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JAPANESE AMMUNITION

C.I.AMN. TECHNICAL REPORT

No. 52

TIME AND TIME & PERCUSSION FUZES USED IN GUN AMMUNITION.

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NOVEMBER 1945

TIME AND TIME & PERCUSSION FUZES
USED IN GUN AMMUNITION

G E N E R A L

The nose fuzes employed by the Japanese in their artillery ammunition to obtain a time burst with H.E. or Shrapnel shell may be divided, according to British and American practice, into two main groups:-

- (i) Combustion.
- (ii) Mechanical.

A number of fuzes of five different types have so far been examined here and it is considered that a detailed report on all types would be very useful. These fuzes are usually of conventional design, being generally based on European designs, for example, the Type Taisho '3 (1914) T. & P. Fuze was introduced by the Japanese about 9 years after our No.80 T. & P. fuze, to which it is generally similar in design and action.

2. A distinctive feature of Japanese Time and T. & P. fuzes is that in almost all cases the tensioning of the time rings is obtained by two dished spring steel washers, placed convex surfaces together, and adjusted by screwing the cap on to the fuze body. The cap is secured by a set screw in the normal way.

3. Another feature is a steel locating stud mounted on the body with its centre over the scribe line to facilitate use in an automatic fuze setter. The intention is to engage this stud into a recess in the fuze setter, the bridge or the slot of the time ring engaging the setting ring of the machine.

Generally a fuze having more than two time rings is provided with a bridge which locks the two movable time rings together and is used for setting the fuze.

4. In all the early type T. & P. fuzes examined so far it has been noticed that the general construction differed from our No.80 fuze in the following respects:-

- (i) The cap is provided with a through hole for a safety pin which would pass through the eyehook of the time pellet plug to provide additional safety.
- (ii) The percussion pellet is locked by two centrifugal bolts in addition to the usual creep spring.
- (iii) In all cases the bottom time ring carries the graduations and not the body.
- (iv) The magazine closing plug is provided with a diaphragm integral with the plug which is ruptured

by the magazine flash as in the magazine of the No. 106-E fuze.

- (v) There does not seem to be any waterproofing composition to protect the composition in the time rings.

5. A chart of all the known types of Time and T. & P. fuzes is given at the end of the Plates showing the nature of shell, equipments, etc. with which these fuzes are used.

6. The five different types of fuzes which have been examined here are described in the order of the year of introduction and are shown in the photograph at Plate A.

DESCRIPTION

FUZE, TIME & PERCUSSION, TYPE TAISHO 3 (1914)

7. As mentioned above this fuze compares very well with our Time and Percussion No.80 fuze. The details of construction will be clear from the drawing at Plate B while the general appearance is shown at Plate A.

8. The fuze cover is made of tin and, being soft fits snugly over the fuze. It is turned over at the skirt for securing to the fuze; the junction which was coated with a waterproofing composition, was found to be stained greenish and, on scraping, the body showed the presence of verdigris. No composition is used to waterproof the time rings. A brass wire 20 S.W.G. and 9 1/2-ins. long is wound round the grooves in the body of the fuze, with one end secured in the body to a depth of 1/8-in. and the other end secured to the locating stud by two turns with an extension forming a loop. This acts as a pull-off tape.

9. The fuze has two time rings (9 & 11), one of which (9) is ungraduated and is locked to the body of the fuze by a dowel pin. The second time ring (11) is graduated 0 - 22, each division being further sub-divided into five equal parts. This ring is provided with two setting (vertical) slots positioned diametrically opposite. Both rings are each provided with an escape hole which is covered with a thin brass foil disc. The composition in the rings is covered with thin tissue paper and thick cloth washers (10) are provided in between each ring. The tension is obtained by screwing in the cap (1) which presses against the dished ring-shaped spring-washers (7). The fuzes examined were found to be set to a tension as high as 500-in. ozs.

When the fuze is set "Safe", the scribe line on the body (12) is in line with the scribe line on the movable time ring (11) and the red line on the fixed time ring. In this position, the flash hole leading to the lower time ring is masked by the bridge in the fixed time ring.

When the fuze is set to zero, the scribe line on the body comes in line with zero on the movable time ring (11) and the red scribe line on the fixed time ring (9). In this position, the flash holes in both rings lead the flash straight to the magazine.

10. The time detonator holder (3) is supported on a stirrup spring (5) which according to small trial carried out here, could be straightened with a pressure of 55 - 60 lbs. A double ended striker (6) is secured centrally in the body by ringing in. Round the striker are six equally spaced flash holes to allow the flash to the fixed time ring.

11. The graze pellet (16) carrying the detonator is held in position by a screwed plug (17) which closes the percussion mechanism.

12. Safety Devices:-

- (a) When set to safe, the flash cannot reach the lower time ring although the top ring may continue to burn.
- (b) The time detonator pellet (3) is supported by a stirrup spring (5). In addition the tensioning cap is provided with a hole for a safety pin which is intended to pass through an eye in the time detonator closing plug. All the plugs examined here, however, had a plain head with a screw driver slot. It is probable that the stirrup spring was at one time weak and necessitated the use of an auxiliary device and was later abandoned on account of a stronger stirrup spring being incorporated.
- (c) Two spring loaded centrifugal bolts (14) which hold the graze pellet.
- (d) A creep spring (13) which holds the graze pellet (16) off the striker (6).

ACTION

13. Time Mechanism:- On acceleration in the gun, the time detonator pellet sets back on to the upper striker, straightening out the arms of the stirrup spring in so doing.

The flash from the detonator passes through an opening in the stem and ignites the powder pellet and the composition in the fixed time ring, blowing out the escape hole disc.

The composition in the time rings then burns for the predetermined time when the flash from the lower ring passes through the perforated pellet to the magazine.

Percussion Mechanism:- Centrifugal force causes the centrifugal bolt to fly out, thus freeing the inertia pellet which, on impact, is driven on to the lower striker. The flash passes through the pellet and fires the G.P. in the magazine.

TIME OF BURNING AT REST

14.. Two fuzes were tested, and the time of burning recorded was as follows:-

	<u>No. 1</u>	<u>No. 2</u>
1st ring	9.8 Secs.	10 Secs.
2nd ring	12.5 Secs.	12.7 Secs.
	22.3 Secs.	22.7 Secs.

Mean time of burning 22.5 Secs.

FUZE, TIME & PERCUSSION, TYPE TAISHO 5 (1916)

15. This fuze is for all practical purposes identical in design, construction and action to the '3 Year Type' fuze, except for the addition of an extra time ring to give a longer time of burning, i.e. the fuze is graduated 0 - 36.

16. The details of the construction will be clear from the drawing at Plate C, while the photograph at Plate A shows the general appearance. It is not possible to give details of weight, natures and types of filling etc. as the fuzes received for examination had been fired or had been affected by moisture etc.

17. The fuze differs from the 3 Year Type in the following respects:-

- (i) The time detonator pellet (3) closing plug has an eyehook to receive a safety pin. The stirrup spring is weak as compared with the 3 Year Type fuze.
- (ii) The dished springs (7) have two internal projections for seating into corresponding recesses in the stem of the fuze body (12).
- (iii) An extra time ring coupled to the bottom ring by a bridge similar to that used in the Type '89 fuze is used for setting the fuze.

FUZE, TIME, TYPE '89

18. A detailed description of this fuze has already been included in C.I.A.M.N. T.A. No. 29 of Jan. 1945. This is a pure Time fuze of the combustion type with four time rings made of brass throughout. Full details of the fuze are shown in the Plates as below:-

- Plate D :- External appearance and markings.
- Plate E :- General assembly and appearance.
- Plate F :- Assembly Sequence of Components.

19. The fuze cover which is shown with the fuze in the photograph at Plate D is made of aluminium alloy and fits snugly over the fuze. It is turned over at the skirt to secure it to the fuze, and further fixed in position by the metal being punched into two slots in the side of the body. These slots and the junction of the cover with the fuze are coated with a waterproofing composition of a waxy nature. It would seem that it is not the intention to obtain a hermetically sealed cover, except by the aid of this waterproofing composition. With properly closed cylinders in visually good condition the covers and fuzes externally were in quite a good condition.

On breaking down the fuzes, however, there was evidence that the composition in the time rings had been affected by damp and was slightly swollen. This damp had not been sufficient, however, to cause any appreciable deterioration of the composition and the gunpowder in the magazine was in good condition. Owing to the effects of this slight damp, or for some other reason, setting with the original tension was practically impossible. Although a setting tension of well over 500-in. ozs. was used, the result was to distort the setting bridge with the key. With the proper setting machine, the fuzes could be set without much damage to the setting bridge, although in some cases it was not possible to set the fuze at all.

20. The Plates are self-explanatory and provide a complete description of the fuze; however, to assist in the study of the fuze and its mechanism the following general remarks may be useful:-

- (i) The second (7) and fourth (9) time rings are coupled together for purposes of setting by a brass setting bridge (10). The ends of this bridge fit in a dove-tailed seating in each ring. The bridge is not positively connected to the rings and when pressure is applied the tendency is to distort the bridge, if the tension is excessive.
- (ii) The brass wire, under the fuze cover is intended for quick removal of the cover, and is secured only to the stud on body of the fuze to prevent weakening of the cover sealing during handling etc. The two slots in the body of the fuze into which the cover is punched are presumably for fuzing and unfuzing.
- (iii) Contrary to usual practice with British time fuzes the gases from the burning composition in the time rings are vented internally and pass up through the grooves in the body stem and out through a small orifice in the nose of the fuze, the closing disc of which is blown out when sufficient pressure is developed.
- (iv) The direction of burning, looking in the direction of the travel of the shell, is:-

Top ring	(6)	-	anti-clockwise;
Second ring	(7)	-	clockwise;
Third ring	(8)	-	anti-clockwise;
Fourth ring	(9)	-	clockwise.
- (v) When the fuze is set to zero, i.e. scribe line on fourth ring (9) is in line with scribe line on body, the flash passes direct from the detonator down through the perforated G.P. pellets in each ring to the magazine of the fuze.
- (vi) When the fuze is set to "Safe" i.e. setting bridge (10) is in line with scribe line on body, the blank portion of the top ring (6) seals the flash channel in the second ring (7). Although the composition in top ring (6) burns, there is no continuity to the second ring (7).
- (vii) The fuze is secured in the nose of the shell by means of a small grub screw.

