

C. I. O. O.

COPY No. 184

**ALLIED LAND FORCES  
HEADQUARTERS**

**SWPA**

**TECHNICAL  
INTELLIGENCE  
SUMMARY**

**No 3**

**JUNE 1943**

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S.W.P.A.

TECHNICAL INTELLIGENCE SUMMARY

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TABLE OF CONTENTS

<u>JAPAN</u>	<u>Page</u>
<u>Weapons</u>	
Japanese 20 m.m. A/A - Tk/A Gun	2 - 8
	Illustrations 9 - 21
Japanese 37 m.m. Tk/A Gun	22 - 27
	Illustrations 28 - 37
Correction - Calibre Solothurn S.M.G.	38
<u>G.W.</u>	
Japanese Service Respirator - Type 93 No. 2	39 - 45
	Illustrations 46 - 60
Japanese Smoke Floats	61 - 62
	Illustrations 63
Japanese Floating Smoke Candle (Type 94) Model B	64 - 66
	Illustrations 67 - 71
Japanese Smoke Candle (White Band) U/I Type	72
	Illustrations 73 - 74
Hydrocyanic Acid HCN	75 - 78
Japanese Flare Bomb - Type 1	79 - 81
	Illustrations 82
<u>Bombs &amp; Ammunition</u>	
Metallurgical examination 37 m.m. Ammunition	83 - 84
	Illustrations 85 - 91
New Type HE & Incendiary Bomb - 250 Kg.	92 - 94
	Illustrations 95 - 97
Trial Firing 37 m.m. Tk/A Gun	98 - 100
Functioning & Velocity Series 13 m.m. A/A-Tk/A Gun	101 - 103
Report on 37 m.m. Ammunition	104 - 105
	Illustrations 106 - 107
Fragmentation Trials 37 m.m. Ammunition	108 - 109
	Illustrations 110 - 112
<u>Miscellaneous</u>	
Japanese Dry Batteries	113 - 115
	Illustrations 116 - 119
Japanese Dial Sight and Carrier	120 - 121
	Illustrations 122 - 124
Japanese Paper Cape	125 - 126
	Illustrations 127
<u>Running Index</u>	128

JAPANESE 20 MM. A/A-TK/A GUN

TYPE 98

1. GENERAL DESCRIPTION.

Both the gun and the carriage were manufactured in December 1940 and a translation of a name plate on the carriage indicated KOKUKA ARSENAL as the place of manufacture. The gun is relatively light and manoeuvrable and it is estimated that a trained crew could prepare the gun for action for A/A purposes from the travelling position in under 3 minutes. It can also be fired from its wheels as an artillery piece, in which case the time for bringing the gun into action from the travelling position would be considerably reduced. Its performance, however, under these conditions, is doubtful. General characteristics are:-

(a) Weight	836 lbs.
(b) Elevation	- 10° to + 85°
(c) Traverse	380°
(d) Max. horizontal range	5450 <sup>x</sup>
(e) " vertical "	12,000'
(f) Rate of fire	120 r.p.m.
(g) m.v.	2,720 f/s
(h) Length of barrel	70 cal.
(j) Type of fire	Automatic only
(k) Magazine	Vertical box type
(l) Capacity of magazine	30 rds.

2. BARREL.

- (a) A translation of markings on the receiver are:-  
"Type 98 (i.e. 1938) 177 December 1940"
- (b) Type of barrel Mono-block
- (c) Slightly pitted : suitable for test.
- (d) Calibre 20 mm.
- (e) Length of barrel:  
(i) With muzzle brake 57½"  
(ii) Without muzzle brake 55½"
- (f) Length of rifling 49½"
- (g) Rifling details:  
(i) Number of lands 8  
(ii) Width of lands 0.100" (2.54 mm.)  
(iii) " " grooves 0.216" (5.48 mm.)  
(iv) Depth " " 0.010" (0.275 mm.)  
(v) Pitch of rifling 1½ turns in 70 cal. of rifling  
(vi) Rifling R.H.
- (h) Chamber details:  
(i) Diameter at breech end 1.54"  
(ii) " " at beginning of centring slope 1.25"  
(iii) Diameter at beginning of neck 0.86"  
(iv) Length of chamber 4.20"  
(v) " " neck 0.85"
- (j) Weight of barrel and receiver 152 lbs.
- (k) Barrel attachment:  
The method of fastening the barrel to the receiver is very simple. The barrel is positioned by a set screw in the top of the receiver body, the head of which may be seen just forward of the magazine opening in Fig. 1. This set screw acts as a key in the slot shown in Fig. 2 - 39. The

interrupted thread bushing (Fig. 2 - 26) has a short radial slot machined into the front face and is located in the correct position on the barrel by a small set screw, which screws through the rear barrel yoke (Fig. 2 - 21) and enters the radial slot. The projecting end of the set screw allows just sufficient radial movement of the bush on the barrel, to allow of engagement and disengagement of the mating thread in the receiver body. Assuming that spare barrels are fitted with yokes and gas cylinder assemblies, barrels may be changed by simply lifting latch (Fig. 2 - 27) and turning bush (Fig. 2 - 26) so that locating set screw through rear barrel yoke engages the lower end of the radial slot. Barrel, with yokes and gas cylinders attached, may then be removed bodily from the receiver body. The spare barrel is then inserted into the receiver, first ensuring that the locating set screw is in engagement with the lower end of the radial slot in the face of the bush. The bush should then pass the interrupted thread in the receiver body, and is finally locked in position by giving 1/6 turn in a clockwise direction. With the bush screwed up tight against the shoulder of the barrel, the latch (Fig 2 - 27) should then engage in the slot in the rim of the interrupted thread bush. Should there be any misalignment, shims should be used.

### 3. BREECH MECHANISM.

- (a) Type of operation : Gas operated, automatic
- (b) Type of breech block : Bren type locked breech
- (c) Type of firing lock : Cam
- (d) Firing pin : Two firing pins were with the gun. One, a single piece, the firing pin and striker being cammed into, and out of, the primer together. The second is in two pieces, the firing pin and the striker. The striker is held to the rear by spring tension, and the firing pin is cammed in and out in the same manner as the first. The explanation of the 2 piece pin may lie in the hardening of the striker.
- (e) Extractors : Single, spring actuated
- (f) Firing mechanism actuator : Cam

### 4. ACTION.

(a) To load, pull back cocking handle which rides in a slot at bottom right side of receiver. The cocking handle engages piston yoke and breech block and the gas piston yoke locks over spring loaded sear in base of body.

(b) To Fire, press firing handle safety catch (Fig. 1 - 2) and move handle forward. This movement is transmitted by linkage through centre of left hand trunnion to trigger lever (Fig. 2 - 4) of sear actuating mechanism housed at lower rear end of the cradle. The movement of the trigger lever raises or lowers a small parallel bar mechanism which in the raised position, contacts a small roller fixed to an extension of the sear. The length of the bar is such that in any position of recoil of the gun, the roller is always in contact with, or directly above, the bar. The sear being depressed, gas piston yoke and breech block move forward under pressure of the return springs (Fig. 2 - 10). The cocking handle moves forward with the first shot and remains

in forward position during automatic firing.

(c) Forward Action. The breech block, in its forward movement carries round from the magazine into the chamber. As the shell is seated into the chamber, its base is gripped by the extractor. The extractor is at the bottom of the face of the breech block (Fig. 2 - 40) and seats into a groove in the rear of the chamber (Fig. 2 - 41). As the breech block is seated home, the bevelled surface on the gas piston yoke (Fig. 2 - 42) slides the rear portion of the breech block (Fig. 2 - 15) upwards, locking it against shoulders set in the sides of the receiver. During this upward movement, an internal cam surface in the rear portion of the breech block drives the firing pin forward into the primer. The locking shoulders for the breech block are screwed into the sides of the receiver and may be replaced when worn.

(d) Backward Action. After firing, some of the gases following the projectile up the barrel, pass through the gas port (Fig. 2 - 43) and force the gas piston yoke to the rear. This allows the lock to drop and the breech block travels to the rear. The ejector, situated at the inside top of the receiver and riding in a groove on top of the breech block (Fig. 2 - 44), ejects the empty case through the ejection opening in the bottom of the receiver. The buffers are spring loaded pistons set in the back plate (Fig. 2 - 7 & 8). The return springs reassert themselves and at conclusion of backward action the gun will continue firing as long as the sear is depressed.

(e) Empty Magazine. A trip mechanism is employed to hold the bolt in the cocked position after the last round has been fired. The principle is similar to that on the 20 mm. "Garlikon". The trip mechanism consists of two spring loaded levers, which interlock with each other. The tongue of the smaller lever, which projects horizontally into the magazine opening, holds the larger lever in the raised or horizontal position while the gun is firing. After the last round leaves the magazine a spring loaded rib on the magazine platform, springs out and contacts the tongue of the small lever, forcing it down and thus releasing the larger lever. The rear end of this lever forms a double sided pawl which moves down and engages the front face of the gas piston yoke backplate (Fig. 2 - c) and holds the bolt in the cocked position. When the magazine catch is lifted to change magazines, the two levers become reset in relation to each other. When released from the larger lever the bolt moves forward slightly and is held by the sear.

## 5. SAFETY FEATURES.

(a) The spring loaded lock on the firing handle must be pressed before handle can be moved forward.

(b) Fig. 2 - 11 & 12 show the disassembled manual safety mechanism. Fig. 3 - 1 shows the firing handle in the firing position. For safety, the handle is rotated in a clockwise direction thus locking Fig. 2 - 12 over point "C" (Fig. 2 - 42) on the yoke.

(c) Fig. 2 - 37 shows a third safety feature. This is a lever located at the rear of the smaller rectangular receiver, housing the sear actuating mechanism and located at the lower end of the cradle beneath the gun body. Rotation of this lever to the right locks the sear actuating mechanism although still allowing the gun to be cocked. The bolt, if drawn back, will latch on the sear when the handle

is set at safe or fire. This feature is more positive than that described in para (b) above, which has the following weakness:-

Assuming the catch set at safety and the bolt in the forward position. Should an attempt be made to cock the gun, the gas yoke backplate moving back would contact the front face of the safety catch and may give the impression that the bolt has been drawn back past the sear. If the cocking handle were released, it would result in a round being fed into the chamber and fired.

6. MIZZLE BRAKE.

The design of this is clearly shown in Figs. 2 - 33, 3 - 3, 4 - 1 and 5 - 1. It is a large flat ring extending out 2" from the muzzle, with holes in the barrel extension to give the escaping gases room for expansion. These gases leaving the muzzle under high pressure exert a force against the flat ring thus resisting the recoil, dispersing the muzzle blast and breaking up the flash.

7. CARRIAGE.

- (a) Type - Dual purpose A/A - Tk/A
- (b) Road clearance - 12"
- (c) Overall length in travelling position - 9'
- (d) Total weight(carriage)- 685 lbs.
- (e) " " Gun plus carriage - 837 lbs.
- (f) Traverse - Pintle type 360°
- (g) Equilibrator - Spring cable
- (h) Trails - Split, or split trail with outrigger.
- (j) Spades - Fixed, with holes for driving stakes for stability (Fig. 1 - 3)
- (k) Levelling - Levelling jacks on trail and outrigger (Figs. 1 - 4, 5 - 2)
- (l) Shields - Nil
- (m) Wheels - Wooden with steel tyres - easily detachable. Equipped with tug rings.

8. RECOIL MECHANISM.

- (a) Type - Spring, constant, with air counter recoil.
- (b) Length of recoil - Estimated 2" - Max. 2.5"
- (c) Mounting - Screwed to yokes on cradle and eye brackets on receiver.
- (d) The two recoil cylinders shown (Fig. 2 - 28 & 30), are spring loaded and the length of recoil can be adjusted; once set, it remains constant. There is a graduated scale fastened to the adjusting screw (Fig. 2 - 45), which aids in the setting of the length of recoil. Fig. 1 clearly shows the mounting of the mechanism, the cylinders being rigidly fastened at A & B and the piston rods fastened to the receiver at C. Valves located in the forward end of the cylinders allow air to be drawn into the cylinders during recoil. As the air

cannot easily escape it acts as a cushion in counter recoil.

#### 9. EQUILIBRATOR.

Fig. 9 shows the equilibrator unit which fits into the bell like housing, (Figs. 1 - 5, 9 - 2 and 10 - 1). This housing mounts the equilibrator springs, 360° traverse bearing, (Fig. 9 - 3) and the azimuth indicator gears, (Figs. 9 - 4, 10 - 2). The system consists of two volute springs (see diagram), with the top anchored, and the bottom connected to an eccentric wheel (Fig. 9 - 5) by means of a cable through the centres of the springs. The eccentric wheel or pulley is rigidly fastened to an axle. Rigidly fastened to the same axle are 2 concentric pulleys which are connected to the cradle, just to the rear of the trunnion, by cables. Thus when the gun is at max elevation the springs are not compressed. As the gun is depressed, the added force due to the muzzle preponderance, is used to compress the springs. This compression force aids in elevation. An adjustment for spring tension is provided at the lower end of the cable A (see diagram) and is a small square spigot engaged from below with a special tool and, when turned, raises or lowers the position of the end of the cable in the adaptor.

#### 10. TRAVELLING POSITION.

Fig. 8 shows the gun in the travelling position. Towing bars or shafts are inserted into the slots (Fig. 8 - 1). The travelling lock which holds the barrel steady in transit is shown in (Fig. 8 - 2). This lock is shown (Fig. 5 - 4) when the gun is not in the travelling position.

#### 11. TRAVERSE.

The gun has a free 360° traverse, the pressure for which is applied at the shoulder rest by the No. 1 Gunner. A flexible cable shaft (Fig. 4 - 2) connects the ring and spur gears in the equilibrator housing to an azimuth dial on the sight mount. This dial is graduated in mils.

#### 12. ELEVATION.

The elevation is accomplished by a simple helical spur and segment gear train. The elevation handwheel (Fig. 5 - 5) is connected to a horizontal shaft (Fig. 5 - 6) perpendicular to the axis of the bore. This shaft has two helical spur gears, one on either end, which mesh with the two helical segment gears shown (Fig. 2 - 5). The gun elevates easily and rapidly.

#### 13. FIRING POSITION.

(a) To place the gun in the firing position from the travelling position, the outrigger (Fig. 5 - 3) is attached to the front of the housing. Rapid attachment is effected by spring loaded locking features.

(b) Axle is rotated to the rear thus raising wheels off the ground. For crank type axle details see Figs. 1 - 9 & 10. The spring loaded lock retaining the outrigger is actuated by folding the jack (Fig. 5 - 2) back against the outrigger leg.

(c) Wheels are removed by releasing spring catches on axles (Fig. 1 - 6) and pulling wheels off.

(d) The gun is cross levelled by means of jacks on the outrigger and trails. Cross levels are located on the upper carriage housing (Figs. 6 - 1 and 9 - 6). The level vials are set in metal cylinders which rotate  $\frac{1}{2}$  a turn and afford protection for the vials when not in use.

(e) Removal of wheels permits 360° traverse at all elevations. As has been stated, it is possible to fire the gun from the wheels but it was not designed for this as it could not be cross levelled, has no equaliser, and would be quite unstable.

#### 14. SIGHTING.

No sights have been recovered to date, however detailed report will be published as soon as complete assembly is recovered.

#### 15. STRIPPING AND ASSEMBLING.

##### (a) To Strip Cradle from Mounting.

- (i) Elevate gun to max. elevation.
- (ii) Apply spanner to squared projection of cable pulley shaft (Fig. 9 - 5) on right hand side of mounting and rotate in clockwise direction thereby taking equilibrator spring tension off side cables.
- (iii) Cables may then be disengaged from cradle (Fig. 2 - 2) at rear of trunnions and spanner eased back to allow spring tension to come off centre cable.
- (iv) Disconnect trigger linkage connection at outside of left hand trunnion.
- (v) Trunnion bearing caps may then be opened (as in Fig. 9) by turning and withdrawing locking pins retaining same.
- (vi) Cradle and gun assembly may then be lifted out of mounting.

Assemble in reverse order.

##### (b) To Strip Gun from Cradle.

- (i) Remove set screw in top of mounting brackets (Fig. 1 - c). Recoil locking nuts (Fig. 2 - 29) may then be unscrewed from ends of piston rods.
- (ii) Remove set screws in top of recoil cylinder brackets (Fig. 2 - 31). Recoil units may then be screwed forward and out of the recoil cylinder brackets.
- (iii) Remove barrel with yokes and gas cylinders assembled as set out in para 2 (k).
- (iv) Remove mounting brackets (Fig. 1 - c). These brackets are dovetailed into the receiver body and may be easily removed by an upward tap.
- (v) Slide receiver body back and out of the cradle slide.

Assemble in reverse order.

##### (c) To Strip Breech Block and Magazine Interlocking Mechanism from Receiver Body.

- (i) Ensure that breech block is in the full forward position.

- (ii) Remove body locking pin (Fig. 2 - 9) by tapping from the smaller diameter end.
- (iii) Remove backplate (Fig. 2 - 7) and recoil springs (Fig. 2 - 10).
- (iv) Remove magazine catch axis pin and remove magazine catch (Fig. 2 - 19).
- (v) Remove magazine catch plunger and springs (Fig. 2 - 36).
- (vi) Remove receiver cover (Fig. 2 - 14) by tapping to rear.
- (vii) Remove axis pins from magazine catch interlocking lever and auxiliary trip lever. Levers with their respective springs may then be removed.

Assemble in reverse order.

(d) To Strip Equilibrator Gear and Pintle.

- (i) Remove internal lock nut at base of equilibrator housing, first removing small retaining grub screw. Equilibrator housing retaining nut, the round knurled head of which may be seen projecting below housing in Fig. 1, may then be removed. This nut combines a spring loaded draining device.
- (ii) Lift pintle assembly bodily out of housing.
- (iii) Open hinged locking sector shown just above 5 on Fig. 9.
- (iv) Rotate upper section through  $\frac{1}{4}$  of a turn to disengage from lower portion of assembly. Upper section may then be removed as shown in Fig. 9.
- (v) Remove small clip at top of cable guide (see diagram) to permit top cable attachment to pass through upper casing.
- (vi) By removing locking screws indicated in diagram, the top section may be unscrewed and the equilibrator casing (the top section of which screws into the lower section) opened to give access to the two springs and cable.

Assemble in reverse order.

16. TYPES OF AMMUNITION.

Specimens of 20 mm. A/P Tracer and H.E. Tracer for this gun have been recovered and a technical report on this ammunition will be published as soon as details are available.

(REPORT BY DESIGN DIVISION, M.G.O., I.H.Q.,  
AND ORDNANCE INTELLIGENCE SECTION USAFFE.)

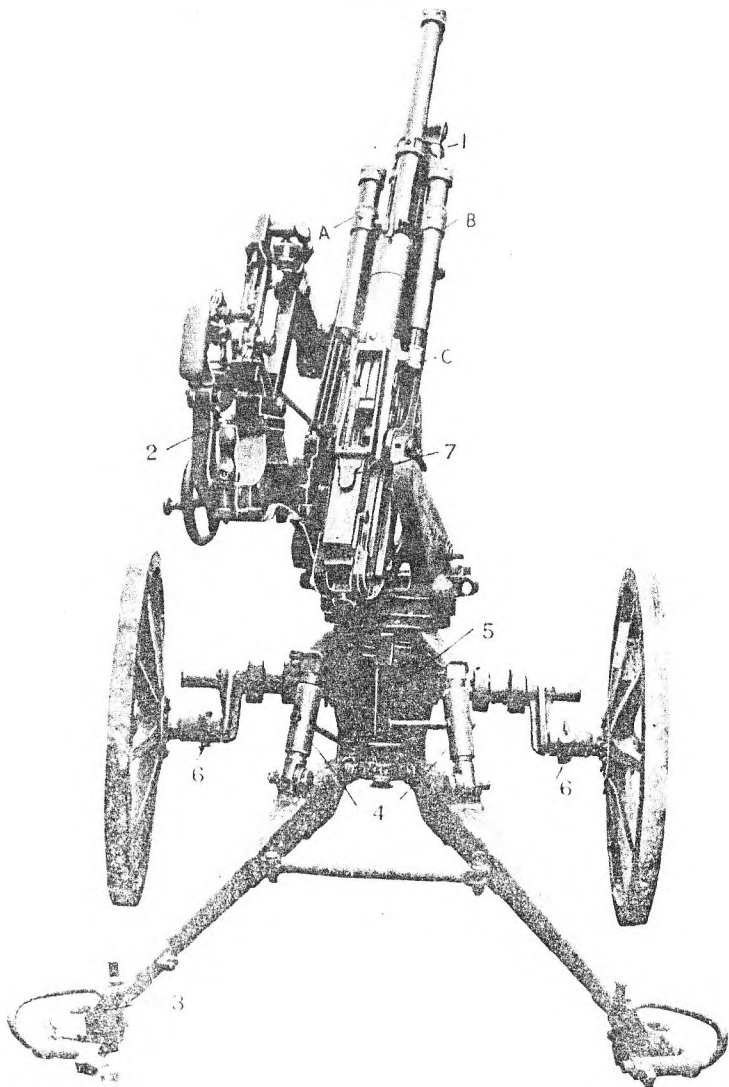


Figure 1. JAPANESE 20 MM A/A - TK/A GUN.

KEY TO DIAGRAM

- |                                 |                           |                                     |
|---------------------------------|---------------------------|-------------------------------------|
| 1. Sight mount bracket.         | 16. Breech block          | 31. Recoil cylinder bracket.        |
| 2. Bottom sleigh (cradle)       | 17. Firing pin.           | 32. Gas cylinder cleaning plug.     |
| 3. Elevation indicator.         | 18. Cam.                  | 33. Muzzle brake.                   |
| 4. Trigger.                     | 19. Magazine catch.       | 34. Magazine.                       |
| 5. Elevating segment gear.      | 20. Gas piston yoke.      | 35. Shims (head space washers)      |
| 6. Receiver.                    | 21. Barrel yoke (rear).   | 36. Magazine catch spring & plunger |
| 7. Back plate.                  | 22. Gas cylinder.         | 37. Safety catch lever.             |
| 8. Buffer assembly.             | 23. Barrel yoke (centre). | 38. Magazine slot cover.            |
| 9. Locking pin, back plate.     | 24. Barrel yoke (front).  | 39. Tube positioning groove.        |
| 10. Return springs.             | 25. Tube.                 | 40. Extractor.                      |
| 11. Safety catch lever.         | 26. Threaded bushing.     | 41. Extractor groove in tube.       |
| 12. Safety catch.               | 27. Barrel lock           | 42. Camming surface.                |
| 13. Magazine interlock lever.   | 28. Recoil cylinder.      | 43. Gas port.                       |
| 14. Receiver cover.             | 29. Recoil locking nut.   | 44. Ejector groove.                 |
| 15. Breech block locking piece. | 30. Recoil adjusting nut. | 45. Recoil adjusting scale.         |

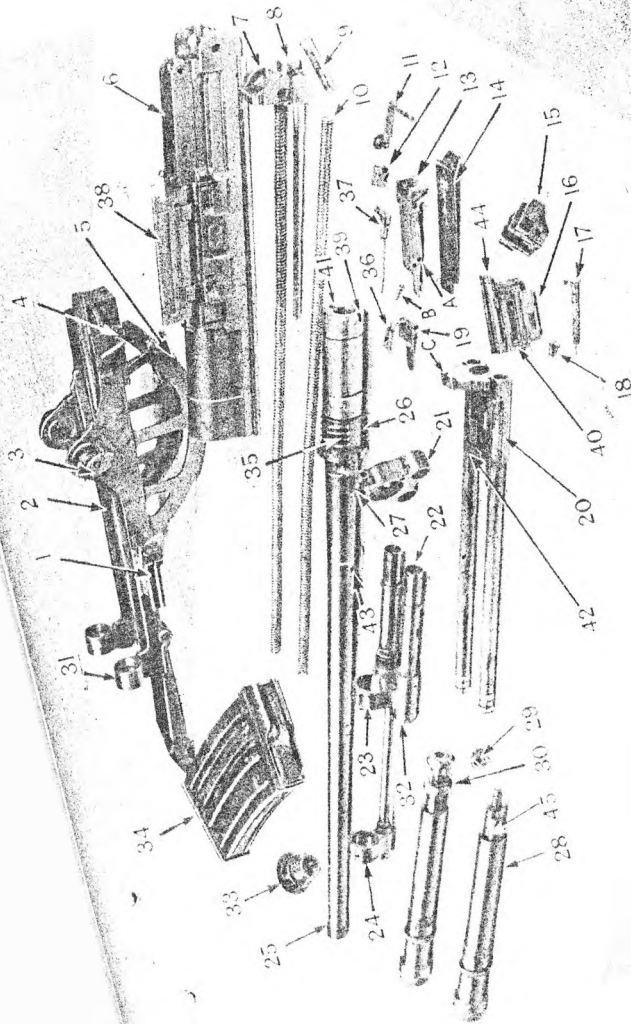


Figure 2. COMPONENT PARTS JAPANESE 20 MM A/A - TK/A GUN.

