The gas cylinder tube is constructed of seamless steel tubing and is threaded to the receiver at the rear. The trigger assembly is made up of two separate sear assemblies riveted to the pistol grip framework. Two pistol grips are located about 6 inches apart; the sears are connected to a horizontal trigger bar mounting a trigger on either end. Both guns may be fired by depressing either trigger. The magazine is the saddle-drum type. Each side holds 50 rounds and feeds one gun. Each side has its own spring so that, in the event of a jam affecting one barrel, the other gun may continue to fire.

The Model 1 (1941) gun appears to be basically the same weapon as the earlier model, Model 100 (1940) which is shown at the bottom of the illustration. The Type 1 gun shown at the top of the picture has a head or shoulder rest attached to the gun. This rest is made of wood and canvas and is attached to the gun with steel frames. The specifications were secured from the earlier weapon.

SPECIFICATIONS

Caliber	7.92 mm
Weight of gun	36 lbs.
Length (overall)	37.5 ins.
Length of receiver	16.25 ins.
Length of barrel	24.5 ins.
Length of rifling	22.37 ins.
Diameter of bore—	
across lands	0.310 in.
across grooves	0.313 in.
Number of lands	4
Width of lands	0.0781 in.
Width of grooves	0.1718 in.
Depth of grooves	0.003 in.
Twist of rifling	Uniform R. H.
Pitch of rifling	7° (approx.)
Type of operation	Gas
Type of fire	Automatic only
Type of feed	Magazine, saddle-drum type
Capacity of magazine	100 rounds
Weight of magazine empty	7¾ lbs.
Weight of magazine filled	13¾ lbs.
Ammunition	A. P.—Incendiary
Rate of fire (estimated)	400–600 r.p.m.
Range	250 to 350 meters

7.7 mm EXPLOSIVE CARTRIDGE



This fixed round of ammunition consists of a brass cartridge case and a high explosive projectile. The semi-rimless case is tapered, forming a neck which fits over the projectile. The top of the neck is coned into the cannellure of the bullet. The base of the case is recessed to take a simple percussion type primer, and the rest of the case is filled with a propelling charge of graphited nitrocellulose grains, about half of which, in the specimens examined, had a very fine axial perforation.

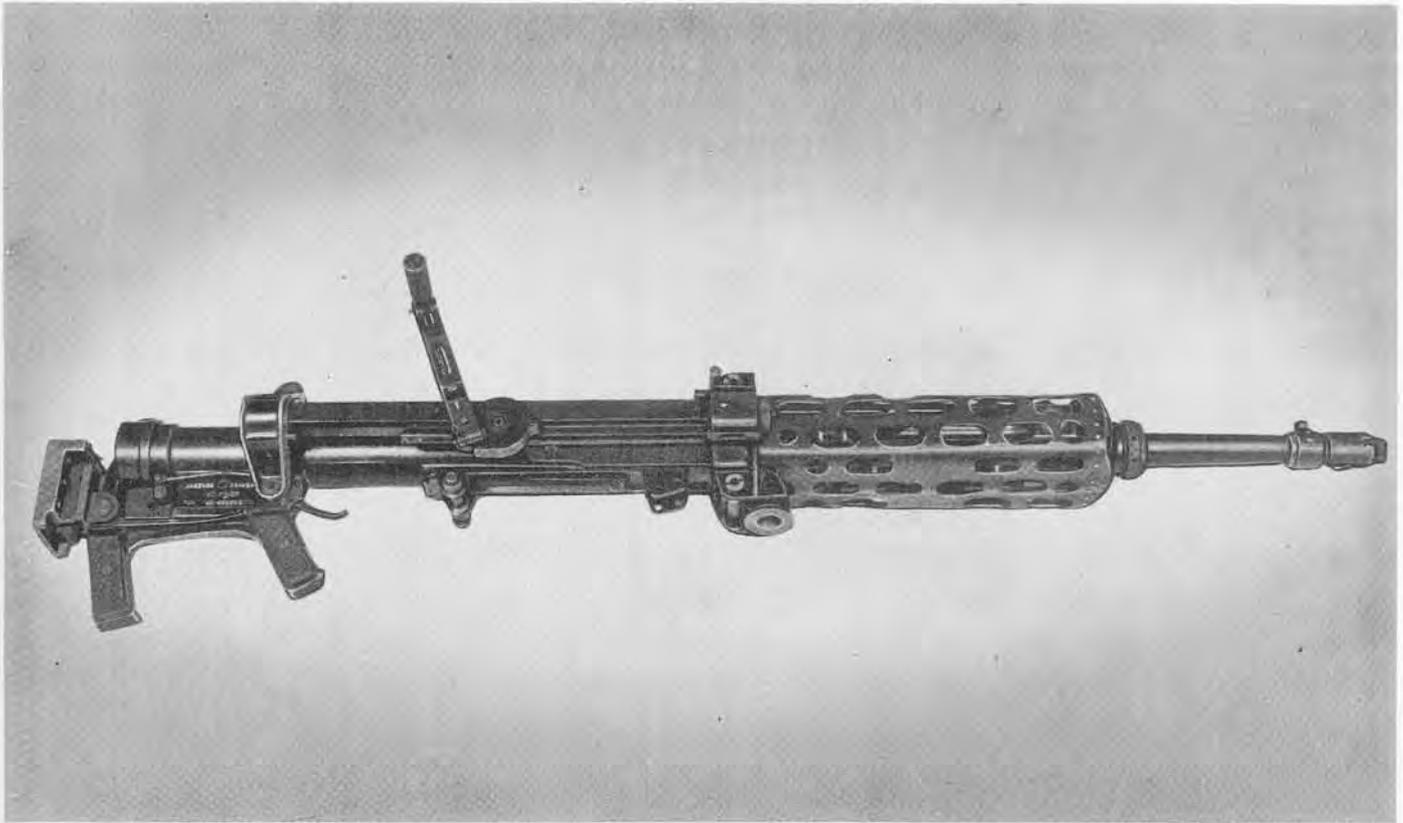
The brass projectile is cylindrical in shape with a truncated ogival nose. It contains a brass inner compartment, ogival in shape and open at the base, and a hammer consisting of a lead antimony plug encased in a brass sheath. The rear of the projectile is also open, the walls being turned in to retain the hammer. Both the main projectile and the inner compartment are filled with the explosive charge, a mixture of PETN and RDX. A white felt washer pressed into the base of the inner compartment protects the explosive charge from the effect of setback when the round is fired.

When the projectile strikes a target, the hammer in the rear end sets forward crushing the explosive against the walls of both the inner and main compartments, causing the projectile to explode.

SPECIFICATIONS

Caliber	7.7 mm (.303 in.)
Weight of complete round....	26.15 grms.—.915 oz.
Length of complete round	3 3/32 ins.
Length of cartridge case	2 9/32 ins.
Weight of cartridge case (without percussion cap)	14.93 grms.—.523 oz.
Weight of projectile	10.69 grms.—.374 oz.
Length of projectile	1 15/32 ins.
Maximum diameter	0.310 in.
Thickness of main compartment walls.....	0.021 in.
Weight of main compart- ment	2.95 grms.—.103 oz.
Thickness of inner compartment walls....	0.008 in.
Weight of inner compartment..	0.20 grms.—.007 oz.
Height of inner compartment	0.390 in.
Length of hammer	0.700 in.
Weight of hammer	6.65 grms.—.233 oz.
Diameter of hammer	0.258 in.

20 mm AIRCRAFT AUTOMATIC CANNON, MODEL 99 Mk 1 FLEXIBLE



This weapon is an air-cooled, blowback-operated, Oerlikon type machine cannon. It operates on the same basic principle as all Oerlikon cannons of this type. The Japanese gun is a close copy of the Swiss gun, in that it is designed for full automatic fire only. The gun is manufactured in Japan on Swiss machinery. The above illustration shows the flexible version.

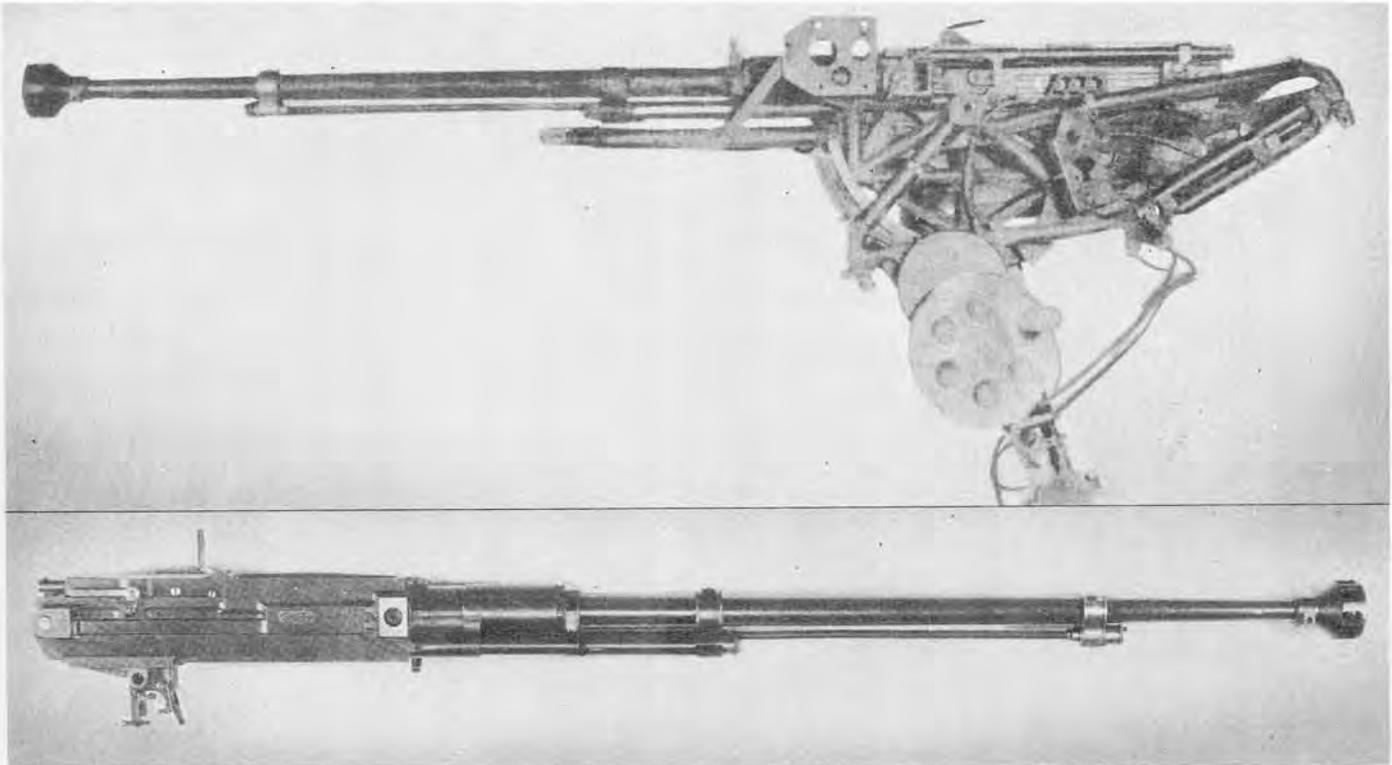
A significant feature is that the parts which are subjected to little wear, such as the grips, mounts, gunners' shoulder rest, and other exterior parts are generally made of light weight metal.

This weapon is almost identical with other Model 99 (1939), 20 mm aircraft cannon reported to be used in the majority of Japanese planes, both as fixed guns in fighter craft, and as flexible guns in bombing planes. The weapon is fed from a drum type magazine. It is cocked or charged by manual means, and has no semiautomatic charger or rounds counter. The cocking handle is rotated to draw the recoiling parts to the rear and cock the gun for the first shot, the gun firing from an open bolt. Cocking operations for succeeding shots are performed by the blowback operation of the gun itself.

SPECIFICATIONS

Caliber	20 mm—0.87 ins.
Weight (without magazine)	62 lbs.
Weight of 60 rd. magazine (empty).....	20 lbs.
Length (overall)	55 ins.
Length of barrel	30 ins.
No. of grooves	9; Uniform right hand twist
Width of grooves	
Depth of grooves	0.022 in.
Width of lands	
Muzzle velocity (shell)	1,930 f/s.
Cyclic rate	510 r.p.m.
Traverse	Flexible aircraft
Length of recoil	
Turns of cocking handle required to cock piece	11½ ins.
Ammunition.....	HE; HE with tracer; HE with self- destroying tracer; HE-I; AP; AP tracer; AP-HEI; Long burning tracer; Practice
Wt. of HE projectile	4.50 ozs.
Type of feed	60 rd. drum

20 mm AIRCRAFT MACHINE GUN (MODIFIED MODEL 97 ANTITANK GUN)



This Japanese 20 mm aircraft gun is a modified version of the Model 97 antitank gun described on page 101. It is a gas-operated, full-automatic, magazine-fed, air-cooled weapon. The barrel, of monobloc construction, is fitted with a muzzle brake and attached to the receiver by means of a bushing of the interrupted screw type. The magazine fits into a rectangular opening in the top of the receiver, and the empty cartridge cases are ejected from a similar opening in the bottom. The ejector is secured to the underside of the receiver top just behind the magazine opening.

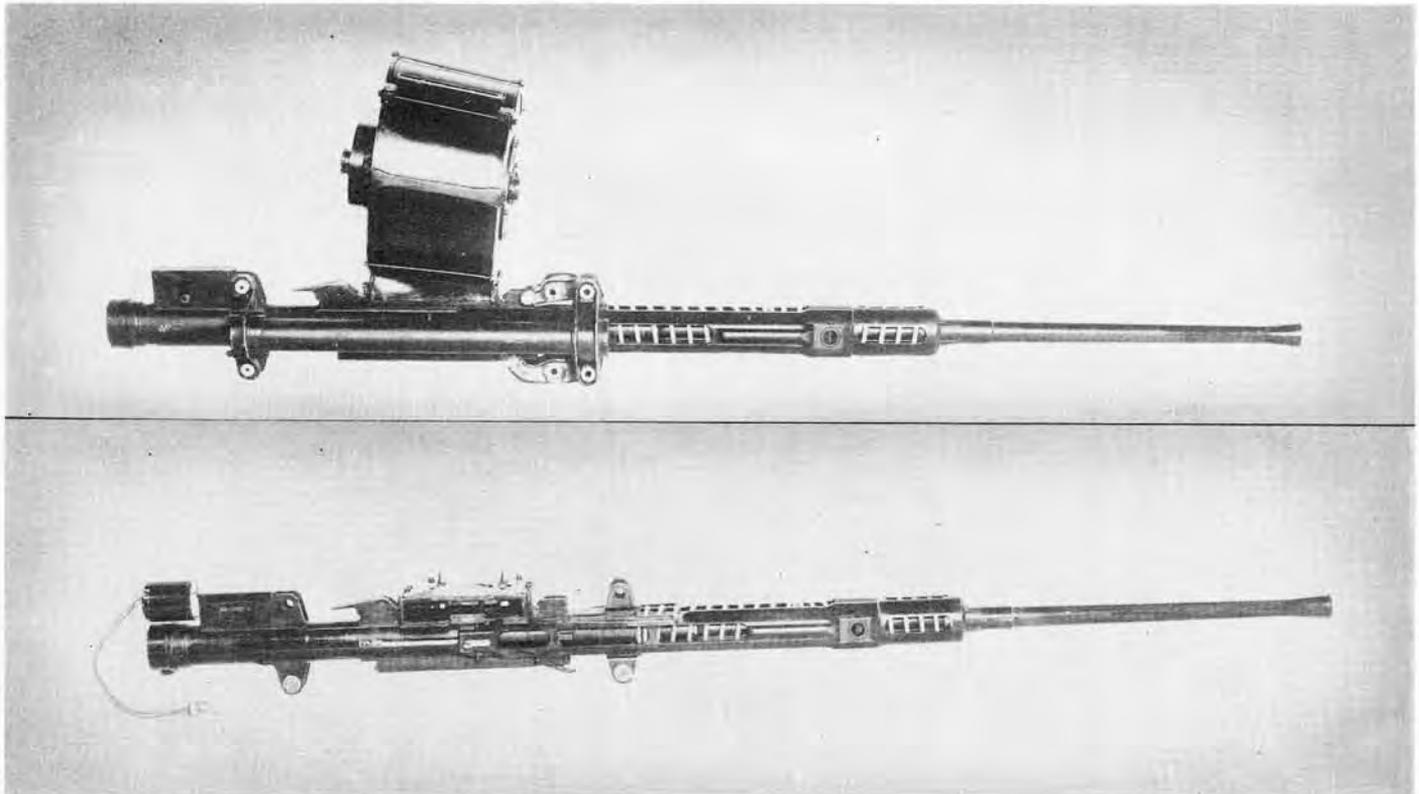
The operation of the aircraft version of this gun is similar to that of the antitank rifle. The six phases are: loading, locking, firing, unlocking, extraction, and ejection.

The first three occur on the counterrecoil, and the last three on the recoil. The gun is cocked the first time by pulling the retracting handle to the rear. This retracts the operating group to the position where the sear will engage the gas piston and hold it to the rear. After the magazine is inserted and locked in place, the gun is ready to fire.

The gun was mounted in the dorsal turret of the Bomber "Helen" on a semicircular-shaped rack, and is fixed to the rack by the lower left hand edge of the receiver. The rack is used for elevating the gun. The gun and mount are in turn mounted on the turret ring. The sight used on this gun is a reflector type sight and it is believed that there is provision made for deflection shooting. A fixed version has also been reported. Documentary evidence discloses that the ammunition for the turret gun is referred to as HO1 and the fixed as HØ3.

SPECIFICATIONS

Caliber	20 mm (.79 in.)
Weight (without mount)	74 lbs.
Length (with muzzle brake)	68 ⁷ / ₈ ins.
(without muzzle brake)	67 ¹ / ₄ ins.
Sight radius .....	.....
Principle of operation	Gas
Capacity of feeding device	
Magazine, 15 rds.	
Inverted saddle type, 50 rds.	
Cooling system	Air
Ammunition types	AP/T; HE/T; HE/I; Ball
Rate of fire (estimated).....	300 rds. per min.
Type of sight	Reflector
Weight of barrel .....	.....
Length of barrel	47 ins.
Length of rifling (approx.)	42 ins.
Rifling	
Twist .....	.....
Form .....	.....
No. of lands & grooves	8
Depth of grooves .....	.....
Width of grooves .....	.....
Chamber pressure .....	.....
Muzzle velocity (estimated).....	2,500-2,900 ft. per sec.
Muzzle energy .....	.....
Effective range	1,000 yds.
Type of mount	Dorsal turret and fixed



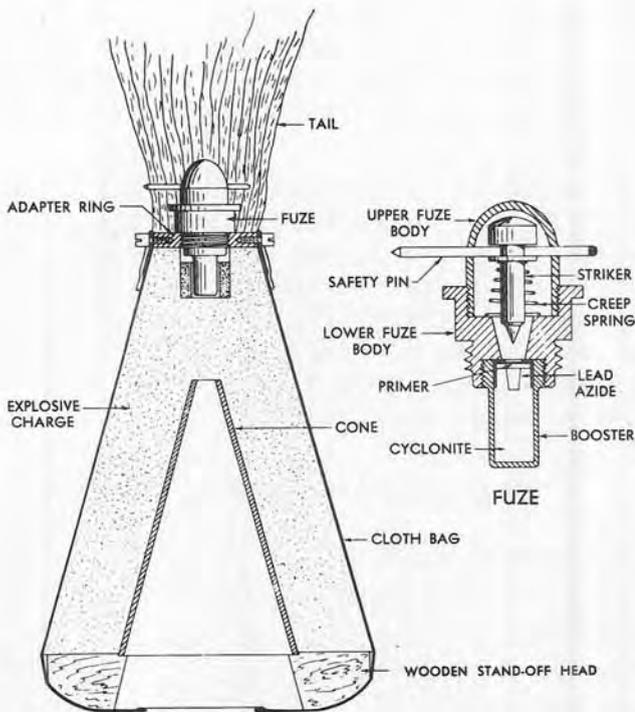
This is a gun of higher power than the Type 99 Mk. I, 20 mm cannon. Like the earlier gun, it operates on the Oerlikon principle and is found both with drum type magazine feed (Mod. III—top photo) and with belt feed (Mod. IV—lower photo).

The principal differences between this model and the Mk. I consist of a longer barrel and a longer chamber. The barrel protrudes 18 inches beyond the leading edge when mounted in the wings of fighter aircraft. The projectiles used are identical to the Mark I, but the cartridge employed contains approximately 40% more propellant than the older type, thereby increasing the velocity of the Mk. II 500 to 700 foot seconds. The muzzle velocity of the weapon varies from 2,500 to 2,700 foot seconds depending upon the type of projectile used. The gun has been found in ZEKES and HAMPs. It is probably fitted in RUFES and as a flexible gun in the tail turret of BETTY.

SPECIFICATIONS

Caliber	20 mm (.787 in.)
Weight of gun	67 lbs.
Length of gun (overall)	73 ins.
Length of barrel	47 ins.
Length of rifling	41.5 ins.
Number of grooves	9
Depth of grooves	0.026 in.
Twist of rifling	Right hand
Principle of operation	Blow back
Feeding device	French drum or belt
Capacity of drum	100 rds.
Cooling system	Air
Sights	Reflector type
Charging mechanism	Pneumatic
Firing system	Flexible cable
Effective range (est.)	600-700 yds.
Rate of fire (est.)	400-500 r.p.m.
Ammunition.....	Ball, A.P., A.P./I., T., H.E., H.E./T., H.E./I.

CONICAL ANTITANK HOLLOW CHARGE HAND GRENADE



This Japanese antitank grenade consists of a Pentolite (50/50 TNT & PETN) explosive charge cast around a thin aluminum cone, a wooden stand-off head, a fuze, and a tail attachment.

The explosive charge, which is shaped in the form of a hollow truncated cone, has a covering of thin waxed paper and a well in the upper end to receive the booster of the fuze. A cast ring pellet surrounds the cyclonite booster. The fuze, an all-ways impact type, is constructed in two parts which are threaded together. It will not function unless the mine has attained a velocity of approximately forty feet per second, and strikes a hard surface. The wooden base provides proper stand-off distance and has a central hole of slightly smaller diameter than that of the cone.

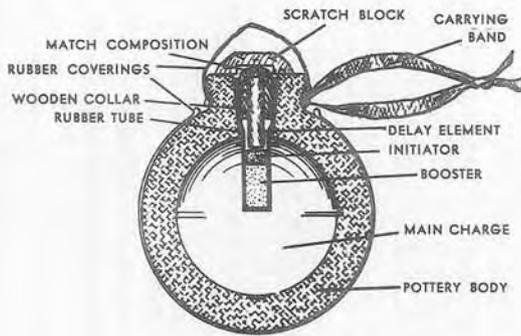
The grenade is encased in a silk bag, either white or olive drab in color, and closed by a draw-string at the bottom. A tail made of hemp is tied around the top of the grenade to provide stability in flight. The device, which will penetrate about 2¾ inches of armor plate, should be thrown from a distance of approximately ten meters.

A modified version of this grenade, referred to as the Type B, has been recovered. It differs from the grenade previously encountered in the Philippines in the following respects: it is smaller, the cover is yellow silk instead of canvas, the fuze is screwed into a metal seat on top of the mine, the fuze body is metal with a single-pronged safety pin, and the detonator tube is larger.

According to reports, there is also a larger grenade of the same type which has a Type 94 explosive charge.

SPECIFICATIONS

	Large Grenade	Small Grenade
Length of grenade.....	6¾ ins.	5¾ ins.
Length of tail.....	14 ins.	
Diameter at base.....	4¾ ins.	4 ins.
Length of fuze.....	1¾ ins.	1¾ ins.
Length of cone.....	3¾ ins.	2¾ ins.
Diameter of cone.....	2¾ ins.	2 ins.
Cone angle, apex.....	30°	38°
Weight complete	1.25 kg.	.84 kg.
Weight of grenade	1.14 kg.	.76 kg.
Weight of fuze	42.3 grams	42.3 grams
Weight of explosive .....	.87 kg.	.60 kg.
Weight of cone	141.7 grams	42.5 grams
Weight of base	56.7 grams	50.0 grams
Weight of booster	5.1 grams	5.1 grams



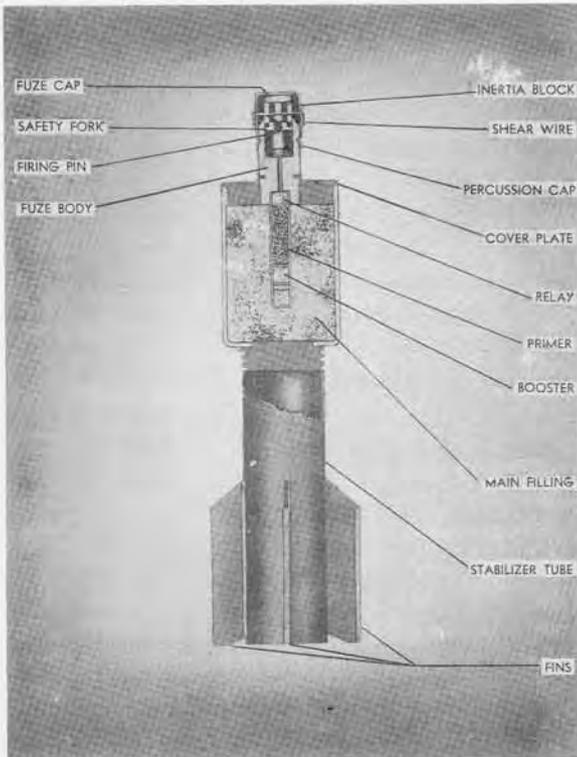
This hand grenade, made of terra cotta, and, like the Model 3 Flower Pot Land Mine, filled with Type 88 explosive, is assumed to be a Navy weapon. Except for the neck at the top, it is spherical, consisting of two halves baked together. It is light brown in color, and lightly glazed both inside and out. The grenade is encased in a straw-colored, waterproof rubber sack.

The ignition system consists of a match composition and scratch block, a 4-5-second delay element, a lead azide initiator, and a tetryl booster. All are encased in a rubber tube except the match composition which is lacquered into the neck of the grenade. In order to operate the grenade, the small rubber covering is removed from the top and the scratch block is struck on the protruding match composition, igniting the delay element.

SPECIFICATIONS

Height (base to top of neck)	99 mm—3.9 ins.
Diameter	79 mm—3.1 ins.
Total weight	1 lb.
Weight of explosive	100 grams—3.5 ozs.
Pottery thickness	7/16 inch

HIGH EXPLOSIVE RIFLE GRENADE MODEL 3

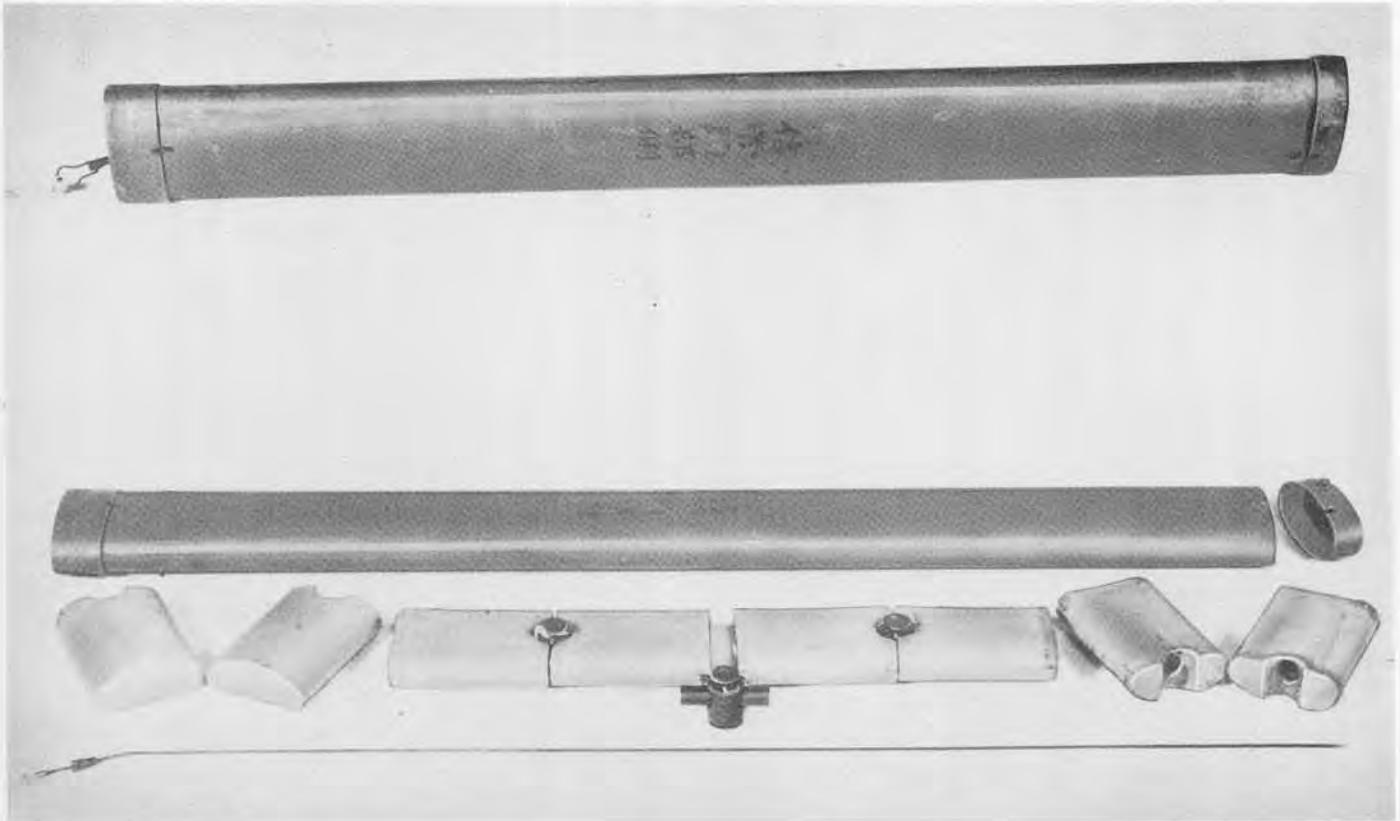


This grenade, designed to be fired from Models 38 and 99 rifles by means of a spigot launcher and wooden bullet, is similar in use and operation to the Model 91 rifle grenade. However, it is smaller and has a smooth-wall body rather than the serrated type. It contains a cyclonite primer enclosed in a brass container, a tetryl booster, and a three-ounce bursting charge of cast TNT; it is also fitted with an instantaneous fuze and a tail assembly with four fins spot welded to the rear part of the tube.

The grenade is armed by the removal of a safety fork. On impact, an inertia block is forced into the fuze body shearing a brass shear wire and driving the firing pin into the detonator.

SPECIFICATIONS

Diameter of grenade body	1.63 ins.
Length of grenade body	2.43 ins.
Wall thickness	1/8 in.
Overall length of grenade	7.88 ins.
Weight of grenade without explosive	14 ozs.
Weight of explosive body without explosive	10 ozs.
Length of fin assembly	4 15/16 ins.
Outside diameter of tube	1 13/16 ins.
Inside diameter of tube	1 1/16 ins.
Width of tail assembly	2 3/8 ins.
Length of tail fin	2 3/8 ins.
Width of tail fin	1/4 in.
Material of construction	Steel
Weight of main charge	3 ozs.
Weight of primer	3 gr.
Weight of booster	1 gr.



This Japanese land mine, of Naval origin, is usually found buried in landing strips. Almost any vehicle will activate the mine, but its use as an anti-personnel device is limited since a pressure of approximately 336 pounds is necessary to set it off.

The mine consists of an oval shaped tube of sheet metal with a cap on both ends; an explosive charge comprising eight blocks of picric acid, each cast in a paper container and coated with paraffin; and four percussion type fuzes.

The picric acid blocks which are flattened on one side do not fill the mine completely. The space between the flat side of the blocks and the wall of the case accommodates the protruding heads of the fuzes which are inserted between blocks.

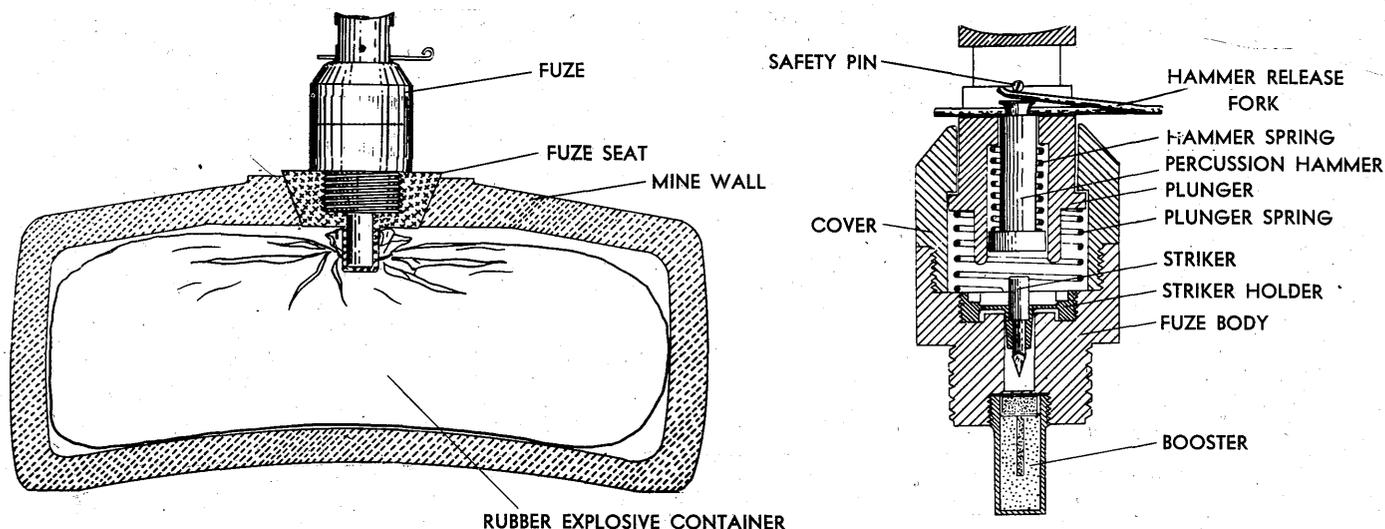
The percussion type fuze consists of a cylindrical body which houses the striker release plunger, a booster housing, and a striker housing. The two latter parts are identical in external appearance and screw into the sides of the main body diametrically opposite each other.