21. Safety Devices:- There are no special safety devices except the usual set "Safe" position of the rings found in fuzes of similar types, e.g. No.199, time fuze (British).

ACTION.

22. On set-back, the inertia pellet (13) with time detonator (12) sets back on to the needle, initiating the detonator, the flash from which passes through a channel to the time ring composition in the top ring (6). The composition in the time rings then burns for the time to which the fuze has been set.

TIME OF BURNING AT REST

23. Owing to the impossibility of setting the time rings and the appearance of a slight swelling of the time ring composition, three fuzes were dried out on a sunny day in the shade for a few hours and the composition carefully smoothed down where any slight roughness appeared. The fuze was then re-assembled and adjusted to the original tension. Efforts to set the fuze with a locally improvised key again failed. The tension applied exceeded 500-in. ozs.

The fuzes were finally set to full by loosening the tensioning nut (2) and grub screw (2A) and proved at rest in the usual way. The time was recorded electrically and checked by hand operated stop watches with the following results:- 33.1, 33.1 & 32.22 Seconds. This gives a mean time of burning of 32.8 and M.D. of 0.39 Seconds. The mean time of burning of each time ring was as follows:-

1st time ring (6)	-	6.36	Seconds.
2nd time ring (7)	-	7.89	"
3rd time ring (8)	-	9.0	"
4th time ring (9)	-	9.86	"

The uniformity of burning, both in the case of each ring and in the total time of burning of all the four rings was reasonably good.

FUZE, TIME & PERCUSSION, TYPE '100

24. This is a 50-Second mechanical Time & Percussion fuze of conventional design; the details and general appearance of which are shown at Plates G, H, J & K, respectively. It is similar in design to the Naval Type '91 time fuze and the method of setting, starting and firing differs somewhat from that employed in typical British and German fuzes. The fuzes received here were complete and in good condition. The fuze consists essentially of the following parts (See Plate H):-

- (i) Body
- (ii) Clockwork Mechanism (8)
- (iii) Dome (7)
- (iv) Screwed Collar (3)
- (v) Cap (2)
- (vi) Fuze Cover (1)

THE BODY

25. This is made of an aluminium alloy and contains the percussion mechanism in a central cavity, at the top of which the percussion striker (11) is ringed in. Two spring loaded centrifugal

bolts (10A) project into the cavity and engage the annular groove of the inertia pellet (15) which contains the percussion detonator. The forward end of the pellet has two slots cut in it to allow assembly. The time detonator is held at the top of a tubular brass detonator holder which screws into the body off centre. The top of the body is recessed to accept the clockwork mechanism which is located by a small stud in the top of the body and by the 3 long bolts which hold the mechanism together. The mechanism is held in the body by three brass nuts which screw on to the long bolts.

THE CLOCKWORK MECHANISM.

26. This is an ordinary clockwork mechanism controlled by a pallet and pallet spring. The details of the components are given at Plate K and the mechanism is shown diagrammatically at Plate J. The mechanism is well built and is largely of plated brass construction. In addition to the mainspring, gear train and escapement the mechanism also contains the setting, starting and firing systems.

The setting lever (15), hand (16), and setting disc (17) are fixed together so that they can rotate as one piece about the central arbor (14) until the projectile is fired. The setting lever (15) engages in a hole in the top of the dome, so that when the latter is turned to set the fuze the setting lever etc. are also rotated. This positions the slot in the setting disc at a distance from the end of the striker release arm (18) corresponding to the time set. The striker release arm (18) supports the striker (20) in a cocked position by resting under a shoulder of the striker; the release arm is itself prevented from bearing against the setting disc (17) by the clock starting detent (7). The hand (16) carries a stop pin (6) on its underside which engages with one elbow of the striker release arm and prevents the mechanism from running (counter clockwise) when set "Safe". A pawl (8) keyed to the torsion spring rod (9) bears against a bush on the clock starting detent (7) and prevents the torsion spring (10) from pulling the escapement release arm (11) from between the teeth of the escape wheel (12); this prevents the mechanism from running until set-back occurs. A spring loaded centrifugal safety catch (22) pivoted off-centre also supports the striker until centrifugal force is sufficient to open it.

No muzzle safety device such as is incorporated in the British No.208 fuze is employed in this fuze; it can, therefore, be set to burst instantaneously.

THE DOME (See Plate H).

27. This is made of aluminium alloy and is graduated from 0-50 secs. A spring loaded set-back plunger (6) fits into the top. In the top of the dome are 2 holes, the smaller of which engages with the setting lever and thereby rotates it when the dome is turned; when the fuze is set "Safe" the larger hole coincides with a corresponding hole in the mechanism so that a key may be inserted for winding up the mainspring. A small brass safety lug is rivetted to the inside of the dome and prevents the dome from being turned past the 50-setting by engaging a further lug on top of the body.

THE SCREWED COLLAR

28. This is also of aluminium alloy and is threaded internally

to screw on to the body. A flange on the dome engages in a cut away portion of the collar so that when the latter is screwed on to the body the dome is forced down on to a waved split copper washer (9) which rests on a shoulder of the body and thus provides the necessary tensioning. Two grub screws retain the collar in place.

THE CAP

29. This is of aluminium alloy and is screwed on to the top of the dome to give the fuze a good shape.

THE FUZE COVER

30. Two types of fuze cover have been encountered and these are shown at Plate G. One is of drawn brass and the other of tinplate; both have a serrated collar soldered to the conical portion.

31. Safety Devices:-

- (a) Safety lug :- This is a brass plate rivetted inside the dome which engages with a lug on the body so that the dome can be turned only clockwise and never past the 50 setting.
- (b) Stop pin (6):- On the hand engages with the small elbow of the striker release arm when set "Safe". Since the arbor rotates anti-clockwise, this prevents the mechanism from functioning should the projectile be fired.
- (c) Clock Starting Detent (7):- This also keeps the striker release arm under the shoulder of the striker until set-back occurs.
- (d) Centrifugal Safety Catch (22):- This engages with a flange on the striker and prevents it from going down until the centrifugal force is sufficient to open the catch.
- (e) Centrifugal Bolts :- These engage in the groove in the inertia pellet until they move out under centrifugal force; the pellet is then kept off the detonator only by the creep spring.

ACTION (See Plate J)

32. (a) Time:- On firing, the set-back plunger (1) overcomes its spring and bends down the thin setting lever (15), thereby disengaging it from the dome. At the same time the plunger drives the tapered clutch bar (2) into the slot of the central arbor (4), thus forcing the ends apart and locking the setting disc (7), setting lever (15), and hand (16) to the arbor.

The clock starting detent (7) also sets back against its spring on firing; this frees the escapement release pawl (8) and allows the torsion spring (10) to pull the escapement release arm (11) from the teeth of the escape wheel (12), thus starting the clock. The detent (7) on setting back, also allows the striker ride against the setting disc (17) until the slot in the latter allows the striker release arm to move out from under the shoulder

of the striker. Centrifugal force has by now opened the centrifugal safety catch (32) and the striker is forced on to the detonator by its spring. The powder in the detonator holder carries the flash to the magazine which initiates the gain.

(b) Percussion:- Centrifugal force causes the centrifugal bolts (10A) to move out and free the inertia pellet (15). On impact, the inertia pellet sets forward against the creep spring and on to the fixed striker (11).

RATE OF OSCILLATION OF PALLET

33. The rate of oscillation of the pallet was calculated in the following manner:-

Circumference of dome 5.8-ins.

Length of arc of dome
graduated 0-50 secs. 4.53-ins.

For a run of 50 secs.,
arbor wheel makes $\frac{4.53}{5.8}$ revs.

Time required for 1 complete)
revolution of arbor wheel) $\frac{50 \times 5.8}{4.53} = 64$ secs.

Now let N_1 speed of arbor wheel 1/64 revs./secs.
& let N_6 speed of escape wheel

Now if N_1	Number of teeth in arbor wheel	= 40
N_2	" " " " 3rd pinion	= 10
N_3	" " " " 3rd wheel	= 54
N_4	" " " " 4th pinion	= 8
N_5	" " " " 4th wheel	= 68
N_6	" " " " escape pinion	= 8

Then $\frac{N_6}{N_1} = \frac{N_1}{N_2} \times \frac{N_3}{N_4} \times \frac{N_5}{N_6}$

$$= \frac{40}{10} \times \frac{54}{8} \times \frac{68}{8} = \frac{1836}{8}$$

$$N_6 = \frac{1}{64} \times \frac{1836}{8} \text{ revs./secs.}$$

But the escape wheel has 24 teeth and so for every revolution of the escape wheel, the pallet must make 24 oscillations,

$$\text{Rate of oscillation of pallet} = \frac{24}{64} \times \frac{1836}{8} = 86.1$$

$$\text{Rate of oscillation of pallet} = 86.1 \text{ vibrations/secs.}$$

FUZE, TIME AND PERCUSSION, TYPE 2.