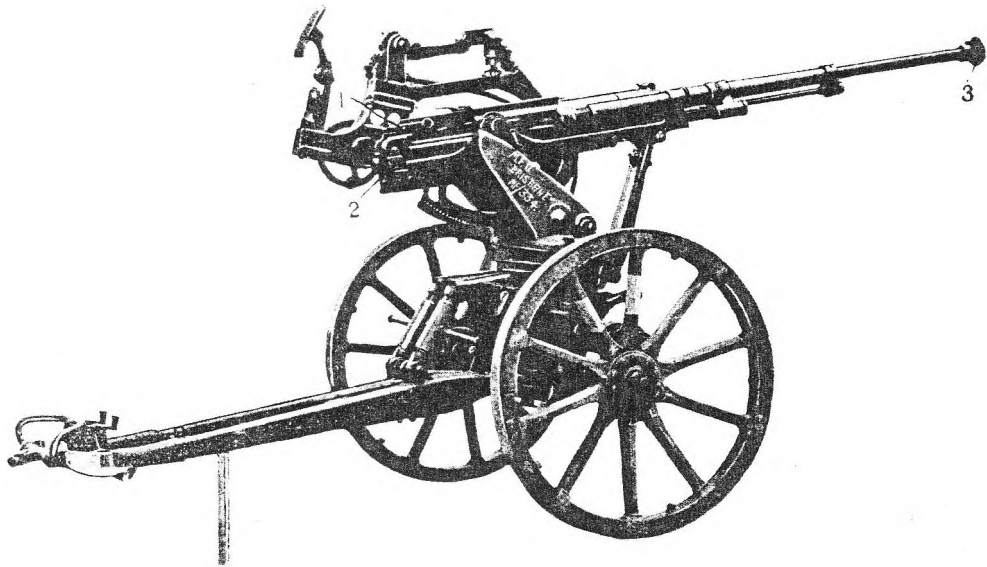


Figure 3. JAPANESE 20 MM A/A - TK/A GUN.

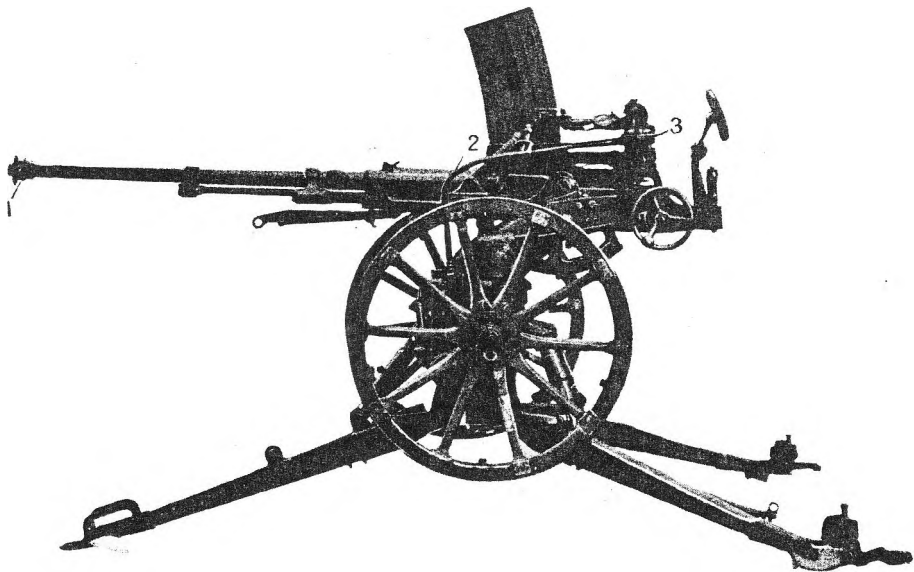


Figure 4. JAPANESE 20 MM A/A - TK/A GUN.

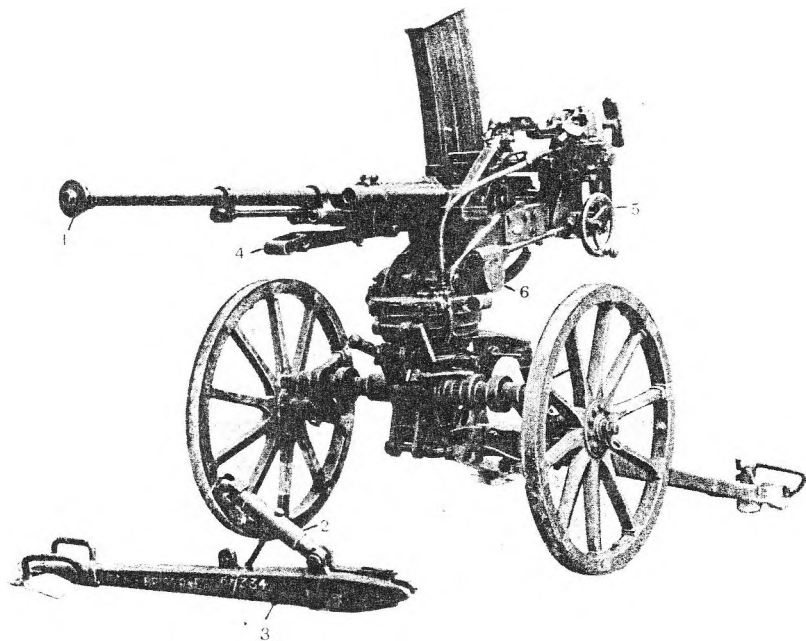


Figure 5. JAPANESE 20 MM A/A - TK/A GUN.



Figure 6. JAPANESE 20 MM. A/A - TK/A GUN.

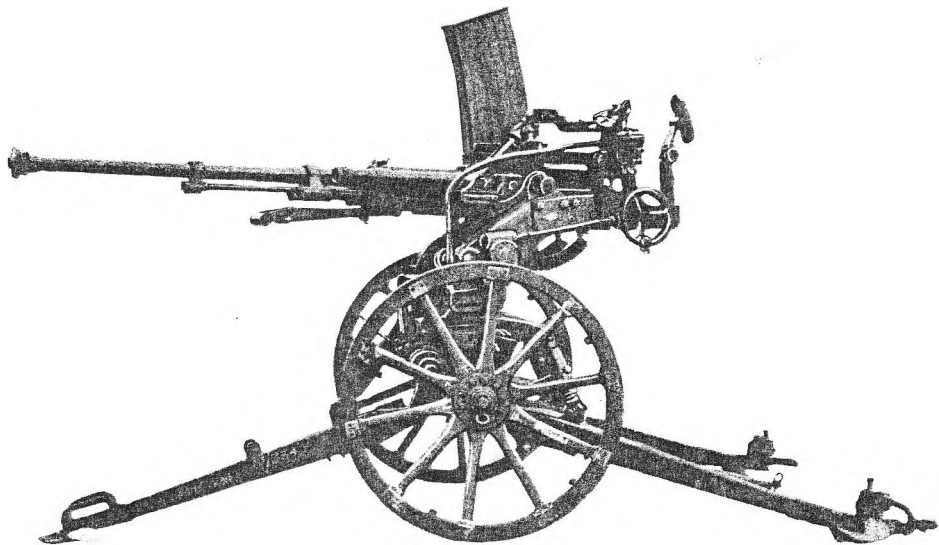


Figure 7. JAPANESE 20 MM. A/A - TK/A GUN.

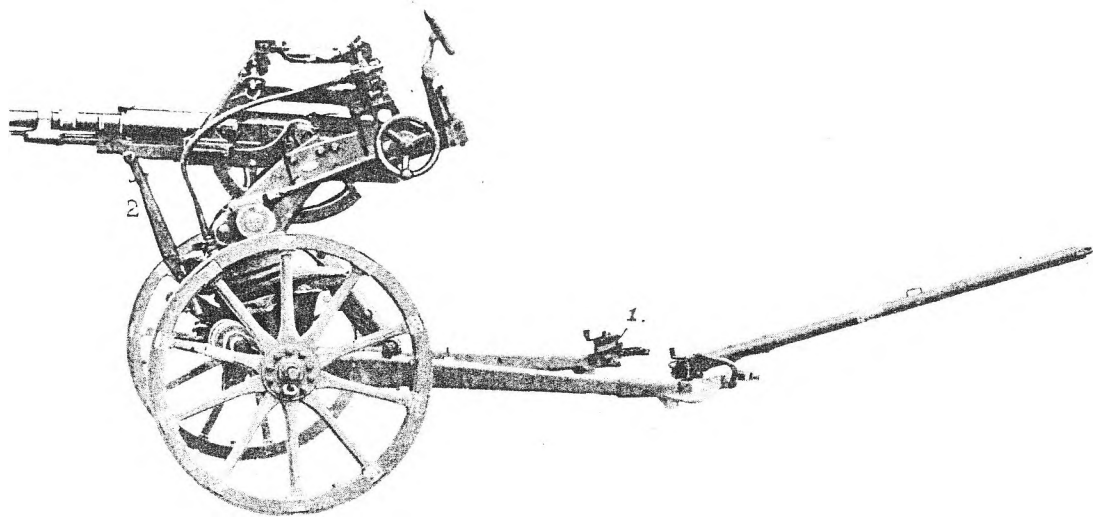


Figure 8. JAPANESE 20 MM. A/A - TK/A GUN.

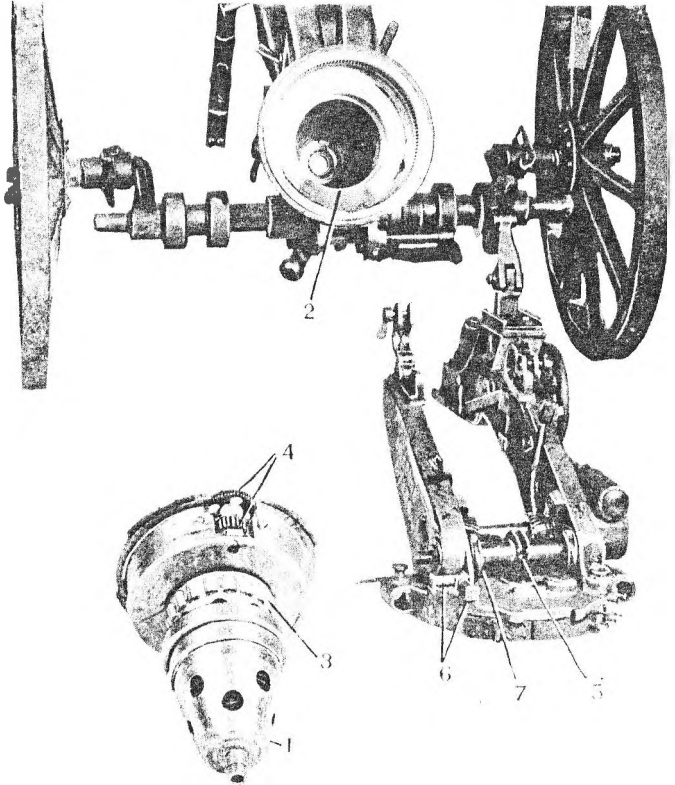


FIG. 9 - JAPANESE 20 MM. A/A - TK/A GUN.

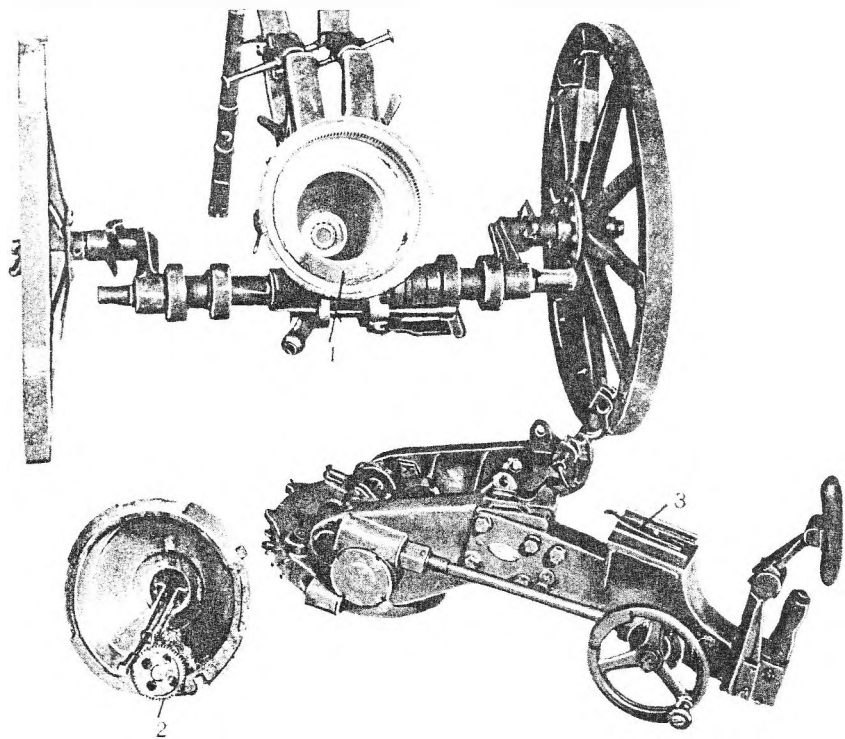


Figure 10. JAPANESE 20 MM. A/A - TR/A GUN.

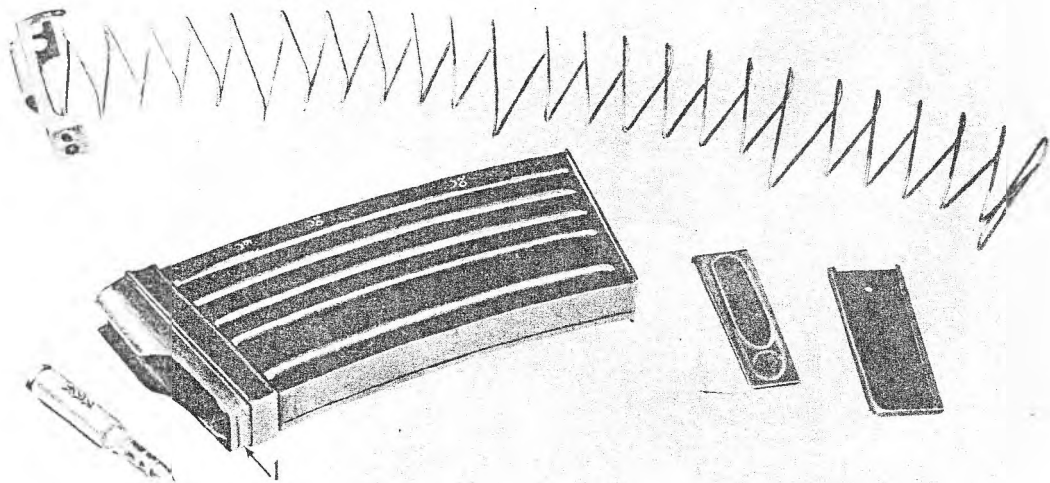
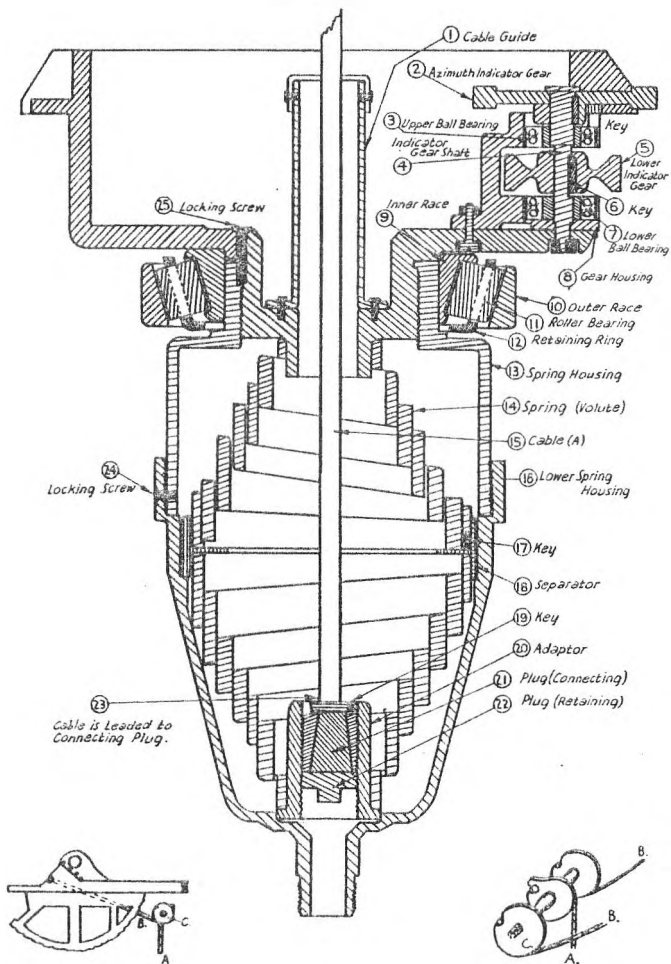


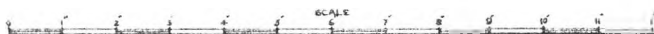
Figure 11. JAPANESE 20 MM. A/A - TE/A CUE.



# EQUILIBRATOR

[JAPANESE 20MM AA/T GUN]

FIGURE 12.



JAPANESE 37 MM Tk/A GUN

1. GENERAL DESCRIPTION.

The standard Tk/A gun of the Japanese Army is the 1935 model, 37 m.m. weapon which, it is believed has been issued down to infantry battalions.

This weapon is of the split trail type of light construction and easily and quickly dismantled for transport.

Traverse and elevation are both gear driven by hand-wheel and free top traverse is not provided.

Breech mechanism is semi-automatic or hand operated, and firing is by link gear from elevating hand-wheel or lanyard from cranked striker arm.

The left side wheel swivels to permit right traverse without fouling of traversing hand-wheel.

A small quickly detachable shield is provided.

2. DIMENSIONS AND WEIGHT.

Carriage

Overall Gun with tail legs closed	304 cms.	(10'-0")
" " " " " " opened	282 "	(9'-3")
Height over shield	103.5 "	(3'-4 $\frac{1}{2}$ ")
Width over stub axles	117 "	(3'-10")
" " tail legs opened	243 "	(8'-0")
Weight (without Barrel and Breech Ring)		653 lbs.

Ordnance

Calibre	37 m.m	
Overall Barrel and Breech Ring	159 cms	(5'-2 $\frac{3}{8}$ ")
Projectile travel	146.5 cms	(4'-9 $\frac{3}{8}$ ")
Number of grooves	12	
Recoil	45 cms	(1'-5 $\frac{7}{8}$ ")
Weight (Barrel, Breech Ring)		159 lbs.
	<u>Total Weight</u>	812 lbs.

3. ORDNANCE.

The barrel, apparently of auto-frettaged construction, tapers from breech ring to muzzle with a pronounced short muzzle swell. Slipper guides are fabricated, integral with barrel, and are located on the underside. Rifling is right handed and has 12 grooves.

The breech ring is box shaped and the breech block is of the horizontal sliding type. Mounted on the top of the breech ring is a spring loaded plunger which bears on a roller arm carried on the top end of the vertical actuating shaft. This spring is compressed when the breech is opened. Also mounted on top of the breech ring and engaging a cam on the actuating shaft immediately below the roller arm is the breech mechanism lever. This lever may be returned to the closed position where it locks and allows the spring loaded roller arm to operate without fouling.

The lower end of the actuating shaft carries a roller arm which on run out engages a cam face (see cradle) which

forces the arm towards the gun centre line and by turning the actuating shaft opens the breech.

The breech block on opening, slides to the left and at the end of its travel engages projections on the extractor levers, forcing them outwards and ejecting the shell case. As the ejectors are forced outwards they engage with landings on the breech block and lock the breech block in the opened position. The insertion of the next shell forces the extractors forward and releases the breech block which closes automatically by the action of the spring loaded actuating shaft.

Mounted on the rear face of the breech ring, a safety lock engages with the breech block and the firing hammer, (see firing gear) and locks the breech in the closed position.

On the underside of the breech ring projections are formed which carry the firing hammer, (see firing gear) and a quick release self locking pin which attaches the ordnance to the recuperator rod (see recoil system).

#### 4. TO DISMANTLE BREECH MECHANISM.

- (a) Open breech fully and lock S/A spring plunger by catch located on right hand side of spring case.
- (b) Partly close breech until scribed lines on actuating shaft and supporting lugs are in line.
- (c) Lift locking plate on extractor pin and turn pin until key is lined with slot. Remove extractor pin and extractors.
- (d) Remove actuating shaft. (Note - a light blow on bottom of actuating shaft where it seats in S/A roller arm may be required).
- (e) Remove breech block.
- (f) Line pin on S/A roller arm with slot in breech ring and remove roller arm.
- (g) Remove safety catch.

Assemble in reverse order.

#### 5. RECOIL SYSTEM.

The recoil system is of the oil buffer and spring recuperator type. Recoil is resisted by both the buffer pressure and recoil spring. Run-out is obtained by the recovery of the spring and is controlled initially by a spring loaded valve on the buffer piston and finally by a control valve with tapered lead on the buffer rod.

The spring case is squared at its rear end, which seats in a mating piece in the cradle and is locked by a quick release cotter pin on the right hand rear of the cradle. The buffer cylinder enters the spring case from the front end and is shouldered externally at its front end to receive the recoil springs which are mounted outside the buffer cylinder.

The rear end of the buffer cylinder is carried in a bushing in the spring case, against the face of which the rear end of the recoil springs seat.

Two recoil springs are provided end to end, one wound right hand and the other left hand and separated by a bronze washer. A collar is screwed into the rear end of the buffer cylinder and is provided with a female square thread. This thread meshes with a shouldered rod which is entered from the rear of the spring case and is palmed and drilled at its rear end to engage with a locking pin on the underside of the breech ring. On assembly this rod is screwed up to place the requisite initial compression in the recoil springs.

The front end of the spring case is provided with a threaded cap which is bored centrally to receive the end of the buffer rod.

The front end of the buffer cylinder is bored and shouldered to receive the packings for the buffer rod. These packings are retained and adjusted by a gland nut which is locked by a locking plate set-screwed to the buffer cylinder.

The buffer piston itself, is of bronze and has fixed parts.

A spring loaded run out valve seats on the rear of the buffer piston and run out is controlled by an adjusting nut which increases or decreases spring compression.

The buffer rod finishes at its rear end with a fine tapered control plunger which operates in a hardened bush retained in the front end of the cylinder housing recoil spring screw.

#### 6. TO DISMANTLE RECOIL SYSTEM.

- (a) Remove locking plate and buffer rod nut from cap to spring case. Remove cap.
- (b) Remove grub screw locking compressor screw to housing. (Reached through opening provided at rear of spring case).
- (c) Unscrew compressor screw and remove.
- (d) Remove recoil springs and buffer cylinder.
- (e) Release locking plate from gland nut and remove nut.
- (f) Remove packings, buffer rod and piston.
- (g) Unscrew grub screw retaining compressor nut housing and remove housing.

Assemble in reverse order.

#### 7. FIRING GEAR.

The firing gear is located in the rear of the breech block and spring retained in a bayonet type seating, and is a simple spring loaded firing pin. To remove the firing pin assembly press forward and rotate through 90°.

On the underside of the breech ring is pivoted a striking hammer and mounted on the left hand end of the shaft actuating is a roller arm.

On the left side rear of the cradle is a spring loaded plunger and block, which when pressed forward is cocked

by locking with a sear. The top surface of the striker block is relieved and houses one end of the actuating arm which is pivoted horizontally on the cradle. The other end of the actuating arm is provided with a roller which is engaged by a projection on the slipper which, on run out, forces the actuating arm round and thus pulling the striker block towards the front, cocks the mechanism. Cocking may be done also by depressing the striking hammer.

The striking hammer is locked in the cocked position by a pin on the underside of the breech block which is released by a guide on the cradle when the gun is fully run out. Thus unless the gun is in the firing position the firing mechanism will not operate.

The sear is tripped by a link mechanism rocker arm connecting to the sliding shaft of the left hand elevating handwheel. A safety lock is also provided on the boss of the elevating handwheel which prevents it from travelling to the rear and operating the firing gear.

#### 8. CRADLE.

The cradle is of a trough section, the front band being semi circular and the rear band circular.

The front band has machined grooves to mate with projections on the spring case of the recoil system, and the rear band is machined inside with a shoulder to receive the rear end of the spring case. The machined shoulder takes the end thrust on recoil.

The front band carries the trunnions.

On either side of the rear band arms extend upwards to support a second elevating gear box on the right hand side.

This elevating gear is handwheel driven, through a worm gear box, the worm wheel shaft of which carries twin pinions which engage with the racks cut on the top of the elevating arc plate.

Also carried on the worm wheel shaft are range drums viewed through windows provided on the rear top face of the gear box.

The operation of the elevating gear arrangement is such that tangential elevation as read from the range drum is put on by the right hand elevating gear. This determines the angle between curved elevating arc plate and the axis of the bore.

Angle of sight is put on by the left hand handwheel which rotates the elevating arc plate and the telescope.

On the left side of the cradle is carried the housing for the spring loaded striker block of the firing gear.

An extension to the rear carries -

- (a) The rocker arm actuated by the slipper which cocks the striker block.
- (b) Machined projection which releases the firing hammer lock on full run out.

(c) Spring loaded S.A. Gear cam.

## 9. SADDLE.

The saddle, of light built up construction, is carried on a pivot pin located on the axletree casing.

The front face of the axletree casing carries the traversing arc provided with machine cut teeth in bronze.

Mounted on the left side of the saddle the traversing handwheel drives into a gear box and by skew gear drive, drives forward through a shaft into the traversing gear box. This box provides worm drive from the connecting shaft then through bevel gears to final pinion driving onto the traversing arc. Traverse is 30° right and left.

Mounted on the top rear of the saddle is a curved plate carrying twin elevating arcs both on its inside and outside faces. This plate slides in slotted guides machined in the saddle cheeks. The curved plate has the trunnions as its centre of curvature. Mounted on the top of the plate is a fixed telescope carrier.

Trunnion bearings are mounted inside the saddle cheeks and are of the hinged cap type. Chain retained locking pins are provided and are entered into bayonet sockets from the outside of the saddle.

Mounted on the left side of the saddle is the elevating gear. This consists of a handwheel driving into a worm gear box. The worm wheel shaft projects through the saddle and carries two pinions meshing with the inside racks of the elevating arc plate.

The elevating handwheel shaft slides in its bearings and operates a rocker arm actuating firing gear (see firing gear).

## 10. TRAIL.

The trail is of the split type with pressed steel wheels. The wheels are fitted with plain bushed bearings and are locked onto stub axles with washers and cotter pins.

The stub axles are carried in underslung cast mountings which engage on square tapers on either end of the axletree. The stub axle mountings are locked on the axletree by a halved cotter pin rotating in the housing. The locking pin operating arm has a spring loaded plunger which holds the pin in the locked or unlocked position.