The striker release plunger, a split pin with an enlarged flat head, is positioned in the fuze body by a copper shear wire. A second hole 90 degrees from the shear wire hole accommodates a safety wire. The lower end of the plunger is split by a slot, the width of which is increased on the inner end.

The mine is held in an unarmed position by the safety wire which is inserted through a hole in one of the end caps, and extends the entire length of the mine. A spring clip on the cap holds the wire in place. When the mine is to be put into operation, the safety wire is removed and a burying plug is screwed into the hole in the cap to make the assembly waterproof. A thick tarry substance is applied to the seams around the end caps probably for the same purpose.

SPECIFICATIONS

Length (overall)	36 ins.
Diameter (oval)	3.35 x 1.8 ins.
Total weight	10.58 lbs.
Weight of mine	4.63 lbs.
Weight of filling	5.95 lbs.
Weight of each explosive block	¾ lb.
Filling	Picric acid
Weight of complete fuze .....	.29 lb.
Color.....	Brown outside; black lacquer inside



The mine case, made of earth-colored terra-cotta, has a thin dull glaze on its outer surface and a highly glazed inner surface. A light rubber bag inside the body contains a Type 88 explosive filler. It is believed that the bursting charge may be a mixture of 50% ammonium nitrate and 50% TNT, or 90% ammonium nitrate and 10% dinitronaphthalene.

The fuze which is interchangeable with the standard Type 88 and Type 100 artillery fuzes (thereby permitting the use of artillery projectiles as land mines) screws into a rubber seat sealed in place in the mine. Fuze body, cover, plunger, and striker holder are made of bakelite; the springs, percussion hammer, striker, and release fork are of metal construction. Because so few of the components are made of ferrous materials, it probably would be difficult to locate the mine with a magnetic type detector.

When rigged, the fuze is fired either by pressure or by pull. The percussion hammer, located within the fuze, is held in place by a release fork to which a trip wire may be attached. When the wire is pulled, the fork releases the hammer which is forced downward by the hammer spring. The hammer comes in contact with the striker forcing it through its bakelite holder into the percussion cap.

When pressure is applied directly on the head of the fuze, the plunger spring is compressed causing the hammer release fork to bear on the cover. As the plunger spring is further compressed, the hammer head cams out the fork. It then fires as above.

SPECIFICATIONS

Weight of mine (fuzed)	11 lbs., 6 ozs.
Diameter (maximum)	220 mm*
Height (without fuze)	105 mm
Height (fuzed)	157.5 mm
Explosive filling	Type 88
Weight of explosive	4 lbs., 8 ozs.
Length of fuze	65 mm
Weight of fuze (without booster)	56 grams

* According to reports, there is a larger mine of this same type. It is 270 mm in diameter, but has the same height as the smaller mine. It is said to contain 6½ pounds of explosive.

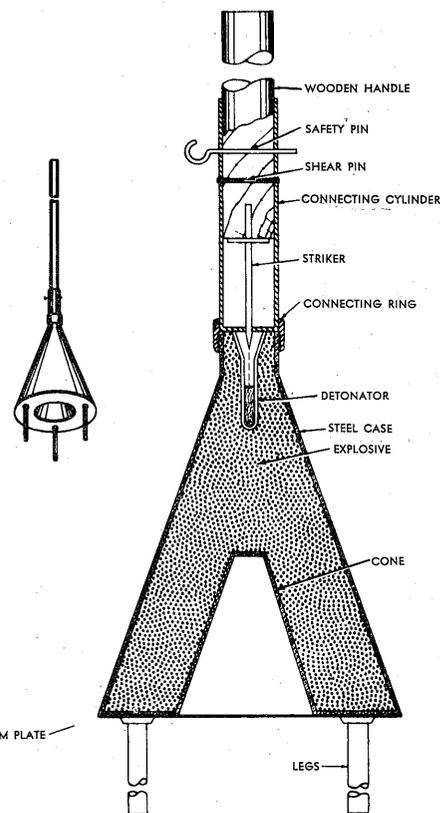
ANTITANK "LUNGE" MINE

This suicide mine, an antitank device used by Japanese Close-quarter Combat Units, consists of a conical-shaped hollow charge encased in a steel container, and a wooden handle. Three legs equally spaced around the base of the charge provide proper stand-off distance. A well in the apex of the charge contains the detonator.

The firing mechanism, quite simple in construction, consisting of a needle type striker, a shear pin, and a safety pin, is housed in a metal sleeve. This sleeve, which holds the mine and the handle 2.4 inches apart, slips over the end of the handle and is held in place by the shear pin and safety pin; it is attached to the body of the mine by a threaded connecting ring.

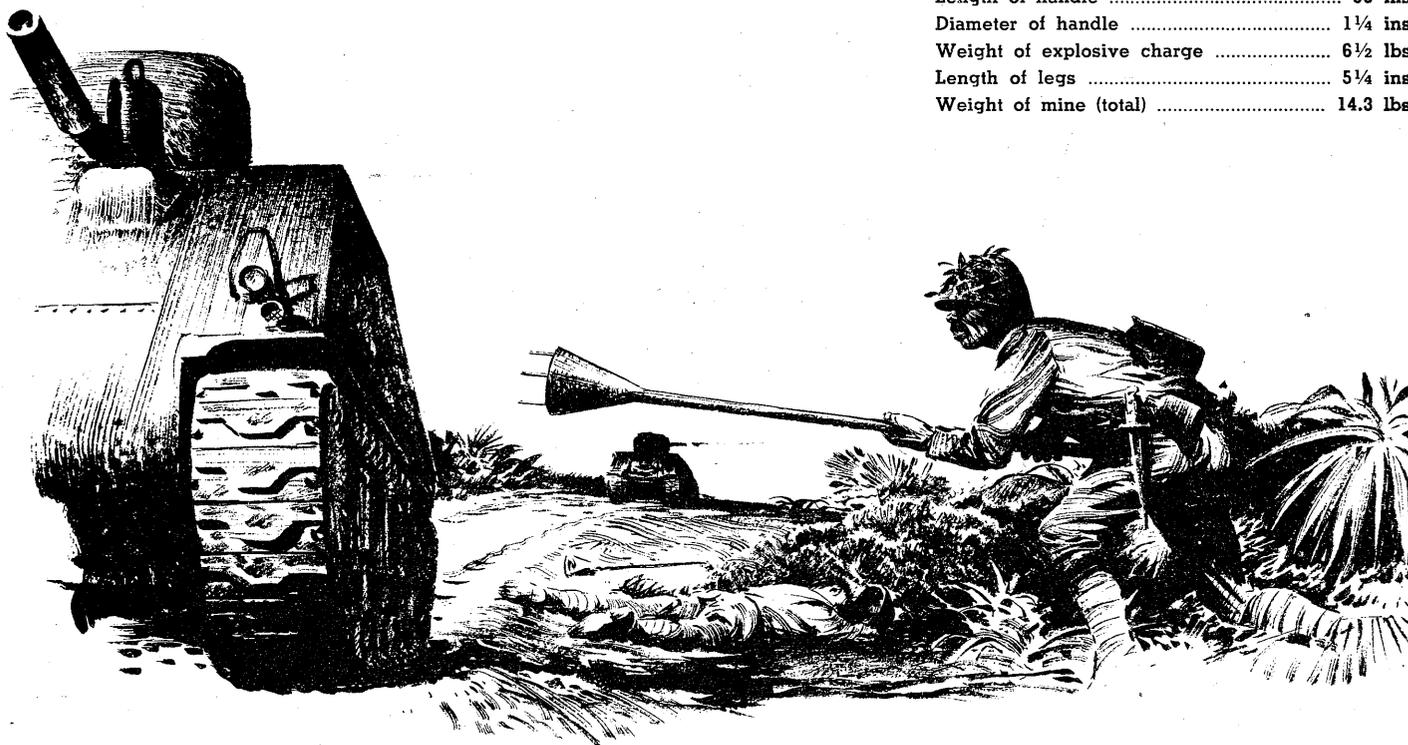
To operate the mine, the soldier must first remove the safety pin, and then, using bayonet tactics, lunge forward striking the mine squarely against the tank. When the legs of the mine strike the target, the handle is driven forward breaking the shear pin, and the striker is driven into the detonator, initiating explosion of the mine.

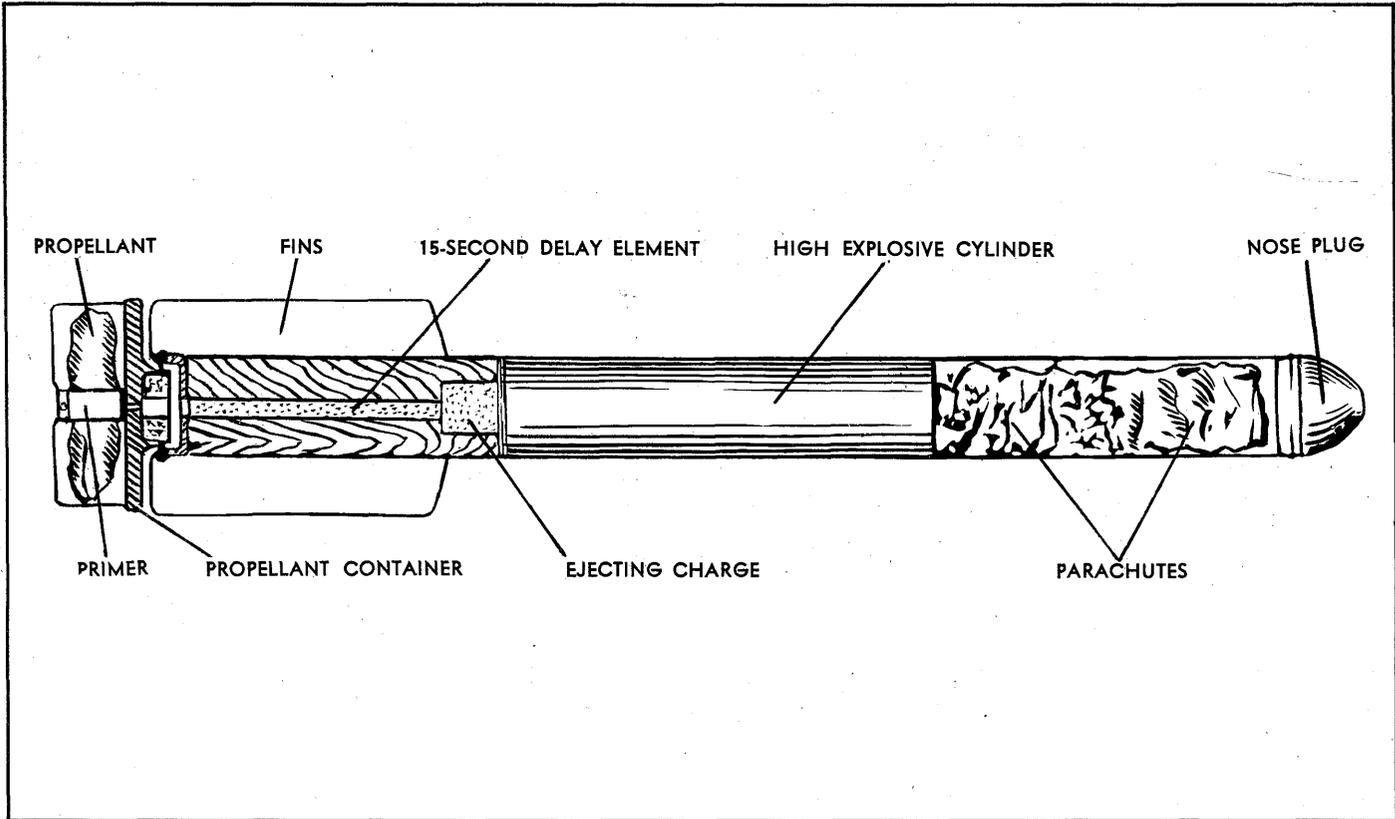
Reports indicate that when head-on contact is made, the mine will penetrate 6 inches of steel plate; with contact at a 60° angle, steel plates of approximately 4 inches can be penetrated.



SPECIFICATIONS

Length of mine body (approx.)	12 ins.
Diameter of base of body (approx.)	8 ins.
Length of handle	59 ins.
Diameter of handle	1¼ ins.
Weight of explosive charge	6½ lbs.
Length of legs	5¼ ins.
Weight of mine (total)	14.3 lbs.





This anti-aircraft projectile, fired from the 81 mm barrage mortar, is composed of three sections. The rear portion consists of a primer, black powder charge, propelling charge, 15-second delay train, and a black powder ejecting charge. The explosive cylinder, or middle section, comprises a 40-second delay pellet in a central cylinder and three H.E. pellets cast around the delay element. The forward end section contains a wooden nose plug, two parachutes, and a suspension cord.

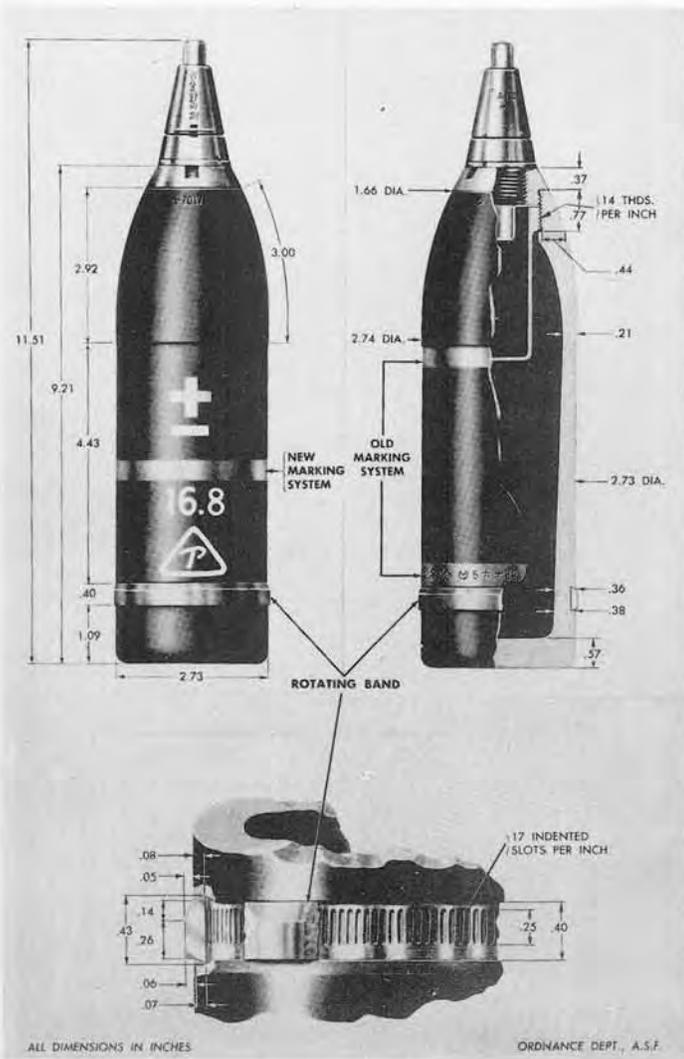
The projectile is slid down the mortar tube in a manner similar to the firing of a standard mortar shell. Upon striking the firing pin, the primer is ignited, and it, in turn, sets off the loose black powder in the base of the round. The black powder ignites the propellant and the 15-second delay train. The shell is propelled from the mortar and continues in flight until the delay train ignites the ejecting charge which forces out the wooden nose plug, the two parachutes, the suspension cord, and the explosive cylinder. At the same time, the 40-second delay pellet is ignited. The explosive cylinder is suspended by a small parachute attached to the cylinder by 12-inch strands, and by a larger parachute attached to the cylinder by the 30-foot suspension cord. The end of the suspension cord is covered with match com-

position and acts as a pull igniter. If an airplane strikes the suspension cord of the floating high explosive assembly, the jerk on the cord pulls the end of the cord through the primer, causing detonation of the high explosive. If the pull igniter is not functioned, the burning train of the 40-second delay pellet reaches the detonator and sets off the explosive cylinder.

An 81 mm flare shell, identical in external appearance except for color markings, is also used. It contains two parachutes and a flare, apparently of a magnesium composition. When the projectile is in flight, a 15-second delay train sets off an ejecting charge of black powder which forces out the nose plug, parachutes, and flare. The burning of the ejecting charge ignites the flare, which floats earthward on the parachutes.

SPECIFICATIONS

Caliber	81 mm
Length (overall)	21 $\frac{1}{2}$ ins.
Diameter of cylinder	1 $\frac{9}{16}$ ins.
Size of fins	$\frac{7}{8}$ in. x 4 $\frac{1}{4}$ ins.
Color	Black with tan nose plug



7 cm (70 mm) MODEL 92 HE

WEAPONS:

- 7 cm Model 92 HowitzerP. 107
- 7 cm Model 94 Tank Gun

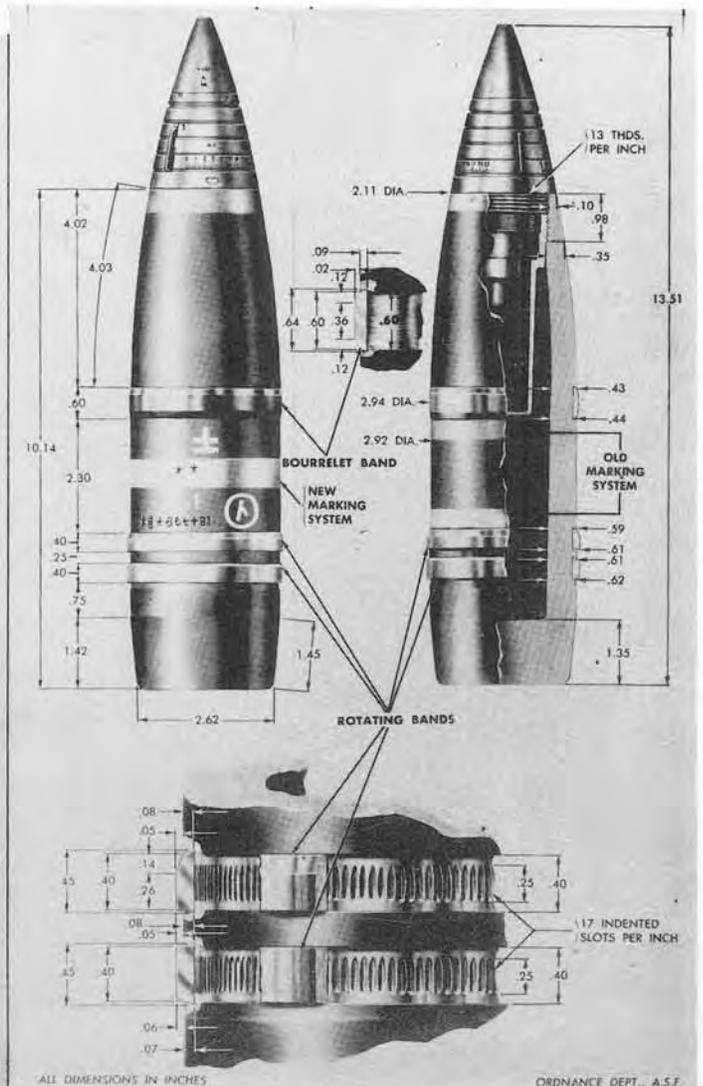
PROJECTILE:

- Caliber—70 mm
- Kind—Shell
- Type—HE
- Weight (with Fuze)—8.4 lbs.
- Color—Black
- Bands—One yellow or one yellow and one white
- Charge:
 - Weight—1.30 lbs.
 - Kind—T.N.T. has been found
- Tracer—None

FUZES:

- Model 88 Instantaneous (Howitzer-Mortar Type) Nose Fuze
- Model 88 Short Delay (Howitzer-Mortar Type) Nose Fuze
- Model 88 Short Delay (Gun Type) Nose Fuze

REMARKS—Captured documents indicate that the Gun Type Fuze is used when this projectile is fired from the tank gun and that the Howitzer-Mortar Type Fuze is used when this projectile is fired from the howitzer.



7 cm (75 mm) MODEL 90 HE POINTED AA

WEAPONS:

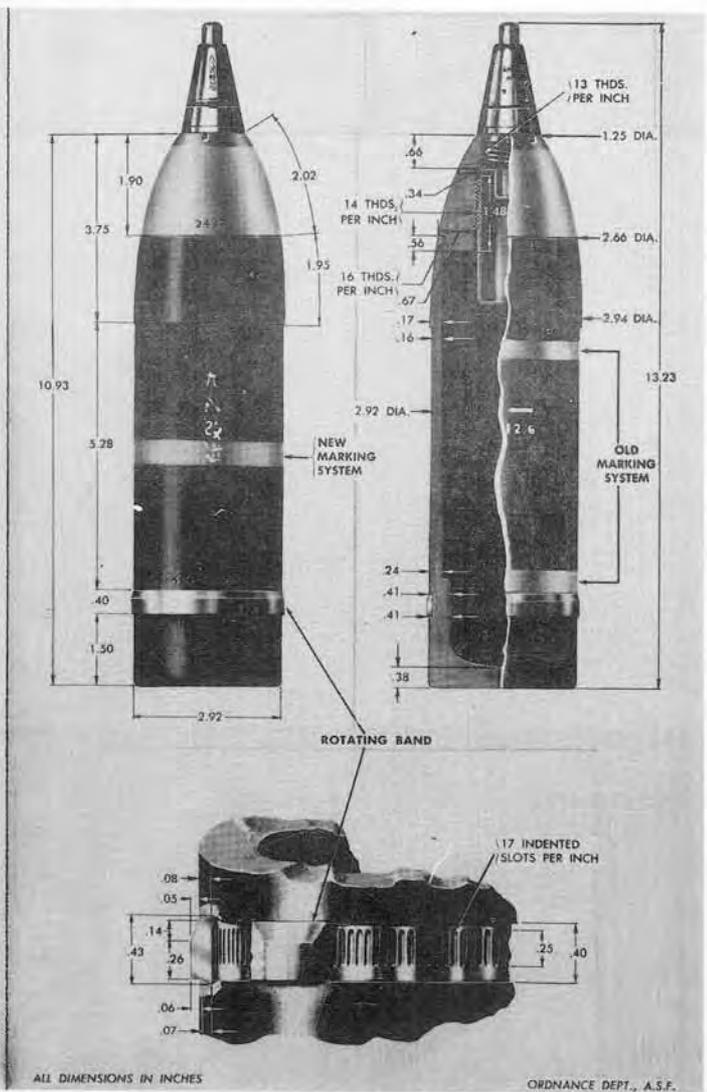
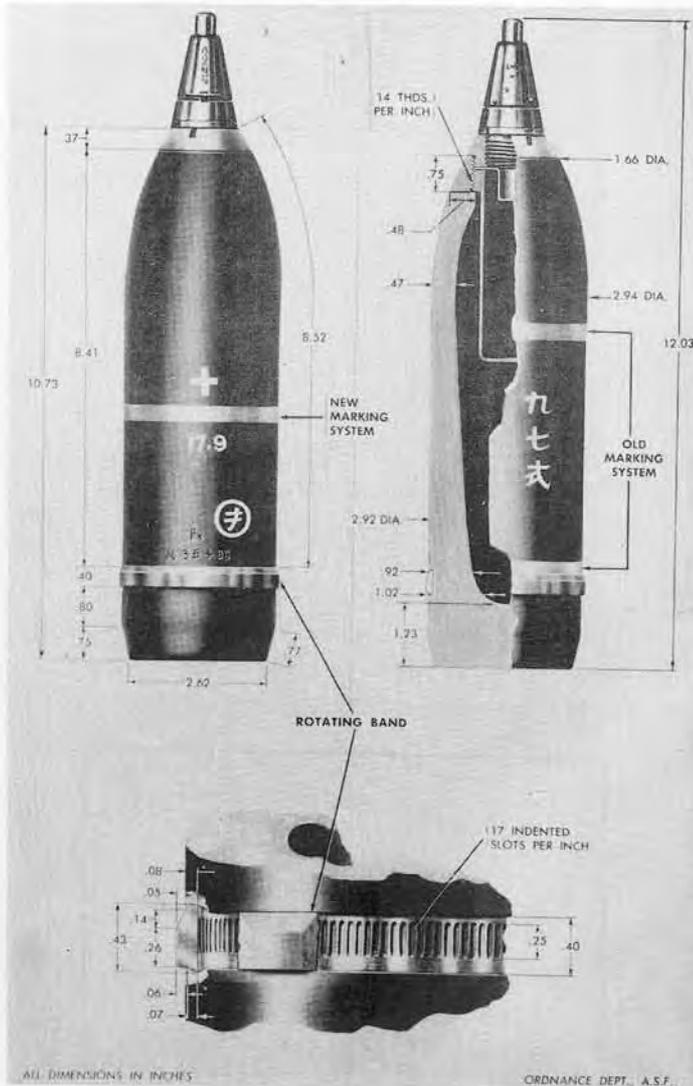
- 7 cm Model 88 Field AA GunP. 110
- 7 cm Model 88 Field AA Gun (Special)P. 110

PROJECTILE:

- Caliber—75 mm
- Kind—Shell
- Type—HE
- Weight (with Fuze)—14.4 lbs.
- Color—Black
- Bands—One yellow or one yellow and one white
- Charge:
 - Weight—0.85 lb.
 - Kind—T.N.T. has been found
- Tracer—None

FUZES:

- Model 89 Time (Powder Train) Nose Fuze and Auxiliary Fuze



7 cm (75 mm) MODEL 97 HE SEMI-STEEL

WEAPONS:

7 cm Model 38 Field Gun	P. 108
7 cm Model 41 Cavalry Gun	
7 cm Modified Model 38 Field Gun	P. 108
7 cm Model 95 Field Gun	P. 113
7 cm Model 41 Mountain Gun	P. 109

PROJECTILE:

Caliber—75 mm
 Kind—Shell
 Type—HE
 Weight (with Fuze)—13.4 lbs.
 Color—Black
 Bands—One green or one yellow and one green
 Charge:
 Weight—0.86 lbs.
 Kind—T.N.T. has been found
 Tracer—None

FUZES:

Model 88 Instantaneous (Gun Type) Nose Fuze
 Model 88 Short Delay (Gun Type) Nose Fuze

REMARKS—Although suspected it is not known definitely that this projectile is used in the 7 cm Model 90 Field Gun, the 7 cm Model 94 Mountain Gun, and the 7 cm Model 88 Field AA Gun (Special)

7 cm (75 mm) MODEL 98 MODIFIED HE

WEAPONS:

7 cm Model 38 Field Gun	P. 108
7 cm Model 41 Cavalry Gun	
7 cm Modified Model 38 Field Gun	P. 108
7 cm Model 95 Field Gun	P. 113
7 cm Model 41 Mountain Gun	P. 109

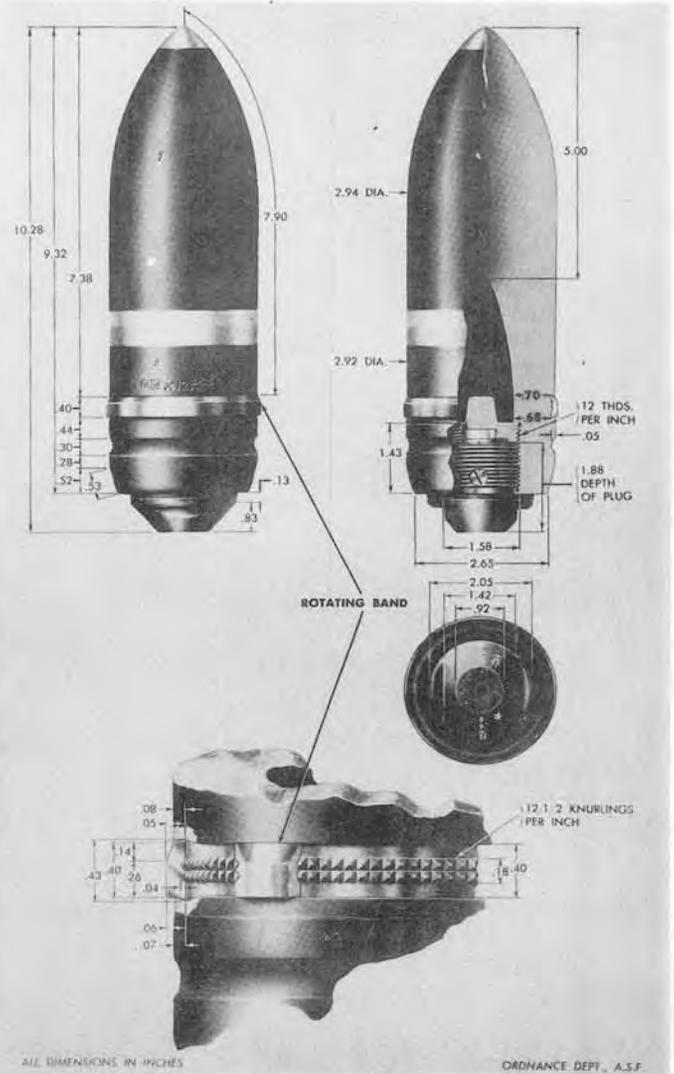
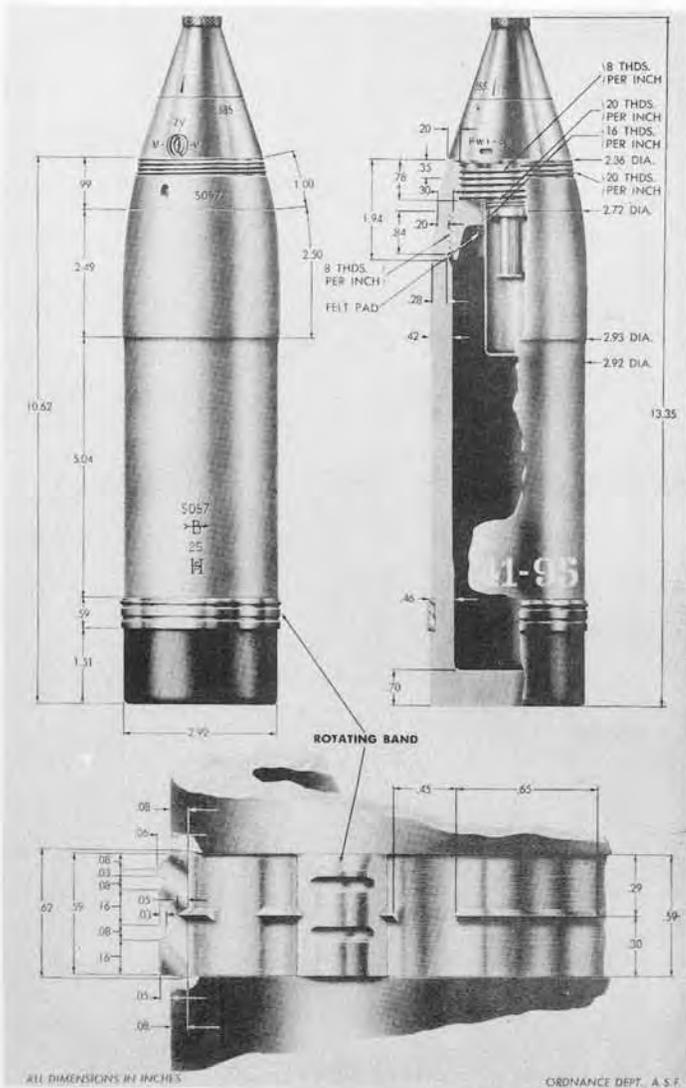
PROJECTILE:

Caliber—75 mm
 Kind—Shell
 Type—HE
 Weight (with fuze)—10.1 lbs.
 Color—Black with the nose painted white
 Bands—One yellow or one yellow and one white
 Charge:
 Weight—2 lbs.
 Kind—T.N.T. has been found
 Tracer—None

FUZES:

Model 88 Instantaneous (Gun Type) Nose Fuze
 Model 88 Short Delay (Gun Type) Nose Fuze

REMARKS—The shell body for this projectile has been converted from shrapnel to HE by the addition of a heavy steel nose. Although suspected, it is not known definitely that this projectile is used in the 7 cm Model 90 Field Gun, the 7 cm Model 94 Mountain Gun, and the 7 cm Model 88 Field AA Gun (Special)



75 mm HE (DUTCH)

WEAPONS:
75 mm Dutch Bofors

PROJECTILE:
Caliber—75 mm
Kind—Shell
Type—HE
Weight (with Fuze)—14.67 lbs.
Color—Yellow
Charge:
Weight—1.4 lbs.
Kind—Picric
Tracer—None