34. This is a 44-secs. combustion time and percussion (D.A.) fuze for use in the Type '90 projectile for the 75-mm. Type '88 A.A. gun and it is reported to have replaced the Type '89 (4 rings) time fuze. The general appearance and details of components of the fuze are shown at Plate I. It consists essentially of the following parts:-

- (i) Body (16).
- (ii) Magazine (21).
- (iii) Head (5).
- (iv) Time rings (14, 15).
- (v) Vent cap (10).
- (vi) Locking collar (11).
- (vii) Wedging sleeve (13).
- (viii) Fuze cover (1).

35. The body is of brass and is bored centrally at the lower end to take the magazine (21). This is of aluminium alloy and is filled with a perforated pellet; a channel is drilled through the centre to carry the flash to the gaine. A deep cavity is drilled slightly off centre in the body to take the time striker (17) and striker spring (18); the cavity is closed with a plug which also carries the time detonator (19). A flash hole drilled in the side of the body leads from this cavity, through the wedging sleeve (13) to the top time ring (14).

Two long channels are also drilled, right through the body, in a different plane to the time striker cavity, to carry the flash from the percussion detonator to the magazine. The flash channel leading from the lower time ring to the magazine contains a perforated pellet at the top and some loose G.P. at the bottom.

36. The head (5) which is made of aluminium alloy screws into a threaded recess in the top of the body and contains the percussion mechanism. A wooden striker (3) fits into the top of the head and rests on top of the steel firing pin (4). A closing disc (2) in the top of the head prevents the striker being forced down on to the detonator (9) by air pressure during flight. The centrifugal bolt (7) is held under the head of the firing pin (4) by the centrifugal bolt spring; the bolt hole is closed by a screwed closing plug (8). The percussion detonator (9) is held in a brass plug which screws into the lower end of the head.

37. The time rings (14, 15) are of conventional design, the top (fixed) ring (14) being keyed to the body. The bottom ring (15) carries a brass setting bridge and is graduated from 0 - 44 secs. each division being again divided into half-second intervals.

The rings are separated from each other and from the platform of the body by thick felt washers and in addition the composition in each ring is covered with thin tissue paper. Tensioning is provided by the locking collar (11) which is screwed down on to two choped spring steel washers (12) resting on the inner flange of the top ring. This collar is provided with 6 vent holes to allow the escape of gas from the time rings and is further secured to the body by a set screw.

The direction of burning of the rings is:-

Top Anticlockwise.
Bottom Clockwise.

The time rings are kept away from the stem of the body by a wedging sleeve (13) which has a number of vertical grooves to allow the escape of gas also. It is driven over the stem of the body and is prevented from turning by a small plug which is screwed into the stem. The vent cap (10) which screws on to the top ring gives the fuze a good shape; it also has 6 vent holes covered with thin tin foil discs for the final escape of the time ring gases.

38. There are several points of interest in this fuze. Firstly although it has only two time rings, the burning time is 44 secs. as opposed to the Type '89 fuze which has 4 rings and burns for only 30 secs. This increased burning time appears to be achieved by the use of a peculiar composition similiar to gunpowder but with the charcoal replaced by woodmeal and with a high sulphur content. Secondly, no striker spring is incorporated in the percussion mechanism. This means that, once the centrifugal bolt is opened, the firing pin is held off the detonator only by creep. Should the closing disc be damaged, air pressure during flight might force the striker and firing pin on to the detonator to cause an early burst. Finally, there are no escape holes in the time rings, the gases being vented internally in much the same way as in the Type '89.

The fuze cover (1) is of pressed steel with a serrated brass collar soldered to the base; it is screwed to the body just below the lower ring and protects the fuze during storage and transit.

39. Safety Devices:-

- (a) When set "Safe" the lower ring is masked from the top ring and so if the shell is fired, only the top ring will burn. The striker spring is relatively strong compared with the light striker, so only a very heavy drop would fire the time detonator.
- (b) Centrifugal bolts (7):- This is held by its spring (6) under the head of the firing pin and prevents the latter from impinging on the detonator until the centrifugal force is sufficient to move it outwards against its spring.
- (c) Closing disc (2):- This prevents air pressure driving the striker and firing pin on to the detonator during flight.

ACTION

40. (a) Time:- On firing the time striker (17) sets back against its spring (18) and fires the time detonator (19). The flash travels up through the grooves in the striker and out of the flash hole to the top ring. The composition burns for the predetermined time after which the flash is carried to the magazine via the pellet and loose powder in the flash channel. When the fuze is set to zero the flash passes straight from the detonator through the pellets in each ring to the magazine.

(b) Percussion:- On firing, the striker and firing pin set back and hold the centrifugal bolt in position. Outside the

muzzle, owing to deceleration, the striker and pin creep forward and allow the centrifugal bolt to fly out. During flight the firing pin is kept off the detonator only by creep, as there is no spring for the percussion striker in this fuze. On impact, the nose of the fuze is crushed in and the firing pin is driven on to the detonator, the flash from which travels down the two long flash channels to the magazine.

41. As only one of these fuzes has been received here for examination, no trials to determine time of burning have been possible, nor could any firing trials be carried out.

P A C K I N G

42. The method of packing of the fuze time & percussion Type '100 is shown in Plate G and it will be seen that following the usual Japanese practice each fuze is issued in a tinned-plate cylinder. A paper label stuck on top of the cylinder lid shows in Japanese characters the type of fuze, fuze correction and date of manufacture. The cylinders are well made and are varnished internally and externally. The joint in the body is folded and soldered, while the bottom is rolled on. The lid screws on to the body, the threads in both being rolled in. The interior is lined with thin board which has been coated with some water-proofing composition. Cardboard discs and packing pieces similarly waterproofed are also provided to ensure a snug fit of the fuze in the cylinder.

CHEMICAL ANALYSIS

(Chief Inspector of Military Explosives, Kirkee)

	<u>Type Taisho 3</u>	<u>Type 2</u>
1. Top ring.	Mealed G.P.: Sulphur 8.9% Pot.Nitrate 73.9% Charcoal 17.2%	Sulphur 31.2% Pot.Nitrate 54.3% Woodmeal 13.5%
2. Bottom ring	G.P. of uneven size:- Sulphur 6.7% Pot.Nitrate 74.5% Charcoal 18.8%	-do-
3. Top ring pellet.	G.P.	Sulphur Pot.Nitrate Woodmeal
4. Bottom ring pellet.	Perforated powder pellet.	-do-
5. Body flash channel.	-do-	(a) Pellet as for (3) & (4) (b) Loose G.P., size G20.
6. Pellet above magazine.	-	Sulphur Pot.Nitrate Woodmeal

7. Magazine.	Gunpowder size G.20:- Sulphur 7.2% Pot.Nitrate 74.4% Charcoal 18.4%	Sulphur Pot.Nitrate Woodmeal
8. Time Detonator.	Mercury Fulminate 18.6% Antimony Sulphide 39.6% Pot.Chlorate 41.8%	Mercury Fulminate Antimony Sulphide Pot.Chlorate
9. Time Detonator Holder.	G.P. size uneven.	-
10. Graze Pellet.	Gunpowder G.20	
11. Time ring Vent holes.	Perforated powder pellets.	-
12. Washers.	All wool. Felt similar to boxcloth.	

Type '89Type '100

1. Time rings (complete samples from second and fourth rings)	Gunpowder:- Sulphur 9.6% Pot.Nitrate 71.9% Charcoal 18.5%	-
2. Magazine.	Gunpowder, size G.20	Gunpowder of uneven size.
3. Time Detonator.	Fulminate composition.	Fulminate composition.
4. Time Detonator Holder.	-	-do-
5. Graze pellet.	-	Gunpowder, size G.20
6. Percussion Detonator.	-	Fulminate composition.
7. Time ring washers.	Pure wool cloth similar to boxcloth.	-

Type Taisho 5

1. First ring	Gunpowder:- Sulphur 6.3% Pot.Nitrate 75.2% Charcoal 18.5%
2. Second ring	Gunpowder:- Sulphur 7.6% Pot.Nitrate 73.7% Charcoal 17.7%
3. Third ring	Gunpowder:- Sulphur 7.4% Pot.Nitrate 75.3% Charcoal 17.3%

4. First ring pellet	)	
5. Second ring pellet	)	
6. Third ring pellet	)	Gunpowder
7. Body flash channel	)	
8. Time ring vent holes	)	
9. Magazine		Gunpowder:-
		Sulphur 10.2%
		Pot.Nitrate 74.3%
		Charcoal 15.5%
10. Time Detonator -		
Top layer		Gunpowder
Bottom layer		Mercury Fulminate
		Antimony Sulphide
		Pot.Chlorate

NOTE:- In cases where percentage composition is not given, quantities were insufficient for quantitative analysis.

APPRECIATION

44. The fuzes show the general trend of Japanese design from 1914-1942 and it will be seen that this closely follows British development. The main improvements realised are improvement in ballistic shape and increase in time of burning corresponding to the longer range of more modern artillery. In early designs this increase in burning time is brought about by an increase in the number of time rings but in the latest design (Type 2) this has been carried out by the use of a very different time ring composition.

45. It is interesting to note that the Japanese are still using a combustion fuze (Type 2) in the 75-mm. A.A.gun, although mechanical fuzes are used in the larger calibre guns employed in an A.A. role.