The left side stub axle is pivoted in its mounting allowing the left wheel to be turned 45° outwards at the rear. This permits right traverse of the piece without fouling the wheel. On the top face of the left stub axle mounting a spring loaded locking arm locks the stub axle in either its normal or pivoted position.

The axletree is pivoted in the centre and surrounded by the axletree casing. The axletree casing is machined each end with slots that engage corresponding slots in the stub axle mountings. These slots act as guides for the up and down movement of the axle due to unevenness of wheel and trail leg ground bearing.

Carried on pivot pins mounted on the rear of the axletree casing are the right and left trail leg stubs. Ratchet type locking pawls lock these stubs in the open position. Segment extensions to the trail leg stubs extend over the top and bottom of the axletree casing and when the legs are in the closed position these segments extend over the joints between axletree casing and stub axle mountings. This locks the axletree assembly for towing purposes.

To receive the trail legs, the trail leg stubs are taper machined inside, and a square hole is machined in the top faces to engage the locking pawls of the trail legs.

The trail legs are rectangular in section and of welded construction. The front ends are provided with a taper machined projection to mate with trail leg stubs. A toggle operated locking pawl draws the legs tight into the taper and is locked by a spring loaded operating arm on the outside of the trail leg.

Box type spades with adjustable spade plates are provided with handspike tee slots. These tee slots are also used for the junction block and towing eye.

A cradle clamp and two handspikes are carried on the right trail leg.

(REPORT BY DESIGN DIVISION  
M.G.O., L.H.Q., AUST.)

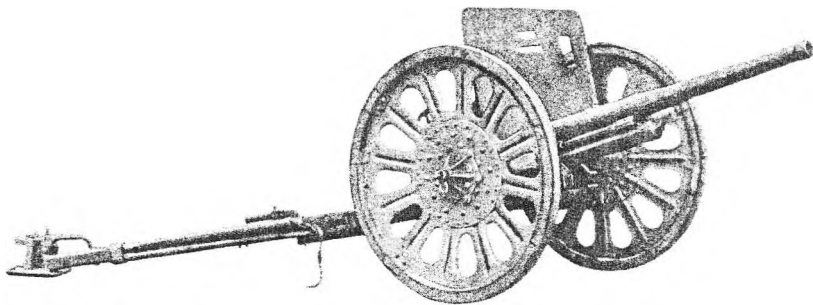


Figure 1. JAPANESE 37 MM TK/A GUN.

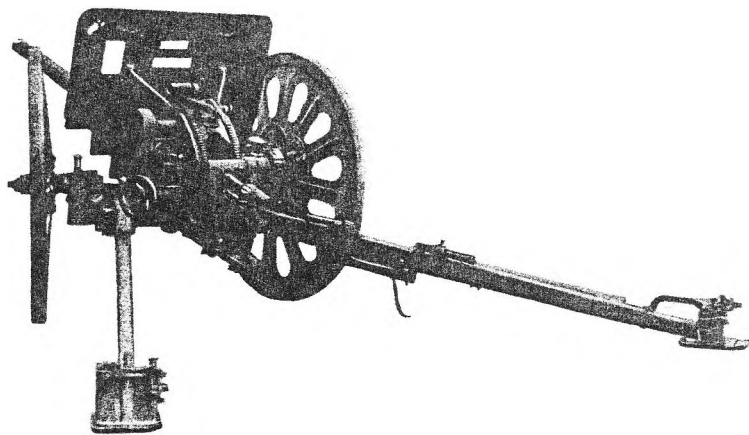


Figure 2. JAPANESE 37 MM. TK/A GUN.

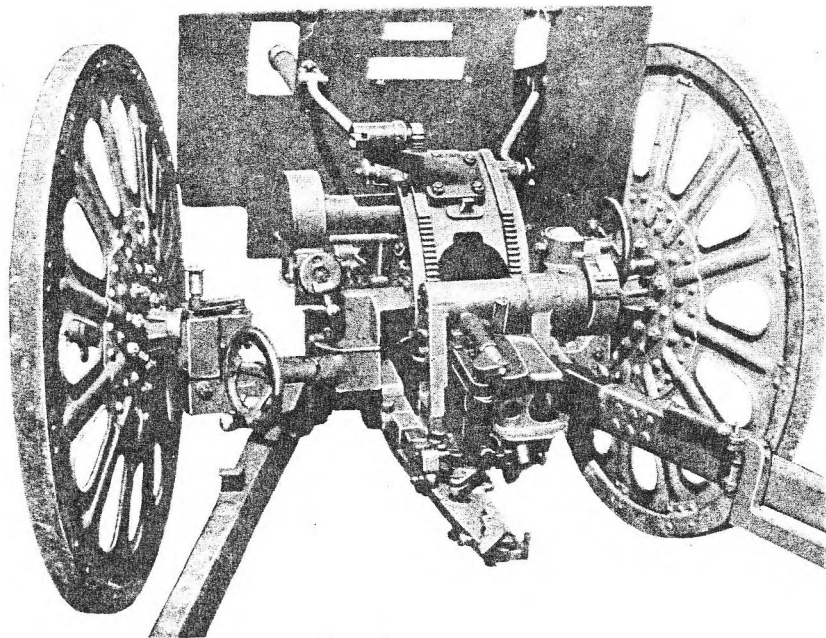


Figure 3. JAPANESE 37 MM. TK/A GUN.

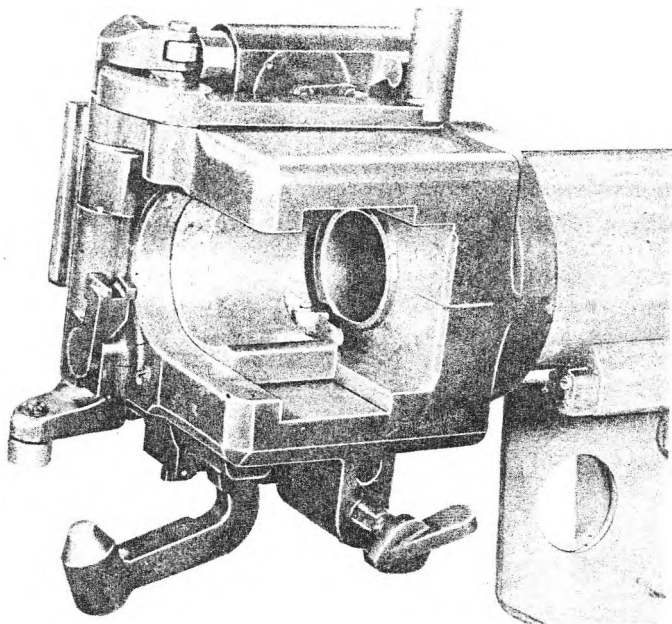


Figure 4. BREECH RING JAPANESE 37 MM. TK/A GUN.

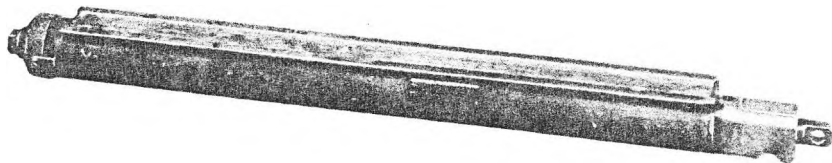


Figure 5. RECUPERATOR JAPANESE 37 MM TK/A GUN.

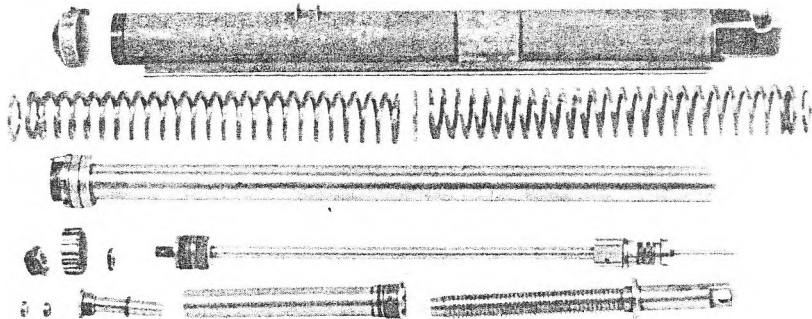
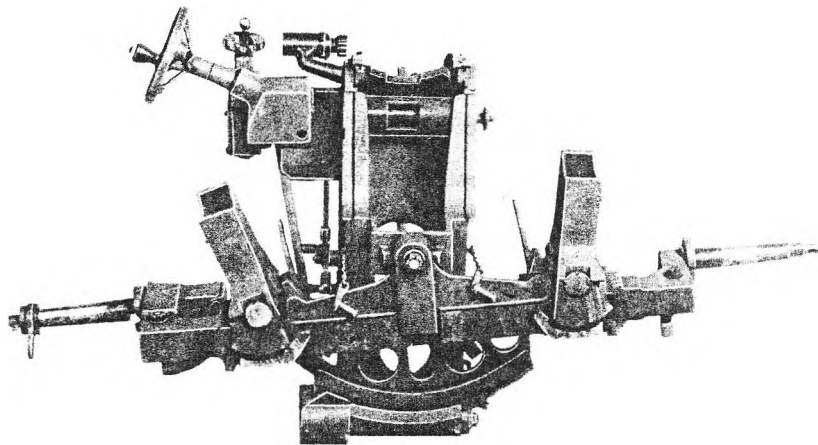


Figure 6. RECUPERATOR COMPONENTS JAPANESE 37 MM. TK/A GUN.



15"

Figure 7. UNDERSIDE AXLETREE AND SADDLE

JAPANESE 37 MM TK/A GUN.

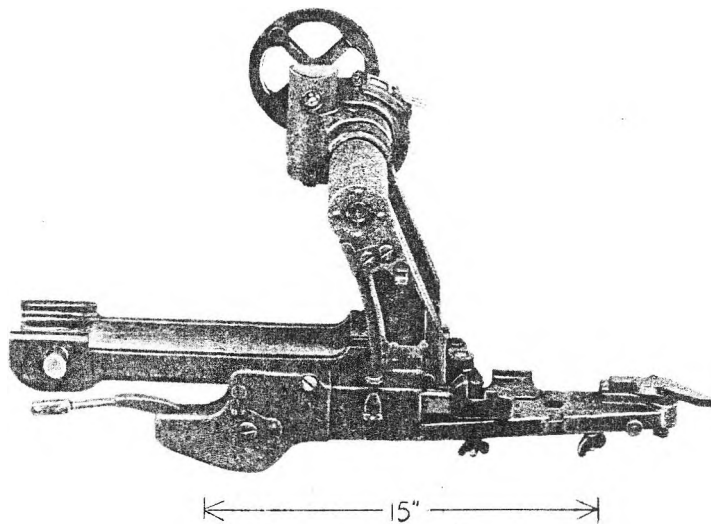
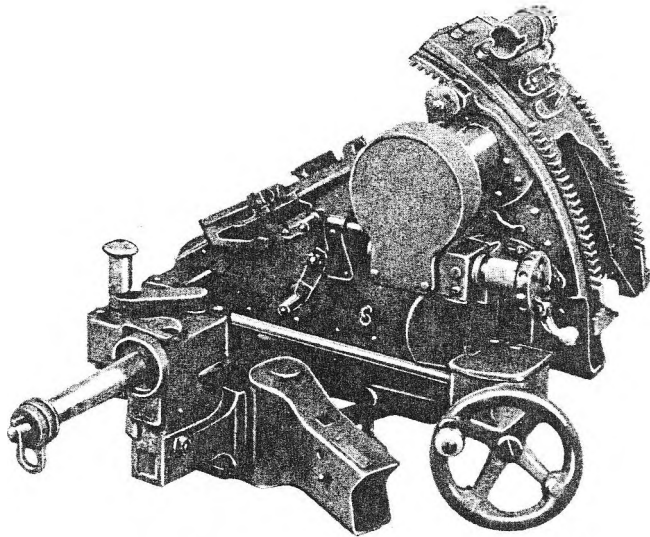


Figure 8. CLIPPER ELEVATING AND S.A.GEAR.  
JAPANESE 37 MM. TK/A GUN.



15"

Figure 9. LEFT SIDE AXLE TREE AND SADDLE

JAPANESE 37 MM. TK/A GUN.

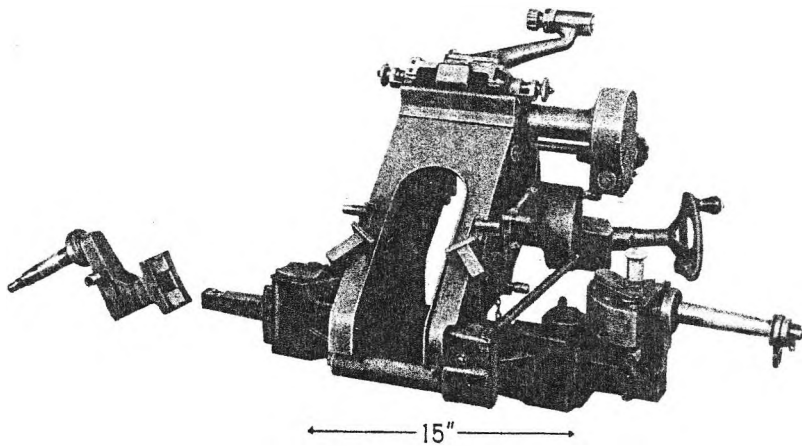


Figure 10. FRONT AXLE TREE AND SADDLE

JAPANESE 37 MM. TK/A GUN.

- CORRECTION -

SOLUTHURN - S.M.G.

The calibre of this weapon was reported in Technical Intelligence Summary No. 1 - Apr. 43 - as being 6.73 m.m. This is a typographical error, and should read 7.63 m.m. (vide - 2 places on page 9).

JAPANESE SERVICE RESPIRATOR

Type 93 No. 2 (Naval)

1. GENERAL.

A respirator of the above type, found in the Solomons, is the heaviest and largest of the Japanese respirators examined to date and consists of the following:-

(a) Facepiece with tube connecting	Weight	504 gm.
(b) Main container with two end plugs	"	998 gm.
(c) Auxiliary container with two end plugs	"	552 gm.
(d) Substitute plug	"	35 gm.
(e) Webbing carrier harness for container	"	14 gm.
(f) Haversack for facepiece	"	197 gm.
(g) Pressed fibre case for complete outfit	"	930 gm.
	<u>TOTAL</u>	<u>3,230 gm.</u>

The complete outfit is shown photographed in Fig. 1 (packed) and Fig. 2 (displayed).

Markings on the respirator are:-

- a. Facepiece (inside chin): The markings refer to date of manufacture - 1941, and the anchor indicates use by naval personnel (see Fig. 3).
- b. Container (top): Translation of these markings is "Type 93 No. 2" (see Fig. 5).
- c. Container (side): Translation of these markings gives year of manufacture - 1941.

2. FACEPIECE.

(a) General. The facepiece is essentially the same as that described in L.H.Q. Tech. Int. Sum. No. 2, (Japanese Respirator - Type 93 No. 3). The main differences are:-

- (i) The harness is entirely of black elastic webbing as against the ribbed rubber strap of type 93 No. 3.
- (ii) The valves have a difference of 0.1" in resistance figures. Comparative figures are as follows:-

<u>TYPE 93 No. 2</u>	<u>TYPE 93 No. 3</u>
Inspiratory Resistance	
0.6"	0.5" for 3 cu.ft./min.
Expiratory Resistance	
0.5"	0.4" " " " "

(b) The Tube Connecting is 21" long as against 17" and has a "clip on" fitting to the container as against a "screw on" fitting for type 93 No. 3. The corrugations are also more widely spaced and have a sharper profile

than in the previously reported respirator.

3. THE CONTAINER (Main) (Figs 4,8,9 & 10)

(a) General

The main container is relatively large and oval in shape (for dimensions see Fig. 4). It is constructed of swaged tin plate lacquered grey - externally and a light brown internally. The container is closed when not in use, by two metal covered caps. The top one fitting internally and the lower being of the bayonet type, closing against a rubber washer. Joints at the top and bottoms and the side seams are soldered.

(b) The filling is placed at the top of the container and is held in position by means of a fixed, perforated, swaged, metal diaphragm and a spring loaded wire gauze. The metal diaphragm is spot soldered to the container body. Above the diaphragm is a swaged dome wire gauze carrying a cotton pad on which the filter rests. The charcoal filling is covered with a cotton pad and then a silk pad stuck to a wire gauze. The gauze is held by four light conical springs secured to it by wires and which press against the container top. The filling consists of a mixture of angular grains of nut shell charcoal (probably coconut) and white granules of soda lime. It covers a cross sectional area of 88 cm<sup>2</sup> to an average depth of 6.4 cm. (Total volume 560 cm<sup>3</sup>, weight 345 gms). The proportions of the mixture are :-

- i. Nutshell charcoal (by weight) 85 %
- ii. Soda Granules (Soda Lime) 15 %

Some properties of the filling are tabulated below :-

	Charcoal	Soda Lime	Mixed Filling	English Charcoal
Weight	393 gms	52 gms	345 gms	-
Moisture Content	15.2	3.0	12.5%	18.5
" Saturation	27.9	-	23.8	27
<u>Tube Tests</u>				
Volume Activity	18.5	-	17.3	16
P.S.	2.0	-	2.1	1.7
Arthur 1% 50% Humidity	-	-	3 Min	50 Min
C.G. " " "	-	-	41 "	40 "
HCN " " "	-	-	15 "	16 "

Grading (B.S.S.)

> 7	2.4
7 - 10	62.7
10 - 14	30.1
14 - 18	4.2
< 18	0.6

The analysis of the Granules shows :-

SiO <sub>2</sub>	11.3 %
Fe <sub>2</sub> O <sub>3</sub> & Al <sub>2</sub> O <sub>3</sub>	8.7
CaO	40.5
Na <sub>2</sub> O	7.9
CO <sub>2</sub>	18.6

(c) The Particulate Filter (Figure 4)

Consists of seven envelopes made from a light coloured paper-like material 1.8 mm thick. The envelopes are joined together by centrally placed aluminium rivets and sealed at the edges by aluminium beading. At the central and edge joints are cardboard spacing pieces. The filter inlet is fixed centrally to the container bottom and the envelopes are held in position by sewn strips of felt. Microscope examination shows that the filter material and the spacing pieces are made from mechanically ground wood pulp fibres (see Fig. 11).

Tests on the Filter show :-

Penetration M.B. (Filter only)	0.08 %
C.P. ( " " )	0.20 %
Resistance 3 Cu.Ft./Min.	1.3"
Gross Filtering area	900 cm <sup>2</sup>
Thickness of paper	0.18 cm
Density - Superficial	0.047 gm/cm <sup>2</sup>
Volume	0.265 gm/cm <sup>3</sup>
Average fibre diam.	5.8 micron
Surface of Fibres	22.5 m <sup>2</sup>
% Voids	80 %
Ash and Filter Material	1.8 %

Particulate Tests on the Main Container show :-

M.B. Penetration	-	0.002 %
C.P.	-	0.02 %
Resistance (3 cu.ft./min)	-	2.2"

Sizing Tests on the Filter Fibres show :-

Diameter (Microns) < 4.0	4.0-7.9	8.0-11.9	12.0-16.0
Frequency %	17.7	75.6	5.5
			1.2

4. THE CONTAINER (Auxiliary) Figs. 12,13,14 & 15.

(a) General

It is understood that the auxiliary container is designed to give protection against Carbon Monoxide. It has the same gross sectional dimensions as the main container but is only 1/3 the length. It is made from tinsplate lacquered externally, grey, and internally, a light brown, has two outward swages running around the body, and all joints are soldered. Holes in the top and bottom are fitted with slots to permit the insertion of clips or plugs or else of a clip on the inlet hole of the main container. It was not possible with the specimen examined to obtain a close fit between the main and the auxiliary cannisters, but whether this is due to distortion of the clip or absence of a special fitting, could not be ascertained. Unless the fitting could be made more secure the filling of the auxiliary container would be of little use under service conditions. A translation of a label attached to the container is :-

1. This will be used only when Carbon Monoxide is present (when explosives blow up and when there is a disaster).

ii. As this container is only efficient for several tens of minutes and due to decrease of efficiency accompanying absorption of moisture, use only on above mentioned occasions. When used in training use the training change stopper.

(b) The Filling occupies an area of 88 cm<sup>2</sup> to a depth of 3 cm, i.e., a volume of 264 cm<sup>3</sup>. It is placed between two cotton pads, one on a fixed perforated piece of tinsplate, the other on a lacquered wire gauze diaphragm to which are attached by fine tie wires, two pairs of conical springs made from a single piece of 21 S.W.G. wire. The filling is homogeneous and consists of angular particles of slightly brownish tinge. The filling of this container absorbs X-rays to a greater extent than does the filling of the main container. Chemical analysis of the filling shows :-

Moisture (110°C)	-	9.7 %
Combined water (200°C)	-	7.2 %
Manganous Oxide	-	43.5 %
Copper Oxide	-	27.1 %
Available Oxygen	-	9.6 %
Ferric & Aluminium Oxides	-	2.2 %
Silica	-	1.2 %
Sulphate & Chloride	-	trace
Bulk density (dry sample)		0.76 gm/cm <sup>3</sup>

The grading B.S.S.

+ 7	7 - 10	10 - 14	14 - 18	- 18
46.1	23.2	21.2	6.5	3.0

From analysis the filling appears to be Hopcalite.

(c) Tests

Tables 1 - 3 show results of the various gas tests made in standard volume activity tubes.

TABLE 1.

Gas	$A_5H_3$	HCN	CO	CO
Concentration (by vol)	1 %	1 %	0.3 %	0.7 %
Humidity %	50%	50%	50%	50%
Breakdown time (min)	270	104	< 1 <sup>x</sup>	< 1 <sup>x</sup>

Note: x - No recovery in 15 minutes.

TABLE 2.

CO tests on filling after drying at 110° for 15 hours  
Concentration 0.3% by volume R.H. = 100%

Conditions of test	Breakdown <sup>x</sup> time to	
	(a) 0.01%	(b) 0.04%
1. Immediately after drying	37 min	58 min
2. After drying air at 100% R.H. through the mixture for 15 min	14 "	20 "
3. After exposing to air at 60% R.H. overnight	< 1 "	< 1 "

TABLE 3.

CO tests on filling dried at 110°C then heated to 200°C for two hours.

Conditions of test	CO% by vol	* Breakdown time to	
		(a) 0.01%	(b) 0.04%
1. Immediately after drying	0.3	87 min	135 min
2. After standing over cacl for 2 days	0.3	45 "	60 "
3. After standing over cacl for 3 days	0.3	25 "	50 "
4. After standing over cacl for 3 days	0.7	169 "	>339 "

Note: \* These are the times required for the effluent gas from the container to reach a concentration of (a) 0.01%, (b) 0.04% CO.

The tables indicate that the Hopcalite as removed from the container gives no protection against carbon monoxide. It can however be regenerated by a suitable drying regime, only to lose its efficiency again on further exposure to moist air. Before drying it is effective against both Arsine and Hydrogen Cyanide. This raises the question whether the Hopcalite is primarily intended to give protection against carbon monoxide or rather against Arsine and Hydrogen Cyanide. The auxiliary container affords some slight amount of particulate protection (carbon penetration 58%) and has a resistance of 0.8" at 3 cu.ft./min.

5. SUBSTITUTE PLUG

This plug is a short cylinder of sheet metal 2½" in diam. and ½" deep, divided transversly into two halves by a perforated plate. The plate is drilled with 24 holes each 5/64" diam. The ends of the substitute plug have fittings into which the two sealing plugs of the auxiliary container can be fitted. (See Fig. 13 for substitute plug with sealing plugs removed). The resistance to an air flow of 3 cu.ft./min is 1.2" which is greater than that of the auxiliary container (0.8") for which it is used as a substitute during training.

6. SHOULDER HARNESS (Fig. 7)

This harness consists of two canvas end pieces fitting over the top and bottom of the container. Two webbing tapes 7/8" wide, are sewn to the upper end piece and arranged so as to pass under the container through slits in the lower end piece; from here the belts pass up through slits in the top end piece and are united with a buckle after passing through a canvas loop on the lower endpiece. It is possible with this arrangement

to attach the container to either the back or front of the body.

7. HAVERSACK (Fig. 2.)

This is designed to hold the facepiece without the container, is made from cotton canvas, and has dimensions 7" long x 8" deep x  $2\frac{3}{4}$ " thick. The flap is closed by knotted tapes. A canvas strap 42" long and  $1\frac{1}{2}$ " wide passes through loops at the back of the haversack, and is fitted with a metal quick release buckle. The haversack contains one patch pocket 3" square. The only markings on the haversack are - II - 2 and the figures 216977.