FUZE:
Selective Super Quick or Short Delay Nose Fuze

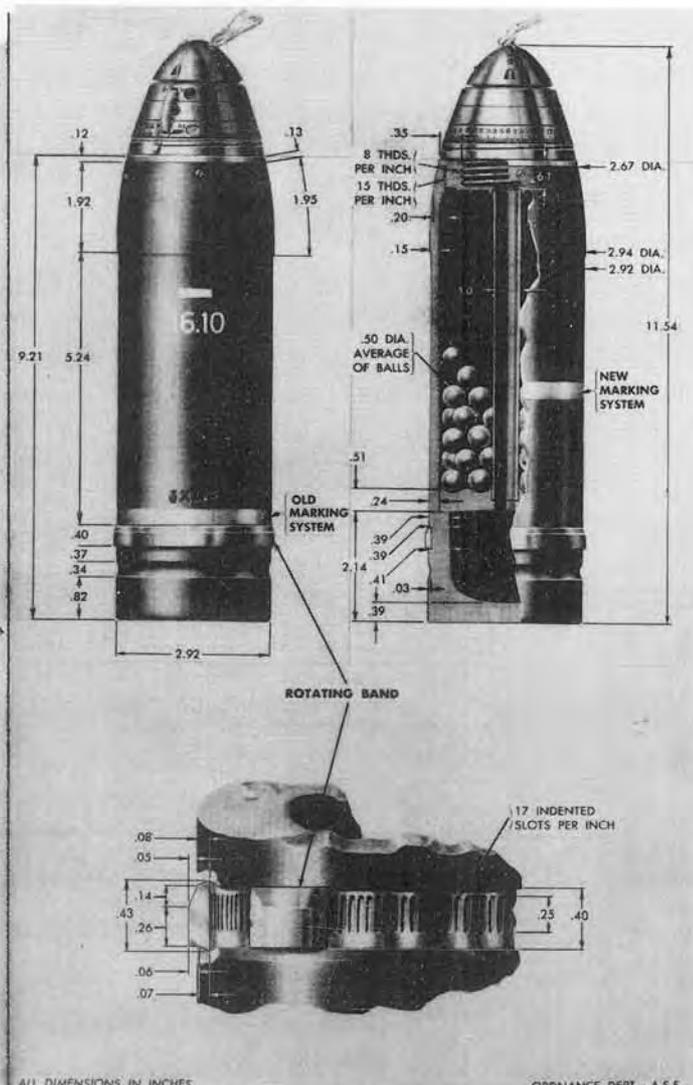
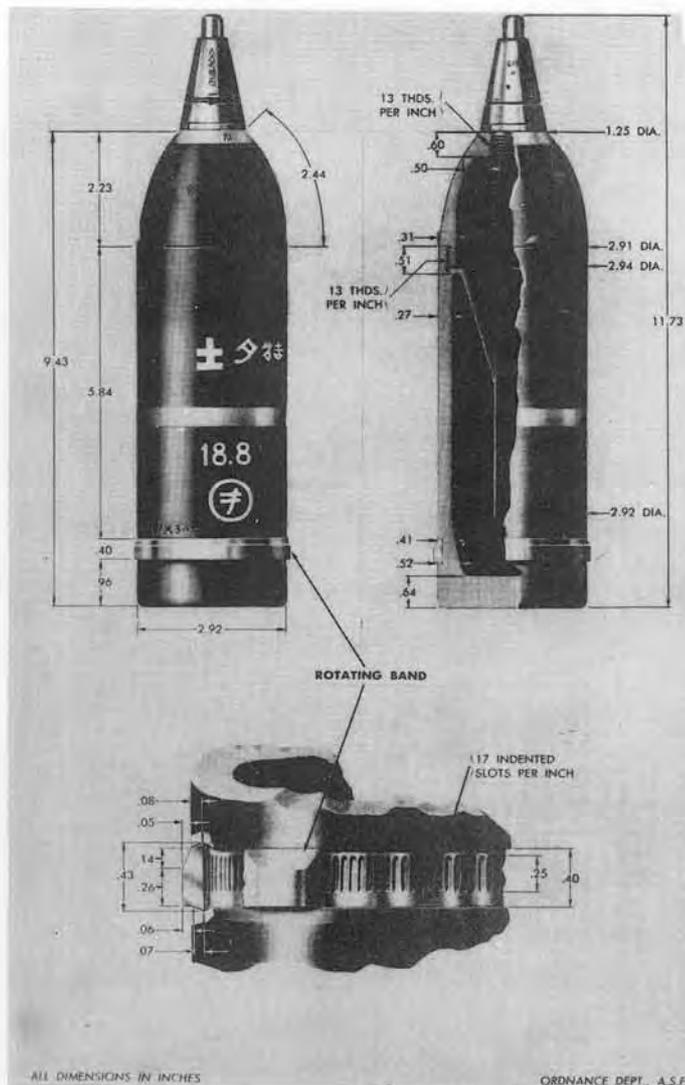
REMARKS—Inasmuch as quantities of this ammunition and weapons have been captured by the Japanese, it may be used against our troops

7 cm (75 mm) MODEL 1 APHE

WEAPONS:
7 cm Model 38 Field GunP. 108
7 cm Model 41 Cavalry Gun
7 cm Modified Model 38 Field GunP. 108
7 cm Model 95 Field GunP. 113
7 cm Model 90 Field GunP. 111
7 cm Model 94 Mountain GunP. 112
7 cm Model 41 Mountain GunP. 109

PROJECTILE:
Caliber—75 mm
Kind—Shell
Type—APHE
Weight (with Fuze)—14.6 lbs.
Color—Black
Bands—One white
Charge:
Weight—0.17 lbs.
Kind—Mixture of cyclonite and wax has been found
Tracer—Yes

FUZE:
Model 1 Medium Short Delay Base Fuze



7 cm (75 mm) MODEL 2 HOLLOW CHARGE

WEAPONS:

- 7 cm Model 41 Mountain GunP. 109
- 7 cm Model 94 Mountain GunP. 112

PROJECTILE:

- Caliber—75 mm
- Kind—Shell
- Type—Hollow Charge
- Weight (with Fuze)—8.21 lbs.
- Color—Black
- Bands—One yellow
- Charge:
 - Weight—1.2 lbs.
 - Kind—Mixture of Cyclonite and T.N.T. has been found
 - Tracer—None

FUZE:

Model 88 Instantaneous (Gun Type) Nose Fuze

REMARKS—Although suspected, it is not known definitely that this projectile is used in the 7 cm Model 38 Field Gun, 7 cm Model 41 Cavalry Gun, 7 cm Modified Model 38 Field Gun, 7 cm Model 95 Field Gun, 7 cm Model 90 Field Gun, and 7 cm Model 88 Field AA Gun (Special)

7 cm (75 mm) MODEL 90 SHRAPNEL

WEAPONS:

- 7 cm Model 38 Field GunP. 108
- 7 cm Model 41 Cavalry GunP. 108
- 7 cm Modified Model 38 Field GunP. 108
- 7 cm Model 95 Field GunP. 113
- 7 cm Model 41 Mountain GunP. 109
- 7 cm Model 90 Field GunP. 111
- 7 cm Model 94 Mountain GunP. 112

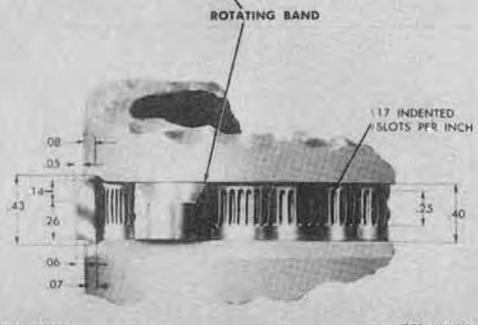
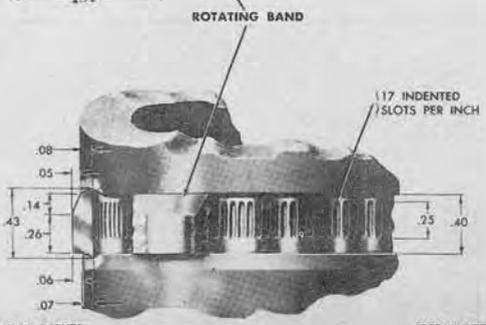
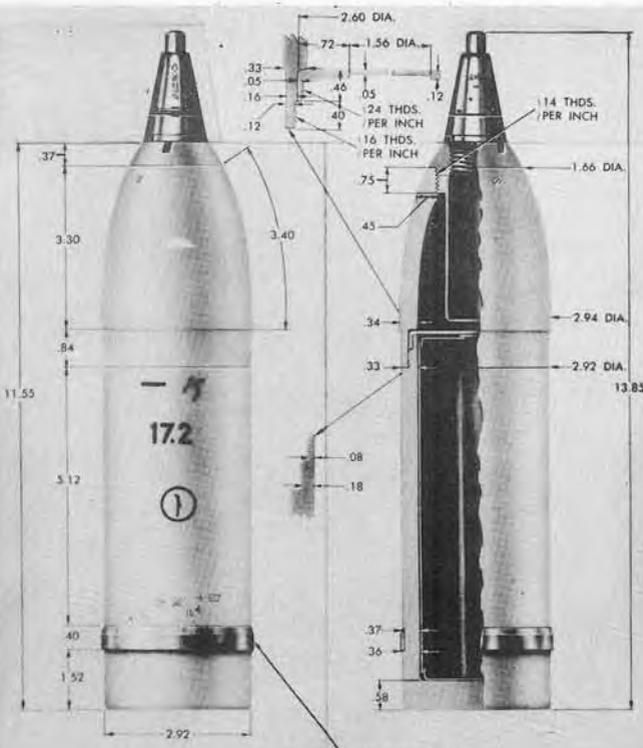
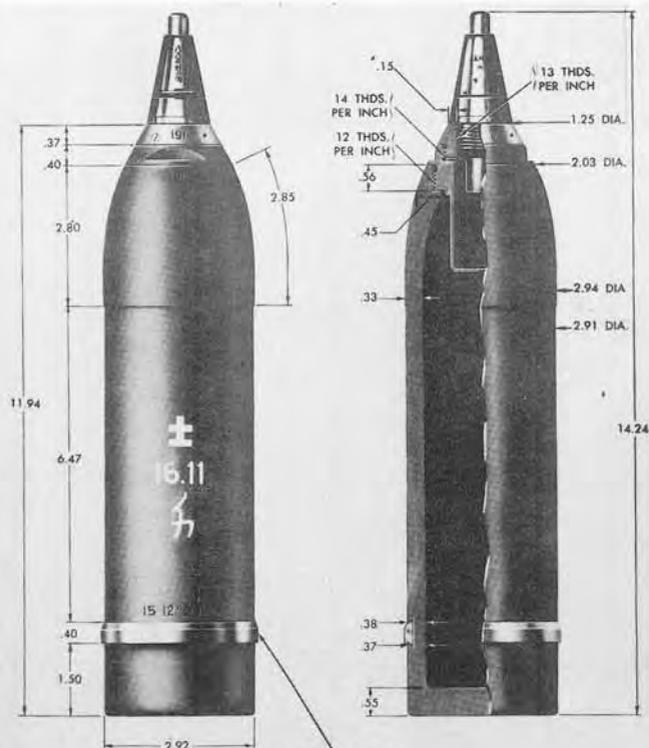
PROJECTILE:

- Caliber—75 mm
- Kind—Shrapnel
- Weight (with Fuze)—15.4 lbs.
- Color—Black
- Bands—One yellow or one yellow and one white
- Charge:
 - Weight—0.22 lb.
 - Kind—Black powder
 - Tracer—None

FUZE:

Model 5 Combination Time and Percussion Nose Fuze

REMARKS—This projectile contains 268 (approximately 5.5 lbs.) lead balls



ALL DIMENSIONS IN INCHES. ORDNANCE DEPT., A.S.F.

ALL DIMENSIONS IN INCHES. ORDNANCE DEPT., A.S.F.

7 cm (75 mm) INCENDIARY

- WEAPONS:**
- 7 cm Model 38 Field GunP. 108
 - 7 cm Model 41 Cavalry GunP. 108
 - 7 cm Modified Model 38 Field GunP. 108
 - 7 cm Model 95 Field GunP. 113
 - 7 cm Model 90 Field GunP. 111
 - 7 cm Model 41 Mountain GunP. 109
 - 7 cm Model 94 Mountain GunP. 112

PROJECTILE:
 Caliber—75 mm
 Kind—Shell
 Type—Incendiary
 Weight (with Fuze)—12.1 lbs.
 Color—Gray
 Bands—None
 Charge:
 Weight—Approx. 1.5 lbs.
 Kind—Solution of white phosphorus and rubber pellets in carbon disulphide
 Tracer—None

FUZE:
 Model 88 Instantaneous (Gun Type)

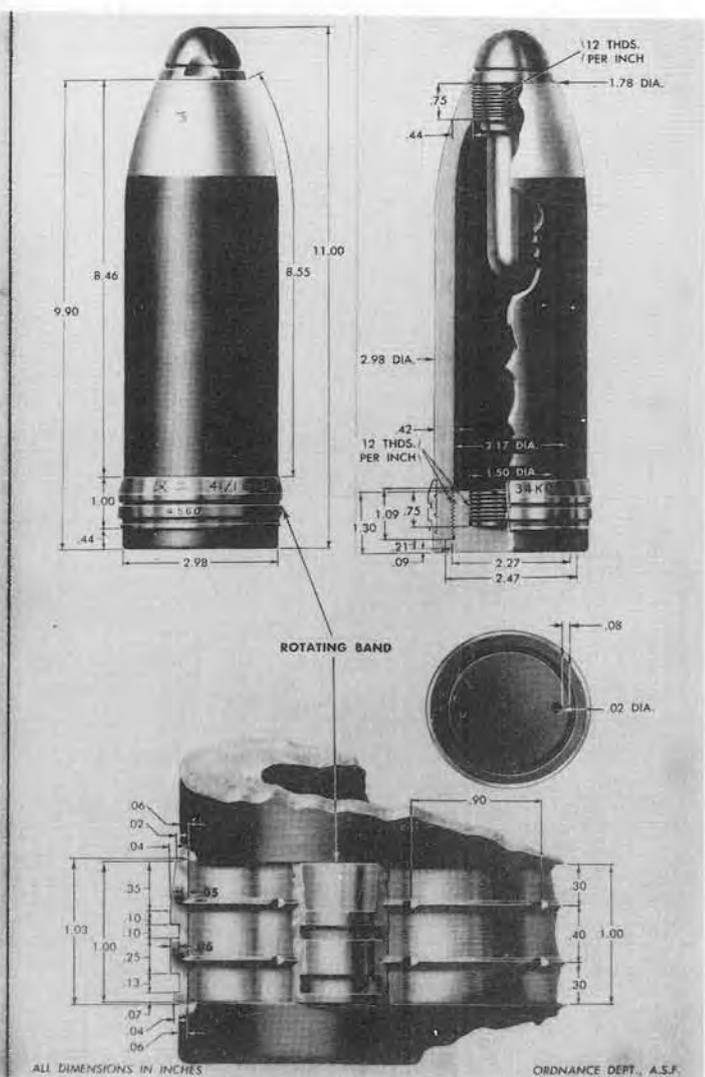
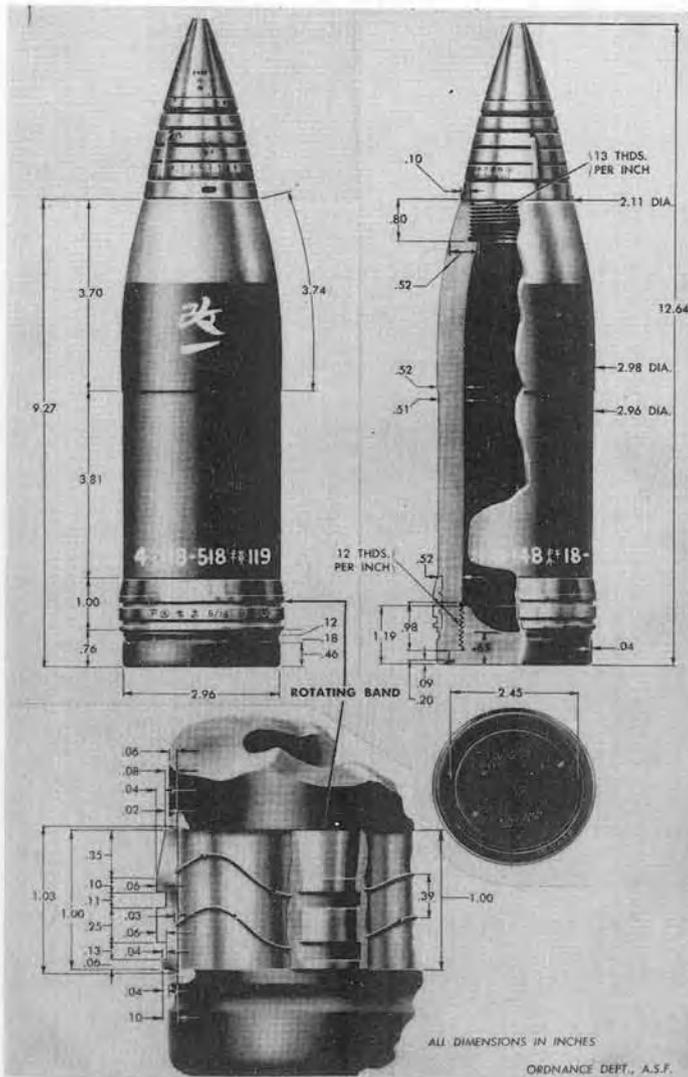
REMARKS—The model number of this projectile has not been determined

7 cm (75 mm) MODEL 90 SMOKE (WP)

- WEAPONS:**
- 7 cm Model 38 Field GunP. 108
 - 7 cm Model 41 Cavalry GunP. 108
 - 7 cm Modified Model 38 Field GunP. 108
 - 7 cm Model 95 Field GunP. 113
 - 7 cm Model 90 Field GunP. 111
 - 7 cm Model 41 Mountain GunP. 109
 - 7 cm Model 94 Mountain GunP. 112

PROJECTILE:
 Caliber—75 mm
 Kind—Shell
 Type—Smoke
 Weight (with Fuze)—12.6 lbs
 Color—White
 Bands—None
 Charge:
 Smoke—1.54 lbs. of white Phosphorus
 Bursting—0.22 lb. of Picric Acid and Dinitronaphthalene
 Tracer—None

FUZE:
 Model 88 Instantaneous (Gun Type)



8 cm (3 inch) HE AA [NAVAL]

WEAPONS:

8 cm AA Gun [Naval]

PROJECTILE:

Caliber—3 inches
 Kind—Shell
 Type—HE
 Weight (with Fuze)—13.5 lbs.
 Color—Maroon body with green nose
 Charge:
 Weight—0.97 lb.
 Kind—Picric has been found
 Tracer—None

FUZE:

Navy Time Nose Fuze (Powder train)*

REMARKS—The model number of the projectile and that of the gun from which fired have not been determined.

* The model number of the fuze has not been determined. However the design is identical to the Army Type 89 fuze, the only difference being that this fuze has Navy inspection stampings.

8 cm (3 INCH) HE [NAVAL]

WEAPONS:

8 cm Low Angle Gun [Naval]

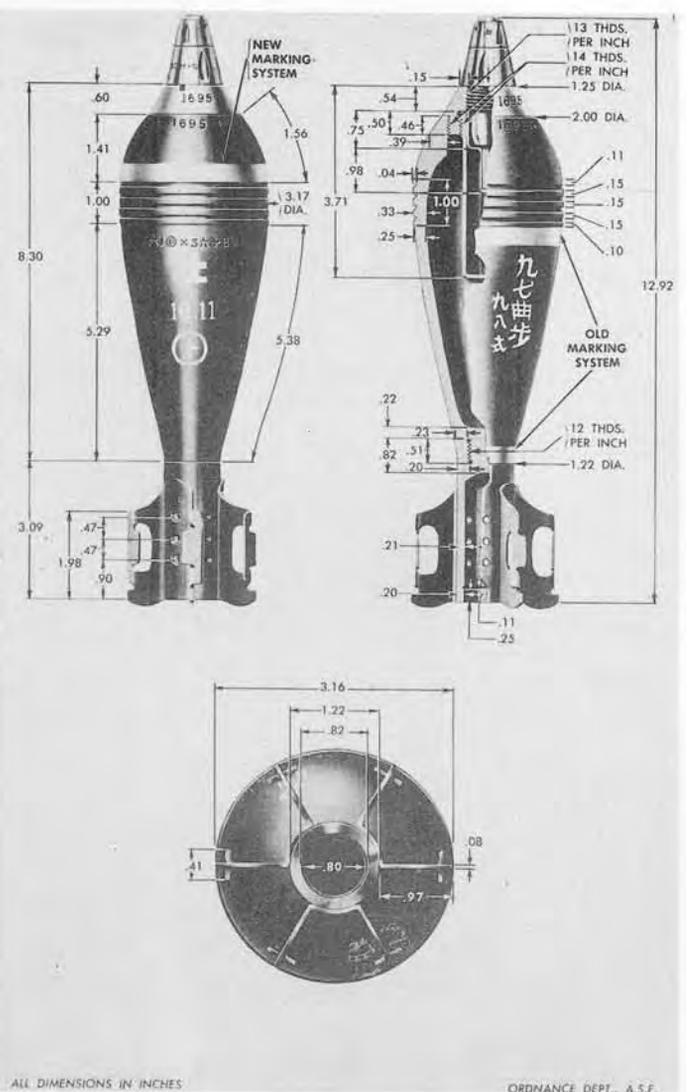
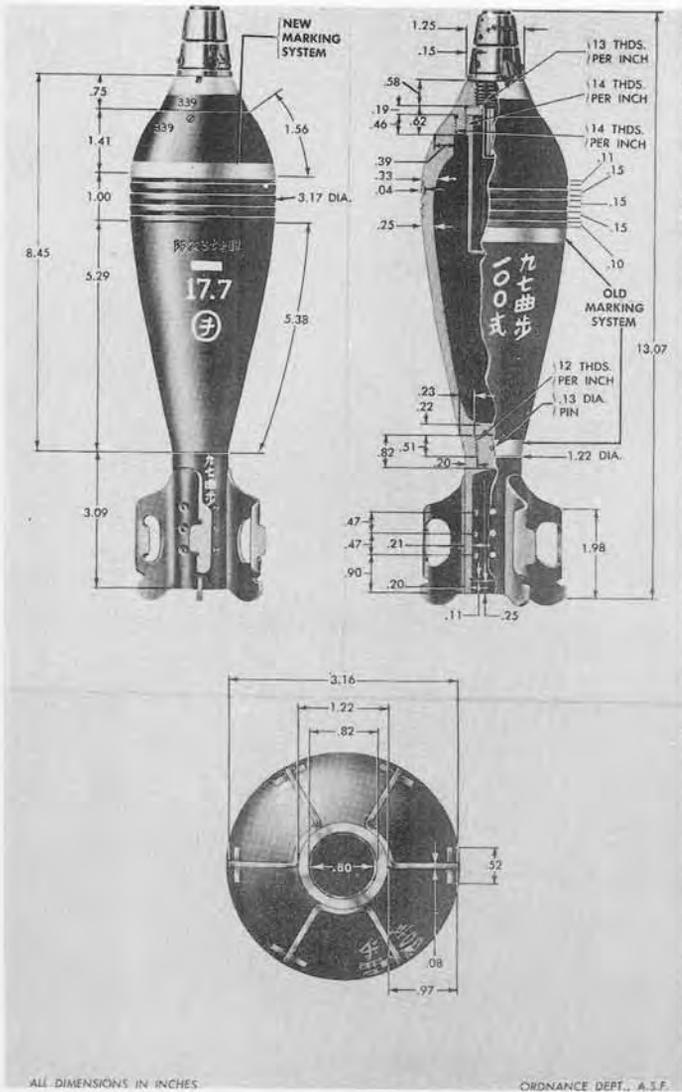
PROJECTILE:

Caliber—3 inches
 Kind—Shell
 Type—HE
 Weight (with Fuze and booster)—13.8 lbs.
 Color—Maroon body with green nose
 Charge:
 Weight—1.38 lbs.
 Kind—Picric has been found
 Tracer—None

FUZE:

Navy Model 5 Nose Fuze

REMARKS—The model number of the projectile and that of the gun from which fired have not been determined.



8 cm (81 mm) MODEL 100 HE MORTAR

WEAPONS:

8 cm Model 97 MortarP. 122

PROJECTILE:

Caliber—81 mm
 Kind—Mortar Shell
 Type—HE
 Weight (without Fuze and propelling charge)—6.75 lbs.
 Color—Black
 Bands—One yellow
 Charge:
 Weight—1.18 lbs.
 Kind—T.N.T. has been found

FUZE:

Model 100 Mortar Fuze

8 cm (81 mm) MODEL 98 HE MORTAR

WEAPONS:

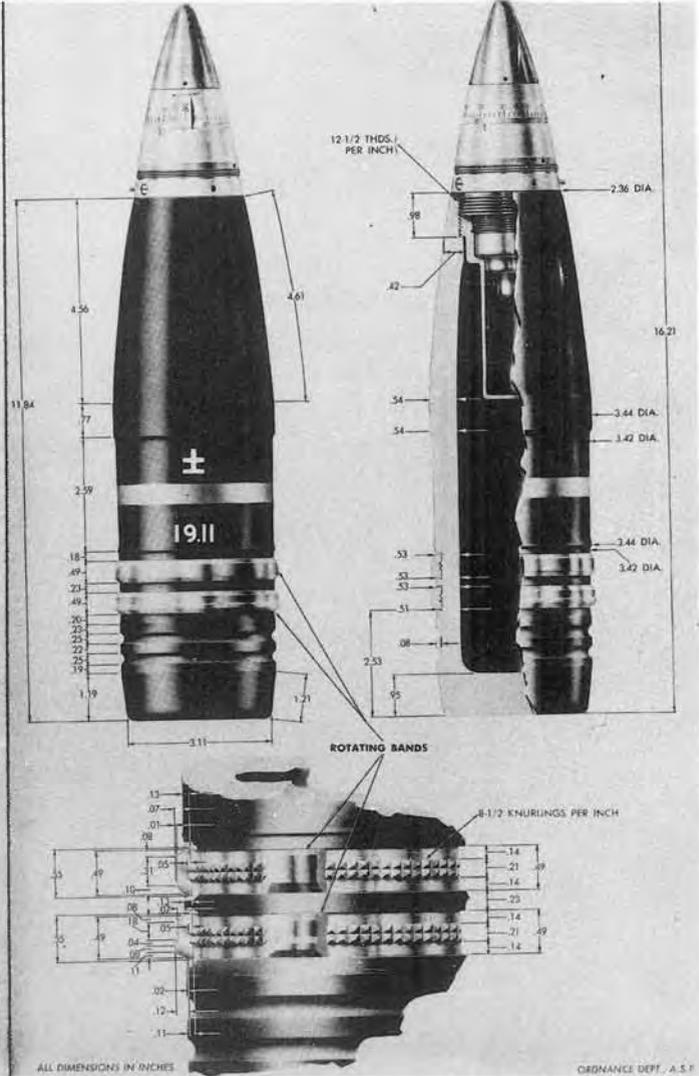
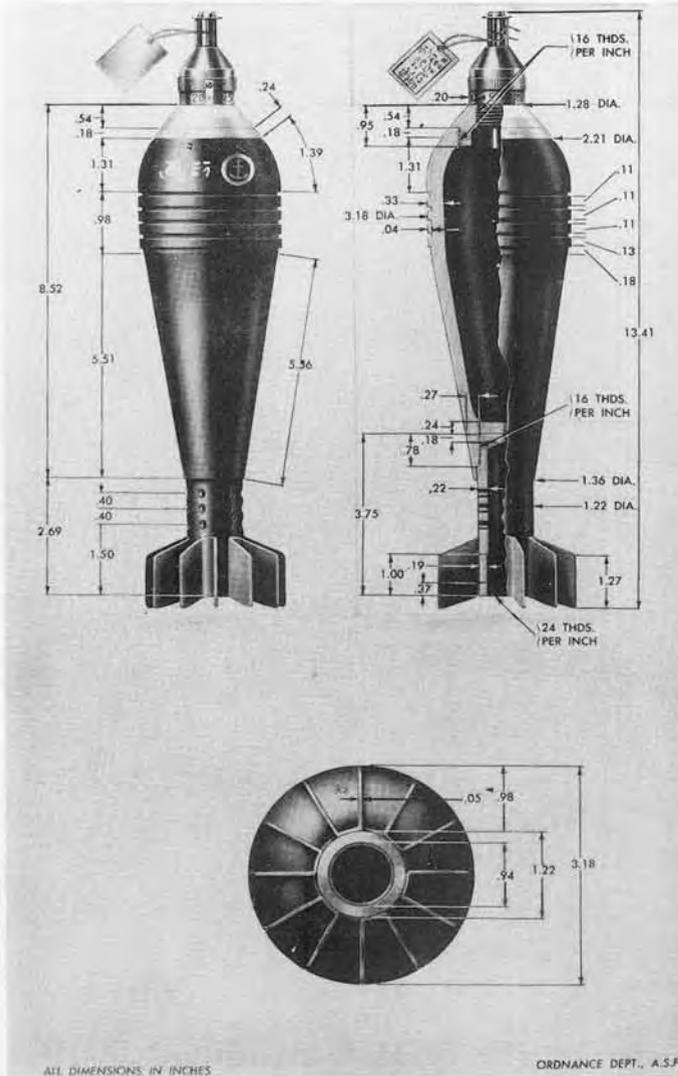
8 cm Model 97 MortarP. 122

PROJECTILE:

Caliber—81 mm
 Kind—Mortar Shell
 Type—HE
 Weight (without Fuze and Propelling Charge)—6.84 lbs.
 Color—Black
 Bands—One yellow or one yellow and one white
 Charge:
 Weight—1.09 lbs.
 Kind—T.N.T.

FUZE:

Model 93 Mortar Fuze



8 cm (81 mm) HE MORTAR [NAVAL]

WEAPONS:

8 cm Model 3 Mortar [Naval]P. 122.1

PROJECTILE:

Caliber—81 mm
 Kind—Mortar Shell
 Type—HE
 Weight (without Fuze)—6.99 lbs.
 Color—Black with red and green nose
 Bands—None
 Charge:
 Weight—Approximately 1.12 lbs.
 Kind—Picric acid and Dinitronaphthalene (Tridite)

FUZE:

Naval Mortar Fuze

REMARKS—The model number of this projectile and that of the fuze have not been determined.

8 cm (88 mm) MODEL 100 HE POINTED AA

WEAPONS:

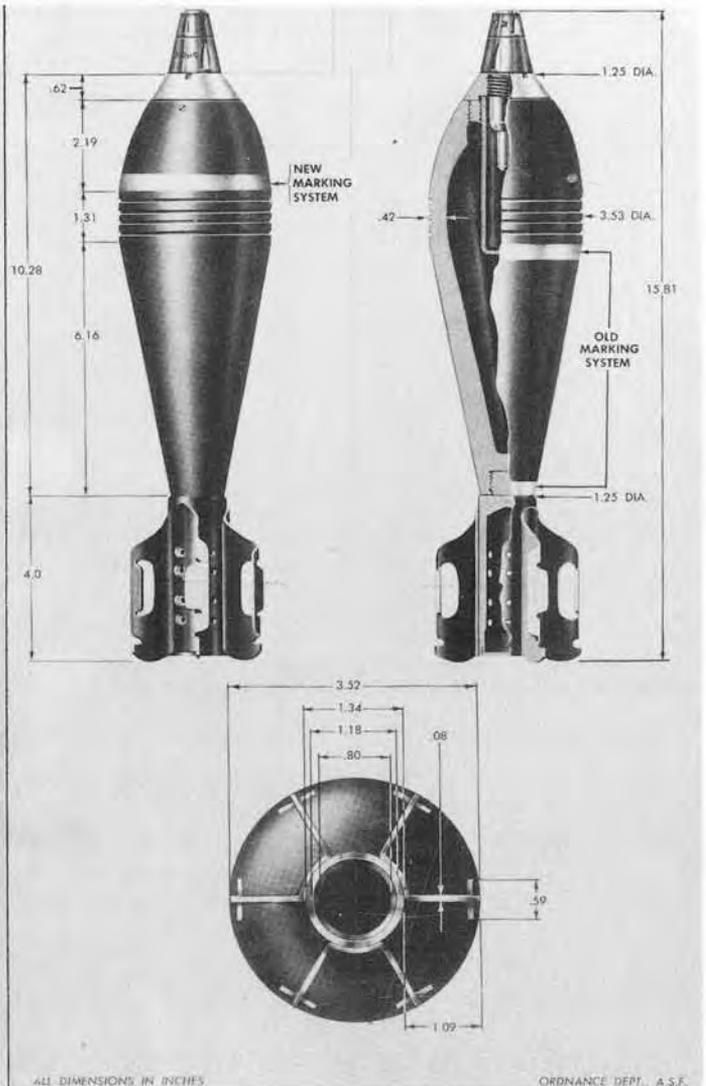
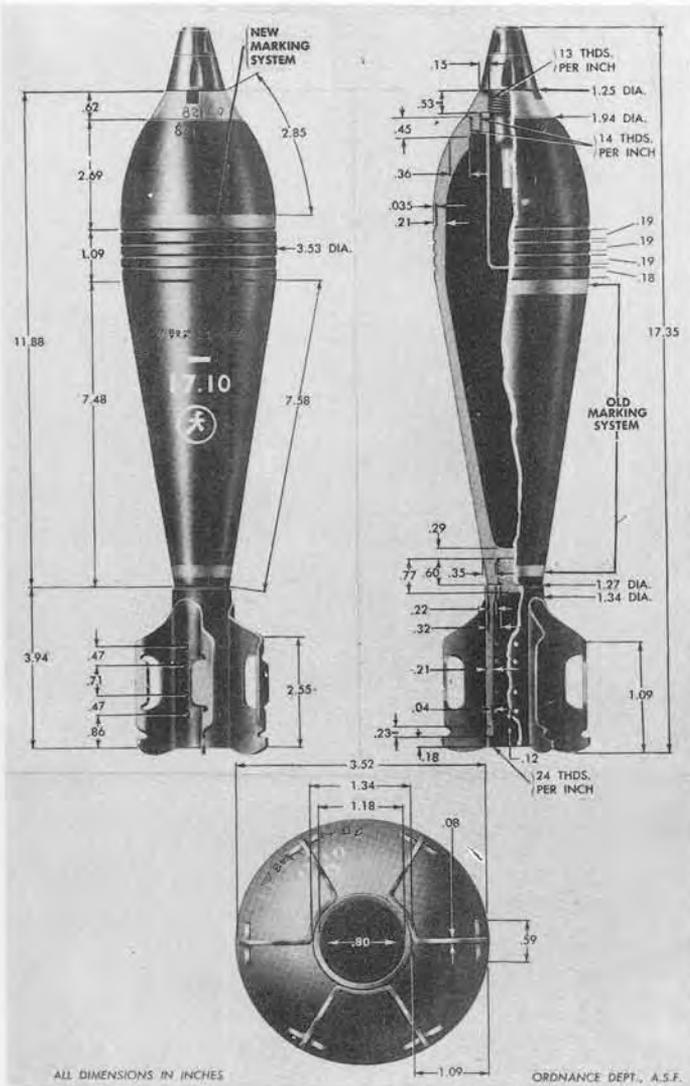
8 cm Model 99 AA Gun

PROJECTILE:

Caliber—88 mm
 Kind—Shell
 Type—HE
 Weight (with Fuze)—19.9 lbs.
 Color—Black
 Bands—One yellow
 Charge:
 Weight—1.98 lbs.
 Kind—T.N.T. has been found
 Tracer—None

FUZE:

Model 100 Mechanical Time Nose Fuze



9 cm (90 mm) MODEL 94 HE MORTAR

WEAPONS:

- 9 cm Model 94 Light Infantry MortarP. 124
- 9 cm Model 97 MortarP. 125

PROJECTILE:

- Caliber—90 mm
- Kind—Mortar Shell
- Type—HE
- Weight (with Fuze—without Propelling Charge)—11.6 lbs.
- Color—Black
- Bands—One yellow or one yellow and one white
- Charge:
 - Weight—2.36 lbs.
 - Kind—T.N.T. has been found

FUZE:

- Model 93 Mortar Fuze

9 cm (90 mm) HE MORTAR SEMI-STEEL

WEAPONS:

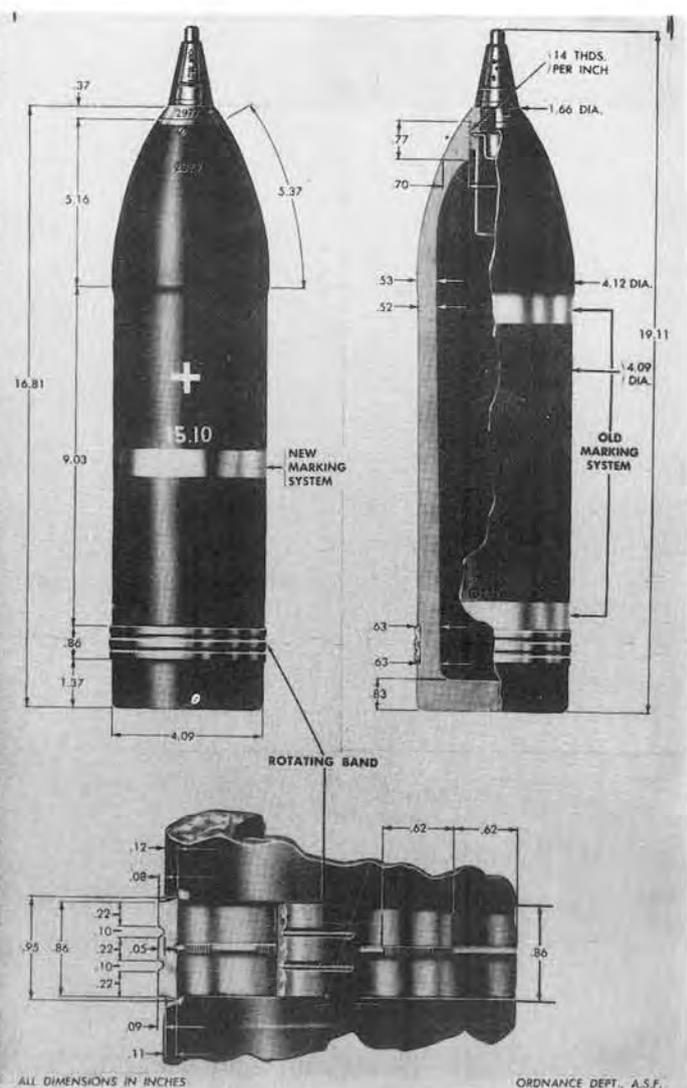
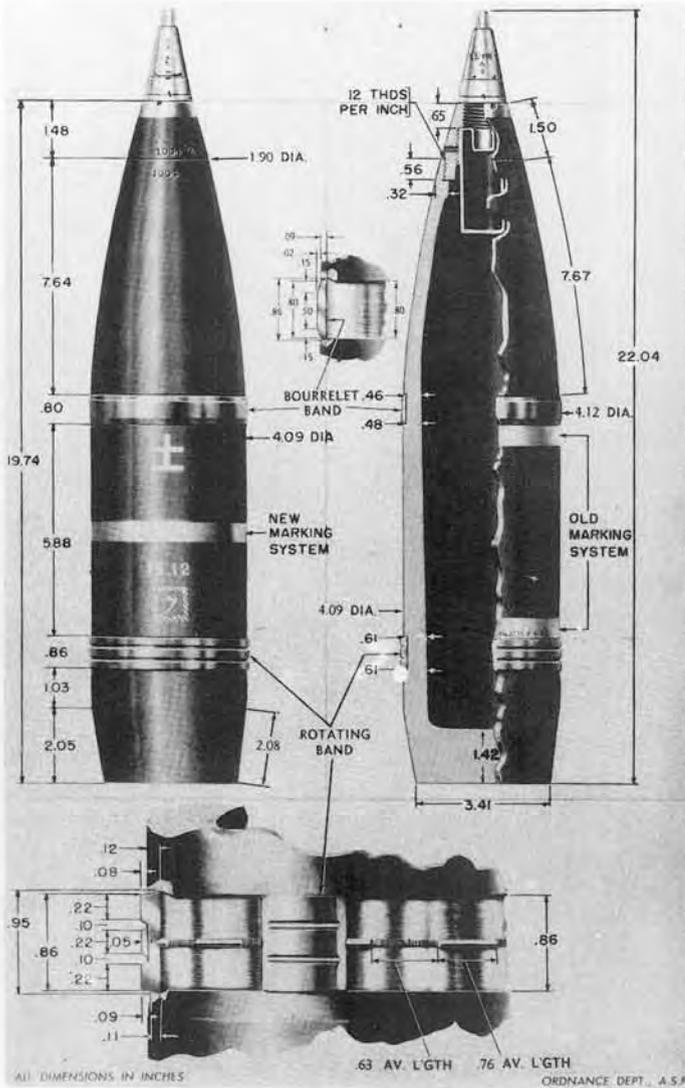
- 9 cm Model 94 Light Infantry MortarP. 124
- 9 cm Model 97 MortarP. 125

PROJECTILE:

- Caliber—90 mm
- Kind—Mortar Shell
- Type—HE
- Weight—
- Color—Black
- Bands—One green or one yellow and one green
- Charge:
 - Weight—
 - Kind—

FUZE:

- Model 93 Mortar Fuze



10 cm (105 mm) MODEL 91 HE POINTED

WEAPONS:

- 10 cm Model 91 HowitzerP. 114
- 10 cm Model 92 GunP. 115
- 10 cm Model 14 Gun
- 10 cm Model 38 Gun

PROJECTILE:

- Caliber—105 mm
- Kind—Shell
- Type—HE
- Weight (with Fuze)—34.65 lbs.
- Color—Black
- Bands—One yellow or one yellow and one white
- Charge:
 - Weight—5.55 lbs.
 - Kind—Mixture of Ammonium Nitrate, Guanidine Nitrate, Cyclonite, or TNT
- Tracer—None

FUZES:

- Model 88 Instantaneous (Howitzer-Mortar Type) Nose Fuze
- Model 88 Short Delay (Howitzer-Mortar Type) Nose Fuze
- Model 88 Instantaneous (Gun Type) Nose Fuze
- Model 88 Short Delay (Gun Type) Nose Fuze

REMARKS—Captured documents indicate that the howitzer type fuze is used when this projectile is fired from a howitzer and that a gun type fuze is used when this projectile is fired from a gun.

10 cm (105 mm) MODEL 91 HE

WEAPONS:

- 10 cm Model 91 HowitzerP. 114
- 10 cm Model 92 GunP. 115
- 10 cm Model 14 Gun
- 10 cm Model 38 Gun

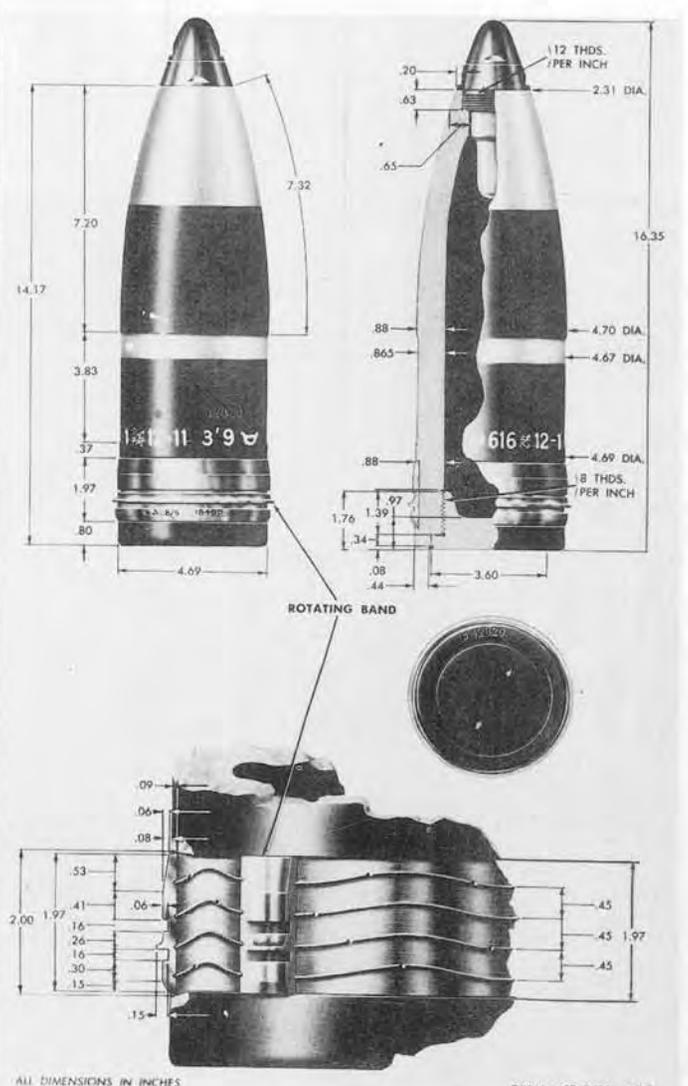
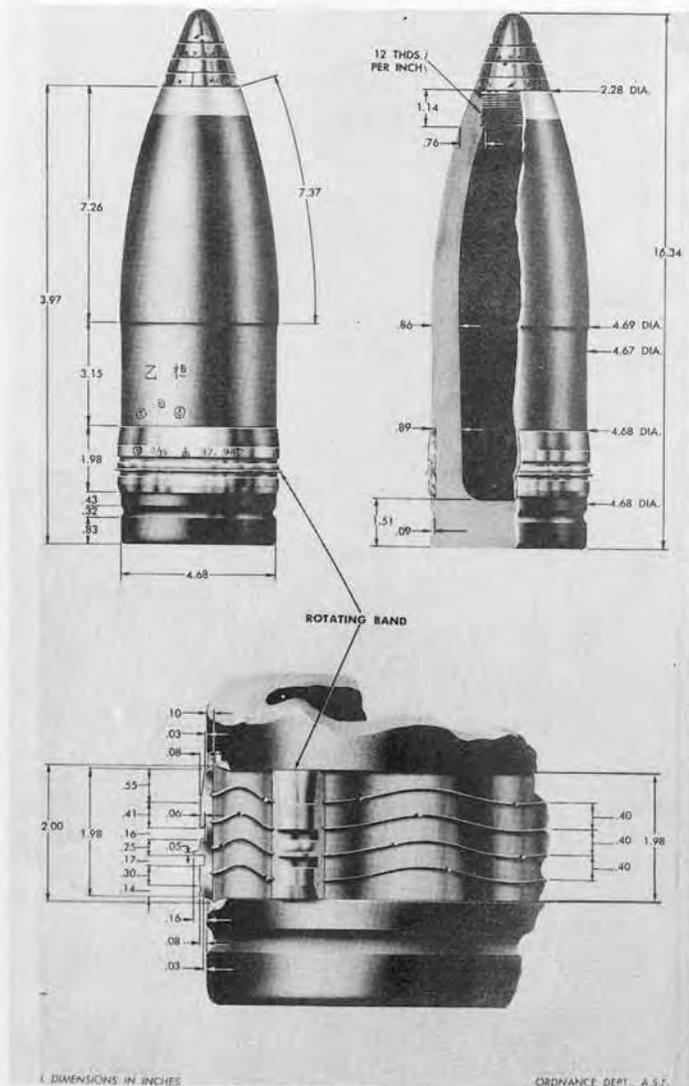
PROJECTILE:

- Caliber—105 mm
- Kind—Shell
- Type—HE
- Weight (with Fuze)—35.3 lbs.
- Color—Black
- Bands—One yellow or one yellow and one white
- Charge:
 - Weight—5 lbs.
 - Kind—T.N.T. has been found

FUZES:

- Model 88 Instantaneous (Howitzer-Mortar Type) Nose Fuze
- Model 88 Short Delay (Howitzer-Mortar Type) Nose Fuze
- Model 88 Instantaneous (Gun Type) Nose Fuze
- Model 88 Short Delay (Gun Type) Nose Fuze

REMARKS—Captured documents indicate that the howitzer type fuze is used when this projectile is fired from a howitzer and that a gun type fuze is used when this projectile is fired from a gun.



12 cm (120 mm) HE AA [NAVAL]

WEAPONS:
12 cm Model 11 AA Gun [Naval]

PROJECTILE:
Caliber—120 mm
Kind—Shell
Type—HE
Weight—(with Fuze)—45.5 lbs.
Color—Maroon Body with green nose
Bands—None
Charge:
Weight—3.7 lbs.
Kind—Trinitroanisole
Tracer—None

FUZE:
Navy Model 91 Mechanical Time Nose Fuze

REMARKS—The model number of the projectile has not been determined. There are three known modifications of the Model 91 Fuze, giving four fuzes, called Model 91, each varying only slightly from the others.

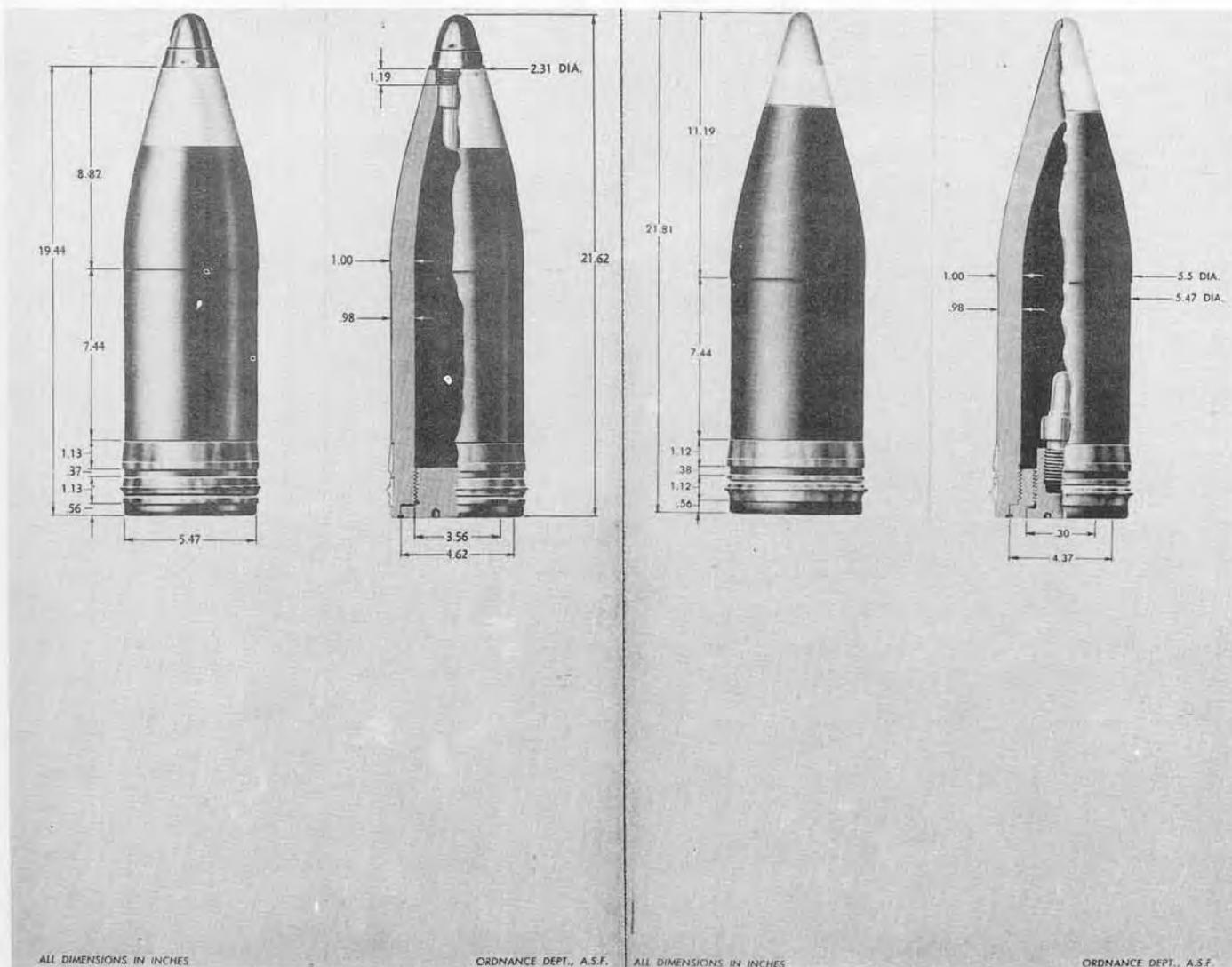
12 cm (120 mm) HE [NAVAL]

WEAPONS:
12 cm Low Angle Gun [Naval]

PROJECTILE:
Caliber—120 mm
Kind—Shell
Type—HE
Weight (without Fuze)—45.37 lbs.
Color—Maroon body with green nose
Bands—One yellow
Charge:
Weight—3.92 lbs.
Kind—Picric acid has been found
Tracer—None

FUZES:
Navy Model 88 Nose Fuze
Navy Model 5 Nose Fuze

REMARKS—When the Navy Model 5 Nose Fuze is used an adapter (brass) is necessary. The Model number of the projectile and that of the gun from which fired have not been determined.



14 cm (140 mm) HE [NAVAL]

WEAPONS:
14 cm Low Angle Gun [Naval]

PROJECTILE:
Caliber—140 mm
Kind—Shell
Type—HE
Weight—
Color—Maroon body with green nose
Bands—None
Charge:
Weight—
Kind—
Tracer—None

FUZE:
Navy Model 88 Nose Fuze

REMARKS—The model number of the projectile and that of the gun from which fired have not been determined.

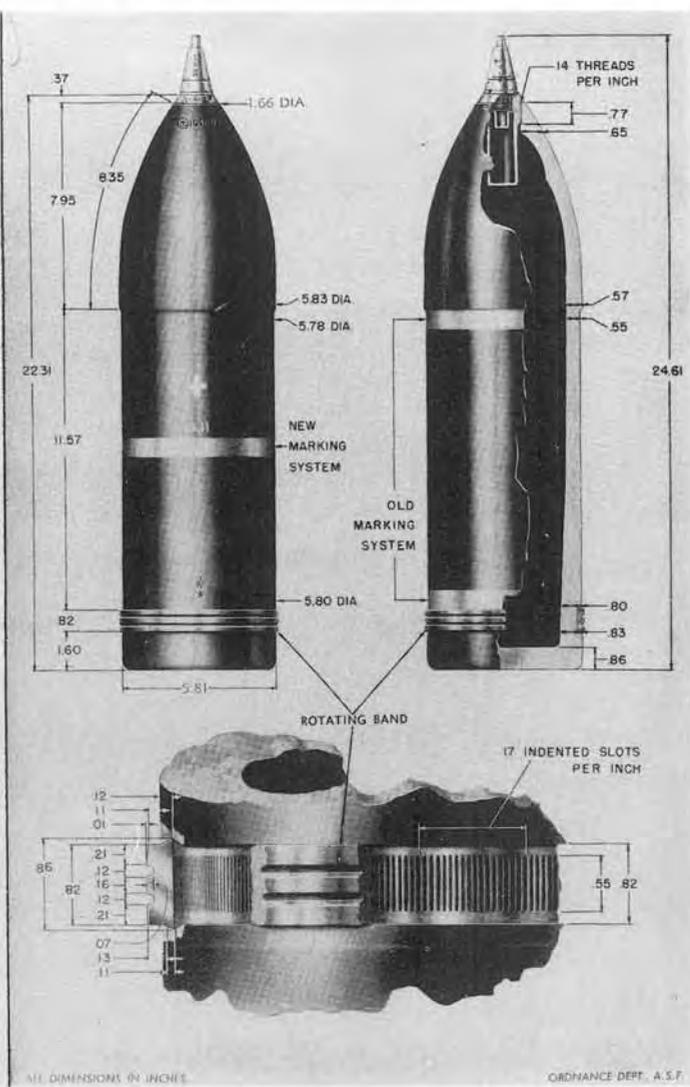
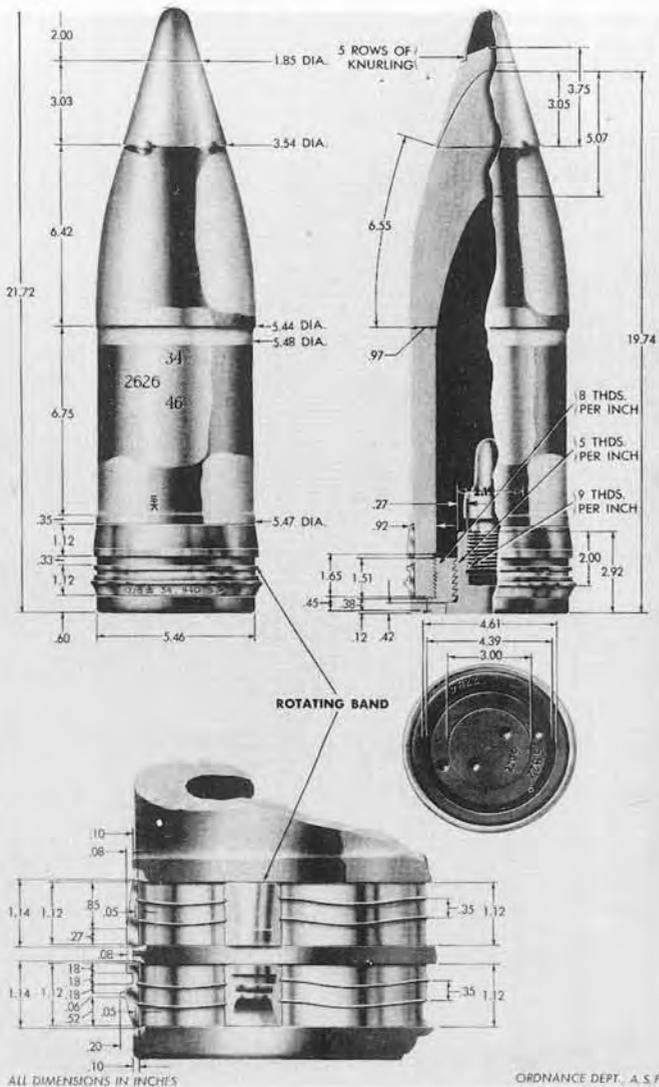
14 cm (140 mm) HE [NAVAL]

WEAPONS:
14 cm Low Angle Gun [Naval]

PROJECTILE:
Caliber—140 mm
Kind—Shell
Type—HE (Base Fuzed)
Weight (with Fuze)—84 lbs.
Color—Maroon body with red and green nose
Bands—None
Charge:
Weight—
Kind—Picric Acid
Tracer—None

FUZE:
Navy Base Detonating Fuze

REMARKS—The model number of the projectile, that of the gun, and that of the fuze have not been determined.



14 cm (140 mm) HE-CAPPED [NAVAL]

WEAPONS:

14 cm Low Angle Gun [Naval]

PROJECTILE:

Caliber—140 mm
 Kind—Shell
 Type—HE (Base Fuzed)
 Weight—
 Color—Maroon and green
 Bands—One yellow
 Charge:
 Weight—
 Kind—
 Tracer—None.

FUZE:

Navy Base Detonating Fuze

REMARKS—The model number of the projectile, that of the gun from which fired, and that of the fuze have not been determined.

15 cm (150 mm) MODEL 92 HE

WEAPONS:

15 cm Model 4 HowitzerP. 116
 15 cm Model 38 Howitzer

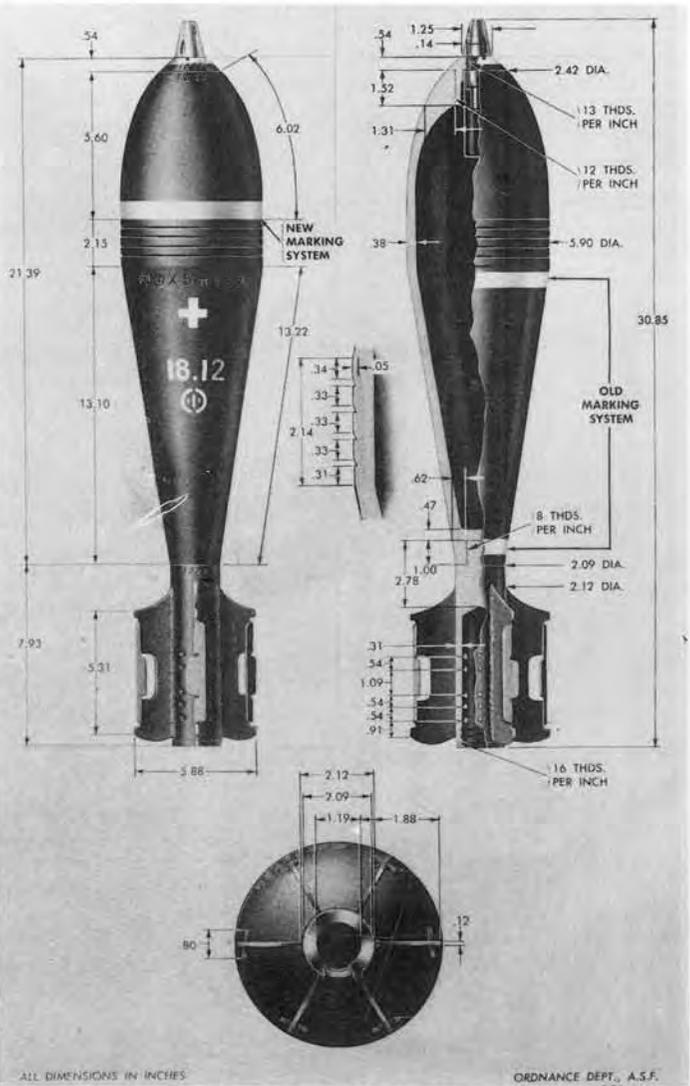
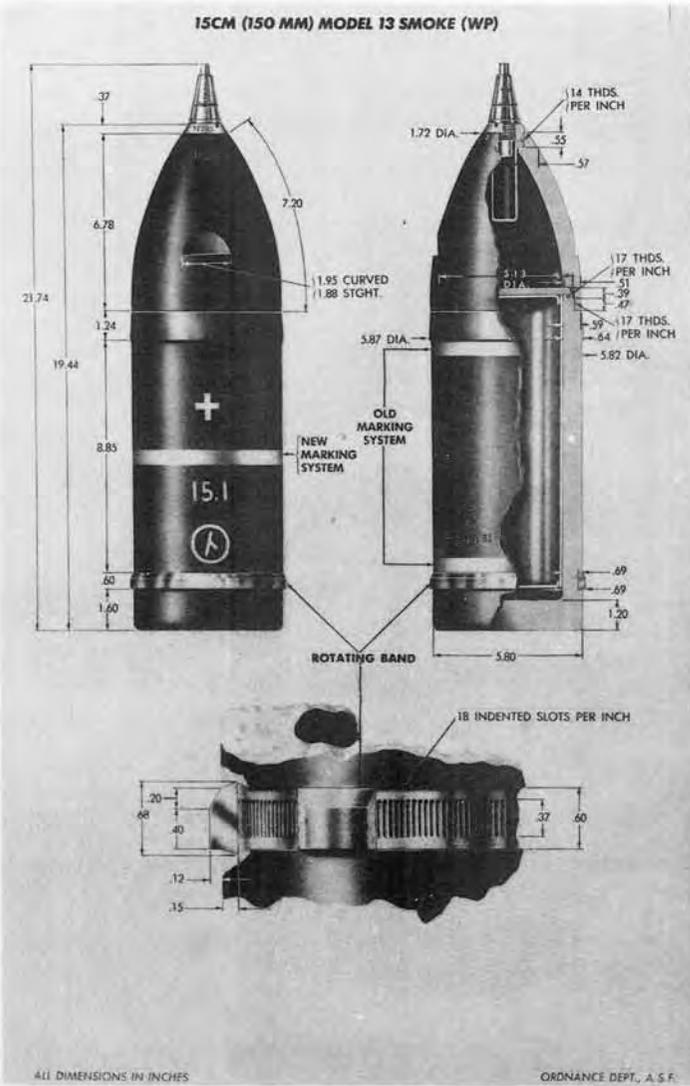
PROJECTILE:

Caliber—150 mm
 Kind—Shell
 Type—HE
 Weight (with Fuze)—79.5 lbs.
 Color—Black
 Bands—One yellow or one yellow and one white
 Charge:
 Weight—16.9 lbs.
 Kind—T.N.T. has been found
 Tracer—None

FUZES:

Model 88 Instantaneous (Howitzer-Mortar Type) Nose Fuze
 Model 88 Short Delay (Howitzer-Mortar Type) Nose Fuze

REMARKS—It is not known definitely but it is expected that this projectile can be fired from the 15 cm Model 96 Howitzer.



15 cm (150 mm) MODEL 13 SMOKE (WP)

WEAPONS:

- 15 cm Model 4 HowitzerP. 116
- 15 cm Model 38 Howitzer

PROJECTILE:

- Caliber—150 mm
- Kind—Shell
- Type—Smoke
- Weight (with Fuze)—73.9 lbs.
- Color—Black
- Bands—One yellow or one yellow and one white
- Charge:
 - 9.9 lbs. of white phosphorus
 - 2.4 lbs. of Picric Acid
- Tracer—None

FUZES:

- Model 88 Instantaneous (Howitzer-Mortar Type) Nose Fuze
- Model 88 Short Delay (Howitzer-Mortar Type) Nose Fuze

REMARKS—The white phosphorus is inclosed in a brass can. The picric acid burster is in the nose. It is not known definitely but it is expected that this projectile can be fired from the 15 cm Model 96 Howitzer.

15 cm (150 mm) MODEL 96 HE MORTAR

WEAPONS:

- 15 cm Model 96 Medium Mortar

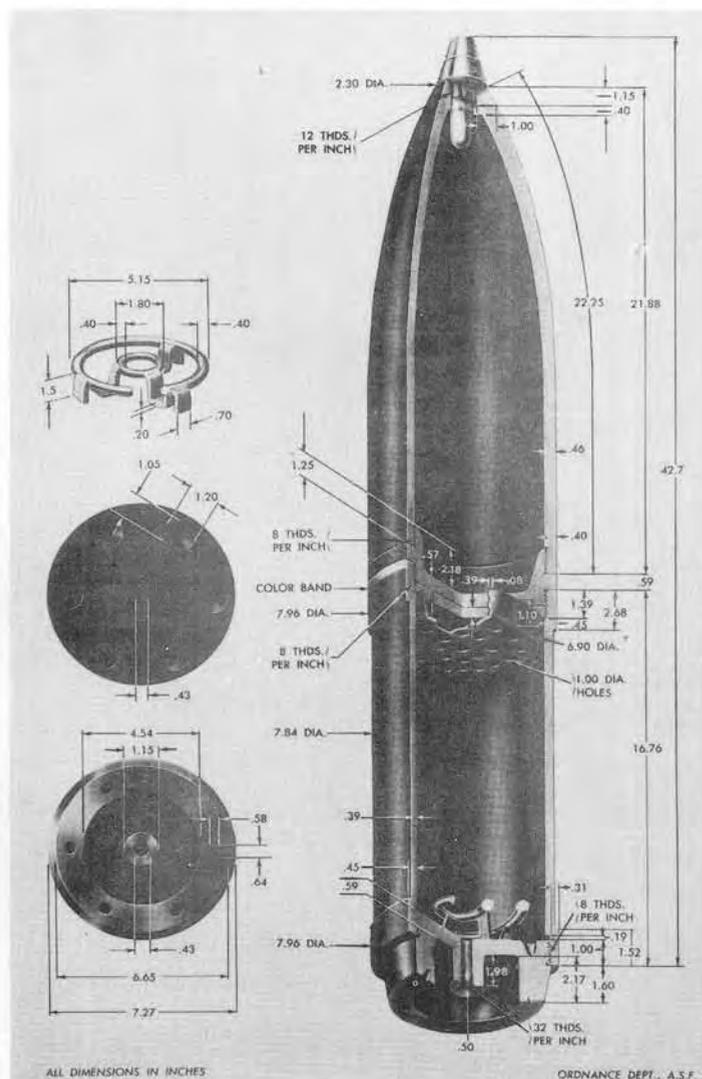
PROJECTILE:

- Caliber—150 mm
- Kind—Mortar Shell
- Type—HE
- Weight (with Fuze)—56.6 lbs.
- Color—Black
- Bands—One yellow or one yellow and one white
- Charge:
 - Weight—13 lbs.
 - Kind—T.N.T. has been found

FUZE:

- Model 93 Mortar Fuze

REMARKS—The Model 96 is called a medium mortar although it is 150 mm.



20 cm (203.2 mm) ROCKET

WEAPONS:

Trough Type LauncherP. 352

PROJECTILE:

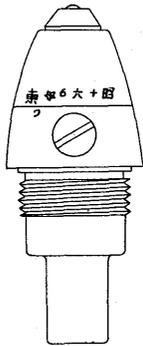
Caliber—203.2 mm
 Kind—Rocket
 Type—HE
 Weight (with Fuze)—195 lbs.
 Color—Maroon
 Charge:
 Weight—34.4 lbs.
 Kind—Trinitroanisole
 Propellant—18.6 lbs. of double base powder

FUZE:

Point Detonating Nose Fuze

REMARKS—The model number of the rocket and that of the fuze have not been determined.

The rocket is spin stabilized by inclined nozzles in the base. The case for the HE head is the same as the projectile body on 20 cm Naval HE Shell and may have a rotating band seat although there is no rotating band. Rockets have been found both with and without the seat.



TYPE 93
SMALL
INSTANTANEOUS
NOSE FUZE

Type 93 Small Instantaneous Nose Fuze

USE: 20 mm and 37 mm guns. Superseded by Type 100 Small Instantaneous Fuze.

OPERATION: The striker is held away from the primer by a spring-loaded forked detent which moves out by centrifugal force. A pivoted shutter, which blocks the flash channel is also forced aside by centrifugal force.

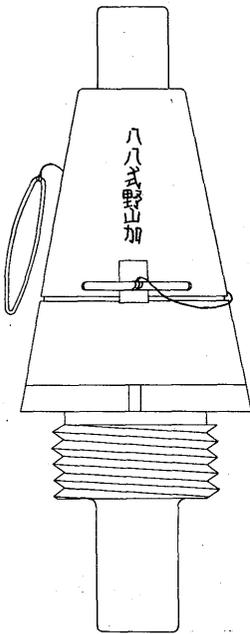
Type 100 Small Instantaneous Nose Fuze

USE: 20 mm and 37 mm guns. Supersedes Type 93 Small Instantaneous Fuze.