46. The Type '91 Naval fuze, to which the Type '100 is very similar in design, dates back to 1931; it is therefore apparent that the Japanese Navy adopted a mechanical time fuze for A.A. purposes some considerable time before the Army.

47. The standard of workmanship and finish of all the fuzes was good and generally comparable with British fuzes of the same type.

SUMMARY OF DATA

See chart at the end of the report.

RESTRICTED.

**CHART OF JAPANESE TIME AND TIME & PERCUSSION FUZES
USED IN GUN AMMUNITION.**

SHEET 1.

SERIAL NO.	FUZE TYPE.	NO. OF TIME RINGS.	W E A P O N.		SHELL IN WHICH USED.		FUZE HOLE. (MM.)	O/A LENGTH. (INS.)	GRADUATIONS.	MEAN TIME OF BURNING.	REMARKS.
			CALIBRE.	TYPE.	NATURE.	TYPE.					
1.	TIME & PERCUSSION FUZE, TYPE TAISHO 3 (1914) MODIFIED.	2	75-MM.	MEIJI 38 FIELD GUN.	H.E.	'A'	47 8 TPI.	2.43	0-22	22.5 SECS.	
			"	MEIJI 41 AND TYPE '94 GUN.	"	'A'					
			"	TYPE MEIJI 38 FIELD GUNS.	SHRAPNEL.	38 (1905)					
			"	TYPE 41 REGIMENTAL GUN.	"	"					
			"	TYPES '90 AND '94 GUNS.	"	"					
			"	TYPE 41 REGIMENTAL GUN.	SUBSTITUTE SHELL.	90					
2.	MODIFICATION TO THE ABOVE FUZE.	2	-	--	A/C. PROPAGANDA BOMB.	-	47 8 TPI.	2.87	0-22	-	
3.	TIME & PERCUSSION FUZE, TYPE TAISHO 5 (1916).	3	75-MM.	TYPE MEIJI 38 SERIES, TYPES 41, '90 & '94 GUNS AND TYPE '88 SPECIAL A.A. GUN.	SHRAPNEL.	90	47 8 TPI.	2.83	0-36	-	A MODIFIED FUZE IS REPORTED TO BE USED IN SOME PROJECTILES.
			"	TYPE '88 SPECIAL A.A. GUN.	"	94					
			"	TYPE '90 FIELD AND TYPE '88 SPECIAL A.A. GUNS.	"	38					
			"	TYPE 38 SERIES, TYPES 41, '90 AND '94 GUNS.	INCENDIARY.	90					
			"	TYPE 38 SERIES AND TYPES 41, '88 SPECIAL, '90 AND '94 GUNS.	ILLUMINATING.	90					
			105-MM.	TYPE 7 (1918) AND MEIJI 38 GUNS.	SHRAPNEL.	14					
			"	TYPE TAISHO 14 & '92 GUNS.	"	14 (1925)					
			"	TYPE 7 (1918) & MEIJI 38 GUNS.	"	38					

DIFFERS FROM TYPE 3 YEAR FUZE IN HAVING AN EXTRA TIME RING AND LONGER BURNING TIME.

RESTRICTED.

SERIAL NO.	FUZE TYPE.	NO. OF TIME RINGS.	WEAPON.		SKILL IN WHICH USED.		FUZE HOLE. (INCH.)	O/A LENGTH. (INCH.)	GRADUATIONS.	MEAN TIME OF BURNING.	REMARKS.
			CALIBRE.	TYPE.	NATURE.	TYPE.					
3. (CONTD.)	TIME & PERCUSSION FUZE, TYPE TAISHO 5 (1916). (CONTD.)	3	105-MM.	TYPE '91 (1931) HOW.	SHRAPNEL.	95					
			"	HEIJI 38 GUN, TYPE '92 (1932) GUN, TAISHO 14 AND TYPE '91 HOW.	INCENDIARY.	95					
			"	TAISHO 14 & HEIJI 38 GUNS.	SMOKE.	14					
			120-MM.	HEIJI 38 HOW.	SHRAPNEL.	A & C					
			150-MM.	TAISHO 4 & HEIJI 38 HOW.	"	A & B					
			"	TYPE 45, 7, '89 & '90 GUNS.	"	-					
			"	HEIJI 38 HOW., TAISHO 4 (1915) HOW., 7TH YEAR GUN, TYPE HEIJI 45 (1912) AND TYPE '90 (1930) GUNS.	ILLUMINATING.	80					
			"	HEIJI 38 HOW.	SUBSTITUTE.	-					
4.	TIME FUZE, TYPE TAISHO 10 (1921).	-	75-MM.	TAISHO 11 A.A. GUN.	H.E.	-					
			"	TAISHO 11 A.A. GUN.	TARGET.	TAISHO 11					
			"	TYPE '88 (1928) A.A. GUN.	"	"					
	TIME FUZE, TYPE TAISHO 10 (WEAK) (1921).	-	105-MM.	TAISHO 14 A.A. GUN.	"	87 (1927)					
5.	TIME & PERCUSSION FUZE, TYPE '88 (1928).	-	120-MM.	HEIJI 38 HOW.	SHRAPNEL.	B			0-35		
			150-MM.	HEIJI 38 HOW.	"	B					
				TAISHO 4 (1915) HOW.	"	B					
6.	TIME FUZE, TYPE '89 (1929) (SMALL).	2	50-MM.	TYPE '89 (GRENADE) DISCHARGER.	SMOKE.	95	20	1.8 (APPROX.)	0-23	15	WHEN SET TO MAXIMUM TIME. SEE J.A.L. DS.

RESTRICTED.

SHEET 3.

SERIAL NO.	FUZE TYPE.	NO. OF TIME RINGS.	W E A P O N .		SHELL IN WHICH USED.		FUZE HOLE. (MM.)	O/A LENGTH. (INS.)	GRADUATIONS.	MEAN TIME OF BURNING.	REMARKS.
			CALIBRE.	TYPE.	NATURE.	TYPE.					
6. (CONTD.)	TIME FUZE, TYPE '89 (1929) (SMALL). (CONTD)	2	70-MM.	TYPE '92 BATTALION GUN.	ILLUMINATING.	95					
			"	TYPE TAISHO 11 DISCHARGER (1922).	ILLUMINATING (SHELL).	95					
7.	TIME FUZE, TYPE '89 (1929).	4	70-MM.	TYPE '92 BATTALION GUN.	ILLUMINATING.	95	47 12.8 TPI. (RH).	3.81	0-30	32.8 SECS.	GAINE USED AS DESCRIBED IN T.R. NO.29.
			75-MM.	TYPE '88 SPECIAL A.A. GUN.	H.E./A.A.	90					
			"	TYPE '88 FIELD A.A. GUN.	"	90					
			"	TYPE TAISHO 11 A.A. GUN,	"	90					
			"	TYPE '88 FIELD A.A. GUN.	AIRBURST PRACTICE.	-					
			8-CM. (3-IN.)	8-CM. (3-IN.) 40 CAL. DUAL PURPOSE CD/AA NAVAL GUN, TYPE TAISHO 10.	H.E./COMMON.	-					USED WITH TYPE '96 GAIN.
			105-MM.	TAISHO 14 (1925) A.A. GUN.	H.E./A.A.	91					
8.	TIME FUZE, MECHANICAL, TYPE '91.	-	120-MM.	TYPE 10 (1935) CD/AA NAVAL GUN.	H.E./COMMON.	-	47 12 TPI.	3.11	0-55	-	THE MECHANISM IN THIS FUZE IS SIMILAR TO THAT EMPLOYED IN THE TYPE 100 FUZE (SERIAL 12).
			"	12-CM. 45 CAL. DUAL PURPOSE A.A. GUN.	H.E.	-					
			"	12-CM. 45 CAL. DUAL PURPOSE A.A. GUN.	INC./SHRAPNEL.	-					
			"	TYPE 10 (1935) DUAL PURPOSE CD/AA NAVAL GUN.	"	-					
			127-MM.	40 CAL. DUAL PURPOSE A.A. GUN	H.E./COMMON.	-					
			140-MM.	TYPE TAISHO 3 (1914) (NAVAL).	H.E./HIGH CAPACITY.	-					
			"	TYPE TAISHO 3 (1914) (NAVAL).	STAR.	-					
			155-MM.	NAVY 15.5-CM. GUN.	H.E./COMMON.	100					TYPE '91 OR TYPE 4 GAIN.

RESTRICTED.

SHEET 4.