8. FIBRE CASE (Figs. 1 & 2)

The whole outfit is contained in a grey coloured fibre case with a metal frame  $13\frac{1}{2}$ " x  $9\frac{1}{2}$ " x  $4\frac{1}{2}$ ". Cotton tapes are sewn to metal loops rivetted inside the case to hold the container in position. The case has a metal handle, two metal hinges and two clips. At each end is a fibre holder for a label. Only one label was decipherable and reads :

Type 93 No 2 Respirator

Make two Nagai

216977

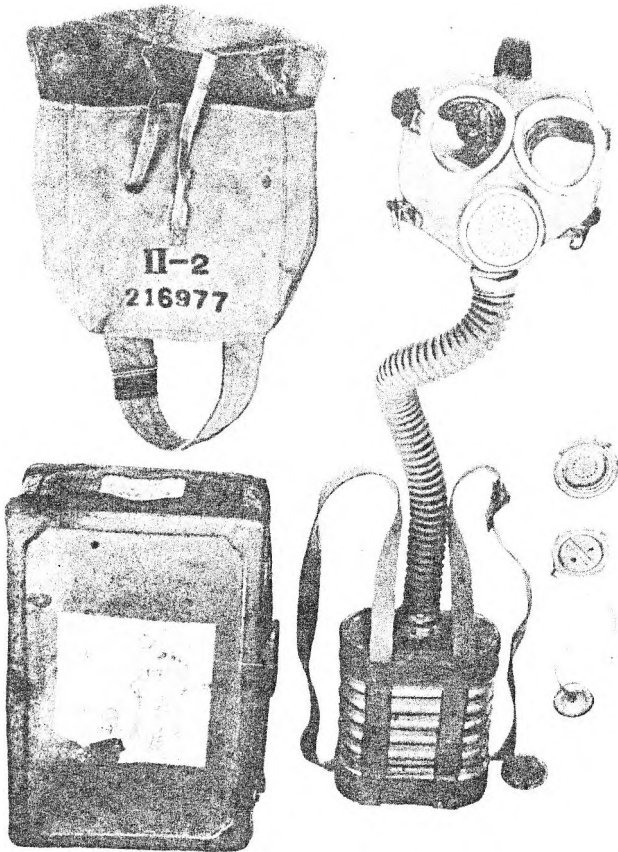
9. CONCLUSION

Everything about this respirator, its weight, fibre case etc. indicate that it is primarily intended for use by ship based personnel. It is unlikely that the poor protection against carbon monoxide is characteristic of the respirator, as this has probably been caused by exposure to tropical conditions. As indicated by the translation of the label, it is recognised that its efficiency is impaired by exposure to moisture.

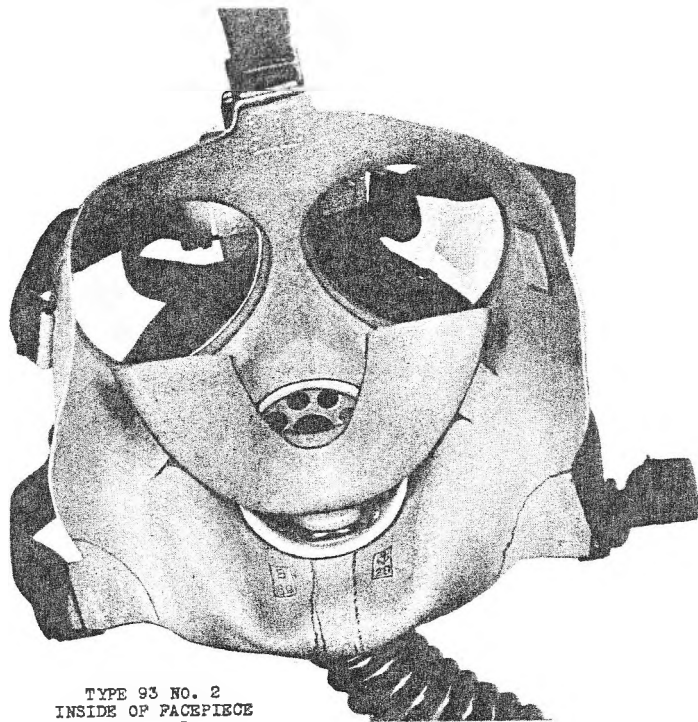
(REPORT BY MUNITIONS SUPPLY  
LABORATORIES, AUST.)



TYPE 93 NO. 2  
OUTFIT PACKED IN CASE  
FIG. 1



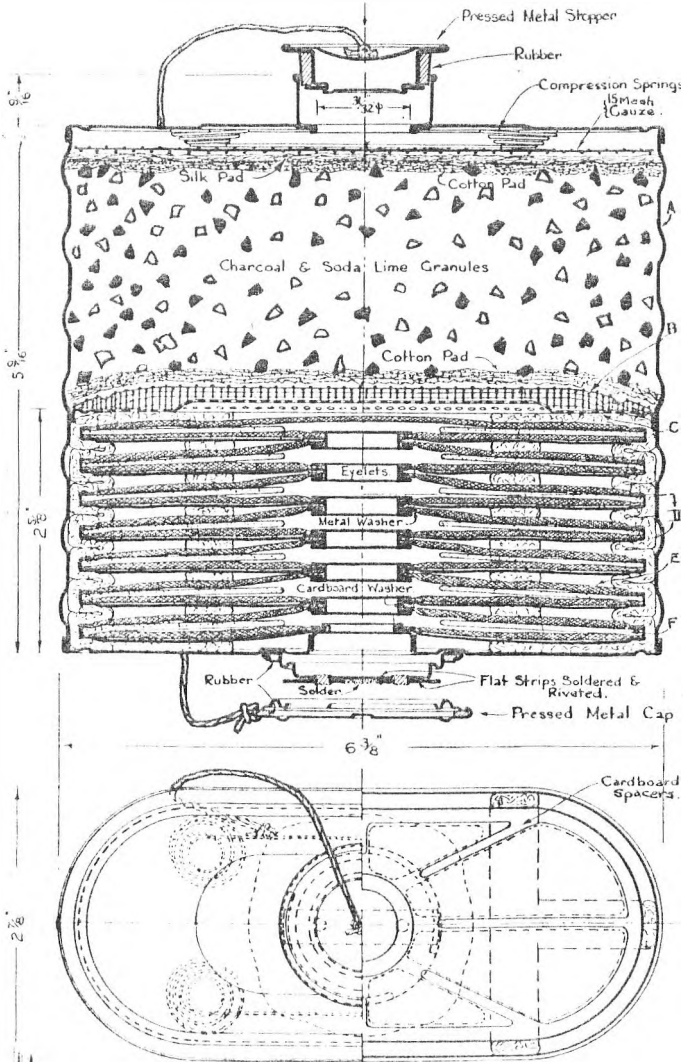
TYPE 93 NO. 2  
OUTFIT REMOVED FROM CASE  
FIG. 2



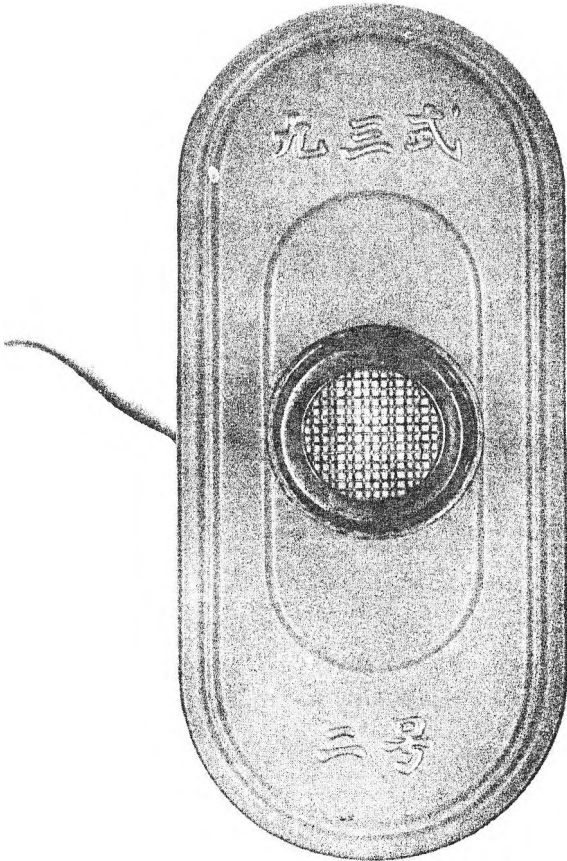
TYPE 93 NO. 2  
INSIDE OF FACEPIECE  
FIG. 3

# JAPANESE RESPIRATOR TYPE 93 No 2

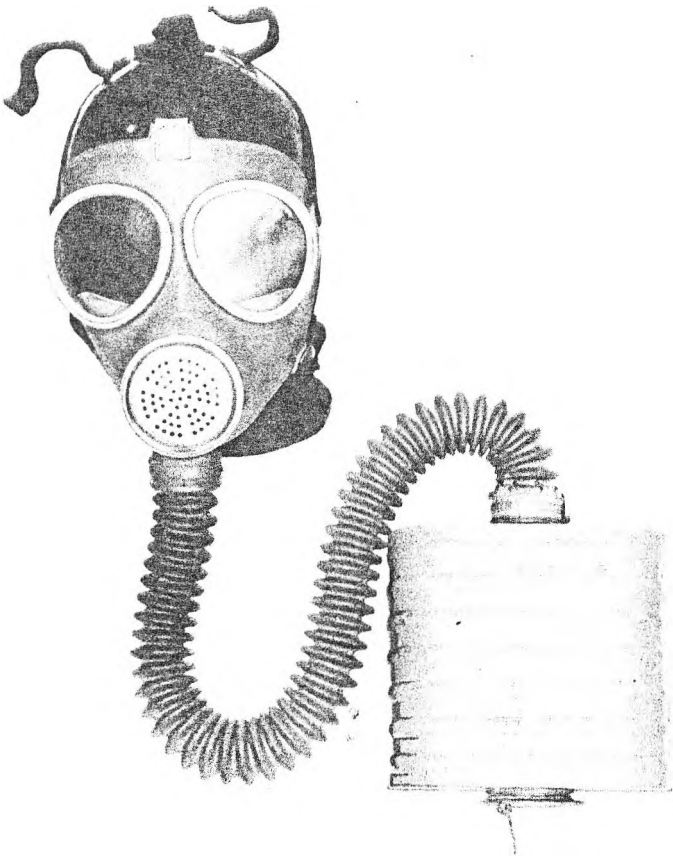
FIG. 4



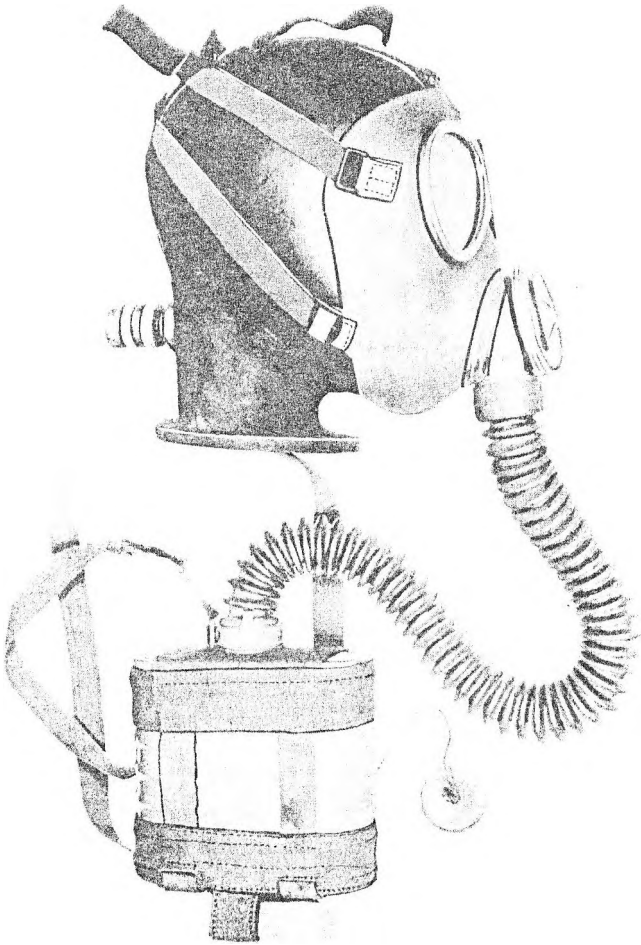
A: 24 SWG. B: GAUZE 15 MESH. C: PERRURATED PLATE,  $\frac{1}{16}$ "  $\phi$  HOLES,  $\frac{1}{8}$ " CEG.  
D: FELT SPACERS. E: CELLULOSE PULP FILTER. F: CARDBOARD SPACERS.



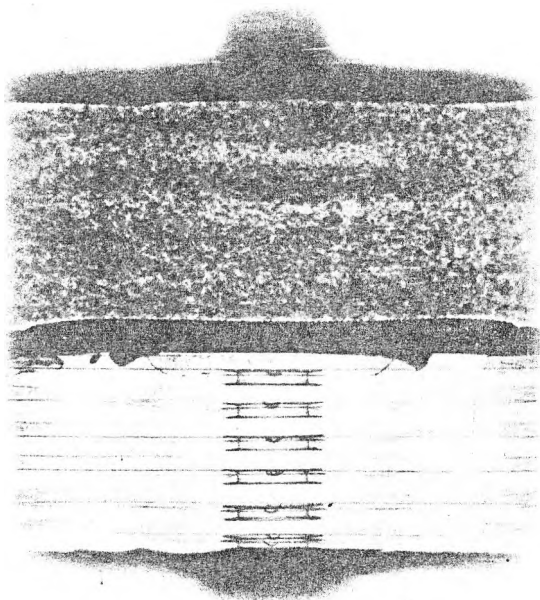
TYPE 93 NO. 2  
CONTAINER TOP  
FIG. 5



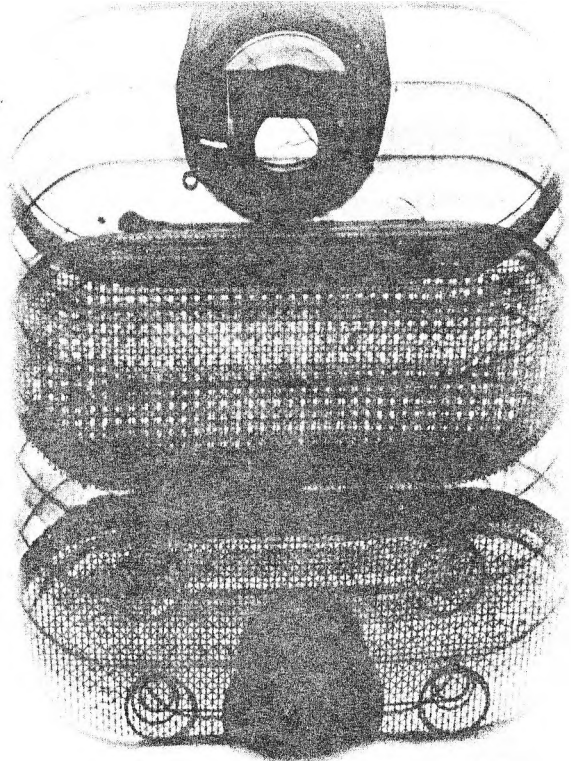
TYPE 93 NO. 2  
FACEPIECE FRONT VIEW  
FIG. 6"



TYPE 93 NO. 2  
SIDE VIEW (WITH SHOULDER HARNESS)  
FIG. 7



TYPE 93 NO. 2  
PRINT OF RADIOGRAPH OF CONTAINER  
FIG. 8



TYPE 93 NO. 2  
PRINT OF RADIOGRAPH OF CONTAINER - DIAGONAL VIEW  
FIG. 9

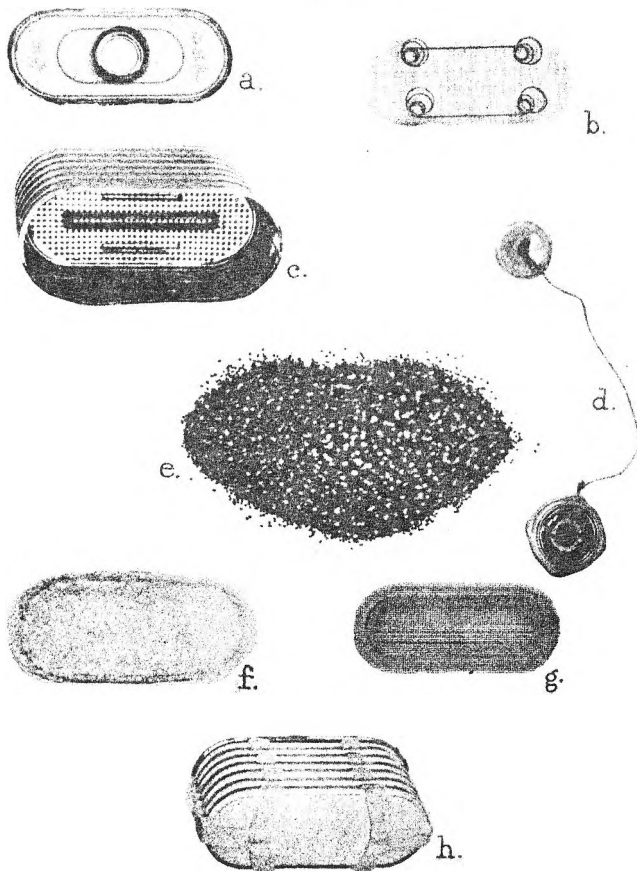
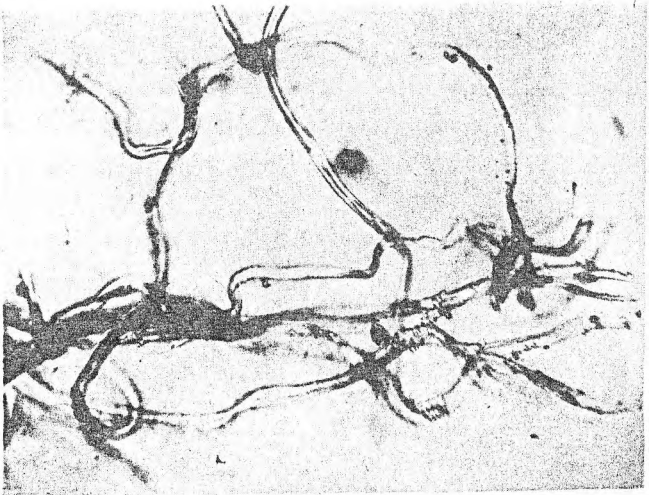


FIG. 10 - JAPANESE RESPIRATOR - TYPE 93 - NO. 2

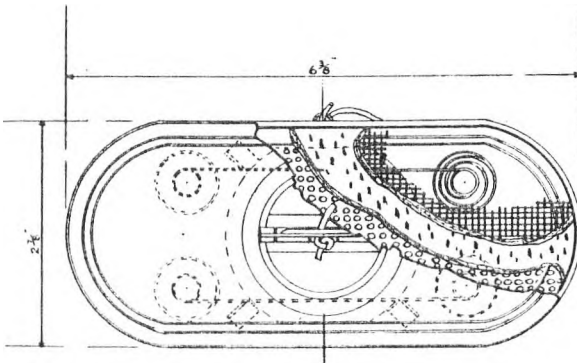
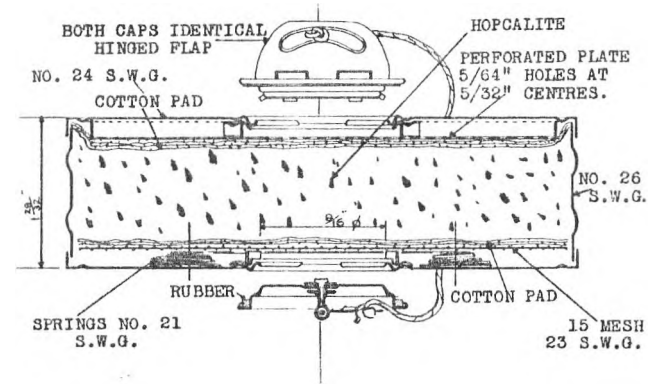
Dismantled Container:-

- (a) Container top.
- (b) Spring loaded diaphragm with silk and cotton pads.
- (c) Container body with swaged perforated diaphragm in position.
- (d) Stoppers - top and bottom.
- (e) Filling - charcoal and soda lime.
- (f) Cotton pad - lower. (g) Swaged domed diaphragm.
- (h) Concertina filter with felt spacers.

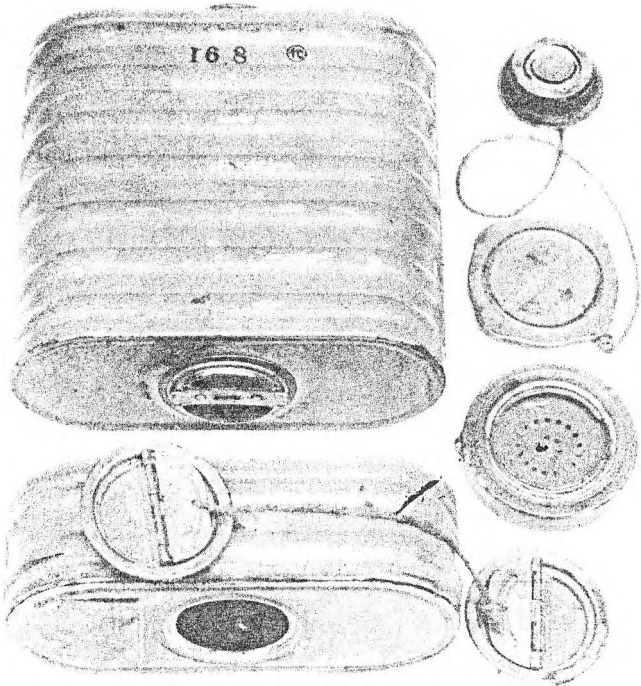


TYPE 93 NO. 2  
MICRO PHOTO OF FIBRES OF PARTICULATE FILTER X350  
FIG. 11

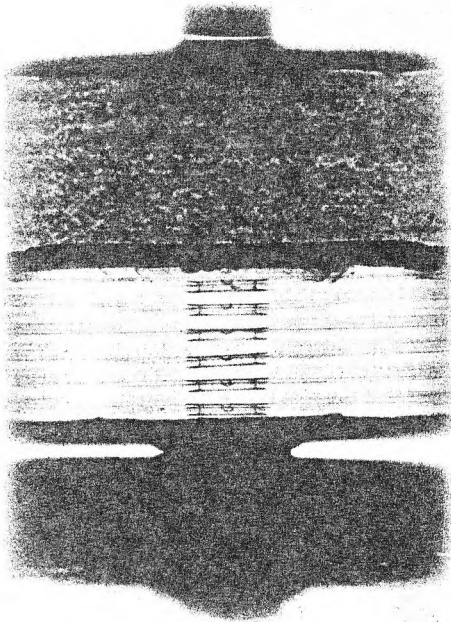
JAPANESE RESPIRATOR



TYPE 93 NO. 2 - AUXILIARY CONTAINER  
FIG. 12



TYPE 93 NO. 2  
MAIN AND AUXILIARY CANNISTERS WITH SUBSTITUTE PLUGS  
FIG. 13



TYPE 93 NO. 2  
RADIOGRAPH OF CONTAINERS - NOTE ABSORPTION IN AUX. CONTAINER  
FIG. 14

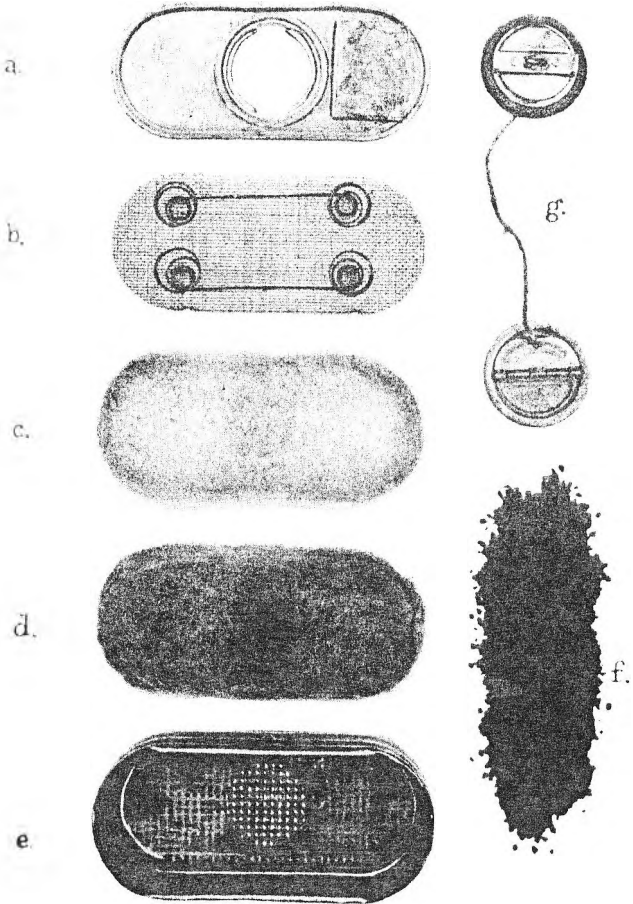


FIG.15 - JAPANESE RESPIRATOR - TYPE 93 - NO. 2

- Components of Auxiliary Container:-
- (a) Bottom lid showing label.
  - (b) Gauze diaphragm with attached springs.
  - (c) - (d) Cotton pad.
  - (e) Body with perforated plate diaphragm.
  - (f) Hopealite filling.
  - (g) Plugs.

JAPANESE SMOKE FLOATS.

1. General.

Two Japanese smoke floats were received for examination, one used and the other apparently unused. Neither was intact, but it would appear that the complete float was constructed from a welded steel drum, divided into two portions; an upper chamber and a lower one containing a C.S.A. mixture. This mixture was forced up a long steel tube fitted with a spraying nozzle. The necessary pressure for ejection appeared to be obtained from the ignition of a charge situated in the top of the upper chamber. This charge was ignited by a detonator. A detachable rubber buoy gave buoyancy to the drum.

2. Description.

The following description refers to Figure 1, which is a drawing of a composite smoke float built up from the two incomplete samples received.

The welded cylindrical drum A of 1/8 inch mild steel plate was divided horizontally into two approximately equal portions by a steel plate, B, 1/16 inch thick, fitting loosely and spot-welded in position. The partition B had three holes 1/8 inch diameter drilled through it; these were equally spaced across a diameter. The lower chamber C contained some 52 lbs. of a C.S.A. smoke mixture; the upper half D served as a pressure chamber. A steel tube E, 7/16 inch internal diameter, passed loosely through a hole in B, and projected nearly to the bottom of the lower chamber C. The bottom of E was closed over and cut off obliquely, and 12 x 1/16 inch diameter vertical holes drilled through. Parallel to and 1/2 inch above the bottom of E, another series of 15 x 1/16 inch holes was drilled. The upper end of E was screwed to take a 1/2 inch steel tube, 22 inches long carrying a spray nozzle F. The nozzle was manufactured from a synthetic resin. It consisted of a plug in which were cut two spiral grooves 3/32 inch x 3/32 inch starting at opposite ends of a diameter. This plug screwed into the nozzle body, which contained a 3/16 inch diameter outlet hole. A detailed sketch is given in Figure 2.