OPERATION: Arms by centrifugal force similar to Type 93 Small Instantaneous Fuze, except that it doesn't have a centrifugal shutter.



TYPE 100
SMALL
INSTANTANEOUS
NOSE FUZE



TYPE 88
INSTANTANEOUS
NOSE FUZE
(FOR GUN AND HOWITZER TYPES)

Type 88 Instantaneous Nose Fuze (Gun and Howitzer Types)

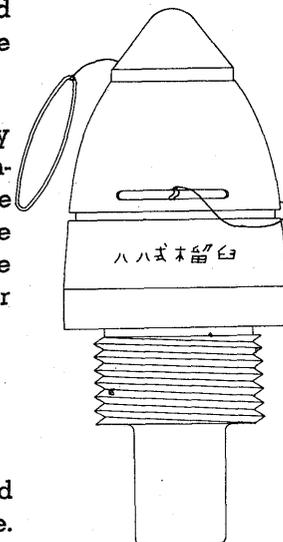
USE: 47 mm, 70 mm, 75 mm, 105 mm, 150 mm guns and howitzers. Interchangeable with Type 88 Short Delay Nose Fuze.

OPERATION: The striker is held off the primer by four safety blocks surrounded by a ferrule and the arming collar. The arming collar moves down on setback and is held down by the stirrup spring. Centrifugal force causes the blocks to move from under the striker against the ferrule. The howitzer type fuze has weaker stirrup springs and ferrule due to weaker setback force and centrifugal force.

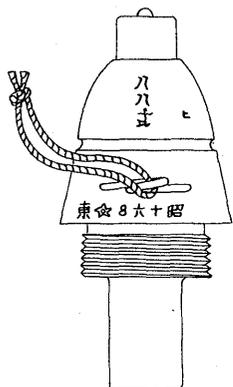
Type 88 Short Delay Nose Fuze (Gun and Howitzer Types)

USE: 57 mm, 70 mm, 75 mm, 105 mm, and 150 mm guns and howitzers. Interchangeable with Type 88 Instantaneous Fuze.

OPERATION: Similar to the Type 88 Instantaneous Fuze. The gun type fuze has a movable primer carrier and striker.



TYPE 88
SHORT DELAY
NOSE FUZE
(FOR GUN AND HOWITZER TYPES)



**TYPE 88
SMALL INSTANTANEOUS FUZE**

Type 88 Small Instantaneous Fuze

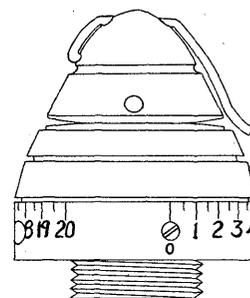
USE: 50 mm and 70 mm rifled mortars.

OPERATION: Arms due to setback and centrifugal force similar to the Type 88 Instantaneous Gun Fuze.

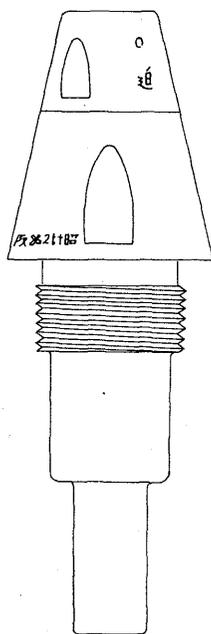
Type 89 Small Time Fuze

USE: 50 mm mortar and 70 mm mortar and howitzer.

OPERATION: Setback forces movable striker onto primer firing black powder delay train in one fixed and one movable ring.



**TYPE 89
SMALL TIME FUZE**



**TYPE 93
INSTANTANEOUS—SHORT DELAY FUZE**

Type 93 Instantaneous-Short Delay Fuze

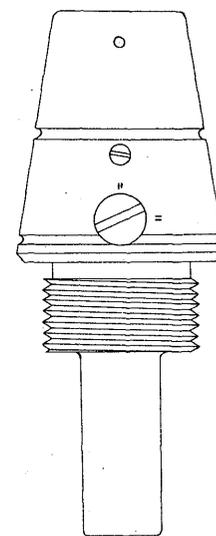
USE: 70 mm, 81 mm, 90 mm, and 150 mm mortars.

OPERATION: On impact the striker housing, which holds a fixed striker, is forced in shearing a shear wire and at the same time the movable primer moves forward against the creep spring onto the firing pin. Choice of instantaneous or short delay is made by inserting or removing a delay pellet below the primer.

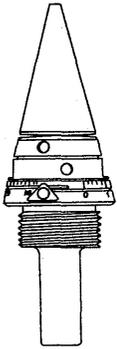
Type 100 Instantaneous-Short Delay Fuze

USE: 81 mm and probably 70 mm, 90 mm, and 150 mm mortars.

OPERATION: Functions in the same manner as the Type 93 Instantaneous-Short Delay Fuze. The delay element is not removable, but is mounted in a cylindrical tube, which has a flash hole running through it with the delay pellet 90° removed. The fuze may be set for instantaneous or short delay, without disassembling the fuze, by turning the setting screw.



**TYPE 100
INSTANTANEOUS—SHORT
DELAY FUZE**



TYPE 93
SMALL POWDER TIME FUZE

Type 93 Small Powder Time Fuze

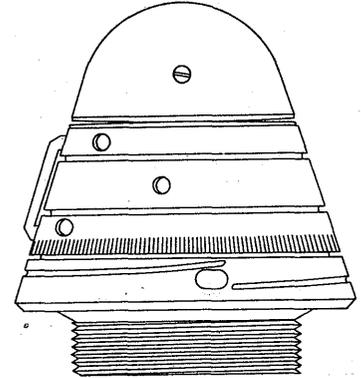
USE: Has not been determined.

OPERATION: On setback, the striker moves against a spring hitting the primer. The resulting flash ignites a variable powder delay train which, in turn, sets off the detonator. No impact feature is incorporated in this fuze. The time ring is graduated from 0-10 and is thought to represent 1,000 yards, i. e., 0-10,000 yards.

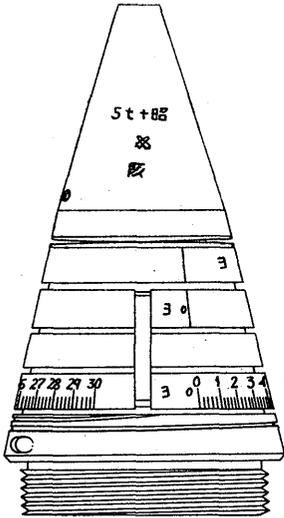
Type 10th Year Time Fuze

USE: Reported to be used in ole H. E. projectile for 75 mm antiaircraft gun and in target projectiles for 75 mm and 105 mm guns.

OPERATION: On setback the movable primer overcomes the resistance of the arming collar and strikes the fixed firing pin thus starting the time rings. There are three time rings, two being movable. The flash from the time ring sets off the black powder magazine in the base of the fuze. No impact feature is incorporated.



TYPE 10TH YEAR
TIME FUZE



TYPE 89
LONG-POINTED FUZE

Type 89 Long-Pointed Fuze

USE: 75 mm antiaircraft guns and is reported to be used in 105 mm antiaircraft guns.

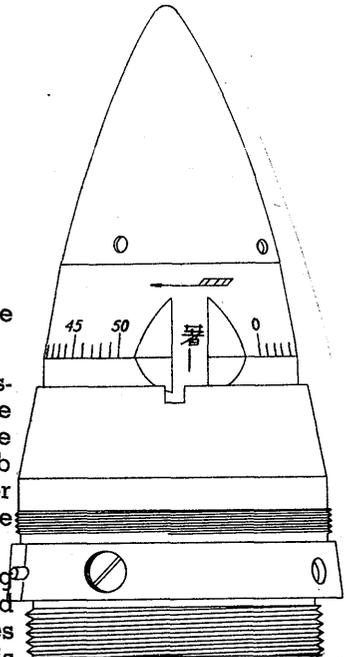
OPERATION: On setback a movable primer overcomes a spring and strikes the fixed firing pin igniting a delay train, which in turn actuates an auxiliary fuze below. No impact feature is incorporated.

Type 100 Combination Impact—Mechanical Time Fuze

USE: Japanese 9 cm (88 mm) antiaircraft gun reported to be used in 105 mm antiaircraft gun.

OPERATION: Time—Setback causes a starting plunger to disengage a locking disc on the clock and a setback pin frees the escape wheel allowing the clock mechanism to function. The clockwork mechanism is like that used in the D-2(a) bomb fuze. Centrifugal force moves a brass safety disc from under the shoulder of the spring-loaded firing pin and at the set time 0-50 seconds the firing pin is released to fire a primer.

Impact—The impact feature consists of a separate fixed firing pin and a movable primer carrier which is held in the unfired position by two centrifugal detents. Centrifugal force causes the detents to move out, freeing the primer carrier which is held off of the firing pin by a creep spring. On impact, the primer-carrier moves against the creep spring onto the firing pin firing the primer.



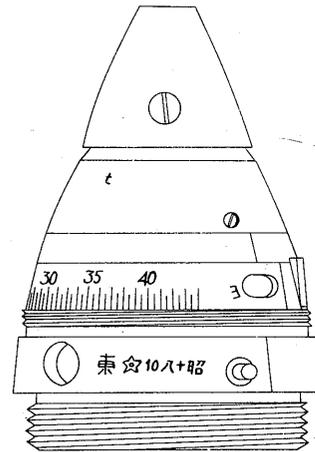
TYPE 100
COMBINATION IMPACT—
MECHANICAL
TIME FUZE

Type 2 Combination Powder Time and Impact Fuze

USE: Undetermined.

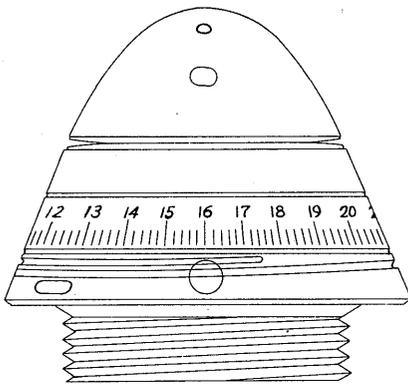
OPERATION: Time—Setback causes the time striker to overcome its spring and set off the primer and powder time ring, which ignites a black powder magazine at the end of the set time up to 44 seconds.

Impact—A separate small impact unit screws into the nose of the time fuze body. Centrifugal force causes a spring-loaded detent to move from under the striker, which is forced into the primer on impact. The flash from the primer passes down through two flash channels to ignite the black powder magazine in the base.

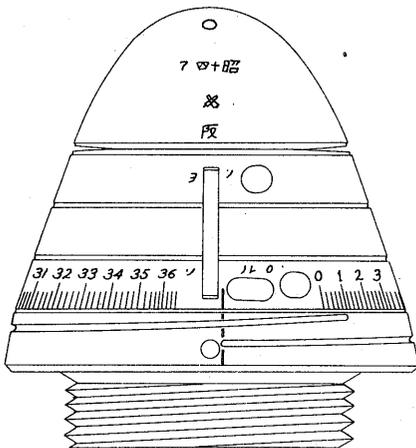


TYPE 2
COMBINATION POWDER
TIME AND
IMPACT FUZE

COMBINATION TIME AND IMPACT NOSE FUZES



TYPE 3RD YEAR
COMBINATION TIME AND IMPACT FUZE



TYPE 5TH YEAR
COMBINATION TIME AND IMPACT FUZE

Type 3rd Year Combination Time and Impact Fuze

Type 5th Year Combination Time and Impact Fuze

USE: Type 3rd year—75 mm shrapnel and old 75 mm H. E. projectiles.

Type 5th year—75 mm shrapnel. Reported to be used in 75 mm incendiary; 105 mm shrapnel and incendiary projectiles; and 150 mm shrapnel and illuminating projectiles.

OPERATION: These two fuzes are identical in operation, differing only in the maximum time settings which are:

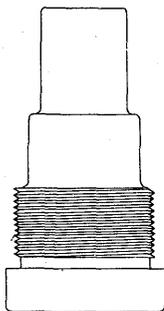
Type 3rd year—maximum 22 sec.

Type 5th year—maximum 36.6 sec.

The Type 3rd year has two time rings, one being movable.

The Type 5th year has three time rings with two being movable. Time—On setback a movable primer, held in the unfired position by a stirrup spring, strikes a fixed firing pin and ignites a powder delay train.

Impact—The impact feature of these fuzes is separate, consisting of a fixed firing pin and a movable primer carrier held in the unfired position by a centrifugal detent. An anti-creep spring separates the primer and firing pin. After firing, centrifugal force moves the detent out, freeing the primer carrier, and on impact it moves forward against the creep spring onto the firing pin functioning the fuze instantaneously.



TYPE 94
SMALL DELAY BASE FUZE

Type 94 Small Delay Base Fuze

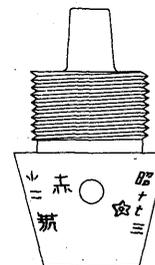
USE: 37 mm A. P. projectiles for tank and antitank guns.

OPERATION: This is a simple setback arming, inertia firing fuze. As the projectile is fired, setback causes an inertia collar to break a shear wire and move back, wedging itself on the striker, thus arming the fuze. On impact, the inertia collar and striker overcome a creep spring and the striker, impinges the primer which in turn ignites a delay train and detonator.

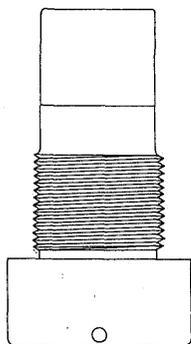
Type—Small Mk. 2 Base Fuze

USE: A. P. projectiles for 47 mm antitank gun.

OPERATION: This fuze has no arming features. The movable primer carrier is separated by a spring from the fixed firing pin, which is threaded into the forward part of the booster. On impact, the primer moves down onto the firing pin and the primer flash passes through a small hole beside the firing pin into the delay.



SMALL MK. 2 BASE FUZE



TYPE 92 SMALL SHORT
DELAY BASE FUZE

Type 92 Small Short Delay Base Fuze

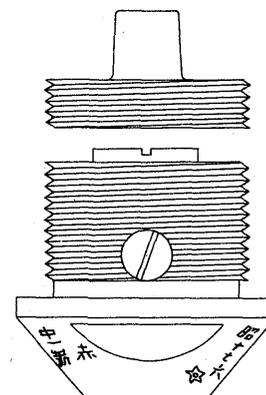
USE: A. P. projectiles for 57 mm tank guns.

OPERATION: Centrifugal force causes two spring-loaded detents to move out from notches in the striker which is separated from the primer by a creep spring. On impact, the striker moves against the spring onto the primer.

Medium Mk. 1 Base Fuze

USE: A. P. projectile for 75 mm gun.

OPERATION: The movable primer carrier is held by two spring-loaded detents. These are moved out by centrifugal force and, on impact, the primer carrier overcomes the creep spring and moves onto the striker. The flash of the primer passes through two holes beside the firing pin into the delay element.

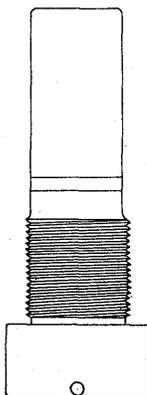


MEDIUM MK. 1 BASE FUZE

Type 95 Small Base Fuze

USE: Reported to be used in A. P. projectiles for the 70 mm tank gun and all 75 mm and 105 mm guns.

OPERATION: The striker is held by two spring-loaded detents which are moved out by centrifugal force. On impact, the striker overcomes the creep spring and moves onto the primer.



TYPE 95 SMALL BASE FUZE

TABULATION OF JAPANESE ROCKETS

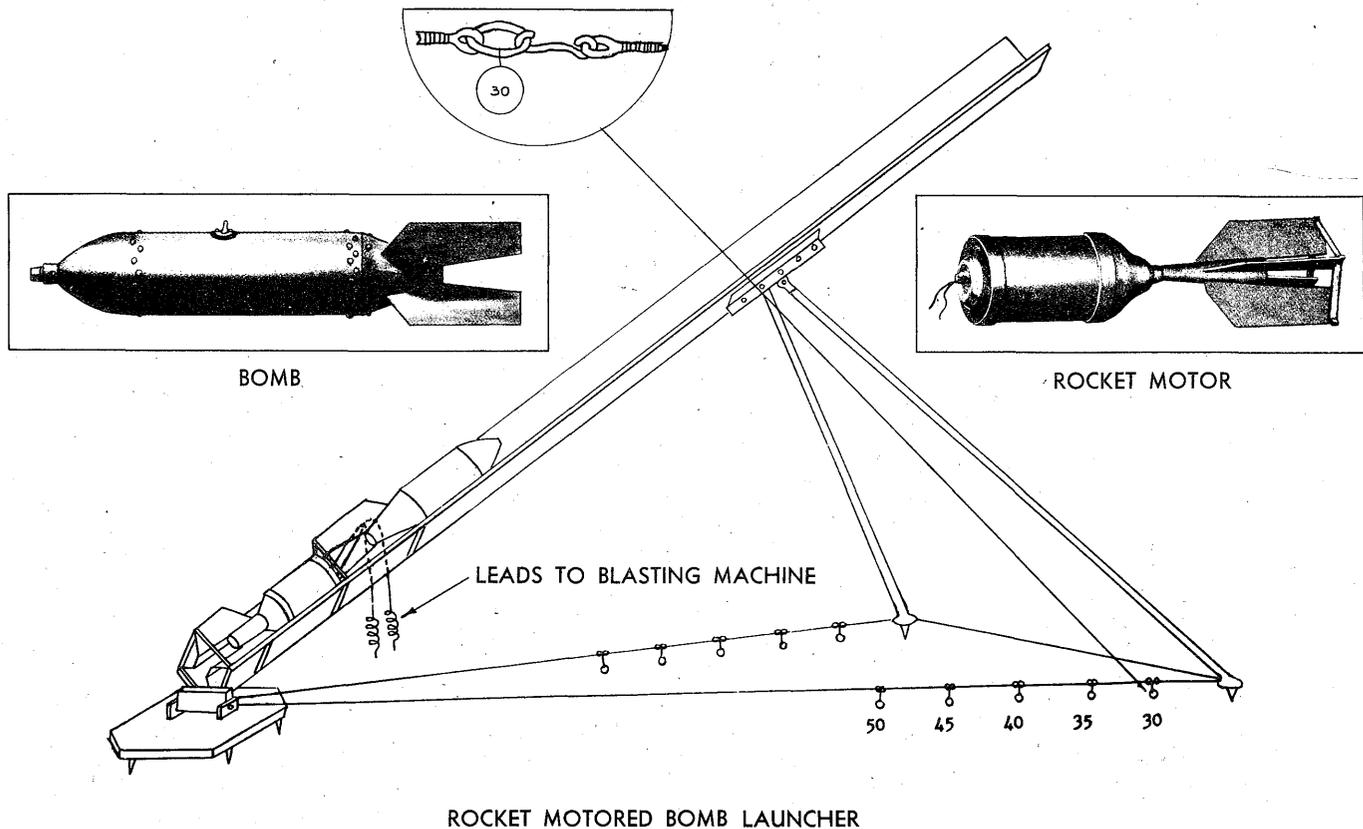
	6.8 cm Possibly a Line Throwing Device	12 cm Incendiary Shrapnel Rocket (Navy)	20 cm (202 mm) Army*	20 cm (210 mm) Navy***	60 kg Type 97 No. 6 Bomb W/Rocket Motor (Small)	60 kg Type 97 No. 6 Bomb W/Rocket Motor (Large)	250 kg. Bomb Body W/ Permanently Attch. Rocket Motor	45 cm Rocket
Total Weight (lbs)		51	200 to 205	198	Bomb only—124	91.9 Motor 124 Bomb	616 w/o Propell.**	1,514
Overall Length (ins.)	10.5	$28\frac{9}{16}$	$38\frac{3}{4}$ or 37	41 approx.	33—Motor	40% Motor	118	67½
Filling		WP Pellets	TNT	TNA	Hexanite & TNA	Hexanite & TNA	TNA—HND	Picric Acid
Weight of Filling (lbs.)			35.7	38.5	50	50	212	
Maximum Range (yds.)		2000-3000 Controlled by Aerial Burst Time Fuze	3,250 yds. Field Test ****	1,970 Field Test	1,094-1,314	2,000 estimate	11,000 (7,500 battle observation)	2,000 Field Test
How Stabilized	Not Known	Spin	Spin	Spin	Fin	Fin	Fin	Spin
Weapons From Which Fired	Triple Rail Guides on Revolving Carriage Mounted on Tripod	Wooden Trough with Metal Bracket	Type 4 Launcher (Looks like a Mortar)	Wooden Rail Type Single & Triple 2-Wheeled Carriage w/6½' Barrel and Split Trails Metal Trough (7'-6" long) on Fixed Bipod	Type 10 Launcher ("V" Shaped Trough)	Wooden W/2 Rail Trough Type 3 Rocket Launcher	Truck Mounted Launcher Reported but not Recovered "V" Shaped Trough 22.9' Long	Wooden Launcher w/ Solid Wood Wheels and Trough Crude & Expendable

* Four modifications of motor encountered in SWPA to 1 April, 1945.

** No propellant recovered to date 23 March, 1945.

*** The Japanese mention three classes of these rockets under trial, all differing in weight.

**** Other field tests resulted in 2,600-2,800 yard ranges.



ROCKET MOTORED BOMB LAUNCHER

This is a device designed to propel the 60 kg. (132 lbs.) aircraft bomb out of an inclined trough.

The launcher is constructed of wood and metal with legs made of iron pipe. The rear is attached by a pin to a base plate with six wedge cut ground pins. The launcher channel is a right angle trough about twenty feet long with a motor and bomb positioner made of 1/8-inch pierced sheet metal. This is "V" shaped, (The motor and bomb positioner is not shown in the schematic sketch above.) slightly over four feet long, and hinged at three points on the lower right side of the launcher. Elevation is controlled by cables run from the base plate to the legs, and between the legs.

The rocket motor resembles a blunt, short-bodied bomb. The propellant container is a cylinder with a cap welded on the front and a tail assembly and venturi tube secured on the rear. The propellant which weighs 12.94 pounds consists of three cylindrical sticks tied in a yellow silk bag. It is ignited by an igniter pad and an igniter fuze in the forward part of the motor by means of wires leading to a small hand blasting machine. When fired the motor propels the bomb from the launcher and then drops off. Ranges up to 1,300 yards are claimed by the Japanese for this device, but it is felt that little, if any, accuracy may be expected. It is evidently designed to deliver fire on beachheads and other similar wide targets at fairly short ranges.

SPECIFICATIONS

LAUNCHER

Length of launcher (overall)	19 ft., 10 ins.
Width at leg shoes	8 ft., 5.5 ins.
Height at 30° range setting	11 ft.
Length of leg	12 ft., 4 ins.
Diameter of leg	1.75 ins.
Width outside of trough at base	10 ins.
Width outside of trough at front	7.5 ins.
Width inside of trough at base	8.5 ins.
Width inside of trough at front	6 ins.
Length of cable from baseplate to leg	20 ft., 3 ins.

ROCKET MOTOR

Length of motor and bomb positioner (overall)	4 ft., 3 ins.
Length of motor (overall)	33 ins.
Length of propellant cylinder	11.5 ins.
Diameter of propellant cylinder (outside)..	7.44 ins.
Diameter of venturi tube (outside)	1.5 ins.
Length of tail fin	11.75 ins.
Width of tail fin	3.625 ins.
Width of tail, fin to fin	11.875 ins.



This ground-launched rocket is fired from a trough shaped launcher approximately 7 feet long, which weighs approximately 175 pounds. The Japanese claim a range of 1,800 meters (1,970 yds.) at 50° elevation. The rocket is spin-stabilized, rotating in a clockwise direction. The complete round, without fuze, is approximately 41 inches long and weighs 198.3 pounds.

The projectile has a straight body and an ogival nose. It is fitted with a centrifugally armed point detonating fuze. In addition to this standard fuze, the Type 91 Time, Type 100 Combination, and Type 88 P. D. fuzes will also fit the fuze pocket. However, it is not known whether the rocket will produce sufficient setback to arm these fuzes. The explosive charge, Type 91 (trinitroanisol), is cast directly into the lacquered interior of the case. The base plate which screws into the projectile body is also threaded to take the motor.

The motor body, a straight cylinder, is closed at the rear by a base plate to which a grid is attached. A perforated cup fits against the motor closing plate at the forward end. Seven sticks of propellant (nitroglycerine, nitrocellulose, NaCl, and centralite) fit securely into the combustion chamber between the perforated cup and the grid. Six sticks form a circle around an identical central stick; all have only a single axial perforation.

The motor base plate of hardened steel has six offset nozzles and a central threaded opening for a percussion type primer. Ignition is mechanical and from the forward end. A black silk powder bag lashed to the perforated cup forms the ignition charge.

SPECIFICATIONS

PROJECTILE

Weight of projectile without fuze	49.9 kg.—110 lbs.
Weight of high explosive filling	17.5 kg.—38.6 lbs.
Overall length of projectile without fuze	588.0 mm—23.14 ins.
Minimum diameter of orifices.....	15.0 mm—.591 ins.
Angular cant of nozzles	25°
Diameter of body.....	210.5 mm (approx. 8.30 ins.)
Wall thickness	12.0 mm—.472 in.

MOTOR

Overall length of motor body.....	460 mm—18.11 ins.
Weight with propellant	40.0 kg.—88 lbs.
Weight of propellant	8.3 kg.—18.3 lbs.
Weight of black powder ignition charge	50.6 grams—1.77 ozs.
Wall thickness	10.0 mm—.39 in.
Length of propellant sticks..	290.0 mm—11.41 ins.
Diameter of propellant sticks..	58.0 mm—2.28 ins.
Diameter of perforation	11.0 mm—.43 in.
Weight of propellant sticks (each—varies slightly)	1.162 kg.—2.56 lbs.

Translation of
**JAPANESE
ORDNANCE
MARKINGS**

U.S. AIR FORCE ★ OFFICE OF THE CHIEF OF ORDNANCE ★ AUGUST, 1945 ★ WASHINGTON, D.C.

KEY CHARACTERS
for Essential Japanese Ordnance Materiel

TABLE	CHARACTER		ORDNANCE
1	車		Tanks Trucks Cars Vehicles
	<i>Sba</i>		
2	彈		Bullet Grenade Shell (w. #12) Bomb (w. #18) Rocket
	<i>Dan</i>		
3	砲		Gun Cannon Howitzer Mortar
	<i>Hō</i>		
4	藥		Explosives Ammunition
	<i>Yaku</i>		
5	式		Type
	<i>Shiki</i>		
6	年	月	Year Month
	<i>Nen</i>	<i>Getsu</i>	
7	油		Gasoline Fuel Oils Lubricating Oils
	<i>Yu</i>		
8	筒		Primer Shell Case Bangalore Torpedo Grenade Launcher Complete Round
	<i>Tō</i>		
9	兵	(or) 軍	Unit or Organization
	<i>Hei</i>	<i>Gun</i>	
10	雷		Mines Torpedo (Aerial)
	<i>Rai</i>		

TABLE	CHARACTER		ORDNANCE
11	銃		MG Rifle Pistol Carbine
	<i>Jū</i>		
12	榴		Artillery Shell (W. #2)
	<i>Ryū</i>		
13	號		Mark Number and Data on Bombs
	<i>Gō</i>		
14	糧	耗	Metric Terms (Weight & Dimension)
	<i>Sanchi</i>	<i>Miri</i>	
15	機		Aircraft
	<i>Ki</i>		
16	鐵		Metals
	<i>Tetsu</i>		
17	管		Fuze Cap Train
	<i>Kan</i>		
18	爆		Airplane Bomb (w. #2)
	<i>Baku</i>		
19	所		Factory
	<i>Sho</i>		
20	廠		Arsenal
	<i>Shō</i>		

**Translation of
JAPANESE ORDNANCE
MARKINGS**

AUGUST, 1945

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**OFFICE OF THE CHIEF OF ORDNANCE
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Complete identification of Japanese materiel often necessitates translation into English of the ideographs and phonetic alphabet characters stamped on equipment or printed on accompanying tags, boxes or pamphlets. Because of their inability to read Japanese, many persons responsible for inspection of captured ordnance items are unable quickly and accurately to identify unfamiliar materiel.

This book has been prepared as a practical guide to the translation of Japanese ordnance nomenclature. Its successful use does not require a prior knowledge of Japanese but depends only upon the application of simple principles that can be learned within a few hours. It explains how the recognition of twenty key ideographs, in conjunction with tables in the text, will enable the reader to translate markings that describe Japanese ordnance.

SECTION ONE

INTRODUCTION

General Discussion of Japanese Characters

KANJI

Until a phonetic alphabet was invented between 774 and 835 A.D. the Japanese depended entirely upon ideographs or picture-characters for written expression of their thoughts. Even today ideographs remain the principal medium for written Japanese, although the phonetic characters have considerable subsidiary use. Since most of the words in the language are represented by an individual character, several thousand ideographs have to be memorized for facility in reading or writing. Most of these characters were adopted from the Chinese in the third century A.D., this Chinese origin being indicated by their name, "Kanji," which means "Chinese characters." During the long period that has elapsed since their adoption, the Chinese sounds for the ideographs have been modified until the present Japanese equivalents are quite different from the original Chinese.

Japanese sentences do not follow normal English structure. While each noun and its descriptive adjectives are represented by a separate ideograph, the position of the noun does not correspond to that in English. Japanese ordnance inscriptions usually have an easily recognized noun character at or near the first part of the sentence. In translating, this permits identification of the noun ideograph to serve as a key to the meaning of the combined characters, as is shown in the section of this book entitled "Explanation of the Key Characters and Their Use." The way in which ideographs are combined to designate a term or item is apparent from the combination of the three characters for picric acid in which the ideographs for yellow, color, and powder are employed.

黃	<i>ō</i>	Yellow	PICRIC ACID
色	<i>Shoku</i>	Color	
藥	<i>Yaku</i>	Powder	

Because the number of word sounds in Japanese are limited, a single sound may have various meanings according to the context of the sentence in which it is used. In written Japanese each of these meanings is clearly denoted by a distinctive ideograph. For instance, there are numerous meanings of the word "Sha," each represented by a different ideograph, some of which are illustrated below.

車	社	舎	遮	左	射
<i>Sha</i>	<i>Sha</i>	<i>Sha</i>	<i>Sha</i>	<i>Sha</i>	<i>Sha</i>

In Japanese ordnance terms, only the "Sha" character on the extreme left of this group of six selected pictures of the sound "Sha" is of value. This particular representation of "Sha" indicates a vehicle and, when so used, is always at the end of the group of characters; for example, "jinrikisha" (a two-wheeled cart), and "sensha" (a battle tank).

CART		
人	<i>Jin</i>	(Man)
力	<i>Riki</i>	(Moves)
車	<i>Sha</i>	(Wagon)

TANK		
戰	<i>Sen</i>	(Battle)
車	<i>Sha</i>	(Wagon)

This form of "Sha" appears in the nomenclature of all Japanese vehicular ordnance items, where it is the terminal sound or ideograph. This "Sha" is the root word for all Japanese vehicles, and is one of 20 key characters in the table of key ordnance characters which will be explained in detail later in this outline.

KANA

The Japanese realized the disadvantages and limitations of their ideograph system in its inability to represent the constantly increasing number of foreign words being absorbed into the language. This problem was solved by use of the phonetic alphabet called "Kana." Unlike Kanji, which cannot express the correct sound or proper construction of words, the

JAPANESE KANA ALPHABET

ア <small>a</small>	イ <small>i</small>	ウ <small>u</small>	エ <small>e</small>	オ <small>o</small>
カ <small>ka</small>	キ <small>ki</small>	ク <small>ku</small>	ケ <small>ke</small>	コ <small>ko</small>
ガ <small>ga</small>	ギ <small>gi</small>	グ <small>gu</small>	ゲ <small>ge</small>	ゴ <small>go</small>
マ <small>ma</small>	ミ <small>mi</small>	ム <small>mu</small>	メ <small>me</small>	モ <small>mo</small>
ナ <small>na</small>	ニ <small>ni</small>	ヌ <small>nu</small>	ネ <small>ne</small>	ノ <small>no</small>
ハ <small>ha</small>	ヒ <small>hi</small>	フ <small>fu</small>	ヘ <small>he</small>	ホ <small>ho</small>
パ <small>pa</small>	ピ <small>pi</small>	ブ <small>pu</small>	ペ <small>pe</small>	ポ <small>po</small>
バ <small>ba</small>	ビ <small>bi</small>	ブ <small>bu</small>	ベ <small>be</small>	ボ <small>bo</small>
タ <small>ta</small>	チ <small>chi</small>	ツ <small>tsu</small>	テ <small>te</small>	ト <small>to</small>
ダ <small>da</small>	ヂ <small>ji</small>	ヅ <small>zu</small>	デ <small>de</small>	ド <small>do</small>
ファ <small>fa</small>	フィ <small>fi</small>	フ <small>fu</small>	フェ <small>fe</small>	フォ <small>fo</small>
ラ <small>ra</small>	リ <small>ri</small>	ル <small>ru</small>	レ <small>re</small>	ロ <small>ro</small>
サ <small>sa</small>	シ <small>shi</small>	ス <small>su</small>	セ <small>se</small>	ソ <small>so</small>
ワ <small>wa</small>	ヰ <small>i</small>	ウ <small>u</small>	エ <small>e</small>	オ <small>o</small>
ヤ <small>ya</small>	イ <small>i</small>	ユ <small>yu</small>	エ <small>e</small>	ヨ <small>yo</small>
ザ <small>za</small>	ジ <small>ji</small>	ズ <small>zu</small>	ゼ <small>ze</small>	ゾ <small>zo</small>

eighty Kana characters represent the basic syllables of the language. Since its characters represent sounds and not letters, Kana may be more accurately considered a syllabary than an alphabet. Because of its phonetic nature Kana can be used for foreign words after they have been reduced to Japanese syllables as closely as possible imitative of the sounds in the original words.

Kana is designed around the five vowels, A, I, U, E, O, and the fifteen consonants, K, G, M, N, H, P, B, T, D, F, R, S, W, Y, Z. The working plan of this table is simple. For example, the consonant K produces five separate syllable sounds when added singly to each one of the five vowels. These are KA, KI, KU, KE, and KO. There is a separate alphabet mark, or Kana character, for not only each of the five vowels, but also for each of the seventy-five two-letter sounds, making a total of eighty individual Japanese Kana characters in the basic table.