SERIAL NO.	FUZE TYPE.	NO. OF TIME RINGS.	WEAPON.		SHELL IN WHICH USED.		FUZE HOLE. (MM.)	O/A LENGTH. (INS.)	GRADUATIONS.	MEAN TIME OF BURNING.	REMARKS.
			CALIBRE.	TYPE.	NATURE.	TYPE.					
8. (CONTD.)	TIME FUZE, MECHANICAL, TYPE '91 (CONTD.)	-	20-CM.	LAUNCHER TYPE N.K.	H.E./ROCKET SHELL.	-					
9.	TIME FUZE, MECHANICAL, TYPE '91 VARIATION 1. (JAPANESE DESIGNATION PROBABLY TYPE '98).	-	-	-	-	-	DIMENSIONS ARE THE SAME AS OF TYPE '91 FUZE.		0-55	-	DIFFERS FROM THE TYPE '91 IN THAT IT HAS A KNURLED GEAR RING ON THE OUTSIDE OF THE TIME RING.
10.	TIME FUZE, MECHANICAL, TYPE '91 VARIATION 2. (JAPANESE DESIGNATION TYPE 'O).	-	20-CM.	EXPERIMENTAL SHORT 20-CM. A.A. ANTI-SUBMARINE DUAL PURPOSE GUN (NAVAL).	H.E.	-	47	3.11	0-55	-	DIFFERS FROM THE TYPE '91 FUZE IN EXTERNAL APPEARANCE IN THAT THE NOSE CAP IS PAINTED RED.
			12-CM.	DUAL PURPOSE A.A. A/S GUN (NAVAL).	"	-					
11.	TIME FUZE, MECHANICAL, TYPE '91 VARIATION 3. (JAPANESE DESIGNATION N.K.).	-	10-CM.	10-CM. DUAL PURPOSE GUN (NAVAL).	H.E.	-	47	4.31	0-45	-	THE DISTINCTIVE FEATURE IS THAT THE TIME SETTING RING IS MARKED 0-45.
12.	MECHANICAL TIME & PERCUSSION FUZE, TYPE 100 (1940).	-	88-MM.	TYPE '99 (1939) A.A. GUN.	H.E./A.A./S.L.	100 (1940)	52 19 TPI (RH).	4.88	0-50	-	SAME GAIN AS THAT USED IN 75-MM. A.A./H.E. SHELL TYPE '90 FOR TYPE '88 A.A./FIELD GUN.
			105-MM.	TAISHO 14 A.A. GUN.	H.E./A.A.	100 (1940)					
13.	TIME FUZE, TYPE 1 (1941).	-	75-MM.	TYPE MEIJI 38 IMPROVED FIELD GUN.	H.E.	1 (1941)	-	-	-	-	
14.	TIME & PERCUSSION FUZE, TYPE 2 (1942).	2	75-MM.	TYPE '88 FIELD A.A. GUN.	H.E./A.A.	90	47 13 TPI (RH).	2.96	0-44	-	THIS IS NOW TO REPLACE TYPE '89 FUZE.
15.	TIME FUZE, TYPE (N.K.).	2	40-MM.	DUAL & SINGLE MOUNTED A.A./A.T. GUNS.	H.E./A.A.	-	26 16 TPI.	3.58 (INCLUDING GAIN).	0-10	-	AMERICAN REPORTS INDICATE THAT THIS IS MODEL 3.

RESTRICTED.

SHEET 6.

SERIAL NO.	FUZE TYPE.	NO. OF TIME RINGS.	W E A P O N.		SHELL IN WHICH USED.		FUZE HOLE (MM.)	O/A LENGTH. (INS.)	GRADUA- TIONS.	MEAN TIME OF BURNING.	REMARKS.
			CALIBRE.	TYPE.	NATURE.	TYPE.					
16.	TIME FUZE, TYPE (N.K.).	2	120-MM.	-	ILLUMINATING.	-	45 5 TPI.	2.75	0-30	-	REFERRED TO AS 'THIRTY SECOND TIME FUZE' IN AMERICAN REPORTS, SINCE NO DEFINITE JAPANESE DESIGN- ATION IS KNOWN.

RESTRICTED.



COMBUSTION



TIME & PERCUSSION
TYPE TAISHO 3 (1914)
 TWO TIME RINGS
 COMMONLY KNOWN AS
 3 YEAR TYPE

0-22

COMBUSTION



TIME & PERCUSSION
TYPE TAISHO 5 (1916)
 THREE TIME RINGS
 COMMONLY KNOWN AS
 5 YEAR TYPE

0-36

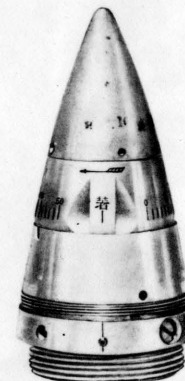
COMBUSTION



TIME
TYPE 89 (1929)
 FOUR TIME RINGS

0-30

MECHANICAL



TIME & PERCUSSION
TYPE 100 (1940)
 MECHANICAL

0-50

COMBUSTION



TIME & PERCUSSION
TYPE '2 (1942)
 TWO TIME RINGS

0-44

GRADUATED

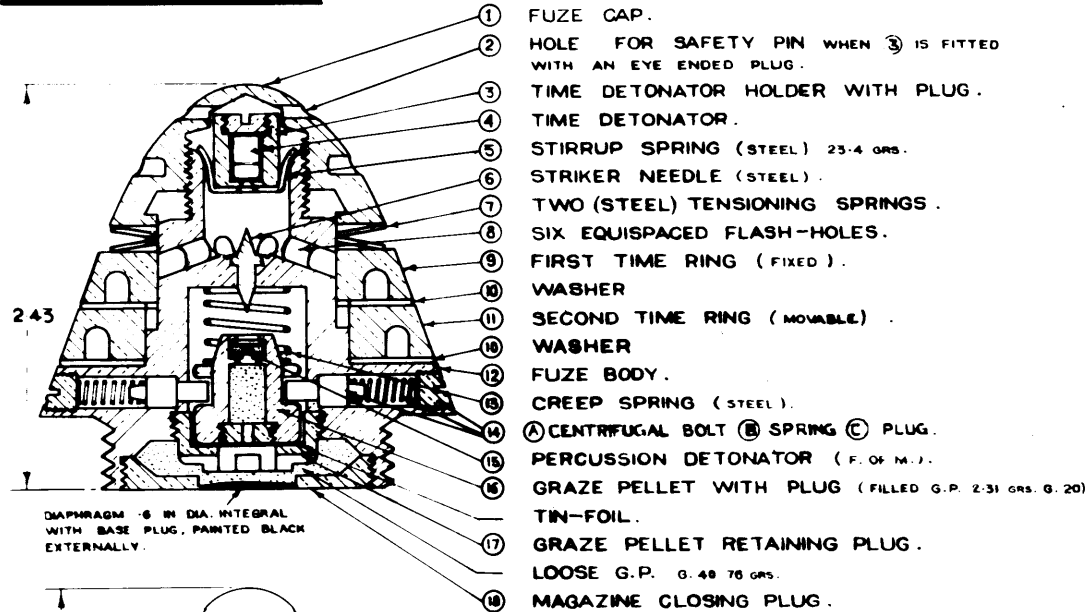
JAPANESE TIME AND TIME & PERCUSSION FUZES
USED IN GUN AMMUNITION

C.I. AMN S/1250
 KIRKEE OCT. '45

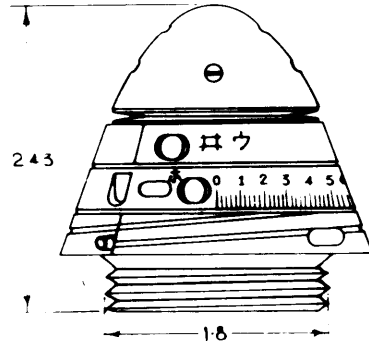
PLATE A

RESTRICTED.

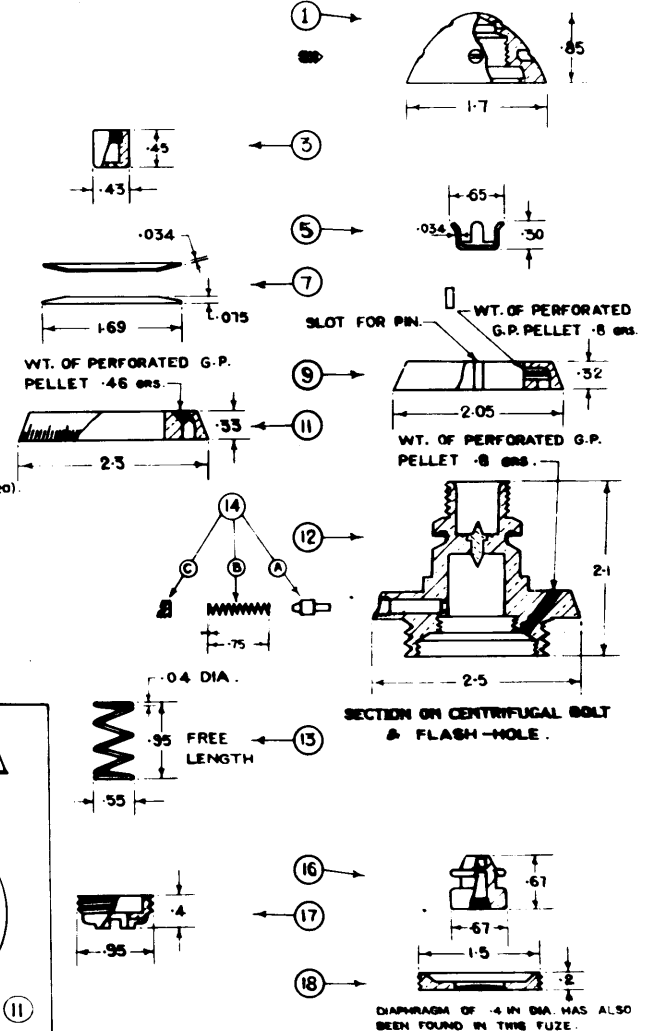
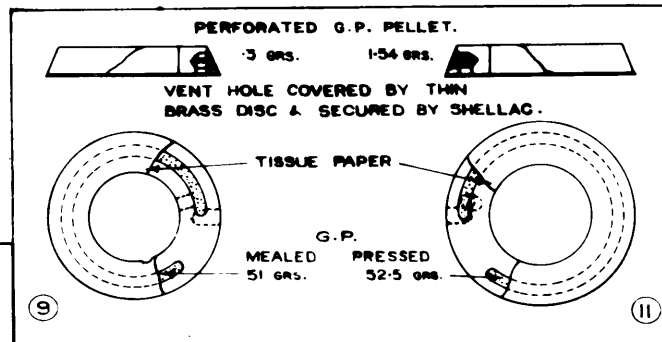
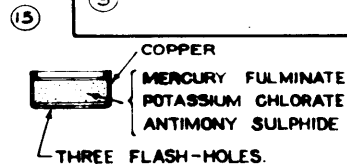
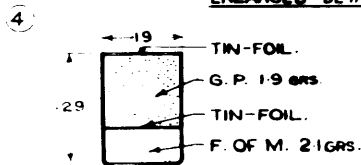
**FUZE MADE OF BRASS EXCEPT WHERE OTHERWISE STATED.
ALL THREADS ARE RIGHT HANDED.**



DIAPHRAGM .6 IN DIA. INTEGRAL WITH BASE PLUG. PAINTED BLACK EXTERNALLY.