The domed top, and flat bottom of the drum were welded to the body. G served presumably as a filling bung. H was a central hollow steel cylinder 1/8 inch thick, with 4 x 3/16 inch holes drilled in the bottom. Within H was a close fitting thin sheet-metal casing, J. In the used float this casing had been burst open, and in the unused float it was not present. Presumably the casing had contained a slow-burning charge, and a central wick, K, also enclosed in sheet-metal. The top of H was drilled and tapped to take either a 5/8 inch screwed plug, or the firing assembly. The firing mechanism was incomplete, but it would appear to have consisted of a firing plunger with safety pin, a detonator, and a short length of fuse.

A rubber buoy, 12 inch inside diameter and 29-3/4 inch outside diameter, was attached by eight apring clips to rings welded to the side of the drum A. The clips were

joined to the buoy by spliced cords, which were covered with sheet rubber vulcanised to the buoy. The weight of the buoy deflated was 3-1/2 lbs. On inflating the buoy to 20 lbs./sq.in., the smoke float, when full, immersed to a depth of 12 inches; empty, 9 inches. This allowed 2 inch free-board when floating full, measured from the welded joint where the domed top was attached to the body.

The total weight of the smoke float full was 91-1/4 lbs.; empty, 39-1/2 lbs. The weight of the filling was, therefore, 51-3/4 lbs. This represented about 2-1/2 gallons of liquid filling.

On opening bung G and/or tube E, no pressure could be observed, either on mercury or water manometers.

#### Filling.

This consisted of a reddish-brown liquid of the following composition :-

Chlorosulphonic acid	42.7%
Free SO <sub>2</sub>	54.2%
Ash	0.3%
Sulphuric acid (by difference)	2.8%
<u>Total:</u>	<u>100.0%</u>

The viscosity at 20°C was 11.3 centipoises; specific gravity at 20°C, 1.914. No sediment formed on standing. The liquid gave dense white fumes on exposure to the atmosphere.

#### Operation.

The mode of operation of the smoke float was probably as follows :-

After removal of the safety pin, a blow on the plunger P (Figure 1), would explode the detonator and ignite the fuse. This fires wick K, which in turn starts the combustion of the slow-burning charge in J from the bottom. The discharge of the combustion gases through the holes in H would build up pressure in D, to force the C.S.A. mixture up through tube E and spraying nozzle F. The spray so formed upon contact with moist air would produce a dense white smoke of suffocating odour.

The partition B would help to prevent rolling and splashing of the liquid filling, and possibly aid in the more even production of smoke.

# JAP SMOKE FLOAT

NOT TO SCALE

FIGURE 1

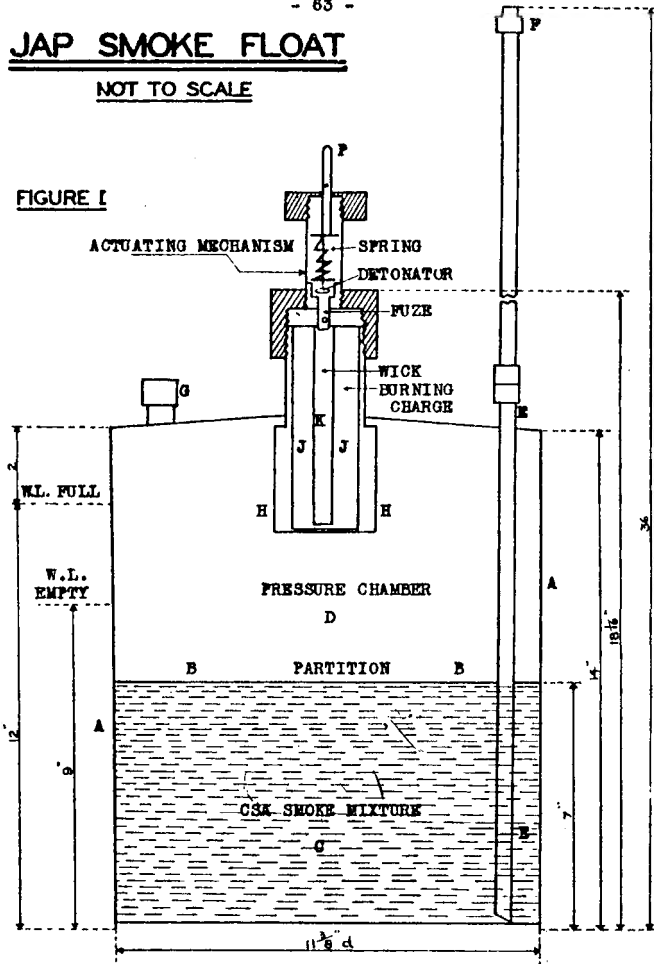
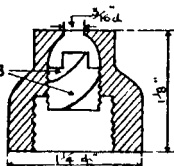


FIGURE 2.

2 SPIRAL GROOVES  
 $3/32"$  x  $5/32"$



DETAIL OF NOZZLE F

JAPANESE TYPE 94 FLOATING SMOKE CANDLE MODEL B

1. General.

Figure 1 shows the Type 94 Floating Smoke Candle, Model B, equipped with ignitor and supporting ring. A rubber tube supports the candle by the two lugs on the supporting ring; however, no tube was captured with the candle.

2. Translation.

(a) A translation of the label on the candle gives the method of operation of the candle. Fig. 11 shows a close-up of the top of the candle showing the fuse in place. A label on the box in which the fuse was packed types the fuse as the "10 year pattern hand grenade time fuse". The fuse is removable. In transporting the candle, the fuse is removed and the "wing-nut" plug is used to seal the candle, while the fuse is carried separately. Diagrams show a sectional view of the candle, and the assembly of the "10 year pattern hand grenade time fuse".

(b) A translation of the label reads as follows :-

"Type 94 Floating Smoke Candle, Model B

Tokyo No 2 Army Arsenal  
Manufactured November, 1941.

- Instructions -

- "1. Make sure the cover plate is satisfactorily fixed.
- "2. Examine the floating belt to see it is sufficiently inflated.
- "3. The waterproof strip on the tube must not be removed.
- "4. When using the candle, hold the candle with the left hand, very carefully remove the safety pin from the fuse and with a wooden mallet hit the head of the fuse firmly. Then it is necessary to point the tube in a direction where the smoke emitted will not be dangerous.
- "5. When using the delayed action ignitor, cut the length of the fuse so that it will burn the required time. After attaching the special ignition point, strike the match head of the ignition point with a scratch block.
- "6. When ignited, immediately throw into water, at which time grasp the upper and lower parts of the floating candle and throw it so that it will be at right angles to the water surface.
- "7. At the first sign of smoking, as there is chance of an explosion if there is a faulty smoke action, it is necessary to keep at least 10 meters away and not to approach until the smoking has finished."

### 3. Ignitor.

The candle is also supplied with a delayed action ignitor. This ignitor is similar in construction to the "10 year pattern hand grenade time fuse", except that the striker and detonator are replaced with a length of ordinary time fuse, which is sealed into the ignitor itself. This ignitor screws into the candle and is used when a delay greater than the 4-7 seconds delay of the hand grenade type fuse is required. A match head in a thin metal tube that slips over the other end of the length of fuse is supplied to ignite the fuse.

### 4. Weights & Fillings.

The candle is of a dark grey color, 792 mm. long and 79 mm. in diameter. The total weight of the candle is 5660 grams and the filling weighs 4910 grams. Table I gives the composition of the main filling; Table II, that of the inner ignitor, and Table III, the composition of the inner match head of the Type 94 Floating Smoke Candle, Model B.

Table I

Main Filling of Type 94 Floating Smoke Candle, Model B

Hexachlorethane	50.0%
Metallic Zinc	23.5%
Zinc Oxide	26.5%
	<hr/>
	100.0%

Table II

Inner Ignitor, Type 94 Floating Smoke Candle, Model B

Potassium Nitrate	55%
Aluminum Powder	17%
Sulfur	23%
Silica	2%
Organic Binder	2%
	<hr/>
	99%

Table III

Inner Match Head, Type 94 Floating Smoke Candle, Model B

Sodium Chromate ( $\text{Na}_2\text{CrO}_4$ )	37.4%
Sulfur	8.3%
Metallic Zinc	14.8%
Metallic Iron	1.6%
Metallic Antimony	
(by difference)	37.9%
	<hr/>
	100.0%

The inner match head is ignited by a point flash from the ignitor in the fuse in the top of the candle over a distance of 58 mm. The inner match head sets off the inner ignitor which in turn ignites the main filling.

Table IV gives the approximate composition of the ignition mixture in the "10 year pattern hand grenade time fuse".

Table IV

Ignition Mixture, "10 Year Pattern Hand Grenade Time Fuse".

Potassium Nitrate	68%
Aluminum and Antimony Powder	25%
Carbon with trace of Silica (by difference)	17%
	<u>100%</u>

(Report by 42nd Chem. Lab. Coy)

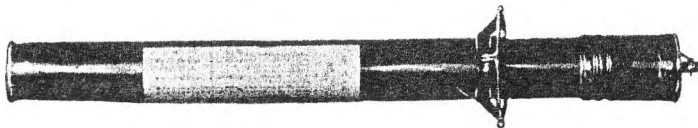


FIG. 1 - JAPANESE FLOATING SMOKE CANDLE TYPE 94 MODEL B.

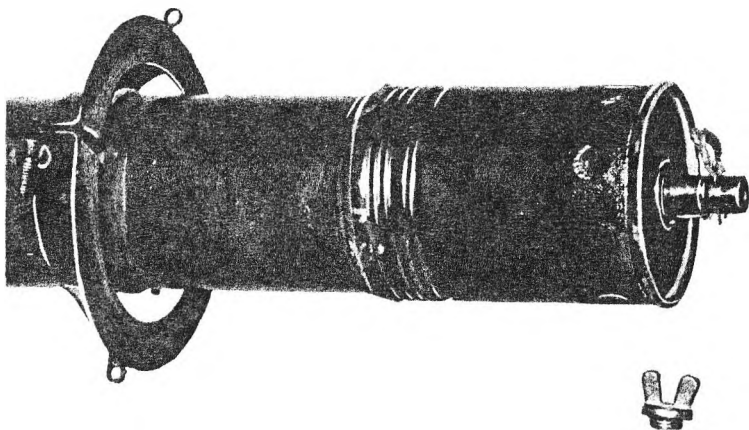
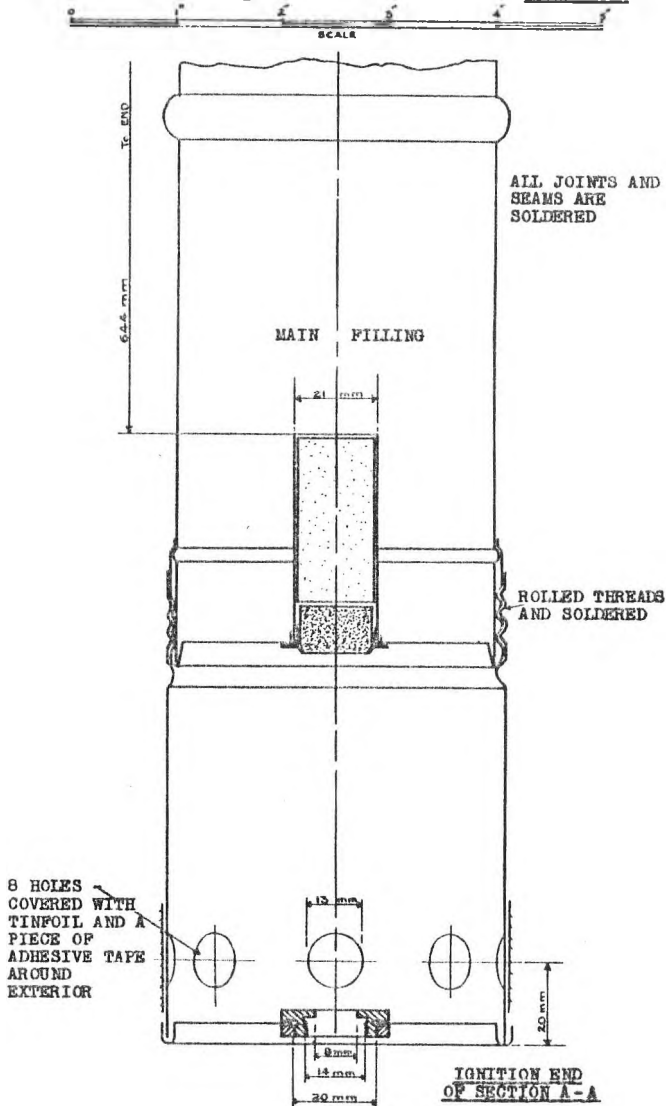


FIG. 2 - JAPANESE FLOATING SMOKE CANDLE TYPE 94 MODEL B.

# JAPANESE FLOATING SMOKE CANDLE

[TYPE 94, MODEL "B"]

FIGURE 3.



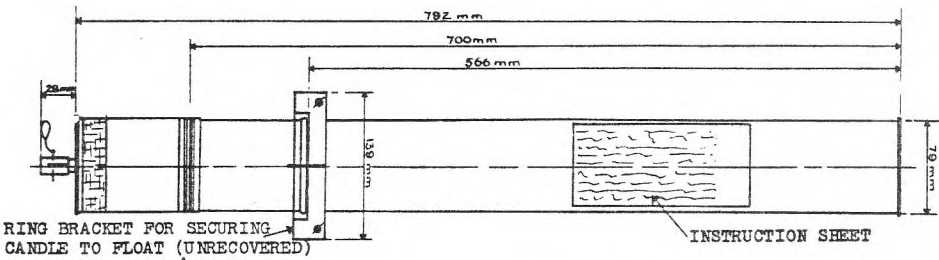
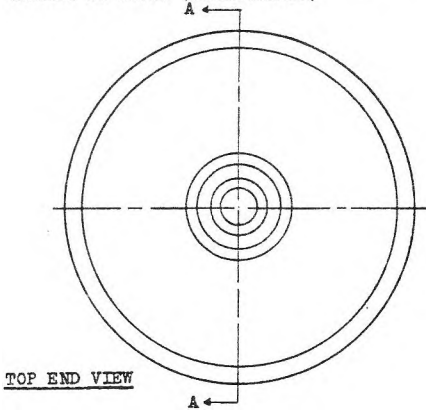


FIGURE 4.

EXTERIOR VIEW



JAPANESE FLOATING SMOKE CANDLE

TYPE 94, MODEL "B"



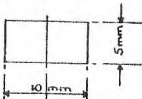
# JAPANESE FUZE - FLOATING SMOKE CANDLE,

TYPE 94, MODEL B.

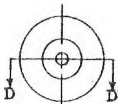
FIGURE 5.



LOWER END



SIDE VIEW

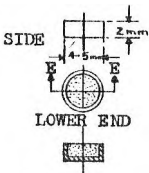


TOP END



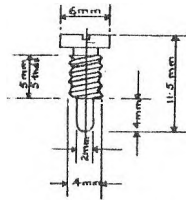
SECTION D-D

DETONATOR PLUG

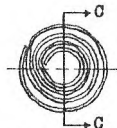


SECTION E-E

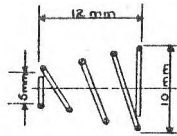
DETONATOR CUP



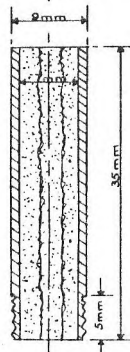
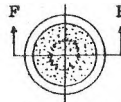
STRIKER SCREW



CREEP SPRING



SECTION C-C



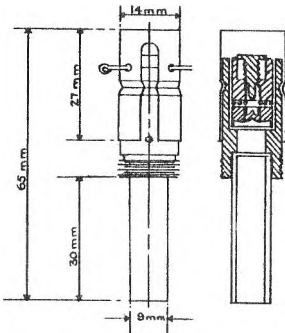
IGNITION TUBE

SECTION F-F

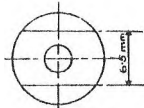


**JAPANESE FUZE**  
**FLOATING SMOKE CANDLE**  
**TYPE 94, MODEL B.**

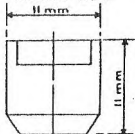
**FIGURE 6.**



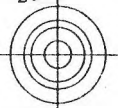
**ASSEMBLED FUZE**  
SCALE



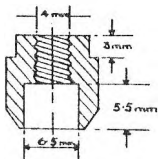
**LOWER END**



**SIDE VIEW**

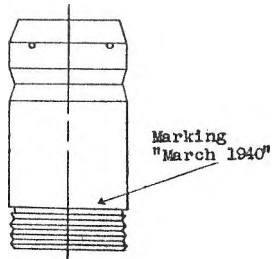


**TOP VIEW**

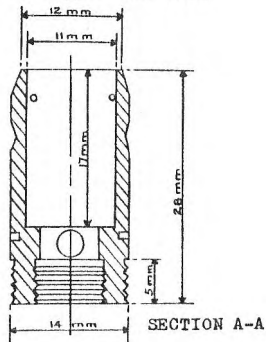
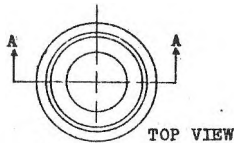


**SECTION B-B**

**STRIKER PLUG**



**SIDE VIEW**



**SECTION A-A**

**BODY**

JAPANESE SMOKE CANDLE, WHITE BAND (UNKNOWN TYPE)

1. GENERAL.

This smoke candle when received for examination was not complete with scratch block and lid as were other candles of similar construction. The candle was 54 mm. in diameter and 176 mm. long (without the top) and was a dark green colour with a 10 mm. white band near the top. Figs. 1 and 2, show the side and top of the candle as received and drawing Fig. 3 shows the construction of the candle. The construction of the candle indicates that it was originally designed to be fitted with a cover.

2. WEIGHT AND FILLINGS.

The candle weighs 946 gms. and was filled with 870 gms. of Berger type smoke mixture of the composition shown below.

TABLE I

SMOKE MIXTURE, WHITE BAND SMOKE CANDLE

Carbon Tetrachloride	44.2%
Metallic Zinc	20.7%
Zinc Oxide	28.6%
Kieselguhr	6.4%
	<u>99.9%</u>

TABLE II

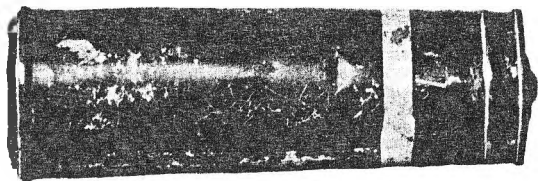
IGNITOR MIXTURE, WHITE BAND SMOKE CANDLE

Potassium Nitrate	42.0%
Barium Nitrate	10.0%
Sulphur	15.0%
Aluminium, Metallic	25.0%
Antimony, Metallic	7.5%
	<u>99.5%</u>

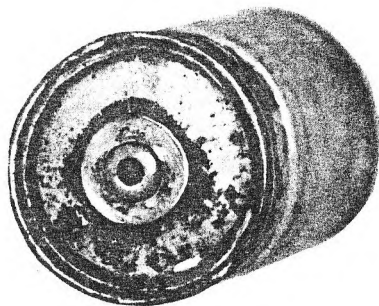
3. ACTION.

The candle is started by scratching the match head with a scratch block (presumably normally in the lid of the candle) which ignites the ignitor mixture (Table II) and thus sets off the smoke mixture.

REPORT BY 42ND CHEM. LAB. COY.



JAPANESE WHITE BAND SMOKE CANDLE - FIG. 1

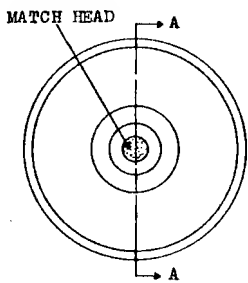


JAPANESE WHITE BAND SMOKE CANDLE - FIG. 2

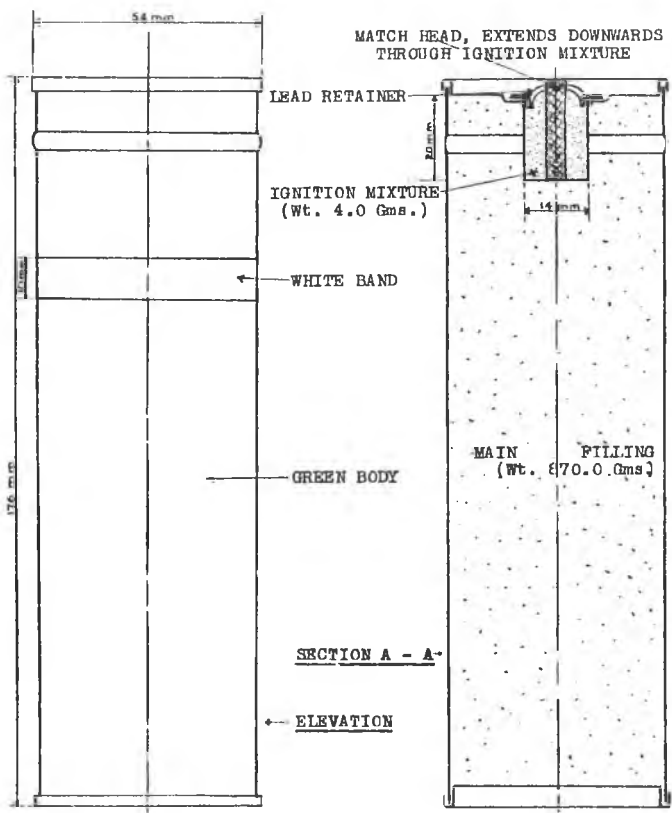
# JAP SMOKE CANDLE

[L1 TYPE]

FIGURE 3.



TOP VIEW - IGNITION END



HYDROCYANIC ACID (HCN)

1. General.

Japanese hydrocyanic acid frangible grenades have been captured in the Asiatic and Southwest Pacific theatres of operations. Instructions found on prisoners indicate that they are to be used in attacking tanks and Pill Boxes. The appended diagram shows a cross-section of such a grenade. It consists essentially of a metal container as protection for a glass flask, the whole weighing 4.6 lbs. The grenade itself is a spherical glass flask  $3\frac{1}{2}$ " in diameter stoppered with a cork and a bottle cap. It weighs 1.2 lbs. It contains approximately 13 ozs of a colorless liquid (HCN) and a small amount of powdered copper. The outer can is  $5\frac{3}{8}$ " high and  $5\frac{1}{2}$ " in diameter, painted olive drab with a  $\frac{3}{4}$ " red band, 3" from the bottom.

2. Physical Properties of hydrocyanic acid.

Boiling point	79.7°F
Melting point	5.0°F
Specific gravity	0.6969 @ 64.4°F
Critical Temperature	217.3°F
Critical Pressure	53.3 atmosphere
Solubility.	Completely soluble in water, alcohol and ether.

HCN, commonly called prussic acid, is a clear colorless liquid. The boiling point (80°F) indicates that on a warm day the liquid would immediately boil off into a gas; however the maximum pressure developed in a container in tropical sunshine is 50 lbs. per square inch.

HCN has a peculiar odor usually compared to that of bitter almonds or crushed peach kernels. It has been said that the substance has an indefinite odor which varies with the degree of its dilution with air and the period of exposure to it. Some persons cannot readily detect the odor, others are supersensitive in this respect. Even in minute quantities it paralyzes the nerves of smell and taste so that after a few seconds in any case, sensitivity to the odor is lost.

Hydrocyanic acid burns with a pale, violet flame. Within certain limits (5.6% to 12.8%), its mixture with air is inflammable.

3. Stability.

HCN without a stabilizer tends to decompose, sometimes with explosive force. It is also unstable to shock. Various agents are used to stabilize the compound. The Japanese use copper powder as a stabilizer in their grenades. Mineral acids and drying agents are sometimes used. Stabilized samples have been stored for twelve years without any decomposition taking place.

4. Detection.

The vapor of HCN is normally invisible but may be seen as a white cloud near the point of release. As has been noted, the detection of HCN by smell varies greatly with the individual. The lower limit usually given is 1

milligram per cubic meter ( $1\text{mg}/\text{m}^3$ ) of air. This is considerably less than the concentration dangerous to man. There are several paper indicators which change color in the presence of HCN. It also can be detected readily by the new U.S. Army Detector set, soon to be issued.

#### 5. Toxic Effect

HCN is a powerful nerve poison. It acts principally on the nerve centers and causes death by paralysis of the central nervous system. It has no irritant effect and does not cause sneezing or coughing. The human body is capable of neutralizing the effects of the gas within certain limits, hence, exposures to low concentrations are not cumulative. Concentrations up to  $30\text{ mg}/\text{m}^3$  are not dangerous but at higher concentrations poisoning is very rapid. Sartori (a recognized authority on C.W.) states that 10 minutes exposure to  $200\text{ mg}/\text{m}^3$  or 30 minutes exposure to  $150\text{ mg}/\text{m}^3$  is fatal.

Breathing weak concentrations of HCN causes a somewhat unpleasant taste in the mouth, dizziness, headache, rush of blood to the head, tightness of the chest and throat, shortness of breath and vomiting. With somewhat stronger concentrations these symptoms are followed by weak and rapid pulse, rapid and shallow breathing, blueness of the lips and face (cyanosis), clammy skin, convulsions, unconsciousness, collapse and death. Breathing of any but weak concentrations is always fatal and generally death is almost instantaneous. There is rarely any occasion for first aid. The poison acts too rapidly. If the concentration has not been enough to kill, the person exposed will probably not require first aid; if the concentration is heavy, first aid will be of no avail.

If death is not instantaneous, however, and symptoms are manifested, treatment must be rapid. The patient should be removed immediately to fresh air, cold applications made on his chest and artificial respiration administered. The patient must be kept warm.