The pronunciation of the vowel sounds is slightly different from the English pronunciation: thus A, I, U, E, O, are pronounced ah, ee, oo, ay, oh, in Japanese. These pronunciation sounds remain the same when they are converted into the two-letter syllables of the Kana Table.

The table of Kana characters appears on Page 3. These Kana characters are used not only for Japanese ordnance items but also for Japanese medical and chemical warfare terms. Examples of the use of Kana are set forth below. Note again that the Kana characters represent syllables.

When the Japanese want to convert a new English word such as "aneroid" into their printed language they use the Kana system of basic sounds. This can only be done after the English word is separated into a grouping of sounds closest to those in the Kana alphabet. To the Japanese, "aneroid" sounds like the following: ah/nay/ro/ee/do. All these sounds appear in the Kana Table, and can be written by using the Kana characters. The following are examples of the method of changing three words, Aneroid, Magnesium, and Browning, into the written Kana language:

ア	ネ	ロ	イ	ド	ANEROID
<i>A</i>	<i>Ne</i>	<i>Ro</i>	<i>I</i>	<i>Do</i>	
<i>ah</i>	<i>nāy</i>	<i>rō</i>	<i>ēē</i>	<i>dō</i>	

マ	グ	ネ	シ	ユ	ーム	MAGNESIUM
<i>Ma</i>	<i>Gu</i>	<i>Ne</i>	<i>Sbiyu</i>	<i>Mu</i>		

ブ	ラ	ウ	ニ	ン	グ	BROWNING
<i>Bu</i>	<i>Ra</i>	<i>U</i>	<i>Ni</i>	<i>En*</i>	<i>Gu</i>	

*A special character, *en* or *an*, generally ending a word.

Since the Kana characters are easier to write than Kanji numerals, Japanese often use Kana to list ordnance items; hence it is common to find a vertical list of items headed by a Kana symbol instead of a number (when used as first, second, third, etc.). On artillery ammunition items, as boosters and fuzes, Kana characters such as "To" are stamped into the metal, or painted thereon. These are important identification marks, discussed later in this publication.

Unusual Methods of Japanese Marking

There are four main types of material on which Japanese character markings describing ordnance items are placed. These are: (1) wooden shipping-cases, (2) metal parts of ordnance items, (3) cardboard tags, tied to the item by string or pasted on metal inner-cases, (4) descriptive booklets, which either accompany the item within the wooden shipping case or are obtained among captured records found with the equipment.

(1) On wooden shipping cases, the Japanese generally describe the item by characters painted across one or more sides of the wooden box, as illustrated:



The first step in translating such an inscription is to determine the order in which the Japanese characters are written. They may start either from left to right or from right to left. The direction in which they are to be read can be found by noting the location of the character for Type ("Shiki") which invariably appears in inscriptions for all ordnance items. In the illustration, it is the third ideograph from the right. By memorizing the Japanese numerals from one to ten, shown in Table No. 5 of Section Two, it is easy to recognize their ideographs, which in Japanese always precede the character for "Type." In the illustration Japanese numerals for "88" are the first two on the extreme right followed by the ideograph for "Shiki" (Type). Thus the direction of placing the characters on this shipping box is from right to left.

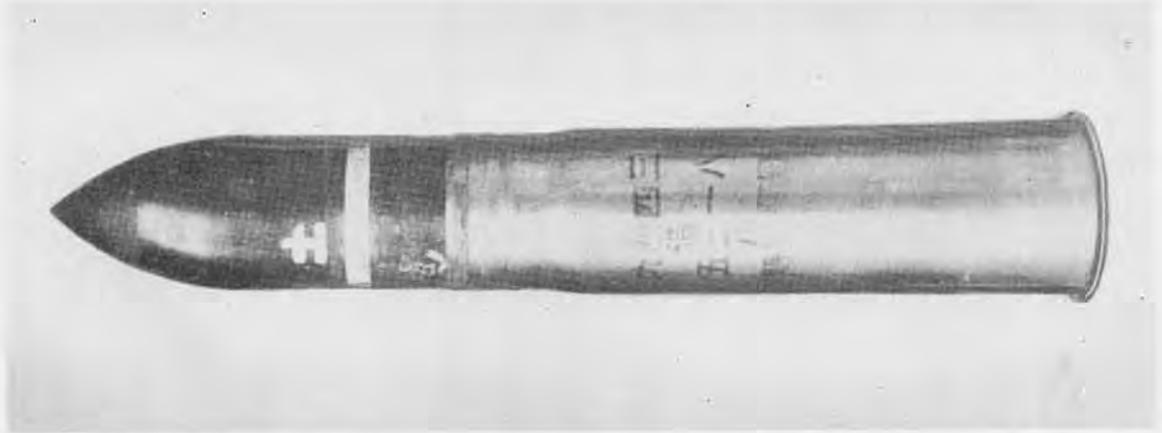
When right to left order has been followed in marking, it is suggested (for simplicity in translation) that the characters be copied on paper as usual, but placed in the opposite direction from that found, as follows:

(2) Japanese mark metal parts of ordnance items with both Kanji and Kana characters. The polished brass surface of an artillery shell cartridge-case lends itself readily to the paint-

八	八	式*	短	延	期	信	管*
<i>Hachi</i>	<i>Hachi</i>	<i>Shiki</i>	<i>Tan</i>	<i>En</i>	<i>Ki</i>	<i>Shin</i>	<i>Kan</i>
88 Type			Short-Delay		Fuze		

*Key Characters

ing of the more intricate Kanji characters for marking purposes. These are to prevent mistakes when several types of shells resemble each other, although intended for different weapons. The markings here generally indicate the type of gun that is to fire this ammunition. The following illustration is arranged, not for the purpose of translation of the markings, but to show their position.



Kana characters are simple in design and make good dies for stamping Japanese metal parts, or for quickly painting an abbreviated arsenal mark. The flexibility of Kana characters in describing various ordnance items is evident in the use of one of the plainest and most widely employed Kana characters, "To."



When "To" is painted on the body of an artillery shell, just above the rotating band, it indicates that the shell was manufactured at the "Tokyo Army Branch Ordnance Depot." This is illustrated by the view of a Japanese 150 mm howitzer shell.



However, when the Japanese mark their machine gun ammunition for airplanes, although they use the same character, "To," to mark the bottom of the cartridge case, it indicates an entirely different place of manufacture. In this case "To" refers to the Toyokawa Navy Yard. As an interesting sidelight on this abbreviated system of marking, the sound of the character "To" is the sound of the first part of the word Toyokawa. Likewise the "A" of the Kana alphabet is used to indicate the Asahi Plant, while "Yo" is used to mark the products of the Yokosuka Navy Yard in airplane machine gun ammunition.

(3) When the Japanese place characters on pasteboard tags or on paper labels attached to ordnance items, they use Kanji.

A sample of such a marking copied from a label glued to the cardboard shipping container for a shell is shown in Section Three of this text. This inscription demonstrates that when the Japanese print ordnance terms on paper they arrange the characters in a long, vertical line reading from top to bottom. The reproduction of characters on this label is accompanied by their actual translation, using the system of selecting the key characters and subsequently referring to the tables in which they are located, as explained in Section Two.

砲
兵
彈
藥

昭和十三年五月

(4) After study of this booklet it will be possible to translate the general descriptive matter in pamphlets accompanying Japanese ordnance items. It is cautioned here that the Japanese put such general descriptions on what we would call the back page of our books. Holding the Japanese book in a normal position it is necessary to turn to the final page and look for key characters.

For example, illustrated here are two sections from the descriptive page of a captured Japanese booklet on Japanese artillery shells. These are shown not for the purpose of translation, but merely to illustrate where to look for them in the book, and to repeat the caution that the characters are to be read along a vertical line from top to bottom.

The heavy-type column to the left is the name: "Artillery Ammunition," while that to the right is the date, "May 1938."

SECTION TWO

INSTRUCTIONS FOR TRANSLATING JAPANESE MARKINGS

Different Japanese Calendar Systems

The Japanese designate types of ordnance materiel, such as mortars, howitzers, rifles, guns, etc., with a descriptive term indicating the year the item was officially adopted. For marking high explosives, a date on the label of the package or outside of the shipping box indicates the date of manufacture. It is common for the Japanese to make liberal use of calendar dates, but it must be remembered that four different systems are employed.

BASIC JAPANESE CALENDAR

One system employs the basic Japanese calendar years, represented either by four digits, as in the year 2598, or by its reduced form 98 derived by dropping the first two digits as is done when our year 1945 is abbreviated to '45. The Japanese Kanji ideograph "Shiki," always employed with the abbreviated date numerals, is shown with the numeral characters for nine and eight.

九	八	式
<i>Ku</i>	<i>Hachi</i>	<i>Shiki</i>
9	8	Type

As an example of a date in a decade preceding that shown, the year 1921 is the equivalent of the Japanese calendar year 2581, and any Japanese models produced in that year would be called their "Type 81."

REIGN OF EMPEROR OR ERA

The Japanese also indicate the date in terms of the year of the reign of a Japanese emperor, each reign being known as an era. Any ordnance materiel produced within one of these periods might be marked as "Showa Era, 18 Year" (our year 1943), as explained later.

昭	和
<i>Sho</i>	<i>Wa</i>
Bright	Era

There have been three different eras representing the reigns of individual Japanese emperors within the past seventy-seven years. The reign of the present emperor, begun in 1926, is referred to as the "Showa Era," meaning the bright period, or the golden era. It is designated by the characters shown at right.

Development of modern Japanese ordnance has occurred only in the three most recent eras.

Era 2 covers the Meiji Era from 1868 to 1912.

Era 3 covers the Taisho Era from 1912 to 1926.

Era 4 covers the Showa Era from 1926 to the present time.

Although Eras 2, 3 and 4 are designated by different ideographs, they employ the same general principle in relation to indicating a date marking. The basis for each is to (a) name the era during which the item was designed or manufactured, and (b) give the particular year of this era to which the date applies.

Conversion of a date within any Japanese era to one in our calendar can be accomplished by adding the given Japanese year to the English date for the year preceding the beginning of the era. For example, the English equivalent of the 20th year of the Showa Era can be found by adding 20 to 1925, which gives our year 1945.

Table No. 6 describes the Kanji characters used by the Japanese to indicate the Meiji Taisho, and Showa Eras.

Japanese Characters for Type and Modification

TYPE

The Japanese always use dates or numerals with a character which refers to dates in classifying their ordnance items. Only one character is used to indicate the type classification. This character is "Shiki." It appears on artillery shells, bombs, small arms, guns, howitzers, fuzes, etc., but always in association with numerals of one or two digits. These numerals are abbreviations for dates in the Japanese calendar.

The following are some common markings used by the Japanese on their ordnance items to express Type and Type Numbers:

二	式	茶	褐	炸	藥
<i>Ni</i>	<i>Shiki</i>	<i>Cha</i>	<i>Katsu</i>	<i>Saku</i>	<i>Yaku</i>
2	Type	Brown		Bursting	Powder
(Year) 1942		TNT		Bursting Charge	

十	一	年	式	海	岸	砲
<i>Ju</i>	<i>Ichi</i>	<i>Nen</i>	<i>Shiki</i>	<i>Kai</i>	<i>Gan</i>	<i>Hō</i>
11th		Year	Type	Sea	Coast	Gun

MODIFICATIONS

The Japanese describe modifications of ordnance items in the following manner:

一	式	改 一	爆 彈		
<i>Ichi</i>	<i>Shiki</i>			<i>Baka</i>	<i>Dan</i>
1	Type			Modification 1	Airplane Bomb
1941		改 二			
			Modification 2		

In marking bombs, the Japanese use, in addition to these characters, three extra characters to indicate "mark," "weight," and "design number." These are discussed in Table No. 13.

Note: It is common to find the ideograph for modification with a numeral placed together near the base of the shell. The meaning is "The new improved type No. 2."

Explanation of the Key Characters and Their Use

On page 11 and on the inside of the cover appears a table of key ordnance characters. Each key character is a base or root word which the Japanese use in designating ordnance materiel. Next to each key character, the Japanese write additional characters which modify the root word to indicate the full description of the particular item, as "Sen Sha" (tank) or "Chu Sen Sha" (medium tank). Also in this section are tables of key characters that list those characters which normally accompany the key ideograph, modify it, and in combination with it give the name of a specific Japanese ordnance item. Except in rare instances, the key character is always the last character in a related group of sounds or written characters, but note that in following this rule the direction of writing must first be ascertained.

One key character, such as "Sha" (a vehicle) is the terminal root word for four classes of ordnance items in the vehicular family, namely: Tanks, Trucks, Cars and Tractors.

The particular type of vehicle referred to by "Sha" can be ascertained by using the table to identify the characters that precede the key ideograph.

Table No. 2 has a key character of "Dan," and includes such items as Bullets and Grenades. Note that this key character, "Dan," is added to another key character, "Ryu," to form a double key character group. From this combination is derived a new table (Table No. 12) to indicate Artillery Shells and Rockets.

Likewise the key character "Dan" just described is joined with a second key character "Baku," to form another double-character group, giving us Table No. 18 on Airplane Bombs.

KEY CHARACTERS for Essential Japanese Ordnance Materiel

TABLE	CHARACTER		ORDNANCE
1	車		Tanks Trucks Cars Vehicles
	<i>Sba</i>		
2	彈		Bullet Grenade Shell (w. #12) Bomb (w. #18) Rocket
	<i>Dan</i>		
3	砲		Gun Cannon Howitzer Mortar
	<i>Hō</i>		
4	藥		Explosives Ammunition
	<i>Yaku</i>		
5	式		Type
	<i>Shiki</i>		
6	年	月	Year Month
	<i>Nen</i>	<i>Getsu</i>	
7	油		Gasoline Fuel Oils Lubricating Oils
	<i>Yu</i>		
8	筒		Primer Shell Case Bangalore Torpedo Grenade Launcher Complete Round
	<i>Tō</i>		
9	兵	(or) 軍	Unit or Organization
	<i>Hei</i>	<i>Gun</i>	
10	雷		Mines Torpedo (Aerial)
	<i>Rai</i>		

TABLE	CHARACTER		ORDNANCE
11	銃		MG Rifle Pistol Carbine
	<i>Jū</i>		
12	榴		Artillery Shell (W. #2)
	<i>Ryū</i>		
13	號		Mark Number and Data on Bombs
	<i>Gō</i>		
14	糧	耗	Metric Terms (Weight & Dimension)
	<i>Sanchi</i>	<i>Miri</i>	
15	機		Aircraft
	<i>Ki</i>		
16	鐵		Metals
	<i>Tetsu</i>		
17	管		Fuze Cap Train
	<i>Kan</i>		
18	爆		Airplane Bomb (w. #2)
	<i>Baku</i>		
19	所		Factory
	<i>Sho</i>		
20	廠		Arsenal
	<i>Shō</i>		

These are the only tables which are made up from double key characters. The materiel to which the other tables relate appears on top of each table.

Method of Using the Key Character Tables in Translation

1. Become thoroughly familiar with each key character, and with the characters for numerals from 1 to 10.
2. Ascertain the direction in which the particular writing to be translated has been written; i. e., from left to right, right to left, or top to bottom. Page 13 of this outline explains the method.
3. Select all the key characters in the writing.
4. Mark off the characters accompanying each key character. This may be done by drawing rectangles around each related group of characters (key characters plus accompanying modifying characters).

Note: Where the writing to be translated involves a considerable number of characters (i. e., more than 50), it is recommended that the writing be treated piecemeal in groups of three or four characters, selecting a key character from a group and translating that group before proceeding to the next group.

車	戰	車	中	戰	車
<i>Sha</i>	<i>Sen</i>	<i>Sha</i>	<i>Chu</i>	<i>Sen</i>	<i>Sha</i>
Vehicle	Battle	Wagon	Medium	Battle	Wagon
Wagon	TANK		MEDIUM TANK		

The three characters "Chu," "Sen," and "Sha" that compose the word for medium tank, are shown above as the Japanese would write them from left to right on a wooden crating for the vehicle. The key character "Sha" is placed last, to the right of the modifying characters "Chu" and "Sen." When the Japanese mark ordnance items they do so without punctuation. That is one reason why it is necessary to memorize the twenty key characters used in ordnance.

The following example is employed to show the method used in building up "Ju" (meaning a small gun), into the compound group of characters, "Ken Ju" (meaning a pistol) and then "Ji Do Ju" (meaning an automatic rifle).

銃	拳	銃	自	動	銃
<i>Jū</i>	<i>Ken</i>	<i>Jū</i>	<i>Ji</i>	<i>Dō</i>	<i>Jū</i>
Small Gun	Hand Operated	Small Gun	Self-	Acting	Small Gun
	PISTOL		AUTOMATIC RIFLE		

Up to now only one key character with its adjective ideographs has been described. The illustration below shows the ideographs for "automatic rifle" by a new key character, "Shiki," plus its descriptive adjective ideographs. Note that there are no periods, commas, or open spaces.

九	八	式	自	動	銃
<i>Ku</i>	<i>Hachi</i>	<i>Shiki</i>	<i>Ji</i>	<i>Dō</i>	<i>Jū</i>
9	8	Type	Self-	Acting	Small Gun
TYPE 98			AUTOMATIC		RIFLE

The direction in which the Japanese wrote these characters must be determined. The finding of "Shiki" (Type), the character third from the left, is the first step. It is always preceded by numerals. Since the numerals for 9 and 8 are to the left of "Shiki" the writing plan is from left to right.

Since it is a key character, the last character of the line (bearing in mind the direction of the writing of the group) is selected. It is "Ju," a key character for small arms, as is shown in Table No. 11.

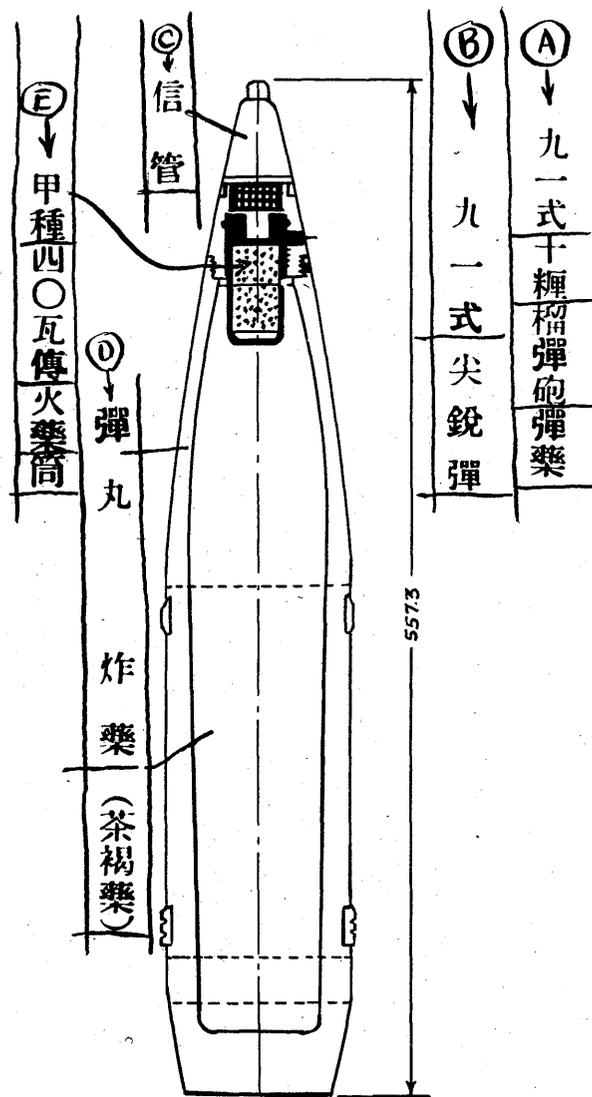
Taking "Ju" and its two preceding characters (the Japanese usually write in groups of two, three, or four characters when describing ordnance), turn to Table No. 11. There the meanings of the three picture characters are found to be automatic rifle. Similarly, it is found that "Ku Hachi Shiki" means Type 98.

Elsewhere in this publication are illustrated actual markings found on a captured Japanese ammunition box, an airplane bomb, and a heavy gun. The names of the Japanese characters are given in each case, the key characters being set off from the long string of modifying characters by placing a cross-line just below the key character. The partial translation and the full translation are given with each example.

Note that if the Japanese write from left to right, the cross-line follows the key character and is to the right of it. If the Japanese write from right to left, then the cross-line follows the key character but is to the left of it.

When the Japanese string of characters proceeds from top to bottom, as illustrated in Section Three (page 72), the cross-line is beneath the key character. In the case mentioned there were 43 Japanese characters appearing in one consecutive vertical line which has been divided into four columns for convenience in printing.

The following illustration is employed to show how several vertical columns of Japanese characters may be broken down into the key characters for translation purposes. It has been taken from a Japanese book on Japanese artillery shells. The only additions to it have been the placing of the letters A, B, C, D, and E for reference purposes and the drawing of a line



beneath each key character to illustrate the method followed in determining key characters and the preceding characters which are used to describe them.

Roughly, the method is to go to the foot of each vertical line for the first key character and strike a line under it.

The best plan, to avoid confusion in locating the next key character, is to work in groups of but two or three characters at a time. When the Japanese write in vertical columns, the reading starts at the top right hand corner. Here the column marked A is the first to be read. Start at the foot of the column for the first key character. It is "Yaku," found in Table No. 4.

The next question is, how many characters relate to "Yaku"? Table No. 4 shows that in this particular case only "Yaku" and its adjoining character "Dan" are in the table and mean Ammunition (General). The third character from the bottom is next found to be a key character "Ho."

In questioning how many characters are to be included with "Ho," look through Table No. 3. Here it is to be noted that "Ho" and "Po," denoted by the same ideograph, are inter-

changeable when referring to artillery pieces and mortars, depending upon the type of weapon. In this particular case the key character is "Po" and the two characters next to "Po" in the Japanese text are included with the key character in line 5 of the table to form the Japanese word "Ryu Dam Po," meaning Howitzer.

The next key character "Sanchi," meaning centimeter, makes translation easy. With it is the numeral "Ju" (ten) to complete the term 10 CM. It is quite evident that the next character "Shiki" is a key character and it is preceded by the numeral characters "Ku" (nine) and "Ichi" (one), given in Table No. 5. The translation of this phrase is thus "Type 91."

By this same method the ideographs in Column B are identified and translated into "Model 91 Streamlined Shell." Column C is translated as "Fuze." Column D has two sections, an upper and a lower section, the first of which is translated as "Projectile," or "Shell Body," while the lower section means "Explosive Charge, TNT."

**TABLES OF BASIC KEY CHARACTERS
FOR JAPANESE ORDNANCE**

TABLE No. 1

<h1>車</h1> <p><i>Sha</i></p>	<p>TANKS TRUCKS VEHICLES</p>
Vehicle	

		<h1>戰車</h1> <p><i>Sen Sha</i></p>	TANK	
		Battle	Wagon	
<h1>輕</h1> <p><i>Kei</i></p>	<h1>戰</h1> <p><i>Sen</i></p>	<h1>車</h1> <p><i>Sha</i></p>	LIGHT TANK	
Light	Battle	Wagon		
<h1>中</h1> <p><i>Chū</i></p>	<h1>戰</h1> <p><i>Sen</i></p>	<h1>車</h1> <p><i>Sha</i></p>	MEDIUM TANK	
Medium	Battle	Wagon		
<h1>重</h1> <p><i>Jū</i></p>	<h1>戰</h1> <p><i>Sen</i></p>	<h1>車</h1> <p><i>Sha</i></p>	HEAVY TANK	
Heavy	Battle	Wagon		
<h1>自</h1> <p><i>Ji</i></p>	<h1>動</h1> <p><i>Dō</i></p>	<h1>車</h1> <p><i>Sha</i></p>	MOTOR CAR	
Self	Moving	Wagon		
<h1>自</h1> <p><i>Ji</i></p>	<h1>動</h1> <p><i>Dō</i></p>	<h1>貨</h1> <p><i>Ka</i></p>	<h1>車</h1> <p><i>Sha</i></p>	MOTOR TRUCK
Self	Moving	Freight	Wagon	

(Continued on next page)

TABLE No. 1
Continued

<h1>車</h1> <p><i>Sha</i></p>	<p>TANKS TRUCKS VEHICLES</p>
Vehicle	

<h2>軌道貨車</h2> <p><i>Ki Dō Ka Sha</i></p>	<p>CATERPILLAR TRUCK</p>
Cycled Track Freight Wagon	
<h2>自動自轉車</h2> <p><i>Ji Dō Ji Ten Sha</i></p>	<p>MOTOR CYCLE</p>
Self-Moving Self-Cycling Vehicle	
<h2>側車</h2> <p><i>Soku Sha</i></p>	<p>SIDE CAR</p>
Side Vehicle	
<h2>指揮車</h2> <p><i>Shi Ki Sha</i></p>	<p>COMMAND CAR</p>
Command Vehicle	
<h2>自動偵車</h2> <p><i>Ji Dō Tei Sha</i></p>	<p>RECONNAISSANCE CAR</p>
Self-Moving Scout Vehicle	
<h2>裝甲車</h2> <p><i>Sō Kō Sha</i></p>	<p>ARMORED CAR</p>
Armor-Plated Vehicle	

(Continued on next page)

TABLE No. 1
Continued

車

Sba

Vehicle

TANKS
TRUCKS
VEHICLES

装甲		兵		車		ARMORED TROOP CAR								
<i>Sō</i>		<i>Kō</i>		<i>Hei</i>										
Armor-Plated		Troop		Vehicle										
彈		藥		車		AMMUNITION WAGON								
<i>Dan</i>		<i>Yaku</i>		<i>Sba</i>										
Ammunition		Wagon												
牽		引		車		TRACTOR								
<i>Ken</i>		<i>In</i>		<i>Sba</i>										
Traction		Vehicle												
火		砲		牽		引		車		ARTILLERY TRACTOR				
<i>Ka</i>		<i>Hō</i>		<i>Ken</i>		<i>In</i>		<i>Sba</i>						
(An) Artillery		Gun		Tractioned		Conveyance								
無		限		軌		道		牽		引		車		CATERPILLAR TRACTOR
<i>Mu</i>		<i>Gen</i>		<i>Ki</i>		<i>Dō</i>		<i>Ken</i>		<i>In</i>		<i>Sba</i>		
Endless		Cycle		Tractioned		Vehicle								
破		戰		車		TANK DESTROYER								
<i>Hakai</i>		<i>Sen</i>		<i>Sba</i>										
To Destroy		Battle		Wagon										
水		陸		兩		用		戰		車		AMPHIBIAN TANK		
<i>Sui</i>		<i>Riku</i>		<i>Ryō</i>		<i>Yō</i>		<i>Sen</i>		<i>Sba</i>				
Sea and Land		Double-Use		Battle		Wagon								

TABLE No. 2

<h2 style="font-size: 2em;">彈</h2> <p><i>Dan</i></p>	<p>BULLETS GRENADES BOMBS (TABLE 18) SHELLS (TABLE 12) ROCKETS</p>
<p>Bullet</p>	

<h2 style="font-size: 2em;">尖</h2> <p><i>Sen</i></p>	<h2 style="font-size: 2em;">彈</h2> <p><i>Dan</i></p>	<p>POINTED BULLET</p>	
<p>Cone-shaped</p>	<p>Bullet</p>		
<h2 style="font-size: 2em;">小</h2> <p><i>Shō</i></p>	<h2 style="font-size: 2em;">銃</h2> <p><i>Jū</i></p>	<h2 style="font-size: 2em;">彈</h2> <p><i>Dan</i></p>	<p>RIFLE BULLET</p>
<p>Small</p>	<p>Gun</p>	<p>Bullet</p>	
<h2 style="font-size: 2em;">曳</h2> <p><i>Ei</i></p>	<h2 style="font-size: 2em;">痕</h2> <p><i>Kon</i></p>	<h2 style="font-size: 2em;">彈</h2> <p><i>Dan</i></p>	<p>TRACER BULLET</p>
<p>Tracer</p>	<p>Bullet</p>		
<h2 style="font-size: 2em;">曳</h2> <p><i>Ei</i></p>	<h2 style="font-size: 2em;">光</h2> <p><i>Kō</i></p>	<h2 style="font-size: 2em;">彈</h2> <p><i>Dan</i></p>	<p>LIGHT TRACER BULLET</p>
<p>Trace</p>	<p>Light</p>	<p>Bullet</p>	
<h2 style="font-size: 2em;">曳</h2> <p><i>Ei</i></p>	<h2 style="font-size: 2em;">煙</h2> <p><i>En</i></p>	<h2 style="font-size: 2em;">彈</h2> <p><i>Dan</i></p>	<p>SMOKE TRACER BULLET</p>
<p>Trace</p>	<p>Smoke</p>	<p>Bullet</p>	
<h2 style="font-size: 2em;">爆裂</h2> <p><i>Baku Retsu</i></p>	<h2 style="font-size: 2em;">銃</h2> <p><i>Jū</i></p>	<h2 style="font-size: 2em;">彈</h2> <p><i>Dan</i></p>	<p>EXPLOSIVE BULLET</p>
<p>Explosive-Burst</p>	<p>Rifle-Bullet</p>		

(Continued on next page)

TABLE No. 2
Continued

彈

Dan

Bullet

BULLETS
GRENADES
BOMBS (TABLE 18)
SHELLS (TABLE 12)
ROCKETS

燒夷	用	小銃	彈	INCENDIARY BULLET	
<i>Shō</i>	<i>I</i>	<i>Shō</i>	<i>Jū</i>	<i>Dan</i>	
Incendiary	(Used by)	Small	Arms	(Bullet)	
		硬材	彈	HARD WOOD BULLET	
		<i>Kō</i>	<i>Zai</i>	<i>Dan</i>	
		Hard Timber (Wood)	Bullet		
ダム	ダム	彈	DUM-DUM BULLET		
<i>Da</i>	<i>Mu</i>	<i>Da</i>	<i>Mu</i>	<i>Dan</i>	
Dum	Dum	Bullet			
		破甲銃	彈	ARMOR PIERCING BULLET	
		<i>Ha</i>	<i>Kō</i>	<i>Jū</i>	<i>Dan</i>
		Pierce	Armor	Rifle	Bullet
		彈子		SHRAPNEL BULLET	
		<i>Dan</i>		<i>Sbi</i>	
		Shrapnel			
		擲	彈	GRENADE	
		<i>Teki</i>	<i>Dan</i>		
		Grenade			

(Continued on next page)

TABLE No. 2
Continued

彈

Dan

Bullet

BULLETS
GRENADES
BOMBS (TABLE 18)
SHELLS (TABLE 12)
ROCKETS

手		榴		彈		HAND GRENADE		
<i>Shu</i>		<i>Ryū</i>		<i>Dan</i>				
Hand (Thrown)		Shell						
銃		用		擲		彈		RIFLE GRENADE
<i>Jū</i>		<i>Yō</i>		<i>Teki</i>		<i>Dan</i>		
Rifle-		(Use)		Grenade				
磷		劑		擲		彈		PHOSPHORUS GRENADE
<i>Rin</i>		<i>Zai</i>		<i>Teki</i>		<i>Dan</i>		
Phosphorus		Filled (Dose)		Grenade				
灼		熱		擲		彈		THERMITE GRENADE
<i>Shaku</i>		<i>Nestu</i>		<i>Teki</i>		<i>Dan</i>		
Intense		Heat (Red Hot)		Grenade				
噴		進		通常		彈		STANDARD ROCKET (PROJECTILE) (of the 20 cm type)
<i>Fun</i>		<i>Shin</i>		<i>Tsū</i>		<i>Jō</i>		
<i>Dan</i>								
Spitting Out		(as it Advances)		Known (as) Regular		Shell		
A ROCKET		STANDARD		PROJECTILE				

TABLE No. 3

<h1>砲</h1> <p><i>Ho</i></p> <p>Gun (larger calibre than <i>Ju</i>)</p>	<p>GUN CANNON HOWITZER MORTAR</p>
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Note: *Ho* and *Po* interchangeable

<h1>山</h1> <p><i>Sam</i></p> <p>Mountain</p>	<h1>砲</h1> <p><i>Pō</i></p> <p>Gun</p>	<p>MOUNTAIN GUN</p>
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Note: Field is "Yagai"

<h1>野</h1> <p><i>Ya</i></p> <p>Field (Abbrev.)</p>	<h1>砲</h1> <p><i>Hō</i></p> <p>Gun</p>	<p>FIELD GUN</p>
--	--	------------------

<h1>平</h1> <p><i>Hei</i></p> <p>Low</p>	<h1>射</h1> <p><i>Sha</i></p> <p>Trajectory</p>	<h1>砲</h1> <p><i>Hō</i></p> <p>Gun</p>	<p>CANNON</p>
---	--	--	---------------

<h1>十五</h1> <p><i>Jū</i></p> <p>15</p>	<h1>糎</h1> <p><i>Sanchi</i></p> <p>Centimeter</p>	<h1>加</h1> <p><i>Ka</i></p> <p>Cannon</p>	<h1>農</h1> <p><i>Non</i></p>	<h1>砲</h1> <p><i>Hō</i></p> <p>Gun</p>	<p>15 CM CANNON</p>
--	---	---	------------------------------	--	---------------------

<h1>榴</h1> <p><i>Ryū</i></p> <p>(Common)</p>	<h1>彈</h1> <p><i>Dam</i></p> <p>Shell</p>	<h1>砲</h1> <p><i>Pō</i></p> <p>Gun</p>	<p>HOWITZER</p>
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Note: Calvary is "Kibo"

<h1>騎</h1> <p><i>Ki</i></p> <p>Cavalry (Abbrev.)</p>	<h1>砲</h1> <p><i>Hō</i></p> <p>Gun</p>	<p>CAVALRY GUN</p>
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(Continued on next page)