ENLARGED DETAILS.



== JAPANESE FUZE TIME & PERCN TYPE TAISHO 3 (1914) ==
== GENERAL ASSEMBLY & COMPONENT DETAILS ==

C.I.A.M.M.S./1254
KIRKKE OCT. 40

NA

SETTING BRIDGE

63

BOY CLETH WASHERS

DIAPHRAGM 6 IN. DIA. INTEGRAL WITH BASE PLUS PAINTED BLACK EXTERNALLY

STEVEN 12 (YEARS) (MONT 12)
(DCT. 1937)
OSAKA RESPECTED MARK
OSAKA

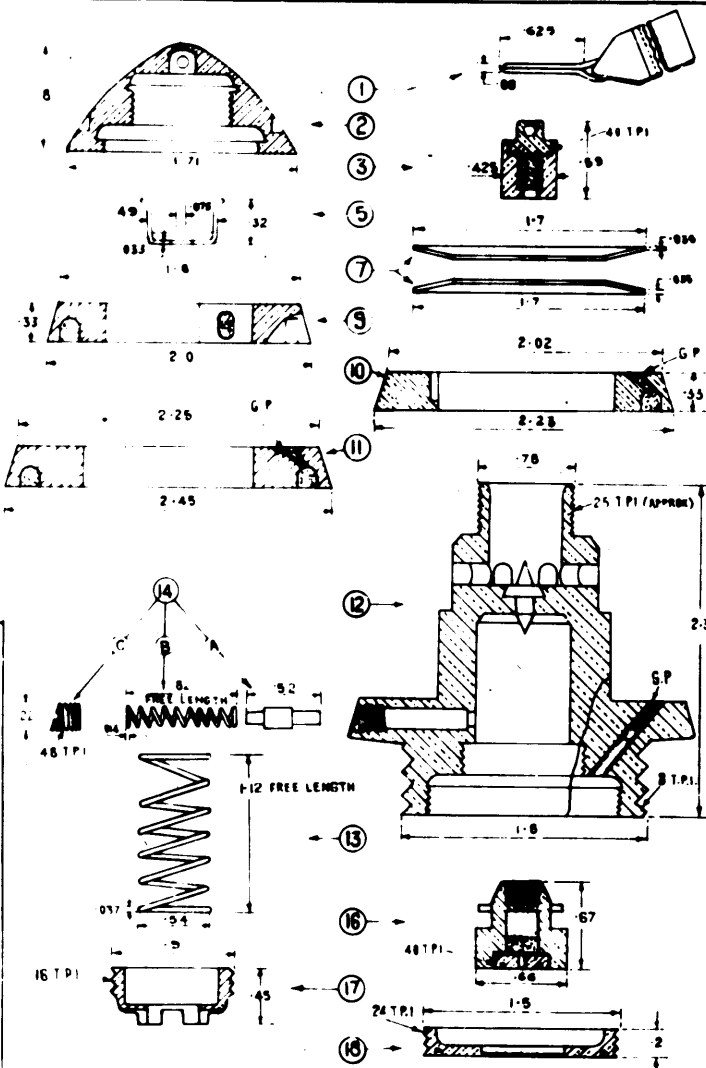
8

2 83

1

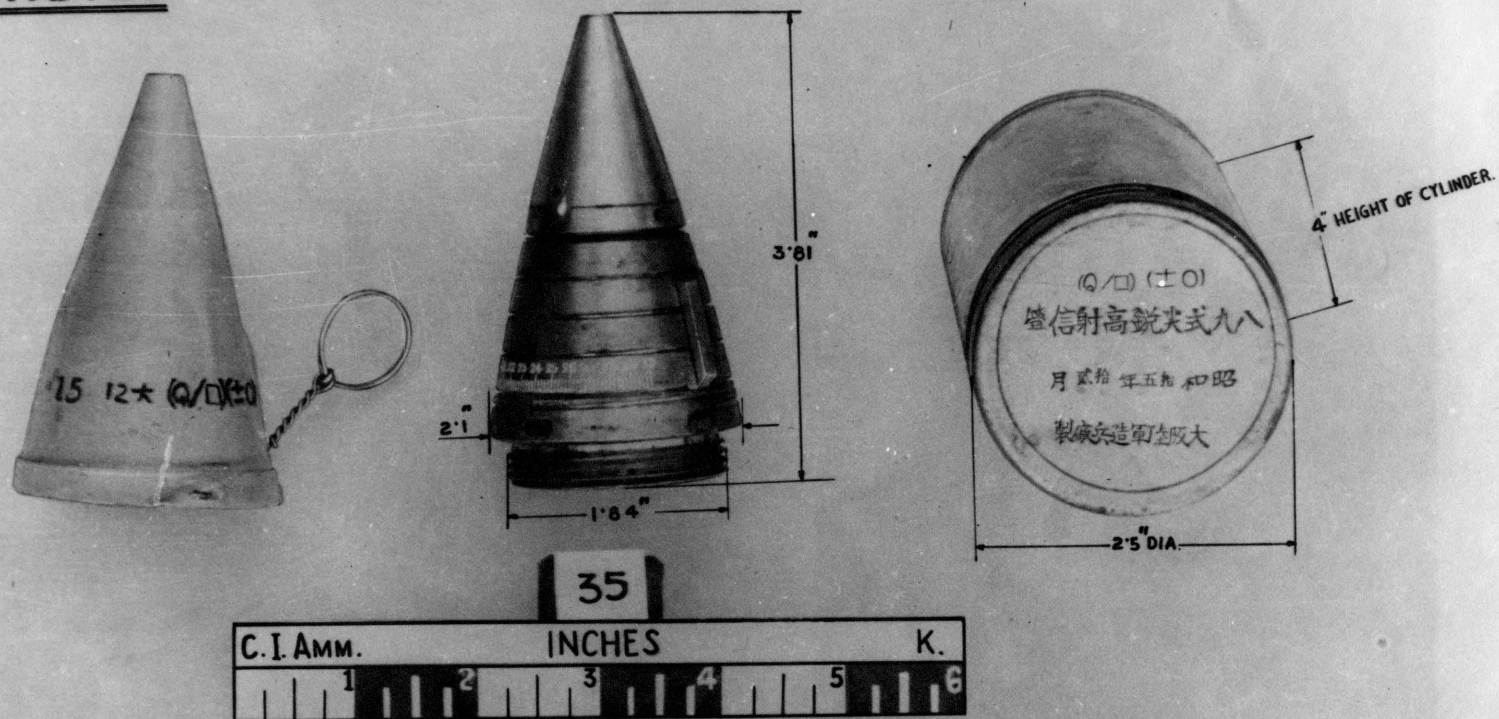
1-8

- 1 SAFETY PIN WHEN 3-IS FITTED
WITH AN EYE ENDED PLUG
- 2 FUZE CAP
- 3 TIME DETONATOR HOLDER WITH PLUG
GRUB SCREW
- 4 TIME DETONATOR
- 5 STIRRUP SPRING (STEEL OR NICKEL)
- 6 STRIKER NEEDLE (STEEL)
- 7 TWO TENSIONING SPRINGS (STEEL)
- 8 SIX EQUI-SPACED HOLES
- 9 FIRST TIME RING (MOVABLE)
- 10 SECOND TIME RING (FIXED)
- 11 THIRD TIME RING (MOVABLE)
- 12 FUZE BODY
- 13 CREEP SPRING (STEEL)
- 14 A) CENTRIFUGAL BOLT B) BOLT SPRING
& C) CLOSING PLUG
- 15 PERCUSSION DETONATOR (F OF M)
- 16 GRAZE PELLET WITH PLUG (G P G 20)
- 17 GRAZE PELLET RETAINING PLUG
- TIN FOIL DISC
- 18 MAGAZINE CLOSING PLUG
- G P.



• GENERAL ASSEMBLY & COMPONENT DETAILS:

RESTRICTED.



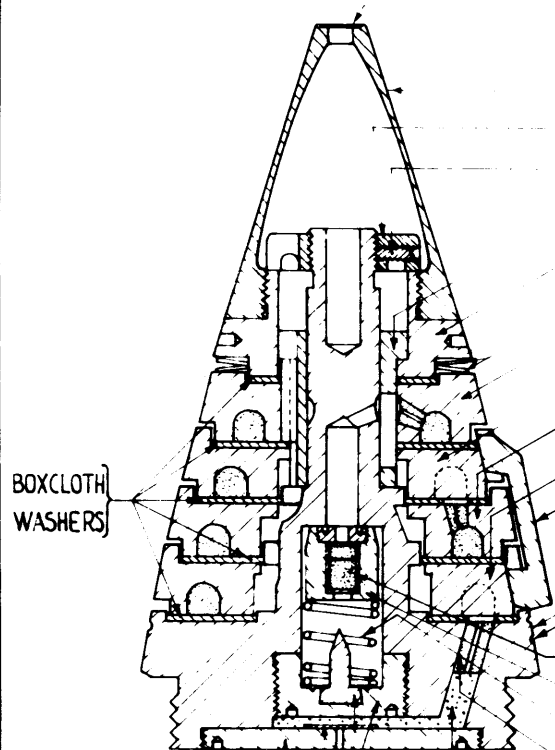
FUZE TIME (COMBUSTION) TYPE '89
WITH FUZE COVER AND CYLINDER
FOR
H.E.A.A. SHELL TYPE '90
FOR
75 MM. A.A./FIELD GUN TYPE '88
(EXTERNAL APPEARANCE, MARKINGS AND DIMENSIONS.)