#### 6. Protection

It is difficult to protect against HCN. An excellent respirator and skill in its speedy adjustment is required. High concentrations can easily penetrate a poor mask. Liquid HCN on the skin is dangerous if not immediately wiped off as it is rapidly absorbed. Because of the high toxic effect of this gas it is important, if there is any indication that HCN is being used, to put on the respirator immediately.

The British recommend the following protective action measures:

- a. "If the face is not splashed-stop breathing and adjust the facepiece.
- b. If the face is splashed-stop breathing, wipe the face with the sleeve or handkerchief, adjust facepiece.
- c. If splashed anywhere else on the bare skin after adjusting the facepiece, wipe the place.
- d. If clothing is splashed after adjusting the facepiece remove the garment (the garment will be safe to wear as soon as the smell has almost gone.)

So rapid is the action of the prussic acid that a single breath of it in a high concentration may cause such dizziness and mental confusion that it is impossible to adjust the facepiece. The safest defence will be to anticipate attack and to adjust facepiece whenever there is reason to believe that an attack from ambush with prussic acid may be imminent."

#### Decontamination.

Because this agent is so volatile (non-persistent) no decontamination is necessary. Contaminated foods not protected by covers would be poisonous, but much of it could be salvaged by competent personnel.

#### History and Tactical Use.

Only the French used HCN in the last war. They used a total of 4,000 tons in artillery shell, mostly as Vincennite or Manganite.

Vincennite is a mixture of 50% HCN, 30% arsenic trichloride, 15% stannic chloride and 5% chloroform. The added ingredients are of value as stabilizers or to make the gas heavy enough to stay near the ground.

Manganite is a mixture of HCN with arsenic trichloride (the latter being used as a stabilizer).

Because of its extreme volatility and the fact that its vapor is lighter than air, most authorities believed a lethal concentration of HCN by means of low caliber artillery shell was almost impossible to obtain in the field. The French, on the other hand have claimed good results from their occasional use of it in the first World War. The following quotations from "Conferences sur les Projectiles Speciaux" (Imprimerie Nationale, Paris, 1917.) are typical:

"An attack with 200 75 mm. HCN (No. 4) shell had been made by a group of the A.D... at 21:30 o'clock, July 16, 1916, on the Bois Bieux about 2 kilometers S.S.W. of Murepas. There had been 250 Boches in the woods; 50 were killed in spite of their masks."

"An attack with 500 75 mm., No. 4 shell had been made by a group of the A.D... during the night of October 10 to 11, 1916 on the trench system of the "Unforgettable Grandfather", between the communicating trenches of Cacholot and Cheve. The front of the objective was 150 meters. The method of firing was the greatest possible rapidity. The result of the attack was indicated to us by a German document which fell into our hands: 'All men were killed who did not have their masks suspended from their necks in advance.'"

Another report was made of a bombardment by the 6th Army in which No. 4 (HCN) 75 mm. and probably 155 mm. shells were used. In the words of the author of this report, "the position had been taken by the infantry and they found 500 German corpses with their masks on their faces; a certain number did not appear to be wounded." (Comment: This may be attributable to a delay in adjusting the mask or to the fact that the mask did not provide protection.)

Tactical Use.

HCN was not utilized to its fullest extent in the last War because of lack of appreciation of proper conditions for its effective use.

The Japanese realizing that the two prime requisites for its successful use were high concentration coupled with surprise, made up frangible grenades which could be broken almost without noise in or near confined spaces such as tanks and dugouts. A recent account tells of the capture of some of these grenades on Guadalcanal in an area not suitable for tanks or armored cars and where the strong points of both forces consisted chiefly of pill boxes and dugouts. This would indicate that Japanese tactics call for the use of HCN frangible grenades against such structures and that they are fully prepared to use them.

In addition to the use of frangible grenades filled with this agent large capacity aerial bombs of HCN might be used to obtain a sudden lethal concentration against massed troops or against troops defending a city or other densely populated areas.

(Report by 42nd Chem Lab. Coy., U.S.A.F.P.E.)

JAPANESE FLARE BOMB, TYPE I.

1. Description.

Fig. 1 is a photograph of the flare bomb as received for examination, and Fig. 2 is a sectional sketch from a radiograph showing the complete flare.

The overall length of the flare is  $21\frac{3}{4}$ " and the weight full is 7 lbs.  $\frac{1}{4}$  oz. It is painted chrom yellow, the point being of the nitrocellulose lacquer type.

The flare is of soldered tinplate construction throughout. A lead weight in the nose and a buoyancy chamber in the tail section keep the flare upright in the water.

Internal construction divides the flare into two sections, the nose, itself made up of a hemispherical cap (Fig. 2a), and cylinder (b), and the body (Fig. 2c), having four tail fins and a conical tail (d). In the centre of this conical tail is a cylindrical extension containing the jet and igniting systems (e), covered by a cap (g).

Nose and body fit together and are secured by a tinplate strap soldered round the joint (f). The joint between (a) and (b) is of the same construction.

Two tear-off strips are provided on the flare. One, extending from the nose-end of (c) along (b) and around the nose (a) covers two holes designed for ingress of water, and the other secures the cap (g) to the tail. When these strips are in position the flare is quite watertight.

Inside the nose section (Fig. 2) is a tinplate tube (h) soldered at one end to the lead weight in (a) and closed at the other. A hole drilled through the lead from the extreme end of (a) permits water to enter the tube (h) and pass into the interior of (a) and (b) through small perforations in (h).

The nose is divided into two compartments by a transverse tinplate diaphragm (i) soldered to the walls at four points so as to leave connecting gaps. The diaphragm fits round, and is soldered to, the tube (h). In each compartment is a wire mesh cylinder containing lumps of Calcium Carbide weighing 2 lbs.  $\frac{1}{2}$  oz. in all. A wire mesh disc covers the carbide in each compartment, and in the upper compartment the disc is held down by a rubber washer which grips round the tube (h). A second tinplate diaphragm (j) similar to (i) is soldered to the top of (b).

The nose section, (a) and (b), acts as a generator of acetylene as soon as water comes into contact with the Calcium Carbide.

In the body section (Fig. 2c), is a tinplate cylinder (k) soldered to and protruding through the conical tail (d). A plate (l) soldered to the walls of (c) has a central circular aperture to the edge of which the nose end of (k) is soldered.

It is the space between the cylinder (k) and the body (c) which forms the buoyancy chamber. Two supports (m) and (n) are present inside the chamber.

Inside the cylinder (k) is a second cylinder (o) having a considerably smaller diameter, and closed at the nose end by a tinplate disc through which passes a tube (p). This tube connects to a hole in the wall of (c). The cylinder (o) is supported by two tinplate strips soldered to (l) and is so held centrally in (k). An annular space is thus left between (k) and (o) through which acetylene from the nose may pass.

At the tail end of (o) is a conical extension (q) closed by a shaped metal plate soldered at its edges to the end of cylinder (k) at (r). This plate carries at its edge three jets directed inwards at an angle and connecting to the annular space between (k) and (q), and centrally a wire mesh cylinder (s) containing a few lumps of Calcium Phosphide. Beside (s) and leading through the plate into the interior of (q) is a small-bore tube. Both (s) and this tube are covered by a shaped rubber cup rivetted to the inside of the cup (g).

Beneath the plate, and across the annular space between (q) and (k) is secured a fine wire mesh screen, which acts on the Davy lamp principle and prevents the burning gases flashing back into the flare body.

Three tinplate cylinders containing wire mesh cylinders (u) are held together and supported inside the cylinder (o) by two tinplate strips (l). The ends of these strips are soldered to the inside of the disc closing the nose end of (o). These cylinders are filled with lumps of Calcium Phosphide weighing  $1\frac{1}{2}$  oz. in all. A further small quantity of Calcium Phosphide is present in a wire mesh container (v) lying loose inside (o).

That portion of the tube (p) which is inside (o) is sealed at its end and has three small holes drilled in its side. Water entering the tube (p) is then able to come into contact with the phosphide firstly in (v) and later in the cylinders (u).

The function of the Calcium Phosphide is to evolve impure phosphine after wetting. This gas is spontaneously inflammable in the air and serves to ignite the acetylene.

## 2. Action of Flare.

Removal of the two tear-off strips and the cap (g) uncovers the two holes leading to the tubes (h) and (p), and also the Calcium Phosphide in (s), and the small bore tube leading into (q). On immersion, water enters (h) and (p), wetting the Calcium Carbide and the Calcium Phosphide. The Phosphide in (s) will be instantly wetted and the Phosphine so generated will ignite the acetylene as soon as it emerges from the three jets. The small tube beside (s) will also allow water to pass into the cylinder (o) while the flare is submerged, but it chiefly serves as an outlet for subsequently generated Phosphine. Any excess production of acetylene in the nose will result in increased pressure in the flare which will lower the water level in (h). As the pressure drops, more water will enter the tube, with consequent increase in

production of acetylene. By this means a fairly constant pressure is maintained. The large quantity of Calcium Phosphide in the cylinders (u) is necessary to provide Phosphine during the functioning of the flare so that, if at any stage the acetylene flame should be extinguished, as for instance in a rough sea, it may be instantly reignited.

(REPORT BY MUNITIONS SUPPLY  
LABORATORIES, AUSTR.)

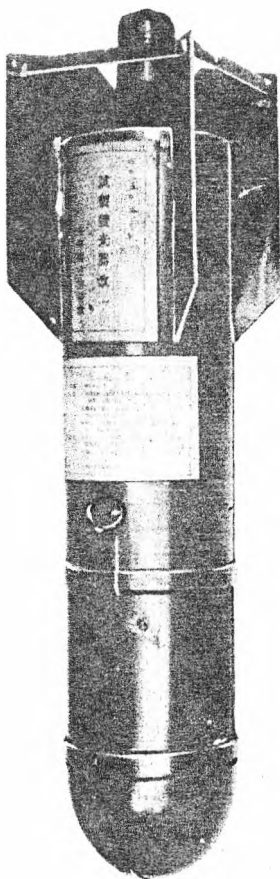


FIG. 1 - JAPANESE FLARE BOMB - TYPE 1

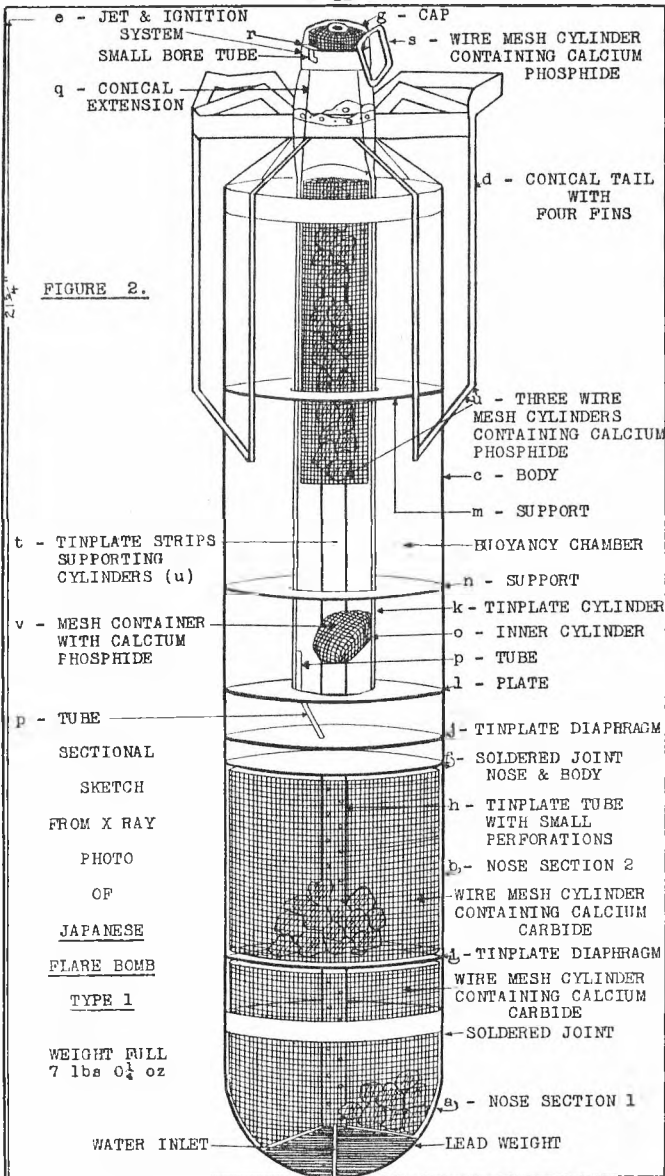


FIGURE 2.

SECTIONAL  
 SKETCH  
 FROM X RAY  
 PHOTO  
 OF  
JAPANESE  
FLARE BOMB  
TYPE 1

WEIGHT ROLL  
 7 lbs 0 1/2 oz

REPORT ON METALLURGICAL EXAMINATION  
OF JAPANESE 37 MM AMMUNITION

1. GENERAL.

Three (3) Japanese 37 mm shells, one (1) high explosive and two (2) armour piercing, have been examined as to method of manufacture and nature of materials employed.

2. HIGH EXPLOSIVE SHELL.

The shell, which carried a yellow painted band  $2\frac{3}{8}$ " from the base, was stamped with the markings shown in Fig 1 attached.

The shell consisted of two portions, namely, the body and a screwed nose insert. The chemical compositions of the steels in these two components were as follows:-

	SHELL BODY	NOSE INSERT
Carbon, per cent	0.55	0.14
Silicon, " "	0.20	0.14
Manganese, " "	0.72	0.26
Chromium, " "	Trace	0.26
Sulphur, " "	0.03	0.07
Phosphorus, " "	0.01	0.07

Both the body and the nose insert had been machined from bar - the macrostructure of the shell is shown in Fig 2. The body had been heat treated by oil quenching and tempering, the hardness being D.P.H. No. 280. The nose insert, hardness D.P.H. No. 130, was in the normalised condition.

The driving band had been made from copper tubing and had been attached to the shell in the usual manner.

3. ARMOUR PIERCING SHELLS.

One of the A.P. shells, with a yellow painted band  $2\frac{1}{4}$ " from the base and a white band forward of the driving band, was stamped with the markings shown in Fig 3. The other shell, with a white band  $1-11/16$ " from the base, was stamped with the markings shown in Fig 4.

The chemical compositions of the steels used in these two shells are shown in the following table:-

	SHELL MARKED WITH TWO BANDS	SHELL MARKED WITH ONE BAND
Carbon, per cent	0.55	0.58
Silicon, " "	0.21	0.16
Manganese, " "	0.74	0.51
Sulphur, " "	0.04	0.03
Phosphorus, " "	0.02	0.01

The cavity in both shell bodies had been formed by piercing followed by machining; very little forging work had been done at the head. (See Fig 5).

Both shells had been oil hardened and tempered throughout followed by surface hardening of the ogival head. The surface hardening, which was approximately  $\frac{1}{4}$ " deep, and extended to a position 2" from the nose, had apparently been carried out by induction heating, probably of low frequency, followed by quenching. The surface hardened zone in one of the shells is shown in Fig 6.

The variation in hardness along the outer surface of the shells is shown graphically in Fig 7. A feature of these curves is the very abrupt drop in surface hardness at the end of the hardened nose section. The hardness of the steel underlying the hardened surface layer ranged between D.P.H. No. 310 and 350, indicating that the steel at this position had reached a temperature exceeding 700°C during induction heating.

#### 4. COMMENTS.

- (a) H.E. Shell. Examination did not reveal any unusual feature in either materials used or method of manufacture.
- (b) A.P. Shells. The A.P. shells showed the following notable features:-
  - (i) the shells had been made from plain carbon steels.
  - (ii) the carbon content of the steel was considerably lower than that of the alloy steels commonly employed for A.P. ammunition.
  - (iii) the surface hardening at the ogival head.

(REPORT BY MUNITIONS SUPPLY LABORATORIES, AUST.)



Figure 1. JAPANESE 37 MM AMMUNITION  
Stamped markings on H.E. Shell.

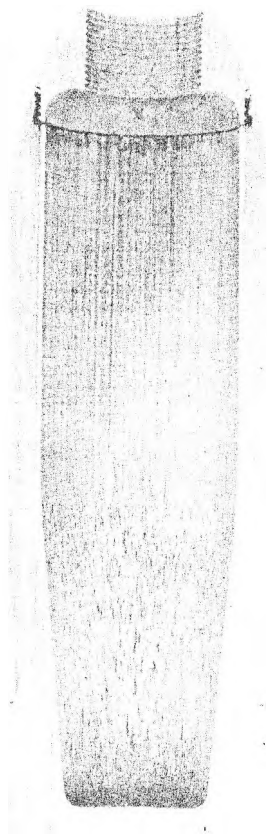


Figure 2. JAPANESE 37 MM AMMUNITION  
Macrostructure of H.E. Shell.

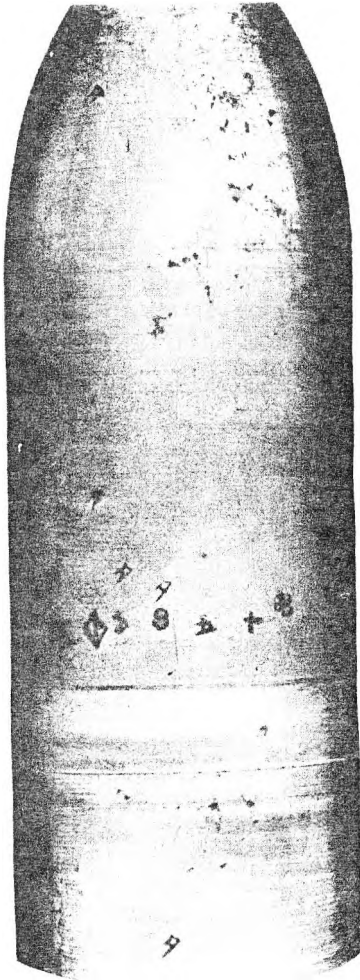


Figure 3. JAPANESE 37 MM AMMUNITION  
Stamped markings on A.P. Shell  
two painted bands.

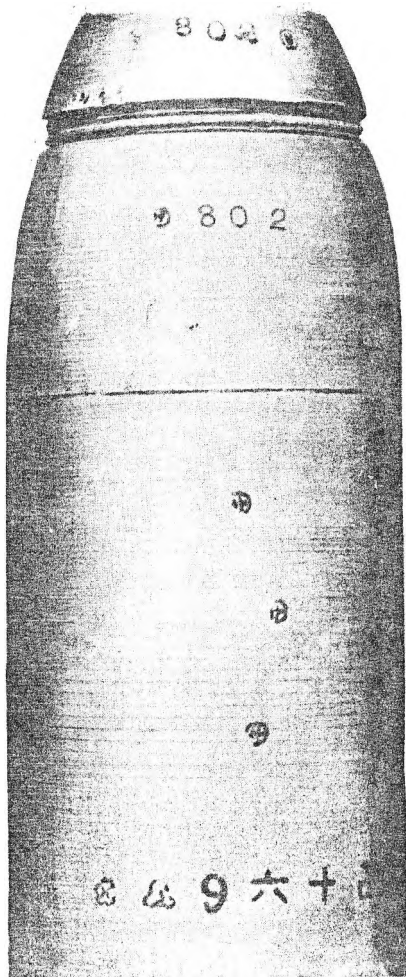


Figure 4. JAPANESE 37 MM AMMUNITION  
Stamped markings on A.P. Shell  
with one painted band.

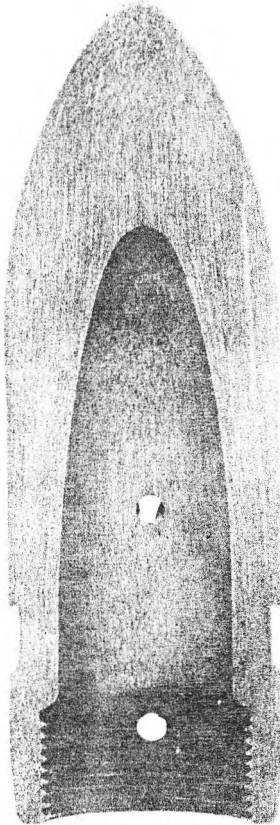


Figure 5. JAPANESE 37 MM AMMUNITION  
Macrostructure of A.P. Shells.

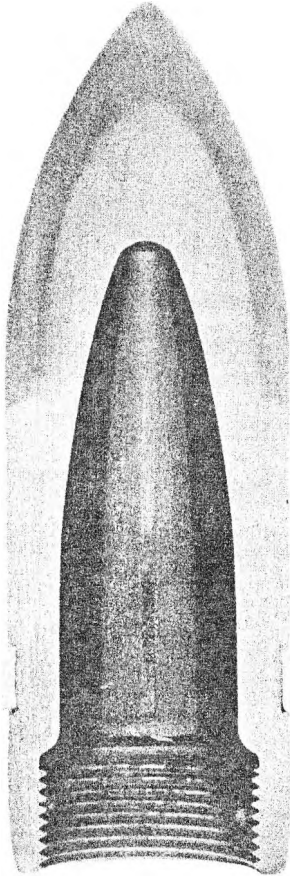


Figure 6. JAPANESE 37 MM AMMUNITION  
A.P Shell showing extent of  
surface hardening.

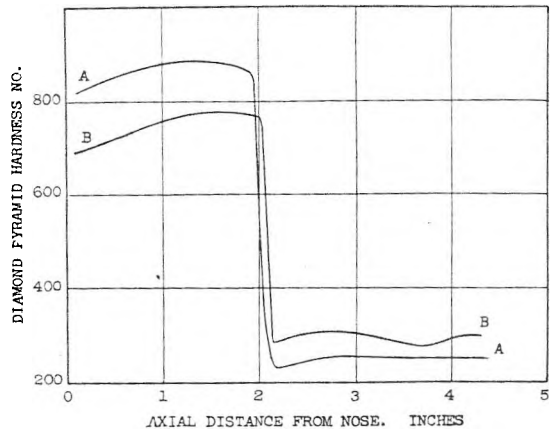


Figure 7.  
JAPANESE 37 MM.  
AMMUNITION.

Graph showing variation of hardness along surface of A.P. shells.

Curve A. Shell marked with two painted bands.

Curve B. Shell marked with one painted band.

ADVANCE INFORMATION ON NEW TYPE HE AND  
INCENDIARY BOMB - JAPANESE. 250 Kg approx.

1. General Details.

Overall length .....	5'9"
Diameter of body .....	12"
Wall thickness .....	7/32"
Total weight .....	250 Kg (approx).
Main filling .....	(H.E. and 750 (approx) (incendiary cylinders.
Colour .....	Light Grey.
Markings .....	(Red band on tail. (6" silver band on end of nose.)

2. Use.

Due to "Air burst", and propulsion by H.E. charge, incendiary cylinders are showered over a comparatively large area. Likely targets would be grounded aircraft, aerodrome installations, Army dumps, and built on areas. Known radius of action of the incendiary cylinders was 176 yards.

3. Description.

The body is made up in three separate parts :-

(a) The barrel, which is a 12" dia. steel tube 7/32" thickness, having holes drilled at the rear end to receive 40 studs for connection to the tail unit, and a suspension lug rivetted at the point of balance. Contained in the barrel are ten layers of incendiary cylinders stacked on end and separated by perforated celluloid trays, the whole being retained in the barrel by fore and aft perforated steel closing discs, each of 3/16" thickness and having 25 in No. 13/16" dia. holes in same.

(b) A Cast Steel Nose, having a threaded opening at the forward end to receive an A.3(A) fuze, the rear end being machined down to form a spigot over which the barrel is fitted and the joint welded externally. There is an internal machined recess into which fits the front perforated steel closing disc. Two trays of cylinders extend into the nose piece. Forward of this closing disc is housed a H.E. charge surrounding the gaine of the nose fuze.

(c) A conical shaped Tail Unit, of 3/16" thickness steel, to which is welded a cast steel insert which connects the tail unit to the barrel by means of 40 studs. At the apex of the cone is welded a tail fuze adaptor. Welded to the sides of the cone are 4 tail fins 1/16" thickness having a cylindrical stabilising band and a perforated steel closing plate. Also welded to the cone are four smaller subsidiary tail fins interspaced between the normal fins and positioned closer to the barrel of the bomb. Information concerning the contents of the tail unit is not yet available, but it is almost certain that the space is fully occupied by H.E. filling.

4. Filling.

Incendiary.

(a) The incendiary filling consists of approximately 750 incendiary cylinders. These are pieces of  $1\frac{1}{2}$ " ext. dia. m.s. tubing of  $\frac{3}{8}$ " wall thickness and of length  $2\frac{3}{4}$ " filled with what is suspected to be a mixture of rubber impregnated with phosphorous and electron fillings. These incendiary cylinders are arranged in ten layers, each layer being separated by a perforated celluloid tray. At present, the method of igniting these cylinders is speculative, suggested methods being outlined in para 7 headed "ACTION". The trays of incendiary cylinders are held in position by a top and bottom perforated steel closing disc as described in para 3a.

H.E.

(b) The type of H.E. filling used is not known at present. It is assumed to fully occupy the spaces indicated in the nose and tail of the bomb.

5. Fuzing.

(a) A tail fuze, which is screwed into the threaded adaptor welded to the tail cone. The fuze is described as incorporating clockwork mechanism, and is designed to achieve an air burst 150' to 200' above the ground. It has a delicately balanced striker, which would respond to a slight jar in the case of a U X B. Arming vanes are incorporated in the fuze.

(b) A Nose Fuze type A.3(A), its probable purpose, if fitted with an instantaneous type gaine, being to detonate the bomb on impact should the tail fuze fail to function as intended. See para 6.c. for suggested additional reason for fitting of a nose fuze.

6. Action.

(a) Normally these bombs burst at a height of 150' to 200' above the ground, so that presumably the tail fuze is capable of being timed to operate in accordance with the proposed height of release of the bombs.

When the tail fuze functions as above, the H.E filling detonates, bursting the bomb and showering the area beneath with incendiary cylinders. The method of igniting the cylinders is not known, but two suggested methods are as follows :-

(i) Heat and flash resultant upon detonation of H.E. has an unimpeded passage through the perforated closing discs, tray openings and spaces between cylinders. The celluloid tray, which is highly inflammable, aids ignition.