TABLE No. 3
Continued

<h1>砲</h1> <p><i>Ho</i></p> <p>Gun (larger calibre than <i>Ju</i>)</p>	<p>GUN CANNON HOWITZER MORTAR</p>
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<h2>海軍砲</h2> <p><i>Kai Gun Ho</i></p> <p>Sea Branch Gun</p>	<p>NAVAL GUN</p>
<h2>守城砲</h2> <p><i>Shu I Ho</i></p> <p>Defenders Man-the-Gun</p>	<p>SIEGE GUN</p>
<h2>海岸砲</h2> <p><i>Kai Gan Ho</i></p> <p>Sea Coast Gun</p>	<p>COAST DEFENSE GUN</p>
<h2>滑腔砲</h2> <p><i>Kak Ko Ho</i></p> <p>Smooth-Bore Gun</p>	<p>SMOOTH-BORE GUN</p>
<h2>自動砲</h2> <p><i>Ji Do Ho</i></p> <p>Self-Acting Gun</p>	<p>AUTOMATIC GUN</p>
<h2>速射砲</h2> <p><i>Soku Sha Ho</i></p> <p>Rapid-Fire Gun</p>	<p>QUICK-FIRING GUN</p>

(Continued on next page)

TABLE No. 3
Continued

砲

Hō

Gun (larger
calibre than *Jū*)

GUN
CANNON
HOWITZER
MORTAR

高角砲 <i>Kō Kaku Hō</i>		DUAL-PURPOSE GUN (HIGH-ANGLE GUN)
High-Angle		Gun
大隊砲 <i>Dai Taī Hō</i>		BATTALION (INFANTRY) GUN
Large-Size Unit		Gun
聯隊砲 <i>Ren Tai Hō</i>		REGIMENTAL GUN
A Multi-Sized Unit		Gun
平射	步兵砲 <i>Hei Sba Hō</i>	INFANTRY CANNON
Low-Trajectory	Infantry Gun	
臼砲 <i>Kyū Hō</i>		MORTAR
Mortar		
施線	臼砲 <i>Sbi Sen Kyū Hō</i>	RIFLED MORTAR
Rifling	Mortar	

(Continued on next page)

TABLE No. 3
Continued

砲

Ho

Gun (larger
calibre than *Ju*)

GUN
CANNON
HOWITZER
MORTAR

輕 <i>Kei</i>	迫 擊 <i>Haku Geki</i>	砲 <i>Hō</i>	LIGHT TRENCH MORTAR
Light	Close-Quarters (Attack)	Gun	
重 <i>Jū</i>	迫 擊 <i>Haku Geki</i>	砲 <i>Hō</i>	HEAVY TRENCH MORTAR
Heavy	Close-Quarters (Attack)	Gun	
曲 射 <i>Kyoku Sha</i>	高 兵 <i>Ho Hei</i>	砲 <i>Hō</i>	INFANTRY MORTAR (81 mm)
High-Angle	Fire	Infantry	Gun
對 空 <i>Tai Ku</i>	高 射 <i>Ko Sha</i>	砲 <i>Hō</i>	ANTI-AIRCRAFT GUN
Anti	Aircraft	High	Angle (Elevation)
	對 戰 車 <i>Tai Sen Sha</i>	砲 <i>Hō</i>	ANTITANK GUN
	Anti	Tank	Gun
高 射 <i>Ko Sha</i>	機 關 <i>Ki Kan</i>	砲 <i>Hō</i>	ANTI-AIRCRAFT MACHINE CANNON
High Angle (Elevation)	Machine-Firing	Large-Size Gun (Cannon)	

TABLE No. 3
Continued

砲

Ho

Gun (larger
calibre than 卍)

GUN
CANNON
HOWITZER
MORTAR

移動		高射		砲	ANTI-AIRCRAFT MOBILE GUN	
<i>I</i>	<i>Dō</i>	<i>Kō</i>	<i>Sba</i>	<i>Hō</i>		
Mobile		High-Angle (Elevation)		Gun		
固定		高射		砲	ANTI-AIRCRAFT FIXED GUN	
<i>Ko</i>	<i>Tei</i>	<i>Ko</i>	<i>Sba</i>	<i>Hō</i>		
Fixed		High-Angle (Elevation)		Gun		
機關		砲			"POM-POM" GUN MACHINE CANNON	
<i>Ki</i>	<i>Kan</i>	<i>Ho</i>				
Machine-Firing		Large-Sized Gun (Cannon)				
長		射程		砲	LONG-RANGE FIELD GUN	
<i>Cho</i>	<i>Sba</i>	<i>Tei</i>	<i>Ho</i>			
Long		Range		Gun		
自動車		牽引		砲	TRACTOR DRAWN ARTILLERY	
<i>Ji</i>	<i>Do</i>	<i>Sba</i>	<i>Ken</i>	<i>In</i>		<i>Ho</i>
Self-Powered		Vehicle		With Traction (Carrying a)		Gun
要塞		重		砲	FORTRESS HEAVY ARTILLERY	
<i>Yo</i>	<i>Sai</i>	<i>Ju</i>	<i>Ho</i>			
Fortress		Heavy		Gun		
噴		進		彈	ROCKET GUN	
<i>Fun</i>	<i>Sbin</i>	<i>Dan</i>	<i>Ho</i>			
Spitting Out-(as it)-Advances		Shell		Gun		
Rocket				Gun		

TABLE No. 4

<h1>藥</h1> <p><i>Yaku</i></p>	<p>EXPLOSIVES</p>
<p>Powder</p>	

<h1>裝藥</h1> <p><i>Sō Yaku</i></p>	<p>PROPELLANT CHARGE</p>
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<h1>點火藥</h1> <p><i>Ten Ka Yaku</i></p>	<p>PRIMING POWDER (IGNITER)</p>
<p>Ignition</p>	<p>Powder</p>

<h1>傳火藥</h1> <p><i>Den Ka Yaku</i></p>	<p>BOOSTER CHARGE</p>
<p>Booster</p>	<p>Powder</p>

<h1>甲種</h1> <p><i>Kō Shu</i></p>	<h1>四</h1> <p><i>Shi</i></p>	 <p><i>Rei</i></p>	<h1>瓦</h1> <p><i>Ga</i></p>	<h1>傳火藥</h1> <p><i>Den Ka Yaku</i></p>	<p>A-GRADE, 40 GRAM, BOOSTER CHARGE</p>
<p>A</p>	<p>Grade</p>	<p>4</p>	<p>0</p>	<p>Gram</p>	<p>Booster</p>
					<p>Powder</p>

Note: Explosion Burst is: "Sakurotsu"
(Example, shrapnel)

<h1>炸藥</h1> <p><i>Saku Yaku</i></p>	<p>EXPLOSIVE BURSTING CHARGE</p>
<p>(Abbrev.) Explosive Burst</p>	<p>Powder</p>

<h1>茶褐炸藥</h1> <p><i>Cha Katsu Saku Yaku</i></p>	<p>TNT BURSTING CHARGE</p>	
<p>TNT</p>	<p>(Bursting)</p>	
		<p>Powder</p>

<h1>彈藥</h1> <p><i>Dan Yaku</i></p>	<p>AMMUNITION (GENERAL)</p>
<p>Ammunition</p>	

(Continued on next page)

TABLE No. 4
Continued

藥

Yaku

Powder

EXPLOSIVES

穿 甲 榴 彈 炸 藥 <i>Sen Kō Ryu Dan Saku Yaku</i>	HOLLOW CHARGE AMMUNITION	
Used to Perforate Armor Plate	Explosive Shell	Bursting Powder
十 五 厘 加 農 彈 藥 <i>Jū Go Sanchi Ka Non Dan Yaku</i>	AMMUNITION FOR 15 CM. CANNON	
1 5 Centimeter	Cannon	Ammunition
無 煙 火 藥 <i>Mu En Ka Yaku</i>	SMOKELESS POWDER	
Smokeless	Gun	Powder
大 粒 藥 <i>Dai Ryū Yaku</i>	LARGE-GRAINED POWDER	
Large	Grain	Powder
小 粒 藥 <i>Shō Ryū Yaku</i>	FINE-GRAINED POWDER	
Small	Grain	Powder
褐 色 藥 <i>Kas Shoku Yaku</i>	BROWN (COLORED) POWDER GUN POWDER	
Brown	Color	Powder
黑 色 藥 <i>Koku Shoku Yaku</i>	BLACK (COLORED) POWDER GUN POWDER	
Black	Color	Powder

(Continued on next page)

TABLE No. 4
Continued

<h1>薬</h1> <p><i>Yaku</i></p> <p>Powder</p>	<p>EXPLOSIVES</p>
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<h2>硝化薬</h2> <p><i>Shō Ka Yaku</i></p> <p>Nitro Powder</p>		<p>NITRO-POWDER</p>
<h2>中</h2> <p><i>Chū</i></p> <p>Medium (Size)</p>	<h2>方形粒</h2> <p><i>Hō Kei Ryū</i></p> <p>Square Flake Powder</p>	<p>MEDIUM SIZE SQUARE FLAKE POWDER</p>
<h2>带状火薬</h2> <p><i>Tai Jo Ka Yaku</i></p> <p>Band-Shaped Gun Powder</p>		<p>STRIP POWDER</p>

NOTE: To indicate the more modern varieties of military high explosives, the Japanese have selected arbitrary symbols or characters which are used as a sort of code. There are no known English equivalents for these symbols, and therefore no English words were placed under the characters as has been done in other tables in this outline.

<h2>硝宇薬</h2> <p><i>Sbo U Yaku</i></p>	<p>$(CH_2)_3 (N. NO_2)_3$</p>	<p>CYCLONITE (EQUIVALENT TO RDX OR HEXYL)</p>
<h2>茶褐薬</h2> <p><i>Cha Katsu Yaku</i></p> <p>Brown Powder</p>	<p>$C_6H_2CH_3 (NO_2)_3$</p>	<p>TNT (TRINITROTOLUOL)</p>
<h2>安瓦薬</h2> <p><i>An Ga Yaku</i></p>	<p>NITROGUANIDINE IS THE CHEMICAL ("GUNIGIN," TR) C. $NHNO_2. NH.NH_2$</p>	<p>CYCLONITE TNT NITROGUANIDINE AMMONIUM NITRATE</p>

(Continued on next page)

TABLE No. 4
Continued

藥

EXPLOSIVES

Yaku

Powder

名 <i>Mei</i>	亞 <i>A</i>	藥 <i>Yaku</i>	$C_6H_2(NO_2)_4NCH_3$	TETRYL
硝 <i>Sbo</i>	英 <i>Ei</i>	藥 <i>Yaku</i>	$C(CH_2ONO_2)_4$	PETN (PENTAERYTHRITETETRANITRATE)
灰 <i>Kai</i>	色 <i>Shoku</i>	藥 <i>Yaku</i>	NH_4ClO_4 C_nH_{2n-2} SEE: CYCLONITE $H_2N.C(NH)NH_2HNO_3$	AMMONIUM PERCHLORATE (MIXTURE) CYCLONITE
平 <i>Hei</i>	寧 <i>Nei</i>	藥 <i>Yaku</i>	$C_6H_2(OC_2H_5)(NO_2)_3$	TRINITROPHENETOL
硝 <i>Sbo</i>	斗 <i>To</i>	藥 <i>Yaku</i>	(TNT — NH_4NO_3) SEE: TNT	AMATOL
鹽 <i>En</i>	斗 <i>To</i>	藥 <i>Yaku</i>	$C_7H_6(NO_2)_2$ — $KClO_3$	DINITROTOLUOL POTASSIUM CHLORATE
黃 <i>Ko</i>	色 <i>Shoku</i>	藥 <i>Yaku</i>	$C_6H_2(NO_2)_3OH$	PICRIC ACID (TRINITROPHENOL)
Yellow	Color	Powder		
茶 <i>Cha</i>	黃 <i>Ko</i>	藥 <i>Yaku</i>	SEE: PICRIC ACID AND TNT	PICRIC ACID TNT

(Continued on next page)

TABLE No. 4
Continued

藥

Yaku

Powder

EXPLOSIVES

黃 <i>Ko</i>	那 <i>Na</i>	藥 <i>Yaku</i>	SEE: BOTH COMPOUNDS	PICRIC ACID DINITRONAPHTALENE
黃 <i>Ko</i>	脂 <i>Sbi</i>	藥 <i>Yaku</i>	SEE: PICRIC ACID	PICRIC ACID PARAFFIN
硝 <i>Sbo</i>	那 <i>Na</i>	藥 <i>Yaku</i>	$C_{10}H_6(NO_2)_2$ — NH_4NO_3	DINITRONAPHTALENE NH_4NO_3
鹽 <i>En</i>	那 <i>Na</i>	藥 <i>Yaku</i>	$C_{10}H_7NO_2$ — $KClO_3$	CHEDDITE (NITRONAPHTALENE POTASSIUM CHLORIDE)
	雷 <i>Kai</i>	汞 <i>Ko</i>	$HgC_2N_2O_2$	FULMINATE OF MERCURY (DETONATOR)
	爆 <i>Baku</i>	粉 <i>Fun</i>	$HgC_2N_2O_2$ $KClO_3$ Sb_2S_3	FULMINATE OF MERCURY POTASSIUM CHLORATE ANTIMONY SULFIDE
窒 <i>Chik</i>	化 <i>Ka</i>	鉛 <i>En</i>	$Pb(N_3)_2$	LEAD AZIDE (DETONATOR)

TABLE No. 5

<h1>式</h1> <p><i>Shiki</i></p>	<p>TYPE DESIGNATION</p>
Type	

TYPE 99	
<h1>九九式</h1> <p><i>Kujuku Shiki</i></p>	
99	MODEL
TYPE 1	
<h1>一</h1> <p><i>Ichi</i></p>	<h1>式</h1> <p><i>Shiki</i></p>
ONE	MODEL
11th Year TYPE	
<h1>十一年式</h1> <p><i>Ju ichi Nen Shiki</i></p>	
11th	Year MODEL

JAPANESE NUMERALS

0	○	<i>Rei</i>
1	一	<i>Ichi</i>
2	二	<i>Ni</i>
3	三	<i>San</i>
4	四	<i>Shi</i>
5	五	<i>Gō</i>
6	六	<i>Roku</i>
7	七	<i>Hichi</i>
8	八	<i>Hachi</i>
9	九	<i>Ku</i>
10	十	<i>Jū</i>
11	十一	<i>Jū ichi</i>
12	十二	<i>Jū ni</i>
13	十三	<i>Jū san</i>
14	十四	<i>Jū shi</i>
15	十五	<i>Jū gō</i>
16	十六	<i>Jū roku</i>
17	十七	<i>Jū shicki</i>
18	十八	<i>Jū hachi</i>
19	十九	<i>Jū kū</i>
20	二十	<i>Ni jū</i>
30	三十	<i>San jū</i>
40	四十	<i>Shi ju</i>
50	五十	<i>Gō jū</i>
100	百	<i>Hyaku</i>
1000	千	<i>Sen</i>
10,000	万	<i>Man</i>
100,000	十万	<i>Jū man</i>
1,000,000	百万	<i>Haku man</i>

TABLE No. 6

<h1>年</h1>	<h1>月</h1>
<i>Nen</i>	<i>Getsu</i>
Year	Month

ERAS

TIME PERIODS DURING REIGN OF THREE RECENT EMPERORS	NAMES	CALENDAR DATES OF ERAS
<h2>明治</h2> <p><i>Mei Ji</i></p>	MEIJI ERA	1868 TO 1912 INCLUSIVE
<h2>大正</h2> <p><i>Tai Sbō</i></p>	TAISHO ERA	1912 TO 1926 INCLUSIVE
<h2>昭和</h2> <p><i>Sbō Wa</i></p>	SHOWA ERA	1926 TO PRESENT TIME

There Are Three Different Dates for the Following:

<h2>十年</h2>	10th YEAR
<i>Jū Nen</i>	
10th Year	

<h2>明治</h2> <p><i>Mei Ji</i></p>	<h2>十</h2> <p><i>Jū</i></p>	<h2>年</h2> <p><i>Nen</i></p>	10th Year MEIJI ERA 1867 10 <hr/> 1877
<i>Meiji (Era)</i>	10th	Year	
<h2>大正</h2> <p><i>Tai Sbō</i></p>	<h2>十</h2> <p><i>Jū</i></p>	<h2>年</h2> <p><i>Nen</i></p>	10th Year TAISHO ERA 1911 10 <hr/> 1921
<i>Taisbo (Era)</i>	10th	Year	
<h2>昭和</h2> <p><i>Sbō Wa</i></p>	<h2>十</h2> <p><i>Jū</i></p>	<h2>年</h2> <p><i>Nen</i></p>	10th Year SHOWA ERA 1925 10 <hr/> 1935
<i>Showa (Era)</i>	10th	Year	

<h2>月</h2>	Month
<i>Getsu</i>	

The first month of the Japanese year is January and the twelfth month is December, the same as in our calendar system.

<h2>十月</h2>	OCTOBER
<i>Jū Getsu</i>	
10th Month	

TABLE No. 7

油

GASOLINE
LUBRICATING OILS
FUEL OILS

Yu

Oil

REFERENCE LINE NUMBER	THESE ARE USED IN PRINTED TEXT FOR ABBREVIATIONS ON CANS OR DRUMS. SEE PAGE 38.			ENGLISH TRANSLATION
1	<p style="text-align: center;">揮發油</p> <p style="text-align: center;"><i>Ki Hatsu Yu</i></p> <p style="text-align: center;">Volatile Oil</p>			GASOLINE (KANJI)
2	<p style="text-align: center;">ガソリン</p> <p style="text-align: center;"><i>Ga So Rin</i></p>			GASOLINE (KANA)
3	<p style="text-align: center;">普通</p> <p style="text-align: center;"><i>Fu Tsū</i></p> <p style="text-align: center;">Ordinary</p>	<p style="text-align: center;">揮發油</p> <p style="text-align: center;"><i>Ki Hatsu Yu</i></p> <p style="text-align: center;">Volatile Oil</p>		ORDINARY GASOLINE
4	<p style="text-align: center;">特種</p> <p style="text-align: center;"><i>Toku Shu</i></p> <p style="text-align: center;">Special</p>	<p style="text-align: center;">揮發油</p> <p style="text-align: center;"><i>Ki Hatsu Yu</i></p> <p style="text-align: center;">Volatile Oil</p>		SPECIAL GASOLINE
5	<p style="text-align: center;">分留</p> <p style="text-align: center;"><i>Bun Ryū</i></p> <p style="text-align: center;">Distilled</p>	<p style="text-align: center;">揮發油</p> <p style="text-align: center;"><i>Ki Hatsu Yu</i></p> <p style="text-align: center;">Volatile Oil</p>		GASOLINE FROM "CRACKING PROCESS" (FRACTIONAL DISTILLATION)
6	<p style="text-align: center;">航空機</p> <p style="text-align: center;"><i>Kō Kū Ki</i></p> <p style="text-align: center;">Aviation</p>	<p style="text-align: center;">揮發油</p> <p style="text-align: center;"><i>Ki Hatsu Yu</i></p> <p style="text-align: center;">Volatile Oil</p>		AVIATION GASOLINE

TABLE No. 7
Continued

油

Yu

Oil

GASOLINE
LUBRICATING OILS
FUEL OILS

REFERENCE LINE NUMBER	THESE ARE USED IN PRINTED TEXT FOR ABBREVIATIONS ON CANS OR DRUMS. SEE PAGE 38.			ENGLISH TRANSLATION
7	<p>原料揮發油</p> <p><i>Gen Ryo Ku Hatsu Yu</i></p> <p>Raw Material Volatile Oil</p>			"BASE" GASOLINE (FOR ADDING TETRA-ETHYL-LEAD)
8	<p>石油</p> <p><i>Seki Yu</i></p> <p>Stone Oil</p>			KEROSENE
9	<p>滑油</p> <p><i>Katsu Yu</i></p> <p>Lubricating Oil</p>			LUBRICATING OIL
10	<p>輕滑油</p> <p><i>Kei Katsu Yu</i></p> <p>Light Lubricating Oil</p>			LIGHT LUBRICATING OIL
11	<p>重滑油</p> <p><i>Ju Katsu Yu</i></p> <p>Heavy Lubricating Oil</p>			HEAVY LUBRICATING OIL
12	<p>パラフィン油</p> <p><i>Pa Ra Pin Yu</i></p> <p>Oil</p>			PARAFFIN OIL

(Continued on next page)

TABLE No. 7
Continued

油

Yu

Oil

GASOLINE
LUBRICATING OILS
FUEL OILS

REFERENCE LINE NUMBER	THESE ARE USED IN PRINTED TEXT FOR ABBREVIATIONS ON CANS OR DRUMS. SEE PAGE 38.		ENGLISH TRANSLATION
13	内部油 <i>Nai Bu Yu</i>		INTERNAL (ENGINE) OIL
	Internal Oil		
14	外方油 <i>Gai Hō Yu</i>		EXTERNAL (GEAR) OIL
	External Oil		
15	燃料油 <i>Nen Ryō Yu</i>		FUEL OIL
	Fuel Oil		
16	蓖麻子油 <i>Hi Ma Sbi Yu</i>		CASTOR OIL
	Castor-Bean Oil		
17	礦油 <i>Kō Yu</i>		MINERAL OIL
	Mineral Oil		

(Continued on next page)

TABLE No. 7
Continued

油

Yu

Oil

GASOLINE
LUBRICATING OILS
FUEL OILS

ABBREVIATED JAPANESE MARKINGS USED ON GAS AND OIL DRUMS		ABBREVIATED JAPANESE MARKINGS USED ON GAS AND OIL DRUMS	
* 1	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px;">2 KI</div> or <div style="border: 1px solid black; padding: 2px;">G 2</div> </div> <p style="text-align: center;">No. 2 Gasoline</p> <p style="text-align: center;">Note: Abbreviation "KI" is derived from KIHATSUYU (Gasoline)</p>	8	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px;">1 SE KI</div> or <div style="border: 1px solid black; padding: 2px;">P-1</div> </div> <p style="text-align: center;">Abbreviation: SEKI YU (Kerosene) No. 1 Kerosene</p>
3	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px;">FU KI</div> or <div style="border: 1px solid black; padding: 2px;">G</div> </div> <p style="text-align: center;">Note: Abbreviation FUTSU (Ordinary)</p>	10	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px;">KEI YU</div> or <div style="border: 1px solid black; padding: 2px;">K</div> </div> <p style="text-align: center;">Abbreviation: KEIKATSU YU Light Oil</p>
4	<div style="border: 1px solid black; padding: 10px; text-align: center;"> <p style="font-size: 2em; margin: 0;">特</p> <p style="margin: 0;">91 G</p> <p style="font-size: 0.8em; margin: 0;"><i>Toku</i></p> </div> <p style="text-align: center;">Special 91-Octane Gasoline</p>	11	<div style="border: 1px solid black; padding: 5px; text-align: center; width: fit-content; margin: 0 auto;"> <p>1 JU</p> </div> <p style="text-align: center;">Abbreviation: JUKATSU No. 1 Heavy Oil</p>
5	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px;">BUN 80</div> or <div style="border: 1px solid black; padding: 2px;">80 CG</div> </div> <p style="text-align: center;">Abbreviation: BUNRYU (Distilled) 90-Octane Cracked-Gasoline</p>	13	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>一</p> <p><i>ichi</i></p> </div> <div style="text-align: center;"> <p>内</p> <p><i>Nai</i></p> </div> </div> <p style="text-align: center;">Abbreviation: NAI BU No. 1 Internal Oil</p>
6	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px;">KU 90 KI</div> or <div style="border: 1px solid black; padding: 2px;">A 90 G</div> </div> <p style="text-align: center;">Abbreviation: KOKUKI (Aviation) 90-Octane Aviation Gasoline</p>	14	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>一</p> <p><i>ichi</i></p> </div> <div style="text-align: center;"> <p>外</p> <p><i>Gai</i></p> </div> </div> <p style="text-align: center;">Abbreviation: GAIBU No. 1 External Oil</p>
7	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px;">KU 87 GEN KI</div> or <div style="border: 1px solid black; padding: 2px;">G 87 B</div> </div> <p style="text-align: center;">Abbreviation: GENRYO and KOKUKI 87-Octane Aviation Base-Gasoline</p>	<p>*Numbers correspond to those in preceding table. (Key Character "Yu")</p>	

TABLE No. 8

<h1>筒</h1> <p><i>To</i></p>	PRIMER SHELL CASE BANGALORE TORPEDO GRENADE DISCHARGER COMPLETE ROUND
Tube (Shaped Container)	

<h1>爆筒</h1> <p><i>Baku Tō</i></p>		PRIMER	
Explosive		Tube	
<h1>藥筒</h1> <p><i>Yaku Tō</i></p>		SHELL CASE	
Powder		Tube Case	
<h1>藥</h1> <p><i>Yaku</i></p>	<h1>爽</h1> <p><i>Kyō</i></p>	<h1>爆筒</h1> <p><i>Baku Tō</i></p>	CARTRIDGE CASE PRIMER
Cartridge	Case	Explosive	Tube
<h1>破壞筒</h1> <p><i>Ha Kai Tō</i></p>		BANGALORE TORPEDO	
Demolition		Tube	
<h1>爆藥筒</h1> <p><i>Baku Yaku Tō</i></p>		BANGALORE TORPEDO	
Explosive-Powder		Tube	
<h1>擲彈筒</h1> <p><i>Teki Dan Tō</i></p>		GRENADE DISCHARGER	
Grenade		Tube	

(Continued on next page)

TABLE No. 8
Continued

筒

To

Tube
(Shaped Container)

PRIMER
SHELL CASE
BANGALORE TORPEDO
GRENADE DISCHARGER
COMPLETE ROUND

	彈 藥	筒	COMPLETE ROUND
	<i>Dan</i> <i>Yaku</i>	<i>Tō</i>	
	Artillery Shell (Complete)	Tube	
榴 彈	彈 藥	筒	COMPLETE ROUND HE SHELL
<i>Ryū</i> <i>Dan</i>	<i>Dan</i> <i>Yaku</i>	<i>Tō</i>	
High Explosive	Artillery Shell (Complete)	Tube	

TABLE No. 9

<h1>兵</h1> <p><i>Hei</i></p>	<p>SERVICE DIVISION</p>
Troops	

<h1>歩</h1> <p><i>Ho</i></p>	<h1>兵</h1> <p><i>Hei</i></p>	<p>INFANTRY</p>	
Walking Troops			
<h1>造</h1> <p><i>Zo</i></p>	<h1>兵</h1> <p><i>Hei</i></p>	<p>ORDANCE</p>	
Manufacture (Arms) for Troops			
<h1>工</h1> <p><i>Ko</i></p>	<h1>兵</h1> <p><i>Hei</i></p>	<p>ENGINEERS</p>	
Construction Troops			
<h1>騎</h1> <p><i>Ki</i></p>	<h1>兵</h1> <p><i>Hei</i></p>	<p>CAVALRY</p>	
Horse Troops			
<h1>砲</h1> <p><i>Ho</i></p>	<h1>兵</h1> <p><i>Hei</i></p>	<p>ARTILLERY</p>	
Gun Troops			
<h1>輕</h1> <p><i>Kei</i></p>	<h1>砲</h1> <p><i>Ho</i></p>	<h1>兵</h1> <p><i>Hei</i></p>	<p>LIGHT ARTILLERY</p>
Light	Gun	Troops	

(Continued on next page)

TABLE No. 9
Continued

<h1>兵</h1> <p><i>Hei</i></p>	<p>SERVICE DIVISION</p>
Troops	

<h2>車</h2> <p><i>Jū</i></p>	<h2>砲</h2> <p><i>Hō</i></p>	<h2>兵</h2> <p><i>Hei</i></p>	<p>HEAVY ARTILLERY</p>
Heavy	Gun	Troops	

<h2>野</h2> <p><i>Ya</i></p>	<h2>戰</h2> <p><i>Sen</i></p>	<h2>砲</h2> <p><i>Hō</i></p>	<h2>兵</h2> <p><i>Hei</i></p>	<p>FIELD ARTILLERY</p>
Field	Warfare	Gun	Troops	

<h2>海</h2> <p><i>Kai</i></p>	<h2>岸</h2> <p><i>Gan</i></p>	<h2>砲</h2> <p><i>Hō</i></p>	<h2>兵</h2> <p><i>Hei</i></p>	<p>COAST ARTILLERY</p>
Sea	Coast	Gun	Troops	

<h2>自</h2> <p><i>Ji</i></p>	<h2>動</h2> <p><i>Dō</i></p>	<h2>重</h2> <p><i>Sba</i></p>	<h2>牽</h2> <p><i>Ken</i></p>	<h2>引</h2> <p><i>In</i></p>	<h2>砲</h2> <p><i>Hō</i></p>	<h2>兵</h2> <p><i>Hei</i></p>	<p>MECHANICALLY-DRAWN ARTILLERY</p>
Self-Moving	Vehicle	Tractioned	Gun	Troops			

<h2>自</h2> <p><i>Ju</i></p>	<h2>動</h2> <p><i>Dō</i></p>	<h2>砲</h2> <p><i>Hō</i></p>	<h2>兵</h2> <p><i>Hei</i></p>	<p>SELF-PROPELLED ARTILLERY</p>
Self-Moving	Gun	Troops		

<h2>騎</h2> <p><i>Ki</i></p>	<h2>砲</h2> <p><i>Hō</i></p>	<h2>兵</h2> <p><i>Hei</i></p>	<p>HORSE-DRAWN ARTILLERY</p>
Horse (drawn)	Gun	Troops	

(Continued on next page)

TABLE No. 9
Continued

<h1>兵</h1> <p><i>Hei</i></p>	<p>SERVICE DIVISION</p>
Troops	

<h2>高射砲兵</h2> <p><i>Kō Sha Hō Hei</i></p>	<p>ANTI-AIRCRAFT ARTILLERY</p>
High Angle Gun Troops	
<h2>師團砲兵</h2> <p><i>Shi Dan Hō Hei</i></p>	<p>DIVISIONAL ARTILLERY</p>
Division Gun Troops	
<h2>陸軍航空兵</h2> <p><i>Riku Gun Kō Kū Hei</i></p>	<p>ARMY AIR SERVICE</p>
Land Unit Air Troops	
<h2>化學戰兵</h2> <p><i>Ka Gaku Sen Hei</i></p>	<p>CHEMICAL WARFARE SERVICE</p>
Chemistry Warfare Troops	
<h2>小火兵</h2> <p><i>Shō Ka Hei</i></p>	<p>SMALL ARMS</p>
Small Fire Troop (Branch)	

(Continued on next page)

TABLE No. 9
Continued

<h1>兵</h1> <p><i>Hei</i></p>	<p>SERVICE DIVISION</p>
Troops	

<h1>軍</h1> <p><i>Gun</i></p>	<p>ARMY AND NAVY UNITS</p>
Unit	

<h1>陸軍</h1> <p><i>Riku Gun</i></p>	<p>ARMY</p>
Land Unit	
<h1>海軍</h1> <p><i>Kai Gun</i></p>	<p>NAVY</p>
Sea Unit	
<h1>空軍</h1> <p><i>Kū Gun</i></p>	<p>AIR FORCES</p>
Air Unit	

TABLE No. 10

雷

Rai

Mine
(Detonating Explosion)

MINES

		地雷		LAND MINE	
		<i>Ji</i>	<i>Rai</i>		
		Land	Mine		
		水雷		WATER MINE	
		<i>Sui</i>	<i>Rai</i>		
		Water	Mine		
觸發		地雷		CONTACT LAND-MINE	
<i>Shoku</i>	<i>Hatsu</i>	<i>Ji</i>	<i>Rai</i>		
Contact		Land	Mine		
戰車		地雷		ANTITANK MINE	
<i>Sen</i>	<i>Sba</i>	<i>Ji</i>	<i>Rai</i>		
Tank		Land	Mine		
鐵線	係	蹄	雷	TRIP-WIRE MINE	
<i>Tes</i>	<i>Sen</i>	<i>Kei</i>	<i>Tei</i>	<i>Rai</i>	
Iron	Wire	Tripping	Purpose	Mine	
自發		地雷		CLOCK-WORK MINE	
<i>Ji</i>	<i>Hatsu</i>	<i>Ji</i>	<i>Rai</i>		
Self-Acting		Land	Mine		

(Continued on next page)

TABLE No. 10
Continued

<p>雷 <i>Rai</i></p>	<p>MINES</p>
<p>Mine (Detonating Explosion)</p>	

		<p>爆 雷 <i>Baku Rai</i></p>	<p>MINE DEMOLITION</p>
		<p>Explosive</p>	<p>Mine</p>
<p>浮 游 <i>Fu Yu</i></p>	<p>水 <i>Sui</i></p>	<p>雷 <i>Rai</i></p>	<p>FLOATING MINE</p>
<p>Floating</p>	<p>Water</p>	<p>Mine</p>	
		<p>空 <i>Ku</i></p>	<p>雷 <i>Rai</i></p>
		<p>Air</p>	<p>Mine</p>
		<p>TORPEDO (Aerial)</p>	

TABLE No. 11

銃

MACHINE GUN
AUTOMATIC RIFLE
PISTOL
RIFLE

Ju

Gun (Smaller
Dimension than "Ho")

	機 關	銃	MACHINE GUN
	<i>Ki Kan</i>	<i>Jū</i>	
	Machine	Gun	
輕	機 關	銃	LIGHT MACHINE GUN
<i>Kei</i>	<i>Ki Kan</i>	<i>Jū</i>	
Light	Machine	Gun	
重	機 關	銃	HEAVY MACHINE GUN
<i>Jū</i>	<i>Ki Kan</i>	<i>Jū</i>	
Heavy	Machine	Gun	
固 定	機 關	銃	FIXED MACHINE GUN
<i>Ko Tei</i>	<i>Ki Kan</i>	<i>Jū</i>	
Fixed	Machine	Gun	
柔 軟	機 關	銃	FLEXIBLE MACHINE GUN
<i>Jū Nan</i>	<i>Ki Kan</i>	<i>Jū</i>	
Flexible	Machine	Gun	
高 射	機 關	銃	ANTI-AIRCRAFT MACHINE GUN
<i>Kō Sha</i>	<i>Ki Kan</i>	<i>Jū</i>	
High-Angle	Machine	Gun	

(Continued on next page)

TABLE No. 11
Continued

<h1>銃</h1> <p><i>Jū</i></p>	<p>MACHINE GUN AUTOMATIC RIFLE PISTOL RIFLE</p>
<p>Gun (Smaller Dimension than "Ho")</p>	

<h2>小銃</h2> <p><i>Sbo Jū</i></p>	<p>RIFLE</p>
<p>Small</p>	<p>Gun</p>
<h2>自動銃</h2> <p><i>Ji Do Jū</i></p>	<p>AUTOMATIC RIFLE</p>
<p>Self-Acting</p>	<p>Gun</p>
<h2>拳銃</h2> <p><i>Ken Jū</i></p>	<p>PISTOL</p>
<p>Hand-Operated</p>	<p>Gun</p>
<h2>騎銃</h2> <p><i>Ki Jū</i></p>	<p>CARBINE</p>
<p>Horse (Cavalry)</p>	<p>Gun</p>

TABLE No. 12

榴 彈

ARTILLERY SHELL

Ryu

Dan

榴 彈		ARTILLERY SHELL
Ryu Dan		
(Type used for Artillery) H.E. Shell		
特 殊 砲 彈		SPECIAL SHELL
Toku Shu Ho Dan		
Special	Gun-Shell	
尋 常 榴 彈		COMMON SHELL
Jin Jo Ryu Dan		
Common	High Explosive Shell	
試 製 彈		EXPERIMENTAL SHELL
Shi Sei Dan		
Experimental	Shell	
大 口 徑 砲 彈		LARGE CALIBER SHELL
Dai Ko Kei Ho Dan		
Large Caliber	Gun-Shell	
高 級 榴 彈		HIGH-EXPLOSIVE SHELL
Ko Kyū Ryū Dan		
High	Explosive Shell	

(Continued on next page)

TABLE No. 12
Continued

榴 彈

ARTILLERY SHELL

Ryu

Dan

曳 光 榴 彈 <i>Ei Kō Ryū Dan</i>	HE SHELL WITH LIGHT-TRACER
Tracer (with) Light	HE Shell

九 二 式 步 榴 彈 <i>Ku Ni Shiki Ho Ryū Dan</i>	TYPE 92 HE SHELL (for Infantry)
9 2 Type	Infantry HE Shell

尖 銳 彈 <i>Sen Ei Dan</i>	LONG-POINTED (Streamlined) SHELL
Come to a Sharp Point	Shell

瓦 斯 彈 <i>Ga Su Dan</i>	GAS SHELL
Gas	Shell

穿 甲 榴 彈 <i>Sen Kō Ryū Dan</i>	HOLLOW CHARGE SHELL
Pierce Through	Armor Plate Shell

燒 夷 彈 <i>Shō I Dan</i>	INCENDIARY SHELL
Incendiary	Shell

(Continued on next page)

TABLE No. 12
Continued

榴 彈

Ryu

Dan

ARTILLERY SHELL

<p>照 明 彈 <i>Sbō Mei Dan</i></p>			<p>STAR SHELL (Illuminating)</p>
Brilliant	Glare	Shell	
<p>發 煙 彈 <i>Hatsu En Dan</i></p>			<p>SMOKE SHELL</p>
Emit	Smoke	Shell	
<p>高 射 尖 銳 彈 <i>Kō Sha Sen Ei Dan</i></p>			<p>ANTI-AIRCRAFT POINTED SHELL</p>
High-Angle (Fire)	Pointed	Shell	
<p>破 甲 榴 彈 <i>Ha Kō Ryū Dan</i></p>			<p>ARMOR-PIERCING HE SHELL</p>
Pierce	Armor-plate	HE Shell	
<p>徹 甲 彈 <i>Tek Kō Dan</i></p>			<p>AP STEEL SHELL (AP Shot)</p>
Remove, Destroy	Armor-plate	Shell	
<p>被 帽 彈 <i>Hi Bō Dan</i></p>			<p>AP SHELL WITH HARDENED CAP</p>
Armor-piercing	Cap	Shell	

Tek is an abbreviation of *Tekkyo* (Remove)

(Continued on next page)

TABLE No. 12
Continued

榴 彈

Ryu

Dan

ARTILLERY
SHELL

鋼 性 銑 榴 彈 <i>Ko Sei Sen Ryū Dan</i>		SEMI-STEEL SHELL	
Semi Steel		Shell	
鍛 鋼 榴 彈 <i>Tan Kō Ryū Dan</i>		DRAWN-STEEL SHELL	
Forge Steel		Shell	
堅 鐵 彈 <i>Ken Tetsu Dan</i>		CHILLED STEEL (AP) SHELL	
Chilled Steel		Shell	
砲 塔 用 加 農 彈 丸 [*] <i>Ho Tō Yō Ka Non Dan Gan</i>	TURRET PROJECTILE FOR CANNON USE		
Gun-Turret	Use	Cannon	Projectile
榴 霰 彈 <i>Ryū San Dan</i>		SHRAPNEL	
High-explosive		Case	Shell
有 翼 彈 <i>Yū Yoku Dan</i>		(Finned Shell) MORTAR SHELL	
Possessing	Wings	Shell	

* This is an exception to the general rule that key characters are terminal characters.