RESTRICTED.

COMPLETE WEIGHT OF FUZE:- 1 LB. 7.5 OZS.

MANUFACTURED & PASSED INSPECTION
IN OSAKA ARSENAL DECEMBER 1941

- BRASS COVER DISC, SPUN LIGHTLY IN.



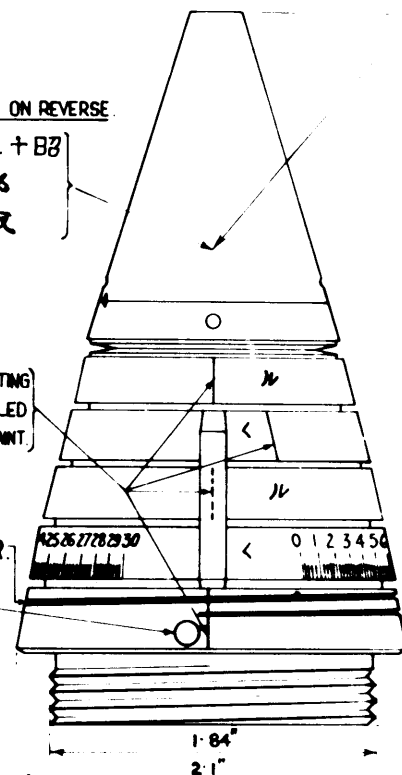
- ① FUZE CAP.
- ② SEGMENTED TENSIONING NUT.
- ②A GRUB SCREW.
- ③ LOCKING BUSH.
- ④ TENSIONING COLLAR.
- ⑤ TWO, STEEL TENSIONING SPRINGS.
- ⑥ 1ST TIME RING (FIXED)
- ⑦ 2ND TIME RING (MOVABLE)
- ⑧ 3RD TIME RING (FIXED)
- ⑨ 4TH TIME RING (MOVABLE)
- ⑩ TIME SETTING BRIDGE.
- ⑪ BODY.
- GROOVE FOR BRASS WIRE HOLDING FUZE COVER.
- STUD FOR ANCHORING WIRE.
- ⑫ TIME DETONATOR.
- ⑬ INERTIA PELLET WITH CLOSING PLUG.
- ⑭ INERTIA PELLET SPRING (STEEL)
- PERFORATED G.P. PELLET (7.7 GRS.)
- LOOSE G.P. (5 GRS.) SIZE G-20.
- ⑮ STEEL NEEDLE & NEEDLE HOLDER.
- TIN FOIL DISC.
- ⑯ MAGAZINE CLOSING DISC.

STAMPED ON REVERSE.

12 五 + BZ

天
取

TIME SETTING
MARKS FILLED
WITH RED PAINT.



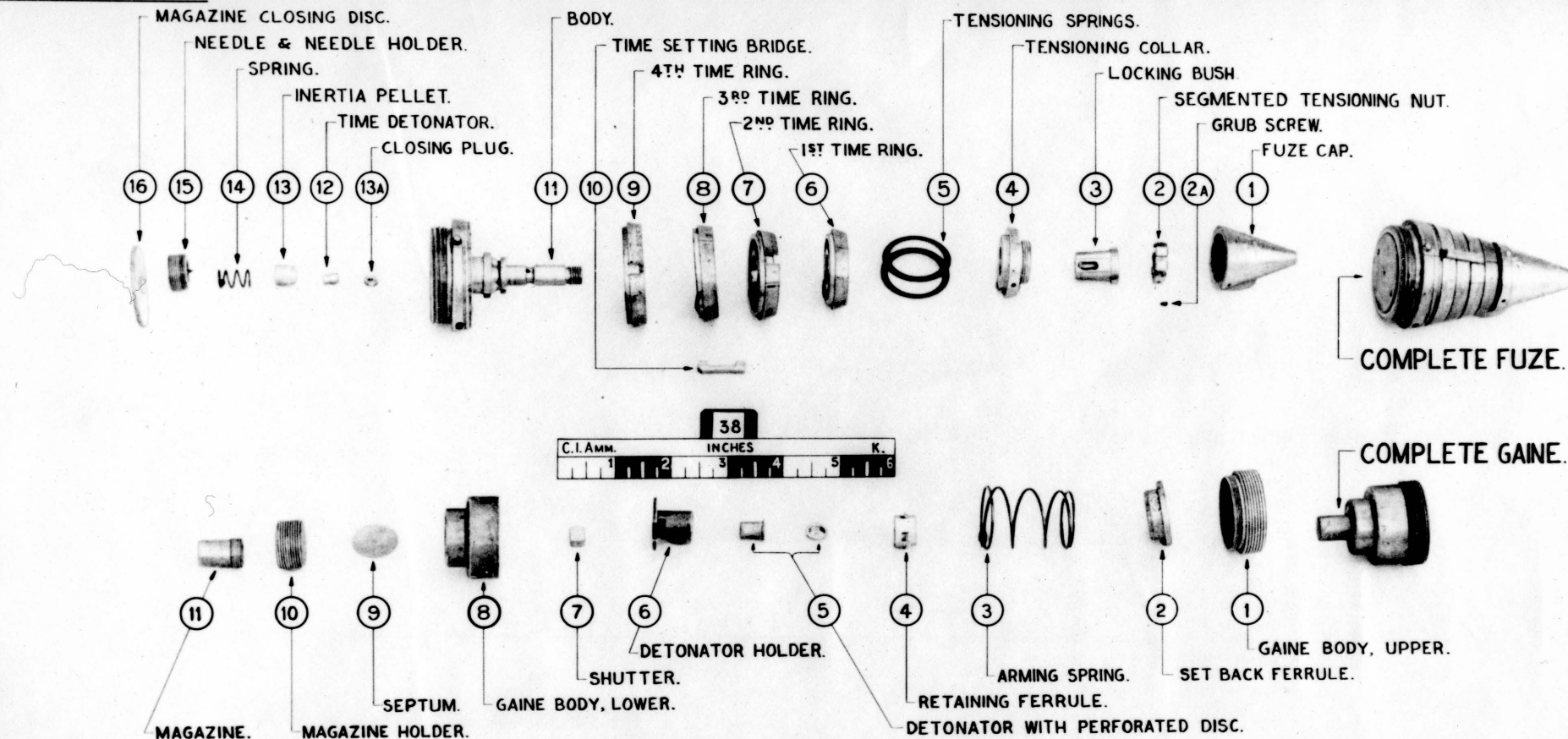
FUZE SET AT SAFE POSITION.

TYPE '89 TIME FUZE (FOUR RINGS) FOR '90 TYPE H.E., A.A. SHELL.
(GENERAL ASSEMBLY & APPEARANCE)

SHEET 1 OF 2 SHEETS
C.I. AMM 5/362
KIRKEE, DEC '44

PLATE 5

RESTRICTED.



JAPANESE TYPE '89 TIME FUZE (FOUR RINGS) AND GAINE

FOR

'90 TYPE H.E. A.A. SHELL.
(ASSEMBLY SEQUENCE OF COMPONENTS.)

C.I. AMM. 5/956.
KIRKEE. DEC. 1944

RESTRICTED.

MARKINGS ON TINNED-PLATE CYLINDER & BRASS COVER
FREE TRANSLATION:-

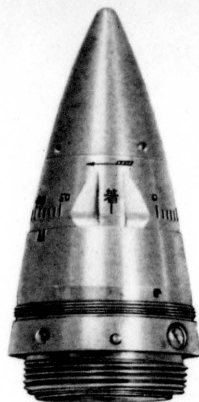
100 TYPE MECHANICAL FUZE (GUN)
SHOWA 18TH YEAR 7TH MONTH (JULY 1943)
TOKYO NO 1 ARMY ARSENAL MANUFACTURE

MARKINGS ON TINNED-PLATE COVER
FREE TRANSLATION:-

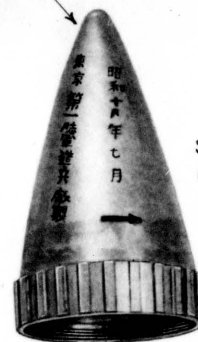
100 TYPE MECHANICAL (GUN)
SHOWA 18TH YEAR 10TH MONTH (OCT. 1943)



TINNED-PLATE CYLINDER



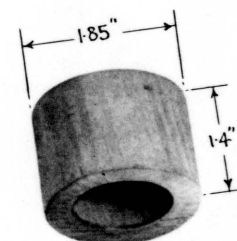
BRASS COVER



SERRATED
COLLAR



TINNED-PLATE COVER



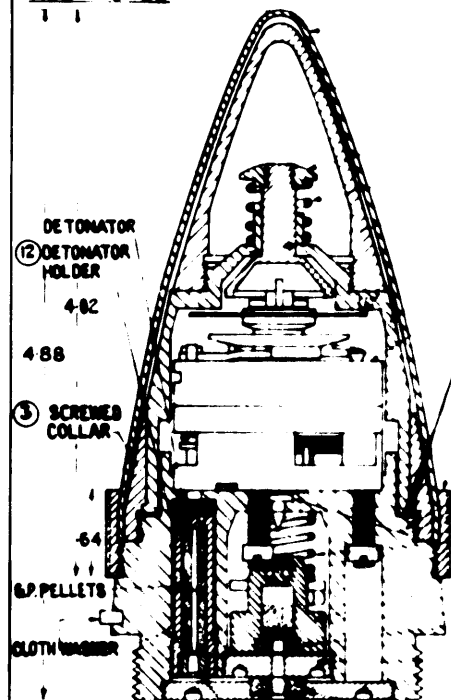
WOODEN PACKING PIECE



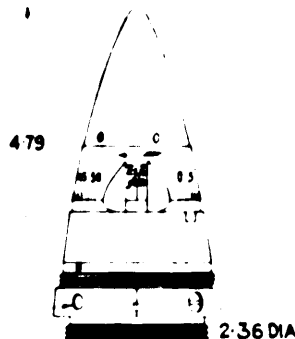
METHOD OF PACKING

JAPANESE FUZE, TIME & PERCUSSION, (MECHANICAL) TYPE 100.