(ii) The cylinders may be provided with short lengths of fuze which are ignited simultaneously in the bomb. (US Navy Bomb Disposal Intelligence Bulletin No. 21 describes a Japanese H.E. incendiary naval projectile which contains about 200 incendiary cylinders of the same type as herein described, but having a short length of safety fuze attached to each cylinder. It is stated that as the main charge detonates, the safety fuzes of the incendiaries are set afire).

The incendiary cylinders are propelled with great force, cylinders striking the ground side on penetrating hard earth to a depth of 4". They burn fiercely for about 65 secs., the steel attaining a red heat and charring wood 4 minutes after ignition has taken place. Very few cylinders were found unburnt. Cylinders were found as far as 176 yards away from point over which bomb had burst.

(b) The elaborate tail assembly is probably designed to achieve the following results :-

(1) Perforated Closing Plate: To reduce speed of bomb flight and so limit penetration, and to produce a scattering effect to a number of bombs released simultaneously from an aircraft.

(ii) Small subsidiary tail fins: To direct a flow of air towards the arming vanes of the tail fuze or to compensate for lightness of tail fin construction.

(c) (i) Of 4 bombs released from an altitude of 20,000 to 26,000' in one area, 3 burst at heights of 150' to 200' above the target, but one penetrated the ground to a depth of 3' before detonating. Apparently this bomb was one in which the tail fuze failed to operate as intended, detonation being caused by the nose fuze functioning on impact with the ground. (refer to para 5b "Fuzing").

(ii) Information furnished by US Navy Bomb Disposal Intelligence Bulletin No. 21 in relation to the Japanese naval HE and incendiary projectile previously referred to, states that incendiary cylinders were scattered over a wide area with terrific force, some piercing as many as 3 bulkheads of a ship and starting fires up to a 40' radius from the explosion. Some shells fired landed short but exploded on impact with the water, showering the ship with incendiaries. Other shells passed as far as 30' through the ship before detonating. Some incendiary cylinders penetrated into and started fires in extremely inaccessible places.

In the light of (ii) above, it is possible that the nose fuze is fitted for an additional reason to that already suggested, because if incorporating a slight delay type of gain the bomb would be suitably fuzed for such targets as shipping and multi-storied buildings, where penetration before explosion, with consequent driving of incendiaries into inaccessible places, is desired.

## 7. Disposal.

Where a UXB occurs: The TAIL FUZE, (see para 5a.), described as being of clockwork type, and incorporating a delicately balanced striker, will most likely, be in an EXTREMELY SENSITIVE condition, and readily susceptible to a slight jar or movement of the bomb.

Until further information is available the method of rendering this fuze safe cannot be given, but a technical instruction covering the matter will be issued as soon as possible.

(Report by E. in C. L.H.Q. AUST.)

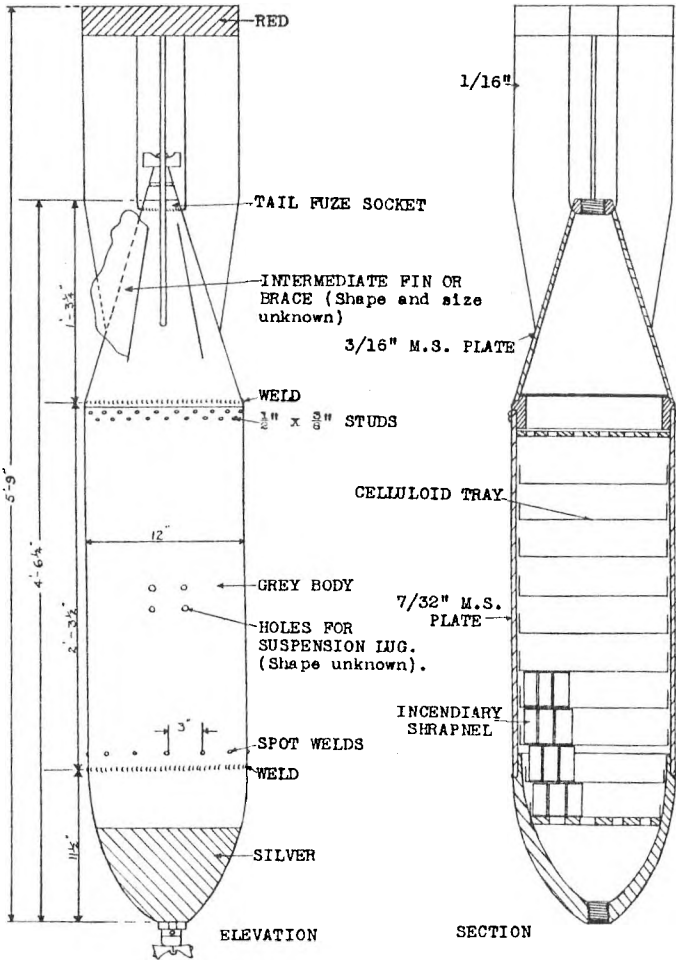
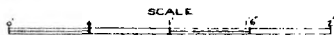
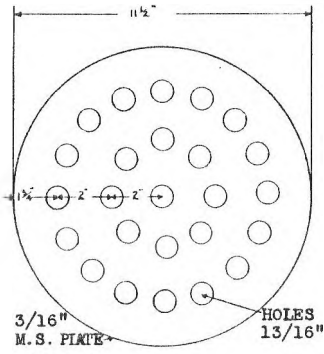


FIGURE I.

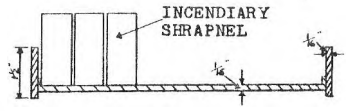
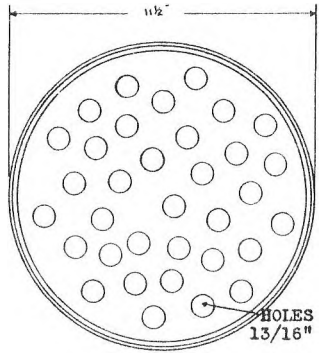
**NEW TYPE  
H.E. & INCENDIARY  
BOMB**

**250 KG. (APPROX)**





TOP COVER PLATE

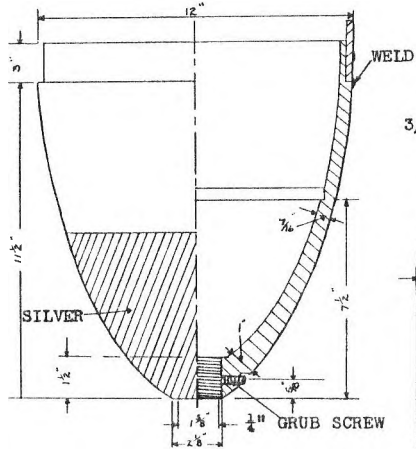


CELLULOID TRAY

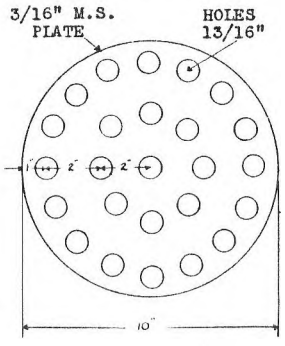
**FIGURE 2.**  
**NEW TYPE**  
**H.E. & INCENDIARY**  
**BOMB**  
**250 KG. (APPROX)**



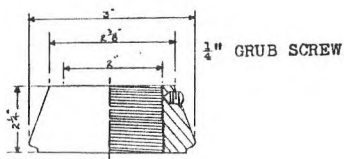
NOSE



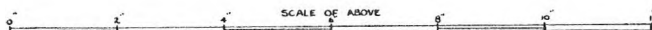
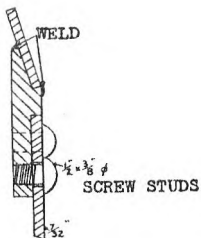
BOTTOM COVER PLATE



TAIL FUZE SOCKET



MACHINED INSERT



INCENDIARY SHRAPNEL

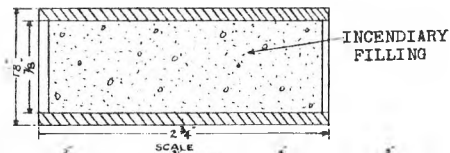


FIGURE 3.

NEW TYPE  
HE. & INCENDIARY BOMB  
250 KG (APPROX)

TRIAL FIRING 37 mm JAPANESE GUN.

1. General.

A trial firing of Q.F. 37 m/m gun and ammunition has been carried out with the object of ascertaining the relative performance of armour piercing and H.E. Japanese ammunition, and locally produced Q.F. 2-pr ammunition (Land and Naval Service).

2. Details.

Ordnance. - Q.F. 37 m/m Japanese No. 822  
 Mounting. - Q.F. 37 m/m Japanese. un-numbered.  
 Ammunition. - Cartridges, Q.F. 37 m/m A.F. shell.  
 (Base Fuzed 1-8-12 $\frac{1}{2}$ )  
 Cartridges, Q.F. 37 m/m H.E. (Fuzed) 1-8-12  
 Temperature. - Air.  
 Q.E. Point Blank.  
 Laying. By clinometer and cross-wires at muzzle.

3. Results.

A. TARGET SERIES

Rd.	Type of Amn.	Target.	Recoil. (m/m)	Results.
	H.E.	Wood 1" planks 6'x6' @ 400'		Round missfired. Cap of primer forward.
1	H.E.	ditto	334	Through target. Hole 6"x6" Main fragmentation 18" behind target. Yellow deposit on ground.
2	A.P. shell	ditto	338	Through target & functioned on bank of sand 100' Fuze recovered whole. Shell broken up. Traces of picric powder at strike.
3	H.E.	ditto	324	Through target. Fuze apparently functioned but shell not detonated. Shell recovered whole.
4	H.E.	.012" Tinned plates 3' apart at normal. 100' from gun.	324	Holed both targets, but detonated on graze. (Piece of hard wood 100' in rear.)
5	H.E.	14 m/m A.B.P.3 plate. 158' from gun.	324	Hole 3.5"x 3". Back damage 4" x 3.6". Functioned in plate. Considerable yellow smoke and considered only partial detonation.

Rd.	Type of Amn.	Target.	Recoil. (m/m)	Results.
6	A.P. Shell	14 m/m A.E.P.S plate. 158' from gun	326	Hole 1.6" x 1.6" Back damage 2.3" x 2.2" Detonated 3' in rear of plate. Yellow stain on ground.

Comments.

Detonations were not good, and gave considerable light coloured smoke. The pungent smell of picric acid was present at all bursts.

B. PLATE SERIES

TARGET:- 40 m/m No.E.2 U.K. rolled armour plate. Spec. I.T. 80D.  
Distance gun to target = 358 feet.  
Plate velocity. - 1697 f.s. @ 30° (Shot Q.F. 2-pr.)

Assessed Ballistic Limit, Q.F. 2-pr Shot A.P. @ normal = 1305 f.s.

Rd	Type of Amn. (Jap.)	Angle of attack	M.V.	S.V.	CODE.	RESULTS
1	A.P. shell	Normal	2206	2097	W	Front damage 2" x 2" 1.45" C.I.A. flat gauge passed. Back damage 2.3" x 2.5" Fragments recovered indicated that an explosion only occurred.
2	H.E.	Normal	2268	2158	-	Detonated on plate. Very slight front damage, but good splash effect.
3	A.P. shell	30°	2224	2115	R	Fuze apparently only functioned. Front damage 2.2" x 3.0". Depth 1.2" Back damage 1.5" x 1.2". Fragments lodged in plate.
4	A.P. shell	30°	2207	2098	C	Front damage 3.2" x 2.25" Depth 1.25"
5	H.E.	30°	2251	2141	-	Detonated on plate. As Rd.2. Good black smoke.

4. General Comments.

(a) Muzzle velocity.

Mean M.V. of H.E. shell = 2260 f.s.  
" " " A.P. " = 2212 f.s.

(b) H.E. shell fuze.

This was not functioned by O12" tinned plate, but was functioned against both 1-inch plank and armour plate. It is therefore less sensitive than fuze 243 in 2-pr. H.E shell and comparable to D.A. fuzes in sensitivity.

Quality of burst was good when complete detonation was obtained, but most rounds gave explosion only.

Fragmentation at rest gave good results, a high percentage of fragments being over 1/25-oz. in weight, which is generally accepted as being lethal in effect. In this connection, 1-grain is equal to 1/28-oz.

Armour piercing performance can only be estimated, since few rounds were available. Detonation in a 14 m/m plate (I.T.100) indicates that the H.E. shell will defeat normal protection on universal carriers and armoured cars, and may defeat armour on light tanks.

(c) A.P. Shell.

Quality of burst was poor. An approximate estimate of armour-piercing performance is as follows :-

ANGLE FROM NORMAL.	I.T. 80 IMMUNITY THICKNESS		
	Jap. A.P.	2-pr.A.P. shell	2-pr. A.P. shot (L.V.)
	m/m	m/m	m/m
Normal	46	52	87
10°	44	51	82
20°	39	49	75
30°	32	46	62

(Report by Ministry of Munitions)

13 M/M JAPANESE A/A - TK/A GUN.

PART 1 - FUNCTIONING AND VELOCITY SERIES.

Trial firings were carried out on 7/4/1943 with the above weapon, firing various types of captured cartridges. (This weapon was reported in detail in L.H.Q. Tech. Int. Sum. No.2.).

The mounting is of a heavy tripod design carrying two 13 mm machine guns. The condition of the barrels, by visual inspection only, revealed apparent excessive spiral wear in the left hand barrel, whilst the bore of the right hand gun showed wear at the commencement of rifling. The right hand gun was used for all series.

It was found that the locking lever, securing gun to mounting on the right hand side was considerably worn, necessitating holding by the firer to retain the gun in its seating.

Details. Q.F. 13 m/m A/A-Tk/A Gun Registered No. 358  
(RH) Japanese.  
" " " " " " Registered No. 357  
(LH) Japanese.

Mounting :- Heavy tripod (Japanese) Not numbered.  
Q.E. As shown.  
Bar. 29,760 inches.  
Temp. (54° Wet Bulb.  
(57° Dry Bulb.  
Wind. 15 - 20 f.s. across, rising to 40 f.s. against.

Ammunition. (Photograph attached)  
Three types were available:-  
Cartridges SA 13 m/m H.M.G. Japanese:-

Ball (white ring around cap)  
A.P. (black ring around cap)  
Tracer (red ring around cap)

Two types, viz. Ball and A.P. were weighed with following results:-

<u>BALL</u>		<u>ARMOUR - PIERCING</u>
Powder (possibly N.C. graphite coated)	232 grains	233 grains.
Bullet	1oz.13½ drams (806 grs)	1oz.13½ drams (806 grs)
Case	1oz.13½ drams (806 grs)	1oz.13½ drams (806 grs)
c.r.h.	approx. 10	approx. 10
Base of shot	Streamlined (approx 10°)	Streamlined (approx 10°)

C<sub>o</sub> estimated to be = 0.62.

Results :-

Series 1. Functioning.  
Cartridge S.A. 13 m/m Ball.

4 Rounds fired for adjustment of Gas Regulator  
10 Rounds fired. Rate of fire = 1.25 secs (480 r.p.m.)  
Mounting extremely steady.  
All cartridges dented on shoulder when ejected. This is apparently due to a perished rubber stop in the ejection recess of the gun.

Series 2. Functioning.  
Cartridge S.A. 13 m/m Tracer.

1 Round fired for time of burning = 4.75 seconds  
10 Rounds for functioning. Rate of fire = 1.31  
(about 460 r.p.m.).  
Tracer effect :- Good, red colour, good cluster effect in sky.

Series 3. Velocity Series.

Screens :- Muzzle wire and Screen at 180 feet.  
Boulenger Chronograph No. 2

Rd.	a Cartridge S.A., Ball		b Cartridge S.A. A.P.	
	observed velocity at 90 ft.	Estimated muzzle velocity.	observed velocity at 90 ft.	Estimated muzzle velocity.
1	2124	2163	-	-
2	2188	2227	2223	2263
3	2198	2237	2251	2291
4	2138	2177	2200	2239
5	2116	2155	2249	2289
6	2232	2272	2221	2261
7	2185	2224	2263	2303
8	2195	2234	2249	2289
9	2230	2270	2251	2291
10	2125	2164	-	-
Mean	2173	2212	2238	2278
m.d.	37.9	38.1	17.9	18.0

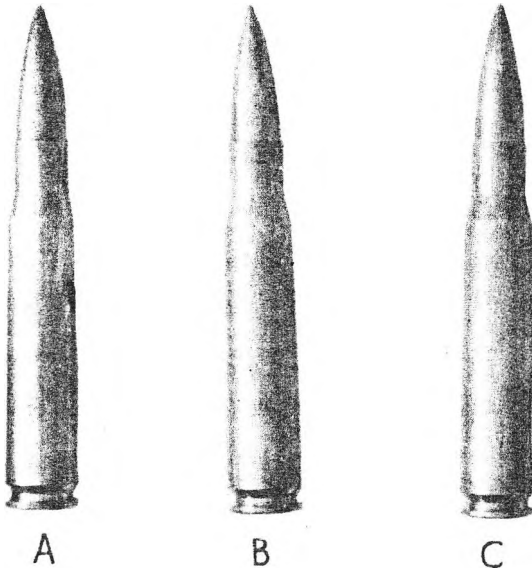
Comments

1. Comparison with British and American equipments :-

	U.S.A.	British	Japanese	
	.5" Browning M.G.	.5" Vickers M.G.	13 m/m A/A-Tk/A Gun.	
Muzzle velocity	36" Barrel 2810 45" Barrel 2900	3000 f.s.	Ball 2212	A.P. 2278
Time of tracer (Tracer Amn)	burns from 250 to 1600 yds.	No tracer	4.75 secs	
Weight of Bullet	Tracer 681 grs. A.P. 718 grs.	AP/BALL 560 grs.	806 grs.	806 grs.

	U.S.A. .5" Browning M.G.	British .5" Vickers M.G.	Japanese 13 m.m A/A Tk/A Gun	
			Ball	A.P.
Nature and weight of propellant	NC Tracer 240 grs. A.P. 235 grs.	NC or Cordite not 7/2 weight unknown	Presumed N.C. graphite coated.	
			232 grs.	233 grs.
Weight of Case	850 grs.	565 grs.	806 grs.	806 grs.
Rate of fire (rounds per minute)	400/450 r.p.m.	350/450 r.p.m.	460 - 480 r.p.m.	

2. Photographs attached
3. Part 11 of this Trial (Penetration series) will be reported as soon as details are available.  
(REPORT BY INSPECTOR GENERAL OF MUNITIONS)



A - Ball - White ring around cap  
 B - A.P. - Black ring around cap  
 C - Tracer - Red ring around cap

FIG. 1 - JAPANESE 13 MM. AMMUNITION

REPORT ON Q.F. 37 MM (JAPANESE) AMMUNITION

1. GENERAL.

The ammunition received was in a poor condition and appeared to have been immersed in water.

Two types were forwarded for trial firing, viz:-

- (a) Shell Q.F. 37 m.m A.P. (Japanese)
- (b) Shell Q.F. 37 m.m H.E. (Japanese)

Metallurgical reports are also included in this summary.

2. CARTRIDGE Q.F. 37 MM A.P. SHELL (Yellow band 2.25 inches from base and white band forward of driving band).

- (a) Case, cart. Q.F. 37 m.m (Japanese) brass.  
Weight:- 0 lbs - 12 ozs - 14 drams
- (b) Primer percussion  
Weight:- 0 lbs - 0 ozs - 8 drams
- (c) Shell Q.F. A.P. with base fuze. (sketch attached)  
Weight:- 1 lb - 8 ozs - 10 drams
- (d) Powder charge (enclosed in silk bag) presumably of the following composition - Nitro-glycerine 30% Nitro-cellulose 60% and Diphenylamine and Graphite 10%. Charge weight including silk cartridge bag = 0 - 4 - 5  
A small igniter is stitched to the end of the cartridge bag.
- (e) Tinfoil charge 20 grains.
- (f) Distance pieces = 3 drams 10 grains.
- (g) Shell filling = 7.7 grammes of Picric Acid, pressed.
- (h) Weight of complete A.P. cartridge assembler = 2 lbs - 10 ozs - 9 dra.

3. CARTRIDGE Q.F. 37 MM H.E. SHELL (Yellow band 2.375 inches from base)

All components as for A.P. shell except shell:-

- (a) Shell Q.F. H.E. with nose fuze (sketch attached)  
Weight:- 1 lb - 6 ozs - 12 drams
- (b) Shell filling:- 21 grammes of Picric Acid with 3.7 grammes T.N.T. pellet.
- (c) Weight of complete H.E. cartridge assembled = 2lbs - 8 ozs - 11 drams.

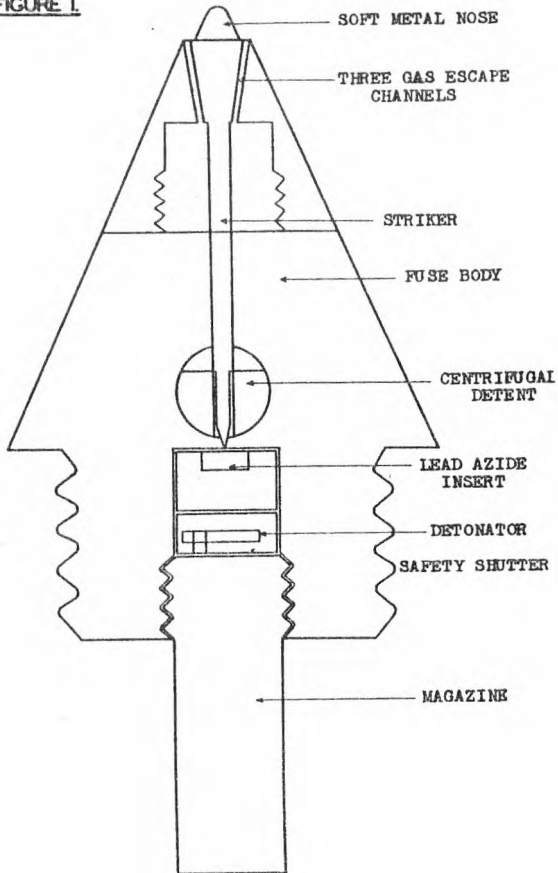
4. METHOD OF ATTACHING SHELL TO CASE.

A small cannellure behind the driving band allows all the case to be coned.

Cardboard discs, 4 in number, were used as distance pieces, 2 being standard ammunition components, the remaining 2 being apparently cardboard scrap pieces. The driving band, which is manufactured from copper tubing, is illustrated in Fig. 3.

(REPORT BY MINISTRY OF MUNITIONS)

FIGURE 1

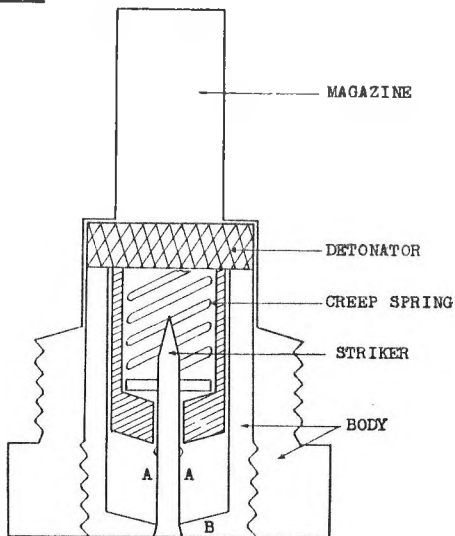


JAPANESE 37MM HE. FUZE

DIAGRAMMATIC ONLY..

NOT TO SCALE

FIGURE 2.



**Safety arrangements -**

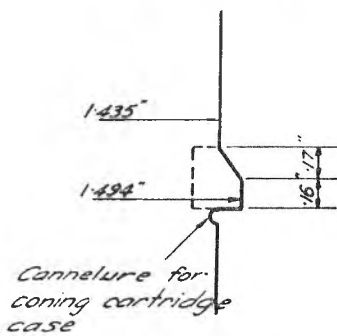
Before firing - Crimped Striker and expanded base (see A.A. & B.)

After firing - Striker held by creep spring.

JAP. 37<sup>M</sup> A.P. SHELL BASE FUSE

NOT TO SCALE

*Sketch only.*



**DRIVING BAND  
JAPANESE  
37 M/M SHELL**

Figure 3. DRIVING BAND JAPANESE 37 MM. SHELL.

REPORT ON SOME FRAGMENTATION TRIALS  
37 mm. JAPANESE SHELLS.

This report describes three (3) Fragmentation Trials carried out at Explosives Factory. In each case, the shell was suspended approximately in the centre of the fragmentation chamber and fired by means of No.6 Electric Detonator resting on the detonator of the fuze in the shell. The chamber was completely lined with sand bags, and all fragments were trapped in the sand, and removed by sieving through a 12 mesh wire screen.

The fragments passing 12 mesh were not removed.

In the attached table, all fragments exceeding one (1) gram (1/28th of an ounce) are classified as lethal.

(Report by Explosives Manufacturing Practices  
Laboratory.).

FRAGMENTATION TRIALS OF 37 MM SHELL.