(Continued on next page)

TABLE No. 12
Continued

榴 彈

ARTILLERY
SHELL

Ryu

Dan

銃		榴 彈		RIFLE GRENADE
Jū		Ryū	Dan	
Rifle		Grenade		
灼	熱	擲 彈		THERMITE GRENADE
Shaku	Netsu	Teki	Dan	
Intense	Heat (Red hot)	Grenade		
柄 付	手	榴 彈		POTATO-MASHER TYPE HAND-GRENADE
E	Tsuki	Sbu	Ryu Dan	
Stick-Hand	Hand	Grenade		
		實 彈		BALL AMMUNITION
		Jitsu	Dan	
		Solid	Ammunition	
		彈	丸 *	PROJECTILE
		Dan	Gan	
		Shell	Body (Form)	

* This is an exception to the general rule that key characters are terminal characters.

TABLE No. 13

PRELIMINARY DESCRIPTION

JAPANESE AIRPLANE BOMBS AND THEIR MARKINGS

1	陸	上	爆彈		LAND BOMB (Thin-cased HE-GP Bomb) Demolition Blast
	<i>Riku</i>	<i>Jō</i>	<i>Baku</i>	<i>Dan</i>	
	Land-Use		Bomb		
2	通	常	爆彈		ORDINARY BOMB (Heavy-cased HE-GP Bomb) Demolition SAP
	<i>Tsu</i>	<i>Jō</i>	<i>Baku</i>	<i>Dan</i>	
	General Purpose		Bomb		
3	特	種	爆彈		SPECIAL PURPOSE BOMB 14 Types (Mark No. Series)
	<i>Toku</i>	<i>Shu</i>	<i>Baku</i>	<i>Dan</i>	
	Special Kind		Bomb		

Group 3, or Special Purpose Bombs, is by far the most important, being composed of a diversified list ranging from chemical bombs to rocket and incendiary bombs. Although there are 26 types of Special Purpose Bombs listed with mark numbers in Japanese ordnance catalogs, there are but 14 known types in actual use and some of these are advanced only to the experimental stage.

While the Japanese characters "Baku Dan" (airplane bomb) appear on all aerial bombs, or their shipping cases, the characters for "mark" number appear only on Special Purpose Bombs, and just preceding "Baku Dan." Look first for the character "mark" and its number. If "mark" is present, then the number following it describes the type (through reference to Table No. 13).

號	二	MARK-2
<i>Gō</i>	<i>Ni</i>	
Mark	2	

爆	彈	BOMB
<i>Baku</i>	<i>Dan</i>	
Airplane	Bomb	

When the ideograph for "mark" is absent, look for "Baku Dan." The characters preceding it will describe whether it is a Land Bomb or an Ordinary (General Purpose) Bomb. These are set forth in Table No. 18.

TABLE No. 13

<h1>號</h1> <p>Gō</p>	<p>MARK (Number) (Airplane Bombs)</p>
----------------------	---

<h1>號</h1> <p>Gō</p>	<p>Meaning is: MARK (Number)</p>
----------------------	--------------------------------------

On "Special Series" bombs a number follows this character to indicate the type as follows:

Mark No.	Type of Bomb	Mark No.	Type of Bomb
1.....	Gas, chemical	14.....	Unclassified
2.....	Antisubmarine	15.....	"
3.....	Incendiary	16.....	"
4.....	Rocket	17.....	"
5.....	Armor-Piercing	18.....	"
6.....	Magnesium Incendiary and Oil Incendiary	19.....	"
7.....	Unknown	20.....	"
8.....	Unclassified	21.....	Cluster, Airdrome
9.....	"	22.....	Stick Cluster
10.....	"	23.....	Long-delay
11.....	"	24.....	Parachute
12.....	"	25.....	Parachute Cluster
13.....	"	26.....	Above Ground

(Continued on next page)

TABLE No. 13
Continued

 <p><i>Ban</i></p>	<p>NUMBER</p>
--	---------------

 <p><i>Roku Ban</i></p>	<p>NUMBER 6</p>
--	-----------------

The Japanese have several common weights for airplane bombs. Examples: 30 Kg.; 60 Kg.; 250 Kg.; 700 Kg.; 800 Kg.

The preceding character indicates the weight of the bomb. In the example illustrated, Roku Ban means number 6. Multiply the 6 by 10, and the result is the weight of the bomb in kilograms. (60 kg.)

 <p><i>Kata</i></p>	<p>Meaning is: DESIGN NUMBER (so-and-so)</p>
--	--

 <p><i>Shiki</i></p>	<p>Meaning is: MODEL (so-and-so)</p>
---	--

 <p><i>Kai</i></p>	<p>Meaning is: MODIFICATION (so-and-so)</p>
---	---

Note: The Japanese characters on this page are related to markings found only on JAPANESE AIRPLANE BOMBS.

TABLE No. 14
Continued

厘

Sanchi

METRIC
TABLES

		厘	CENTIMETER
		<i>Sanchi</i>	
耗	or	密位	MILLIMETER
<i>Miri</i>		<i>Mi Ri</i>	
		瓦	GRAM (15.432 grains)
		<i>Guramu</i>	
		秒	1 SECOND
		<i>Byo</i>	
		瓦	KILOGRAM (2.2 lbs.)
		<i>Kilo</i>	
		1. K. 205 = 1.205 Kg.	
		立	1 LITER (1.7607 pints)
		<i>Rittoru</i>	
		立十	1 DECALITER (10 liters) (2.2008 gallons)
		<i>Deka Rittoru</i>	
		封	1 POUND (120.96 momme)
		<i>Pondo</i>	

(Continued on next page)

TABLE No. 14
Continued

厘

Sanchi

METRIC
TABLES

匁		1 MOMME (120.96 momme = 1 lb.)
<i>Momme</i>		
瓦		1 GALLON (2.5188 Sho)
<i>Ga Ron</i>		
升		2.5188 = 1 Gallon
<i>Sho</i>		
長	サ	LENGTH
<i>Naga</i>	<i>Sa</i>	
重	量	WEIGHT
	吋	INCH
	<i>Inchi</i>	
	呎	FOOT
	<i>Futo</i>	
	碼	YARD
	<i>Yado</i>	

TABLE No. 15

<h1>機</h1>	<p>"AIRCRAFT" WEAPONS AND AMMUNITION</p>
<i>Ki</i>	
<p>Machine</p>	

<h1>航</h1>	<h1>空</h1>	<h1>機</h1>	<p>AIRCRAFT</p>
<i>Kō</i>	<i>Kū</i>	<i>Ki</i>	
<p>Flying (in) Air</p>		<p>Machine 1</p>	
<h1>陸</h1>	<h1>軍</h1>	<h1>機</h1>	<p>ARMY PLANE</p>
<i>Riku</i>	<i>Gun</i>	<i>Ki</i>	
<p>Land</p>	<p>Branch</p>	<p>(Flying) Machine</p>	
<h1>海</h1>	<h1>軍</h1>	<h1>機</h1>	<p>NAVY PLANE</p>
<i>Kai</i>	<i>Gun</i>	<i>Ki</i>	
<p>Sea</p>	<p>Branch</p>	<p>(Flying) Machine</p>	
<h1>陸</h1>	<h1>上</h1>	<h1>機</h1>	<p>LAND PLANE</p>
<i>Riki</i>	<i>Jō</i>	<i>Ki</i>	
<p>Land</p>	<p>Best (Use)</p>	<p>(Flying) Machine</p>	
<h1>水</h1>	<h1>上</h1>	<h1>機</h1>	<p>SEA PLANE</p>
<i>Sui</i>	<i>Jō</i>	<i>Ki</i>	
<p>Sea</p>	<p>Best (Use)</p>	<p>(Flying) Machine</p>	
<h1>雷</h1>	<h1>擊</h1>	<h1>機</h1>	<p>TORPEDO AIRPLANE</p>
<i>Rai</i>	<i>Geki</i>	<i>Ki</i>	
<p>Water Mine 2</p>	<p>Attack 3</p>	<p>(Flying) Machine</p>	

(Continued on next page)

TABLE No. 15
Continued

機 <i>Ki</i>	"AIRCRAFT" WEAPONS AND AMMUNITION
Machine	

裝甲 <i>Sō Kō</i>	飛行 <i>Hi Kō</i>	機 <i>Ki</i>	ARMORED AIRCRAFT
Armor	Plated	Flight	(Flying) Machine
	爆 <i>Baku</i>	擊 <i>Geki</i>	機 <i>Ki</i>
	Bomb 4	Attack	(Flying) Machine
爆 <i>Baku</i>	擊 <i>Geki</i>	照準 <i>Shō Jun</i>	機 <i>Ki</i>
Bomb 4	Attack 3	Sighting Device (For a)	(Flying) Machine

FOOTNOTES TO TABLE 15
Abbreviations reference

1

機 <i>Ki</i>	械 <i>Kai</i>	MACHINE
Machine		

2

空 <i>Kō</i>	雷 <i>Rai</i>	TORPEDO Aerial
Air	Mine	

3

攻 <i>Kō</i>	擊 <i>Geki</i>	ATTACK
-----------------------	-------------------------	--------

4

爆 <i>Baku</i>	彈 <i>Dan</i>	AIRPLANE BOMB
-------------------------	------------------------	------------------

TABLE No. 16

鐵

Tetsu

Iron

METALS
TABLE

鐵 <i>Tetsu</i> Iron	IRON
鋼 鐵 <i>Kō Tetsu</i> Steel	STEEL
黃 銅 <i>Ō Dō</i> Yellow Copper	BRASS
銅 <i>Dō</i> Copper	COPPER
青 銅 <i>Sei Dō</i> Bluish Copper	BRONZE
鉛 <i>Namari</i> Lead	LEAD

(Continued on next page)

TABLE No. 16
Continued

鐵

Tetsu

Iron

METALS
TABLE

合金 <i>Gō Kin</i>		ALLOY
Compound Metal		
鑄鐵 <i>Chu Tetsu</i>		CAST IRON
Cast Iron		
クローム <i>Ku Ro Ma</i>	鋼鐵 <i>Kō Tetsu</i>	CHROMIUM STEEL
Chromium Steel		
* 鋼性銑 <i>Kō Sei Sen</i>		SEMI-STEEL
Steel with Steel-type pig-iron		
* 鋼鍛 <i>Tan Kō</i>		DRAWN STEEL
Forged Steel		
* 堅鐵 <i>Ken Tetsu</i>		CHILLED STEEL
Chilled Steel		

* *Ko* is an-abbreviation of *KoTetsu* (steel)

(Continued on next page)

TABLE No. 16
Continued

鐵

Tetsu

Iron

METALS
TABLE

	鑄	鋼*	CAST STEEL
	<i>Chū</i>	<i>Kō</i>	
	Cast	Steel	
合	金	鋼*	ALLOY STEEL
<i>Gō</i>	<i>Kin</i>	<i>Kō</i>	
Compound Metal		Steel	
	鋼*	板	STEEL PLATE
	<i>Kō</i>	<i>Ban</i>	
	Steel	Plate	
	亞	鉛	ZINC
	<i>A</i>	<i>En</i>	
		Lead	

* *Kō* is an abbreviation of *KōTetsu* (steel)

TABLE No. 17

<h1 style="margin: 0;">管</h1> <p style="margin: 0;"><i>Kan</i></p>	<p style="margin: 0;">FUZE POWDER TRAIN</p>
<p style="margin: 0;">A Pipe or Tube</p>	

<h2 style="margin: 0;">彈</h2> <p style="margin: 0;"><i>Dan</i></p>	<h2 style="margin: 0;">頭</h2> <p style="margin: 0;"><i>Tō</i></p>	<h2 style="margin: 0;">信</h2> <p style="margin: 0;"><i>Sbin</i></p>	<h2 style="margin: 0;">管</h2> <p style="margin: 0;"><i>Kan</i></p>	<p style="margin: 0;">NOSE FUZE</p>	
Projectile	Head	Communicating	Tube (Fuze)		
<h2 style="margin: 0;">彈</h2> <p style="margin: 0;"><i>Dan</i></p>	<h2 style="margin: 0;">底</h2> <p style="margin: 0;"><i>Tei</i></p>	<h2 style="margin: 0;">信</h2> <p style="margin: 0;"><i>Sbin</i></p>	<h2 style="margin: 0;">管</h2> <p style="margin: 0;"><i>Kan</i></p>	<p style="margin: 0;">BASE FUZE</p>	
Projectile	Base	Fuze			
<h2 style="margin: 0;">曳</h2> <p style="margin: 0;"><i>Ei</i></p>	<h2 style="margin: 0;">火</h2> <p style="margin: 0;"><i>Ka</i></p>	<h2 style="margin: 0;">信</h2> <p style="margin: 0;"><i>Sbin</i></p>	<h2 style="margin: 0;">管</h2> <p style="margin: 0;"><i>Kan</i></p>	<p style="margin: 0;">TIME FUZE</p>	
Slow-moving	Fire	Fuze			
<h2 style="margin: 0;">着</h2> <p style="margin: 0;"><i>Chaku</i></p>	<h2 style="margin: 0;">發</h2> <p style="margin: 0;"><i>Hatsu</i></p>	<h2 style="margin: 0;">信</h2> <p style="margin: 0;"><i>Sbin</i></p>	<h2 style="margin: 0;">管</h2> <p style="margin: 0;"><i>Kan</i></p>	<p style="margin: 0;">PERCUSSION FUZE</p>	
Arrival - Departure		Fuze			
<h2 style="margin: 0;">複</h2> <p style="margin: 0;"><i>Fuku</i></p>	<h2 style="margin: 0;">働</h2> <p style="margin: 0;"><i>Dō</i></p>	<h2 style="margin: 0;">信</h2> <p style="margin: 0;"><i>Sbin</i></p>	<h2 style="margin: 0;">管</h2> <p style="margin: 0;"><i>Kan</i></p>	<p style="margin: 0;">COMBINATION FUZE (Time and Percussion)</p>	
Double-Motion		Fuze			
<h2 style="margin: 0;">瞬</h2> <p style="margin: 0;"><i>Shu</i></p>	<h2 style="margin: 0;">發</h2> <p style="margin: 0;"><i>Matsu</i></p>	<h2 style="margin: 0;">信</h2> <p style="margin: 0;"><i>Sbin</i></p>	<h2 style="margin: 0;">管</h2> <p style="margin: 0;"><i>Kan</i></p>	<p style="margin: 0;">INSTANTANEOUS FUZE</p>	
Instant	Depart (Fire)	Instantaneous	Fuze		
<h2 style="margin: 0;">短</h2> <p style="margin: 0;"><i>Tan</i></p>	<h2 style="margin: 0;">延</h2> <p style="margin: 0;"><i>Eb</i></p>	<h2 style="margin: 0;">期</h2> <p style="margin: 0;"><i>Ki</i></p>	<h2 style="margin: 0;">信</h2> <p style="margin: 0;"><i>Sbin</i></p>	<h2 style="margin: 0;">管</h2> <p style="margin: 0;"><i>Kan</i></p>	<p style="margin: 0;">SHORT-DELAY FUZE</p>
Short-time	Late-Period		Fuze		

TABLE No. 17
Continued

<h1>管</h1> <p><i>Kan</i></p>	<p>FUZE POWDER TRAIN</p>
<p>A Pipe or Tube</p>	

	<h2>除</h2> <p><i>Jō</i></p>	<h2>信管</h2> <p><i>Shin Kan</i></p>	<p>UNFUZED</p>
	<p>Without</p>	<p>Fuze</p>	
<h2>爆</h2> <p><i>Baku</i></p>	<h2>彈</h2> <p><i>Dan</i></p>	<h2>信管</h2> <p><i>Shin Kan</i></p>	<p>BOMB FUZE</p>
<p>Airplane</p>	<p>Bomb</p>	<p>Fuze</p>	
<h2>爆</h2> <p><i>Baku</i></p>	<h2>裂</h2> <p><i>Retsu</i></p>	<h2>信管</h2> <p><i>Shin Kan</i></p>	<p>DETONATING FUZE</p>
<p>Explosive (Force)</p>		<p>Fuze</p>	
<h2>火</h2> <p><i>Ka</i></p>	<h2>道</h2> <p><i>Dō</i></p>	<h2>信管</h2> <p><i>Shin Kan</i></p>	<p>POWDER TRAIN (of a Fuze)</p>
<p>Fire-Road (Powder Train) Fuze</p>			
<h2>藥</h2> <p><i>Yaku</i></p>	<h2>盤</h2> <p><i>Ban</i></p>	<h2>信管</h2> <p><i>Shin Kan</i></p>	<p>TIME TRAIN (of a Fuze)</p>
<p>Powder-Block</p>		<p>Fuze</p>	
	<h2>雷</h2> <p><i>Rai</i></p>	<h2>管</h2> <p><i>Kan</i></p>	<p>PERCUSSION CAP (of a Cartridge)</p>
	<p>Detonating</p>	<p>Tube (Cap)</p>	
<h2>爆</h2> <p><i>Bak</i></p>		<h2>管</h2> <p><i>Kan</i></p>	<p>PRIMER CAP</p>
<p>Explosive</p>		<p>Tube (Cap)</p>	

TABLE No. 18

<h1 style="font-size: 2em;">爆 彈</h1> <p style="text-align: center;"><i>Baku</i> <i>Dan</i></p> <p style="text-align: center;">Explosive Shell (Bomb)</p>	<p>AIRPLANE BOMBS</p>
---	---------------------------

<h2 style="font-size: 1.5em;">陸</h2> <p style="text-align: center;"><i>Riku</i></p>	<h2 style="font-size: 1.5em;">上</h2> <p style="text-align: center;"><i>Jo</i></p>	<h2 style="font-size: 1.5em;">爆</h2> <p style="text-align: center;"><i>Baku</i></p>	<h2 style="font-size: 1.5em;">彈</h2> <p style="text-align: center;"><i>Dan</i></p>	<p>LAND BOMB</p>	
For (Land) Use		(the) Best		Explosive	Shell
<h2 style="font-size: 1.5em;">通</h2> <p style="text-align: center;"><i>Tsu</i></p>	<h2 style="font-size: 1.5em;">常</h2> <p style="text-align: center;"><i>Jo</i></p>		<h2 style="font-size: 1.5em;">爆</h2> <p style="text-align: center;"><i>Baku</i></p>	<h2 style="font-size: 1.5em;">彈</h2> <p style="text-align: center;"><i>Dan</i></p>	<p>GENERAL PURPOSE (HE) (Ordinary) BOMB</p>
Known as		Regular (Standard)		Bomb	
<h2 style="font-size: 1.5em;">特</h2> <p style="text-align: center;"><i>Toku</i></p>		<h2 style="font-size: 1.5em;">種</h2> <p style="text-align: center;"><i>Shu</i></p>	<h2 style="font-size: 1.5em;">爆</h2> <p style="text-align: center;"><i>Baku</i></p>	<h2 style="font-size: 1.5em;">彈</h2> <p style="text-align: center;"><i>Dan</i></p>	<p>SPECIAL PURPOSE BOMB</p>
Special		Kind (of)		Bomb	
<h2 style="font-size: 1.5em;">燒</h2> <p style="text-align: center;"><i>Sho</i></p>	<h2 style="font-size: 1.5em;">夷</h2> <p style="text-align: center;"><i>I</i></p>	<h2 style="font-size: 1.5em;">用</h2> <p style="text-align: center;"><i>Yo</i></p>	<h2 style="font-size: 1.5em;">爆</h2> <p style="text-align: center;"><i>Baku</i></p>	<h2 style="font-size: 1.5em;">彈</h2> <p style="text-align: center;"><i>Dan</i></p>	<p>INCENDIARY BOMB (Airplane)</p>
Incendiary-		Use		Bomb	
<h2 style="font-size: 1.5em;">磷</h2> <p style="text-align: center;"><i>Rin</i></p>		<h2 style="font-size: 1.5em;">爆</h2> <p style="text-align: center;"><i>Baku</i></p>		<h2 style="font-size: 1.5em;">彈</h2> <p style="text-align: center;"><i>Dan</i></p>	<p>PHOSPHORUS BOMB</p>
Phosphorus		Bomb			
<h2 style="font-size: 1.5em;">火</h2> <p style="text-align: center;"><i>Ka</i></p>	<h2 style="font-size: 1.5em;">焰</h2> <p style="text-align: center;"><i>En</i></p>	<h2 style="font-size: 1.5em;">爆</h2> <p style="text-align: center;"><i>Baku</i></p>	<h2 style="font-size: 1.5em;">彈</h2> <p style="text-align: center;"><i>Dan</i></p>	<p>LIQUID FLAME BOMB</p>	
Fire-Flame		Bomb			

(Continued on next page)

TABLE No. 18
Continued

爆 彈

AIRPLANE
BOMBS

Baku Dan

Explosive Shell (Bomb)

細		裂	爆 彈	FRAGMENTATION BOMB
<i>Sai</i>		<i>Retsu</i>	<i>Baku Dan</i>	
(Into) Smallest		Pieces	Bomb	
瓦		斯	爆 彈	GAS BOMB
<i>Ga</i>		<i>Su</i>	<i>Baku Dan</i>	
Gas		Bomb		
爆	破 [*]	用	爆 彈	DEMOLITION BOMB
<i>Baku</i>	<i>Ha</i>	<i>Yo</i>	<i>Baku Dan</i>	
Explosive	Demolition	Use	Bomb	
破		甲	爆 彈	ARMOR-PIERCING BOMB
<i>Ha</i>		<i>Kō</i>	<i>Baku Dan</i>	
Pierce		Armor	Bomb	
擬		爆 彈	DUMMY BOMB	
<i>Gi</i>		<i>Baku Dan</i>		
Abbrev. for Gi Sei (Dummy)		Bomb		

破	壞 [*]
<i>Ha</i>	<i>Kai</i>
Demolition	

擬	製 [*]
<i>Gi</i>	<i>Sei</i>
Dummy	

TABLE No. 19

<h1>所</h1> <p><i>Sbo</i></p>	<p>FACTORY</p>
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		<h1>製</h1> <p><i>Sei</i></p> <p>Made in</p>	<h1>造</h1> <p><i>Zō</i></p> <p>Work</p>	<h1>所</h1> <p><i>Sbo</i></p> <p>Plant</p>	<p>FACTORY</p>
<h1>小</h1> <p><i>Sbō</i></p> <p>Small</p>	<h1>銃</h1> <p><i>Jō</i></p> <p>Rifle</p>	<h1>製</h1> <p><i>Sei</i></p> <p>Made in</p>	<h1>造</h1> <p><i>Zō</i></p> <p>Work</p>	<h1>所</h1> <p><i>Sbo</i></p> <p>Plant</p>	<p>SMALL ARMS FACTORY</p>
<h1>火</h1> <p><i>Ka</i></p> <p>Fire (Gun)</p>	<h1>藥</h1> <p><i>Yaku</i></p> <p>Powder</p>	<h1>製</h1> <p><i>Sei</i></p> <p>(Made in)</p>	<h1>造</h1> <p><i>Zō</i></p> <p>Manufacturing</p>	<h1>所</h1> <p><i>Sbo</i></p> <p>Plant</p>	<p>POWDER FACTORY</p>

TABLE No. 20

<h1>廠</h1> <p><i>Sho</i></p>	<p>ARSENAL</p>
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		<h2>工廠</h2> <p><i>Kō Sho</i></p> <p>Work Shop</p>	<p>ARSENAL WORKSHOP</p>
<h2>陸軍</h2> <p><i>Riku Gun</i></p> <p>Land Branch</p>	<h2>工廠</h2> <p><i>Kō Sho</i></p> <p>Work Shop</p>	<p>ARMY ARSENAL</p>	
		<h2>造兵廠</h2> <p><i>Zo Hei Sho</i></p> <p>Manufacture (Arms for) Troops Shop</p>	<p>ARSENAL</p>
<h2>吳</h2> <p><i>Kure</i></p> <p>Kure</p>	<h2>海軍</h2> <p><i>Kai Gun</i></p> <p>Naval</p>	<h2>工廠</h2> <p><i>Kō Sho</i></p> <p>Arsenal</p>	<p>THE NAVAL ARSENAL AT KURE</p>

SECTION THREE

**PRACTICAL READING AND TRANSLATION OF
JAPANESE CHARACTERS**

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JAPANESE MARKINGS COPIED FROM A TAG WITHIN AN AMMUNITION BOX

Start at left top corner and read down.

航 <i>Kō</i>	AIRCRAFT
空 <i>Kū</i>	
機 <i>Ki</i>	Table 15
用 <i>Yō</i>	
二 <i>Ni</i>	20 MM
十 <i>Jū</i>	
耗 <i>Hō</i>	Metric Table 14
機 <i>Ki</i>	
關 <i>Kan</i>	POM-POM GUN
砲 <i>Hō</i>	Table 3

彈 <i>Dan</i>	AMMUNITION
藥 <i>Yaku</i>	Table 4
昭 <i>Shō</i>	SHOWA
和 <i>Wa</i>	18th YEAR
十 <i>Jū</i>	1943
八 <i>Hachi</i>	
年 <i>Nen</i>	Table 6
十 <i>Jū</i>	
一 <i>Ichī</i>	NOVEMBER
月 <i>Getsu</i>	Table 7

二 <i>Ni</i>	TYPE 2
式 <i>Shiki</i>	Table 5
曳 <i>Ei</i>	LIGHT TRACER
光 <i>Kō</i>	
徹 <i>Ha</i>	AP SHELL
甲 <i>Kō</i>	
彈 <i>Dan</i>	Table 2
彈 <i>Dan</i>	AMMO.
藥 <i>Yaku</i>	Table 4
筒 <i>Tō</i>	COMPLETE ROUND Table 8

東 <i>Tō</i>	TOKYO
京 <i>Kyō</i>	
第 <i>Riku</i>	ARMY
陸 <i>Gun</i>	Table 10
軍 <i>Gun</i>	
造 <i>Zō</i>	ARSENAL
兵 <i>Hei</i>	
廠 <i>Shō</i>	Table 20
川 <i>Sei</i>	
越 <i>Zō</i>	FACTORY
製 <i>Sei</i>	
造 <i>Zō</i>	
所 <i>Sho</i>	Table 19

Note: The Japanese characters on this page were copied direct from tags within ammunition boxes that had been captured in the Philippines.

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JAPANESE MARKINGS ON AN AIRPLANE BOMB

<p>二 五 番 ^{**}</p> <p><i>Ni Go Ban</i></p>			<p>號 二 ^{**}</p> <p><i>Go Ni</i></p>		<p>爆 彈 ^{**}</p> <p><i>Baku Dan</i></p>		<p>NUMBER 25 (250 Kg.) Mark 2 . . . Anti- submarine Airplane Bomb</p>
Two	Five	Number	Mark	Two	Airplane-Bomb		

<p>一 式 ^{**}</p> <p><i>Ichi Shiki</i></p>		<p>一 型 ^{**}</p> <p><i>Ichi Kata</i></p>		<p>改 一 ^{**}</p> <p><i>Kai Ichi</i></p>		<p>TYPE 1 . . . (1941) MODEL 1 MODIFICATION 1</p>
(No.) One	Type	(No.) One	Model	Modification	(No.) One	

** Indicates KEY CHARACTERS that appear on bombs.
(Reference to Table 13)

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JAPANESE MARKINGS ON A HEAVY GUN



Japanese 150 mm Howitzer



Inscriptions on Weapon

After transposing characters, left to right.

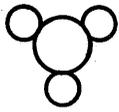
九 六 式	十 五 厘	榴 彈 砲
<i>Ku</i> <i>Roku</i> <i>Sbiki</i>	<i>Ju</i> <i>Go</i> <i>Sanchi</i>	<i>Ryu</i> <i>Dan</i> <i>Po</i>
TYPE 96	15 CENTIMETER	HOWITZER

昭 和	十 五 年	大 阪 工 廠
<i>Sho</i> <i>Wa</i>	<i>Ju</i> <i>Go</i> <i>Nen</i>	<i>O</i> <i>Saka</i> <i>Ke</i> <i>Sho</i>
SHOWA	15th YEAR (1940)	OSAKA ARSENAL

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JAPANESE MARKINGS USED TO INDICATE ARSENALS

The following are the markings found on ordnance items, such as Cannon and Artillery Shells, and represent Japanese Arsenals.

SYMBOL	JAPANESE ARSENAL OR MANUFACTURING PLANT
	Kokura Arsenal
	Tokyo Arsenal
	Gas and Electric Co.
	Nagoya Arsenal
	Heijo Arsenal
	Osaka Arsenal
	Chiyoda Arsenal
	South Arsenal
	Tokyo Explosives Factory

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<p>彈道 <i>Dan Do</i></p>	<p>TRAJECTORY</p>
<p>彈道學 <i>Dan Dō Gaku</i></p>	<p>BALLISTICS</p>
<p>最小射程 <i>Sai Shō Sha Tei</i></p>	<p>MINIMUM RANGE</p>
<p>最大射程 <i>Sai Dai Sha Tei</i></p>	<p>MAXIMUM RANGE</p>
<p>初速 <i>Sho Soku</i></p>	<p>MUZZLE VELOCITY</p>
<p>射角 <i>Sha Kaku</i></p>	<p>ANGLE OF ELEVATION</p>
<p>仰度 <i>Gyō Do</i></p>	<p>DEGREES OF ELEVATION</p>
<p>米突每秒 <i>Mei Toru Mai Byō</i></p>	<p>METERS PER SECOND</p>

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JAPANESE BALLISTICS TERMS

(Continued)

經過時間 <i>Kei Ka Ji Kan</i>	TIME OF FLIGHT
高速度 <i>Kō Soku Do</i>	HIGH VELOCITY
低速度 <i>Tei Soku Do</i>	LOW VELOCITY
命中速度 <i>Mei Chū Soku Do</i>	STRIKING VELOCITY
方位角 <i>Hōi Ka Ku</i>	AZIMUTH
照準 <i>Sbō Jun</i>	LAYING (of a gun)
口徑 <i>Kō Kei</i>	DIAMETER OF BORE
腔長 <i>Kō Chō</i>	LENGTH OF BORE

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