RESTRICTED

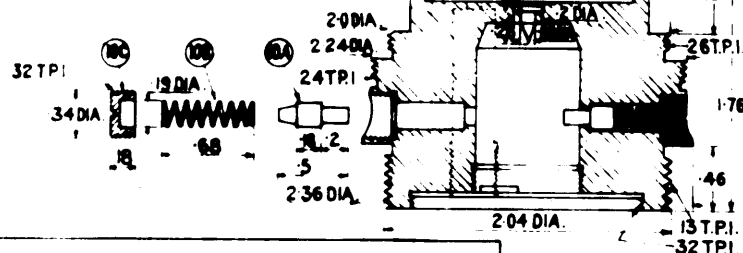
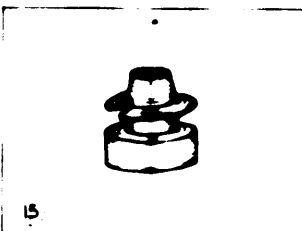
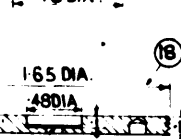
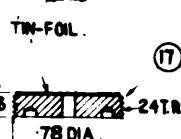
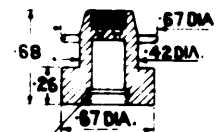
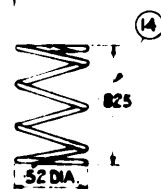
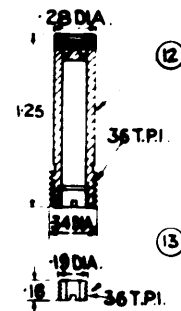
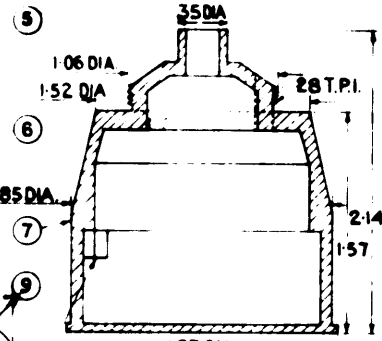
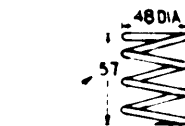
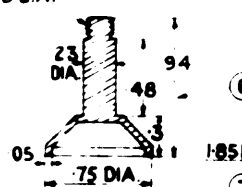
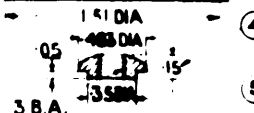
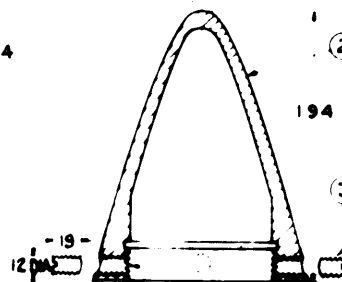


(13) CLOSING PLUG
SECTION THROUGH TIME SETTING MARK



FUZE MADE OF DURALUMIN.
UNLESS OTHERWISE STATED

- (1) COVER (BRASS)
- (2) CAP (VARNISHED) SECURED BY 4 GRUB SCREWS
- (4) PLUNGER NUT (BRASS)
- (5) PLUNGER SPRING (STEEL)
- (6) PLUNGER
- (7) DOME (TIME SETTING)
- (8) CLOCK
- (9) COPPER WASHER CORRUGATED
- (10) KNURLED COLLAR (BRASS) SOLDERED TO COVER
- (11) BASE WITH (8A) CENTRIFUGAL BOLTS (8B) SPRINGS & (8C) CLOSING PLUGS
- (12) PERCUSSION STRIKER (STEEL)
- (14) CREEP SPRING (STEEL)
- (15) INERTIA PELLET, BRASS
- (16) G.P. RETAINING PLUG, BRASS, NICKLED
- (17) CLOSING PLUG, BRASS NICKLED
- (18) MAGAZINE, BRASS, NICKLED



JAPANESE, FUZE, TIME AND PERCUSSION, MECHANICAL TYPE 100.
FOR 88 MM. H.E. SHELL (52 MM. F.H.) FOR TYPE 99A.A GUN.

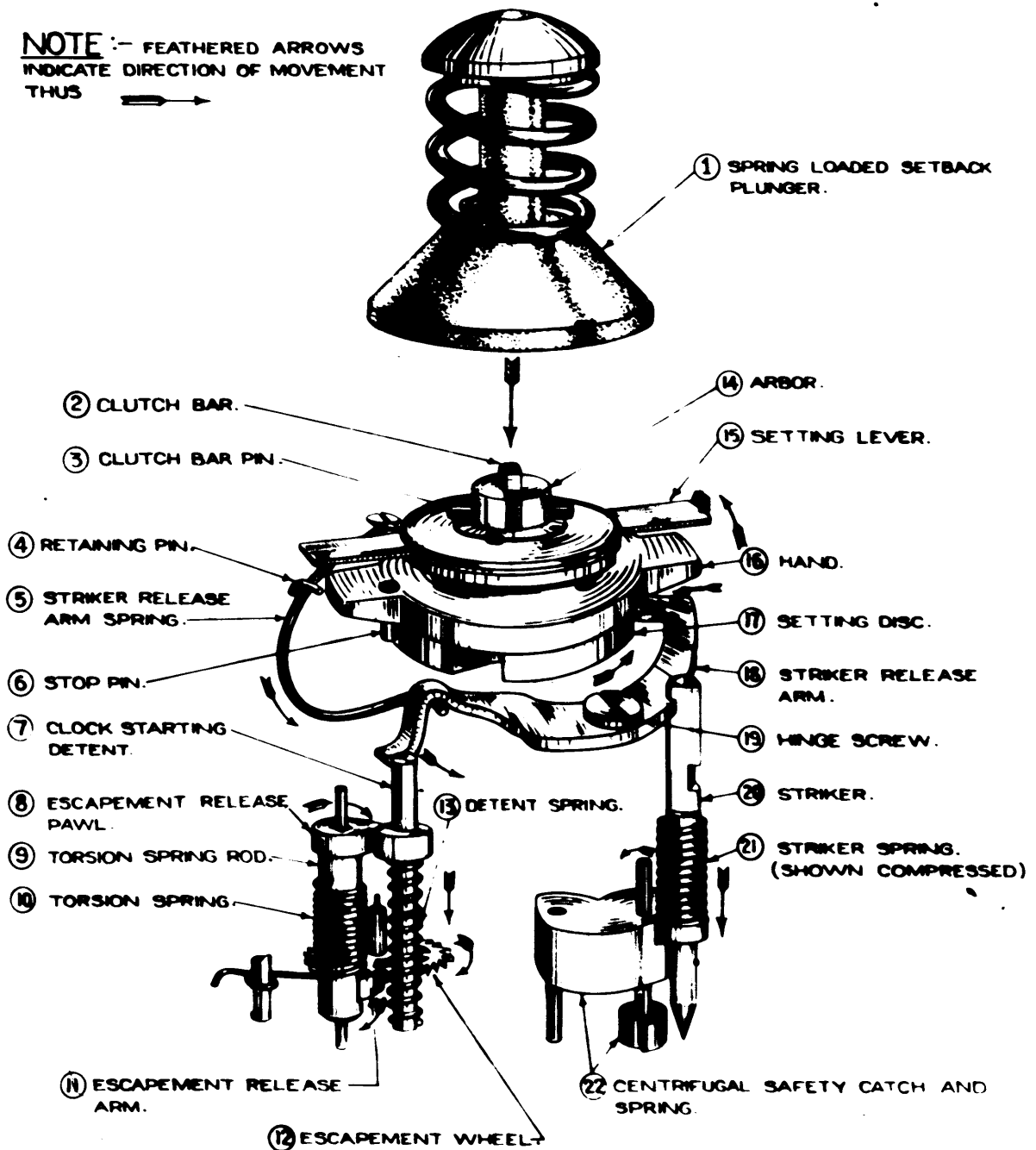
DIMENSIONS IN INCHES

C.I.A.M.N. S1265
KIRKEE, OCT. 45.

PLATE H

RESTRICTED.

NOTE :- FEATHERED ARROWS
INDICATE DIRECTION OF MOVEMENT
THUS 



JAPANESE FUZE, T. & P. (MECHANICAL) TYPE 100
METHOD OF OPERATION