S H E L L	Approx weight of metal in shell. <u>grammes</u>	Total number of Fragments.	Total weight of fragments. <u>grammes</u>	Percentage of Shell recovered as Fragments.
Shell Q.F. H.E., 2 Pr., H.V. MK 1 T	700	301	663	94.7
Japanese Nose Fuzed 37 mm H.E. Shell	560	490	547	97.7
Japanese Base Fuzed 37 mm A.P. Shell	678	15	670	98.8

LETHAL FRAGMENTS.  
(i.e Fragments 1 gramme or more in weight)

	Number	Average weight <u>gramme</u>	% weight of shell forming lethal fragments.	Remarks
Shell Q.F. H.E. 2 Pr. H.V. MK 1 T	132	4.6	87	Good detonation
Japanese Nose Fuzed 37 mm Shell	143	3.1	80	Good detonation
Japanese Base Fuzed 37 mm A.P. Shell	7	91.5	94	Partial explosion only

JAPANESE SHELL 37<sup>MM</sup> NOSE FUSED  
LETHAL FRAGMENTS

SCALE :

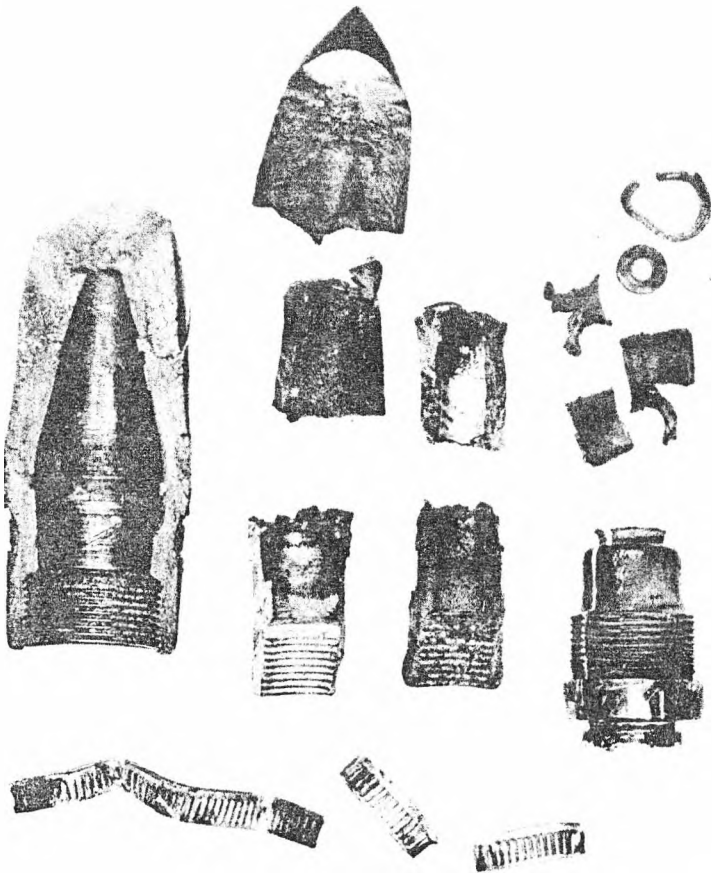
0 1 2 3 INS.



SHELL Q.F. H.E. 2PDR. HV. Mk. I t  
LETHAL FRAGMENTS.

SCALE  INCH





JAP. 37<sup>MM</sup> A.P. SHELL. BASE FUSED

SCALE :



JAPANESE DRY BATTERIES.

Two kinds of batteries have been examined and for the purpose of this report will be described as follows:-

A. Nippon Dry Cell.

B. High Tension Battery 22½ volt.

A. Nippon Dry Cell.

This cell was part of a portable wireless receiver - Transmitter No 1801 (reported in L.H.Q. Tech. Int. Sum. No. 1). It was still active when examined, though partly run down.

Nippon Dry Cell.

Terminal Volts	1.6 (shown on label. In some cells the measured voltage was 1.7
Ampere - Hour Capacity	10.4 (shown on label.)
Discharge Rate	2.6 Amps (shown on label)
Weight	2 lbs 0 ozs.
Ratio Amp Hrs/Weight	5.2
Dimensions	2½" x 3½" x 4⅞". (5⅝" to clear terminals)
Waterproofing.	Good. The zinc case is covered by one layer of bitumenised paper and a well waxed cardboard carton. The top is sealed by a Bitumastic filling with one gas vent. .062" diameter.
Construction.	Robust, and very rigid. The cell is contained in a zinc case, .048" thick which forms the negative electrode. Terminals are plated with nickel or chromium preventing corrosion in damp atmospheres. Internally the cell is divided into three compartments by the provision of two zinc partitions, and there are three carbon plates, one for each compartment. These are connected together and to the positive terminal by a lead alloy strap which

<p>Construction (Cont)</p>	<p>is soldered to brass saddles on the tops of the carbons. These saddles are in turn soldered to copper plating on the carbon plates. A layer of cotton wool and unsized paper reinforced with cotton thread separates the depolarising filling from the zinc container, and provides a reservoir for the activating salts of the cell.</p>
<p>Novel features which could be adapted.</p>	<p>The most unusual feature is the division of the cell into three compartments. This has two effects:</p> <ol style="list-style-type: none"> <li>1. It lowers the internal resistance of the cell.</li> <li>2. It increases the mechanical strength of the cell.</li> </ol> <p>It is doubtful, however, whether this feature is very valuable since the same results can be produced by connecting together a number of smaller cells in parallel. The chromium or nickel plating of the terminals is however a very good feature indeed.</p>

B. High Tension Battery 22½ Volt.

Three of these batteries formed part of the plate supply to the wireless equipment described in Wireless Equipment No. 1801 (Tech. Int. Sum. No.1). The batteries were discharged when received. Apart from the shape of each cell, which is square, there are no unusual features apparent. The internal surfaces of the zinc containers are lined with a paper-cotton material as described under "A" above.

<p>Terminal volts.</p>	<p>22½ volts and 12 volts.</p>
<p>Ampere-Hour Capacity.</p>	<p>400 milliamperes hours. (From label)</p>
<p>Working current.</p>	<p>100 milliamperes (From label).</p>
<p>Condition.</p>	<p>Discharged.</p>
<p>Weight.</p>	<p>11b 9ozs.</p>
<p>Dimensions.</p>	<p>2½" x 4" x 2½" (2½" to clear terminals).</p>

High Tension Battery 22½ volt.

Waterproofing.	No special provision. Individual cells are coated with brown wax.	
Construction.	Number of cells	15
	Separators	Bakelite
	Zinc Casing	0.027 inch.
	Shape of cells	Square
	Outer cover	Lightly waxed straw-board
	Finish	Conforms to commercial practice
	Sealing	Cells are individually sealed

(Report by S.O in C L.H.Q. AUSTR.)

NIPPON DRY CELL BATTERY

CROSS SECTION VIEW

HORIZONTAL SECTION

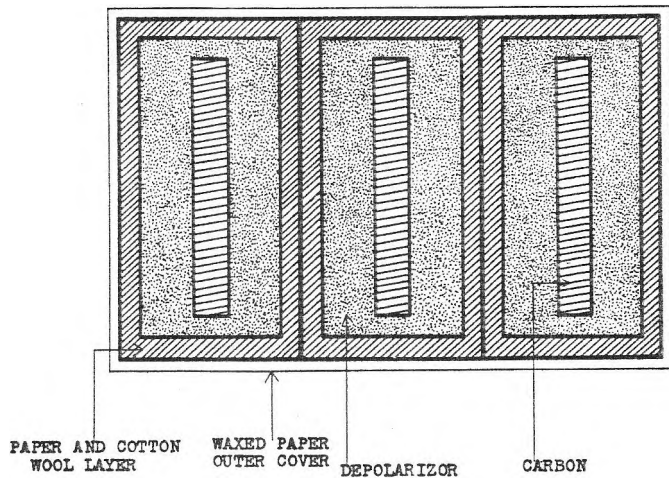


Figure 1. NIPPON DRY CELL BATTERY.

NIPPON DRY CELL BATTERY

SECTIONAL VIEW

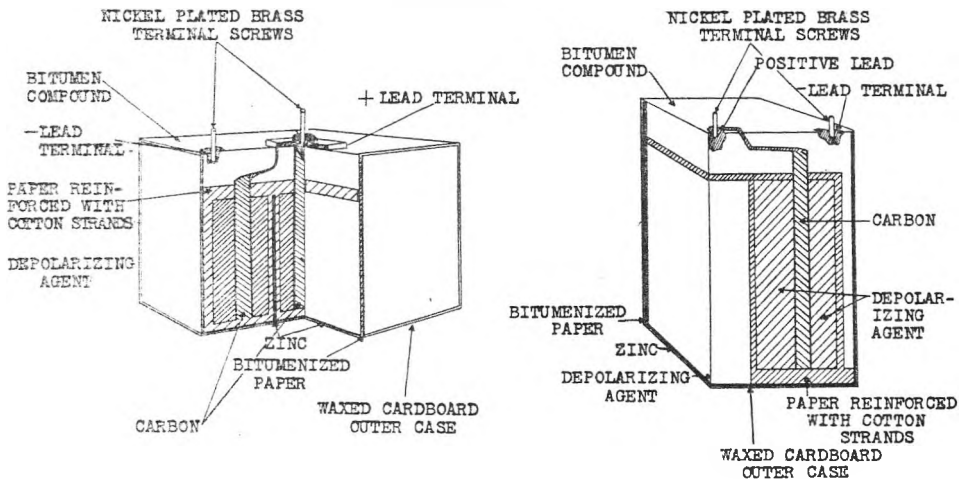


Figure 2. NIPPON DRY CELL BATTERY.

22½ VOLT BATTERY

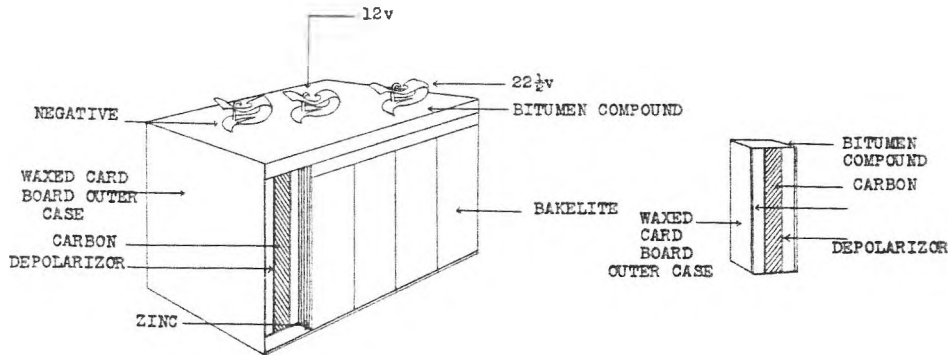


Figure 1. 22½ VOLT BATTERY.

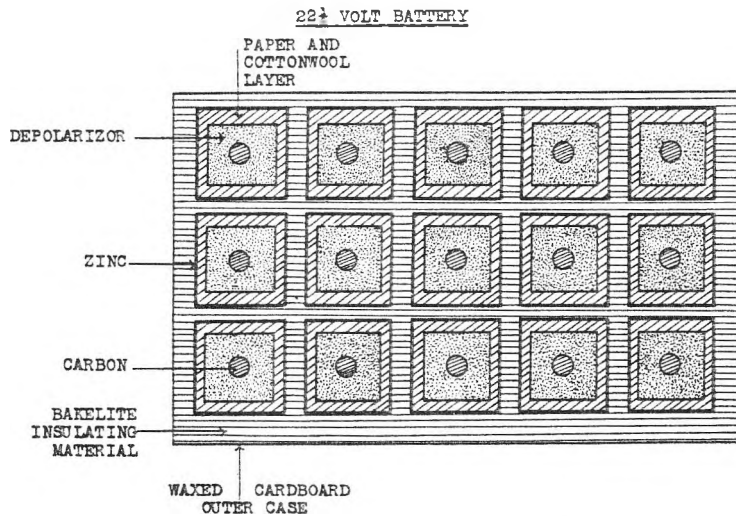


Figure 2. 22½ VOLT BATTERY.

REPORT ON JAPANESE DIAL SIGHT NO. 21028 AND CARRIER NO. 1488.

1. General.

An inspection of the above shows these conform to the usual principles of manufacture and the standard of workmanship is good. The dial sight is from a Japanese 37 mm gun and the carrier from a 70 mm Inf. En Gun.

2. The Dial Sight.

It would appear that this is a universal dial sight for all Japanese field artillery. It attaches to the carrier by means of a horizontal dove tailed slide.

The sight is much shorter than the British No. 7 Dial Sight and to compensate for this the lower portion with the eyepiece has a free rotating movement independent of the upper part of the sight, so that when laid on a rear aiming point the eyepiece may be swung sideways, so keeping the layer's head clear of the line of sight.

The optical system seems to be of a good standard, magnification and field of view are stated to be 3 x 13.

The graticule has interrupted horizontal and vertical lines with a diagonal cross in the centre.

A separate technical report on the optical system will be published later.

The main scale plate is engraved 32 right and left of zero each graduation equalling 100 mils, every second 100 being numbered.

There is only one micrometer drum, which is positioned on the right side and is graduated from 0 - 100, every tenth graduation being numbered. Each graduation equals 1 mil.

There is a quick release lever on the left side to enable quick setting.

A micrometer head on the dial sight cowl is engraved with 100 graduations numbered at 0. to 50, the index plate has 2 arrows engraved, one pointing to the right marked + and the other pointing to the left marked -. This micrometer head elevates and depresses the roof prism.

3. The Carrier.

The carrier is evidently that used with the 70 mm. Inf. Battalion Gun. It is the medium whereby quadrant elevation is applied to the sights and is also the carrier for the dial sight.

The range drum is operated by a serrated knob situated at the front of the carrier, at the rear of the carrier there is a quick release lever which enables a large change in elevation to be applied rapidly. The drum is graduated for 4 charges the graduations being as follows:-

Charge 1.            Charge 2.            Charge 3.            Charge 4.  
0 to 28 to 16.    0 to 18 to 11.    0 to 12 to 8.    0 to 9 to 6.

The maximum range for each charge would therefore be:-

Charge 1		2800 meters	
" 2		1800 "	
" 3		1200 "	
" 4		900 "	

The 70 mm Inf. Battalion Gun can apparently fire at angles of elevation over 45° on the Mortar principle. Therefore when elevated over 45° the range drum scales are graduated on a decreasing scale.

There is a fifth scale on the extreme right of the drum which is apparently an angular elevation scale and is graduated from -10 to + 128.

The range drum is viewed through a small window in the front of the carrier which is covered by 4 metal strips engraved i, ii, iii, iv, from left to right. In use the strip numbered for the selected charge is pulled back disclosing the range scale for that charge.

The sight clinometer and cross level bubble are mounted on the same bracket on top of the carrier, at the left. The sample examined was damaged, therefore no tests could be carried out; however it is noted that both the bubbles are too small and inconveniently placed to facilitate speedy laying. The cross level bubble compensates for tilt of carriage but it is not known whether it is offset to compensate for drift.

Both of these instruments were sealed by means of a wire and lead seal to obviate tampering by unqualified personnel.

Cross levelling of the sight is effected by a serrated knob situated at the left of the carrier.

A short tube projecting from the base of the carrier is the means of attachment to the carriage.

This carrier and sight do not embody any unusual departures from common laying practice. Whilst very compact, difficulties would arise from the use of small scales and bubbles.

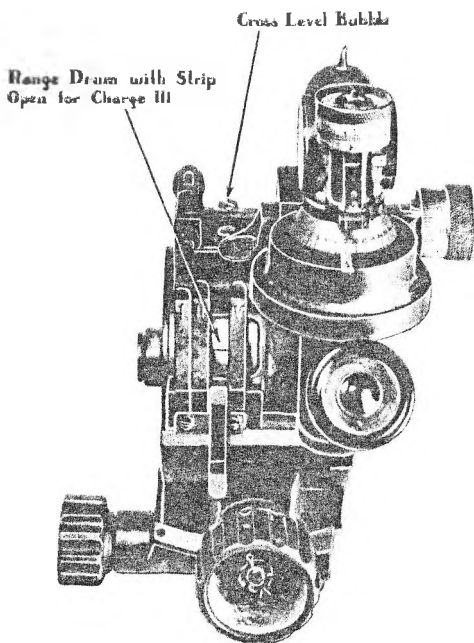


Figure 1. JAPANESE DIAL SIGHT AND CARRIER.

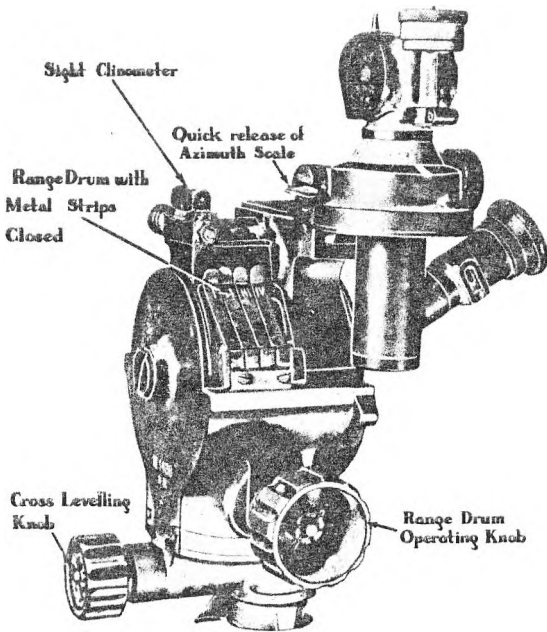


Figure 2. JAPANESE DIAL SIGHT AND CARRIER.

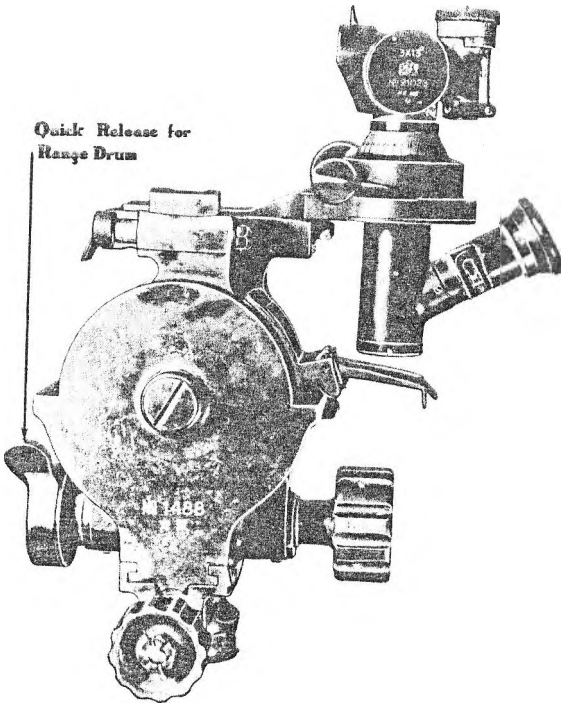


FIGURE 3. JAPANESE DIAL SIGHT AND CARRIER.

JAPANESE PAPER CAPE.

1. General Description.

This garment, captured in New Guinea, is in the form of a simple cape, with a triangular hood attached for protection of the head. (See Figure I for dimensions). The hood and part of the cap covering the shoulders are made from double thickness of material. The garment is packed in a small cotton wallet and thus becomes badly creased in the folding. The results show that while a single thickness - creased or uncreased - affords little protection against H, in the case of double thickness, when uncreased, the protection is quite good. Both single and double thicknesses, however, afford no protection at all when creased. It is therefore concluded that the garment would be of little use as an anti gas cape as the method of packing involves the formation of numerous creases. Results of tests against H are given in para 2.

2. Penetration Tests.

<u>Sample</u>	<u>H Penetration Time</u> <u>C.R.I. Mirror Test</u>
1. Single Thickness uncreased	2 minutes.
5. " " "	3 minutes.
5a. " " "	Nil. Immediate penetration.
6a. " " "	11 minutes.
4. " " creased	Nil. Immediate penetration.
6. " " "	Nil. Immediate penetration.
2. Double " uncreased	84 minutes.
3. " " "	84 minutes.
7a. " " "	+ 120 minutes.
8a. " " "	+ 120 minutes.
1a. " " creased	Nil. Immediate penetration.
2a. " " "	Nil. Immediate penetration.
3a. " " "	Nil. Immediate penetration.
7. Reinforced edge	42 minutes.
4a. " " "	Nil. Immediate penetration.
8. Badly crushed	Nil. Immediate penetration.

3. Composition of Paper.

The paper has a high "crackle" and a high bursting strength. When wet the "crackle" is lost but the bursting strength remains high. The fibres are of softwood, probably kraft, not heavily beaten, and, under microscopic examination, there appeared a thin sheet of glossy material, as though the paper had been coated or soaked in some substance which formed a binding in the sheet and probably accounted for the high bursting strength. The condition of the fibres indicated that they had had no parchmentising treatment. A comparative test was carried out between the paper of the cape and an 18 D.C. normal Kraft before and after light parchmentising (unplastified). Only dry strengths were measured and the results are given below:-

<u>Paper.</u>	<u>Caliper.</u>	<u>Burst.</u>	<u>Tear.</u>	<u>Tensile.</u>
18 D.C. Kraft	2.9	17	6	5
18 D.C. Kraft lightly parchmentised	4.1(?)	12	7	5

Paper.	Caliper.	Burst.	Tear.	Tensile.
Paper from cape	3.3	42	6	?
Paper from cape after extraction with petrol ether.	3.3	45	6	4

(?) - Doubtful owing to crinkling or folds in the sheet.

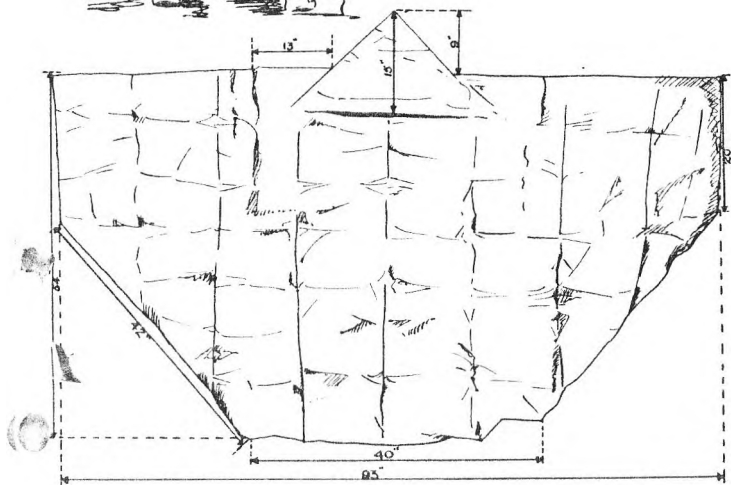
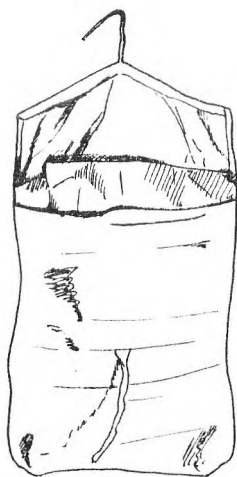
A test was made to determine whether a Urea-formaldehyde resin had been used. A sodium fusion test, however, indicated that nitrogen was absent. The coating does not appear to be a common cellulose ester, as it is insoluble in acetone. It is also insoluble in petrol ether and alcohol. As previously stated the paper is probably made from soft wood kraft, about 18 D.C. It is coated or treated with a sheet forming addition and plasticised with 2% or 3% of an oily material which may include Butyric Acid or a Butyrate. The burst of the paper of the cape remained high was unaffected by extraction, with petrol ether for 5 hours, in a Soxhlet apparatus.

#### 4. Waterproof Tests.

A portion of the paper from the cape was formed into a bag and filled with water. After 24 hrs only a slight amount of water had penetrated the paper. It has been concluded, therefore, that the garment is purely a tropical waterproof cape and not a cape anti-gas, as was thought at first.

(Report by Munitions Supply Laboratories Aust.  
and Australian Paper Manufacturers Limited.)

- 127 -  
JAPANESE PAPER CAPE



ALLIED LAND FORCES

HEADQUARTERS

S.W.P.A.

TECHNICAL INTELLIGENCE SUMMARY

TABLE OF CONTENTS - SUMMARIES NOS. 1 & 2

	<u>Page</u>	<u>Sum. No.</u>
<u>JAPAN</u>		
<u>Weapons.</u>		
6.5 m.m. (.256") L.M.G. "TYPE 96"	2 - 8	1
7.63 m.m. SOLOTHURN S.M.G.	9 - 14	1
8 m.m. Automatic Pistol	15 - 19	1
7.7 m.m. M.M.G. TYPE 92 JUKI	21 - 31	1
Bangalore Torpedo	33 - 35	1
Grenade Discharger TYPE 89	36 - 40	1
13 m.m. A/A - Tk/A Gun - Dual Mounted	2 - 29	2
7.7 m.m. (.303") L.M.G.	30 - 36	2
6.5 m.m. (.256") L.M.G. TAISHO II	37 - 44	2
<u>C.W.</u>		
Civilian Respirator No. 2	41 - 54	1
Service Respirator - Military Pattern	55 - 68	1
Flame Thrower - Portable	69 - 77	1
Rifle Grenade - Smoke	78 - 80	1
Smoke Projector (TYPE 99) Charge Propelled	81 - 83	1
Service Respirator (TYPE 93 No. 3 - Naval)	45 - 60	2
Self Projecting Smoke Candle (Type 1612-K)	61 - 64	2
Daylight Flare - "Yellow Dragon"	65 - 68	2
75 m.m. Chemical Shell	69 - 74	2
75 m.m. Chemical Shell (Metallurgical Rep.)	75 - 76	2
75 m.m. Chemical Shell (Vesicant Filling)	77	2
<u>Equipment.</u>		
Portable W/T Apparatus No. 1801	84 - 101	1
S/W Mobile Transmitter (No. 937 - Model 2)	79 - 110	2
<u>Miscellaneous.</u>		
Optical Report - 7.7 m.m. Tank Gun	102 - 104	1
" " 6.5 m.m. L.M.G. (TYPE 96)	105 - 107	1
" " 7.7 m.m. M.M.G. (TYPE 92)	108 - 111	1
Ballistic Report - Japanese Armour Plate	113 - 119	1
Land Mine "TYPE 93"	121 - 123	1
Ballistic Tests - Japanese Armour	111	2
Armour and Components	112 - 118	2
Molotov Cocktail	119 - 124	2
Medical Equipment	125 - 126	2
Gains - with choice of delay	127 - 128	2